Saturday, 16 June 2018

Go to top
Weekend Course

Deep Learning: Everything You Want to Know: Part 1

Organizers: Daniel Sodickson, Joshua Trzasko

N01	Saturday 8:00 - 9:30	*Moderators:* Dong Liang & Joshua Trzasko

8:00	What Exactly Is Deep Learning?
	Bradley Erickson
	Deep learning has captured much attention because in many image recognition tasks, it surpasses human performance. The potential for this technology in radiology is substantial, and this talk will describe some of the areas in which deep learning has been or soon will be applied to improve radiological practice.

8:30	Nuts & Bolts: How Does DL Work?
	Thomas Pock
	In this talk I will highlight connections between recent deep neural networks and classical methods for solving inverse problems in computer vision and image processing. I will focus on variational methods, graphical models which are known to be extremely flexible and also come along with a deep theoretical understanding. It turns out that many iterative algorithms for solving variational and graphical models can be unrolled and hence interpreted as layers in a deep neural network. The structure provided by these methods helps in reducing the number of model parameters and hence are less prone to overfitting. Moreover, the structure helps in interpreting the learned model parameters. I will show applications to stereo, motion and image reconstruction.

9:00	Limitations & Caveats of Deep Learning
	Jeffrey Fessler
	This presentation will describe data-driven methods for image reconstruction, including adaptive dictionaries, sparsifying transforms, convolutional neural network (CNN) models, and deep learning techniques. It will also discuss limitations and challenges of such methods.

9:30	Break & Meet the Teachers

Weekend Course

Physics for Physicists: Part 1

Organizers: Matthias Günther, Herbert Köstler

N02	Saturday 8:00 - 9:40	*Moderators:* Michael Steckner & Susann Boretius

8:00	MRI: The Classical Description
	Adrienne Campbell-Washburn
	This lecture will cover the basics of MRI physics and image formation using the classical description. It will describe the basic concepts in magnetic moments, net magnetization of tissue and precession, as well as the manipulation of magnetization using RF pulses and magnetic field gradients to generate an image. Spin echoes and gradient echoes will be described along with the basics of T_1 and T_2 relaxation and their effect on image contrast. The Bloch equations will be used to summarize the evolution of magnetization and pulse sequence diagrams will be introduced to describe image formation.

8:25	MRI: A Systems Overview
	Ralf Loeffler
	MRI systems consist of 3 main components plus computer systems for user interaction, measurement control and signal processing. The 3 components are dedicated to static and gradient magnetic field generation, as well as the RF system for RF transmission and reception. While the purpose of the components has not changed over time, actual implementation has due to technological advances as well as demands by new MRI techniques. This talk will present the basic designs for the different components and discuss current implementations and potential future developments.

8:50	Bioeffects & Hazards from Static Field, Gradient, & RF Exposures
	Johan van den Brink
	This talk provides an overview of the MR safety risks and its scientific background

9:15	T1- & T2-Contrasts & Their Molecular Origin

	Siegfried Stapf
	This tutorial aims at introducing the molecular mechanisms behind the relaxation times, and possible pitfalls in their experimental determination. The focus of the contribution is on the field-dependence of relaxation times, the importance of parasitic effects, and on addressing non-exponential signal behavior in a quantitative manner.

9:40	Break & Meet the Teachers

Weekend Course

Introduction to fMRI: Basics & Applications: Part 1

Organizers: Richard Buxton, Benedikt Poser, Joshua Shimony

N03	Saturday 8:00 - 9:40	*Moderators:* Jonathan Polimeni & Joshua Shimony

8:00	BOLD Signal Physiology
	Nicholas Blockley
	To understand the strengths and limitations of functional MRI we must understand the interaction between the physiology of the brain and the physics of the measured signal. In this talk I will introduce the major physiological drivers of the Blood Oxygenation Level Dependent (BOLD) effect and describe how they affect the MRI signal. We can then use this knowledge to consider how stimulus evoked changes in the BOLD signal can be quantified as changes in oxygen metabolism. Whilst the BOLD signal is considered to be complex, through this understanding, we can observe it provides a rich source of physiological information.

8:25	Practical BOLD Acquisition Consideration
	Kevin Murphy
	In this educational course, we will explain basic BOLD scanning parameters; what they mean and how they interact with each other. We will discuss ways to improve BOLD time series quality using external recordings of physiology. Finally, we will touch on complementary MRI sequences that can further denoise BOLD fMRI time series.

8:50	Basic Analysis of Task-Based fMRI
	Susan Francis

	The general linear model (GLM) is one of the most commonly used methods to analyse task-based fMRI data. This talk outlines the basic concepts of the GLM, how it is used to study block and event-related paradigms and associated statistical analysis, as well as some example applications. The talk will then describe some limitations of a GLM, and briefly outline alternative methods to study task-based fMRI paradigms, such as the phase-encoding or travelling-wave method, and independent component analysis.

9:15	Introduction: Resting-State Functional Connectivity
	Jonathan Power
	"Functional connectivity" or "resting state" MRI has become commonplace in neuroscience over the last decade, and is increasingly used for clinical studies. This talk introduces some of the central concepts and findings in resting state fMRI. Earlier talks will cover fMRI data acquisition, this talk will mainly discuss data analysis and interpretation. This talk will open by introducing a convenient way to visualize fMRI scans, and then will use this approach to visually fractionate resting state fMRI data (via multi-echo analyses) into non-BOLD and BOLD signals. Only BOLD signals are typically thought to be of interest, but both kinds of signals are prevalent in fMRI scans, and both kinds of signals correlate with cognitive and behavioral variables of interest, making it important to recognize the signatures of each kind of signal. We will discuss the spatial and temporal manifestations of these signals and illustrate how these signals influence functional connectivity properties. We will illustrate how individual denoising techniques remove particular kinds of signals, and that no single denoising technique removes all unwanted signals from a dataset. Effective denoising requires multiple simultaneous approaches to best isolate BOLD signals of interest.

9:40	Break & Meet the Teachers

Weekend Course

MR Systems Engineering: Part 1

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Saturday 8:00 - 9:30	*Moderators:* Christoph Juchem & Sebastian Littin

8:00	MR Systems Overview
	Hubertus Fischer
	This educational talk provides a comprehensive overview on the building blocks of a clinical MR system. It concentrates on the essential functions to generate and to detect an MR signal, and how to achieve spatial resolution. It provides short look into the field generating unit, the RF transmit and receive system as well as the real time control unit. These topics outlined briefly as it is covered in detailed lectures of this session. The MR Systems overview is completed by covering the patient interface (patient table, communication and physiological triggering) and support functions as cooling, component supervision and RF shielding.

8:30	Magnets: Design, Manufacturing, Installation, Present & Future Technology
	Ben Parkinson
	This is an educational presentation to give ISMRM participants an understanding of the design and manufacturing processes required to produce a typical MRI magnet. The presentation explains the background to the magnetic field requirements for MRI and, using a worked example, explains typical MRI magnet design and the constraints under which that design occurs. In addition to the electromagnetic design, focus is placed on different cryogenic solutions for MRI magnets, and practical implementation of magnet design aspects.

9:00	Shimming: Superconducting & Passive Shims; Higher-Order Shims, Shim Arrays & Dynamic Shimming
	Vincent Boer
	Magnetic resonance imaging (MRI) and spectroscopy (MRS) rely on a strong and highly homogeneous magnetic field inside the scanner. Although magnets have a highly sophisticated design, there are still several techniques used to homogenize the field. Secondly, all biological samples will induce (dynamic) distortion in the field due to the tissue magnetic susceptibility. In this part of the course both passive shimming of a magnet, as well as active shimming with a subject in the magnet, will be discussed. Furthermore, several new advanced shimming strategies have emerged recently, some of the most promising ones will be discussed.

9:30	Break & Meet the Teachers

Weekend Course

Advanced Clinical MR Imaging in MSK: Part 1

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S01	Saturday 8:00 - 9:30	*Moderators:* Paolo Felisaz & Matthew Koff

8:00	Rapid MR (3D, CS, Machine Learning)
	Garry Gold
	This presentation will cover new methods for rapid three-dimensional musculoskeletal imaging, including compressed sensing and machine learning methods.

8:30	Shoulder
	Luis Beltran
	This presentation will discuss imaging of the shoulder with an emphasis on operative management of anterior shoulder instability and rotator cuff tears. The learning objectives are to a) understand the mechanisms of injury and associated pathologies in anterior shoulder instability and rotator cuff tears, b) be familiar with current treatment guidelines for management of anterior shoulder instability and rotator cuff disease, c) recognize the normal and abnormal appearances of postoperative MRI studies for anterior shoulder instability surgery and rotator cuff repairs. I give permission to record this presentation.

9:00	Advanced Imaging in Hand & Wrist in Common Rheumatologically & Traumatic Conditions
	Mikael Boesen
	The lecture will show the conventional ways of imaging most common rheumatically and traumatic conditions in the hand and wrist and show the potential added value of new 3-dimensional and multi-parametric imaging technologies like dynamic contrast enhanced MRI (DCE-MRI), PET-CT and PET MRI, ultrasound, dual energy- and conebeam CT of the hand and wrist as promising methods to complement the imaging portfolio that adds further to the understanding and quantification of the pathophysiology, inflammatory load and morphological disease patterns in patients with rheumatoid arthritis (RA), psoriasis arthritis (PsA), crystal deposition diseases (Urate and CPPD), osteoarthritis (OA) and trauma.

9:30	Break & Meet the Teachers

Weekend Course

Body MRI: Realities & Controversies: Expanding the MRI Clinical Frontier

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Saturday 8:00 - 9:30	*Moderators:* Dow-Mu Koh & Mark Schiebler

8:00	Current State of the Art
	Hersh Chandarana

	Abdominal or Body MRI suffers from number of limitations such as (1) slow and inefficient acquisition (2) sensitivity to motion related artifacts and (3) limited volumetric coverage and spatial resolution which are constrained by the breath-hold capacity of the patients. Various methods are used clinically and are being investigated to overcome these limitations in order to permit motion robust and rapid imaging of the abdomen. This talk will briefly discuss some of these methods for (1) fast imaging and (2) motion compensated imaging of the abdomen.

8:22	Non-Vascular Thoracic MRI
	Constantine Raptis
	Despite advances in imaging unit technology and research in the field, the utilization of thoracic MRI in regular clinical practice for noncardiac and nonangiographic applications has lagged behind expectations. While there are several clinical scenarios in which nonvascular thoracic MRI has a potential primary role, it is at present most frequently utilized as a problem solving modality to answer specific questions that cannot be determined via other imaging modalities, most commonly CT. The purpose of this talk is to explore commonly encountered situations in which thoracic MRI can be utilized to its fullest extent as a problem solving modality.

8:44	Body MR in ED
	Bobby Kalb
	Magnetic resonance imaging is increasingly being used in the emergency department setting, and offers potential advantages related to safety, diagnostic accuracy and efficiency, compared to the more commonly utilized modalities of CT and ultrasound. This presentation will describe methods for advantages of performing MRI in the ED for acute abdominopelvic pain and also PE, in addition to detailing suggested imaging protocols and techniques.

9:06	Whole-Body Imaging
	Taro Takahara

9:30	Break & Meet the Teachers

Weekend Course

Analyzing the Brain: New Paradigms: Part 1

Organizers: Qiyong Gong, Kei Yamada

S03	Saturday 8:00 - 9:30	*Moderators:* Qiyong Gong & Kei Yamada

8:00	Optimizing Acquisition for Robust MR Data
	James Pipe

8:22	Standardization Challenges: Multi-Site
	Thomas Chenevert

8:44	Population-Based Neuroimaging for Disease Etiology & Prediction
	Meike Vernooij
	Many neurological diseases, especially those occurring at older age, have a long subclinical phase during which a person is asymptomatic and does not seek medical attention. As a consequence, once symptoms manifest, in many instances the pathologic changes caused by the disease process are already advanced and mostly irreversible. To study disease in the asymptomatic stage, population-based studies are of great importance. Medical imaging applied in these studies, or 'population imaging' can, non- or minimally-invasively, show the changes that occur in the human body that may reflect either early disease, intermediate factors or risk indicators of disease.

9:06	Automatic Segmentation
	Susumu Mori
	In this presentation, the basic concept of anatomical segmentation is explained. This presentation first discusses about the importance of tissue segmentation for modern medical data analysis, in which difficult neurological conditions are often the target of the research. Then different types of segmentation approaches are explained. In the last section, an interesting paradox of the tissue segmentation, namely the lack of ground truth, is discussed in detail. This presentation should be informative for both method developers and users.

9:28	Break & Meet the Teachers

Weekend Course

Molecular Imaging for Beginners: Part 1

Organizers: Ichio Aoki, Arvind Pathak

S04	Saturday 8:00 - 9:15	*Moderators:* Christin Sander & Arvind Pathak

8:00	Introduction to MR Molecular Imaging
	Peter Caravan

8:25	Multimodality Molecular Imaging for Beginners
	Kristine Glunde
	Multimodality molecular imaging applies imaging modalities beyond visualizing anatomy and morphology to include the ability of imaging disease-specific biomolecules and pathways in cancer, cardiovascular disease, and inflammation, among others. Imaging modalities used in molecular imaging are computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance spectroscopic imaging (MRSI), optical imaging, positron emission tomography (PET), single-photon-emission computerized tomography (SPECT), and ultrasound (US). This lecture will give an overview of the most important concepts and applications in multimodality molecular imaging for beginners.

8:50	Fundamentals of MR Relaxation for Molecular Imagers
	Silvio Aime

9:15	Break & Meet the Teachers

Weekend Course

Deep Learning: Everything You Want to Know: Part 2

Organizers: Daniel Sodickson, Joshua Trzasko

N01	Saturday 10:00 - 11:30	*Moderators:* Dong Liang & Joshua Trzasko

10:00	Applications: Image Acquisition & Reconstruction
	Leslie Ying
	Deep learning, as a powerful tool for artificial intelligence, has attracted a lot of attention in the MRI community. Recently deep learning has shown success in image acquisition and reconstruction. It has demonstrated some unique benefits over the existing methods. This course will teach how to use deep learning to perform image reconstruction from acquired k-space data.

10:30	Applications: Image Processing, Analysis & Interpretation
	Daniel Rueckert
	We will give an overview of the current state-of-the-art in deep learning for medical imaging applications such as segmentation and classification. In particular We will illustrate deep learning approaches for semantic image segmentation based on Convolutional Neural Networks (CNN). We will also show how adversarial approaches can be used to train CNNs that invariant to differences in the input data (e. g. different scanners and imaging protocols), and which does not require any labelled data for the test domain. Finally, we show some applications of CNNs in the context of image classification.

11:00	How to Jump-Start Your Deep Learning Research
	Florian Knoll
	This talk will provide a practical hands-on overview of how to get started in machine learning research from the point of view of an imaging lab. Common hurdles and pitfalls will be discussed via didactic examples from classification and reconstruction. The key differences of medical imaging data and computer vision applications will be highlighted. The talk will also discuss software frameworks and implementation, including code demos, which will be made available as open source.

11:30	Adjournment & Meet the Teachers

Weekend Course

Physics for Physicists: Part 2

Organizers: Matthias Günther, Herbert Köstler

N02	Saturday 10:00 - 11:15	*Moderators:* Susann Boretius & Michael Steckner

10:00	Spatial Encoding (Introduction to k-Space, MRI as a Linear & Stationary System, PSF, MTF, Nyquist)
	Tobias Wech
	This presentation will provide an introduction to the k-space formalism. MRI will be approximated as a linear and stationary system and the point spread function as well as the modulation transfer function will be introduced as descriptive tools. Finally, the sampling-theorem of Nyquist and Shannon will be discussed with respect to classical MRI and newer techniques like compressed sensing or MR-fingerprinting.

10:25	How to Get the Optimal Signal-to-Noise
	Claudia Hillenbrand
	Acquiring an optimal image for clinical applications often means to strike the right balance between resolution, scan time, and signal to noise (SNR) in order to achieve the desired imaging objectives. The SNR is a fundamental measure of quality and performance in MRI. This presentation will review the basic principles relevant to signal and noise, measurement of SNR, factors influencing SNR, and discuss techniques that attempt to optimize SNR.

10:50	More than One RF-Pulse: Echoes & Phase Graphs
	Matthias Weigel
	The basic ideas and the resulting potential of the Extended Phase Graph (EPG) concept are described. It represents an elegant means for the pictorial and quantitative depiction of the resulting magnetization response in multi pulse sequences. EPGs also aid in the understanding and classification of echo generation. Based on these powerful properties and possibilities, the EPG concept has got a lot of attention during the last years. Additionally, the syllabus provides a collection of known and less known references.

11:15	Lunch & Meet the Teachers

Weekend Course

Introduction to fMRI: Basics & Applications: Part 2

Organizers: Richard Buxton, Benedikt Poser, Joshua Shimony

N03	Saturday 10:00 - 11:40	*Moderators:* Jonathan Polimeni & Joshua Shimony

10:00	Clinical fMRI: Presurgical Mapping
	Alberto Bizzi

10:25	Clinical fMRI: Psychiatric Applications
	Xiaoqi (Juliana) Huang

	Psychiatric disorders traditionally have been classified as broad syndromes defined by symptoms rather than underlying neurobiologic substrate. The ability to visualize and quantify brain function, in vivo, noninvasively, is particularly important for psychiatric disorders. Recently, BOLD-fMRI has been widely used to identify brain functional or physiologic abnormalities in patients with psychiatric disorders. This lecture will introduce how the BOLD-fMRI can help us know more about psychiatric disorders in terms of mechanism, prediction and classification. This understanding will lay a foundation for building imaging biomarkers for psychiatric disorders.

10:50	ASL techniques for perfusion and/or BOLD imaging
	Dimo Ivanov
	Arterial spin labeling (ASL) enables non-invasive, quantitative MRI measurements of tissue perfusion, and has a broad range of applications including functional brain imaging. ASL can concurrently measure perfusion and blood oxygenation level dependent (BOLD) signal changes, which proves useful for investigating the brain's physiology in health and disease. However, ASL suffers from limited temporal resolution and has a lower signal-to-noise ratio (SNR) compared to conventional BOLD imaging. In this lecture, the functioning, advantages, disadvantages and application areas of ASL will be summarized. Furthermore, the acquisition approaches and imaging parameters that influence ASL's SNR and temporal resolution will be reviewed.

11:15	BOLD & EEG/MEG
	Rene Scheeringa
	Electrophysiological and hemodynamic measures are the two most prominent tools to study brain function non-invasively in humans. The two methodological approaches are thought to provide complementary information on how the brain functions. For this it is important to understand how these two methodologies are related. In this lecture I will mainly focus on how neural oscillations relate to BOLD/fMRI. I will explore how neural oscillations recorded both invasively, and with MEG and EEG relate to the BOLD signal and present my own work that relates neural oscillations to laminar specific changes in the BOLD signal and fMRI-based connectivity.

11:40	Adjournment & Meet the Teachers

Weekend Course

MR Systems Engineering: Part 2

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Saturday 10:00 - 11:30	*Moderators:* Christoph Juchem & Sebastian Littin

10:00	Gradient Coil Design Considerations, Manufacturing & Limitations
	Richard Bowtell
	Magnetic resonance imaging relies on the use of magnetic field gradients – that is a magnetic field, B (r) which varies linearly withposition, r, such that B (r) = G.r – to spatially encode the NMR signal. Such gradients are generated by passing currents throughspecially arranged coils of wire, placed on a former that surrounds the imaging subject. Three separate coils are needed in order toproduce a linear variation of the z-component of the magnetic field along each of the three Cartesian directions (x, y and z). Theperformance of the gradient coils and the amplifiers that are used to drive them dictates the kind of gradient waveforms that can beused in an MR scanner, particularly controlling the maximum gradient strength and rate of change of gradient with time that can be employed. Since the use of strong and rapidly switched gradients generally improves image quality and the speed of imagea cquisition, considerable benefits can result from optimising gradient coil performance.

10:30	Gradient Drivers: Amplifier Considerations, Power, Tuning & Cooling
	Juan Sabate
	Improvements in magnetic resonance imaging (MRI) require increased performance of the gradient amplifier. The objective of the presentation is to provide a description of the gradient amplifier functionality as part of the gradient system and to explain the design of the amplifier to meet the MRI requirements. PSDs reproduction fidelity and power needed for gradient fields requires switched amplifiers. The fidelity is achieved using digital control with high control bandwidth, feedforward and adequate compensations. New SiC semiconductors reduce losses keeping high performance and reducing volume and cost. The presentation provides detailed description of high-performance amplifier implementation and test results.

11:00	Eddy Currents & Interactions: Characterization & Compensation
	S. Johanna Vannesjo
	Magnetic resonance imaging relies on the ability to produce spatially linear magnetic fields (i.e. gradient fields) with a defined temporal evolution. This is achieved with room-temperature gradient coils, through which time-varying currents are passed. The resulting change in magnetic field will however induce eddy currents in nearby conducting structures according to Faraday’s Law of induction. This distorts the time-course of the gradient fields, leading to artefacts in imaging and spectroscopy. This presentation will give an overview of how eddy currents are generated, how to characterize them and how to compensate for their effects on the field.

11:30	Lunch & Meet the Teachers

Weekend Course

Advanced Clinical MR Imaging in MSK: Part 2

Organizers: Jenny Bencardino, Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S01	Saturday 10:00 - 11:30	*Moderators:* Paolo Felisaz & Matthew Koff

10:00	Peripheral Nerves
	Zehava Rosenberg
	This talk will focus on MR imaging of peripheral nerve of the knee, ankle and foot. The talk will be subdivided into two parts. A. A discussion of general MRI features of entrapment neuropathies in the lower extremity. The listener will be provided with distinctive direct and indirect features of neuropathy. B. Focused discussion of specific nerves commonly susceptible to neuropathy, with a brief initial review of normal anatomy followed by MRI examples of common neuropathies.

10:30	Imaging Around Metal (Physics)
	Kevin Koch

11:00	Hip
	Andoni Toms

11:30	Lunch & Meet the Teachers

Weekend Course

Body MRI: Realities & Controversies: Liver Imaging

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Saturday 10:00 - 11:30	*Moderators:* Shetal Shah & Bachir Taouli

10:00	MRI Diffuse Liver Disease
	Shahid Hussain

10:22	Imaging of the Portal Venous System

	Reena Jha
	Radiologists commonly encounter portal venous abnormalities. Understanding the varying appearances of acute and chronic portal venous thromboses and the associated changes of hepatic enhancement patterns is important for patient management. Furthermore, it is important to recognize that portal venous thrombosis may change the contour of the liver, and simulate cirrhosis. Congenital and acquired chronic portal vein thrombosis may lead to the development of hepatic masses, and may alter the appearance of the bile ducts and mimic malignancy.

10:44	Liver Lesions: Malignant
	Thomas Vogl
	In summary, liver imaging has found its place in the reality of cross-sectional imaging. The use of contrast agent is still controversial. Here further developments are directed in order to improve the qualitative and quantitative information. Artificial intelligence techniques will integrate multiparametric MRI information in the concept of radionics and radiogenomics.

11:06	Biliary Imaging & Pathology
	Mi-Suk Park
	In this talk, I will present differential diagnosis of biliary lesions based on imaging phenotypes with pathologic correlation. And then TNM staging with pathologic correlation will be reviewed based on the 8th edition of NCCN guidelines.

11:28	Lunch & Meet the Teachers

Weekend Course

Analyzing the Brain: New Paradigms: Part 2

Organizers: Qiyong Gong, Kei Yamada

S03	Saturday 10:00 - 11:30	*Moderators:* Qiyong Gong & Kei Yamada

10:00	Lesion Detection (MS, Vascular Lesions)
	Shingo Kakeda

	The role of brain MRI in diagnosis of multiple sclerosis (MS) and vascular lesions is well established, and the recently developed MR techniques, including synthetic MRI, myelin map with q-Space diffusion MRI, susceptibility-weighted imaging (SWI) and quantitative susceptibility mapping (QSM), further improve the diagnostic value in a research and clinical routine setting. This course will introduce the recent data pertaining to the use of new MR techniques in assessing MS lesion and small vascular lesions (cerebral microinfarcts).

10:22	Graph-Theory Brain Network Analysis
	Yong He

10:44	Adversarial generative network - new generation of image generation
	Masayuki Ohzeki
	We introduce a concept of the generative adversarial network and consider its possibility of medical application.

11:06	Machine Learning II (For Medicine)
	Bradley Erickson
	This session will describe the basic concepts of machine learning, both traditional machine learning and deep learning. Particular emphasis will be placed on how ML methods can give results that appear good, but may not be correct or representative of real world performance.

11:28	Adjournment & Meet the Teachers

Weekend Course

Molecular Imaging for Beginners: Part 2

Organizers: Ichio Aoki, Arvind Pathak

S04	Saturday 10:00 - 11:40	*Moderators:* Christin Sander & Arvind Pathak

10:00	MR Spectroscopy - The Forgotten Molecular Imaging Modality

	Robin de Graaf
	MR-based molecular imaging typically relies on the high detection sensitivity of water to indirectly observe the underlying molecular and cellular processes. The ubiquitous presence of water demands that image contrast and specificity is obtained through molecular imaging probe design. MR spectroscopy uses the *intrinsic* specificity provided by the chemical shift to allow detection of a wide range of metabolites and metabolic pathways. When combined with spatial imaging gradients, MR-based metabolic imaging can provide a unique and complementary addition to the arsenal of molecular imaging techniques.

10:25	Principles of Probe Design for Molecular Imagers
	Horacio Cabral
	Molecular imaging allows the visualization of biological events in real-time at tissue, cellular and subcellular levels in living systems by merging conventional imaging techniques with probes designed to report the expression of biomarkers or variations in physiological factors. Successful molecular imaging agents should provide high contrast intensity with low noise-to-signal ratio at the target in vivo for sufficient time. Herein, I recapitulate the principles for designing effective molecular imaging probes for various imaging modalities, and provide fundamental strategies for the development of these probes and their application in biology, diagnosis and therapy.

10:50	Introduction to "Cellular" Molecular Imaging
	Ben Bartelle

11:15	How to Design a Molecular Imaging Experiment
	Emmanuel Barbier
	This course will address the steps that a beginner should follow to develop a molecular imaging experiment in small animals: after setting the target and choosing the appropriate animal model, we will evaluate the pros and cons of existing imaging modalities, with a focus on MRI data acquisition and integration during post-processing. Examples will be taken from oncology and neuroscience.

11:40	Adjournment & Meet the Teachers

Weekend Course

Statistical Analysis for Imaging Studies: Part 1

Organizers: Jennifer Keegan, Dwight Nishimura

N01	Saturday 13:15 - 14:45	*Moderators:* Jayashree Kalpathy-Cramer & Jennifer Keegan

13:15	Designing Studies of Diagnostic Imaging
	Susan Mallett

13:40	Basic Concepts in Measurement Error
	Alice Sitch

14:05	Break & Meet the Teachers

14:20	Study Designs and Bias
	TBD

14:45	Monitoring Studies
	Alice Sitch

15:10	Break & Meet the Teachers

Weekend Course

Physics for Physicists: Part 3

Organizers: Matthias Günther, Herbert Köstler

N02	Saturday 13:15 - 14:55	*Moderators:* Patricia Figueiredo & Maxim Zaitsev

13:15	Spin Echo, RARE, GRASE
	Jürgen Schneider

	Starting from the basic spin-echo sequence, this talk will subsequently introduce more advanced imaging sequence, which are based on multiple refocusing pulses. Advantages and technical challenges for these sequences will be discussed, and example applications will be given.

13:40	Gradient Echo Sequences
	Oliver Bieri
	The fundamental signal generation in magnetic resonance imaging (MRI) sequences is based on the principle of either spin echoes or gradient echoes or a combination of the two. This course elucidates concepts and basic properties of gradient echo methods with a special focus on fast gradient echo sequences.

14:05	Basic Preparation of Image Contrast
	Ute Goerke
	The lecture covers the basic principles of the molecular origin of image contrast, how the choice of sequence type and imaging parameters influence contrast and the implementation of additional sequence components to create a specific image contrast. The theory behind the presented concepts will be discussed and illustrated with examples from relevant applications.

14:30	RF Pulse Design
	Markus Barth
	This course part will cover the concepts to understand the theory and implementation of radiofrequency (RF) pulses including the small tip angle tip angle approximation, the Shinnar-LeRoux (SLR) algorithm and numerical methods.

14:55	Break & Meet the Teachers

Weekend Course

Advanced fMRI: Connectivity & Cutting Edge: Part 1

Organizers: Richard Buxton, Benedikt Poser, Joshua Shimony

N03	Saturday 13:15 - 14:30	*Moderators:* Shella Keilholz & Benedikt Poser

13:15	Connectivity: Analysis
	Mark Lowe
	An overview of current analysis methods for assessing functional connectivity using resting state fMRI data. A brief review of important preprocessing steps necessary for quality resting state data as well as various complex network analysis methods, including structural equation modeling, clustering methods and graph theoretic methods. Dynamic functional connectivity methods are briefly discussed.

13:40	A Multi-modal Parcellation of Human Cerebral Cortex
	Matthew Glasser
	We will discuss the Human Connectome Project's multi-modal cortical parcellation version 1.0—the data acquisition and analysis requirements, how the parcellation was made, and how it can be applied to individuals. This state of the art map of the cerebral cortex was made possible by using exceptionally high quality MRI data precisely aligned across individuals. Cortical areal boundaries were identified when visible in multiple modalities and areas were painstakingly related to the neuroanatomical literature. A machine learning classifier was then trained to automatically identify each cortical area based on its multi-modal fingerprint in individual subjects, replicating the parcellation.

14:05	fMRI Connectivity, Depression, and Anhedonia: a Bayesian network analyses in Schizophrenia, Bipolar Disorder, ADHD, and Healthy Controls
	Ariana Anderson
	Although MRI, fMRI, and genetic biomarkers have been implicated in depression, it is unclear how much these measures illuminate the disorder compared to behavioral and demographic measurements. Using these measurements, we predicted depressive symptoms to compare the effect size of these modalities. In 119 subjects with a diagnosis of Bipolar disorder (n=43), Schizophrenia (n=39), and ADHD (n= 37), random forests models predicted both generalized depression (Hopkin Symptom Checklist) and anhedonia-specific measures (Chapman Scales for Physical and Social Anhedonia) using genetic, structural MRI volumetric measures, resting-state fMRI network connectivity measures, demographic features, and behavioral assessments measures. We found that comorbid behavioral symptoms accounted for nearly 75% of predictive ability. When removing behavioral assessments, only 8.75% of variance in the depression symptom scores were predictable from neuroimaging, demographic, genetic measures. Demographics retained the strongest predictive ability.

14:30	Break & Meet the Teachers

Weekend Course

MR Systems Engineering: Part 3

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Saturday 13:15 - 14:45	*Moderators:* Christoph Juchem & Sebastian Littin

13:15	RF Transmit: Power Delivery, Decoupling & Duty Cycle
	Natalia Gudino
	This talk will cover different RF engineering methods used in the design and implementation of transmit systems currently available in clinical MRI settings and research sites.

13:45	RF Receivers: Signal Detection Chain, Digitization, System Noise Figures - from MRI Signal to Bits
	Nicola De Zanche
	This lecture covers the components of the RF chain from detection of the signal in the RF coil to its final representation as digital data. Each component is described and its effect on signal strength and quality is discussed.

14:15	Controlling the MR Subsystems: Pulse Sequence Control, Waveform Generation & Real-Time Control
	Juan Santos
	Lecture for scientists and clinicians interested in learning more details about the core software structure and control systems of an MRI machine.

14:45	Break & Meet the Teachers

Weekend Course

Advanced Clinical MR Imaging in MSK: Part 3

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S01	Saturday 13:15 - 14:45	*Moderators:* Emily McWalter & Alissa Burge

13:15	Knee

	Jung-Ah Choi
	The purpose of lecture is to review and apply current and emerging techniques in MR imaging of the knee joint.

13:45	Foot/Ankle
	James Linklater

14:15	Body composition, Lipid & Fat Imaging
	Martin Torriani
	Body composition can be assessed using multiple imaging modalities, such as CT, MRI, MRS and PET, and provide valuable information in conditions associated with abnormal lipid distribution.

14:45	Break & Meet the Teachers

Weekend Course

Body MRI: Realities & Controversies: Other GI Imaging

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Saturday 13:15 - 14:45	*Moderators:* Jeffrey Brown & Naranamangalam Jagannathan

13:15	DWI for the Pancreas
	Yashihiko Fukukara
	DWI reflects changes in water mobility caused by interactions with cell membranes, macromolecules, and alterations to the tissue environment. It enables quantitative assessment of tissue diffusivity based on the apparent diffusion coefficient. Advances in image quality have made DWI a routinely implemented clinical protocol for the pancreas, as it can be performed relatively quickly and has excellent contrast resolution without the administration of contrast agents. DWI is a promising technique for the evaluation of pancreas tumors, including detection, characterization, monitoring treatment response, and prediction of patient prognosis. Its role in the above mentioned clinical settings will be discussed.

13:37	MR Enterography
	Jordi Rimola
	In this lecture we are going to discuss the key signs for detecting and grading active inflammation and characterizing complications, in particular strictures. We also highlight the current limitations of the technique and potential ways to overcome them.

13:59	MRI of Perianal Fistula
	Ellie Korngold

14:21	Advances in Abdominal Imaging
	Shreyas Vasanawala

14:45	Break & Meet the Teachers

Weekend Course

MR for Neuropsychiatric Disorders: Part 1

Organizers: Qiyong Gong, John Port

S03	Saturday 13:15 - 14:45	*Moderators:* Qiyong Gong

13:15	Overview of MR Brain Methods
	Kelvin Lim
	Magnetic resonance has the advantage of having multiple acquisition methods and parameters that result in the collection of different types of information. This capability to collect multimodality information has made MR a critical tool for the study of neuropsychiatric disorders. This presentation will provide an overview of the multiple modalities available with MR. Part 1 will provide an intuitive conceptual framework for comparing and contrasting the different modalities available with MR. in Part 2, we will use this framework to compare and contrast the major MR modalities, focussing on the following categories of information: Anatomy, Diffusion, Function and Spectroscopy.

13:45	MR of Aging and Dementia

	Prashanthi Vemuri
	Universally observed cognitive decline in the elderly due to the pathological aging of the brain will have a significant impact on public health. This presentation will aid in understanding 1) the recent advances in the field of aging and dementia; 2) MR methodologies that are used for the evaluation of age and dementia related brain changes specifically due to Alzheimer's disease pathophysiology and cerebrovascular disease as tools for diagnosis, prognosis, measuring disease progression, and mechanistic inferences into the disease process in cognitive aging and dementia; and 3) open questions and directions in this research area for MR.

14:15	MR of Depression/Bipolar Disorders
	Su Lui
	Depression is a heterogeneous condition. Some patients who meet symptom criteria for major depressive episode (MD) also identify with bipolar disorder (BD). Until now, there are no objective markers for differentiating MD and BD, and also for early diagnosis, risk evaluation and treatment options. We reviewed the MRI findings of structural and functional alternations in MD and BD at the time of premorbid, before treatment and after treatment with multi-modal MRI image data. The research above provided the possibility of diagnosis, finding out high-risk individuals before disease and predicting treatment effects by MRI.

14:45	Break & Meet the Teachers

Weekend Course

Novel Approaches in Molecular Imaging: Part 1

Organizers: Natalie Serkova, Damian Tyler

S04	Saturday 13:15 - 14:45	*Moderators:* Natalie Serkova & Damian Tyler

13:15	PET-MRI: The Technical Aspects
	TBD

13:37	PET-MRI: The Application
	Andreas Kjaer

13:59	Hyperpolarized 13C MRI: The Technical Aspects from Hamiltonian to Homo sapien
	Jack Miller
	We will examine the mechanistic details behind dissolution-Dynamic Nuclear Polarisation with small molecules for in vivo applications, and additionally discuss some of the technical challenges that arise in the design of pulse sequences to use the magnetisation that the technique generates.

14:21	Hyperpolarized 13C MRI: The Application
	Jessica Bastiaansen

14:43	Break & Meet the Teachers

Weekend Course

Statistical Analysis for Imaging Studies: Part 2

Organizers: Jennifer Keegan, Dwight Nishimura

N01	Saturday 15:15 - 16:30	*Moderators:* Jayashree Kalpathy-Cramer & Jennifer Keegan

15:15	Understanding Variability Including Inter-reader and Intra-reader Studies
	Alice Sitch

15:45	Advanced Methods & Reporting
	Susan Mallett

16:15	Adjournment & Meet the Teachers

16:45	Reporting Guidelines and Making Your Research Useful
	TBD

Weekend Course

Physics for Physicists: Part 4

Organizers: Matthias Günther, Herbert Köstler

N02	Saturday 15:15 - 16:30	*Moderators:* Patricia Figueiredo & Maxim Zaitsev

15:15	Susceptibility, Flow, Chemical Shift, Motion Artifacts & Imaging
	Frederik Laun
	Following this lecture, the audience will understand the effect of magnetic susceptibility, flow, chemical shift, and motion on MRI. They will be able to use this knowledge to identify and minimize related artifacts or, alternatively, to measure the underlying effects.

15:40	EPI as Workhorse for Diffusion, Perfusion, fMRI....
	Penny Gowland
	Traditionally MRI is used to produce high quality, high resolution images of the human anatomy. However it is also has the capacity to capture a range of dynamic processes in the body, and one of the best imaging sequences for doing this is EPI. This talk will consider the advantages and disadvantages of EPI as a readout scheme, its use in quantitative imaging and in imaging dynamic processes.

16:05	Arbitrary Trajectories: ACQ, Gradients, Reconstruction, Artifacts
	S. Johanna Vannesjo
	Cartesian k-space sampling on a regular grid provides optimal conditioning for image reconstruction. Yet, there are several reasons why it can be beneficial to deviate from the regular Cartesian sampling scheme. It may for example be to achieve faster coverage of k-space, to make use of self-navigating properties, to shape the point-spread function or to reduce the echo time. The most commonly used non-Cartesian acquisitions are radial and spiral sampling, but a large range of advanced sampling schemes have been explored. This presentation will cover basic considerations related to arbitrary sampling, from gradient waveform design to image reconstruction.

16:30	Adjournment & Meet the Teachers

Weekend Course

Advanced fMRI: Connectivity & Cutting Edge: Part 2

Organizers: Richard Buxton, Benedikt Poser, Joshua Shimony

N03	Saturday 15:15 - 16:55	*Moderators:* Shella Keilholz & Benedikt Poser

15:15	BOLD Acquisition Beyond 2D EPI
	Wietske van der Zwaag
	Although the vast majority of fMRI studies is still performed with 2D-EPI, there are several other BOLD-sensitive sequences, available on most clinical platforms, that may perform better. The main alternatives to 2D-EPI are 3D-EPI and SMS-EPI, although EVI, MR-encephalography, ME-EPI and SE-EPI have also recently gathered interest. All these sequences will be discussed and compared to one another in terms of their strengths, weaknesses and artifacts. Specific situations in which a specific sequence would be preferred will be used to highlight the relevant strong points.

15:40	fMRI Acquisition Beyond BOLD
	J. Jean Chen
	Although the BOLD signal has been the workhorse of fMRI, BOLD fMRI is limited by its intrinsic T2/T2* sensitivity and exhibits exaggerated weighting towards large veins. Moreover, the BOLD signal is a relative rather than quantitative measure of brain function that depends on the interplay of perfusion and oxygenation, leaving room for ambiguous interpretation. This talk will summarize recent efforts to explore alternative fMRI methods, including those based on blood flow, blood volume and blood oxygenation. The applications of these methods in both task-based and resting-state studies will be introduced.

16:05	High Resolution Applications: Cortical Layers
	Jonathan Polimeni
	Laminar fMRI refers to the study of functional activation *within* the cerebral cortex, with the goal of detecting distinct functional activity within cortical layers, and is an emerging application of high-resolution fMRI. Although individual cortical layers cannot be resolved with current human fMRI techniques, and hemodynamic coupling and variation of fMRI signals across layers is incompletely understood, because of the roles cortical layers play in distributed neuronal processing measuring layer-specific activation is key to understanding brain circuitry, which motivates work towards surmounting these difficulties. This presentation will introduce laminar fMRI, summarize recent advances, and focus on challenges faced when interpreting these data.

16:30	Combining fMRI with Advanced Neurotechniques
	Xin Yu

	By combining fMRI with fiber optic calcium recording and optogenetics, as well as two-photon microscopy or convetional optical imaging techniques, the circuit-specific regulatory mechanism of the unique neuro-glial-vascular (NGV) interaction model can be studied at varied brain states in animals. Combine fMRi with advanced neurotechniques provides very powerful methodological platforms to deepnen our understanding how enural circuits mediate specific behavioral outputs, as well as link the cellular mechaism and neural circuit regulation (causality) to the systems level correlation (e.g. fMRI) to behavioral index.

16:55	Adjournment & Meet the Teachers

Weekend Course

MR Systems Engineering: Part 4

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Saturday 15:15 - 16:45	*Moderators:* Christoph Juchem & Sebastian Littin

15:15	Multi-Modality Imaging in an MRI Scanner: Making the Systems Compatible
	Chrit Moonen
	Focused ultrasound (FUS) is increasingly used for therapy. It can be guided by MRI, ultrasound imaging, or both. Here, three examples are elaborated how MRI and ultrasound imaging can be used simultaneously and beneficially for guiding FUS: 1) Tracking of beampath obstructions (ribs); 2) Motion evaluation; 3) Monitoring of cavitation during drug delivery with microbubbles.

15:45	Basic MR Safety: SAR to Temperature, Power Deposition/Monitoring, Effects of RF Coils & Field Strength
	Nicolas Boulant
	The advent of parallel transmission at high field has led to many studies aiming at quantifying more accurately the Specific Absorption Rate (SAR)/temperature aspects while understanding in more details the risks involved in MRI experiments. This talk gives a review of different techniques employed for SAR calculations, their validations and real-time supervision. Safety margins arising from each step of the evaluation chain are described and future directions for temperature evaluation are presented.

16:15	Peripheral Nerve Stimulation, Implants & Devices: Safe Use & Considerations for MRI
	Mark Conroy

	This presentation will describe the MRI related risks to patients with active implantable devices with respect to unintended electrical tissue stimulation. The mechanisms due to RF rectification and gradient induced electrical potential will be described using simplified circuit models. Standard test methods for characterizing device performance in the MRI environment will be described. Finally, risk mitigation strategies and MR Conditional labeling strategies will be reviewed.

16:45	Adjournment & Meet the Teachers

Weekend Course

Advanced Clinical MR Imaging in MSK: Part 4

Organizers: Jenny Bencardino, Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S01	Saturday 15:15 - 16:45	*Moderators:* Emily McWalter & Alissa Burge

15:15	Spine
	Amelie Lutz
	Back and neck pain are among the most common reasons to seek medical advice. While there are clearly established guidelines for cross-sectional imaging study utilization in the diagnostic work-up, there has been a significant increase in these exams. But cross-sectional imaging findings have been shown to often poorly correlate with patients' symptoms. In order to better serve patients, we need new tools to enhance or replace existing MRI methods. In this talk, four potential approaches will be discussed to reach this goal: kinematic MRI, novel sequences to complement existing MRI protocols, MRI around metal in the post-operative setting, and PET/MRI.

15:45	Bone Marrow MRI: from Reconversion to Infiltration
	Joan C. Vilanova
	MRI is the technique of choice to analyze the bone marrow. It is essential to understand the normal composition and distribution of bone marrow and the changes that occur with age, as well as other physiologic factors that can affect those signals. The normal distribution of red and yellow marrow in the skeleton changes with age in a predictable sequence. It is mandatory to understand the standard and advanced techniques such as diffusion and DIXON to perform an accurate evaluation of bone marrow from a physiologic process such as reconversion through an infiltration process.

16:15	Panel Discussion

16:45	Adjournment & Meet the Teachers

Weekend Course

Body MRI: Realities & Controversies: Why Rads?

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Saturday 15:15 - 16:45	*Moderators:* Kathryn Fowler & Elizabeth Hecht

15:15	LI-RADS: Pro
	An Tang
	The Liver Imaging Reporting And Data System (LI-RADS) was developed to standardize the interpretation, reporting and data collection for imaging examinations in patients at risk for hepatocellular carcinoma (HCC). The system has been developed by committees composed of radiologists, hepatologists, pathologists, and surgeons. In this debate, we will discuss the reasons why LI-RADS is needed and the problems that it solves. In response to current limitations of LI-RADS, we will discuss strategies to address unmet needs and to refine the system in response to new scientific evidence and user feedback.

15:37	LI-RADS: Con
	John Leyendecker
	LI-RADS is an important advance in standardization of HCC imaging and reporting. However, there are still many deficiencies that must be addressed for widespread implementation to succeed. This talk will highlight the concerns of LI-RADS users and the potential ways these concerns can be addressed in the future.

15:59	PI-RADS: Pro
	Francois Cornud
	The PI-RADS scoring system consists in a visual assessment to detect the presence of suspicious foci within the prostate. It has also been developped to describe signs of tumor extraprostatic extension. Diffusion Weighted Imaging (DWI) plays an unvaluable role to achieve this goal. Very high computed b-values allow to visually increase the conspicuity of tumor foci within the peripheral zone (PZ). DWI has also an important role to increase the sensitivity of T2W-MRI to localise tumor foci originating in the transition zone (TZ), without affecting the specificity. Dynamic Contrast Enhanced MRI plays a role to confirm the presence of a tumor in specific areas, like the Anterior FibroMuscular Stroma or to detect signs of seminal vesicle invasion, which may remain undetected by DWI alone.

16:21	PI-RADS - Con
	Alberto Vargas
	This talk will emphasize the weaknesses of the Prostate Imaging Reporting and Data system, highlight areas of potential improvement, and discuss ways of dealing with commonly encountered limitations of the guideline in "real-life" scenarios

16:43	Adjournment & Meet the Teachers

Weekend Course

MR for Neuropsychiatric Disorders: Part 2

Organizers: Qiyong Gong, John Port

S03	Saturday 15:15 - 16:45	*Moderators:* Qiyong Gong

15:15	MR of Schizophrenia
	John Sweeney
	Schizophrenia is a common, debilitating psychiatric disorder with profound impact on cognitive and social functions. There are several areas in which structural and functional brain imaging are advancing understanding of the pathophysiology of this disorder. Beyond identifying illness associated features, these include: 1) identifying biologically homogeneous subgroups of patients within and across disorders, 2) providing quantitative traits for identifying genetic associations, 3) clarifying how antipsychotic drugs alter brain systems, and 4) characterizing long term progression of illness. This presentation will review progress in each of these areas.

15:45	MR of Post-Traumatic Stress Disorder
	Osamu Abe
	With the advancement not only in magnetic resonance imaging technologies but also sophisticated post-processing techniques and powerful analytical tools, there should be certain CNS differences between PTSD patients and normal control. Hippocampus, amygdala and prefrontal cortex including anterior cingulate cortex are three key structures in the pathophysiology of PTSD, reproducibly confirmed by structural, diffusional, and functional MRI. Furthermore, these structures are related to the impairment both in salience network and default mode network in patients with PTSD. In this talk, we will show the audience recent results for voxel-based analyses and brain connectivity measured by diffusion and functional MRI.

16:15	Panel Discussion

16:45	Adjournment & Meet the Teachers

Weekend Course

Novel Approaches in Molecular Imaging: Part 2

Organizers: Natalie Serkova, Damian Tyler

S04	Saturday 15:15 - 16:45	*Moderators:* Natalie Serkova & Damian Tyler

15:15	CEST MRI: The Technical Aspects
	Michael McMahon
	Chemical Exchange Saturation Transfer (CEST) imaging has emerged as an attractive alternative MRI contrast mechanism to T1 and T2 contrast (1-7). This lecture will cover the basic steps in generating CEST contrast maps, including acquisition, B0 map creation, and Post-processing of CEST MRI data.

15:37	CEST MRI: The Application
	Kevin Ray
	During this presentation, I will discuss some of the difficulties of clinical translation of CEST MRI, highlight the similarities and differences between endogenous and exogenous CEST MRI methods, and outline some of the principle applications of these methods in pre-clinical and clinical settings. Examples of such applications include: (1) pH imaging in ischaemic stroke using endogenous amide proton transfer, (2) pH imaging in cancer using exogenous diaCEST and paraCEST agents, (3) endogenous metabolite concentration imaging (e.g. GluCEST, GagCEST, GlycoCEST), and (4) glucose uptake and perfusion imaging using GlucoCEST.

15:59	Nanoparticle-Based Imaging: The Technical Aspects
	Kevin Bennett
	This presentation will outline the physical chemical and physical basis for nanoparticle contrast agent development, modification, and detection for imaging by MRI. Several emerging nanoparticle agents will be discussed in detail.

16:21	Nanoparticle-Based Imaging: The Application Heike Daldrup-Link This presentation will provide an overview of clinical applications of iron oxide nanoparticles for MR imaging and PET/MR imaging of patients with cancer. This will include safety considerations, applications for whole body cancer staging, applications for monitoring response to cancer immunotherapies and theranostic (combined therapeutic and diagnostic) applications.

16:45	Adjournment & Meet the Teachers

Event

Newbie Reception

Level 7.4 Rooftop Terrace	Saturday 19:00 - 21:00	*(no CME credit)*

Sunday, 17 June 2018

Go to top
Weekend Course

Concurrent MRI: Imaging of Real-Time Events: Part 1

Organizers: Guoying Liu, Elena Vinogradov, Yi-Fen Yen

N01	Sunday 8:00 - 9:28	*Moderators:* Chrit Moonen & Bruno Madore

8:00	Introduction: Concurrent MR Imaging of Real-Time Event Bruno Madore The expression 'concurrent MRI' relates to the use of an MR scanner as part of a larger integrated system, as opposed to a standalone diagnostic tool. Examples include image-guided therapies and hybrid imaging, where changes to tissues can be induced and tracked in real time. In this session, the ability of MRI to capture changes caused by ultrasound energy deposition, radiation therapy, brain plasticity and catheter steering will be presented. In the present talk, our work on hybrid ultrasound+MR imaging and on MR-compatible sensor development will also be detailed.

8:30	MR Imaging of Neuromodulation Feedback

	Heidi Johansen-Berg
	The talk will provide examples of use of MRI in humans to monitor effects of neuromodulation (using feedback or brain stimulation). This can be used to provide insights into healthy brain function and also to develop novel interventions for use in neurological or neuropsychiatric disorders.

9:00	MR Imaging of Therapeutic Ultrasound
	Chrit Moonen
	High Intensity Focused Ultrasound (HIFU), similar to External Beam Radiotherapy (EBRT), can be guided by imaging to plan, provide real-time guidance, and evaluate the therapeutic efficacy. MRI has major advantages for guidance because of its superior anatomic detail, and for HIFU for its thermal mapping. Here, we will pay particular attention how MRI can be used to describe and correct displacement of the target area.

9:30	Break & Meet the Teachers

Weekend Course

Image Acquisition & Reconstruction: Part 1

Organizers: Edward DiBella, Neville Gai, Vikas Gulani, Ileana Hancu

N02	Sunday 8:00 - 9:30	*Moderators:* Neville Gai & Ileana Hancu

8:00	MR Basics (Refresher) Recap of Physics of RF & k-Space Acquisition
	David Higgins
	Basic MR physics will be reviewed, to provide a foundation for discussion of more advanced concepts in the course. The mechanism of simple radiofrequency excitation will be shown, and the information content of k-space will be illustrated and discussed.

8:30	Excitation & Parallel Transmission
	V. Andrew Stenger

	This lecture will cover the basic concepts needed to understand the theory and implementation of multi-dimensional RF pulses. The ideas of excitation k-space and the Fourier picture for small tip angle RF pulses will be covered in detail. The common k-space trajectories and pulse designs will be discussed. Examples of 2D and 3D spatially selective excitations as well as spectral spatial pulse designs will be presented. Applications including field inhomogeneity compensation and parallel transmission will be covered as well.

9:00	Cartesian & Non-Cartesian Sampling Schemes - Advantages & Disadvantages
	Maria Altbach
	Cartesian sampling is widely used in conventional MRI, however, non-Cartesian sampling schemes (e.g. radial or spiral sampling) offer advantages over Cartesian schemes. Among them is flexibility and efficiency of k-space sampling, motion insensitivity, and the ability to generate images with high spatio-temporal resolution from limited data. The lecture will cover the basic acquisition schemes of Cartesian and non-Cartesian sampling along with the conventional and state-of-the-art reconstruction methods with an emphasis on advantages and disadvantages.

9:30	Break & Meet the Teachers

Weekend Course

Basics of Perfusion Imaging: Part 1

Organizers: Fernando Calamante, Hanzhang Lu, Steven Sourbron

N03	Sunday 8:00 - 9:28	*Moderators:* Laura Parkes & Ze Wang

8:00	Physiology of Perfusion
	Osamu Togao
	This presentation covers macro- and micro-anatomy of cerebral vasculature and the basic mechanism and physiology of cerebral perfusion.

8:22	DSC Acquisition & Reconstruction
	Ashley Stokes

	Dynamic susceptibility contrast (DSC) MRI methods provide valuable information regarding cerebral perfusion. In this talk, I will discuss current recommendations for best practices in clinical DSC-MRI acquisition and reconstruction. I will also highlight more recent technological advancements for DSC-MRI, along with the associated advantages and trade-offs of these methods. This talk will provide both a basic foundation for understanding current DSC-MRI protocols and insight into future directions for DSC-MRI acquisition and reconstruction.

8:44	DSC Post-Processing & Modeling (with Demo)
	Irene Mikkelsen
	Pivotal in the understanding of processing of Dynamic Susceptibility Contrast perfusion imaging, is the concept of the Residue Function. This function is the underlying tissue function, which is indepent on how the contrast agent is administered to the tissue. This presentation describes the inverse problem and two ways of solving it.

9:06	DCE Acquisition & Reconstruction
	Anders Garpebring
	This talk will describe the basics of dynamic contrast-enhanced (DCE) MRI with focus on the acquisition of the data. Key prerequisites for accurate quantification of perfusion parameters such as K^{trans} are sufficiently high spatial and temporal resolution but also accurate quantification of the contrast agent (CA) concentration. The basics of how this can be achieve will be covered in the talk.

9:28	Break & Meet the Teachers

Weekend Course

RF Engineering: Coils: Part 1

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Sunday 8:00 - 9:30	*Moderators:* Natalia Gudino & Michael Twieg

8:00	Basics of Transmission Lines & Power Transfer
	Nicola De Zanche

	This lecture covers the basic concepts of RF power transfer over transmission lines. Tools such as scattering parameters and the Smith chart are also discussed.

8:30	Volume & Surface Coils
	Christoph Leussler
	RF coils (antennas) for MRI are designed to generate a RF magnetic field inside the body. Large body volume coils are optimized for the generation of a homogeneous RF magnetic field. Local surface coils are designed to provide high signal to noise ratio. Different designs and related physical aspects are discussed.

9:00	Multi-Tuned Coils
	Dennis Klomp
	Ever wanted to build your own multi-tuned RF coil to enable metabolic imaging? This 30 minute session will start from scratch and ends with you capable to make the most advanced multi-tuned, transmit and receive coil array (in theory)...

9:30	Break & Meet the Teachers

Weekend Course

Cardiovascular MRI: Vascular: Part 1

Organizers: James Carr, Tim Leiner

S01	Sunday 8:00 - 9:20	*Moderators:* Alex Barker & Christopher François

8:00	Contrast Agents: Practical Use & Safety Aspects
	Giles Roditi

8:20	Contrast-Enhanced MRA
	Jeremy Collins

8:40	Non-Contrast-Enhanced MRA
	Ioannis Koktzoglou
	This presentation will review established and emerging methods for non-contrast-enhanced magnetic resonance angiography.

9:00	Basics of Flow Imaging Including Extraction of Quantitative Measurements
	Jos Westenberg
	Time-of-Flight and Phase-Contrast imaging will be discussed for their role in aniography. Phase contrast imaging is sensitized to flow velocity, affecting the phase signal of flowing spins. This encoding of velocity enables flow velocity quantitation. Quantitative measures derived from velocity encoding will be discussed: valvular flow mapping with regurgitation assessment, transstenotic pressure drop, kinetic energy distribution and wall shear stress. Furthermore, some potential sources of error of phase contrast imaging will be discussed.

9:20	Break & Meet the Teachers

Weekend Course

Advanced Spectroscopy: Part 1

Organizers: Anke Henning, Roland Kreis

S02	Sunday 8:00 - 9:15	*Moderators:* Anke Henning & Roland Kreis

8:00	UHF MRSI: SNR, Speed & Resolution
	Michal Považan
	The temporal and spatial resolution of an MR experiment is always influenced by the available signal-to-noise ratio (SNR). In general, SNR increases with a higher static magnetic field (B_0). Magnetic resonance spectroscopic imaging may benefit from the ultra-high field, however novel approaches are necessary to overcome the technical challenges that arise at such high magnetic field strengths. In this talk we focus on the specifics of UHF MRSI and present the most recent MRSI methods where the SNR gain can be traded off for higher spatial or temporal resolution.

8:25	Undersampled Spectroscopic Imaging: Benefits & Pitfalls

	Ricardo Otazo
	This lecture presents the main techniques to undersample MR spectroscopic imaging (MRSI) for increased imaging speed, including parallel imaging, compressed sensing and model-based subspace reconstruction

8:50	Spectral Editing: MEGA & Beyond
	Ovidiu Andronesi

9:15	Break & Meet the Teachers

Weekend Course

Lost in Translation: Neuroradiologists vs Physicists: Part 1

Organizers: Christopher Hess, Alex MacKay

S03	Sunday 8:00 - 9:50	*Moderators:* Christopher Hess & Alex MacKay

8:00	What Am I Looking for in a New Technique?
	Scott Reeder
	Acceptance of a new technique generally requires that the acquisition have one or more of the following qualities: faster, more robust/reliable, improved image quality, or offers new information not previously available by other acquisition techniques. Evaluation of new imaging techniques should focus on the specific anatomy of interest or on a specific clinical question, not the overall appearance of an image. Ultimately, determination of clinical impact requires evaluation of diagnostic accuracy, clinical effectiveness and the impact on clinical decision-making. Effective development and translation of new imaging techniques into clinical care requires partnership with clinical imaging experts.

8:20	Brain Perspective
	Ari Blitz

8:40	Spine Perspective
	Majda Thurnher

9:00	Head & Neck Perspective
	Christine Glastonbury
	While spatial and contrast resolution has greatly advanced in HN MR imaging and extraordinary detail can be seen with cranial nerve and inner ear imaging, our greatest problem in HN imaging remains the routine neck scan. Obtaining at least two-plane imaging of the neck with T1, T2 FS and T1 post contrast FS sequences is necessary. Diffusion weighted imaging has become an essential component of neck and skull base imaging and should also be included in a HN protocol. Trying to achieve at least 6 sequences in a reasonable time frame is problematic for HN MR imaging, and trying to achieve it with patients who have difficulty with secretion management after chemoradiation is even more complex.

9:20	What Do I Need to Know to Design a New Technique?
	Jeffrey Duerk

9:40	Break & Meet the Teachers

Weekend Course

Introduction to Diffusion: Part 1

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

S04	Sunday 8:00 - 9:30	*Moderators:* Dmitry Novikov & Jennifer McNab

8:00	The Physics of Diffusion: What Are We Measuring?
	Sune Jespersen
	This lecture covers the basic physics of diffusion. I cover the random walk as a conceptual model of diffusion as well as a tool for simulations. The relation for the mean square displacement is derived, and scenarios leading to time-dependent diffusivities are described, along with their universal short and long time regimes. A central quantity, the propagator, is introduced, and the diffusion equation describing its evolution derived. Examples of solutions are given, and the cumulant expansion as a general framework to describe diffusion in complex media is presented. The connection to the diffusion MR signal is outlined.

8:22	Diffusion Encoding Using MRI: Single Pulse, Double Pulse, Oscillating Gradients
	Andrada Ianus

8:44	Image Encoding for Diffusion MRI: EPI, Spiral, Radial, Multi-Shot, Etc.
	Robert Frost
	Single-shot echo-planar imaging, with parallel imaging and simultaneous multi-slice improvements, remains the most commonly used sequence for diffusion imaging of the brain. Many other sequences have been developed with the goal of increasing the spatial resolution of whole-brain diffusion data and their designs are influenced by several considerations including image artefacts, SNR and efficiency, scan time per image, motion sensitivity, and slice acquisition paradigm. These issues will be discussed and illustrated with examples of recent diffusion sequences.

9:06	Diffusion MR Signal to Quality Data: Preprocessing & Distortion Correction
	Stamatios Sotiropoulos
	In this talk, I will present an overview of the issues we encounter in diffusion MRI data and the preprocessing steps needed prior to starting any data analysis. Geometric distortions due to off-resonance effects, distortions due to subject motion, artifacts from physiological noise, detection of outliers and quality control are some of the topics that will be covered. Correcting for artifacts and distortions is key in order to extract the most from the data and allow subsequent analysis in an unbiased and precise manner.

9:28	Break & Meet the Teachers

Weekend Course

Concurrent MRI: Imaging of Real-Time Events: Part 2

Organizers: Guoying Liu, Elena Vinogradov, Yi-Fen Yen

N01	Sunday 10:00 - 11:30	*Moderators:* Bruno Madore & Chrit Moonen

10:00	Image-Guided Interventional Stroke Treatment: State of the Art and Future Directions
	Steven Hetts
	Periprocedural and intraprocedural imaging for acute ischemic stroke treatment are evolving rapidly. We will discuss the current imaging approach and evolving trends in imaging during stroke treatment.

10:30	MR Imaging of Drug & Gene Delivery & Therapeutic Effects

	Kullervo Hynynen

11:00	MRI-guided Radiation Therapy
	Cornelis van den Berg
	This educational discusses the use of MRI in radiation therapy with a focus on MRI-guided radiation therapy. It explains the technological development in relation to how this disruptive technology can change radiation therapy improving outcome and patient toxicity.

11:30	Panel Discussion

12:00	Adjournment & Meet the Teachers

Weekend Course

Image Acquisition & Reconstruction: Part 2

Organizers: Edward DiBella, Neville Gai, Vikas Gulani, Ileana Hancu

N02	Sunday 10:00 - 11:30	*Moderators:* Neville Gai & Ileana Hancu

10:00	Flow & Velocity Imaging
	Martin Graves
	The standard method of quantifying cardiovascular velocity and flow in MRI is to use a phase contrast (PC) imaging technique. This presentation will describe the basic principles of the PC method, its practical implementation and clinical optimisation.

10:30	Motion Compensation: Pulse Sequence & Reconstruction Strategies
	Pelin Aksit Ciris

	MRI is slow relative to the time scale of patient motion. Fundamentals of spin physics restrict scan times for most applications to the order of several seconds to minutes. Demand for higher resolution isotropic volumes has further increased acquisition times for some scans. Motion over the course of an MR acquisition has the potential to corrupt imaging data. This talk will describe potential sources of motion and their impact on MR data, then review conventional and emerging strategies for pulse sequence and reconstruction strategies for motion compensation. Advantages and disadvantages of various methods will be discussed.

11:00	Reduced FOV, Reference Scans, Gradient Pre-Emphasis
	Xiaohong Joe Zhou
	This lecture focuses on three pulse sequence strategies to improve the image quality. First, methods for reducing the field-of-view (FOV) are described using examples of spatial saturation, multiple one-dimensional selective RF pulses, and/or multi-dimensional RF excitation. Second, reference scans are presented for measuring errors in k-space and enabling various phase corrections in pulse sequences utilizing echo trains. Third, gradient pre-emphasis is discussed as an effective method to reduce the adverse effects caused by eddy currents. Although these three topics may appear isolated, together they reflect a central theme of how to improve image quality by managing the artifacts.

11:30	Lunch & Meet the Teachers

Weekend Course

Basics of Perfusion Imaging: Part 2

Organizers: Fernando Calamante, Hanzhang Lu, Steven Sourbron

N03	Sunday 10:00 - 11:30	*Moderators:* Laura Parkes & Ze Wang

10:00	DCE Post-Processing & Modeling (with Demo)
	Jesper Kallehauge
	Post-processing and modeling of DCE time curves allow for reducing a vast amount of data into a set of parametric maps related to the underlying tissue properties: Permeability, Perfusion, compartmental composition etc. Multiple steps and methods are involved in reaching this point with possible pitfalls resulting in potential misinterpretation of the acquired data. Participants should come away from this seminar understanding these steps and how choices made during data acquisition influence what can sensibly be extracted from the data.

10:22	ASL Acquisition & Reconstruction

	Weiying Dai
	The lecture will cover the key components of arterial spin labeling (ASL) data acquisition and reconstruction, including basic principles, different labeling approaches, background suppression techniques to improve the temporal stability of ASL signals, advanced ASL techniques, readout options, and image reconstruction.

10:44	ASL Post-Processing & Modeling (with Demo)
	Michael Chappell
	The aim of this talk is to introduce the key steps involved in the analysis of ASL data to produce a perfusion-weighted image, a full quantified perfusion image and even images of other haemodynamic parameters. We will see that ASL analysis is for the most part quite simple and eve more advance methods are quite accessible through software tools that are now freely available.

11:06	ASL: Beyond CBF
	Peiying Liu
	This talk will cover advanced ASL-based techniques which provide quantitative measurements of hemodynamic and physiological parameters beyond brain perfusion measured in conventional ASL. Such advances include the implementation of different preparation and acquisitions modules, as well as comprehensive modeling of the signals. With these techniques, new hemodynamic and physiological parameters, including blood oxygenation, tissue transit time, arterial blood volume, vascular compliance, and water permeability of blood-brain barrier, can be obtained.

11:28	Adjournment & Meet the Teachers

Weekend Course

RF Engineering: Coils: Part 2

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Sunday 10:00 - 11:30	*Moderators:* Natalia Gudino & Michael Twieg

10:00	Receive Arrays & Circuity
	Peter Roemer

	Fundamental limits of Signal-to-Noise(SNR) ratio exist that cannot be exceeded even with an idealized noiseless receiver coil. These limits can be approached in certain circumstances with proper coil design. The objective is to provide the audience with an understanding of these limits and their relationship to practical aspects of coil design. In turn this will help guide the choice of coil element size, array extent, and total coil count for imaging a specific anatomical location.

10:30	Transmit Arrays & Circuitry for UHF Body Imaging
	Stephan Orzada
	As the main magnetic field strength increases, the corresponding RF wavelength is shortened. This leads to pronounced wave effects in the transmit field, causing inhomogeneous excitation. Multi-channel arrays provide additional degrees of freedom to mitigate such effects and to manipulate (or to tailor) RF transmission. Roughly these can be divided in 3 types, namely local arrays, remote circumferential arrays and travelling wave arrays. Examples of these arrays are presented in this educational talk.

11:00	RF Modelling
	Joseph Rispoli
	Radiofrequency (RF) modelling offers an efficient means to characterize the design and performance of RF coils. Simulations are particularly important for establishing MRI scan parameters to ensure safety compliance. This talk provides an overview of several numerical methods that may be employed to model the electrodynamics of RF coils; emphasis is placed on the finite-difference time-domain (FDTD) method and considerations for achieving accurate simulation and validation.

11:30	Lunch & Meet the Teachers

Weekend Course

Cardiovascular MRI: Vascular: Part 2

Organizers: James Carr, Tim Leiner

S01	Sunday 10:00 - 11:40	*Moderators:* Alex Barker & Christopher François

10:00	Advanced Techniques: 4D Flow, TKE
	Pim van Ooij

	The first part of the talk will show the derivation of clinically relevant parameters (velocity vectors, peak velcocity, wall shear stress) from 4D flow MRI data in laminar flow conditions. the second part of the talk will show the derivation of clinically relevant parameters (turbulent kinetic energy, turbulent wall shear stress) from 4D flow MRI data in turbulent flow conditions.

10:20	MR Techniques for stroke-related vessel wall imaging
	Zhaoyang Fan
	Stroke is one of the major causes of morbidity and mortality worldwide and is the number one cause of adult disability. This disease primarily arises from pathogenesis in a large blood vessel such as the aorta, carotid artery, and intracranial artery and venous sinus. Black-blood MR, commonly known as MR vessel wall imaging (VWI), has emerged as a leading noninvasive imaging modality for directly assessing the vessel wall. Many of previous studies have shown the promise of using MR VWI for characterizing different vessel wall pathologies that potentially result in a stroke. The present lecture will focus on recent (within the last decade) technical developments in MR VWI at the carotid artery, intracranial vessels, and aortic arteries.

10:40	Cerebrovascular Vessel Wall Imaging from a Clinical Perspective
	Anja van der Kolk
	Vessel wall MRI of the supra-aortic and intracranial vasculature has seen an exponential increase in popularity in the last two decades. It can provide a wealth of information on pathologic processes of the vessel wall associated with cerebrovascular diseases – like atherosclerosis, vasculitis, Moyamoya disease and aneurysms – that may be used in the differential diagnosis of vasculopathies, in (stroke) risk assessment, and for planning individual patient-based treatment strategies. This lecture will discuss the clinical potential of vessel wall MRI in these cerebrovascular diseases, with a specific focus on intracranial vessel wall pathology.

11:00	Chest & Abdominal
	Iacopo Carbone

	Cardiovascular MRI: Vascular: Part 2 The target audience of this lecture will be imagers (radiologists or cardiologists), dealing with vascular examinations on regular daily practice. Training doctors will particularly benefit from this lecture. The presentation will give the basis on how to perform Vascular MRI study of the aorta.The main focus of the presentation will be the acute aortic syndromes, encompassing the whole spectrum of the topic from its pathophysiology and revised classification to different MRI protocols and diagnosis. At the end of the presentation the audience will be able to recognize and classify the main acute aortic clinical scenarios, differentiating real emergencies from deferrable urgencies and to eventually integrate imaging techniques including CT and echocardiography.

11:20	Peripheral Vascular Disease	
	Jeremy Collins	

11:40	Adjournment & Meet the Teachers

Weekend Course

Advanced Spectroscopy: Part 2

Organizers: Anke Henning, Roland Kreis

S02	Sunday 10:00 - 11:40	*Moderators:* Anke Henning & Roland Kreis

10:00	Spectral Simulations in GAMMA: Gradients & Soft Pulses Jan Willem van der Veen Gradients and soft pulses are simulated in GAMMA to correct for technical shortcomings of actual mrs sequences. Simulations are made in a spatial grid to handle chemical shift artifacts, four compartment problem, and the effect of crushers. Described is how to prevent aliasing of the grid with the phase roll of the crushers and how to speed up the calculations. Finally a few practical applications are mentioned to improve quantification of the metabolites.

10:25	Classification Tools for MRS of Cancer Sabine Van Huffel

	This lecture explains how to extract diagnostic information from the raw MR spectra possibly combined with information from other MR modalities. Starting from basic and advanced concepts in machine learning, the most important classification methods are surveyed. The application of these classifiers in assessing brain tumor heterogeneity is illustrated in a variety of case studies. In-vivo single-voxel MR Spectroscopy (MRS) as well as chemical Shift Imaging are considered, long-echo time as well as short-echo time acquisition schemes. Moreover, it is shown how to combine these measurements with other basic (T1-weighted,T2-weighted) as well as advanced (PWI, DWI, DTI, DKI) MR modalities.

10:50	Functional MR Spectroscopy
	Paul Mullins
	Proton MRS is often thought of as a static measure. In the past 10 years however, this view has been challenged by several studies showing that it is actually sensitive to fluctuations in neurometabiolites as a result of neural activity. This technique of "functional" MRS (fMRS) is not new, having been around since 1991, however with the ready availability of 3T or higher MRI systems, improved acquisition techniques and accurate fitting packages, fMRS has seen renewed interest. A discussion of the main technique, the result that might be expected and experimental considerations for fMRS will be presented using Glutamate as the model neurometabolite. Attendees should come away with a renewed appreciation for the role 1H-fMRS may play in understanding neural activity and function.

11:15	Diffusion-weighted MR Spectroscopy
	Francesca Branzoli
	Diffusion-weighted ^{1}H MR spectroscopy (DW-MRS) provides unique cell-specific and compartment-specific microstructural information based on the diffusion properties of intracellular metabolites in brain tissue. In this talk, the basic aspects of DW-MRS data acquisition and processing will be presented, together with some clinical and preclinical applications.

11:15	Adjournment & Meet the Teachers

Weekend Course

Introduction to Diffusion: Part 2

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

S04	Sunday 10:00 - 11:30	*Moderators:* Chun-Hung Yeh & Jennifer McNab

10:00	Diffusion Data Interpretation: Data-Driven

	Jürgen Finsterbusch
	The signal of diffusion-weighted MR reflects the tissue structure on a cellular or microstructure scale. Many different approaches have been proposed that aim to characterize diffusion-weighted data or derive diffusion or microstructural tissue properties from it. They could be divided into model- and data-driven approaches. Data-driven approaches either derive diffusion or structural properties directly from the data or, in a broader sense, approximate the data with equations that are “borrowed” from diffusion in simple physical systems or motivated mathematically. The most important of these approaches will be covered in this presentation.

	Diffusion Data Interpretation: Model-Driven
	Ariel Rokem
10:22	Models of diffusion MRI are mathematical expressions that describe the data, summarize it and approximate it. The values of the fit parameters are used to interpret the data in light of the structure of the tissue or its physical properties. This presentation will introduce a framework for model comparison using cross-validation: the model is fit to one part of the data and the model parameters are used to predict the signal in another part of the data. Cross-validation is used to assess parameter reliability, as well as accuracy of the model with respect to the data.

	Tractography
	Thijs Dhollander
10:44	In this introductory course on diffusion MRI based tractography, I will introduce the basics of tractography. I will by no means provide a comprehensive overview or review of all possible techniques and literature, but rather focus on the most essential basics of this area and a selection of its applications. As a result of attending this course, participants should be empowered to participate in the ongoing discussions about the strengths and limitations of tractography, as well as make informed and critical decisions on the use of tractography in their own work.

	Microstructure for In-Vivo Human Applications
	Susie Huang
11:06	This lecture will provide a brief overview of technical considerations involved in *in vivo* diffusion MR microstructural imaging studies with a focus on human neuroimaging. We will cover biophysical models and signal representations of the diffusion MRI signal as they relate to probing tissue microstructure in the human brain. We will study metrics derived using different diffusion models and acquisition schemes in the setting of normal development and pathological changes in white matter disease. In addition, the specific advantages of high-gradient systems for characterizing tissue microstructure for *in vivo* human imaging will be explored.

11:28	Adjournment & Meet the Teachers

Weekend Course

Lost in Translation: Neuroradiologists vs Physicists: Part 2

Organizers: Christopher Hess, Alex MacKay

S03	Sunday 10:10 - 12:00	*Moderators:* Christopher Hess & Alex MacKay

10:10	Fast Imaging - Parallel Imaging, Compressed Sensing & Beyond
	John Pauly
	Throughout the history of MRI a long sequences of techniques have been developed to make images with less data. When MRI first emerged as a clinical imaging modality, images were acquired by fully sampling a rectangular region in spatial-frequency, or k-space. Faster acquisitions have been based on the structure of the data, knowledge of the receive array sensitivity, models of the statistics of the image, and, more recently, models of the images themselves. The common thread is using other knowledge we have about the MRI system and subject to provide additional prior information to reduce the amount of data we need to collect. This talk will highlight this sequence of methods, and look at the potential and challenges they present for clinical application.

10:32	Modern Functional & Diffusion Imaging
	Mara Cercignani
	Diffusion and functional MRI are among the most popular MRI techniques used in neuroscience research. Although basic versions of these techniques have found their way to the clinic relatively soon after their introduction, almost none of the technological advances introduced in the past 20 years have been adopted outside the research setting. This lecture will review some of the latest flavours of diffusion and functional MRI and their potential clinical applications

10:54	Fingerprinting & Synthetic MRI
	Nicole Seiberlich

11:16	MRS of Novel Metabolites
	Gulin Oz

	This talk will start with an overview of neurochemicals (beyond NAA, Cr, Cho) measurable by MRS and the cellular/biochemical processes that they reflect, present examples of their utility in addressing novel biological questions, then follow with data quality requirements to be able to reliably quantify these neurochemical profiles and finish with a summary of recent efforts to simplify and automate acquisition of high quality MRS data at 3T and make advanced MRS acquisitions MR technologist friendly.

11:38	Panel Discussion

12:00	Adjournment & Meet the Teachers

Weekend Course

Probing Biomolecules: Magnetic Susceptibility & CEST/MT: Part 1

Organizers: Chunlei Liu, Peter van Zijl, Elena Vinogradov

N01	Sunday 13:15 - 14:45	*Moderators:* Jongho Lee & Elena Vinogradov

13:15	Paramagnetic & Diamagnetic Susceptibility in Tissue
	Ferdinand Schweser
	This class will discuss the chemistry and physics of magnetic susceptibility, explaining why some substances affect tissue susceptibility substantially when they are present in very low concentrations whereas other substances need to be present in high concentrations to alter the tissue's susceptibility measurably. We will discuss the how and why of the differential effects of magnetic susceptibility on gradient-echo magnitude and phase image contrast. An overview of the clinical potential of Quantitative Susceptibility Mapping (QSM) will be provided by discussing the different tissue properties that have been related to magnetic susceptibility in the more recent past.

13:37	Magnetization Transfer: MTC, NOE, CEST
	Alexej Jerschow
	The aim of this presentation is to give the MRI practitioner a good overview of the methods used in CEST and MT imaging, the underlying mechanisms, the current state of the art, and to outline the opportunities and limitations of the methods.

13:59	Tissue Magnetic Susceptibility Mapping (QSM)
	Barbara Dymerska

14:21	What Are We Really Measuring in CEST?
	Daniel Gochberg
	This talk will examine the underlying drivers of the CEST signal, and it will discuss the implications for choosing CEST pulse sequences and metrics that maximize solute specificity.

14:43	Break & Meet the Teachers

Weekend Course

Image Acquisition & Reconstruction: Part 3

Organizers: Edward DiBella, Neville Gai, Vikas Gulani, Ileana Hancu

N02	Sunday 13:15 - 14:35	*Moderators:* Jeffrey Fessler & Berkin Bilgic

13:15	Parallel Imaging
	Suchandrima Banerjee
	With the increasing use of multicoil array for MR signal reception, and motivated by the need to increase acquisition speed, parallel imaging has become as essential part of MR scans. This talk will aim to impart basic understanding and develop an intuition for underlying concepts of parallel imaging reconstruction with a focus on most widely used methods such as SENSE and GRAPPA. Dynamic acceleration and extension to non-cartesian trajectories will be touched upon and the impact of parallel imaging reconstruction on signal-to-noise will be discussed.

13:35	Basic Sparsity & Compressed Sensing
	Michael Lustig

	MRI is excellent for pediatric diagnosis, offering superb contrast, without risk to a population particularly susceptible to cancer from ionizing radiation of computed tomography. However, MRI's impact in children is limited by technical demands of imaging small, fast moving structures, long exams that limit access, result in motion artifacts, and most often require anesthesia with attendant risk. This talk will review our decade long work to mitigate these challenges through development of dedicated pediatric receiver arrays, fast compressed sensing and parallel imaging accelerated exams, non-rigid motion correction, dynamic imaging and multi-contrast MRI with rapid computation — all of which resulted in significant reduction in the incidence, depth, and duration of anesthesia. Finally, the talk will review the remaining challenges and offer possible solutions through existing, emerging and future technologies including machine learning, 3D dynamic non-Cartesian MRI with massive computation, automated scanning, rapid silent scanning and dedicated pediatric scanners that could ultimately eliminate completely the need for anesthesia in pediatric MRI.

13:55	Low-Rank Methods
	Bradley Sutton
	For dynamic imaging or parameter mapping applications, there is a significant amount of spatiotemporal correlations in the data, with many parts of the image sharing similar temporal signal profiles. This results in a data matrix that is low rank. Several methods have been developed to exploit this low-rank structure to achieve very high imaging speed. This talk will describe these low rank methods and demonstrate the imaging speed that can be achieved.

14:15	Dictionary & Model-Based Methods
	Mariya Doneva
	This lecture explains the principles of model-based reconstruction methods and their linearization using dictionaries for MR parameter mapping.

14:35	Break & Meet the Teachers

Weekend Course

Advanced Topics in Perfusion MRI: Part 1

Organizers: Fernando Calamante, Hanzhang Lu, Steven Sourbron

N03	Sunday 13:15 - 14:55	*Moderators:* Laura Parkes & Thomas Christen

13:15	Novel Labeling Techniques of ASL
	Qin Qin

	This lecture will describe in depth the most recent developments of ASL labeling techniques. PCASL has been further optimized to minimize sensitivity to off-resonance and pulsatile velocity at the labeling plane. Multi-delay PCASL aims to reduce the effect of prolonged transit time. In addition to the improvements of spatially selective ASL, advanced velocity-selective pulse trains have been proposed, for more robustness to eddy current effects, or higher perfusion signal with Fourier transform based velocity selective inversion. Acceleration-selective ASL has also been demonstrated. The pros and cons of each labeling method will be compared.

13:40	Technical Advances in Body ASL
	Charlotte Buchanan
	There have been a number of recent advances in body ASL. ASL has been applied in the heart, liver, kidney and placenta with studies using ASL in diseases such as diabetes, compensated liver cirrhosis and chronic kidney disease. There are however a number of considerations that are required for use of ASL in the body including which labelling and readout schemes to use and how to deal with respiratory and cardiac motion. Efforts are now needed to harmonise techniques and assess variation in sensitivity, specificity and reproducibility in order to make ASL a clinically useable tool for body applications.

14:05	Is ASL Useful for Brain Mapping?
	Wen-Chau Wu
	Since its introduction in 1990's, ASL has gone through abundant developments that have remarkably improved this contrast-material-free technique in data acquisition, image quality, and quantitative modeling. We now have a variety of methods to choose from and a number of review articles to refer to. However, it still seems an open question when it comes to the usefulness of ASL in brain mapping. In this presentation, the issues that have been keeping us from saying yes to the question will be reviewed. The usefulness and caveats of ASL in brain mapping will be discussed from the viewpoint of clinical application.

14:30	DCE/DSC Beyond Perfusion & Permeability
	Ben Dickie
	A healthy cerebrovasculature is crucial for meeting the brains ever changing demand for oxygen and nutrients. Aging and many neurodegenerative diseases lead to insidious vascular changes to vessel size, geometry, and blood brain barrier (BBB) integrity. New approaches to the acquisition and analysis of DCE- and DSC-MRI data are providing novel insights into these cerebrovascular abnormalities, aiding understanding of disease mechanisms and helping to identify novel treatment targets.

14:55	Break & Meet the Teachers

Weekend Course

RF Engineering: Coils: Part 3

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Sunday 13:15 - 14:25	*Moderators:* Natalia Gudino & Michael Twieg

13:15	Dielectric Materials & Resonators
	Rita Schmidt
	This talk will review and explain effects in dielectric materials relevant to MRI. It will cover effects due to the body tissues properties, tailoring of the RF field using high permittivity dielectric materials as well as resonant structure implementations. Applications of dielectrics for MRI in a range of magnetic fields will be shown.

13:50	UHF Coil & Array Design
	Tamer Ibrahim
	The clinical and research potential of MRI for whole-body applications at high (≥ 3 tesla) fields and of head applications at ultrahigh (UHF) (≥7 tesla) fields appears to be limitless. It is however limited by technical challenges. The most notable of these difficulties include 1) safety concerns regarding exceeding radiofrequency (RF) power deposition in tissue and 2) large image inhomogeneity/voids due to “undesired” RF field inhomogeneity across the anatomy. The main aim of this course is to explore UHF coil and array designs that aim at addressing these issues.

14:25	Break & Meet the Teachers

Weekend Course

Cardiac MR: From the Basics to New Horizons: Part 1

Organizers: Sebastian Kozerke, Reza Nezafat, Bernd Wintersperger

S01	Sunday 13:15 - 14:35	*Moderators:* Aleksandra Radjenovic & Peng Hu

13:15	Cardiac Function
	Pierre Croisille

13:35	Myocardial Perfusion
	Raymond Kwong

13:55	Scar Imaging
	Charlene Liew
	Scar imaging is the backbone of viability quantification of post myocardial infarction scarring. There are also other important applications of scar imaging in various conditions apart from ischaemic cardiomyopathy. This session explores the fundamentals of scar imaging, from physical principles to anatomy and new paradigms.

14:15	Clinical Needs & Applications
	David Sosnovik

14:35	Break & Meet the Teachers

Weekend Course

Prostate MRI, MRI in Pregnancy & Genitourinary: Part 1

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Sunday 13:15 - 14:45	*Moderators:* Masoom Haider & David Karow

13:15	Technical Considerations for Prostate MRI Acquisition
	Alberto Vargas
	The aim of this session is to summarize the latest technical developments relevant to optimization of clinical prostate MRI protocols

13:37	Guidelines & Recommendations
	Jelle Barentsz

	In this talk, a literature review will be shown of PI-RADS v2. The role of experience and training will be discussed. To ensure optimal quality, certification and quality criteria will be provided. Finally, the role of an expertise network will be emphasized. It will be concluded, that it has been shown that PI-RADSv2 is an adequate ‘‘language’’ for assessing the risk of the presence of clinically significant PCa. The sensitivity is significantly better than that of PI-RADSv1. Nonetheless, there is large heterogeneity that could be reduced by an improved PI-RADSv3 and by training and certification of radiologists. Equally important, however, is the training of urologists and other involved physicians in being able to communicate in the same ‘‘language’’.

13:59	Prostate MRI & Recurrence
	Jurgen Fütterer
	mpMRI is a helpful tool in the evaluation of the treated prostate gland.

14:21	PET/MRI of Prostate Cancer
	Joseph Ippolito
	This educational talk provides an overview of PET/MRI in the evaluation of prostate cancer with a focus on the strengths and weaknesses of PET/MRI versus PET/CT as well as the individual strengths and weaknesses of MRI versus PET. This talk also discusses methods for evaluating initial staging as well as biochemical recurrence in prostate cancer patients and discusses current progress made in the radiopharmaceutical field and its ability to synergize with emerging methods in MRI.

14:43	Break & Meet the Teachers

Weekend Course

Is MR/PET Better than MR + PET for the Brain?: Part 1

Organizers: Fernando Boada, Elna-Marie Larsson

S03	Sunday 13:15 - 14:45	*Moderators:* Fernando Boada & Elna-Marie Larsson

13:15	MR/PET Methodology Brain (Advantages & Limitations)
	Julie Price

13:45	Attenuation Correction with MR/PET
	Hongyu An
	PET/MR is a promising multi-modality imaging approach. Attenuation is by far the largest correction required for quantitative PET imaging. The challenges in MR based PET attenuation correction have negatively impacted the acceptance of PET/MR in clinical trials. Since the inception of PET/MR, MR based attenuation correction approaches have been extensively pursued, especially for brain imaging. In this presentation, I will provide background of PET/MR attenuation correction and review various methods. The advantages and disadvantages of these methods are discussed.

14:15	Hybrid PET/MR in Epilepsy
	Jie Lu

14:45	Break & Meet the Teachers

Weekend Course

Advanced Microstructural Imaging: Part 1

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

S04	Sunday 13:15 - 14:30	*Moderators:* Jennifer McNab & Noam Shemesh

13:15	Tissue Architecture & Water Diffusion Obstacles
	Itamar Ronen

13:40	Spatial & Temporal Features of Diffusion Encoding
	Frederik Laun
	Links between measured signal, the temporal profile of the diffusion-encoding gradients and spatial features of the measured probes will be explained. Among others, the temporal gradient profiles "short-short", "long-long", "long-short", and gradient profiles with multiple gradient pulses will be discussed.

14:05	Looking from Within: Diffusion of Compartment Specific Metabolites

	Julien Valette
	Diffusion-weighted NMR spectroscopy (DW-MRS) offers the unique ability to non-invasively quantify diffusion properties of endogenous brain metabolites *in vivo*. In contrast to water molecules, which are ubiquitous in biological tissues, most brain metabolites are confined into the intracellular space, and some of them are even thought to exhibit preferential cellular compartmentation (within neurons or glial cells). It is thus expected that DW-MRS may provide specific cellular information. Here we will see how DW-MRS can be related to cellular microstructure, opening perspectives for non-invasive and quantitative measurements of cell-specific morphology under normal and pathological conditions.

14:30	Break & Meet the Teachers

Weekend Course

Probing Biomolecules: Magnetic Susceptibility & CEST/MT: Part 2

Organizers: Chunlei Liu, Peter van Zijl, Elena Vinogradov

N01	Sunday 15:15 - 16:43	*Moderators:* Jongho Lee & Elena Vinogradov

15:15	Susceptibility Anisotropy
	Richard Bowtell

15:37	CEST MRI of Biomolecules
	Kannie WY Chan
	Chemical Exchange Saturation Transfer (CEST) MRI allows us to access molecular information with an enhanced sensitivity. Various contributing proton exchange mechanisms provide ample information for imaging biomolecules and their related pathophysiology. This molecular contrast is sensitive to alterations of exchanging environments in vivo, e.g. CEST contrast of proteins in the brain is different from that in brain tumors with acidic pH. Thus, CEST contrast characterized by the z-spectrum provides readouts for comprehensive physiological and molecular assessments. This talk will present CEST imaging of biomolecules in the brain, and its applications, challenges and opportunities in studying brain tumors and neurological disorders.

15:59	QSM Clinical Applications
	Yukunori Korogi

	The QSM values of the substantia nigra were significantly higher in PD patients than in healthy subjects. QSM showed higher diagnostic performance than R2* mapping for the discrimination between PD patients and controls. The QSM value in GPI increases gradually with age, which allows for the identification of GPm in elderly PD subjects. QSM can detect the abnormalities in normal-appearing basal ganglia in patients with neuropsychiatric systemic lupus erythematosus (NPSLE), which likely represents increased iron deposition.

16:21	CEST Almost Clinical Applications
	Seth Smith
	The goal of this educational presentation is to discuss the important contributions that CEST MRI can have for clinical-translational studies, by highlighting the unique contrasts available and examining the current applications of CEST MRI in the literature. We will further discuss the potential limitations for more clinically viable adoption of CEST and discuss the opportunities to overcome these limitations, including some studies that have begun to take the clinical leap. We will close by discussing the potential impact of a unique contrast to clinical-translational studies of the human condition.

16:43	Adjournment & Meet the Teachers

Weekend Course

Image Acquisition & Reconstruction: Part 4

Organizers: Edward DiBella, Neville Gai, Vikas Gulani, Ileana Hancu

N02	Sunday 15:15 - 16:55	*Moderators:* Berkin Bilgic & Jeffrey Fessler

15:15	MR Fingerprinting: Introduction
	Martijn Cloos
	Magnetic Resonance Fingerprinting (MRF) is an exciting new framework to rapidly acquire simultaneous quantification of multiple tissue properties, but what is it that distinguishes MRF from other quantitative MR techniques?

15:35	MR Fingerprinting: Reconstruction Considerations
	Debra McGivney

	This lecture will outline various considerations associated with the quantification of tissue properties in the framework of MR fingerprinting

15:55	Machine Learning: Introduction
	Martin Uecker
	Machine learning has been a hot topic lately due to the substantial advances in classification, image segmentation and many other tasks where the best-performing methods are now often based on deep neural networks. Machine learning can be applied even when a mathematical description of the model is not at hand or too complicated. This talk will give a brief introduction to machine learning with a focus on artificial neural networks.

16:15	Machine Learning: Practical Approaches to Reconstruction
	Mehmet Akçakaya
	Machine learning methods have found wide use in MRI reconstruction, with a recent focus on artificial neural networks, in particular convolutional neural networks. In this talk, we will overview both model-based and data-driven machine learning approaches for reconstruction. We will also consider practical aspects of implementing deep artificial neural networks for MRI reconstruction.

16:35	Alternate Reconstruction Workflows: Practical Experience
	Craig Meyer
	This educational talk will discuss image reconstruction software platforms that go beyond the platforms provided by the vendors. These platforms can be used for prototyping new reconstruction methods and for enabling capabilities such as real-time interactive scanning. Open-source image reconstruction software libraries accelerate image reconstruction research and enable reproducible research.

16:55	Adjournment & Meet the Teachers

Weekend Course

Advanced Topics in Perfusion MRI: Part 2

Organizers: Fernando Calamante, Hanzhang Lu, Steven Sourbron

N03	Sunday 15:15 - 16:30	*Moderators:* Thomas Christen & Laura Parkes

15:15	Advanced Reconstruction Techniques for DCE/DSC
	Krishna Nayak
	This talk will review advanced reconstruction methods for DCE-MRI and DSC-MRI. These methods allow for superior extraction of perfusion, permeability, and other tracer-kinetic parameters of interest (from noisy data), and allow for improvements in spatio-temporal resolution and coverage through the use of sparse data sampling (in k,t space). We will start by reviewing the current workflow in DCE/DSC, and identifying the opportunity for improvement. Then we will go through four classes of reconstruction, which have some overlap: 1) spatial and temporal sparsity constraints, 2) data-driven constraints, 3) tracer-kinetic model-based constraints, 4) arterial input function estimation. Finally, we will discuss the magnitude of the improvement that can be achieved using these techniques.

15:40	Methods to Validate Quantitative Perfusion Measures
	Audrey Fan
	Cerebral blood flow (CBF) is a critical physiological biomarker that select appropriate treatments for cerebrovascular patients and is affected in aging and numerous neurological disorders. However, validation of perfusion biomarkers has been challenging, due to (a) inability to compare with a simultaneous reference standard; and (b) insufficient testing in disease cases, where pathology may interact with the imaging mechanism itself to create CBF inaccuracies. This talk describes how to define an appropriate perfusion measure to address a research/clinical question, and design experiments to validate this measurement. It also describes multi-modal imaging and challenge studies (cerebrovascular reactivity) contribute confidence in quantitative perfusion measures.

16:05	New Contrast Agent/Tracer in Perfusion Imaging?
	Thomas Christen
	The vast majority of perfusion MR approaches require the injection of a gadolinium based contrast agent or the magnetic labeling of arterial spins. Yet, other types of contrasts or tracers have also been proposed to probe the micro or macro vascular network. This lecture will present recent perfusion techniques based on the use of (1) iron oxide particles, (2) spontaneous or challenge-based BOLD contrast fluctuations, and (3) hyperpolarized compounds. These methods can offer high SNR, short acquisition times, and provide access to new biophysical markers such as microvessel geometry, hematocrit and blood oxygenation.

16:30	Adjournment & Meet the Teachers

Weekend Course

RF Engineering: Coils: Part 4

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Greig Scott

N04	Sunday 15:15 - 16:15	*Moderators:* Natalia Gudino & Michael Twieg

15:15	Construction of Rx Arrays
	Robin Etzel
	The main aim of this course is to demonstrate MRI researchers/students the basic procedures for phased-array construction and show an optimized protocol for constructing, tuning and decoupling a highly parallel array coil. The goal is to provide a better understanding of the basic experimental RF tools and procedures to facilitate the efficient design and construction of highly parallel MRI receive-arrays. We demonstrate the protocol with the construction of a 16-channel coil array of overlapped surface coil elements.

15:45	Construction of Rx Arrays
	Robin Etzel
	The main aim of this course is to demonstrate MRI researchers/students the basic procedures for phased-array construction and show an optimized protocol for constructing, tuning and decoupling a highly parallel array coil. The goal is to provide a better understanding of the basic experimental RF tools and procedures to facilitate the efficient design and construction of highly parallel MRI receive-arrays. We demonstrate the protocol with the construction of a 16-channel coil array of overlapped surface coil elements.

16:15	Adjournment & Meet the Teachers

Weekend Course

Cardiac MR: From the Basics to New Horizons: Part 2

Organizers: Sebastian Kozerke, Reza Nezafat, Bernd Wintersperger

S01	Sunday 15:15 - 16:55	*Moderators:* Aleksandra Radjenovic & Elie Mousseaux

15:15	Myocardial Strain Assessment: Techniques & Processing
	El-Sayed Ibrahim

	Different MRI techniques have been developed over the past 30 years for measuring heart mechanics and assessing regional cardiac function. These techniques include tagging with saturation bands, spatial modulation of magnetization (SPAMM), complementary SPAMM (CSPAMM)), harmonic-phase (HARP) analysis, strain-encoding (SENC), displacement-encoding with stimulated-echoes (DENSE), tissue phase-mapping (TPM), cine cardiac feature-tracking (FT), and magnetic resonance elastography (MRE). Further, the recent advancements in in vivo MRI diffusion tensor imaging (DTI) of the heart allowed for better understanding of the cardiac myofiber structure and its effect on the heart function. In this presentation, these techniques will be reviewed along with their clinical applications.

15:35	Cardiac DTI: Techniques & Postprocessing
	Andrew Scott
	Diffusion tensor cardiovascular magnetic resonance is unique in noninvasively assessing cardiac microstructure. In this session we examine the acquisition and processing techniques used to overcome the difficulties in measuring microscopic diffusion while the heart is moving with the cardiac and respiratory cycles.

15:55	Clinical Needs & Applications
	Andrew Taylor
	Cardiac magnetic resonance (CMR) Imaging is now an essential investigation in the management algorithm of many cardiac conditions. By providing highly accurate structural and functional information, as well as non-invasive tissue characterization, CMR can improve both diagnostic accuracy and quantification of disease severity, leading to more effective healthcare delivery. Evolving CMR techniques, such as those utilizing parametric mapping and 4-dimensional flow quantification, offer new mechanistic insights into disease processes and may ultimately drive the development of novel targets for intervention.

16:15	T1/T1rho/MT Imaging: Principles & Techniques
	Walter Witschey

16:35	T2/T2* Imaging: Principles & Techniques
	Rohan Dharmakumar
	This presentation will aim to achieve three tasks: a) outline key cardiac MRI approaches used for T2 and T2* imaging;(b) describe the recent advances in T2 and T2* imaging; and (c) summarize the evolving T2- and T2*-based cardiac MRI-based biomarkers that are being actively studied for improving the clinical management of heart disease.

16:55	Adjournment & Meet the Teachers

Weekend Course

Prostate MRI, MRI in Pregnancy & Genitourinary: Part 2

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S02	Sunday 15:15 - 16:45	*Moderators:* Masoom Haider & David Karow

15:15	Placenta & Pregnant Patient
	Nathalie Siauve
	Understanding placental functions remains largely concealed from non-invasive in vivo investigations, although placental insufficiency is responsible for most failures in pregnancy. Functional MRI offers new perspectives for placental imaging. The vascularisation can be studied with IVIM and the pseudo perfusion coefficient (D*) and the perfusion fraction (f), and with ASL and the blood flow (fASL). DCE MRI also provides a definite assessment of perfusion but requires an exogenous contrast agent. The oxygenation can be studied with BOLD. The placental structure can be studied with DWI and the apparent diffusion coefficient (ADC), and with IVIM and the diffusion coefficient (Dr).

15:37	Fetal MRI
	Manjiri Dighe
	This presentation will review the technique and common indication of fetal MRI with a review of the newer techniques at the end. Illustrative cases will be presented.

15:59	Renal & Adrenal Pathologies
	Nicolas Grenier

16:21	MRU & Bladder
	David Childs

	MR urography has proven to be a robust technique for the assessment of the urothelium in both the pediatric (congenital anomalies) and adult (urothelial carcinoma) populations. Technical challenges (motion, contraindication to contrast, etc.) remain, although newer MRI techniques are increasingly providing solutions to these issues. The increasing use of diffusion and perfusion-weighted imaging has also provided the benefit of multi-parametric data. While the detection of urothelial carcinoma can be achieved with various endoscopic and urographic imaging tests, the accurate staging of tumors (both T and N stage) remains a challenge. Advances have been achieved in anatomic MRI, perfusion MRI, and diffusion weighted imaging for the T-staging of bladder carcinoma, although the assessment of nodal status remains a significant challenge. Newly described PET/MRI methods have shown promising results in improving both the specificity of focal urothelial lesions and accurate determination of nodal status, though research is ongoing.

16:43	Adjournment & Meet the Teachers

Weekend Course

Is MR/PET Better Than MR + PET for the Brain?: Part 2

Organizers: Fernando Boada, Elna-Marie Larsson

S03	Sunday 15:15 - 16:45	*Moderators:* Fernando Boada & Elna-Marie Larsson

15:15	Dementia
	Ian Law
	The benefits of PET/MRI in dementia is still in development. There is no firm evidence to suggest added value of this hybrid technique for dementia work-our over sequential scanning besides convenience for patient and clinician.

15:45	Multimodal Simultaneous MR-PET Imaging
	Irene Neuner
	Simultaneous measurement of PET-MR-EEG has become feasible now a day with the aim of best utilizing the complementary information provided by each modality. Several studies have already shown the possibility of simultaneous measurement of PET-MR-EEG. However such possibility comes with technical and practical challenges. To that extent, we aim to give an overview about the technical challenges in integrating EEG in to hybrid PET-MR scanners and with possible solutions.

16:15	Epilepsy
	Timothy Shepherd

16:45	Adjournment & Meet the Teachers

Weekend Course

Advanced Microstructural Imaging: Part 2

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

S04	Sunday 15:15 - 16:55	*Moderators:* Jennifer McNab & Noam Shemesh

15:15	Looking from the Outside: Extracellular Diffusion
	Dmitry Novikov
	Diffusion in the extracellular space is considered as a function of an increasing diffusion time, equivalent to the coarse-graining of the cellular arrangement over an increasing diffusion length. The three major limits are covered: Short-time S/V limit; long-time limit of approaching the tortuosity asymptote; and the tortuosity limit. The relevant degrees of freedom of cell packing, distinct in each of the three limits, will be discussed.

15:40	Macro- vs. Micro-Anisotropy
	Filip Szczepankiewicz
	What are the distinguishing marks of anisotropic structures in a microscope, and how are these features reflected in the diffusion weighted signal? The lecture will survey the features of anisotropic diffusion on the micro- and macro-scale and connect them to the MRI experiments that may be used to probe such features.

16:05	How Small Is Small? Probing Very Small Compartment-Short Diffusion Time
	Manisha Aggarwal
	This lecture will cover the concepts and applications of oscillating-gradient diffusion MRI acquisition methods to probe tissue microstructure using short effective diffusion times. We will discuss how oscillating diffusion-encoding gradients can be used to characterize restricted diffusion in neuronal tissues, using selective sampling of the temporal diffusion spectrum D(ω) over discrete narrow frequency bands. We will then explore the applications as well as some current limitations of OGSE diffusion MRI acquisitions for probing tissue microstructure over varying length scales.

16:30	Panel Discussion

16:55	Adjournment & Meet the Teachers

Plenary Session

Mansfield Lecture: How Early Life Events Shape Our Brain: An MRI Perspective

Plenary Hall (Paris Room)	Sunday 17:30 - 18:15

17:00	Welcome

18:15	How Early Life Events Shape Our Brain: An MRI Perspective

18:15	Adjournment

Event

Opening Reception

Exhibition Hall	Sunday 18:30 - 20:00	*(no CME credit)*

Monday, 18 June 2018

Go to top
Sunrise Session

Is ASL Ready to Replace Contrast-Agent Perfusion Methods in the Clinic?

Organizers: Fernando Calamante, Hanzhang Lu, Steven Sourbron

N03	Monday 7:00 - 7:50	*Moderators:* Lirong Yan & Irene Mikkelsen

7:00	Yes, It Is Ready!

	Marion Smits

7:25	No, It Is Not!
	Ona Wu

7:50	Adjournment & Meet the Teachers

Sunrise Session

Go Faster in Clinical Imaging: Compressed Sensing

Organizers: Jongho Lee, Utaroh Motosugi, Yi-Fen Yen

N04	Monday 7:00 - 7:50	*Moderators:* Utaroh Motosugi & Yi-Fen Yen

7:00	Basic Physics of Compressed Sensing
	Jong Chul Ye

7:25	Clinical Applications of Compressed Sensing
	Akira Yamamoto

7:50	Adjournment & Meet the Teachers

Sunrise Session

From Diagnosis to Assessing Therapy Response: Rectal Cancer

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Monday 7:00 - 7:50	*Moderators:* Kathryn Fowler & Marc Gollub

7:00	Staging/Pre-Op
	Stephanie Nougaret

7:25	Response
	Regina Beets-Tan

7:50	Adjournment & Meet the Teachers

Sunrise Session

Advanced Techniques in Cardiovascular MR: More Motion

Organizers: Tim Leiner, Bernd Wintersperger

S02	Monday 7:00 - 7:50	*Moderators:* Dana Peters & Walter Witschey

7:00	Respiratory motion correction
	Markus Henningsson

7:25	Correcting Cardiac Motion
	Keigo Kawaji

7:50	Adjournment & Meet the Teachers

Sunrise Session

Application of Molecular Imaging in Cancer

Organizers: Guanshu Liu, Natalie Serkova, Damian Tyler

S03	Monday 7:00 - 7:50	*Moderators:* Gregory Metzger & Xiang Xu

7:00	Recent Technical Developments of Molecular MRI in Cancer Imaging
	Willem Mulder

7:25	Clinical Translation & Applications of Molecular MRI in Cancer
	Craig Malloy

7:50	Adjournment & Meet the Teachers

Sunrise Session

Emerging Methods in MSK MRI: Muscle

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S04	Monday 7:00 - 7:50	*Moderators:* Erin Englund & Hermien Kan

7:00	MRI of Muscle Physiology
	David Bendahan

7:25	Clinical Muscle Imaging with Emerging Techniques
	Kimberly Amrami

7:50	Adjournment & Meet the Teachers

Sunrise Session

Your Brain on Drugs: Alcohol

Organizers: Andre Obenaus, Pia Maly Sundgren

S05	Monday 7:00 - 7:50	*Moderators:* Andre Obenaus & Natalie Zahr

7:00	Alcohol: WM & Alcohol
	Natalie Zahr

7:25	Alcohol: Effects of Alcohol Using MRS

	Mark Frye

7:50	Adjournment & Meet the Teachers

Sunrise Session

Maker: Electronics

Organizers: Gregor Adriany, Matthias Günther, Michael Hansen, Christoph Juchem, Greig Scott

S06	Monday 7:00 - 7:50	*Moderators:* Mary McDougall & Greig Scott

7:00	Fabricating Electronics
	Pascal Stang

7:25	Gradient Controller Tutorial
	Michael Twieg

7:50	Adjournment & Meet the Teachers

Traditional Poster: Spectroscopy & Non-Proton MR

Exhibition Hall 1271-1304	Monday 8:15 - 10:15	*(no CME credit)*

Traditional Poster: Musculoskeletal

Exhibition Hall 1369-1393	Monday 8:15 - 10:15	*(no CME credit)*

Electronic Poster: Diffusion

Exhibition Hall	Monday 8:15 - 9:15	*(no CME credit)*

Electronic Poster: Neuro

Exhibition Hall	Monday 8:15 - 9:15	*(no CME credit)*

Study Groups

Psychiatric MR Spectroscopy & Imaging Business Meeting

W07	Monday 8:15 - 9:15	*(no CME credit)*

Study Groups

Interventional MR Business Meeting

W08	Monday 8:15 - 9:15	*(no CME credit)*

Member-Initiated Symposium

QSM: From Principles to Clinical Application

Organizers: Ulrich Katscher, Jose Marques, Stefan Ropele

S05	Monday 8:15 - 10:15	*(no CME credit)*

	8:15	Introduction to Magnetic Susceptibility Mapping: From Magnetism to Magnetic Fields & Back to the Start!
		Richard Bowtell[1]
		[1]University of Nottingham

	8:35	QSM, the Quantitative & Qualitative Susceptibility Mapping
		Andreas Deistung[1]
		[1]Medical Physics Group, Institute of Diagnostic and Interventional Radiology, Jena University Hospital, Jena, Germany

	8:50	QSM Technical Implementation Challenges
		Pascal Spincemaille[1]
		[1]Cornell University, United States

	9:00	Roundtable: What Is Missing to Make QSM a Clinical Product?

		Heiko Meyer

	9:00	Roundtable: What Is Missing to Make QSM a Clinical Product?
		Kim van de Ven[1]
		[1]Philips Healthcare

	9:00	Roundtable: What Is Missing to Make QSM a Clinical Product?
		Samir Sharma

	9:15	Iron Accumulation in Neurodegenerative Diseases & Aging: QSM as a New Tool in Clinical Research
		Birte Forstmann

	9:35	Clinical Applications of a Myelin & Iron Biomarker: The Contribution of QSM to the Study of Multiple Sclerosis
		Susan Gauthier

	9:55	Debate: Is QSM Ready for Clinical Use as a Diagnostic Tool?
		Alex Rovira[1]
		[1]Hospital Universitari Vall D'Hebron

	9:55	Debate: Is QSM Ready for Clinical Use as a Diagnostic Tool?
		Won-Jin Moon[1]
		[1]Konkuk University Medical Center

Member-Initiated Symposium

Challenges & Successes in Imaging the Developing Brain

Organizers: Franklyn Howe, Petra Huppi, Duan Xu

W05/06	Monday 8:15 - 10:15	*(no CME credit)*

	8:15	Imaging Early Brain Development: Challenges & Potential of MRI in Infants
		Jessica Dubois[1]
		[1]Cognitive Neuroimaging Unit U992, INSERM, Gif-sur-Yvette, France

	8:45	Imaging Function in Developing Preterm Brain with Simultaneous EEG-fMRI
		Tomoki Arichi[1]
		[1]Kings College London

	9:15	Quantitative MRI from Childhood to Young Adulthood, Development & Clinical Application
		Chris Clark[1]
		[1]UCL Institute of Child Health, United Kingdom

	9:45	Learning-Based Quantification of Baby Brain Development
		Dinggang Shen[1]
		[1]UNC-Chapel Hill

Weekday Course

ISMRM-SMRT Joint Forum: AI in Radiology: Man vs. Machine

Organizers: John Port, Martin Sherriff

N01	Monday 8:15 - 10:15	*Moderators:* James Stuppino & John Port

	8:15	The Bright Future of AI/ML in Radiology
		Bradley J. Erickson[1]
		[1]Mayo Clinic, United States
		Artificial intelligence will result in substantial changes in the way that radiology and medicine are practiced. Portions of diagnosis and therapeutics that have a clear pattern are likely to be replaced, augmented, or improved with computer technologies. This will also happen more broadly in all of the world. We must be prepared for these changes, and with proper involvement, we can use this technology to improve everyone's lives.

	8:45	MR Tech View: Will AI/ML Put My Job at Risk?
		Vera Kimbrell[1]
		[1]Brigham and Women's Hospital, United States
		MR Technology and our mother modality Radiology are on the brink of significant change. Computer programming and hardware exist to automat many functions once done by technologists or physicians. We are grudging moving forward to embrace these improvements. Somewhat untrusting and with great trepidation we struggle to balance faster exam times, greater ancillary tasks and new technology. We must carefully but quickly earn these new skills and build new workflows in our departments. MR Technologists are very resilient and with proper education and support can make this new world a better one for our patients and ourselves.

	9:15	Radiologist View: Will AI/ML Put My Job at Risk?
		Konstantin Nikolaou[1]
		[1]University Hospitals Tuebingen, Germany
		The routine use of Artificial Intelligence (AI) in medicine and in medical imaging will become reality, that´s a fact. This is true not only for radiology, but for all medical professions. The question is, how fast this may happen, for which indications and clinical scenarios, and how this will be implemented in our routine workflows. Indeed, implementation and use of AI in radiology is even beneficial and wanted, given the exponentially rising demand of diagnostic imaging and radiological procedures. But will AI replace our profession? Will we have to stop training radiologists? Radiology is always changing and has always been developing alongside new technologies. Therefore, AI will not replace our profession, but it will change our work and it will make us have to train even more. There are a number of reasons why diagnostic radiology has a bright future, implementing AI and ML.

	9:45	Panel Discussion

	10:15	Adjournment & Meet the Teachers

Weekday Course

Theranostics & Novel Molecular Probes

Organizers: Guanshu Liu, Arvind Pathak

S02	Monday 8:15 - 10:15	*Moderators:* Robia Pautler & Xiaolei Song

	8:15	MRI Capable Theranostic Agents
		Hui Mao[1]
		[1]Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, GA, United States
		New generation magnetic resonance imaging (MRI) contrast agents such as nanoparticles can be developed as theranostic agents which integrate the MRI contrast enhancing capability with therapeutic functions. The objective of this lecture is to give the audience an update of the recent developments in MRI enabled theranostics and stimulate the interests and new ideas to further advance the research and clinical translations of MRI enabled theranostics. The rational design of MRI capable theranostics agents, approaches for making the desired theranostic platforms, and MRI methods developed to enable MRI visualization of delivery processes will be discussed and presented with examples.

	8:55	Treatment Monitoring Using Smart MRI Agents
		Dmitri Artemov[1]
		[1]Johns Hopkins Univ. Sch. of Medicine, United States
		In this presentation we will summarize the current state of molecular MRI using biologically active and/or targeted “smart” imaging agents to detect treatment response in several preclinical models of human diseases including cancer. Both methodological and biological aspects of the MR imaging strategies will be considered. We anticipate that by the end of the talk the audience should have improved understanding and appreciation of mechanisms and applications of novel state-of-the-art MRI imaging agents to various disease processes in preclinical models.

	9:35	Potential & Requirements for Clinical Translation

		John Waterton[1]
		[1]University of Manchester, United Kingdom
		This presentation discusses clinical translation of novel agents. Firstly, the conventional diagnostic drug development pathway is outlined. Then six unconventional pathways are introduced and illustrated with examples from MR and other diagnostic imaging modalities.

	10:15	Adjournment & Meet the Teachers

	10:55	
		TBD

Power Pitch

Pitch: CV PowerBeat: Part 1

Power Pitch Theater A - Exhibition Hall	Monday 8:15 - 9:15	*Moderators:* sergio uribe & Michael Hope	*(no CME credit)*

1	8:15	Non-invasive pressure estimations by virtual fields – cardiovascular pressure drops from 4D flow MRI
		David Marlevi [1,2], Bram Ruijsink[3], Maximilian Balmus[3], Desmond Dillon-Murphy[3], Daniel Fovargue[3], Kuberan Pushparajah[3,4], Pablo Lamata[3], C. Alberto Figueroa[3,5], Massimiliano Colarieti-Tosti[1,6], Matilda Larsson[1], Reza Razavi[3,4], and David A. Nordsletten[3]
		[1]Department of Medical Engineering, KTH Royal Institute of Technology, Stockholm, Sweden, [2]Clinical Sciences, Karolinska Institutet, Stockholm, Sweden, [3]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, [4]Department of Congenital Heart Disease, Evelina Children's Hospital, London, United Kingdom, [5]Departments of Surgery and Biomedical Engineering, University of Michigan, Ann Arbor, MI, United States, [6]Department of Clinical Science, Intervention and Technology (CLINTEC), Karolinska Institutet, Stockholm, Sweden

2	8:15	The Effect of Model Compliance and Pulsatile Flow for In-Vitro Simulation of the Aorta
		Timothy Aaron Ruesink[1], Matthew Smith[2,3], Katrina Ruedinger[4], Christopher J François[2,3], and Alejandro Roldán-Alzate[1,2,4]

		[1]Mechanical Engineering, University of Wisconsin, Madison, WI, United States, [2]Radiology, University of Wisconsin, Madison, WI, United States, [3]School of Medicine and Public Health, University of Wisconsin, Madison, WI, United States, [4]Biomedical Engineering, University of Wisconsin, Madison, WI, United States

3	8:15	3D Hemodynamics Characterization in Patients with Hypercholesterolemia using 4D Flow data and a Finite Element Method.
		Julio Sotelo[1,2], Animesh Tandon[3], Andrew Tran[3], Joaquín Mura[1], Daniel E Hurtado[4,5], Tarique Hussain[3], and Sergio Uribe[1,4,6]
		[1]Biomedical Imaging Center, Pontificia Universidad Católica de Chile, Santiago, Chile, [2]Department of Electrical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [3]Department of Radiology and Biomedical Engineering, University of Texas Southwestern, Dallas, TX, United States, [4]Institute for Biological and Medical Engineering, Schools of Engineering, Medicine and Biological Sciences, Pontificia Universidad Católica de Chile, Santiago, Chile, [5]Department of Structural and Geotechnical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [6]Department of Radiology, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile

4	8:15	Caval Blood Flow Distribution in Fontan Circulation: Comparison between ASL-Measured Pulmonary Perfusion and 4D Flow
		Joshua S. Greer[1,2], Jerry Michael[3], Barbara Burkhardt[3], Animesh Tandon[2,3], Gerald F. Greil[2,3,4], Tarique Hussain[2,3], and Ananth J. Madhuranthakam[2,4]
		[1]Bioengineering, University of Texas at Dallas, Richardson, TX, United States, [2]Radiology, UT Southwestern Medical Center, Dallas, TX, United States, [3]Pediatrics, UT Southwestern Medical Center, Dallas, TX, United States, [4]Advanced Imaging Research Center, UT Southwestern Medical Center, Dallas, TX, United States

5	8:15	Postoperative changes in volume flow rate in the thoracic aorta and the aortic arch branches in patients with aortic valve stenosis: a prospective serial 4D flow MRI study
		Hiroki Kamada[1], Hideki Ota[1], Masanori Nakamura[2], Yohsuke Imai[3], Wenyu Sun[1], Yoshiaki Komori[4], Ko Sakatsume[5], Ichiro Yoshioka[5], Yoshikatsu Saiki[6], and Kei Takase[1]
		[1]Department of Diagnostic Radiology, Tohoku University Hospital, Sendai, Japan, [2]Department of Electrical and Mechanical Engineering, Nagoya Institute of technology, Nagoya, Japan, [3]School of Engineering, Tohoku University, Sendai, Japan, [4]Siemens Japan K.K., Tokyo, Japan, [5]Division of Cardiovascular Surgery, Tohoku University Hospital, Sendai, Japan, [6]Division of Cardiovascular Surgery, Tohoku University Graduate School of Medicine, Sendai, Japan

6	8:15	4D-Flow-MRI analysis of aortic flow patterns after replacement of the ascending aorta with a physiologically pre-shaped, 90° bent prosthesis
		Thekla Helene Oechtering[1], Jennifer Schlueter[1], Malte Maria Sieren[1], Michael Scharfschwerdt[2], Christian Auer[2], Markus Huellebrand[3], Hans-Hinrich Sievers[2], Joerg Barkhausen[1], and Alex Frydrychowicz[1]
		[1]Department of Radiology and Nuclear Medicine, University Hospital Schleswig-Holstein, Luebeck, Germany, [2]Department of Cardiac and Cardiothoracic Vascular Surgery, University Hospital Schleswig-Holstein, Luebeck, Germany, [3]Fraunhofer MEVIS, Bremen, Germany
7	8:15	Impact of field strength (1.5, 3.0 and 7.0 Tesla) and sequence on quantification of aortic flow volumes, peak velocity and wall shear stress using 4D flow MRI
		Stephanie Funk[1,2], Sebastian Schmitter[3], Marcel Prothmann[1], Carsten Schwenke[4], Florian von Knobelsdorff-Brenkenhoff[1,5], Andreas Greiser[6], Emilie Bollache[7], Michael Markl[7], and Jeanette Schulz-Menger[1,2]
		[1]Experimental and Clinical Research Center, a joint cooperation between the Charité Medical Faculty and the Max-Delbrueck Center for Molecular Medicine and HELIOS Hospital Berlin Buch, Department of Cardiology and Nephrology, Berlin, Germany, [2]DZHK (German Center for Cardiovascular Research), partner site Berlin, Berlin, Germany, [3]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig and Berlin, Germany, [4]SCO:SSIS Statistical Consulting, Berlin, Germany, [5]Clinic Agatharied, Department of Cardiology, Ludwig-Maximilians-University Munich, Hausham, Germany, [6]Siemens Healthcare, Erlangen, Germany, [7]Department of Radiology, Northwestern University, Feinberg School of Medicine, Chicago, IL, United States
8	8:15	Quantifying the Impact of Velocity Field Distortions on Particle Tracking Techniques
		Magnus Ziegler[1,2], Martin Welander[1,3], Marcus Lindenberger[1,3], Niclas Bjarnegård[1,3], Jonas Lantz[1,2], Matts Karlsson[1,2], Tino Ebbers[1,2], Toste Länne[1,3], and Petter Dyverfeldt[1,2]
		[1]Linköping University, Linköping, Sweden, [2]Center for Medical Image Science and Visualization (CMIV), Linköping, Sweden, [3]University Hospital Linköping, Linköping, Sweden
9	8:15	Quantitative MRI detects acute vascular effects of e-cig aerosol inhalation
		Michael C Langham[1], Alessandra Stella Caporale[2], and Felix W Wehrli[3]
		[1]3400 Spruce St, University of Pennsylvania, Philadelphia, PA, United States, [2]Radiology, University of Pennsylvania, Philadelphia, PA, United States, [3]University of Pennsylvania, Philadelphia, PA, United States

10	8:15	Accelerating 4D-Flow Acquisitions by Reducing TE and TR with Optimized RF and Gradient Waveforms
		Michael Loecher[1], Patrick Magrath[2], Eric Aliotta[3], and Daniel B Ennis[1,2,3]
		[1]Radiological Sciences, University of California, Los Angeles, CA, United States, [2]Bioengineering, University of California, Los Angeles, CA, United States, [3]Biomedical Physics, University of California, Los Angeles, CA, United States
11	8:15	A Dual Echo, Dual VENC (DEDV) phase contrast method for Simultaneous Measurement of Myocardial and Blood Flow Velocities
		Afis Ajala[1], Jiming Zhang[2], Benjamin Cheong[2], Pei-Herng Hor[1], and Raja Muthupillai[2]
		[1]Physics and Texas Center for Superconductivity, University of Houston [Main Campus], HOUSTON, TX, United States, [2]Baylor St. Luke's Medical Center, Houston, TX, United States
12	8:15	30 times accelerated 4D flow MRI in the carotids using a Pseudo Spiral Cartesian acquisition and a Total Variation constrained Compressed Sensing reconstruction
		Eva S Peper[1], Lukas M Gottwald[1], Qinwei Zhang[1], Bram F Coolen[2], Pim van Ooij[1], Gustav J Strijkers[2], and Aart J Nederveen[1]
		[1]Radiology and Nuclear Medicine, Academic Medical Center (AMC), Amsterdam, Netherlands, [2]Biomedical Engineering and Physics, Academic Medical Center (AMC), Amsterdam, Netherlands
13	8:15	Alterations of Cardiac 4D Hemodynamics and Blood Energetics in Hypertrophic Cardiomyopathy
		Aakash Gupta[1], Michael Markl[1,2], Bradley Allen[1], Lubna Choudhury[3], James Carr[1,2,3], Robert Bonow[3], and Jeremy Collins[1]
		[1]Department of Radiology, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [2]Department of Biomedical Engineering, McCormick School of Engineering, Northwestern University, Chicago, IL, United States, [3]Department of Medicine, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States
14	8:15	Dynamic flow imaging and quantification using cine FISS arterial spin labeling
		Robert R Edelman[1,2], Ali Serhal[2], Amit Pursnani[3], Jianing Pang[4], and Ioannis Koktzoglou[1,5]

		[1]Radiology, NorthShore University HealthSystem, Evanston, IL, United States, [2]Radiology, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [3]Medicine, NorthShore University HealthSystem, Evanston, IL, United States, [4]Siemens Medical Systems, Chicago, IL, United States, [5]Radiology, Prtizker School of Medicine, University of Chicago, Chicago, IL, United States

15	8:15	4D Flow Cardiac MRI Using Semi-Automated Retrospective Valve Tracking for Assessment of Severe Mitral Insufficiency
		Carmen PS Blanken[1], Jos JM Westenberg[2], Pim van Ooij[1], Geertruida P Bijvoet[3], Steven AJ Chamuleau[3], Jean-Paul Aben[4], Stefan M Boekholdt[1], Aart J Nederveen[1], Tim Leiner[3], and R Nils Planken[1]
		[1]Academic Medical Center Amsterdam, Amsterdam, Netherlands, [2]Leiden University Medical Center, Leiden, Netherlands, [3]Utrecht University Medical Center, Utrecht, Netherlands, [4]Pie Medical Imaging, Maastricht, Netherlands

Power Pitch

Pitch: Trending Topics: Flexible, Material, Portable, Wireless

Power Pitch Theater B - Exhibition Hall	Monday 8:15 - 9:15	*Moderators:* Fraser Robb & Natalia Gudino	*(no CME credit)*

16	8:15	The iPRES-W AIR Coil: A Flexible RF Coil for Simultaneous MR Image Acquisition, Wireless Communication, and Localized B_0 Shimming
		Jonathan D. Cuthbertson[1,2], Dean Darnell[1], Julia Bresticker[1,2], Robert Stormont[3], Fraser Robb[3], Allen W. Song[1,2], and Trong-Kha Truong[1,2]
		[1]Brain Imaging Analysis Center, Duke University, Durham, NC, United States, [2]Medical Physics Graduate Program, Duke University, Durham, NC, United States, [3]GE Healthcare, Aurora, OH, United States

17	8:15	Towards wearable MR detection: A stretchable wrist array with on-body digitization
		Andreas Port[1], Jonas Reber[1], Christian Vogt[2], Josip Marjanovic[1], Benjamin Sporrer[3], Lianbo Wu[3], Andreas Mehmann[2], David Otto Brunner[1], Thomas Burger[3], Gerhard Troester[2], Qiuting Huang[3], and Klaas Paul Pruessmann[1]
		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland, [2]Electronics Laboratory, ETH Zurich, Zurich, Switzerland, [3]Integrated Systems Laboratory, ETH Zurich, Zurich, Switzerland

18	8:15	High Impedance Detector Arrays for Magnetic Resonance
		Bei Zhang[1,2], Daniel K. Sodickson[1,2,3], and Martijn A. Cloos[1,2]
		[1]Bernard and Irene Schwartz Center for Biomedical Imaging, New York University School of Medicine, New York, NY, United States, [2]Center for Advanced Imaging Innovation and Research (CAI2R), New York University School of Medicine, New York, NY, United States, [3]The Sackler Institute of Graduate Biomedical Sciences, New York University School of Medicine, New York, NY, United States
19	8:15	Highly Flexible, Light Weight 24 Channel 3T Bilateral Brachial Plexus Array Worn as a Close Fitting Variable Size Vest
		Ed Boskamp[1], Victor Taracila[1], Scott Lindsay[2], Robert Stormont[2], Reni Biswas[3,4], Sheronda Statum[3,4], Shane Aldas[5], Cesar Barraza[5], Fraser Robb[1], Christine B Chung[3,4], and Won Bae[3,4]
		[1]G. E. Healthcare Technologies, Aurora, OH, United States, [2]G. E. Healthcare Technologies, Waukesha, WI, United States, [3]Radiology, University of California, San Diego, La Jolla, CA, United States, [4]Radiology, VA San Diego Healthcare System, San Diego, CA, United States, [5]Electrical Engineering, University of California, San Diego, La Jolla, CA, United States
20	8:15	Custom, 3D Sprayed MRI receive coils
		Alla Zamarayeva[1], Michael Liu[2], Joseph Corea[1], Karthik Gopalan[1], Kelvin Pang[3], Miki Lustig[1], and Ana Claudia Arias[1]
		[1]EECS, UC Berkeley, Berkeley, CA, United States, [2]Georgia Institute of Technology, Atlanta, GA, United States, [3]ME, UC Berkeley, Berkeley, CA, United States
21	8:15	First clinical pilot study using screen-printed flexible MRI receive coils for pediatric applications
		Simone Angela Winkler[1], Joseph Corea[2], Balthazar Lechene[2], Kendall O'Brien[3], John Ross Bonanni[3], Fraser Robb[4], Greig Scott[5], John Pauly[5], Michael Lustig[2], Ana Claudia Arias[2], and Shreyas Vasanawala[1]
		[1]Department of Radiology, Stanford University, Stanford, CA, United States, [2]University of California Berkeley, Berkeley, CA, United States, [3]Lucile Packard Children's Hospital Stanford, Stanford, CA, United States, [4]GE Healthcare, Aurora, OH, United States, [5]Department of Electrical Engineering, Stanford University, Stanford, CA, United States
22	8:15	Volumetric resonators based on novel materials for 3 T MRI

		Anna Mikhailovskaya[1], Alena Shchelokova[1], Dmitry Dobrykh[1], Ivan Sushkov[2], Alexey Slobozhanyuk[1,3], and Andrew Webb[4]
		[1]Department of Nanophotonics and Metamaterials, ITMO University, Saint Petersburg, Russian Federation, [2]Department of Radiology, Vreden Russian Institute of Traumatology and Orthopedics, Saint Petersburg, Russian Federation, [3]Nonlinear Physics Center, Research School of Physics and Engineering, Australian National University, Canberra, Australia, [4]C.J. Gorter Center for High Field MRI, Department of Radiology, Leiden University Medical Center, Leiden, Netherlands

23	8:15	New ferroelectric ceramics for transmit efficiency enhancement at 1.5 Tesla
		Irena Zivkovic[1], Alexey Slobozhanyuk[2], Elizaveta Nenasheva[3], and Andrew Webb[1]
		[1]Radiology Department, C.J. Gorter Center for High Field MRI, Leiden University Medical Center, Leiden, Netherlands, [2]Department of Nanophotonics and Metamaterials, ITMO University, Saint Petersburg, Russian Federation, [3]Giricond Research Institute, Ceramics Co., Saint Petersburg, Russian Federation

24	8:15	Comparison of a 16-channel monopole/dipole hybrid array with a combined 8-channel monopole + 8-channel high dielectric constant (HDC) disk dipole array for head imaging at 10.5T
		Myung Kyun Woo[1], Lance DelaBarre[1], Jerahmie Radder[1], Russell Lagore[1], Yigitcan Eryaman[1], Kamil Ugurbil[1], and Gregor Adriany[1]
		[1]Center for Magnetic Resonance Research, Minneapolis, MN, United States

25	8:15	Pilot Tone Software Synchronization for Wireless MRI Receivers
		Greig Scott[1], Shreyas Vasanawala[2], Fraser Robb[3], Pascal Stang[4], and John Pauly[1]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Stanford University, Stanford, CA, United States, [3]GE Healthcare, Aurora, OH, United States, [4]Procyon Engineering, San Jose, CA, United States

26	8:15	Demonstration of a new volumetric wireless coil for extremities imaging
		Alena Shchelokova[1], Dmitry Dobrykh[1], Stanislav Glybovski[1], Mikhail Zubkov[1], Ekaterina Brui[1], Cornelis A.T. van den Berg[2], Irina Melchakova[1], and Pavel Belov[1]

		[1]Department of Nanophotonics and Metamaterials, ITMO University, Saint Petersburg, Russian Federation, [2]Centre for Image Sciences, University Medical Center Utrecht, Utrecht, Netherlands

27	8:15	High Precision Wireless Clock Recovery for On-Coil MRI Receivers Using Round-Trip Carrier Phase Tracking.
		Arne Reykowski[1], Paul Redder[1], Rodrigo Calderon Rico[1], Tracy Wynn[1], Tim Ortiz[1], Greg Dowling[1], Randy Duensing[2], and Scott B King[1]
		[1]Invivo Corporation, Gainesville, FL, United States, [2]Philips Research, Hamburg, Germany

28	8:15	Antenna Design for Wireless Clock Syncing and Q-spoiling in MRI
		Jonathan Y Lu[1], Thomas Grafendorfer[2], Shreyas Vasanawala[1], Fraser Robb[2,3], John M Pauly[1], and Greig C Scott[1]
		[1]Stanford University, Stanford, CA, United States, [2]GE Healthcare Inc., Stanford, CA, United States, [3]GE Healthcare Inc., Aurora, OH, United States

29	8:15	3D imaging with a portable MRI scanner using an optimized rotating magnet and 1D gradient coil
		Patrick McDaniel[1], Clarissa Z Cooley[2,3], Jason P Stockmann[2,3], and Lawrence L Wald[2,3]
		[1]Massachusetts Institute of Technology, Cambridge, MA, United States, [2]Athinoula A Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [3]Harvard Medical School, Boston, MA, United States

30	8:15	Portable single-sided MR: multicomponent T2 relaxometry and depth profiling with a Unilateral Linear Halbach sensor
		Ashvin Bashyam[1,2], Chris J Frangieh[1,2], Matthew Li[2], Jason Stockmann[3,4], and Michael J Cima[2,5]
		[1]Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [2]David H. Koch Institute For Integrative Cancer Research, Massachusetts Institute of Technology, Cambridge, MA, United States, [3]A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [4]Harvard Medical School, Boston, MA, United States, [5]Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA, United States

Rapid Comprehensive MRI

Organizers: Michael Lustig, Demian Wassermann

S01	Monday 8:15 - 10:15	*Moderators:* Oliver Bieri & Christiane Kuhl

	8:15	Clinical Needs
		Vikas Gulani[1]
		[1]Case Western Reserve University, United States

	8:45	Technical Trends
		Julia Velikina[1]
		[1]University of Wisconsin-Madison, United States

31	9:15	Non-ECG, free-breathing myocardial T1-T2 mapping of acute myocardial infarction using low-rank tensor MR multitasking
		Anthony G Christodoulou[1], Jaime L Shaw[1,2], Christopher Nguyen[1], Yibin Xie[1], Nan Wang[1,2], Qi Yang[1,3], and Debiao Li[1,2]
		[1]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [2]Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA, United States, [3]Department of Radiology, Xuanwu Hospital, Beijing, China
		Myocardial tissue characterization by T1-T2 mapping is promising for diagnosing myocardial infarction, ischemia, and more. This is typically performed using ECG triggering and breath-holding, which is uncomfortable and unreliable in patients. This work describes a novel method for non-ECG free-breathing joint T1-T2 mapping using cardiovascular MR multitasking, modeling the underlying 6D multidimensional image—which has 2 spatial dimensions + 4 time dimensions (cardiac, respiratory, T1, and T2)—as a low-rank tensor. T1 and T2 measurements in acute myocardial infarction patients agreed with reference methods and predicted late gadolinium enhancement with 100% sensitivity and 92% specificity.

32	9:27	5D Flow MRI – Respiratory Motion Resolved Accelerated 4D Flow Imaging Using Low-Rank + Sparse Reconstruction
		Jonas Walheim[1] and Sebastian Kozerke[1]

		[1]ETH Zurich, Zurich, Switzerland
		We present a low-rank + sparse reconstruction method which resolves respiratory motion in 4D flow magnetic resonance imaging as a low-rank signal component. Respiratory motion resolved 4D flow MRI data is reconstructed and compared to the total variation based XD-GRASP method and a standard parallel imaging acquisition protocol. Good agreement of the reconstructed results with the reference shows that a low-rank model is effective in resolving respiratory motion in 4D flow magnetic resonance imaging.

33	9:39	Multi-echo Magnetic Resonance Fingerprinting: Simultaneous derivation of T1, T2, B0, T2*, T2', Tx/Rx phase maps, and T2*-corrected magnitude maps in in-vivo and phantom studies
		Thomas Amthor[1], Jakob Meineke[1], Karsten Sommer[1], Peter Koken[1], and Mariya Doneva[1]
		[1]Tomographic Imaging, Philips Research Europe, Hamburg, Germany
		This work describes a Magnetic Resonance Fingerprinting (MRF) implementation using multiple echo acquisitions within one TR. In this way, B0, T2*, R2', and Tx/Rx phase maps are derived in addition to the standard M0, T1, and T2 maps, as demonstrated in in-vivo and phantom experiments. Accounting for the difference in T2 and T2*, the inherent bias of MRF-derived M0 maps can be corrected. The derived R2' map may have diagnostic relevance for neurodegenerative diseases.

34	9:51	MP2RAGEME: T1, T2* and QSM mapping in one sequence at 7 Tesla
		Matthan W.A. Caan[1,2], Pierre-Louis Bazin[2,3,4], Alessio Fracasso[2], José Marques[5], Serge Dumoulin[2], and Wietske van der Zwaag[2]
		[1]Radiology, Academic Medical Center, Amsterdam, Netherlands, [2]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands, [3]Social Brain Laboratory, Netherlands Institute for Neuroscience, Amsterdam, Netherlands, [4]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [5]Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands
		Quantitative T_1, T_2* and QSM information can be acquired in a single acquisition, using a multi-echo extension of the MP2RAGE sequence, MP2RAGEME. This simultaneous acquisition results in large time savings, perfectly coregistered data and minimal image quality differences. Following a correction for residual transmit B1-sensitivity quantitative T_1 and T_2* and QSM-values were in excellent agreement with those obtained from separately acquired MP2RAGE and GRE data. Values were also in correspondence with literature. From the MP2RAGEME data, a multiparametric cortical parcellation was obtained, as well as a combined arterial and venous map.

35	10:03	Simultaneous Proton Density Fat Fraction Imaging and Water T1-Mapping with Low B1+ Sensitivity (PDFF-T1)

		Richard B Thompson[1], Kelvin Chow[2], and Justin Grenier[1]
		[1]Department of Biomedical Engineering, University of Alberta, Edmonton, AB, Canada, [2]Cardiovascular MR R&D, Siemens Medical Solutions USA, Inc., Chicago, IL, United States
		Quantitative multi-parametric MR imaging is an important component of diagnosis and objective staging of diffuse liver disease, reducing the need for biopsy. The goal of the current study was to validate a new simultaneous proton density fat fraction and water T1-mapping approach (PDFF-T1) with low B1+ sensitivity in a short, patient-friendly breath-hold acquisition. It is shown (simulations, phantoms, in-vivo) that a time-varying flip angle excitation scheme leads to improved accuracy of PDFF and that fat-water separation enables water-specific T1 mapping, all in a single patient-friendly breath-hold, with low sensitivity to inhomogeneity in the transmitted radiofrequency (B1+) field.

	10:15	Adjournment & Meet the Teachers

Oral

Diffusion MRI: From Fiber Orientation to Connectivity

N02	Monday 8:15 - 10:15	*Moderators:* Stamatios Sotiropoulos & Robert Smith

36	8:15	Super-resolution for spherical deconvolution of multi-shell diffusion MRI data
		Ben Jeurissen[1], Gabriel Ramos-Llordén[1], Floris Vanhevel[2], Paul M Parizel[2], and Jan Sijbers[1]
		[1]imec-Vision Lab, Dept. of Physics, University of Antwerp, Antwerp, Belgium, [2]Dept. of Radiology, Antwerp University Hospital and University of Antwerp, Antwerp, Belgium
		Multi-tissue constrained spherical deconvolution (MT-CSD) can simultaneously estimate the full white matter fiber orientation distribution function (fODF) and the apparent densities of cerebrospinal fluid and grey matter from multi-shell diffusion MRI data, making it an attractive option for clinical and neuroscientific studies. Unfortunately, MT-CSD at high spatial resolution is challenging due to scan time and signal-to-noise ratio constraints. We propose a new MT-CSD approach that enables super-resolution estimation from multiple thick-sliced data sets with varying slice orientation. Using data acquired on a clinical scanner, we demonstrate high-quality tissue density maps and fODFs at $1\times1\times1mm^3$ spatial resolution in under 10 minutes.

37	8:27	Differential Sensitivity of Various Microstructural Metrics to Training-Induced White Matter Dynamics
		Debbie Anaby[1], Benjamin Tendler[2], Chantal M.W. Tax[1], Greg D Parker[1], Yaniv Assaf[3,4], and Derek K Jones[1]

		[1]Cardiff University Research Imaging Centre (CUBRIC), School of Psychology, Cardiff University, Cardiff, United Kingdom, [2]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [3]Department of Neurobiology, Tel Aviv University, Tel Aviv, Israel, [4]Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel
		Previous *in-vivo* MRI studies on training-induced WM microstructural dynamics were mostly based on DTI measurements showing changes in FA. The non-specificity of FA as a WM marker stimulated us to obtain a more specific characterization of WM microstructural changes. Using multi-parametric MR with the 'Tractometry' approach we show significant changes in the fornix post a navigation working memory task. Critically, we report here for the first time significant microstructural changes with susceptibility, shown in vast areas of the fornix. Fr, MD, RD and λ1 also show significant changes but in limited areas of the fornix.

38	8:39	Reducing false positives in tractography with microstructural and anatomical priors
		Alessandro Daducci[1,2,3], Muhamed Barakovic[2], Gabriel Girard[2], Maxime Descoteaux[4,5], and Jean-Philippe Thiran[2,3]
		[1]Computer Science department, University of Verona, Verona, Italy, [2]Signal Processing Laboratory 5 (LTS5), Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, [3]Radiology department, University Hospital Center (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [4]Sherbrooke Connectivity Imaging Laboratory (SCIL), University of Sherbrooke, Sherbrooke, QC, Canada, [5]Department of Nuclear Medicine and Radiobiology, Faculty of Medicine and Health Science, Sherbrooke Molecular Imaging Center, Sherbrooke, QC, Canada
		Tractography has proven particularly effective for studying noninvasively the neuronal architecture of the brain but recent studies have showed that the high incidence of false positives can significantly bias any connectivity analysis. We present a novel processing framework that can dramatically reduce these false positives, i.e. improving specificity, without affecting the sensitivity, by considering two very basic observations about white-matter anatomy. Our results may have profound implications for the use of tractography to study brain connectivity.

39	8:51	Fast and accurate white matter bundle segmentation
		Jakob Wasserthal[1,2], Peter F. Neher[1], and Klaus H. Maier-Hein[1]
		[1]Division of Medical Image Computing, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Medical Faculty, University of Heidelberg, Heidelberg, Germany
		Automatic white matter fiber bundle segmentation in diffusion-weighted MRI brain scans enables detailed studies of white matter characteristics in healthy and diseased brains. Existing approaches combine processing steps such as tractography, atlas registration and cortical parcellation, resulting in pipelines that are computationally intensive and tedious to set up. We present a novel convolutional neural network-based approach that incorporates or circumvents most of the usually required processing steps (no registration, no tracking, no parcellation). We demonstrate in 105 subjects from the Human Connectome Project that the proposed approach is much faster than existing methods while providing more accurate results.

40	9:03	A data-driven groupwise fiber clustering atlas for consistent white matter parcellation and anatomical tract identification of subjects across the lifespan
		Fan Zhang[1], Ye Wu[1], Isaiah Norton[1], Yogesh Rathi[1], Nikos Makris[1], and Lauren J. O'Donnell[1]
		[1]Harvard Medical School, Boston, MA, United States
		We propose an anatomically curated white matter parcellation atlas generated from a large population of 100 healthy adult subjects, leveraging a well-established data-driven groupwise fiber clustering pipeline and expert neuroanatomy knowledge. We demonstrate the ability of the proposed method to parcellate a total of 541 subjects ranging in age from 1 day to 82 years. The results suggest that our parcellation algorithm provides high generalization and consistency of white matter parcellation and tract identification for subjects across the lifespan.
41	9:15	Bundle-Wise Deep Tracker: Learning to track bundle-specific streamline paths
		Philippe Poulin[1], Francois Rheault[1], Etienne St-Onge[1], Pierre-Marc Jodoin[1], and Maxime Descoteaux[1]
		[1]University of Sherbrooke, Sherbrooke, QC, Canada
		We propose a novel bundle-wise tracking algorithm based on deep learning and recurrent neural networks. This allows bundle-specific features to be learned directly from the diffusion signal without the need to reconstruct a fiber orientation distribution. With a high amount of examples, the proposed method improves classic algorithms for several quantitative measures such as tracking efficiency, number of valid streamlines, and volume coverage.
42	9:27	Anchor tracts: a novel concept for reducing false positives in fiber tractography
		Peter F. Neher[1] and Klaus H. Maier-Hein[1]
		[1]Division of Medical Image Computing, German Cancer Research Center (DKFZ), Heidelberg, Germany
		Numerous reports have shown that fiber tractography suffers from a difficult sensitivity-specificity tradeoff. We present an approach that leverages knowledge about certain well studied tracts (*anchor tracts*) in a tractogram to quantitatively assess and score the remaining tracts (*candidate tracts*) according to their plausibility in conjunction with this context information. We show that our approach has the potential for greatly reducing the number of false positive tracts in fiber tractography while maintaining high sensitivities.
43	9:39	Investigating U-Shape Fibers from Data-Driven Clustering of White Matter Tractography

		Jason Kai[1], Loxlan W Kasa[2], Terry M Peters[1,2,3], and Ali R Khan[1,2,3]
		[1]Medical Biophysics, Western University, London, ON, Canada, [2]Biomedical Engineering, Western University, London, ON, Canada, [3]Robarts Research Institute, Western University, London, ON, Canada
		Studies of white matter tractography typically investigate fibers that make up long association tracts, such as the arcuate fasciculus. As a result, the local structural connections comprising short association (cortico-cortical), U-shaped fibers, or U-fibers, are poorly understood. Previous work suggests these fibers play an important role in communication between adjacent cortical regions. We introduce a flexible, data-driven tool incorporating multimodal MRI techniques to aid differentiation of fiber tracts via clustering techniques, including a filter to identify and extract U-fibers. Using this tool, we present a preliminary investigation of U-fibers between controls (N=20) and patients diagnosed with temporal lobe epilepsy (N=19).

44	9:51	Tractography-based parcellations show limited sensitivity to internal structure
		Jonathan D Clayden[1], David L Thomas[2], and Alexander Kraskov[3]
		[1]Developmental Imaging and Biophysics Section, UCL GOS Institute of Child Health, University College London, London, United Kingdom, [2]Neuroradiological Academic Unit, UCL Institute of Neurology, University College London, London, United Kingdom, [3]Sobell Department of Motor Neuroscience and Movement Disorders, UCL Institute of Neurology, University College London, London, United Kingdom
		Connectivity-based parcellation of subcortical structures using diffusion tractography is a common paradigm. Typically, these analyses imply voxel-level specificity of connectivity, and spatial coherence is taken as imaging-based evidence for anatomically distinct subnuclei. However, by spatially permuting diffusion parameters and repeating the parcellation, we demonstrate that internal structure in diffusion anisotropy is not necessary for a plausible parcellation to be obtained. This suggests that such parcellations should be interpreted with some caution.

45	10:03	Ultra-high resolution multi-shell dMRI and tractography of the ex vivo human brain using kT-dSTEAM at 9.4T
		Francisco J. Fritz[1], Shubharthi Sengupta[1], Robbert L. Harms[1], Benedikt A. Poser[1], and Alard Roebroeck[1]
		[1]Cognitive Neuroscience, Maastricht University, Maastricht, Netherlands
		Here we explore the high resolution acquisition of multi-shell and undersampled diffusion data with 9.4T kT-dSTEAM and analysis of such data for crossing fiber tractography. This permits effective usage of both high SNR and diffusion-weighting inherent to data with multiple b-values and shows superior definition of white matter tracks at ultra-high resolution for tractography. In addition, 3D undersampled acquisition allows more room in the trade-off between acquisition time, resolution, b-values and directions.

Oral

fMRI: Physiology & Neurovascular Coupling

N03	Monday 8:15 - 10:15	*Moderators:* Kai-Hsiang Chuang & Ian Driver

46	8:15	Covariation of pulse oximetry amplitude and BOLD fMRI across vigilance states
		Catie Chang[1], Pinar Ozbay[1], Jacco de Zwart[1], Dante Picchioni[1], Miranda Chappel-Farley[1], Hendrik Mandelkow[1], and Jeff Duyn[1]
		[1]NIH, Bethesda, MD, United States
		While pulse oximetry (PO) is often used with fMRI to provide the timing of heart beats, few studies have focused on fluctuations in the amplitude of PO waveform in the context of fMRI signals. Here, we examine correlations between spontaneous fMRI signals and PO amplitude (POA) variations, observing a strong dependence on vigilance state. During alertness, POA-fMRI correlations were weaker but encompassed regions comprising the default-mode network. During drowsiness and NREM sleep, POA co-varied extensively with BOLD signals across the brain.

47	8:27	Mechanisms underlying negative fMRI response in the striatum
		Domenic H. Cerri[1], Daniel Albaugh [1], Brittany Katz[1], SungHo Lee[1], Weiting Zhang[1], Lindsay Walton[2], Martin MacKinnon[1], Esteban Oyarzabal[1], Heather Decot[1], Nathalie Van Den Berge[1], Chunxiu Yu[3], Colleen Mills-Finnerty[4], Warren Grill[3], Amit Etkin[4], Guohong Cui[5], Garret Stuber[6], and Yen-Yu Ian Shih[1]
		[1]Neurology & Biomedical Research Imaging Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [3]Duke University, Durham, NC, United States, [4]Stanford University, Stanford, CA, United States, [5]National Institute of Environmental Health Sciences, Durham, NC, United States, [6]Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States
		Optogenetic stimulation of striatal neurons and several afferents evoke robust negative fMRI responses in the striatum, while striatal electrophysiological recordings during the same stimulations show increases in neuronal activity. Pharmacological manipulations during D1MSN-induced negative striatal responses suggest responses are downstream of MSN activity, but not interneurons or local DA release. Fiber-photometry data from D2MSNs shows a similar pattern of neurovascular uncoupling/negative coupling. This negative fMRI response is also apparent in the human brain. Our results indicate that positive BOLD in the striatum is mediated through DA release, and that negative BOLD in the striatum is induced by local neuronal activations.

48	8:39	Visually evoked negative BOLD signal coupled with silenced neuronal activity; an fMRI and intra-cranial electrocorticography study in humans
		Alessio Fracasso[1], Anna Gaglianese[2], Serge O Dumoulin[1], Nick F Ramsey[2], and Natalia Petridou[2]

		[1]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands, [2]University Medical Centre Utrecht, Utrecht, Netherlands
		Neuroimaging techniques provide a unique window on the study of human brain function in healthy as well as pathological conditions. Intra-cranial electrocorticography (ECoG) at high frequency broadband power is associated with positive blood-oxygenation-level-dependent signal, but the electrophysiological correlates of negative BOLD signals are are less well understood. Here we investigate the relationship between negative BOLD and neuronal population activity measured with ECoG, in humans, using a paradigm that excludes blood stealing as a source of negative BOLD signal.

49	8:51	Visual contrast levels modulate excitation and inhibition in the human visual cortex – a combined fMRI-MR Spectroscopy study at 7 Tesla
		Betina Ip[1,2], Uzay E Emir[1,3], Andrew J Parker[2], and Holly Bridge[1]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB Division, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]Department of Physiology, Anatomy & Genetics, University of Oxford, Oxford, United Kingdom, [3]College of Health and Human Sciences, Purdue University, West Lafayette, IN, United States
		We used 7 Tesla combined fMRI-MRS to show that simultaneously measured hemodynamic and neurochemical responses in the human visual cortex changed as a function of visual contrast. BOLD change increased linearly to rise in visual contrast, glutamate increased and GABA decreased. Quantification of this change using an excitation:inhibition index demonstrated a switch from inhibitory-dominant to excitatory-dominant neurochemical response. Our results are a step towards disambiguating contributions of cortical excitation and inhibition to stimulus evoked hemodynamic response.

50	9:03	The potential for gas-free measurements of absolute oxygen metabolism during both baseline and activation states in the human brain
		Eulanca Y. Liu[1,2], Jia Guo[3], Aaron B. Simon[4], Frank Haist[5], David J. Dubowitz[2,6], and Richard B. Buxton[2,6]
		[1]Neurosciences Graduate Program, Medical Scientist Training Program, University of California, San Diego, La Jolla, CA, United States, [2]Center for Functional MRI, University of California, San Diego, La Jolla, CA, United States, [3]Radiology, Stanford University, Stanford, CA, United States, [4]Radiation Medicine and Applied Sciences, University of California, San Diego, La Jolla, CA, United States, [5]Psychiatry, Center for Human Development, University of California, San Diego, La Jolla, CA, United States, [6]Radiology, University of California, San Diego, La Jolla, CA, United States

		We tested noninvasive methods to measure absolute oxygen metabolism ($CMRO_2$) in both baseline and activation states without the use of special gases: VSEAN to measure baseline O_2 extraction fraction (OEF), and FLAIR-GESSE to measure R_2' to estimate the scaling parameter *M*. Primary findings were: *M* derived from R_2' had less variation across subjects compared to hypercapnia-derived *M*; OEF values were in good agreement with previous PET findings; and, variation of baseline CBF/$CMRO_2$ coupling across subjects does not follow activation coupling, suggesting different mechanisms may be involved. These results support the potential of gas-free methods for quantitative physiological measurements.

51	9:15	The dynamic BOLD-CBF coupling during resting-state in the aging brain: a dual-echo pCASL study
		Piero Chiacchiaretta[1] and Antonio Ferretti[1]
		[1]Neuroscience, Imaging and Clinical Sciences, Department of Neuroscience, Imaging and Clinical Sciences - Institute for Advanced Biomedical Technologies, Chieti, Italy
		Simultaneous acquisition of BOLD and CBF data using ASL allows the study of resting-state brain function from a different perspective with respect to functional connectivity. In particular, recent evidence showed that spontaneous BOLD and CBF fluctuations are strongly coupled in the cortex. Here we show that this coupling is markedly reduced in elderlies with normal cognitive scores, with a regional specific effect in the left supramarginal gyrus, an area known to be involved in different memory functions. These findings suggest that the study of dynamic BOLD-CBF coupling can potentially offer early biomarkers of functional changes in the aging brain.

52	9:27	Dynamic measurement of oxygen extraction fraction using a Multiple-Offset-Spin-Echo Echo-Planar Imaging (MOSE-EPI) pulse sequence
		Yayan Yin[1], Yaoyu Zhang[1], Yang Fan[2], Bing Wu[2], and Jia-Hong Gao[1]
		[1]Center for MRI Research, Peking University, Beijing, China, [2]MR Research China, GE Healthcare, Beijing, China
		The development of neuroimaging methods to detect functional oxygen extraction fraction (OEF) is crucial for understanding mechanisms of physiologic function and the underlying neuronal activities. However, dynamic measurement of the OEF is currently limited by the long acquisition time. In this study, a novel pulse sequence using a multiple-offset-spin-echo (MOSE) with an echo-planar imaging (EPI) acquisition scheme was developed to improve the temporal resolution of dynamic OEF measurements. A motor task experiment was performed for ten subjects. The OEF activation maps generated through the proposed technique and compared to traditional blood oxygenation level-dependent (BOLD) activation maps.

53	9:39	Influence of end-tidal CO2 on cerebrovascular reactivity mapping: within-subject and across-subject effects
		Jill Britt De Vis[1], Xirui Hou[1], Peiying Liu[1], Zheyu Wang[2], Siyuan Cheng[2], Yang Li[1], Harshan Ravi[3], and Hanzhang Lu[1]

		[1]Division of MR Research, Johns Hopkins University, Baltimore, MD, United States, [2]Johns Hopkins University, Baltimore, MD, United States, [3]National Institutes of Health, Bethesda, MD, United States
		The relationship between end-tidal (Et) CO_2, and the output measure, BOLD signal, is highly non-linear, due to both physiological non-linearity between cerebral blood flow (CBF) and CO_2 as well as biophysical non-linearity between CBF and BOLD. In this study, we found that, across subjects, baseline $EtCO_2$ and $\Delta EtCO_2$ inversely influenced the measured CVR values. Therefore, these factors should be taken into account when comparing CVR between groups or patients. However, these inter-subject differences appear to have an independent physiological underpinning, as manipulations of these factors within the subject did not seem to have an effect on the measured CVR values.

54	9:51	Hemodynamic response altered by focused ultrasound-mediated disruption of the blood-brain barrier
		Nick Todd[1], Yongzhi Zhang[1], Margaret Livingstone[2], Lino Becerra[3], David Borsook[3], and Nathan McDannold[1]
		[1]Brigham and Women's Hospital, Boston, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Boston Children's Hospital, Boston, MA, United States
		Focused ultrasound (FUS) disruption of the blood-brain barrier (BBB) is a promising technology for achieving targeted delivery of pharmacological agents into the brain. While the method has been shown to be safe from the standpoint of not damaging tissue cells, it causes other changes to local physiology that are not fully understood. This study aims to characterize the effects on the hemodynamic response that FUS BBB opening causes. We present BOLD fMRI data showing the effect and preliminary ASL measurements of cerebral blood flow designed to better understand the effect.

55	10:03	Active, neuronal-activity-dependent trans-membrane water cycling detected by NMR
		Ruiliang Bai[1], Charles S Springer[2], Dietmar Plenz[3], and Peter J Basser[4]
		[1]Interdisciplinary Institute of Neuroscience and Technology, Qiushi Academy For Advanced Studies, Zhejiang University, Hangzhou, China, [2]Advanced Imaging Research Center, Oregon Health & Science University, Portland, OR, United States, [3]Section on Critical Brain Dynamics, LSN, NIMH, National Institutes of Health, Bethesda, MD, United States, [4]Section on Quantitative Imaging and Tissue Sciences, DIBGI, NICHD, National Institutes of Health, Bethesda, MD, United States
		Transmembrane water cycling has long been thought an entirely passive, diffusion-dominated process. Recent studies suggest that an energetically active water cycling (AWC) mechanism, driven by Na^+-K^+-ATPase (NKA) pump activity, also occurs in different cell types, including neurons and astrocytes. Here we hypothesize that monitoring AWC could provide a new, more direct physical indicator of neuronal activity, which involves much ion cycling and enhanced NKA activity. By investigating neuronal populations in vitro under resting conditions with spontanotanous activity, and perturbed with tetrodotoxin (TTX), we found TTX simultanously reduces neuronal spiking activity and AWC (by >63%) suggesting AWC directly reflects neuronal activity.

Oral

Novel Pulse Sequences

N04	Monday 8:15 - 10:15	*Moderators:* Gigi Galiana & Christian Guenthner

56	8:15	High Spatial Resolution BOLD fMRI Using Simultaneous Multislice Excitation with Echo-Shifting Gradient Echo at 7 Tesla
		Shi Su[1], Na Lu[2], Xiaojing Long[1], Chunxiang Jiang[1], Hang Zhang[1], Ye Li[1], Rong Xue[3], Haifeng Wang[1], Lijuan Zhang[1], Liang Dong[1], Xin Liu[1], and Guoxi Xie[1,2]
		[1]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, [2]Department of Biomedical Engineering, Guangzhou Medical University, Guangzhou, China, [3]Beijing MRI Center for Brain Research, Institute of Biophysics, Chinese Academy of Sciences, Beijing, China
		Signal to noise gain at ultra-high field has pushed blood oxygen level dependent functional MRI towards high spatial resolution with the benefit of improved accuracy in functional mapping. However, the techniques available for high spatial resolution fMRI are mainly based on echo-planar imaging technique, which faces geometric distortion. In this work, we proposed a technique combining simultaneous multislice excitation with echo-shifting, which can be virtually free from distortion artifacts, for high spatial resolution fMRI. Significant activation was identified in visual and motor experiments with in-plane resolution of 1.0×1.0 mm^2 and an acceleration factor of 10 at 7 Tesla.

57	8:27	Simultaneous Multi-VENC and Multi-Slice (SMVMS) Phase Contrast Imaging Using Dual Steady-State Sequence
		Suhyung Park[1], Liyong Chen[2], and David A Feinberg[1,2]
		[1]Helen Wills Neuroscience Institute, University of California, Berkeley, CA, United States, [2]Advanced MRI Technologies, Sebastopol, CA, United States
		Phase contrast (PC) MRI has been successfully applied to quantify flow velocity over the cardiac cycle by adding bipolar gradients with opposite polarity to cine gradient echo (GRE) sequences with prospective cardiac gating. However, PC-MRI suffers from a couple of disadvantages: 1) velocity aliasing which requires multiple acquisition without prior knowledge of the highest potential velocity and 2) excessive lengthy scan with whole brain coverage. In this work, we propose the Simultaneous Multi-VENC and Multi-Slice (SMVMS) technique to eliminate both issues. Instead of sequentially acquiring multiple slices with low and high velocity encoding (VENC) schemes, this interleaves an echo-shift technique in a Dual TR Steady-State (DSS) sequence using SMS excitation, which allows fast acquisition by sharing low- and high-VENC acquisitions with multiple slices in a single measurement.

58	8:39	Diffusion interleaved and slice-shuffled (DiSS) imaging for joint diffusion-relaxometry studies

		Jana Hutter[1], Daan Christiaens[1], Thomas Roberts[1], Paddy Slator[2], Anthony N Price[1], and Joseph V Hajnal[1]
		[1]Biomedical Engineering, King's College London, London, United Kingdom, [2]Centre for Medical Image Computing, University College London, London, United Kingdom
		Imaging protocols that allow diverse contrast mechanisms to be sampled with different mixes open up exciting opportunities for joint modelling of tissue properties. However joint sampling with conventional sequence structures can be extremely inefficient and so prohibitively time consuming. Here we explore the joint inversion recovery-diffusion sampling challenge and create an efficient capability by breaking the “one-volume – one encoding” paradigm to interleave the diffusion encoding not per volume but for every slice. Flexible sampling during inversion recovery allowing sufficient samples for a joint fit to be acquired in a much shorter time. The approach has been tested in normal volunteer brain examinations.

59	8:51	High Contrast and Resolution Simultaneous T1 and T2 MPRAGE at 7T
		Chan Hong Moon[1], Hoby Hetherington[1], and Jullie W. Pan[1]
		[1]MRRC, Dept. of Radiology, University of Pittsburgh, Pittsburgh, PA, United States
		T2W MRI is useful for lesion detection in neurological disorders. At 7T, while SNR can be excellent for high-resolution imaging, T2W imaging is known to be difficult due to problems with B_1 amplitude and homogeneity, as well as low T2 contrast between WM vs. GM. To address these, we developed new simultaneous T1W/T2W MP2RAGE sequence. We simulated the new sequence to optimize brain contrast and implemented on 7T combined with B_1-shimmed pTx multi-transceiver and high-order B0 shim. The results show homogeneous contrast of WM vs. GM over whole brain with excellent SAR efficiency, giving high resolution detection of hippocampal sub-structures.

60	9:03	A 2D multi-shot inversion recovery EPI (MS-IR-EPI) sequence for high spatial resolution T1-mapping at 7T
		Rosa Sanchez Panchuelo[1], Robert Turner[1,2,3], Olivier Mougin[1], and Susan Francis[1]
		[1]Sir Peter Mansfield Imaging Centre, University of Nottingham, Nottingham, United Kingdom, [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [3]University of Amsterdam, Amsterdam, Netherlands
		The present study uses an efficient 2D, multi-shot, inversion-recovery EPI (MS-IR-EPI) acquisition that combines separately excited k-space segments after each inversion pulse together with steps in slice ordering to generate T_1-maps with high SNR per unit time. We show that although the inversion times systematically vary across slices, consistent T1-maps can be generated across the whole brain. Such T_1-maps provide high spatial resolution and SNR, with little image distortion and can be collected in a short acquisition time.

61	9:15	Silent, 3D MR Parameter Mapping using Magnetization Prepared Zero TE
		Florian Wiesinger[1], Martin A Janich[1], Emil Ljungberg[1,2], Gareth J Barker[2], and Ana Beatriz Solana[1]
		[1]ASL Europe, GE Healthcare, Munich, Germany, [2]Neuroimaging, King's College London, London, United Kingdom
		Here we describe a novel method for 3D, quantitative, silent MR parameter mapping based on 1) combined T_1 and T_2 magnetization preparation, 2) Zero TE image encoding and 3) least-squares dictionary matching.

62	9:27	Multiband zoom TSE imaging: increasing efficiency with multiband tip-back preparation pulses
		Anthony N Price[1], Lucilio Cordero-Grande[1], Shaihan J Malik[1], and Joseph V Hajnal[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom
		Inner volume imaging can be appealing as it negates the need to encode a large field of view when the region of interest resides within a larger tissue structure. However, conventional zoom approaches with precisely limited field of view produce strong saturation throughout the image volume, placing a restrictive lower limit on the minimum TR, in order to avoid reduced signal and contrast. Here we present a new multiband tip-back preparation pulse in combination with a zoom multiband TSE sequence, which realises the benefits of reduced field of view encoding without the penalty of saturation in the intermediate slice areas.

63	9:39	Simultaneous Magnetic Resonance Angiography and Multiparametric Mapping in the Transient-state
		Pedro A Gomez[1,2], Miguel Molina-Romero[1,2], Guido Buonincontri[3], Bjoern H Menze[1], and Marion I Menzel[2]
		[1]Technical University of Munich, Munich, Germany, [2]GE Global Research, Munich, Germany, [3]Imago7 Foundation, Pisa, Italy
		Quantitative Transient-state Imaging (QTI) is a non-random, dictionary-less MR Fingerprinting alternative. Through iterative reconstructions, QTI recovers a series of contrast-weighted images from transient-state acquisitions and subsequently estimates the parameters that best describe the resulting dynamic signal evolutions. Here, we extend the QTI framework by incorporating a simple velocity model that accounts for blood flowing into and out of the imaging slice. The model, however wrong, can be very useful: it predicts signal hyperintensities in the presence of flow, allowing for the simultaneous reconstruction of MR Angiography images, hundreds of dynamic contrast-weighted images, and their corresponding parametric maps.

64	9:51	Novel Tumor-Selective Dual-Contrast 3D MRI Toward Zero False-Positiveness in Brain Metastases: A Feasibility Study

		Hoonjae Lee[1,2], Seong-gi Kim[1], and Jaeseok Park[3]
		[1]Center for Neuroscience Imaging Research, Institute for Basic Science (IBS), Suwon, Republic of Korea, [2]Department of Brain and Cognitive Engineering, Korea University, Seoul, Republic of Korea, [3]Department of Biomedical Engineering, Sungkyunkwan University (SKKU), Suwon, Republic of Korea
		The purpose of this work is to develop a novel, tumor-selective dual-contrast 3D MRI technique that can clearly differentiate small brain metastases from contrast-enhanced vessels while potentially eliminating false-positiveness in the corresponding diagnosis. After injecting contrast agents, the proposed pulse sequence employs a pair of mixed encodings in each TR, yielding highly tumor-selective, blood-suppressed images from the latter to increase the sensitivity of metastases detection while producing blood-enhanced signals from the former to evaluate the false-positiveness of the detected metastases. It is expected that the proposed method enhances detection sensitivity to brain metastases while substantially reducing false-positiveness.

65	10:03	Clinical Imaging Potential of FRONSAC
		Nadine Luedicke Dispenza[1], Sebastian Littin[2], Maxim Zaitsev[2], R. Todd Constable[3,4], and Gigi Galiana[3]
		[1]Department of Biomedical Engineering, Yale University, New Haven, CT, United States, [2]Department of Diagnostic Radiology, Medical Physics, University Medical Center Freiburg, Freiburg, Germany, [3]Department of Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States, [4]Department of Neurosurgery, Yale University, New Haven, CT, United States
		Despite potential for more flexible and efficient encoding that better complements receiver geometry, the past decade of work with nonlinear gradients (NLGs) has shown relatively modest improvements on accelerated image quality. In this work we present the first experimental evidence that the previously introduced ROtary Nonlinear Spatial ACquisition (FRONSAC) can notably improve accelerated image quality, both in vitro and in humans. Furthermore, this work introduces and demonstrates a number of robust and flexible attributes of this method, which are crucial to reducing scan times in a clinical setting.

Oral

Young Investigator Awards

S03	Monday 8:15 - 10:15	*Moderators:* Houchun Hu & Elizabeth Hecht

66	8:15	Arterial-Spin-Labeling (ASL) perfusion MRI predicts cognitive function in elderly individuals: a four-year longitudinal study
		Jill B De Vis[1], Shin-Lei Peng[2], Xi Chen[3], Yang Li[1], Peiying Liu[1], Sandeepa Sur[1], Karen M Rodrigue[3], Denise C Park[3], and Hanzhang Lu[1]

		[1]MR Research, Johns Hopkins University, Baltimore, MD, United States, [2]Biomedical Imaging and Radiological Science, China Medical University, Taichung, Taiwan, [3]Center for Vital Longevity, School of Behavioral and Brain Sciences, University of Texas, Dallas, TX, United States
		Identification of biomarkers that can predict cognitive decline is of utmost importance for advance in dementia pharmacotherapy. In this study, cerebral blood flow (CBF) is investigated as a predictor for cognitive decline in a healthy aging population. We found CBF in the frontal lobe to be most predictive for cognitive decline, specifically for episodic memory and in the older population. This suggest that CBF can be used as a biomarker to identify subjects susceptible to cognitive decline, to identify suitable cohorts for clinical trials, and to monitor the effects of pharmacotherapy.

67	8:35	Measuring human placental blood flow with multi-delay 3D GRASE pseudo-continuous arterial spin labeling at 3 Tesla
		Xingfeng Shao[1], Dapeng Liu[2], Thomas Martin[2], Teresa Chanlaw[3], Sherin U. Devaskar[3], Carla Janzen[4], Aisling M. Murphy[4], Daniel Margolis[2], Kyunghyun Sung[2], and Danny J.J. Wang[1]
		[1]Laboratory of FMRI Technology (LOFT), Mark & Mary Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States, [2]Department of Radiology, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [3]Department of Pediatrics, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [4]Department of Obstetrics and Gynecology, Division of Maternal Fetal Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States
		Placenta influences the health of both a woman and her fetus during pregnancy. Maternal blood supply to placenta can be measured non-invasively using arterial spin labeling (ASL). The purpose of this study is to present a multi-delay pseudo-continuous arterial spin labeling (pCASL) combined with a fast 3D inner-volume gradient- and spin-echo (GRASE) imaging technique to simultaneously measure placental blood flow (PBF) and arterial transit time (ATT), and to study PBF and ATT evolution with gestational age during the second trimester. The PBF values were compared with uterine arterial Doppler ultrasound to assess its potential clinical utility.

68	8:55	Reverse double inversion-recovery: improving motion robustness of cardiac T2-weighted dark-blood turbo spin-echo sequence
		Chenxi Hu[1], Steffen Huber[1], Syed R Latif[2], Guido Santacana-Laffitte[1], Hamid R Mojibian[1], Lauren Baldassarre[2], and Dana C Peters[1]
		[1]Department of Radiology and Biomedical Imaging, Yale School of Medicine, New Haven, CT, United States, [2]Department of Internal Medicine, Section of Cardiovascular Medicine, Yale School of Medicine, New Haven, CT, United States

		The cardiac T2-weighted dark-blood turbo spin-echo (TSE) sequence based on double inversion-recovery (DIR) is subject to motion artifacts due to mismatching of slices from the dark-blood preparation and the TSE readout. Here we propose reverse double inversion-recovery (RDIR), which performs the slice-selective inversion of the DIR preparation in the same cardiac phase as the TSE readout to minimize the slice mismatching. RDIR was evaluated in healthy subjects and patients. Results show that RDIR-TSE achieved a significantly improved image quality in the right ventricle and an improved image quality in the left ventricle compared to the standard DIR-TSE.

69	9:15	Phase-encoded xSPEN: A novel high-resolution volumetric alternative to RARE MRI
		Zhiyong Zhang[1], Michael Lustig[2], and Lucio Frydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA, United States
		We have recently introduced cross-term SPatiotemporal ENcoding (xSPEN), a technique with exceptional resilience to field heterogeneities. This study explores a multi-scan extension of xSPEN, which simultaneously yields ky/kz data containing low and high frequency components as well as transposed low-resolution z/y images, with unique downsampling characteristics. A reconstruction scheme converting this information into high resolution 3D images with fully multiplexed volumetric coverage is introduced. The Results provide a series of high-resolution multiscan xSPEN imaging examples and analyzes their sensitivity vis-a-vis commonly used 2D RARE and multi-slab 3D RARE MRI techniques.

70	9:35	Prospective motion correction with NMR markers using only native sequence elements
		Alexander Aranovitch[1], Maximilian Haeberlin[1], Simon Gross[1], Benjamin E Dietrich[1], Bertram J Wilm[1], David O Brunner[1], Thomas Schmid[1], Roger Luechinger[1], and Klaas P Pruessmann[1]
		[1]Institute for Biomedical Engineering, ETH Zurich and University of Zurich, Zurich, Switzerland
		A new method for tracking active NMR markers is presented. It requires no alterations of the MR sequence and can be used for prospective motion correction (PMC) in brain MRI. The proposed method collects high-frequency information present due to gradient switching from multiple short, temporally separated snippets within one or more TR of the given sequence. A tracking precision on the order of 10µm and 0.01° (RMS) for translational and rotational degrees of freedom is obtained. The method is demonstrated in-vivo with high-resolution 2D T2*-weighted GRE and 3D MPRAGE brain scans.

71	9:55	Learning a Variational Network for Reconstruction of Accelerated MRI Data
		Kerstin Hammernik[1,2], Erich Kobler[1], Teresa Klatzer[1], Michael P Recht[2], Daniel K Sodickson[2], Thomas Pock[1,3], and Florian Knoll[2]

		[1]Institute of Computer Graphics and Vision, Graz University of Technology, Graz, Austria, [2]Center for Biomedical Imaging and Center for Advanced Imaging Innovation and Research (CAI2R), Department of Radiology, NYU School of Medicine, New York, NY, United States, [3]Safety & Security Department, AIT Austrian Institute of Technology GmbH, Vienna, Austria
		In this work, we propose variational networks for fast and high-quality reconstruction of accelerated multi-coil MR data. A wide range of experiments and a dedicated user study on clinical patient data show that the proposed variational network reconstructions outperform traditional reconstruction approaches in terms of image quality and residual artifacts. Additionally, variational networks offer high reconstruction speed, which is substantial for the incorporation into clinical workflow.

Oral

Hepatobiliary: Neoplasm

S04	Monday 8:15 - 10:15	*Moderators:* Satoshi Goshima & Ihab Kamel

72	8:15	View-Sharing Artifact Reduction with Retrospective Compressed Sensing Reconstruction in the Context of Contrast-Enhanced Liver MRI for Hepatocellular Carcinoma (HCC) Screening
		Jamil Shaikh[1], Paul Stoddard[1], Evan Levine[2], Stephanie Chang[1,3], Albert Roh[1], Brian Hargreaves[2], Shreyas S. Vasanawala[1], and Andreas M. Loening [1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering and Radiology, Stanford University, Stanford, CA, United States, [3]Radiology, Veteran Affairs Palo Alto Health Care System, Palo Alto, CA, United States
		View-sharing (VS) increases spatiotemporal resolution in dynamic contrast-enhanced (DCE) MRI by temporally sharing high frequency k-space data across contrast phases. However, this temporal sharing results in respiratory motion occurring in any single phase to propagate artifacts across all phases. Compressed sensing (CS) can eliminate need for VS by recovering missing k-space data from pseudorandom under-sampling, reducing temporal blurring while maintaining spatial resolution. We tested CS versus VS in the setting of DCE MRI for HCC. CS reduced respiratory artifacts, produced images with a more synthetic appearance, and did not result in a difference in lesion detection.

73	8:27	Dynamic Gd-EOB-DTPA enhanced MR imaging of the liver: Value of High Temporal-resolution Images with Parallel imaging and Compressed Sensing
		Takayuki Masui[1], Motoyuki Katayama[1], Mitsuteru Tsuchiya[1], Masako Sasaki[1], Kenshi Kawamura[1], Yuki Hayashi[1], Takahiro Yamada[1], Naoyuki Takei[2], Yuji Iwadate[2], Kang Wang[3], and Dan Rettmann[4]

		[1]Radiology, Seirei Hamamatsu General Hospital, Hamamatsu, Japan, [2]Global MR Applications and Workflow, GE Healthcare, Hino, Japan, [3]Global MR Applications and Workflow, GE Healthcare, Madison, WI, United States, [4]Global MR Applications and Workflow, GE Healthcare, Rochester, MN, United States
		With ARC and CS, breath-hold dynamic Gd-EOB-DTPA enhanced MR imaging for the liver can be successfully performed with acceptable image quality and lesion recognitions on a clinical 3T magnet. High temporal resolution images with CS-LAVA for dynamic contrast MR study may give us benefits in comparison of Turbo-LAVA with lower temporal resolutions.

74	8:39	Prospective Comparison of Gadoxetic Acid-Enhanced Liver MRI And Contrast-Enhanced CT With Histopathological Correlation For Preoperative Detection Of Colorectal Liver Metastases Following Chemotherapy And Potential Impact On Surgical Plan
		Kartik Jhaveri[1], Sandra Fischer[1], Hooman Hosseini Nik[1], Ravi Menezes[1], Steven Gallinger[1], and Carol-Ann Moulton[1]
		[1]UHN, Toronto, ON, Canada
		Complete resection of colorectal cancer liver metastases increases survival and is a recommended therapeutic option. Thus accurate detection of liver metastases is crucial. Many patients receive preoperative chemotherapy which often causes hepatic steatosis and decreases sensitivity of CT in detecting liver metastases. This prospective study with histopathological correlation compared the diagnostic performance of gadoxetic acid Liver MRI in the preoperative detection of liver metastases following chemotherapy including the influence of hepatic steatosis and lesion size. We also evaluated the potential change in the hepatic resection plan due to inclusion of gadoxetic acid MRI compared to CT.

75	8:51	Combined Gadoxetic Acid and Gadobenate Dimeglumine Enhanced Liver MRI for Liver Metastasis Detection: A Parameter Optimization Study
		Gesine Knobloch[1], Timothy Colgan[1], Xiaoke Wang[1,2], Tilman Schubert[1], Diego Hernando[3], and Scott Reeder[1,2,3,4,5]
		[1]Department of Radiology, University of Wisconsin – School of Medicine and Public Health, Madison, WI, United States, [2]Department of Biomedical Engineering, University of Wisconsin – School of Medicine and Public Health, Madison, WI, United States, [3]Department of Medical Physics, University of Wisconsin – School of Medicine and Public Health, Madison, WI, United States, [4]Department of Medicine, University of Wisconsin – School of Medicine and Public Health, Madison, WI, United States, [5]Department of Emergency Medicine, University of Wisconsin – School of Medicine and Public Health, Madison, WI, United States

		The detection of small perivascular metastatic lesions can be challenging with gadoxetic acid-enhanced liver MRI because both, blood vessels and metastases appear hypointense during the hepatobiliary phase. We sought to demonstrate the feasibility of combined gadoxetic acid (GA)/gadobenate dimeglumine (GD) liver MRI for improved lesion detection and optimize the imaging protocol regarding GA-dosing, imaging time after GD-injection and flip angle. Preliminary results show a homogenously enhanced liver and vasculature (“plain-white-liver”) 1-3min after GD-bolus detection with optimal contrast using flip angles of 25-35°. The combined GA/GD protocol has potential to improve the diagnostic performance of hepatobiliary phase liver MRI.

76	9:03	Gadoxetate-enhanced abbreviated MRI is reliable and effective for HCC surveillance in high-risk patients. Ryan L Brunsing[1], Dennis Chen[1], Alexandra Schlein[1], Paul Murphy[2], Yesenia Covarrubias[1], Alex Kuo[3], Michel Mendler[4], Irene Vodkin[4], Rohit Loomba[4], Yuko Kono[4], and Claude B Sirlin[1] *[1]Liver Imaging Group, University of California San Diego, San Diego, CA, United States, [2]Radiology, University of California San Diego, San Diego, CA, United States, [3]Gastroenterology and Hepatology, Virginia Mason Medical Center, Seattle, WA, United States, [4]Hepatology, University of California San Diego, San Diego, CA, United States* Gadoxetate enhanced abbreviated MRI (AMRI) is a simple, rapid acquisition protocol aimed at reducing the cost and increasing the throughput of MRI-based HCC surveillance. Here we analyze 330 consecutive patients with cirrhosis or chronic HBV who underwent at least one screening AMRI. The rate of HCC detected at cross sectional analysis (3.3%) was in line with published incidence of HCC, while the technical failure rate was low (5.8%) despite high prevalence of cirrhosis and ascites. Longitudinal analysis demonstrated high sensitivity, specificity, and negative predictive value in HCC detection, using a composite reference standard.

77	9:15	Volumetric Apparent Diffusion Coefficient Histogram Analysis in Differentiating Intrahepatic Cholangiocarcinoma from Hepatocellular Carcinoma Xianlun Zou[1], Yaqi Shen[1], Zhen Li[1], and Daoyu Hu[1] *[1]Department of Radiology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China* Accurate differentiation between intrahepatic cholangiocarcinoma (IHCC) and hepatocellular carcinoma (HCC) is essential for adequate treatment planning. In the present study, non-contrast volumetric ADC histogram analysis was employed to differentiate IHCC (n=33) and HCC (n=98). The results suggested that except the kurtosis and skewness, all the volumetric ADC histogram parameters, were helpful in distinguishing IHCC from HCC. Among all the parameters, 75th percentile ADC was most helpful to distinguish the two diseases. This non-contrast method provides useful information in differentiating IHCC from HCC, it benefits patients who are contraindicate to contrast agents.

78	9:27	Motion Correction of Diffusion-weighted imaging in the analysis of Apparent Diffusion Coefficient for preoperative staging of hepatocellular carcinoma
		Wu Zhou[1], Qiyao Wang[2], Guoxi Xie[3], Fei Yan[2], Yaoqin Xie[2], Guangyi Wang[4], Zaiyi Liu[4], Changhong Liang[4], Hairong Zheng[2], and Lijuan Zhang[2]
		[1]School of Medical Information Engineering, Guangzhou University of Chinese Medicine, Guangzhou, China, [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, [3]Guangzhou Medical University, Guangzhou, China, [4]Department of Radiology, Guangdong General Hospital, Guangdong Academy of Medical Sciences, Guangzhou, China
		Preoperative tumor staging of hepatocellular carcinoma (HCC) is a critical issue that influences tumor recurrence and patient survival in clinical practice. One of the challenges encountered in DWI of the liver is cardiac motion that can affect the accuracy of ADC measurements, which may inevitably influence the performance of DWI for HCC staging. However, the impact of motion for ADC and HCC staging has not been thoroughly investigated. In this work, we quantitatively investigate the relationship of motion correction, ADC and staging of HCC in order to widen the understanding of applications in DWI for tumor assessment.

79	9:39	Partial velocity-compensated diffusion encoding for combined motion compensation and residual vessel signal suppression in liver DWI
		Anh T Van[1], Barbara Cervantes[1], Tetsuo Ogino[2], Johannes M Peeters[3], Andreas Hock[4], Ernst J Rummeny[1], Rickmer Baren[1], and Dimitrios C Karampinos[1]
		[1]Department of Diagnostic and Interventional Radiology, Technical University of Munich, Munich, Germany, [2]Philips Japan, Tokyo, Japan, [3]Philips MR Clinical Science, Best, Netherlands, [4]Philips Healthcare, Hamburg, Germany
		Despite its strong clinical significance in lesion detection and tumor staging, liver DWI remains challenged by its strong sensitivity to motion effects. Motion-compensated diffusion encoding schemes have been recently proposed to improve DW liver signal homogeneity especially in the left liver lobe, a region typically affected by cardiac motion. However, motion-compensated diffusion encoding is associated with hyperintense vessel signal even at high b-values, which can obscure lesion detection. The present work proposes a partial velocity-compensated diffusion encoding for combined motion compensation and residual vessel signal suppression in liver DWI.

80	9:51	Characterization of Abdominal Neoplasms using a Fast T2 Mapping Radial TSE Technique
		Mahesh Bharath Keerthivasan[1,2], Diego Blew[2], Jean-Philippe Galons[2], Diego Martin[2], Ali Bilgin[1,3], and Maria Altbach[2]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Medical Imaging, University of Arizona, Tucson, AZ, United States, [3]Biomedical Engineering, University of Arizona, Tucson, AZ, United States

		Radial turbo spin-echo (RADTSE) based methods have been proposed for quantitative T2 mapping. RADTSE yields high spatio-temporal resolution and allows the reconstruction of co-registered images at multiple TE times from a short acquisition (i.e. a breath hold). We investigate the clinical utility of RADTSE for the quantitative characterization of abdominal neoplasms.

81	10:03	Using Tumor Stiffness as a Potential Biomarker for Predicting Hepatocellular Carcinoma Recurrence
		Jin Wang[1], Hao Yang[1], Yong Liu[2], Sichi Kuang[1], Bingjun He[1], Yao Zhang[1], Qungang Shan[1], Jingbiao Chen[1], TianHui Zhang[1], Kevin J. Glaser[3], Cairong Zhu[4], Jun Chen[3], Meng Yin[3], Bogdan Dzyubak[3], Sudhakar K. Venkatesh[3], and Richard L. Ehman[3]
		[1]Department of Radiology, the Third Affiliated Hospital of Sun Yat-sen University(SYSU), Guangzhou, China, [2]Department of Pathology, the Third Affiliated Hospital of Sun Yat-sen University(SYSU), Guangzhou, China, [3]Department of Radiology, Mayo Clinic, Rochester, MN, United States, [4]Department of Epidemiology and Biostatistics, West China School of Public Health Sichuan University, ChengDu, China
		Hepatocellular carcinoma (HCC) is a highly aggressive cancer and one of the leading causes of cancer-related deaths around the world. Our preliminary analysis of 78HCCsshowed 3D MRE is a promising, noninvasive technique for predicting the early recurrence of HCCs after hepatic resection. MRE-assessed tumor stiffness correlates with features such as encapsulation, macrovascular invasion, and histological grade. In the future, larger studies will improve our understanding of the relationship between HCC stiffness, invasiveness, and outcome for better allocation of treatment strategies and surveillance follow-up.

Oral

Multiple Sclerosis: Lesions Everywhere

S06	Monday 8:15 - 10:15	*Moderators:* Irene Vavasour & Frederik Barkhof

82	8:15	Spatial Distribution of Multiple Sclerosis lesions in the Cervical Cord
		Dominique Eden[1], Charley Gros[1], Atef Badji[1,2], Sara Dupont[1,3], Josefina Maranzano[4], Ren Zhuoquiong[5], Yaou Liu[5,6], Jason Talbott[3], Elise Bannier[7,8], Anne Kerbrat[9], Gilles Edan[9,10], Pierre Labauge[11], Virginie Callot[12,13], Jean Pelletier[12,13], Bernard Audoin[12,14], Henitsoa Rasoanandrianina[12,13], Paola Valsasina[15], Massimo Filippi[15], Rohit Bakshi[16], Shahamat Tauhid[16], Ferran Prados[17], Marios Yiannakas[17], Hugh Kearney[17], Olga Ciccarelli[17], Constantina A Treaba[18], Caterina Mainero[18], Russell Ouellette[18,19], Tobias Granberg[18,19], Sridar Narayanan[4], and Julien Cohen-Adad[1,20]

		[1]NeuroPoly Lab, Polytechnique Montreal, Montreal, QC, Canada, [2]Faculty of Medicine, University of Montreal, Montreal, QC, Canada, [3]Department of Radiology and Biomedical Imaging, Zuckerberg San Francisco General Hospital, University of California, San Francisco, CA, United States, [4]Montreal Neurological Institute, Montreal, QC, Canada, [5]Department of Radiology, Xuanwu Hospital, Capital Medical University, Beijing, China, [6]Department of Radiology, Beijing Tiantan Hospital, Capital Medical University, Beijing, China, [7]Department of Radiology, University Hospital of Rennes, Rennes, France, [8]University of Rennes, INRIA, CNRS, INSERM, Rennes, France, [9]University Rennes, INRIA, CNRS, INSERM, Rennes, France, [10]Department of Neurology, University Hospital of Rennes, Rennes, France, [11]University Hospital of Montpellier, Montpellier, France, [12]CRMBM, CNRS, Aix-Marseille University, Marseille, France, [13]CEMEREM, Hôpital de la Timone, AP-HM, Marseille, France, [14]Department of Neurology, CHU Timone, APHM, Marseille, France, [15]Neuroimaging Research Unit, INSPE, Division of Neuroscience, San Raffaele Scientific Institute, Vita-Salute San Raffaele University, Milan, Italy, [16]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States, [17]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [18]Massachusetts General Hospital, Boston, MA, United States, [19]Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden, [20]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montreal, QC, Canada
		The study of the spatial distribution of multiple sclerosis (MS) lesions in the cervical spinal cord provides a means to further understand the disease pathophysiology. In this study we involve 358 patients across 7 sites, where cervical lesions were manually segmented. Using Spinal Cord Toolbox, lesion segmentations were registered to a common-space template and voxel-based lesion probability maps (LPMs) were computed across the patient population to assess lesion topography. Results revealed a predominance of lesions in the upper cord (C1-C3) and dorsal column, which confirms prior histopathology work and encourages further study of associations between cervical spine lesion volume and distribution with clinical status.

83	8:27	Spatiotemporal development of spinal cord lesions in a primate model of multiple sclerosis
		Jennifer A. Lefeuvre[1,2], Pascal Sati[1], Cecil Chern-Chyi Yen[3], Seung Kwon A. Ha[1], Wen-Yang Chiang[3], Mathieu D. Santin[2], Steven Jacobson[4], Afonso C. Silva[3], Stéphane Lehéricy[2], and Daniel D. Reich[1]
		[1]NINDS, National Institutes of Health, bethesda, MD, United States, [2]CENIR, Institut du Cerveau et de la Moelle epinière, Paris, France, [3]National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, MD, United States, [4]National Institute of Neurological Disorders and Stroke, National Institutes of health, Bethesda, MD, United States
		The spatiotemporal development of spinal cord (SC) lesions in multiple sclerosis (MS) is poorly understood, despite the high prevalence of these lesions and their important contribution to patient disability. In this study, we report for the first time the serial imaging of SC lesions in a nonhuman primate model of MS. The results demonstrated substantial clinical and imaging features shared between this animal model and human MS. In particular, we observed focal and subpial demyelinating lesions that appeared at disease onset and proceeded to affect much of the entire cord over the course of several weeks to months.

84	8:39	Thalamic lesions, thalamic volume and cognitive deficit in secondary progressive MS

		Floriana De Angelis[1], Jonathan Stutters[1], Arman Eshaghi[1], Ferran Prados[1,2], Domenico Plantone[1], Anisha Doshi[1], Nevin John[1], David MacManus[1], Sebastien Ourselin[2], Sue Pavitt[3], Gavin Giovannoni[4], Richard Parker[5], Chris Weir[5], Nigel Stallard[6], Clive Hawkins[7], Basil Sharrack[8], Peter Connick[9], Siddharthan Chandran[9], Claudia Angela Gandini Wheeler-Kingshott [1,10,11], Frederik Barkhof[2,12,13], and Jeremy Chataway[1]
		[1]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [2]Translational Imaging Group (TIG), Centre for Medical Image Computing (CMIC), University College London, London, United Kingdom, [3]Leeds Institute of Health Sciences, University of Leeds, Leeds, United Kingdom, [4]Blizard Institute, Barts and The London School of Medicine and Dentistry, Queen Mary University London, London, United Kingdom, [5]Edinburgh Clinical Trials Unit, Usher Institute of Population Health Sciences and Informatics, University of Edinburgh, Edinburgh, United Kingdom, [6]Statistics and Epidemiology, Division of Health Sciences, Warwick Medical School, University of Warwick, Warwick, United Kingdom, [7]Keele University Medical School, Royal Stoke University Hospital, Stoke-on-Trent, United Kingdom, [8]Department of Neurology, Royal Hallamshire Hospital, Sheffield, United Kingdom, [9]Centre for Clinical Brain Sciences, University of Edinburgh, Edinburgh, United Kingdom, [10]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [11]Brain MRI 3T Research Centre, C. Mondino National Neurological Institute, Pavia, Italy, [12]National Institute for Health Research (NIHR), University College London Hospitals (UCLH) Biomedical Research Centre (BRC), London, United Kingdom, [13]Department of Radiology and Nuclear Medicine, VU University Medical Center, Amsterdam, Netherlands
		We investigated the cross-sectional relationships between thalamic lesions (i.e. total thalamic lesion volume), thalamic volume, and cognitive deficit in 55 subjects with secondary progressive multiple sclerosis. We measured: total intracranial volume, T2 lesion volume (T2LV), thalamic volume, thalamic lesions, and symbol digit modalities test (SDMT). Thalamic lesions inversely correlated with thalamic volume and these two variables were independently associated with cognitive deficit as measured by SDMT. After adjusting for T2LV, thalamic volume was the strongest predictor of cognitive deficit. Thalamic lesions may have clinical relevance independent of thalamic volume and will be longitudinally investigated in a bigger sample size.

85	8:51	QSM identifies pro-inflammatory iron-positive MS lesions
		Kelly Gillen[1], Mayyan Mubarak[2], Ishan Negi[2], Somiah Dahlawi[2], Thanh D Nguyen[1], David Pitt[2], and Yi Wang[1]
		[1]Radiology, Weill Cornell Medical College, New York, NY, United States, [2]Neurology, Yale University, New Haven, CT, United States
		Multiple sclerosis is an autoimmune disorder whose demyelinated plaques may be connected with elevated iron. We combined quantitative susceptibility mapping (QSM) with histopathological techniques to quantify iron, macrophages/microglia, and pro/anti-inflammatory markers to demonstrate that regions of high susceptibility on QSM correspond to pro-inflammatory iron-positive macrophages/microglia. QSM is therefore a valuable clinical tool to identify smoldering lesions not visible using conventional MRI techniques.

86	9:03	A longitudinal study of lesion evolution in Multiple Sclerosis using multi-contrast 7T MRI

		Kingkarn Aphiwatthanasumet[1], Olivier Mougin[1], Nicolas Geades[2], Nikos Evangelou[3], Molly Bright[3], Richard Bowtell[1], and Penny Gowland[1]
		[1]Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom, [2]Philips Healthcare, Mölndal, Sweden, Mölndal, Sweden, [3]Division of Clinical Neuroscience, School of Medicine, University of Nottingham, Nottingham, United Kingdom
		We use multi-contrast 7T MRI to evaluate longitudinal changes in white matter tissue properties prior to and after lesion appearance. Four MS patients were scanned 6 times at 6-week intervals, and 20 new lesions were identified on FLAIR images in that period. Of these, 35% showed a hypointense rim and 65% showed no rim in QSM data. Subtle changes in MT, NOE, and QSM relative to NAWM values could be detected 6 weeks prior to the first clinical appearance of new lesions. In future studies, these data will provide insight into specific tissue changes that precede lesion development in MS.

87	9:15	A 3-year follow-up study of enhancing and non-enhancing multiple sclerosis (MS) lesions in MS patients with clinically isolated syndrome (CIS) using a multi-compartment T2 relaxometry (MCT2) model
		Sudhanya Chatterjee[1], Olivier Commowick[1], Onur Afacan[2], Benoit Combès[1], Anne Kerbrat[1,3], Simon K Warfield[2], and Christian Barillot[1]
		[1]University of Rennes, INRIA, CNRS, INSERM, IRISA UMR 6074, VISAGES ERL U-1228, F-35000 Rennes, France, Rennes, France, [2]CRL, Boston Children's Hospital, Department of Radiology, 300 Longwood Avenue, WB215, Boston, MA 02115, USA, Boston, MA, United States, [3]Department of Neurology, Rennes University Hospital, Rennes, France, Rennes, France
		Obtaining information on condition of tissue microstructures (such as myelin, intra/extra cellular cells, free water) can provide important insights into MS lesions. However, MRI voxels are heterogeneous in terms of tissue microstructure due to the limited imaging resolution owing to existing physical limitations of MRI scanners. Here we evaluated a multi-compartment T2 relaxometry model and then used it to study the evolution of enhancing (USPIO and gadolinium positive) and non-enhancing lesions in 6 MS patients with CIS characteristics over a period 3 years with 7 follow-up scans after baseline.

88	9:27	A multi-parametric study of MS lesions
		Mara Cercignani[1,2], Camilla Vizzotto[1], Davide Esposito[1], Barbara Spano[2], Giovanni Giulietti[2], and Marco Bozzali[1,2]
		[1]Department of Neuroscience, Brighton & Sussex Medical School, Brighton, United Kingdom, [2]Neuroimaging Laboratory, Santa Lucia Foundation IRCCS, Rome, Italy

		Counter-intuitively, reduced orientation dispersion has been reported in MS lesions, and confirmed by histology. Here we classify lesional tissue based on its orientation dispersion, and we compute a series of indices from from diffusion and magnetization transfer MRI to highlight potential differences in the pathological substrate of lesions with reduced vs increased orientation dispersion. We show that lesions with reduced dispersion are more likely to show extensive demyelination and axonal loss.

89	9:39	The Age effect on Multi-parametric Magnetic Resonance Imaging changes in Multiple Sclerosis lesions
		Elda Fischi-Gomez[1,2], Mário João Fartaria[2,3,4], Guillaume Bonnier[1], and Cristina Granziera[1,5]
		[1]Martinos Center for Biomedical Imaging, Massachusetts General Hospital and Harvard Medical School, Boston, MA, United States, [2]Signal Processing Laboratory (LTS 5), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [3]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [4]Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [5]Neurology Department and Neuroimaging Laboratory, Basel University Hospital, Basel, Switzerland
		We assessed the effect of age on the longitudinal evolution of intralesional neurite density and orientation dispersion indices, magnetization transfer ratio and T1 relaxometry in a cohort of relapsing-remitting MS patients. While we observed a decrease of neurite dispersion in lesions and stable neurite density, MTR and qT1, age did not seem to influence those longitudinal changes in MS lesions.

90	9:51	Linking macrostructural and microstructural damage in early MS: a geostatistical and diffusion MRI study
		Carmen Tur[1], Robert Marschallinger[2,3], Ferran Prados[1,4], Sara Collorone[1], Daniel R Altmann[1,5], Sébastien Ourselin[4], Claudia Angela Gandini Wheeler-Kingshott[1,6,7], and Olga Ciccarelli[1]
		[1]Queen Square MS Centre. Neuroinflammation department. UCL Institute of Neurology, University College London, London, United Kingdom, [2]Department of Geoinformatics - Z_GIS, Salzburg University, Salzburg, Austria, [3]Department of Neurology, Christian Doppler Medical Center, Paracelsus Medical University, Salzburg, Austria, [4]Translational Imaging Group, CMIC, Department of Medical Physics and Biomedical Engineering, University College London, London, United Kingdom, [5]Department of Medical Statistics, London School of Hygiene and Tropical Medicine, University of London, London, United Kingdom, [6]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [7]Brain MRI 3T Research Centre, C. Mondino National Neurological Institute, Pavia, Italy
		Macroscopic white matter (WM) lesion volume has been extensively used to predict disability progression in multiple sclerosis (MS). However, currently used lesion-related metrics fail to capture the complexity of WM-lesion spatial distribution. Here we used geostatistics, an emerging approach to model spatial data projected onto a common coordinate space, to characterise the spatial distributional features of WM lesions of patients with their first MS attack, the clinical relevance of lesion distributional properties and their microstructural correlates, through diffusion MRI. We conclude that WM-lesion spatial distributional features reveal novel aspects of MS pathology, are clinically relevant and possess specific microstructural features.

91	10:03	The relevance of cortical lesions in cortical thinning in multiple sclerosis by ultra-high field MRI
		Constantina Andrada Treaba[1,2], Elena Herranz[1,2], Russell Ouellette IV[1], Tobias Granberg[1,2,3,4], Celine Louapre[1,2], Valeria Barletta[1,2], Ambica Mehndiratta[1], Jacob A Sloane[2,5], Revere Kinkel[6], and Caterina Mainero[1,2]
		[1]Department of Radiology, A.A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Department of Clinical Science, Intervention and Technology, Karolinska Institutet, Stockholm, Sweden, [4]Department of Radiology, Karolinska University Hospital, Stockholm, Sweden, [5]Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, United States, [6]Department of Neurosciences, University of California, San Diego, CA, United States
		Cortical lesions (CL) and cortical atrophy are frequent in multiple sclerosis (MS) and main determinants of disease progression. The relationship between them is still unknown, mostly due to the low sensitivity of clinical magnetic resonance imaging (MRI) to CL. Disconnection from white matter (WM) lesions has also been proposed as a pathogenic mechanism for cortical MS atrophy. Using 7 Tesla MRI that has shown increased sensitivity to CL than clinical MRI, we showed, in a large MS cohort that WM lesions are the main determinant of cortical thinning. Nevertheless, CL resulted as the main contributors of physical and cognitive disability.

Oral

Breast

W03/04	Monday 8:15 - 10:15	*Moderators:* Ileana Hancu & Savannah Partridge

92	8:15	The role of diffusion-weighted MRI in the prediction of response in I-SPY 2 TRIAL
		Wen Li[1], Lisa J Wilmes[1], David C Newitt[1], John Kornak[2], Ella F Jones[1], Savannah C Partridge[3], Jessica Gibbs[1], Bo La Yun[1], Matthew S Tanaka[1], Laura J Esserman[4], and Nola M Hylton[1]
		[1]Radiology & Biomedical Imaging, UCSF, San Francisco, CA, United States, [2]Epidemiology and Biostatistics, UCSF, San Francisco, CA, United States, [3]School of Medicine, University of Washington, Seattle, WA, United States, [4]Surgery and Radiology, UCSF, San Francisco, CA, United States
		Diffusion weighted MRI can be used to characterize water mobility and cellularity of tumor by measuring the apparent diffusion coefficient (ADC). Functional tumor volume (FTV) measures size change along the treatment. This study showed that after only 3 weeks of pre-surgery chemotherapy, ADC added value to the logistic regression model of using FTV alone to predict pCR or RCB as outcomes for patients with advanced breast cancer in I-SPY 2 TRIAL. The effect of adding ADC is statistically significant and increase the estimated area under the ROC curve after adjusted for breast cancer subtype categorized by HR and HER2 status.

93	8:27	ACRIN 6702 DWI Trial: The Value of Alternate ADC Metrics Compared to Standard ADC for Decreasing Breast MRI False-Positives
		Habib Rahbar[1], Zheng Zhang[2], Justin Romanoff[2], Lucy G Hanna[2], Christopher E. Comstock[3], and Savannah C Partridge[1]
		[1]Radiology, University of Washington, Seattle, WA, United States, [2]ACRIN Biostatistics Center, Brown University, Providence, RI, United States, [3]Memorial Sloan Kettering Cancer Center, New York, NY, United States
		The ACRIN 6702 trial confirmed that standard ADCs from multi b-value DWI acquisition are lower in malignancies than in benign lesions and that application of standard ADCs can eliminate one in five unnecessary biopsies. Secondary analysis from this trial demonstrated that application of alternate ADC metrics, including perfusion insensitive $ADC_{Ø}$ and normalized ADC provide no practical benefit over standard ADC for improving conventional DCE-MRI performance. These findings suggest that standard ADC calculations alone are sufficient for improving breast MRI specificity and should be the primary metric included in the next edition of the BI-RADS atlas.

94	8:39	DCE-MRI based radiomics signature: a potential biomarker for preoperative prediction of sentinel lymph node metastasis in breast cancer
		Jie Ding[1], Chunling Liu[2], Karl Spuhler[1], Tim Duong[3], Changhong Liang[2], Shahid Hussain[3], and Chuan Huang[1,3,4,5]
		[1]Biomedical Engineering, Stony Brook University, Stony Brook, NY, United States, [2]Radiology, Guangdong General Hospital/Guangdong Academy of Medical Sciences, Guangzhou, China, [3]Radiology, Stony Brook Medicine, Stony Brook, NY, United States, [4]Computer Science, Stony Brook University, Stony Brook, NY, United States, [5]Psychiatry, Stony Brook Medicine, Stony Brook, NY, United States
		This study is the first to combine DCE-MRI radiomics with clinical information to predict sentinel lymph node (SLN) metastasis in breast cancer. The prediction model was established in a training set, and was further validated in a completely independent validation set, with AUC of 0.898 and negative predictive value of 0.902. This prediction performance surpasses the previous study using T2w and DWI, and is particularly useful for eliminating the unnecessary, invasive SLN biopsy and axillary dissection in patients with negative SLN, offering a step towards precision medicine of breast cancer.

95	8:51	Multi-compartmental sodium quantification in breast using a bilateral dual-tuned proton/sodium coil and multi-pulse excitation scheme at 7T
		Carlotta Ianniello[1,2], Guillaume Madelin[1], and Ryan Brown[1]
		[1]Center for Advanced Imaging Innovation and Research (CAI2R) and Center for Biomedical Imaging, New York, NY, United States, [2]The Sackler Institute of Graduate Biomedical Science, New York University School of Medicine, New York, NY, United States

		Sodium is an important electrolyte in the human body and is a distinct MRI contrast mechanism in breast cancer as it provides insight on cellular viability, ion homeostasis, inflammation, and fluid content. Due to sodium low SNR, intracellular sodium concentration (C_1), volume fractions for the intracellular (α_1) or extracellular compartments (α_2), and fluid (α_3) remain largely unexplored. We built a custom bilateral dual-tuned $^{1}H/^{23}Na$ RF coil and developed a novel fingerprinting-based sodium excitation scheme on a 7T system to enable multi-compartmental sodium quantification in breast. In this work we describe the coil, pulse sequence and preliminary results in one subject.

96	9:03	CEST MRI – a potential tool for breast cancer grade and proliferation rate differentiation
		Olgica Zaric[1], Alex Farr[2], Esau Poblador Rodriguez[1], Vladimir Mlynarik[1], Claudia Kronnerwetter[1], Benjamin Schmitt[3], Wolfgang Bogner[1], Christian Singer[2], and Siegfried Trattnig[1]
		[1]High Field MR Center, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Department of Obstetrics and Gynecology, Medical University of Vienna, Vienna, Austria, [3]Siemens Healthineers, Sydney, Australia
		I this study, we investigated which CEST contrast changes are characteristic and dominant for breast malignancies. In 18 female patients, we performed DWI, CEST imaging, and T1-CE MRI. Significant differences in MTRasym between G1 and G3 was found (P= 0.007). Between G1 and G2 (P=0.066) as well as between G2 and G3 no difference were observed (P= 0.089). Correlation test demonstrated a strong positive correlation between mean MTRasym measured in region of its maximum and proliferation factor, Ki-67 (r=0.890, P<0.001). This preliminary results show that CEST-MRI of the breast has a potential to provide information regarding the tumor histological features.

97	9:15	ACRIN 6702 Multisite Breast DWI Trial: Comparison of Site vs. Centralized ADC Measures and Factors Affecting Data Quality
		Savannah C Partridge[1], Zheng Zhang[2], Jennifer Whisenant[3], Averi E Kitsch[1], Justin Romanoff[2], Habib Rahbar[1], Thomas Yankeelov[4], and Thomas L Chenevert[5]
		[1]Radiology, University of Washington, Seattle, WA, United States, [2]ACRIN Biostatistics Center, Brown University, Providence, RI, United States, [3]Hematology/Oncology, Vanderbilt University, Nashville, TN, United States, [4]Biomedical Engineering, University of Texas, Austin, TX, United States, [5]Radiology, University of Michigan, Ann Arbor, MI, United States
		Diffusion-weighted imaging (DWI) shows potential to improve lesion characterization and diagnostic performance of conventional contrast-enhanced breast MRI. Promising preliminary data from the ACRIN 6702 multisite trial show that DWI can reduce false-positive breast MRIs. Comparison of independently performed site and centrally-measured ADC values showed reasonable agreement, but suggest that further standardization of DWI interpretation and analysis tools across sites could improve diagnostic performance. Results also show more work is needed to address image quality issues and increase utility for measuring ADC values in MRI-detected breast lesions.

98	9:27	Radiomics with magnetic resonance imaging of the breast for early prediction of response to neo-adjuvant chemotherapy in breast cancer patients
		Katja Pinker-Domenig[1], Amirhessam Tahmassebi[2], Georg Wengert[3], Thomas H Helbich[3], Zsuzsanne Bago-Horvath[4], Sousan Akaei[4], Elisabeth A Morris[1], and Anke Meyer-Baese[2]
		[1]Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States, [2]Department of Scientific Computing, Florida State University, Tallahassee, FL, United States, [3]Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [4]Department of Pathology, Medical University of Vienna, Vienna, Austria
		Breast cancer patients that achieve pCR after NAC have a significantly improved DFS and OS. The aim of this study was to assess radiomics with multiparametric MRI using DCE and T2w imaging for the early prediction of pCR to NAC in breast cancer patients. In 41 women radiomics analysis of MRI data was performed. Histopathology using the Residual Cancer Burden (RCB) score and class were the standard of reference. Radiomics analysis of MRI achieved AUCs for RCB score (AUC 0.85), metastases (AUC 0.87) and death (AUC 0.92). Radiomics with multiparametric MRI enables prediction of response to NAC with high accuracy.

99	9:39	Ultrafast Dynamic Contrast Enhanced MRI of the Breast Using DISCO: Are the Quantitative Parameters Helpful in Differentiating between BI-RADS 4 and 5 Subcentimeter Invasive Carcinomas and Benign Lesions?
		Natsuko Onishi[1], Meredith Sadinski[1], Katherine M. Gallagher[1,2], Brittany Z. Dashevsky[1,3], Theodore M. Hunt[1], Blanca Bernard-Davila[1], Danny F. Martinez[1], Amita Shukla-Dave[1,4], Elizabeth A. Morris[1], and Elizabeth J. Sutton[1]
		[1]Department of Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States, [2]Lenox Hill Radiology, New York, NY, United States, [3]Department of Radiology & Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [4]Department of Medical Physics, Memorial Sloan Kettering Cancer Center, New York, NY, United States
		The quantitative parameters derived from ultrafast dynamic contrast enhanced (UF-DCE) breast MRI using DISCO were analyzed for the assessment of possible utility in the differentiation between subcentimeter invasive carcinoma and benign lesions. Of all these parameters (MS, CER, IAUGC, BAT and Ktrans), BAT was the only parameter that predicted subcentimeter invasive carcinoma. We believe the significantly shorter BAT for subcentimeter invasive carcinomas is congruent with the known pathophysiology of cancer and may reflect its increased vascularity or shunt formation. BAT can be a complementary parameter to conventional steady-state DCE MRI, which could further stratify subcentimeter BI-RADS 4 and 5 lesions.

100	9:51	Lymph node multi-parametric MRI characteristics of responders and non-responders of neoadjuvant chemotherapy
		Renee F. Cattell[1,2], James J. Kang[1], Silu Han[1,2], Thomas Ren[1], Pauline B. Huang[1], Haifang Li[1], Jules A. Cohen[3], Paul Fisher[1], Roxanne Palermo[1], and Tim Q. Duong[1]

		[1]Department of Radiology, Stony Brook University, Stony Brook, NY, United States, [2]Department of Biomedical Engineering, Stony Brook University, Stony Brook, NY, United States, [3]Department of Medicine, Stony Brook University, Stony Brook, NY, United States
		In the I-SPY 1 breast cancer clinical trial, change in size of the primary in-breast tumor in response to neoadjuvant therapy was a strong predictor of pathologic complete response. In this study, I-SPY 1 MRI lymph node characteristics was studied. Lymph nodes of patients who achieved pathologic complete response after chemotherapy had different characteristics from those who have residual disease in the tumor bed. The percent change of the signal enhancement ratio of each individual lymph node was the best parameter to differentiate between pathologic complete responders versus incomplete or non-responders.

101	10:03	Evaluation of microstructure heterogeneity from diffusion q-space imaging (QSI), diffusion weighted imaging (DWI) and non-Gaussian diffusion models in whole breast tumour
		Nicholas Senn[1], Yazan Masannat[2,3], Ehab Husain[3,4], Bernard Siow[5], Steven D Heys[2,3], and Jiabao He[1]
		[1]Aberdeen Biomedical Imaging Centre, University of Aberdeen, Aberdeen, United Kingdom, [2]Breast Unit, Aberdeen Royal Infirmary, Aberdeen, United Kingdom, [3]School of Medicine, University of Aberdeen, Aberdeen, United Kingdom, [4]Pathology Department, Aberdeen Royal Infirmary, Aberdeen, United Kingdom, [5]Francis Crick Institute, London, United Kingdom
		QSI was compared against conventional DWI and non-Gaussian diffusion models, namely diffusion kurtosis imaging (DKI) and stretched-exponential model (SEM) to evaluate diffusivity heterogeneity for profiling breast tumour cell diversity. We investigated whole breast tumours excised from surgery, with imaging performed overnight on the same day on a clinical system. Asymmetry in diffusivity distribution was quantified as histogram skewness, median and 25^{th}-percentile. Correlation analysis was performed to compare QSI against other models. The skewness of diffusivity distribution derived from QSI was the highest among the models and provided a wider spread of values across cohort, allowing more sensitive clinical applications.

Study Groups

X-Nuclei Imaging Business Meeting

W07	Monday 9:15 - 10:15	*(no CME credit)*

Study Groups

MR Safety Business Meeting

W08	Monday 9:15 - 10:15	*(no CME credit)*

Plenary Session

Cardiovascular Imaging: From Structure to Function

Organizers: James Carr, Tim Leiner, Reza Nezafat, Bernd Wintersperger, Jennifer Keegan, Sebastian Kozerke, Winfried Willinek

Plenary Hall (Paris Room)	Monday 10:30 - 12:15	*Moderators:* James Carr & Reza Nezafat

10:30	ISMRM & ESMRMB Awards

11:15	Tissue Characterization in the Human Heart
	Raymond Kwong[1]
	[1]Brigham & Women's Hospital, United States

11:35	Current & Emerging Techniques for Evaluating Cardiac Function
	Sergio Uribe Arancibia[1]
	[1]Pontificia Universidad Catolica de Chile, Chile

11:55	Putting it All Altogether: What is the Clinical Impact?
	Marianna Fontana[1]
	[1]University College London

12:15	Adjournment

Event

Gold Corporate Symposium: Philips Healthcare

Plenary Hall (Paris Room)	Monday 12:30 - 13:30	*(no CME credit)*

Electronic Poster: Young Investigator Awards

Exhibition Hall	Monday 13:45 - 15:45	*(no CME credit)*

66	13:45	Arterial-Spin-Labeling (ASL) perfusion MRI predicts cognitive function in elderly individuals: a four-year longitudinal study
		Jill B De Vis[1], Shin-Lei Peng[2], Xi Chen[3], Yang Li[1], Peiying Liu[1], Sandeepa Sur[1], Karen M Rodrigue[3], Denise C Park[3], and Hanzhang Lu[1]
		[1]MR Research, Johns Hopkins University, Baltimore, MD, United States, [2]Biomedical Imaging and Radiological Science, China Medical University, Taichung, Taiwan, [3]Center for Vital Longevity, School of Behavioral and Brain Sciences, University of Texas, Dallas, TX, United States
		Identification of biomarkers that can predict cognitive decline is of utmost importance for advance in dementia pharmacotherapy. In this study, cerebral blood flow (CBF) is investigated as a predictor for cognitive decline in a healthy aging population. We found CBF in the frontal lobe to be most predictive for cognitive decline, specifically for episodic memory and in the older population. This suggest that CBF can be used as a biomarker to identify subjects susceptible to cognitive decline, to identify suitable cohorts for clinical trials, and to monitor the effects of pharmacotherapy.

67	14:05	Measuring human placental blood flow with multi-delay 3D GRASE pseudo-continuous arterial spin labeling at 3 Tesla
		Xingfeng Shao[1], Dapeng Liu[2], Thomas Martin[2], Teresa Chanlaw[3], Sherin U. Devaskar[3], Carla Janzen[4], Aisling M. Murphy[4], Daniel Margolis[2], Kyunghyun Sung[2], and Danny J.J. Wang[1]
		[1]Laboratory of FMRI Technology (LOFT), Mark & Mary Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States, [2]Department of Radiology, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [3]Department of Pediatrics, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [4]Department of Obstetrics and Gynecology, Division of Maternal Fetal Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States
		Placenta influences the health of both a woman and her fetus during pregnancy. Maternal blood supply to placenta can be measured non-invasively using arterial spin labeling (ASL). The purpose of this study is to present a multi-delay pseudo-continuous arterial spin labeling (pCASL) combined with a fast 3D inner-volume gradient- and spin-echo (GRASE) imaging technique to simultaneously measure placental blood flow (PBF) and arterial transit time (ATT), and to study PBF and ATT evolution with gestational age during the second trimester. The PBF values were compared with uterine arterial Doppler ultrasound to assess its potential clinical utility.

68	14:25	Reverse double inversion-recovery: improving motion robustness of cardiac T2-weighted dark-blood turbo spin-echo sequence
		Chenxi Hu[1], Steffen Huber[1], Syed R Latif[2], Guido Santacana-Laffitte[1], Hamid R Mojibian[1], Lauren Baldassarre[2], and Dana C Peters[1]
		[1]Department of Radiology and Biomedical Imaging, Yale School of Medicine, New Haven, CT, United States, [2]Department of Internal Medicine, Section of Cardiovascular Medicine, Yale School of Medicine, New Haven, CT, United States
		The cardiac T2-weighted dark-blood turbo spin-echo (TSE) sequence based on double inversion-recovery (DIR) is subject to motion artifacts due to mismatching of slices from the dark-blood preparation and the TSE readout. Here we propose reverse double inversion-recovery (RDIR), which performs the slice-selective inversion of the DIR preparation in the same cardiac phase as the TSE readout to minimize the slice mismatching. RDIR was evaluated in healthy subjects and patients. Results show that RDIR-TSE achieved a significantly improved image quality in the right ventricle and an improved image quality in the left ventricle compared to the standard DIR-TSE.
69	14:45	Phase-encoded xSPEN: A novel high-resolution volumetric alternative to RARE MRI
		Zhiyong Zhang[1], Michael Lustig[2], and Lucio Frydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA, United States
		We have recently introduced cross-term SPatiotemporal ENcoding (xSPEN), a technique with exceptional resilience to field heterogeneities. This study explores a multi-scan extension of xSPEN, which simultaneously yields ky/kz data containing low and high frequency components as well as transposed low-resolution z/y images, with unique downsampling characteristics. A reconstruction scheme converting this information into high resolution 3D images with fully multiplexed volumetric coverage is introduced. The Results provide a series of high-resolution multiscan xSPEN imaging examples and analyzes their sensitivity vis-a-vis commonly used 2D RARE and multi-slab 3D RARE MRI techniques.
70	15:05	Prospective motion correction with NMR markers using only native sequence elements
		Alexander Aranovitch[1], Maximilian Haeberlin[1], Simon Gross[1], Benjamin E Dietrich[1], Bertram J Wilm[1], David O Brunner[1], Thomas Schmid[1], Roger Luechinger[1], and Klaas P Pruessmann[1]
		[1]Institute for Biomedical Engineering, ETH Zurich and University of Zurich, Zurich, Switzerland

		A new method for tracking active NMR markers is presented. It requires no alterations of the MR sequence and can be used for prospective motion correction (PMC) in brain MRI. The proposed method collects high-frequency information present due to gradient switching from multiple short, temporally separated snippets within one or more TR of the given sequence. A tracking precision on the order of 10µm and 0.01° (RMS) for translational and rotational degrees of freedom is obtained. The method is demonstrated in-vivo with high-resolution 2D T2*-weighted GRE and 3D MPRAGE brain scans.

71	15:25	Learning a Variational Network for Reconstruction of Accelerated MRI Data
		Kerstin Hammernik[1,2], Erich Kobler[1], Teresa Klatzer[1], Michael P Recht[2], Daniel K Sodickson[2], Thomas Pock[1,3], and Florian Knoll[2]
		[1]Institute of Computer Graphics and Vision, Graz University of Technology, Graz, Austria, [2]Center for Biomedical Imaging and Center for Advanced Imaging Innovation and Research (CAI2R), Department of Radiology, NYU School of Medicine, New York, NY, United States, [3]Safety & Security Department, AIT Austrian Institute of Technology GmbH, Vienna, Austria
		In this work, we propose variational networks for fast and high-quality reconstruction of accelerated multi-coil MR data. A wide range of experiments and a dedicated user study on clinical patient data show that the proposed variational network reconstructions outperform traditional reconstruction approaches in terms of image quality and residual artifacts. Additionally, variational networks offer high reconstruction speed, which is substantial for the incorporation into clinical workflow.

Traditional Poster: MR Safety

Exhibition Hall 1451-1475	Monday 13:45 - 15:45	*(no CME credit)*

Traditional Poster: Interventional MRI

Exhibition Hall 1476-1508	Monday 13:45 - 15:45	*(no CME credit)*

Electronic Poster: Cardiovascular

Exhibition Hall	Monday 13:45 - 14:45	*(no CME credit)*

Electronic Poster: Acquisition, Reconstruction & Analysis

Exhibition Hall	Monday 13:45 - 14:45	*(no CME credit)*

Study Groups

High Field Systems & Applications Business Meeting

W07	Monday 13:45 - 14:45	*(no CME credit)*

Study Groups

Hyperpolarisation Methods & Equipment Business Meeting

W08	Monday 13:45 - 14:45	*(no CME credit)*

Member-Initiated Symposium

Non-Invasive Axon Diameter Mapping: So Fascinating, So Challenging & So Many Questions

Organizers: Muhamed Barakovic, Alessandro Daducci, Tim Dyrby

S05	Monday 13:45 - 15:45	*Moderators:* Ileana Jelescu & Muhamed Barakovic	*(no CME credit)*

	13:45	Developmental & Computational Properties of Axons
		Giorgio Innocenti

	14:05	Diffusion MRI Techniques for Mapping Axon Diameter: Can We Image Axon Diameter in the Brain?
		Andrada Ianus[1]
		[1]University College London, United Kingdom

	14:25	Axon Diameter Mapping with q-t MRI: Is It the Inner or the Outer?
		Els Fieremans Fieremans[1]
		[1]Radiology, New York University School of Medicine, New York, NY, United States

	14:45	The Effect of Axon Diameter on High Temporal Resolution Functional Data
		Samuel Deslauriers-Gauthier

	15:05	Axons, Axons, So Many Axons … What Do We Really Need to Measure?
		Derek Jones[1]
		[1]CUBRIC, School of Psychology, United Kingdom

	15:25	Discussion

Member-Initiated Symposium

Zooming into the "Little Brain": Advances in Cerebellar Imaging

Organizers: Pierre-Louis Bazin, Wietske van der Zwaag

W05/06	Monday 13:45 - 15:45	*Moderators:* Pierre-Louis Bazin & Wietske van der Zwaag	*(no CME credit)*

	13:45	Cerebellar Lobular Structure & Connectional Architecture
		Christopher Steele[1]
		[1]Max Planck Institute

	14:15	Structural & Functional MRI of the Human Cerebellar Nuclei
		Dagmar Timmann

	14:45	Insights into Cerebellar Microstructure from Diffusion in Many Dimensions
		Henrik Lundell[1]
		[1]DRCMR, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark

	15:15	Cerebellar Structural & Functional Abnormalities in Multiple Sclerosis
		Cristina Granziera

Weekday Course

Machine Learning in Cardiovascular Disease

Organizers: Sebastian Kozerke, Tim Leiner, Reza Nezafat

N02	Monday 13:45 - 15:45	*Moderators:* Sebastian Kozerke & Tim Leiner

13:45	Nuts & Bolts of Machine Learning
	Daniel Rueckert[1]
	[1]Imperial College London, United Kingdom
	This talk will give an overview of machine learning techniques for medical image analysis. We will describe both supervised and supervised machine learning approaches. A particular focus will be on deep learning approaches, including Convolutional Neural Networks (CNN) and how these can be used in cardiovascular MR imaging. We will demonstrate machine learning applications for the fast reconstruction of cardiac MR images from undersampled k-space data, image super-resolution as well segmentation of the cardiovascular anatomy in cine cardiac MRI.

14:15	Role of Machine Learning in Image Acquisition & Reconstruction
	Kerstin Hammernik[1,2]
	[1]Institute of Computer Vision and Graphics, Graz University of Technology, Austria, [2]Center for Biomedical Imaging, New York University School of Medicine, New York, NY, United States
	In this educational, we give an overview how deep learning is currently used in static and dynamic MRI reconstruction of undersampled k-space data. While we observe large improvements in terms of image quality and artifact removal for learning-based approaches compared to traditional approaches, we have to consider also several challenges. We will discuss both advantages and challenges using examples of current deep learning-based approaches for reconstruction of undersampled k-space data, focusing on the design of network architectures and loss functions.

14:45	Machine Learning: A Clinical Perspective on CV Disease
	Bharath Ambale Venkatesh[1]

		[1]Johns Hopkins University, United States
		Machine learning methods are better suited for meaningful risk prediction in extensively phenotyped large-scale epidemiological studies than traditional methods or risk scores. This strategy could yield insights about specific use of variables for specific event prediction and guiding strategies to prevent cardiovascular disease outcomes. Potentially, these techniques could be applied retrospectively to analyze large data sets for identifying disease mechanisms, and as a means of hypothesis generation, without prior assumptions.

	15:15	Will ML Replace Radiologists?
		Declan O'Regan
		In this presentation the current state of the art of Machine Learning in medical image analysis will be discussed and what impact this may have on the role of clinical radiologists.

	15:45	Adjournment & Meet the Teachers

Weekday Course

MRI Value in Body Imaging: Role for Abbreviated Protocols?

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Monday 13:45 - 15:45	*Moderators:* Thomas Hope & Ihab Kamel

	13:45	Liver Fat, Iron, & Fibrosis Abbreviated Protocols
		Sudhakar K Venkatesh[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States
		With the emergence of non-alcoholic fatty liver disease (NAFLD) as most common chronic liver disease, detection and quantification of liver fat and fibrosis becomes important. Iron overload frequently seen in association with fatty liver and liver fibrosis. Noninvasive quantification of liver fat, iron and fibrosis with MRI is now considered the standard for diagnosis and monitoring. In this presentation, typical clinical scenarios that requires MRI abbreviated protocol for liver fat, iron and fibrosis quantification, candidate sequences and multi-parametric MRI protocols will be discussed. MRI protocols will be illustrated with clinical examples and limitations will be highlighted.

	14:09	Liver Screening & Surveillance-HCC
		Bachir Taouli[1]
		[1]Mount Sinai School of Medicine, United States
		In this presentation, we will discuss the different scenarios in which AMRI can be used: 1) in the context of cancer screening or diagnosis (liver cancer, liver metastases, prostate cancer); 2) for liver health assessment (fat, fibrosis and iron), 3) in cases of contra-indications to gadolinium contrast. We will discuss the current evidence on the use of AMRI, cost savings, limitations and future directions.

	14:33	Screening the High-Risk Pancreas
		Giovanni Morana[1]
		[1]Radiological Department, General Hospital Ca' Foncello, Treviso, Italy
		MRI is an imaging method useful in screening high risk patients for pancreatic cancer

	14:57	Active Surveillance in Managing Prostate Cancer
		Katarzyna J. Macura[1]
		[1]Radiology, Johns Hopkins University, Baltimore, MD, United States
		Active surveillance (AS) has emerged as an important management strategy to avoid overtreatment of low-risk indolent prostate cancer and MRI of the prostate has been documented to offer high accuracy for the detection and localization of clinically significant cancer with high negative predictive value. The main role of MRI in AS is in patient selection and monitoring with a potential to minimize the invasiveness of follow-up. Abbreviated prostate MRI protocols offer a diagnostic accuracy and cancer detection rates that are equivalent to those of conventional full multiparametric MRIs.

	15:21	Breast Cancer Screening
		Savannah Partridge[1]
		[1]University of Washington, United States

		Abbreviated breast MRI protocols hold potential to reduce time and overall costs of breast MRI examinations, which could increase accessibility for more widespread screening. A growing number of studies have demonstrated that abbreviated MRI protocols can provide comparable diagnostic accuracy to that of conventional full MRI protocols for breast cancer screening. Current approaches and performance results will be reviewed, along with discussion of future directions.

	15:45	Adjournment & Meet the Teachers

Power Pitch

Pitch: Molecular & Metabolic Imaging

Power Pitch Theater A - Exhibition Hall	Monday 13:45 - 14:45	*Moderators:* Amnon Bar-Shir & Marion Menzel	*(no CME credit)*

102	13:45	A novel iterative sparse deconvolution method for multicolor 19F-MRI
		Jasper Schoormans[1], Claudia Calcagno[2], Mariah Daal[1], Christopher Faries[2], Brenda L Sanchez-Gaytan[2], Aart J Nederveen[3], Zahi A Fayad[2], Willem J M Mulder[2], Bram F Coolen[1], and Gustav J Strijkers[1,2]
		[1]Department of Biomedical Engineering and Physics, Academic Medical Center, Amsterdam, Netherlands, [2]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Radiology, Academic Medical Center, Amsterdam, Netherlands

103	13:45	Multimodal Assessment of Orbital Immune Cell Infiltration and Tissue Remodeling During Development of Graves' Disease by 1H/19F MRI
		Ulrich Flögel[1], Anke Schlüter[2], Christoph Jacoby[1], Sebastian Temme[1], J Paul Benga[2], Anja Eckstein[2], Jürgen Schrader[1], and Utta Berchner-Pfannschmidt[2]
		[1]Experimental Cardiovascular Imaging, Heinrich Heine University, Düsseldorf, Germany, [2]University of Essen, Essen, Germany

104	13:45	Hyperpolarized Xe-129 Imaging of Pluripotent Stem Cell-Derived Alveolar-Like Macrophages in the Lungs: Proof-of-Concept Study Using Superparamagnetic Iron-Oxide Nanoparticles
		Vlora Riberdy[1,2], Michael Litvack[2], Elaine Stirrat[2], Marcus Couch[2], Martin Post[2], and Giles Santyr[1,2]

		[1]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada, [2]Translational Medicine, The Hospital for Sick Children, Toronto, ON, Canada
105	13:45	In Vivo Molecular Imaging of MUC1-Expressing Colorectal Tumors Using Targeted Hyperpolarized Silicon Particles
		Nicholas Whiting[1,2], Jingzhe Hu[1,3], Shivanand Pudakalakatti[1], Caitlin McCowan[1,3], Daniel Carson[3], Jennifer Davis[1], Niki Millward[1], David Menter[1], Pamela Constantinou[3], and Pratip Bhattacharya[1]
		[1]The University of Texas MD Anderson Cancer Center, Houston, TX, United States, [2]Rowan University, Glassboro, NJ, United States, [3]Rice University, Houston, TX, United States
106	13:45	Imaging glutathione depletion in the rat brain using ascorbate-derived hyperpolarized MR and PET probes
		Hecong Qin[1,2], Valerie Carroll[1], Renuka Sriram[1], Cornelius von Morze[1], Zhen Jane Wang[1], Christopher Mutch[1], Kayvan R. Keshari[3], Robert R. Flavell[1], John Kurhanewciz[1,2], and David M. Wilson[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]UC Berkeley-UCSF Graduate Program in Bioengineering, University of California, Berkeley and San Francisco, CA, United States, [3]Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States
107	13:45	In-vivo metabolism of co-hyperpolarized [1-13C] pyruvate and [1,3-13C] acetoacetate identifies cytosolic and mitochondrial redox in ischemic perfused hearts
		Gaurav Sharma[1], Craig R. Malloy[1,2,3], A. Dean Sherry[1,2,4], and Chalermchai Khemtong[1,2]
		[1]Advanced Imaging Research Center, University of Texas Southwestern Medical Center, Dallas, TX, United States, [2]Department of Radiology, University of Texas Southwestern Medical Center, Dallas, TX, United States, [3]Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, TX, United States, [4]Department of Chemistry, University of Texas at Dallas, Dallas, TX, United States
108	13:45	Probing perturbed hepatic metabolism in bile-duct-ligated rats with hyperpolarized 13C pyruvate and arginine
		Hikari A. I. Yoshihara[1], Dmitri Firsov[2], Cristina Cudalbu[3], and Rolf Gruetter[4]

		[1]Laboratory for Functional and Metabolic Imaging, Swiss Federal Institute of Technology, Lausanne (EPFL), Lausanne, Switzerland, [2]Department of Pharmacology and Toxicology, University of Lausanne, Lausanne, Switzerland, [3]Centre d'Imagerie Biomedicale (CIBM), Swiss Federal Institute of Technology, Lausanne (EPFL), Lausanne, Switzerland, [4]Laboratory for Functional and Metabolic Imaging & Centre d'Imagerie Biomedicale (CIBM), Swiss Federal Institute of Technology, Lausanne (EPFL), Lausanne, Switzerland

109	13:45	Hollow Manganese-Silicate (HMS) Nanoparticles as a Liver Specific MRI contrast agent
		Moon-Sun Jang[1], Jin Goo Kim[2], Geun Ho Im[1], Jung Hee Lee[1,3], Won Jae Lee[1], and In Su Lee[2]
		[1]Department of Radiology and Center for Imaging Science, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea, [2]National Creative Research Initiative Center for Nanospace-confined Chemical Reactions and Department of Chemistry, Pohang University of Science and Technology (POSTECH), Gyeongbuk, Republic of Korea, [3]Departments of Health Science and Technology and Medical Device Management and Research, Samsung Advanced Institute for Health Science and Technology, Sungkyunkwan University, Seoul, Republic of Korea

110	13:45	Magnetic Resonance Temperature Imaging for Nanoparticle-Mediated Tumor Photothermal Therapy
		Fu Guifeng[1,2], Guo Jianxin[1], Wei Xiaocheng[3], Zhang Fan[2], and Yang Jian[1]
		[1]Medical Imaging Department, First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, China, [2]Center for Molecular Imaging and Translational Medicine, Xiamen University, Xiamen, China, [3]MR Research China, GE Healthcare, Beijing, China

111	13:45	Amide proton transfer-weighted imaging in meningioma: Prediction of tumor grade, histologic subtype and association with Ki-67 proliferation status
		Hao Yu[1], Xianlong Wang[1], Qihong Rui[1], Shanshan Jiang[2], Jinyuan Zhou[2], and Zhibo Wen[1]
		[1]Department of Radiology, Zhujiang Hospital of Southern Medical University, Guangzhou, China, [2]Division of MR Research, Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States

112	13:45	Brown Adipose Tissue Mass Measurement by Z-Spectrum Imaging
		Alessandro M Scotti[1,2,3], Rongwen Tain[1,3], Weiguo Li[1,4,5], Victoria Gil[6], Chong Wee Liew[6], and Kejia Cai[1,3]

		[1]Radiology, University of Illinois, Chicago, IL, United States, [2]Bioengineering, University of Illinois at Chicago, Chicago, IL, United States, [3]Center for MR Research, University of Illinois at Chicago, Chicago, IL, United States, [4]Research Resource Center, University of Illinois at Chicago, Chicago, IL, United States, [5]Radiology, Northwestern University, Chicago, IL, United States, [6]Physiology and Biophysics, University of Illinois, Chicago, IL, United States
113	13:45	Carbon Nanodots as Diamagnetic CEST MRI Contrast Agents for Cell Labeling
		Jia Zhang[1], Minling Gao[2,3], Yue Yuan[1,4], Yuguo Li[1], Peter van Zijl[1,5], Mingyao Ying[2,3], and Guanshu Liu[1,5]
		[1]Department of Radiology and Radiological Science, Johns Hopkins University, School of Medicine, Baltimore, MD, United States, [2]Department of Neurology, Johns Hopkins University, School of Medicine, Baltimore, MD, United States, [3]Kennedy Krieger Institute, Baltimore, MD, United States, [4]Institute for Cell Engineering, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [5]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States
114	13:45	Correlation of tissue pH via 31P-MRSI with MTRasym derived from APT-CEST-MRI in glioblastoma and normal appearing white matter
		Jan Rüdiger Schüre[1], Stella Breuer[1], Manoj Shrestha[2], Ralf Deichmann[2], Marlies Wagner[1], and Ulrich Pilatus[1]
		[1]Neuroradiology, University Hospital Frankfurt, Frankfurt am Main, Germany, [2]Brain Imaging Center, Goethe University Frankfurt, Frankfurt am Main, Germany
115	13:45	Imaging vascular inflammation as a marker for T-cell infiltration in preclinical tumor models.
		Johannes Riegler[1], Vincent Javinal[2], Maj Hedehus[1], Jill Schartner[2], and Richard A.D. Carano[1]
		[1]Biomedical Imaging, Genentech, South San Francisco, CA, United States, [2]Genentech, South San Francisco, CA, United States
116	13:45	Translational Radiogenomics of Brain Tumors: From Lab-Invesigation to Clinical Application
		Dieter Henrik Heiland[1], Horst Urbach[2], and Irina Mader[3]
		[1]Department of Neurosurgery, Medical Center Freiburg, Freiburg, Germany, [2]Department of Nueroradiology, Medical Center Freibrurg, Freibrurg, Germany, [3]Medical Center Freiburg, Freiburg, Germany

Power Pitch

Pitch: MRI in Cancer Therapy & Diagnostics

Power Pitch Theater B - Exhibition Hall	Monday 13:45 - 14:45	*Moderators:* Pek Lan Khong & Irene Marco-Rius	*(no CME credit)*

117	13:45	MRI-only Treatment Planning using Pseudo CT Generation from Deep Learning Approach
		Fang Liu[1], Poonam Yadav[2], Andrew M Baschnagel[2], and Alan McMillan[1]
		[1]Department of Radiology, University of Wisconsin-Madison, Madison, WI, United States, [2]Department of Human Oncology, University of Wisconsin-Madison, Madison, WI, United States

118	13:45	Online Super-resolution 4D T2-weighted MRI for MRI-guided Radiotherapy
		Joshua Nathan Freedman[1,2], David John Collins[2], Oliver Jacob Gurney-Champion[1], Simeon Nill[1], Uwe Oelfke[1], Martin Osmund Leach[2], and Andreas Wetscherek[1]
		[1]Joint Department of Physics, The Institute of Cancer Research and The Royal Marsden NHS Foundation Trust, London, United Kingdom, [2]CR-UK Cancer Imaging Centre, The Institute of Cancer Research and The Royal Marsden NHS Foundation Trust, London, United Kingdom

119	13:45	Rapid MR Imaging of Ocular Movement using Shared K-Space Data for Radiotherapy Planning
		Luc van Vught[1,2], Kirsten Koolstra[2], and Jan-Willem Beenakker[1,2]
		[1]Ophthalmology, Leiden University Medical Center, Leiden, Netherlands, [2]Radiology, C.J. Gorter Center for High Field MRI, Leiden University Medical Center, Leiden, Netherlands

120	13:45	Visual pathway structure and localisation of tumour-induced disturbance in optic pathway glioma: correlations between diffusion-MRI, visual evoked potentials, and optical coherence tomography
		Patrick W Hales[1], Sian Handley[2], Alki Liasis[2], Darren Hargrave[3], and Chris Clark[1]
		[1]UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom, [2]Opthalmology Department, Great Ormond Street Children's Hospital, London, United Kingdom, [3]Haematology and Oncology Department, Great Ormond Street Children's Hospital, London, United Kingdom

121	13:45	Differentiation between vasogenic edema and infiltrative tumor in patients with high grade gliomas using texture patch based analysis
		Moran Artzi[1,2], Gilad Liberman[1,3], Deborah T. Blumenthal[2,4], Orna Aizenstein[1], Felix Bokstein[2,4], and Dafna Ben Bashat[1,2,5]
		[1]Functional Brain Center, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel, [2]Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel, [3]Department of Chemical Physics, Weizmann Institute, Rehovot, Israel, [4]Neuro-Oncology Service, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel, [5]Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel
122	13:45	Evaluating intratumoral necrosis in gliomas: a multi-modal study of acidosis, cellularity, and vascularity
		Maxime Parent[1], John J. Walsh[2], Lucas C. Adam[1], Daniel Coman[1], and D.S. Fahmeed Hyder[1,2]
		[1]Radiology & Biomedical Imaging, Yale University, New Haven, CT, United States, [2]Biomedical Engineering, Yale University, New Haven, CT, United States
123	13:45	Oxygen enhanced-MRI detects radiotherapy-induced change in hypoxia in xenograft models and lung cancer patients
		Ahmed Salem[1,2], Ross Little[3], Adam Featherstone[3], Muhammad Babur[4], Hitesh Mistry[4], Susan Cheung[3], Yvonne Watson[3], Victoria Tessyman[4], Marie-Claude Asselin[3], Alan Jackson[3], Kaye Williams[4], Geoffrey Parker[3,5], Corinne Faivre-Finn[1,2], and James O'Connor[1,6]
		[1]Division of Cancer Sciences, University of Manchester, Manchester, United Kingdom, [2]Department of Clinical Oncology, The Christie Hospital NHS Trust, Manchester, United Kingdom, [3]Division of Informatics, Imaging and Data Sciences, University of Manchester, Manchester, United Kingdom, [4]Division of Pharmacy and Optometry, University of Manchester, Manchester, United Kingdom, [5]Bioxydyn Ltd, Manchester, United Kingdom, [6]Department of Radiology, The Christie Hospital NHS Trust, Manchester, United Kingdom
124	13:45	Assessment of Distant Tumor Stimulation from Liver Radiofrequency Ablation in a Rat Breast Carcinoma Model using Hyperpolarized 13C-Pyruvate MRI
		Joseph Scott Goodwin[1], David Mwin[1], Patricia Coutinho de Souza[1], Svayam Dialani[1], John T Moon[1], Aaron K Grant[1], Muneeb Ahmed[1], and Leo L Tsai[1]
		[1]Radiology, Beth Israel Deaconess Medical Center, Boston, MA, United States

125	13:45	Late gadolinium enhancement of colorectal liver metastases post-chemotherapy is associated with tumour fibrosis and overall survival post-hepatectomy
		Helen Cheung[1], Paul J Karanicolas[2], Eugene Hsieh[3], Natalie Coburn[2], Tishan Maraj[1], Jin J Kim[1], Howaida Elhakim[3], Masoom A Haider[1], Calvin Law[2], and Laurent Milot[1]
		[1]Department of Medical Imaging, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada, [2]Department of Surgery, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada, [3]Department of Pathology, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada
126	13:45	Human Hyperpolarized ^{13}C MR of Liver and Bone Metastases using both EPSI and EPI Acquisitions
		Zihan Zhu[1,2], Jeremy W Gordon[1], Hsin-Yu Chen[1], Eugene Milshteyn[1,2], Daniele Mammoli[1], Lucas Carvajal[1], Peter J Shin[1], Rahul Aggarwal[3], Robert Bok[1], John Kurhanewicz[1], Pamela Munster[3], and Daniel B Vigneron[1]
		[1]Department of Radiology and Biomedical Imaging, UCSF, San Francisco, CA, United States, [2]UC Berkeley - UCSF Graduate Program in Bioengineering, UCSF, San Francisco, CA, United States, [3]Department of Medicine, UCSF, San Francisco, CA, United States
127	13:45	Two Dimensional COSY on Biopsy Distinguishes Indolent From Aggressive Kidney Masses
		Aaron Urquhart[1], Sharon Del Vecchio[2], Lutz Krause[3], Robert Ellis[2], Keng Lim Ng[4], Hema Samaratunga[5], Sonja Gustafson[6], Graham Galloway[1,3], Glenda Gobe[2], Peter Malycha[1], Simon Wood[4], and Carolyn Mountford[1]
		[1]Translational Research Institute, Brisbane, Australia, [2]Faculty of Medicine, The University of Queensland, Brisbane, Australia, [3]The University of Queensland, Brisbane, Australia, [4]Department of Urology, Princess Alexandra Hospital, Brisbane, Australia, [5]Aquesta Uropathology, Brisbane, Australia, [6]Department of Radiology, Princess Alexandra Hospital, Brisbane, Australia
128	13:45	In vivo cancer detection and dynamics with magnetic particle imaging
		Elaine Yu[1], Mindy Bishop[1], Bo Zheng[1], R Matthew Ferguson[2], Amit P Khandhar[2], Scott J Kemp[2], Kannan M Krishnan[2,3], Patrick Goodwill[1,4], and Steven Conolly[1,5]
		[1]Department of Bioengineering, University of California, Berkeley, CA, United States, [2]Lodespin Labs, Seattle, WA, United States, [3]Department of Material Science and Engineering, University of Washington, Seattle, WA, United States, [4]Magnetic Insight, Inc., Alameda, CA, United States, [5]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA, United States

129	13:45	Ferumoxytol-enhanced MRI: Early Results in Solid Organ Masses.
		Puja Shahrouki[1,2], Woo Kyoung Jeong[1,3], Steven S. Raman[1], Ely R. Felker[1], David S. Lu[1], and J. Paul Finn[1,2]
		[1]Department of Radiological Sciences, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [2]Diagnostic Cardiovascular Imaging Laboratory, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [3]Department of Radiology and Imaging Sciences, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

130	13:45	Whole-Body MRI for Metastatic Cancer Detection using T2-Weighted Imaging with Fat and Fluid Suppression
		Xinzeng Wang[1], Ali Pirasteh[1], James Brugarolas[2,3], Neil M. Rofsky[1,4], Robert E. Lenkinski[1,4], Ivan Pedrosa[1,3,4], and Ananth J. Madhuranthakam[1,4]
		[1]Radiology, UT Southwestern Medical Center, Dallas, TX, United States, [2]Internal Medicine, UT Southwestern Medical Center, Dallas, TX, United States, [3]Kidney Cancer Program, Simmons Comprehensive Cancer Center, UT Southwestern Medical Center, Dallas, TX, United States, [4]Advanced Imaging Research Center, UT Southwestern Medical Center, Dallas, TX, United States

131	13:45	Whole body functional and anatomical MRI: Accuracy in staging and interim response monitoring of Childhood and Adolescent Hodgkin's Lymphoma compared to multimodality conventional imaging
		Arash Latifoltojar[1], Shonit Punwani[1], Andre Lopes[2], Paul D Humphries[1], Deena Neriman[3], Leon Menezes[3], Stephen Daw[4], Ananth Shankar[4], Bilyana Popova[2], K M Mak[2], Heather Fitzke[1], Paul Smith[2], Laura Clifton-Hadley[2], and Stuart Andrew Taylor[1]
		[1]Centre for Medical Imaging, University College London, London, United Kingdom, [2]Cancer Research UK and UCL Cancer Trial Centre, University College London, London, United Kingdom, [3]Institute of Nuclear Medicine, University College London Hospital, London, United Kingdom, [4]Department of Paediatric Haemato-oncology, University College London Hospital, London, United Kingdom

Combined Educational & Scientific Session

Applications of Microstructural Imaging in Disease

Organizers: Noam Shemesh, Fernando Calamante, Jennifer McNab

N01	Monday 13:45 - 15:45	*Moderators:* Fernando Calamante & Noam Shemesh

	13:45	Microstructure/Diffusion-Mediated MRI Signals

		Jens H Jensen[1]
		[1]Department of Neuroscience, Medical University of South Carolina, Charleston, SC, United States
		Diffusion MRI is highly sensitive to the microstructural properties of biological tissues, such as cellularity and membrane permeability. However, the connections between standard diffusion measures and specific microstructural properties are complex and subtle, making the biological interpretation of changes in diffusion measures associated with disease very challenging. Microstructural modeling has frequently been combined with diffusion MRI to improve interpretability, but the reliability of model predictions is often limited by uncertainties in their underlying assumptions. Here we review these considerations by examining several examples of how microstructure affects commonly employed diffusion measures.

	14:15	Application of Microstructure/Diffusion-Mediated Signals to Study Disease
		Matthew Budde[1]
		[1]Medical College of Wisconsin, United States
		This talk will summarize state-of-the-art techniques to probe tissue microstructure and describe ongoing efforts to understand how the biology of nervous system tissue relates to DWI signal and models.

132	14:45	Do Non-Gaussian diffusion MRI methods improve the detection or specification of cellular alterations following traumatic brain injury?
		Elizabeth B Hutchinson[1,2], Sarah King[1], Alexandru Avram[3], M Okan Irfanoglu[1], Michal Komlosh[2,4], Susan Schwerin[2,5], Eli Shindell[5], Sharon Juliano[5], and Carlo Pierpaoli[1]
		[1]QMI/NIBIB, National Institutes of Health, Bethesda, MD, United States, [2]Henry M. Jackson Foundation, Bethesda, MD, United States, [3]NIBIB, National Institutes of Health, Bethesda, MD, United States, [4]NICHD, National Institutes of Health, Bethesda, MD, United States, [5]APG, Uniformed Services University, Bethesda, MD, United States
		Following traumatic brain injury (TBI), numerous microscale cellular alterations appear and evolve with a range of consequences for adverse outcomes and recovery. Diffusion tensor MRI (DTI) has been identified as a potentially sensitive tool for characterizing these changes, but is notably limited in providing specific information about particular cellular alterations and more advanced non-Gaussian frameworks have been developed that may address these limitations. To assess the utility of non-Gaussian modeling for improved detection and specification of TBI-related cellular alterations, we compared DTI, DKI and MAP-MRI in mouse brains following mild TBI and their correspondence to histopathology in the same tissue.

133	14:57	Histological Validation of in-vivo VERDICT MRI for Prostate using 3D Personalised Moulds
		Elisenda Bonet-Carne[1,2], Maira Tariq[1], Hayley Pye[3], Mrishta Brizmohun Appayya[2], Aiman Haider[4], Colleen Bayley[1], Joseph Jacobs[1], Alexander Freeman[4], David Hawkes[1], David Atkinson[2], Greg Shaw[5], Hayley Whitaker[3], Daniel C Alexander[1], Shonit Punwani[2], and Eleftheria Panagiotaki[1]
		[1]Centre for Medical Image Computing, University College London, London, United Kingdom, [2]Centre for Medical Imaging, University College London, London, United Kingdom, [3]Research Department for Tissue & Energy, University College London, London, United Kingdom, [4]Department of Pathology, University College London Hospital, London, United Kingdom, [5]Division of Surgery and Interventional Science, University College London, London, United Kingdom
		VERDICT analysis can successfully distinguish benign from malignant prostate tissue *in-vivo* showing promising results as a cancer diagnostic tool. However, the accuracy with which model parameters reflect the underlying tissue characteristics is unknown. In this study, we quantitatively compare the intracellular, extracellular-extravascular and vascular volume fractions derived from *in-vivo* VERDICT MRI against histological measurements from prostatectomies. We use 3D-printed personalised moulds designed from *in-vivo* MRI that help preserve the orientation and location of the gland and aid histological alignment. Results from the first samples using the 3D mould pipeline show good agreement between *in-vivo* VERDICT estimates and histology.

134	15:09	Microscopic diffusion anisotropy reveals microstructural heterogeneity of malformations of cortical development associated with epilepsy: A b-tensor encoding study at 7T
		Björn Lampinen[1], Ariadni Zampeli[2], Filip Szczepankiewicz[3,4], Maria Compagno Strandberg[5], Kristina Källén[6], Isabella M Björkman-Burtscher[4], and Markus Nilsson[4]
		[1]Clinical Sciences Lund, Medical Radiation Physics, Lund University, Lund, Sweden, [2]Clinical Sciences Lund, Neurology, Lund University, Lund, Sweden, [3]Random Walk Imaging AB, Lund, Sweden, [4]Clinical Sciences Lund, Diagnostic Radiology, Lund University, Lund, Sweden, [5]Skane University Hospital, Department of Clinical Sciences Lund, Neurology, Lund University, Lund, Sweden, [6]Skane University Hospital, Department of Clinical Sciences Lund, AKVH-Neurology Helsingborg, Lund University, Lund, Sweden
		Malformations of cortical development are macro- or microscopic abnormalities of the cerebral cortex. Here, we investigated such malformations associated with epilepsy using b-tensor encoding, which is a recently developed technique that permits estimation of microscopic anisotropy also in regions where diffusion is isotropic on the voxel level. Results show a large heterogeneity in microscopic anisotropy between lesions, which we hypothesize represents different levels of axonal content. The characteristics of some types of lesions depended strongly on whether they were associated to other lesions, which could be clinically helpful for indicating hidden sources of epileptic seizures.

135	15:21	Investigating microstructural heterogeneity of white matter hyperintensities in Alzheimer’s disease using single-shell 3-tissue constrained spherical deconvolution

		Remika Mito[1,2], Thijs Dhollander[1], David Raffelt[1], Ying Xia[3], Olivier Salvado[3], Amy Brodtmann[1,2], Christopher Rowe[4,5], Victor Villemagne[4,5], and Alan Connelly[1,2]
		[1]Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, [2]Florey Department of Neuroscience and Mental Health, University of Melbourne, Melbourne, Australia, [3]The Australian eHealth Research Centre, CSIRO Health and Biosecurity, Brisbane, Australia, [4]Department of Medicine, Austin Health, University of Melbourne, Melbourne, Australia, [5]Department of Molecular Imaging & Therapy, Centre for PET, Austin Health, University of Melbourne, Melbourne, Australia
		White matter hyperintensities (WMH) observed on FLAIR MRI are highly prevalent in Alzheimer's disease. Although often associated with cognitive decline, such associations are highly variable, likely due to the underlying pathological heterogeneity within these lesions. Here, we explore this potential heterogeneity *in vivo* in an Alzheimer's disease cohort, by investigating relative tissue fractions obtained using single-shell 3-tissue constrained spherical deconvolution (SS3T-CSD). We show distinguishable tissue profiles of lesions based on classification as periventricular or deep, and additionally show heterogeneity *within* lesions, thus highlighting the pitfalls of binary classification of WMH, and the value of investigating their underlying diffusional properties.

136	15:33	Neurite Orientation Dispersion and Density Imaging: Added Value in the Detection of Tubers in Patients With Tuberous Sclerosis Complex
		Xiali Shao[1], Xuewei Zhang[2], Wenrui Xu[1], Hua Guo[3], Zhe Zhang[3], Jieying Zhang[3], Tao Jiang[4], and Weihong Zhang[1]
		[1]Department of radiology, Peking Union Medical College Hospital, Peking Union Medical College and Chinese Academy of Medical Sciences, Beijing, China, [2]Department of interventional radiology, China Meitan General Hospital, Beijing, China, [3]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [4]Department of Neurosurgery, China National Clinical Research Center for Neurological Diseases, Beijing, China
		The aim of this study was to evaluate the performance of Neurite Orientation Dispersion and Density Imaging (NODDI) in depicting cortical tubers in patients with tuberous sclerosis complex (TSC). By comparing with conventional MRI and DTI, the intracellular volume fraction (ICVF) derived from NODDI showed privilege over both techniques with higher sensitivity and better contrast ratio. Our result has revealed that NODDI was better at detecting microstructural disruption than DTI and conventional MRI sequences with a more reasonable model assumption, and may somehow shed light on the management of epilepsy in TSC patients.

	15:45	Adjournment & Meet the Teachers

Oral

RF Arrays & Systems

N03	Monday 13:45 - 15:45	*Moderators:* Nicola De Zanche & Manushka Vaidya

137	13:45	The MRF Array: an iPRES Coil Array for Accelerated Magnetic Resonance Fingerprinting
		Michael Twieg[1], Bhairav B. Mehta[1], Shinya Handa[2], Haoqin Zhu[2], Michael Wyban[2], Steven Tokar[2], Labros Petropoulos[2], Hiroyuki Fujita[2], Sherry Huang[3], Andrew Dupuis[3], and Mark A Griswold[1,3]
		[1]Department of Radiology, Case Western Reserve University, Cleveland, OH, United States, [2]Quality Electrodynamics, Mayfield Heights, OH, United States, [3]Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States
		Magnetic Resonance Fingerprinting (MRF) depends on spatially and temporally incoherent encoding fields for fast quantitative imaging. However the achievable encoding is limited by hardware. The iPRES concept, which adds ΔB_0 and B_1^+ encoding to a receive array, is an excellent candidate for additional encoding for MRF. Here we present preliminary results of a 16 channel iPRES array, referred to as the MRF array. The MRF array uses in-bore power amplifiers to provide vastly increased encoding capabilities while minimizing the cost of additional hardware. Such encoding schemes are expected to allow for acceleration of quantitative imaging techniques such as MRF.

138	13:57	Optimization and validation of dipole antenna geometry for body imaging at 10.5T
		Bart R. Steensma[1], Pierre-Francois van de Moortele[2], Arcan M. Erturk[2], Andrea Grant[2], Gregor Adriany[2], Gregory J. Metzger[2], and Alexander J.E. Raaijmakers[1,3]
		[1]Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [2]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [3]Biomedical Image Analysis, Eindhoven University of Technology, Eindhoven, Netherlands
		Body MRI at 10.5T shows potential for improving signal-to-noise ratio compared to 7T, but is limited by increased specific absorption rate (SAR) levels. In this work, the geometry of a dipole antenna is optimized for body imaging with low SAR levels at 10.5T. The optimized dipole geometry is compared to a previous design in simulations on a human model, where it is shown that SAR levels can be decreased by 36% for an equal transmit efficiency. Simulations are validated by magnetic resonance thermometry and B_1^+-mapping experiments with a 12-channel multi-transmit array.

139	14:09	Ultimate intrinsic transmit efficiency for RF shimming
		Ioannis P. Georgakis[1], Athanasios G. Polimeridis[1], and Riccardo Lattanzi[2,3,4]

		[1]Center for Computational and Data-Intensive Science and Engineering (CDISE), Skolkovo Institute of Science and Technology, Moscow, Russian Federation, [2]Center for Advanced Imaging Innovation and Research (CAI2R), Department of Radiology, New York University School of Medicine, New York, NY, United States, [3]Bernard and Irene Schwartz Center for Biomedical Imaging (CBI), Department of Radiology, New York University School of Medicine, New York, NY, United States, [4]Sackler Institute of Graduate Biomedical Sciences, New York University School of Medicine, New York, NY, United States
		We introduce a new performance metric for RF shimming, the ultimate intrinsic transmit efficiency (UITXE), which provides an absolute reference independent of any particular coil design. We show in simulation that it represents a performance upper bound, which could be approached with finite transmit arrays with an increasing number of coils. In particular, we demonstrated that a 24-channel array could achieve 70% of the UITXE. UITXE could be employed in a straightforward manner in experiments to assess absolute performance of actual arrays and evaluate RF shimming approaches. The associated ideal current patterns could provide new insight for optimal array design.

140	14:21	32-Channel Combined Surface Loop / “Vertical” Loop Tight-Fit Array Provides for Full-Brain Coverage, High Transmit Performance, and SNR Improvement at 9.4T: an Alternative to Surface Loop / Dipole Antenna Combination.
		Nikolai Avdievich[1,2], Ioannis Angelos Giapitzakis[2], and Anke Henning[1,2]
		[1]Institute of Physics, Ernst-Moritz-Arndt University Greifswald, Greifswald, Germany, [2]High-Field MR Center, Max Planck Institute for Biological Cybernetics, Tübingen, Germany
		Tight-fit human head ultra-high field (UHF,>7T) transceiver (TxRx) surface loop phased arrays improve transmit (Tx)-efficiency in comparison to Tx-only arrays, which are larger to fit receive (Rx)-only arrays inside. A drawback of the TxRx-design is that the number of array elements is restricted by the number of available RF Tx-channels (commonly $\leq$16), which limits the Rx-performance. A new 32-element tight-fit human head array, which consists of 18 TxRx-loops and 14 Rx-only vertical loops, was constructed. The array provides for full-brain coverage, ~50% greater B_1^+, and ~30% greater SNR near the brain center as compared to common Tx-only/ Rx-only (ToRo) array.

141	14:33	Evaluation of Parallel Imaging performance gains with 64 channel receivers at 7 Tesla
		Steen Moeller[1], Andrea Grant[1], Xiaoping Wu[1], Lance Delabarre[1], Pierre-Francois Van de Moortele[1], Jerahmie Radder[1], Scott Schillack[2], Edward Auerbach[1], Gregor Adriany[1], and Kamil Ugurbil[1]
		[1]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [2]Lifeservices LLC, Minneapolis, MN, United States

		Evaluation of a 64 channel receiver relative to a 32 channel receiver shows that gains in parallel imaging performance for SMS/MB of 40 to 60% is feasible, such that, highly desirable, single-shot, multislice, whole brain coverage with <1s TR and 1mm or better isotropic resolutions would be achievable at 7T.

142	14:45	Feasibility Study of a Double Resonant (23Na/1H) 8 Channel Rx Head Coil for MRI at 3T
		Matthias Malzacher[1], Mathias Davids[1], Jorge Chacon-Caldera[1], and Lothar R. Schad[1]
		[1]Computer Assisted Clinical Medicine,Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
		The implementation of ^{23}Na-sodium MRI in the clinical routine is of increasing interest since it can provide valuable information on tissue viability. A design criterion of such double resonant RF setups is to keep the performance of the ^{1}H MRI approximately at the same level as single resonant setups while optimizing the ^{23}Na imaging. This work investigates the feasibility and performance of a double resonant 8 channel receive (Rx) head coil for ^{1}H and ^{23}Na MRI at 3T using EM simulations and a head model.

143	14:57	Whole-body 7T 31P birdcage transmit coil driven by a 35kW RF amplifier with an integrated 30-element 31P receive array and an 8-element 1H transmit/receive array
		Ladislav Valkovic[1,2], Alex Batzakis[3], Jane Ellis[1], Lucian Purvis[1], Albrecht I Schmid[1,4], Matthew D Robson[1], Dennis WJ Klomp[3,5], and Christopher T Rodgers[1,6]
		[1]Oxford Centre for Clinical MR Research (OCMR), RDM Cardiovascular Medicine, University of Oxford, Oxford, United Kingdom, [2]Department of Imaging Methods, Institute of Measurement Science, Slovak Academy of Sceinces, Bratislava, Slovakia, [3]MR Coils BV, Zaltbommel, Netherlands, [4]High-Field MR Centre, Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Vienna, Austria, [5]Department of Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [6]The Wolfson Brain Imaging Centre, University of Cambridge, Cambridge, United Kingdom
		We describe our experiences implementing a whole-body transmit coil driven by a 35kW RF power amplifier, with a 30-element ^{31}P receive array, and an 8-element ^{1}H transmit/receive array, optimised for cardiac ^{31}P-MRS at 7T. We describe an adaptation to the vendor's standard SAR monitoring to monitor RF power levels up to the full 35kW output of the RFPA. This new hardware was found to achieve better ^{31}P B_1^+ and SNR at the depth of the heart than other coils available in our institution. This setup promises to allow the first regionally-resolved, whole-heart ^{31}P-MRSI studies at 7T in the near future.

144	15:09	A 16-channel Rx-only radiofrequency coil for MR spine imaging at 7T
		Stefan HG Rietsch[1,2], Stephan Orzada[1], Jonathan Weine[1], Leonard Ruschen[1], Sarah Handtke[1,3], Raphaela M Berghs[1,3], Jessica Kohl[1,4], Sascha Brunheim[1,2], Mark E Ladd[5], and Harald H Quick[1,2]

		[1]Erwin L. Hahn Institute for Magnetic Resonance Imaging, University of Duisburg-Essen, Essen, Germany, [2]High-Field and Hybrid MR Imaging, University Hospital Essen, Essen, Germany, [3]Hamm-Lippstadt University of Applied Sciences, Hamm, Germany, [4]University of Applied Science Ruhr West, Mülheim an der Ruhr, Germany, [5]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany
		In clinical MRI systems operating at 1.5 and 3T, built-in 1-channel radiofrequency (RF) transmit body coils are broadly used in conjunction with local receive RF coils. Recently, a 32-channel Tx/Rx remote body coil has been presented for 7T body MRI. In this work we present an additional 16-channel receive-only spine coil to boost signal-to-noise ratio in comparison to measurements where only the 32-channel Tx/Rx remote body coil is used for reception. The SNR gain is demonstrated in a body-sized phantom. Furthermore, first in-vivo imaging results for 7T MRI of the spine during free-breathing are shown.

145	15:21	Higher and more homogeneous B$$$_1^+$$$ for bilateral breast imaging at 7T using a multi-transmit setup with 5 dipole antennas and a 30-loop element receive array
		Erwin Krikken[1], Bart R. Steensma[1], Ingmar J. Voogt[1], Erik R. Huijing[1], Dennis W.J. Klomp[1], Jannie P. Wijnen[1], and Alexander J.E. Raaijmakers[1,2]
		[1]Radiology, UMC Utrecht, Utrecht, Netherlands, [2]Biomedical Image Analysis, Eindhoven University of Technology, Eindhoven, Netherlands
		Imaging of the breast at 7 tesla is compromised by the inhomogeneous B_1^+. To overcome this challenge we explored the use of five fractionated dipole antennas in a multi-transmit system in combination with 30 receiver coils. This coil shows larger SNR, larger FOV and higher and more homogeneous B_1 field in the breasts than the currently used breast coil at our institute. The high B_1^+ and an increased field of view achieved by the fractionated dipole antennas, opens the way to translate routinely used breast imaging protocols from 3T to 7T enabling advanced clinical research.

146	15:33	31-channel receive coil array combined with an 8-channel whole-brain dipole transmit array
		Jérémie Clément[1], Rolf Gruetter[1,2,3], and Özlem Ipek[4]
		[1]LIFMET, EPFL, Lausanne, Switzerland, [2]Department of Radiology, University of Lausanne, Lausanne, Switzerland, [3]Department of Radiology, University of Geneva, Geneva, Switzerland, [4]CIBM-AIT, EPFL, Lausanne, Switzerland
		To increase the parallel imaging performances while keeping high transmit field, the combination of a high-density receive coil array and a tight-fitted whole-brain dipole coil array was investigated. Measured noise correlation matrix, signal-to-noise ratio and g-factor maps were evaluated for the 31-channel receive coil array, and MRI acquisition time could be decreased up to 3.4 times without attenuation in data quality. MR images demonstrated a large spatial coverage, including cerebellum and cerebral cortex, thanks to the whole-brain dipole transmit array while the 31-channel receive coil array provided highly accelerated image acquisition.

Oral

fMRI: Spatiotemporal Dynamics

N04	Monday 13:45 - 15:45	*Moderators:* Catie Chang & Laurentius Huber

147	13:45	Imaging Primary Neuronal Activity in the Human Optical Cortex at 1.35Hz
		Jose de Arcos[1], Daniel Fovargue [1], Katharina Schregel[2,3], Radhouene Neji[1,4], Samuel Patz[2], and Ralph Sinkus[1]
		[1]Department of Biomedical Engineering, King's College London, London, United Kingdom, [2]Brigham and Women's Hospital, Boston, MA, United States, [3]Institute of Neuroradiology, University Medical Center Goettingen, Goettingen, Germany, [4]MR Research Collaborations, Siemens Healthcare Limited, Frimley, United Kingdom
		In this work we have developed a novel functional MRE system for humans capable of probing stiffness changes in the brain driven by monocular visual stimulation. A continuous visual stimulus was applied at an ON/OFF frequency of 1.35 Hz during a segmented 2D multi-slice MRE sequence with 3D motion encoding operating at 50 Hz vibration frequency. Significant stiffness changes were recorded between ON/OFF during the stimulus experiment that also differed in baseline to control scans (OFF/OFF). Since the BOLD signal is entirely saturated at such high stimulation frequencies, we hypothesize that stiffness changes are due to direct neuronal activities. Data match similar results obtained in mice.

148	13:57	Inter-Regional BOLD Latency after Vascular Reactivity Calibration is Correlated to Reaction Time
		Yi-Tien Li[1,2], Pu-Yeh Wu[1], Jacky Tai-Yu Lu[3], Ying-Hua Chu[1], Yi-Cheng Hsu[1], and Fa-Hsuan Lin[1,4]
		[1]Institute of Biomedical Imaging, National Taiwan University, Taipei, Taiwan, [2]Department of Medical Imaging, Taipei Medical University-Shuang Ho Hospital, New Taipei, Taiwan, [3]Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University, Taipei, Taiwan, [4]Department of Neuroscience and Biomedical Engineering, Aalto University, Espoo, Finland
		Inter-regional BOLD latency between visual and sensimotor cortices were first monitored with fast fMRI (TR=0.1 s) and then calibrated for vascular reactivity using a breath-holding task. Significant delayed response (left: t=4.0, p=0.0019; right: t=6.0, p<0.0001) in the sensorimotor cortex was observed than the visual cortex was detected after removing the vascular confound. Significant correlation between reaction time (428 ± 41ms) and the inter-regional BOLD timing difference (432 ± 149ms) was found within and across subjects.

149	14:09	Global responses to microstimulation at 7T and comparison with vibrotactile stimulation

		Ayan Sengupta[1], Rochelle Ackerley[2], Roger Watkins[2], Rosa Sanchez Panchuelo[1], Paul Glover[1], Johan Wessberg[2], and Susan Francis[1]
		[1]Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom, [2]Department of Physiology, University of Gothenburg, Gothenburg, Sweden
		Single unit intra-neural microstimulation (INMS) allows the precise delivery of low-current electrical pulses into human peripheral nerves to stimulate individual afferent nerve fibres. We compare the global pattern of positive and negative BOLD response to INMS with that of perceptually matched vibrotactile stimulation of the skin. INMS and vibrotactile stimulation result in a similar pattern of positive BOLD response, but distinct differences in negative BOLD signals. INMS results in strong negative BOLD response of the DMN, whilst vibrotactile stimulation results in strong ipsilateral negative BOLD response likely to represent active inhibition which is not seen for INMS.

		Ultrahigh spatiotemporal-resolution fMRI reveals distinct brain-wide functional networks of different hippocampal subfields
		Wei-Tang Chang[1], Kelly Sullivan Giovanello[2], and Weili Lin[1]
		[1]BRIC, UNC at Chapel Hill, Chapel Hill, NC, United States, [2]Department of Psychology, UNC at Chapel Hill, Chapel Hill, NC, United States
150	14:21	The hippocampal formation consists of distinct subfields, which contribute to different aspects of memory function, and exhibit different brain network topologies. However, the brain-wide resting-state functional connectivity of hippocampal subfields in human remains poorly understood mainly due to technical limitations. Previous efforts to identify hippocampal subfield functional networks compromised either spatial resolution, spatial coverage or temporal resolution. We have developed a new approach, named Partition-encoded Simultaneous Multi-slab (PRISM), capable of acquiring ultrahigh isotropic resolution images while maintaining the acceleration capability. Our results of resting-state functional connectivity at 7T reveal distinct brain-wide functional networks associated with different hippocampal subfields.

151	14:33	High-frequency BOLD responses in human thalamus detected through fast fMRI at 7 Tesla
		Laura D Lewis[1,2], Kawin Setsompop[1,3], Bruce Rosen[1,4], and Jonathan R Polimeni[1,4]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, United States, [2]Society of Fellows, Harvard University, Cambridge, MA, United States, [3]Radiology, Harvard Medical School, boston, MA, United States, [4]Radiology, Harvard Medical School, Boston, MA, United States

		No current technique can noninvasively localize neural activity in human subcortical structures at subsecond temporal resolution. Recent studies have demonstrated that fast (>0.2 Hz) fMRI responses can be detected in human cortex. We aimed to test whether fast fMRI signals can also be detected in the thalamus. We presented oscillating visual stimuli in order to induce oscillatory neural activity in visual thalamus, and observed large-amplitude fMRI oscillations at 0.5 Hz. We conclude that high-frequency fMRI responses can be detected in thalamus, suggesting fast fMRI has the potential to be used for whole-brain imaging.

152	14:45	Functional organization of visual temporal frequency preference revealed by thalamo-visual correlation
		Yuhui Chai[1], Daniel Handwerker[1], Sean Marrett[1], Andrew Hall[1], Javier Gonzalez-Castillo[1], Peter Molfese[1], and Peter Bandettini[1]
		[1]National Institute of Mental Health, National Institutes of Health, Bethesda, MD, United States
		Thalamo-visual connections play an important role in the visual system. Little is known about the temporal frequency tuning properties of the thalamo-visual correlation in humans. Here we demonstrated that thalamo-visual correlation is significantly modulated by the temporal frequency of a stimulus. Using correlation with thalamus as an index, human visual cortex is organized along a temporal dimension, with the anterior calcarine preferring low temporal frequencies and posterior calcarine preferring higher temporal frequencies.

153	14:57	Probing temporal information in fast-TR fMRI data during attention modulations
		Luca Vizioli[1] and Essa Yacoub[1]
		[1]CMRR, University of Minnesota, Minneapolis, MN, United States
		The introduction of fast-TRs has allowed for explorations of temporal features in fMRI data. Further, the ability to concurrently retain relatively high degrees of spatial precision as well as large volume coverage, while also maintaining high SNR efficiency, could provide unprecedented axis to the human brain. In this work we explore the possibility of exploiting the temporal specificity of fMRI using a temporal multi-voxel pattern analysis and high temporal resolution 7T fMRI data during attention modulations.

154	15:09	Mesoscopic and microscopic imaging of sensory responses in the same animal
		Davide Boido[1], Ravi L Rungta[1], Bruno-Felix Osmanski[2], Morgane Roche[1], Tomokazu Tsurugizawa[3], Denis LeBihan[3], Luisa Ciobanu[3], and Serge Charpak[1]

		[1]INSERM U1128, Laboratory of Neurophysiology and New Microscopy, Université Paris Descartes, Paris, France, [2]INSERM U979 'Wave Physics for Medicine' Lab, Paris, France, [3]NeuroSpin, Bât 145, Commissariat à l'Energie Atomique-Saclay Center, Gif-sur-Yvette, France
		We developed a chronic olfactory bulb preparation compatible with repetitive imaging of the same mice with BOLD-fMRI (17.2 T), functional ultrasound imaging (fUS) and two-photon laser scanning microscopy. BOLD-fMRI and fUS mesoscopic signals are highly correlated with microscopic vascular and dendritic neuronal signals in response to odour concentrations. Furthermore, minimal odour stimulation reveals that there is no threshold of neuronal activation below which functional hyperemia is not triggered, warranting measurement of blood flow dynamics to detect the lowest levels of brain activation. These data establish the strengths and limits of mesoscopic imaging techniques to report neural activity.

155	15:21	A transfer function model for local signal propagation in spatiotemporal MR data
		Henning U. Voss[1], Jörg Stadler[2], Jonathan P. Dyke[1], and Douglas J. Ballon[1]
		[1]Weill Cornell Medicine, New York, NY, United States, [2]Leibniz Institute for Neurobiology, Magdeburg, Germany
		In order to understand the sources of dynamic EPI signals under complex stimuli or in the resting state, local signal transfer functions were computed from natural stimulation data sets, and the coherence vector was mapped and color coded analogously to conventional methods for structural connectivity maps. As expected, signal propagation is frequency dependent, whereas high frequencies are caused by cardiovascular pulsations, but low frequencies are less well understood. We conclude that the observed frequency dependence of this local signal transfer model might aid the understanding of the foundation of functional connectivity analysis and the meaning of observed complex patterns such as the resting states.

156	15:33	Visceral stimulation triggers high-frequency BOLD responses in the rat brain
		Jiayue Cherry Cao[1], Kun-Han Lu[2], Robert Phillips[3], Terry L. Powley[1,3], and Zhongming Liu[1,2]
		[1]Biomedical Engineering, Purdue University, West Lafayette, IN, United States, [2]Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States, [3]Psychological Science, Purdue University, West Lafayette, IN, United States

		Blood oxygen level dependent (BOLD) fMRI reports brain activity by measuring the vascular response to neural activity mediated through neurovascular coupling. Theoretical modeling of neurovascular coupling suggests its effect as a low-pass filter that cuts off at <0.2Hz. However, recent evidence suggests that BOLD fluctuations may also contain high frequency components. From a different perspective to address the origin of high-frequency BOLD signals in the rat brain, we examined the BOLD and local field potential (LFP) responses to visceral stimulation (electrical stimulation of the stomach or the vagus nerve), in comparison with the corresponding responses to commonly used sensory stimulation, such as forepaw stimulation. We report herein that visceral (forestomach and vagal nerve) stimulation can induce high-frequency (up to 0.8Hz) BOLD responses. The neuronal origins of such responses are different from those underlying the responses to forepaw stimulation, and likely modulate hemodynamic fluctuations through a more rapid mechanism of vascular control.

Oral

MRS/MRSI Reconstruction & Quantification

S02	Monday 13:45 - 15:45	*Moderators:* Cristina Cudalbu & Nuno Miguel Pedrosa de Barros

157	13:45	Automatic Removal of Ghosting Artifacts from MR Spectra using Deep Learning
		Sreenath Pruthviraj Kyathanahally[1], André Döring[1], and Roland Kreis[1]
		[1]Depts. Radiology and Biomedical Research, University of Bern, Bern, Switzerland
		Ghosting artifacts in clinical MR spectroscopy are problematic since they superimpose with metabolites and lead to inaccurate quantification. Here, we make use of “Deep Learning” (DL) methods to remove ghosting artifacts in MR spectra of human brain. The DL method was trained on a huge database of simulated spectra with and without ghosting artifacts, which represent complex variants of ghost-ridden spectra, transformed to time-frequency spectrograms. The trained model was tested on simulated and in-vivo spectra. The preliminary results for ghost removal show potential in simulated and in-vivo spectra, but need further refinement and quantitative testing.

158	13:57	A novel structured low-rank framework for ghost removal and denoising of EPSI data
		Ipshita Bhattacharya[1], Ralph Noeske [2], Rolf F Schulte[3], and Mathews Jacob[1]
		[1]Electrical and Computer Engineering, The University of Iowa, Iowa City, IA, United States, [2]GE Healthcare, Postdam, Germany, [3]GE Global Research, Munich, Germany

		Spectral interleaving is often used in echoplanar spectroscopic imaging (EPSI) sequences to achieve high spatial and spectral resolution, especially on high field scanners with larger chemical shift dispersion. Unfortunately, a major roadblock is the spurious Nyquist ghost artifacts, resulting from phase errors between interleaves. We introduce a novel framework, that simultaneously capitalizes on annihilation relation between the interleaves introduced by phase relations, as well as a linear predicability of the spectra, to remove the phase errors and to provide spectral denoising of the spectra. In addition, we also exploit on the low-rank structure of the EPSI data to provide additional spatial denoising, which will further improve the signal to noise ratio of the datasets.

159	14:09	To which extent the Cramér-Rao bound (CRB) is a reliable benchmark in quantitative MRS? Guilhem Pagès[1] and Jean-Marie Bonny[1] *[1]AgroResonance - UR370 QuaPA, INRA, Saint Genès Champanelle, France* Following MRS data fitting, absolute or relative Cramér-Rao bounds (CRB and rCRB, respectively) are often computed as indices of parameter uncertainties. However, the unknown true values of parameters are required to compute CRB. Here, we studied the effect of substituting the true values by the noisy estimates on the bounds (noted CRB* and rCRB*). We showed by simulations that both CRB* and rCRB* are particularly sensitive to noise. Also, the mode of rCRB* distribution is left-shifted, which leads to a significant false positive risk when rCRB* is thresholded. A threshold not exceeding 20% is recommended to limit this risk.

160	14:21	Multi-vendor, multi-site comparison of ^{1}H-MRS PRESS data acquired at 25 research sites Michal Považan[1,2], Mark Mikkelsen[1,2], Adam Berrington[1,2], Peter B. Barker[1,2], Pallab K. Bhattacharyya[3,4], Maiken K. Brix[5,6], Pieter F. Buur[7], Kim M. Cecil[8], Kimberly L. Chan[1,2,9], David Y.-T. Chen[10], Alexander R. Craven[11,12], Koen Cuypers[13,14], Michael Dacko[15], Niall W. Duncan[16], Ulrike Dydak[17], David A. Edmondson[17], Gabriele Ende[18], Lars Ersland[11,12,19], Fei Gao[20], Ian Greenhouse[21], Ashley D. Harris[22], Naying He[23], Stefanie Heba[24], Nigel Hoggard[25], Tun-Wei Hsu[26], Jacobus F. A. Jansen[27], Alayar Kangarlu[28,29], Thomas Lange[15], R. Marc Lebel[30], Yan Li[23], Chien-Yuan E. Lin[31], Jy-Kang Liou[26], Jiing-Feng Lirng[26], Feng Liu[29], Ruoyun Ma[17], Celine Maes[13], Marta Moreno-Ortega[28], Scott O. Murray[32], Sean Noah[21], Ralph Noeske[33], Michael D. Noseworthy[34], Georg Oeltzschner[1,2], James J. Prisciandaro[35], Nicolaas A. J. Puts[1,2], Timothy P. L. Roberts[36], Markus Sack[18], Napapon Sailasuta[37,38], Muhammad G. Saleh[1,2], Michael-Paul Schallmo[32], Nicholas Simard[39], Stephan P. Swinnen[13,40], Martin Tegenthoff[24], Peter Truong[37], Guangbin Wang[20], Iain D. Wilkinson[25], Hans-Jörg Wittsack[41], Hongmin Xu[23], Fuhua Yan[23], Chencheng Zhang[42], Vadim Zipunnikov[43], Helge J. Zöllner[41,44], and Richard A. E. Edden[1,2]

[1]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University, School of Medicine, Baltimore, MD, United States, [2]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Imaging Institute, Cleveland Clinic Foundation, Cleveland, OH, United States, [4]Radiology, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH, United States, [5]Department of Radiology, Haukeland University Hospital, Bergen, Norway, [6]Department of Clinical Medicine, University of Bergen, Bergen, Norway, [7]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands, [8]Department of Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [9]Department of Biomedical Engineering, The Johns Hopkins University, School of Medicine, Baltimore, MD, United States, [10]Department of Radiology, Taipei Medical University Shuang Ho Hospital, New Taipei City, Taiwan, [11]Department of Biological and Medical Psychology, University of Bergen, Bergen, Norway, [12]NORMENT – Norwegian Center for Mental Disorders Research, University of Bergen, Bergen, Norway, [13]Department of Kinesiology, KU Leuven, Leuven, Belgium, [14]REVAL Rehabilitation Research Center, Hasselt University, Diepenbeek, Belgium, [15]Department of Radiology, Medical Physics, Medical Center - University of Freiburg, Faculty of Medicine, Freiburg, Germany, [16]Brain and Consciousness Research Centre, Taipei Medical University, Taipei, Taiwan, [17]School of Health Sciences, Purdue University, West Lafayette, IN, United States, [18]Department of Neuroimaging, Central Institute of Mental Health, Mannheim, Germany, [19]Department of Clinical Engineering, Haukeland University Hospital, Bergen, Norway, [20]Shandong Medical Imaging Research Institute, Shandong University, Jinan, China, [21]Helen Wills Neuroscience Institute, University of California, Berkeley, Berkeley, CA, United States, [22]Department of Radiology, University of Calgary, Calgary, AB, Canada, [23]Department of Radiology, Ruijin Hospital, Shanghai Jiao Tong University, School of Medicine, Shanghai, China, [24]Department of Neurology, BG University Hospital Bergmannsheil, Bochum, Germany, [25]Academic Unit of Radiology, University of Sheffield, Sheffield, United Kingdom, [26]Department of Radiology, Taipei Veterans General Hospital, National Yang-Ming University, School of Medicine, Taipei, Taiwan, [27]Department of Radiology, Maastricht University Medical Center, Maastricht, Netherlands, [28]Department of Psychiatry, Columbia University, New York, NY, United States, [29]New York State Psychiatric Institute, New York, NY, United States, [30]GE Healthcare, Calgary, AB, Canada, [31]GE Healthcare, Taipei, Taiwan, [32]Department of Psychology, University of Washington, Seattle, WA, United States, [33]GE Healthcare, Berlin, Germany, [34]Department of Electrical and Computer Engineering, McMaster University, Hamilton, ON, Canada, [35]Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, SC, United States, [36]Department of Radiology, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [37]Research Imaging Centre, Centre for Addiction and Mental Health, Toronto, ON, Canada, [38]Department of Psychiatry, University of Toronto, Toronto, ON, Canada, [39]School of Biomedical Engineering, McMaster University, Hamilton, ON, Canada, [40]Leuven Research Institute for Neuroscience & Disease (LIND), KU Leuven, Leuven, Belgium, [41]Department of Diagnostic and Interventional Radiology, Medical Faculty, Heinrich-Heine-University, Duesseldorf, Germany, [42]Department of Functional Neurosurgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China, [43]Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, United States, [44]Institute of Clinical Neuroscience and Medical Psychology, Medical Faculty, Heinrich-Heine-University, Duesseldorf, Germany

In vivo ^{1}H MR spectroscopy (MRS) provides valuable information regarding various brain disorders. In order to enable further clinical acceptance of MRS, this technique needs to be robust across multiple sites and MR vendors. Therefore, we analyzed data from 288 healthy subjects from 25 research sites across the three major vendors and examined vendor-, site- and participant-related effects on metabolites detected by PRESS ^{1}H-MRS at 3T. Within-site and inter-site coefficients of variation were between 2-16%. Significant effects of vendor were found for Ins/tCr and Glx/tCr. Effect of sites contributed ~30% to total variance of all quantified metabolites.

161	14:33	Towards in vivo neurochemical profiling of multiple sclerosis with MR spectroscopy at 7 Tesla: Apparent increase in frontal cortex water T2 in aged patients with progressive multiple sclerosis stabilizes in biexponential model constrained by tissue and CSF partial volumes

		Kelley M. Swanberg[1,2], Hetty Prinsen[1], Abhinav V. Kurada[2], Katherine DeStefano[3], Mary Bailey[4], David Pitt[3], Robert K. Fulbright[1], and Christoph Juchem[1,2,3,5]
		[1]Department of Radiology and Biomedical Imaging, Yale University School of Medicine, New Haven, CT, United States, [2]Department of Biomedical Engineering, Columbia University School of Engineering and Applied Science, New York, NY, United States, [3]Department of Neurology, Yale University School of Medicine, New Haven, CT, United States, [4]Mandell Multiple Sclerosis Center, Saint Francis Hospital, Hartford, CT, United States, [5]Department of Radiology, Columbia University Medical Center, New York, NY, United States
		Water is a common internal reference for metabolite quantification by ^{1}H-MRS. We investigate potential influences on water-referenced metabolite quantification by differences in frontal cortex water T_2 in individuals with relapsing-remitting, progressive, and no multiple sclerosis. Water T_2 differed in monoexponential models, exhibiting highest values in progressive multiple sclerosis only when analyses were not age-controlled. Groupwise T_2 did not differ in biexponential models constrained by tissue and CSF partial volumes, suggesting that monoexponential T_2 differences reflected disparate proportions of water in tissue and CSF rather than differential behavior within them. Our results suggest stability of water T_2 within frontal cortex tissue and CSF with multiple sclerosis and emphasize the superiority of metabolite quantification with group-specific T_2 values when voxel composition may differ.

162	14:45	Metabolite Quantification of 1H-MRSI spectra in Multiple Sclerosis: A Machine Learning Approach
		Dhritiman Das[1,2,3], Mike E Davies[2], Jeremy Chataway[4], Siddharthan Chandran[3], Bjoern H Menze[1], and Ian Marshall[3]
		[1]Department of Computer Science, Technical University of Munich, Munich, Germany, [2]Institute for Digital Communications, University of Edinburgh, Edinburgh, Scotland, [3]Centre for Clinical Brain Sciences, University of Edinburgh, Edinburgh, Scotland, [4]Queen Square Multiple Sclerosis Centre, Department of Neuroinflammation, University College London, London, United Kingdom
		As an alternative to model-based spectral fitting tools, we introduce a machine-learning framework for estimating metabolite concentrations in MR spectra acquired from a homogeneous cohort of 42 patients with Secondary Progressive Multiple Sclerosis. Our framework based on random-forest regression performs a 42-fold cross validation on this dataset which involves (1) learning the spectral features from this cohort; (2) estimating concentrations and calculating relative error over the LCModel estimates. Compared to the LCModel, our method, after training, gives a low estimation error and a 60-fold improvement in estimation speed per patient.

163	14:57	Quantification of Phosphatidylcholine in the gall bladder using 31P MRSI suggest differences in biliary disorders: A Pilot Study.
		Lorenz Pfleger[1,2], Emina Halilbasic[3], Martin Gajdošík[1,4], Marek Chmelík[2,5,6], Sigfried Trattnig[2,7], Michael Trauner[3], and Martin Kršňák[1,2]

		[1]Division of Endocrinology and Metabolism, Department of Medicine III, Medical University of Vienna, Vienna, Austria, [2]High-field MR Centre, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [3]Division of Gastroenterology and Hepatology, Department of Medicine III, Medical University of Vienna, Vienna, Austria, [4]Center for Biomedical Imaging, Department of Radiology, New York University School of Medicine, New York, NY, United States, [5]Faculty of Healthcare, University of Prešov, Prešov, Slovakia, [6]Department of Radiology, General Hospital of Levoča, Levoča, Slovakia, [7]Christian Doppler Laboratory for Clinical Molecular MR Imaging, Vienna, Austria
		This study focuses on quantification of phosphatidylcholine (PtdC) in the gall bladder and investigates concentration differences between biliary pathologies and healthy subjects. Significant different PtdC content was detected in patients suffering from primary sclerosing cholangitis (PSC). Subjects with primary biliary cholangitis (PBC) showed high variances in PtdC concentration. Even though, the PSC and control group are relatively small our results justify for further ongoing studies on this topic.

164	15:09	Neural-network discrimination of cardiac disease from 31P MRS measures of myocardial creatine kinase energy metabolism
		Meiyappan Solaiyappan[1], Robert G. Weiss[2], and Paul A. Bottomley[3]
		[1]Radiology, Division of MR Research, Johns Hopkins University, Baltimore, MD, United States, [2]Medicine, Division of Cardiology, Johns Hopkins University, Baltimore, MD, United States, [3]Radiology, Division of MR Resaerch, Johns Hopkins University, Baltimore, MD, United States
		Myocardial energy demands are the highest in the body and cardiac metabolism is altered in common diseases. Only phosphorus magnetic resonance spectroscopy (MRS) can measure ATP and creatine-kinase (CK) metabolism, a primary reserve of ATP, noninvasively in the human heart. Here, neural-network analysis is used to test whether the combination of ^{31}P MRS measurements of phosphocreatine and [ATP] concentrations, the CK reaction-rate and its ATP flux, can discriminate cardiac diseases among prior study data from 178 subjects. We find that a three-layer neural-network adequately discriminates diseases without over-training, suggesting that heretofore unidentified differences in CK metabolism may underlie cardiac disease.

165	15:21	Enhancing In Vivo Hyperpolarized 13C Chemical Shift Imaging by an Iterative Reconstruction
		Gil Farkash[1], Stefan Markovic [1], and Lucio Frydman[1]
		[1]Chemical & Biological Physics, Weizmann Institue, Rehovot, Israel

		Hyperpolarized ^{13}C magnetic resonance spectroscopic imaging (MRSI) is a powerful metabolic technique, but it's challenged by a rapid and irreversible decay of the signal that usually compromises its achievable spatial resolution. In this work we explore a way to improve this by utilizing *a priori* anatomical information derived from ^{1}H MRI. Enhanced HP-MRSI implementations based on Spectroscopy with Linear Algebraic Modeling (SLAM) were thus assayed, to enhance HP-MRSI's spatial resolution without compromising SNR. ^{13}C experiments were performed *in-vivo* and pyruvate/lactate images reconstructed for physiological compartments by SLAM; we compare these results to those arising by traditional Fourier analyses.

166	15:33	Constrained MRSI Reconstruction Using Water Side Information with a Kernel-Based Method
		Yudu Li[1,2], Fan Lam[2], Bryan Clifford[1,2], Rong Guo[1,2], Xi Peng[2,3], and Zhi-Pei Liang[1,2]
		[1]Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [3]Paul C. Lauterbur Research Center for Biomedical Imaging, Institutes of Advanced Technology, Shenzhen, China
		Reconstruction for MR spectroscopic imaging (MRSI) is a challenging problem where incorporation of spatiospectral prior information is often necessary. While spectral constraints have been effectively utilized in the form of temporal basis functions, spatial constraints are often imposed using spatial regularization. In this work, we present a new kernel-based method to incorporate a priori spatial information, which was motivated by the success of kernel-based methods in machine learning. It provides a new mechanism for constrained image reconstruction, effectively incorporating a priori spatial information. The proposed method has been evaluated using both simulation and *in vivo* data, producing very impressive results. This new reconstruction scheme can be used to process any MRSI data, especially those from high-resolution MRSI experiments.

Oral

Measuring & Correcting Imperfections

S03	Monday 13:45 - 15:45	*Moderators:* Nicolas Boulant & S. Johanna Vannesjo

167	13:45	On pseudo-concomitant fields caused by gradient coil vibrations
		Yi-Cheng Hsu[1,2], Ying-Hua Chu[1,2], Fa-Hsuan Lin[2], and Maxim Zaitsev[1]
		[1]Dept. of Radiology, Medical Physics, Medical Center University of Freiburg, Faculty of Medicine, Freiburg, Germany, [2]Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan

		We demonstrate that a negative quadratic phase accrual, which we term a pseudo-concomitant field, is likely to be caused by gradient vibration and has a nearly constant spatial distribution. Accounting for this effect may be of importance for phase-sensitive MR applications utilizing strong gradients, such as flow imaging.

168	13:57	$$$B_{0}$$$-component determination of the gradient system transfer function using standard MR scanner hardware
		Manuel Stich[1,2], Tobias Wech[1], Anne Slawig[1,2], Gudrun Ruyters[3], Andrew Dewdney[3], Ralf Ringler[2], Thorsten A. Bley[1], and Herbert Köstler[1]
		[1]Department of Diagnostic and Interventional Radiology, University Hospital Würzburg, Würzburg, Germany, [2]X-Ray and Molecular Imaging Laboratory, Ostbayerische Technische Hochschule Amberg-Weiden, Weiden, Germany, [3]Siemens Healthcare GmbH, Erlangen, Germany
		As a linear and time-invariant (LTI) system, the dynamic gradient system can be described by the system transfer function. While special measurement equipment like field cameras can be used to precisely determine even higher orders of the transfer function, phantom-based approaches were introduced for alternative determination without additional hardware needed. This study reports on phantom-based measurements of B_0-components, which resulted in transfer functions with sufficiently high resolution for the characterization of mechanical resonances.

169	14:09	GIRF measurement using a combination of triangular and chirp waveform input functions
		Peter Mazurkewitz[1], Jürgen Rahmer[1], and Peter Börnert[1]
		[1]Philips Research Europe, Hamburg, Germany
		Gradient-impulse-response-function (GIRF) measurement is a well-established method for MRI gradient-system characterization. Typical GIRF input-functions are triangles or chirps. For triangles, measurements have to be performed with different pulse lengths to get a continuous frequency spectrum due to blind spots in the spectrum, requiring long scan times. In contrast, the spectrum of the chirp waveform covers a large frequency range without blind spots. However, at low frequencies the chirp fails due to a diverging intensity in its spectrum. We interleaved both waveforms and obtained a continuous gradient modulation transfer function (GMTF) spectrum down to low frequencies in short measurement time.

170	14:21	Spatially-selective excitation using a tailored nonlinear ΔB0 pattern generated by an integrated multi-coil ΔB0/Rx array
		Jason Stockmann[1,2], Nicolas S Arango[3], Benedikt Poser[4], Thomas Witzel[1,2], Jacob White[3], Lawrence L Wald[1,2,5], and Jonathan R Polimeni[1,2,5]

		[1]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [4]Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, Netherlands, [5]Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States
		Multi-coil ΔB_0 shim arrays have recently been used for zoomed imaging of target ROIs in mice, providing improved acquisition efficiency without the high SAR, long RF pulses, and other limitations of conventional selective excitation methods that rely solely on linear gradients. We extend this work to zoomed 3D EPI in humans using an integrated ΔB_0/Rx array coil to dynamically switch-on a static, spatially-tailored nonlinear ΔB_0 pattern during RF excitation. Proof-of-concept selective excitations of the occipital visual cortex and the peripheral cerebrum are shown, with strong correspondence to the target patterns. Four-fold in-plane undersampled EPI of occipital visual cortex demonstrates the method's potential for efficient high-resolution neuroimaging.

171	14:33	Improved multi-band RF performance using GRATER-based predistortion
		Vanessa Landes[1] and Krishna Nayak[2]
		[1]Biomedical Engineering, University of Southern California, Los Angeles, CA, United States, [2]Electrical Engineering, University of Southern California, Los Angeles, CA, United States
		The Gradient Reversal Approach to Evaluate RF (GRATER) has been shown to accurately measure small-tip RF pulses in phantoms, without the need for added hardware or sophisticated processing. Imperfect RF production can be measured with GRATER, and RF waveforms can be appropriately predistorted. We demonstrate substantial improvements in multi-band RF performance using this approach. For example, a 0.648 ms, 30º FA, 4- band RF pulse with 2 cm center-to-center spacing and 5 mm slice thickness (desirable for SMS cardiac imaging) excites spurious side-lobes with 10.4% and 3.4% max signal before and after GRATER-based RF predistortion, respectively.

172	14:45	MR Fingerprinting (MRF) incorporating simultaneous detection of RF transmit field and B0 inhomogeneity
		Huihui Ye[1,2], Qing Li[2], Xiaozhi Cao[2], Qiuping Ding[2], Hongjian He[2], Huafeng Liu[1], and Jianghui Zhong[2]
		[1]State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China, [2]Center for Brain Imaging Science and Technology, Department of Biomedical Engineering, Zhejiang University, Hangzhou, China
		MR fingerprinting with B1+ and B0 field inhomogeneity detection is proposed with an IR-spoiled GRE based sequence. With this sequence, a 12s/slice acquisition simultaneously provide unbiased T1, T2* maps and B1+, B0 information at isotropic 1mm resolution.

173	14:57	Deep Learning Based Approach for Main and RF Field Maps Estimation in MRI
		Kavitha Manickam[1] and Jaganathan Vellagoundar[1]
		[1]GE Healthcare, Bangalore, India
		In MRI, automatic estimation of main (B0) and RF (B1) field maps from the scanned images will help daily quality assurance and field corrected reconstruction. In this paper, a novel approach based on deep learning technique is presented to estimate B0 and B1 maps from the scanned images. A modified version of stacked convolutional encoder with random skip connections deep learning network is constructed. Two separate networks are used to estimate B0 and B1 maps individually. The networks are trained and tested with phantom images. The results show that the estimated maps are comparable to the actual field maps. Automatic map estimation based on deep learning approach is the first step towards achieving daily quality assurance and field correction from the regular scanned images.

174	15:09	An empirical $$$B^-_1$$$ Non-uniformity Correction of Phased-Array Coil Images without Measuring Coil Sensitivity
		Frederick C Damen[1] and Kejia Cai[1]
		[1]Radiology, University of Illinois at Chicago Medical Center, Chicago, IL, United States
		Radio Frequency (RF) receiving coil arrays improve the signal-to-noise ratio (SNR), and enable partial parallel imaging. However, these benefits often come at the cost of image non-uniformity. $$$B^-_1$$$ non-uniformity correction techniques are confounded by signal that not only varies due to coil induced $$$B^-_1$$$ sensitivity, but also due to true signal variations in proton density, susceptibility, and relaxation rates. Herein, we propose an empirical method that produces a $$$B^-_1$$$ non-uniformity-corrected complex image from the phased-array coil images themselves using minimal assumptions and without measuring the coil sensitivities. This method is validated using MRI of the abdomen, brain, and a homogeneous phantom.

175	15:21	Improved image quality for long readout imaging using piecewise linear field map model
		Giang-Chau Ngo[1], Alex Cerjanic[1], and Bradley P. Sutton[1,2]
		[1]Bioengineering Department, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Beckman Institute, University of Ilinois at Urbana-Champaign, Urban, IL, United States

		Trajectories such as spiral or EPI enable fast acquisition compared to spin warp imaging. While a spin warp acquisition has a readout of 2-3 ms, a spiral trajectory readout can be as long as 60 ms. The efficiency of the spiral trajectory comes at a cost of image quality through magnetic field inhomogeneity and T2* decay during long readouts. In this work, a signal model with a piecewise linear field map is used to correct for the magnetic field inhomogeneity effects during long imaging readouts . The proposed method shows the ability to correct for resulting image artifacts.

176	15:33	Measuring MRI Gradient Trajectory Dynamics using Simultaneous EEG-FMRI
		Mark Chiew[1], Jostein Holmgren[1], Dean Fido[1], Catherine E Warnaby[1], and S Johanna Vannesjo[1]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom
		Simultaneous EEG-FMRI data acquisition provides an opportunity for characterization of magnetic field dynamics during imaging, by leveraging the information contained in the EEG induced gradient artefacts. Using a simple effective loop model, we reduce the complex EEG electrode geometry to small effective loops located at off-isocentre positions, which we use to fit first order (linear in space) models of the magnetic field rate of change. From these, estimates of the actual field dynamics, and trajectory/encoding information can be derived at no cost. In this proof-of-principle, we demonstrate estimation of gradient dynamics during a conventional EPI acquisition using simultaneous EEG recordings.

Oral

Quantitative Neurovascular Imaging Methods

S04	Monday 13:45 - 15:45	*Moderators:* John Detre & Sung-Hong Park

177	13:45	Interleaved qBOLD: Combining Extravascular R2’ and Intravascular R2 Mapping for Improved Estimation of Brain Hemodynamic Parameters
		Hyunyeol Lee[1] and Felix W Wehrli[1]
		[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States

		In qBOLD, the accuracy of local deoxygenated blood volume (DBV) and hemoglobin oxygen saturation (Yv) maps is impaired because of coupling of these two parameters in the signal model. Here, we introduce an interleaved qBOLD method that combines extravascular R2' and intravascular R2 mapping in a single pulse sequence. Prior knowledge for DBV and Yv is obtained from the velocity-selective-spin-labeling module in the sequence, subsequently used as priors for qBOLD processing. Data obtained in eight subjects demonstrates significantly improved performance yielding plausible values averaging 60.1±3.3% for Yv and 3.1±0.5% and 2.0±0.4% for DBV in gray and white matter, respectively.

178	13:57	Multi-delay arterial spin labeling (ASL) more accurately detects hypoperfusion in Moyamoya disease: comparison with a normative PET/MRI database
		Audrey P. Fan[1], Mohammad M. Khalighi[2], Jia Guo[1], Yosuke Ishii[1], Mirwais Wardak[1], Jun-Hyung Park[1], Bin Shen[1], Dawn Holley[1], Harsh Gandhi[1], Prachi Singh[1], Tom Haywood[1], Gary K. Steinberg[3], Frederick T. Chin[1], and Greg Zaharchuk[1] *[1]Radiology, Stanford University, Stanford, CA, United States, [2]GE Healthcare, Menlo Park, CA, United States, [3]Neurosurgery, Stanford University, Stanford, CA, United States*
		We directly compared multi-delay arterial spin labeling (ASL) and standard ASL measurements of cerebral blood flow (CBF) to simultaneously acquired [^{15}O]-PET scans on hybrid PET/MRI in Moyamoya disease. For these Moyamoya patients (*N=15*) with extremely long arterial transit times, multi-delay ASL outperforms standard ASL in regional correlation and reduces bias relative to PET. We also constructed a voxelwise, normative CBF database based on healthy controls (*N=15*) with PET/MRI, and identified regions of hypoperfusion in frontal and parietal regions of patients. Multi-delay ASL is more specific to areas of Moyamoya hypoperfusion (more similar to PET), whereas standard ASL overestimates these areas due to low signal.

179	14:09	Cerebral Metabolic Rate of Oxygen (CMRO2) mapping by a joint model of quantitative susceptibility mapping (QSM)-based method and quantitative BOLD (qBOLD)
		Junghun Cho[1], Youngwook Kee[2], Pascal Spincemaille[2], Thanh Nguyen[2], Jingwei Zhang[1], Ajay Gupta[2], Shun Zhang[2,3], and Yi Wang[1,2] *[1]Biomedical Engineering, Cornell University, Ithaca, NY, United States, [2]Radiology, Weill Cornell Medical College, New York, NY, United States, [3]Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China*
		In this work, we propose a gradient echo (GRE) based measurement of oxygen extraction fraction (OEF) based on a simultaneous modeling of the magnitude (using quantitative BOLD corrected for non-blood tissue susceptibility) and phase (based on QSM), without additional vascular challenges and empirical assumptions. Compared to methods based on QSM only and on qBOLD only, the proposed model provided better CMRO2 contrast between gray and white matter, and more uniform OEF in healthy subjects.

180	14:21	3D MRI Mapping of Whole-Brain Water Permeability with Intrinsic Diffusivity Encoding of Arterial Labeled Spins (IDEALS)
		Xiang He[1], Kenneth T Wengler[2], Tim Q Duong[1], and Mark Schweitzer[1]
		[1]Radiology, Stony Brook University Hospital, Stony Brook, NY, United States, [2]Biomedical Engineering, Stony Brook University, Stony Brook, NY, United States
		Breakdown of the blood-brain barrier has been hypothesized as a key mechanism leading to neuronal dysfunction that underlies many neurological and psychiatric diseases. Compared with exogenous contrast agents, trans-capillary water permeability may provide a more direct and sensitive assessment of BBB integrity at disease onset and progression. While the current gold standard approach to measure water permeability is O^{15}-H_2O PET, its widespread use is limited by availability and cost. Here, we propose a novel MRI-based method, IDEALS, to non-invasively map BBB water permeability with high sensitivity and whole-brain coverage. This method was applied in healthy participants and brain tumor patients.
181	14:33	Identify the neurovascular coupling efficacy of long-term depolarization or seizer-like events in the hippocampus with optogenetic single-vessel fMRI
		Xuming Chen[1,2,3], Filip Sobczak[1,4], Yi Chen[1,4], and Xin Yu[1]
		[1]High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]University of Tuebingen, Tuebingen, Germany, [3]Neurology, Renmin Hospital of Wuhan Universit, Wuhan University, Wuhan, China, [4]Graduate Training Centre of Neuroscience, University of Tuebingen, Tuebingen, Germany
		Optogenetic activation can elicit seizure-like events in the hippocampus of anesthetized rats. However, it remains unclear how the hemodynamic signaling responds to the seizure-like events or long-term depolarization in hippocampus. Here, we applied the multi-model fMRI platform to acquire concurrent single-vessel fMRI and calcium signal upon optogenetic stimulation in the hippocampus. The neurovascular coupling coefficient was significantly lower for the long-term depolarization/seizure-like calcium event than that of normally evoked events. The reduced neurovascular coupling efficacy during seizure-like events indicates the lack of sufficient blood supply under high-energy demand of long-term depolarization, and eventually causes tissue damage.
182	14:45	Black-blood angiography of the lenticulostriate artery at 3T using a high-resolution intracranial vessel wall MR technique: a comparison validation with 7T TOF-MRA
		Zihao Zhang[1,2], Zhaoyang Fan[3], Qingle Kong[1,2,4], Jing An[5], Yan Zhuo[1,2], and Qi Yang[6]

		[1]State Key Laboratory of Brain and Cognitive Science, Institute of Biophysics, Chinese Academy of Sciences, Beijing, China, [2]The Innovation Center of Excellence on Brain Science, Chinese Academy of Sciences, Beijing, China, [3]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [4]University of Chinese Academy of Sciences, Beijing, China, [5]Siemens Shenzhen Magnetic Resonance Ltd., Shenzhen, China, [6]Xuanwu Hospital, Beijing, China
		The lenticulostriate artery (LSA) supplies blood to the basal ganglia and its vicinity. Noninvasive imaging of the LSA could be clinically useful to understand mechanisms of microvascular pathology or guide early therapeutic intervention. In this study, we used a recently developed high-resolution intracranial vessel wall MR imaging technique to visualize the LSA in a black-blood (BB) fashion at 3T. Compared to 7T TOF-MRA, this approach can depict the LSA, particularly the stems and proximal segments, with comparable image quality.

183	14:57	Periventricular cerebral blood flow: A biomarker for small vessel ischemia
		Sudipto Dolui[1,2], Marta Vidorreta[2,3], David A. Wolk[2], and John A. Detre[1,2]
		[1]Department of Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Department of Neurology, University of Pennsylvania, Philadelphia, PA, United States, [3]Siemens Healthineers, Madrid, Spain
		We evaluated periventricular white matter (PVWM) cerebral blood flow (CBF) as a mechanistically specific biomarker for small vessel ischemia and demonstrated the feasibility of its measurement using state-of-the-art arterial spin labeling. We constructed the PVWM region of interest and demonstrated that mean CBF in PVWM had higher correlation with lesion volumes than global, grey matter, or white matter CBF, even after correction for global CBF, age, and sex. PVWM CBF also showed higher correlation with Trail A and B processing speed than CBF in other regions, or lesion volumes.

184	15:09	Quantification of flow hemodynamics using non-contrast enhanced 4-dimensional dynamic magnetic resonance angiography
		Xingfeng Shao[1], Danny J.J. Wang[1], and Lirong Yan[1]
		[1]Laboratory of FMRI Technology (LOFT), Mark & Mary Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States
		Arterial spin labeling (ASL)-based non-contrast enhanced dynamic MR angiography (NCE-dMRA) can provide not only dynamic flow depiction but also quantitative hemodynamics. According to the indicator dilution theory, we proposed a novel analytical solution for arterial blood flow (aBF) quantification in NCE-dMRA. Compared to the previous truncated singular value decomposition (t-SVD), reliable aBF measures were obtained using the proposed method from both simulation and experimental data. Hemodynamic maps including aBF, arterial blood volume and arterial transit time were successfully generated. Our preliminary patient data suggest that the dynamic flow patterns in conjunction with quantitative hemodynamic may provide complementary information for clinical diagnosis.

185	15:21	Investigation of Intracranial Artery Selective Visualization in Superselective 4D-MR Angiography with Pseudo-Continuous Arterial Spin Labeling Combined with CENTRA-Keyhole and View-sharing (SS-4D-PACK)
		Makoto Obara[1], Osamu Togao[2], Helle Michael[3], Tetsuhiro Wada[4], Hiroo Murazaki[4], Masami Yoneyama[1], Yuta Akamine[1], and Marc Van Cauteren[5]
		[1]Philips Japan, Tokyo, Japan, [2]Department of Clinical Radiology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan, [3]Philips Research, Hamburg, Germany, [4]Division of Radiology, Department of Medical Technology, Kyushu University Hospital, Fukuoka, Japan, [5]Philips Healthtech, Tokyo, Japan
		Four dimensional (4D) MR Angiography with Pseudo-Continuous Arterial Spin Labeling (pCASL) combined with CENTRA-Keyhole and View-sharing (4D-PACK) has demonstrated high flow visualization ability in clinical use. In this study, we combined Superselective-pCASL with 4D-PACK (SS-4D-PACK) and investigated artery-selective visualization ability in SS-4D-PACK through comparison with contrast inherent inflow enhanced multi-phase angiography combining vessel-selective arterial spin labeling technique (CINEMA-Select). SS-4D-PACK showed higher vessel selectivity and vessel visualization in peripheral artery compared with CINEMA-Select.

186	15:33	Acceleration of Vessel-Selective 4D MR Angiography by pCASL in combination with Acquisition of Control and Labeled Images in the Same Shot (ACTRESS)
		Yuriko Suzuki[1], Thomas W. Okell[2], and Matthias J.P. van Osch[1]
		[1]C.J. Gorter Center for High Field MRI, Department of Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]FMRIB Centre, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom
		In the last decade, MR dynamic angiography (4D-MRA) using arterial spin labeling has become an important alternative to contrast-enhanced 4D-MRA, although scan-time is usually much longer than contrast-enhanced 4D-MRA. Among other advantages, it has the attractive possibility to allow for vessel-selective visualization. In this study, we propose an adaptation of ACTRESS (Acquisition of ConTRol and labeled Images in the Same Shot) approach for pCASL to enable vessel-selective 4D-MRA with almost halved scan-time. In an in-vivo study, it was shown that pCASL-ACTRESS approach provided vessel-selective 4D-MRA with comparable image quality to a conventional pCASL-approach, but acquired in approximately half the scan-time.

Oral

Magnetic Susceptibility Imaging

S06	Monday 13:45 - 15:45	*Moderators:* Jürgen Reichenbach & Masaki Fukunaga

187	13:45	Direct Imaging of Diamagnetic Susceptibility of Beta Amyloid Aggregates in Transgenic Mouse Models of Alzheimer's Disease using Quantitative Susceptibility Mapping MRI
		Nan-Jie Gong[1,2], Russell Dibb[2], and Chunlei Liu[1,2]
		[1]University of California Berkeley, Berkeley, CA, United States, [2]Duke University School of Medicine, Durham, NC, United States
		We demonstrated in a phantom that beta amyloid is diamagnetic and can generate strong contrast on susceptibility maps. Based on this, it is further shown both in vivo and ex vivo that magnetic susceptibility mapping could be used to monitor accumulation of amyloid plaques in AD mouse models. Most importantly, the diamagnetic susceptibility map and paramagnetic susceptibility map provided histology-like image contrast for identifying deposition of beta amyloid plaques and iron.

188	13:57	Iron-induced relaxation mechanisms in the human substantia nigra: towards quantifying iron load in dopaminergic neurons
		Malte David Brammerloh[1,2], Isabel Weigelt[3], Thomas Arendt[3], Filippos Gavriilidis[2], Nico Scherf[2], Steffen Jankuhn[4], Markus Morawski[3], Nikolaus Weiskopf[2], and Evgeniya Kirilina[2]
		[1]Faculty of Physics and Earth Sciences, Leipzig University, Leipzig, Germany, [2]Department of Neurophysics, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [3]Paul Flechsig Institute of Brain Research, Leipzig, Germany, [4]Felix Bloch Institute for Solid State Physics, Leipzig University, Leipzig, Germany
		Pathological iron accumulation in the human brain is a biomarker for neurodegeneration. Several diagnostically promising MR-based methods for in vivo iron quantification were proposed, based on the empirical relationship between R_2* and iron concentration. However, these do not account for different chemical forms and cellular distribution of iron. We combined post mortem MRI, advanced quantitative histology and biophysical modeling to develop a generative theory linking obtained iron concentrations to quantitative MR parameters. The impact of nanoscale molecular interaction of water with iron and of iron-rich dopaminergic neurons was quantified in substantia nigra.

189	14:09	Accurate and Efficient QSM Reconstruction using Deep Learning
		Enhao Gong[1], Berkin Bilgic[2], Kawin Setsompop[2], Audrey Fan[3], Greg Zaharchuk[3], and John Pauly[1]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Radiology, Stanford University, Stanford, CA, United States

		Quantitative Susceptibility Mapping (QSM) is a powerful MRI technique to quantify susceptibility changes and reveal pathology such as multiple sclerosis (MS) lesions and demyelination. QSM reconstruction is very challenging because it requires solving an ill-posed deconvolution and removing the effects of a dipole kernel on tissue phases to obtain susceptibility. To address the limitations of existing QSM reconstruction methods in accuracy, stability and efficiency, an iteration-free data-driven QSM reconstruction is proposed that trains a deep learning model to approximate COSMOS QSM quantification from acquired signals and pre-processed phases. Cross-validated on in-vivo datasets with 15 single direction QSM scans and 3 COSMOS QSM results from 3 healthy subjects, the proposed deep learning method achieves accurate QSM reconstruction, outperforming state-of-the-art methods across various metrics. The deep learning solution is also faster than iterative reconstruction by several orders of magnitude, which enables broader clinical applications.

190	14:21	Quantitative susceptibility mapping using deep neural network
		Jaeyeon Yoon[1], Jingyu Ko[1], Jingu Lee[1], Hosan Jung[1], Berkin Bilgic[2], Kawin Setsompop[2], and Jongho Lee[1]
		[1]Department of Electrical and Computer Engineering, Seoul National University, Seoul, Republic of Korea, [2]Department of Radiology, Harvard Medical School, Boston, MA, United States
		In this study, we designed a deep neural network that functions as dipole deconvolution in QSM reconstruction. For label data, COSMOS reconstructed QSM maps were used so that the network produces ground truth like COSMOS results without streaking artifacts. The performance of our network was superior to conventional QSM results with lower RMSE for multiple head orientation input data.

191	14:33	Vertebral Column Quantitative Susceptibility Mapping using Joint Background Field Removal and Dipole Inversion
		Maximilian N. Diefenbach[1], Anh Van[2], Jakob Meineke[3], Andreas Scharr[4], Jan S. Kirschke[4], Alexandra Gersing[1], Thomas Baum[4], Benedikt Schwaiger[1], and Dimitrios C. Karampinos[1]
		[1]Diagnostic and Interventional Radiology, Technical Univeristy of Munich, Munich, Germany, [2]Institute of Medical Engineering, Technical University of Munich, Munich, Germany, [3]Philips Research Laboratory, Hamburg, Germany, [4]Department of Diagnostic and Interventional Neuroradiology, Technical University of Munich, Munich, Germany
		Quantitative susceptibility mapping (QSM) with joint background field removal and dipole inversion is applied in the spine of osteoporosis patients and healthy volunteers. Preliminary multi-MR-parametric patient results are compared to low-dose CT scans to investigate the feasibility of QSM to qualitatively and quantitatively detect features of diseased tissues and differentiate positive and negative susceptibility sources in comparison to R_2*-mapping.

192	14:45	Microscopic susceptibility anisotropy imaging: A clinically viable gradient-echo MRI technique

		Enrico Kaden[1], Umesh Rudrapatna[2], Irina Y. Barskaya[3], Mark D. Does[3], Derek K. Jones[2], and Daniel C. Alexander[1]
		[1]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [2]Cardiff University Brain Research Imaging Centre, School of Psychology, Cardiff University, Cardiff, United Kingdom, [3]Institute of Imaging Science, Department of Biomedical Engineering, Vanderbilt University, Nashville, TN, United States
		The orientation dependence of the gradient-echo MR signal in brain white matter conflates two principal effects, (i) the susceptibility properties of tissue microenvironments, especially the myelin microstructure, and (ii) the axon orientation distribution with respect to the external magnetic field. This work introduces a clinically feasible MRI method based on gradient-echo and diffusion measurements, which we refer to as microscopic susceptibility anisotropy imaging, that disentangles both effects, hence enabling us to estimate microscopic susceptibility anisotropy unconfounded by fibre crossings and orientation dispersion as well as magnetic field direction.

193	14:57	How should we compare QSM results? A correlation based analysis as an alternative to traditional error metrics
		Jiaen Liu[1] and Pinar S Özbay[1]
		[1]Advanced MRI Section, LFMI, NINDS, National Institutes of Health, Bethesda, MD, United States
		During the last QSM Workshop, the results of first “Quantitative Susceptibility Mapping (QSM) Reconstruction Challenge” were presented, which was performed to allow a systematic comparison of various QSM algorithms. One unresolved issue was the fact that the comparison metrics did not properly deal with the effect of smoothing. Here, we propose a comparison method based on pearson correlations, which are calculated over 1D lines throughout the QSM volumes, and show its robustness relative to other metrics under the influence of over-smoothing.

194	15:09	Age- and sex-related spatial patterns of variation in normal brain magnetic susceptibility (QSM) revealed by Blind Source Separation (BSS) and Supervised Machine Learning
		Ferdinand Schweser[1,2], Balint Sule[1], Juliane Damm[1], Niels P Bergsland[1,3], Michael G Dwyer[1], Akshay V Dhamankar[1], Bianca Weinstock-Guttman[4], and Robert Zivadinov[1,2]
		[1]Buffalo Neuroimaging Analysis Center, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York, Buffalo, NY, United States, [2]Center for Biomedical Imaging, Clinical and Translational Science Institute, University at Buffalo, The State University of New York, Buffalo, NY, United States, [3]MR Research Laboratory, IRCCS, Don Gnocchi Foundation ONLUS, Milan, Italy, [4]BairdMS Center, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York, Buffalo, NY, United States

		Previous studies using QSM have demonstrated a relatively high inter-subject variation of brain susceptibility. In the present work, we combined a blind source separation technique with a machine learning strategy to disentangle spatial networks of independent variation of brain susceptibility. As a first step toward a better understanding of the underlying causes of variation, we studied their associations with age and sex. The analysis revealed several networks with distinct anatomical features, although the applied analysis technique did not involve any information about anatomy, age, or sex.

195	15:21	Constrained Dipole Inversion for Quantitative Susceptibility Mapping Using a "Kernel+Sparse" Model
		Xi Peng[1,2], Yudu Li[1,3], Fan Lam[1], Rong Guo[1,3], Bryan Clifford[1,3], and Zhi-Pei Liang[1,3]
		[1]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Paul C. Lauterbur Research Center for Biomedical Imaging, Shenzhen Institutes of Advanced Technology, Shenzhen, China, [3]Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States
		In quantitative susceptibility mapping (QSM), constrained dipole inversion is often necessary to overcome the ill-posedness of the underlying dipole deconvolution problem. Existing methods achieve this by the use of spatial regularization. In this work, we propose a novel "kernel+sparse" model for constrained dipole inversion. In this model, the kernel term absorbs the prior information by representing the susceptibility as a function of prior features while the sparse term accounts for the localized novel features. The proposed method has been evaluated using both simulated and in vivo data, producing impressive results. This method may prove to be useful for many QSM studies.

196	15:33	Sensitivity of Relaxometry and Quantitative Susceptibility Mapping to Microscopic Iron Distribution
		Timothy J Colgan[1,2], Gesine Knobloch[1], Scott B Reeder[1,2,3,4,5], and Diego Hernando[1,2]
		[1]Radiology, University of Wisconsin - Madison, Madison, WI, United States, [2]Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [3]Medicine, University of Wisconsin - Madison, Madison, WI, United States, [4]Biomedical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [5]Emergency Medicine, University of Wisconsin - Madison, Madison, WI, United States
		MRI-based iron quantification enables the non-invasive assessment of tissue iron concentration. MRI relaxation parameters such as R2 and R2* are sensitive to iron concentration, but may depend on the microscopic spatial distribution of iron. Quantitative Susceptibility Mapping (QSM) is a promising iron quantification technique, but its sensitivity to the spatial distribution of iron remains unknown. In this work, we performed simulations and in vitro experiments using whole versus lysed erythrocytes to investigate this sensitivity. Our results suggest that QSM, unlike R2 and R2* relaxometry, is independent of the microscopic distribution of iron.

Oral

Loose Cartilage

W03/04	Monday 13:45 - 15:45	*Moderators:* Jeff Dunn & Konstantin Momot

197	13:45	Correlations of T1ρ with properties of articular cartilage depend on the spin-lock amplitude and orientation of the sample
		Mikko Johannes Nissi[1], Isabel Stavenuiter[1,2], and Nina Hänninen[3]
		[1]Department of applied physics, University of Eastern Finland, Kuopio, Finland, [2]Department of Biomedical Engineering, Eindhoven University of Technology, Eindhoven, Netherlands, [3]Research Unit of Medical Imaging, Physics and Technology, University of Oulu, Oulu, Finland
		Several studies have reported different findings on the correlations of the CW-T1ρ relaxation time in articular cartilage with its different properties. Most studies agree on the sensitivity of CW-T1ρ to cartilage proteoglycans, although reports specifically against this also exist. Furthermore, CW-T1ρ has been connected to the collagen network properties and also correlated with T2 relaxation time. Orientation dependence of CW-T1ρ has been reported, as well as its dependence on the spin-locking amplitude. This study aims to combine all of these aspects in a single study.

198	13:57	Using Multidimensional Data Analysis to Identify Traits of Hip OA
		Jasmine Rossi-deVries[1], Valentina Pedoia[1], Michael A Samaan[1], Adam Ferguson[1], Richard B Souza[1], and Sharmila Majumdar[1]
		[1]UCSF, San Francisco, CA, United States
		This study aims to use big data analytics and imaging to simultaneously analyze all the combined variables in order to identify biomarkers able to classify the different disease progression of hip OA. 102 subjects and their 184 variables were examined. Big data analytics tool, Topological Data Analysis (TDA), was used to generate hypotheses. Three main groups were identified: healthy control subjects, subjects with radiographic and morphological evidence of OA, and subjects who progressed inconsistently were separated by knee biomechanics. The analysis obtained with TDA proposes new phenotypes of these subjects also shows the potential for further examination.

199	14:09	T2 Texture Analysis Reveals Potential Cartilage-preserving Effect in Presence of Heterozygous WNT1 Mutation in Human
		Sami Lehtovirta[1,2], Riikka E Mäkitie[3], Victor Casula[1,2], Marianne Haapea[1], Jaakko Niinimäki[1,2], Tuukka Niinimäki[4], Arttu Peuna[2], Eveliina Lammentausta[2], Outi Mäkitie[3,5,6], and Miika T Nieminen[1,2]

		[1]Research Unit of Medical Imaging, Physics and Technology, University of Oulu, Oulu, Finland, [2]Medical Research Center, University of Oulu and Oulu University Hospital, Oulu, Finland, [3]Folkhälsan Institute of Genetics and University of Helsinki, Helsinki, Finland, [4]Department of Orthopedics, Oulu University Hospital, Oulu, Finland, [5]Children's Hospital, University of Helsinki and Helsinki University Hospital, Helsinki, Finland, [6]Center for Molecular Medicine, Karolinska Institutet, and Clinical Genetics, Karolinska University Hospital, Stockholm, Sweden
		Quantitative MRI (qMRI) assessment of tibiofemoral articular cartilage was performed in 13 *WNT1* mutation-positive (MP) subjects and 13 mutation-negative (MN) controls. Cartilage thickness, T2 and T1ρ relaxation times, and texture features *contrast*, *homogeneity* and *dissimilarity* of T2 maps were determined in six regions of interests. Texture features demonstrated an opposing trend with age between the two groups in medial tibiofemoral cartilage, suggesting a possible age-related cartilage preservation in MP subjects. Similar differences were not observed in the other qMRI parameters, suggesting that texture analysis is a more sensitive and accurate tool for quantitative cartilage assessment than mere mean relaxation time measurements.

200	14:21	Can A Machine Diagnose Knee MR Images? Fully-automated Cartilage Lesion Detection by using Deep Learning
		Fang Liu[1], Zhaoye Zhou[2], Kevin Lian[1], Shivhumar Kambhampati[1], and Richard Kijowski[1]
		[1]Department of Radiology, University of Wisconsin-Madison, Madison, WI, United States, [2]Department of Biomedical Engineering, University of Minnesota, Minneapolis, MN, United States
		This study evaluated a fully-automated cartilage lesion detection system utilizing a deep convolutional neural network (CNN) to segment bone and cartilage followed by a second CNN classification network to detect structural abnormalities within the segmented tissues. The CNN network was trained to detect cartilage lesions within the knee joint using sagittal fat-suppressed T2-weighted fast spin-echo images in 125 subjects. The proposed CNN model achieved high diagnostic accuracy for detecting cartilage lesions with a 0.914 area under curve on receiver operation characteristics analysis. The optimal threshold for sensitivity and specificity of the CNN model was 84.3% and 84.6% respectively.

201	14:33	Automated Knee Cartilage Segmentation with Very Limited Training Data: Combining Convolutional Neural Networks with Transfer Learning
		Alexander R Toews[1,2], Zhongnan Fan[3], Marianne S Black[2,4], Jin Hyung Lee[1,3,5,6,7], Garry E Gold[2,5,8], Brian A Hargreaves[1,2,5], and Akshay S Chaudhari[2,5]

		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States, [3]LVIS Corporation, Palo Alto, CA, United States, [4]Mechanical Engineering, Stanford University, Stanford, CA, United States, [5]Bioengineering, Stanford University, Stanford, CA, United States, [6]Neurology & Neurological Sciences, Stanford University, Stanford, CA, United States, [7]Neurosurgery, Stanford University, Stanford, CA, United States, [8]Orthopaedic Surgery, Stanford University, Stanford, CA, United States
		Magnetic resonance imaging is commonly used to study osteoarthritis. In most cases, manual cartilage segmentation is required. Recent advances in deep-learning methods have shown promise for automating cartilage segmentation, but they rely on the availability of large training datasets that rarely represent the exact nature or extent of data practically available in routine research studies. The goal of this study was to automate cartilage segmentation in studies with very few training datasets available by creating baseline segmentation knowledge from larger training datasets, followed by creating transfer learning models to adapt this knowledge to the limited datasets utilized in typical study.

202	14:45	Isotropic 3D T_2 mapping of knee cartilage with a novel water excitation technique
		Roberto Colotti[1], Jessica A.M. Bastiaansen[1], Patrick Omoumi[1], and Ruud B. van Heeswijk[1,2]
		[1]Department of Radiology, Lausanne University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [2]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland
		The goal of this study was to develop an isotropic 3D lipid-insensitive T_2 mapping technique of knee cartilage. Therefore we combined an existing isotropic 3D T_2-prepared gradient-echo T_2 mapping technique (Iso3DGRE) with the novel lipid-insensitive binomial off-resonant RF excitation (LIBRE) pulse. LIBRE pulse optimization was performed through numerical simulations and verified in phantom experiments, yielding complete fat signal nulling using a LIBRE pulse as short as 1 ms. T_2 mapping of knee cartilage performed in five healthy volunteers with LIBRE excitation allowed for improved cartilage delineation and precise T_2 values compared with normal excitation.

203	14:57	Accelerating 3D-Biexponential T1ρ Mapping of Cartilage using Compressed Sensing with Different Regularizations
		Marcelo V. W. Zibetti[1], Azadeh Sharafi[1], Ricardo Otazo[1], and Ravinder R. Regatte[1]
		[1]Center for Biomedical Imaging, New York University School of Medicine, New York, NY, United States

		Quantitative T1ρ imaging usually requires multiple spin-lock times to obtain T1ρ maps, which makes the acquisition time demanding especially for biexponential models. Compressed Sensing has demonstrated significant acquisition time reduction in MRI. Similar improvements are expected for T1ρ relaxation mapping, given the extensive correlations in the series of images. However, it is not clear which combination of sparsifying transform and regularization function performs best for biexponential T1ρ mapping. Here, we compare five CS approaches: l1-norm of principal component analysis, spatio-temporal finite differences, exponential dictionaries, low rank, and low rank plus sparse. Our preliminary results, with three datasets, suggest that L+S is the most suitable method with least T1ρ estimation error.

204	15:09	UTE-T2* Shows Deep Cartilage Subsurface Matrix Changes 2 Years After ACL Reconstruction
		Ashley Williams[1,2], Matthew Titchenal[1,2], Aditi Guha[1,2], Bao H. Do[2,3], and Constance R Chu[1,2]
		[1]Department of Orthopaedic Surgery, Stanford University, Stanford, CA, United States, [2]Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, United States, [3]Department of Radiology, Stanford University, Stanford, CA, United States
		The purpose of this study is to compare 2-D and 3-D assessments of UTE-T2* maps for evidence of alterations to the subsurface cartilage matrix suggestive of cartilage at risk for early OA 2 years after ACL reconstruction. UTE-T2* values from small 2-D, single slice ROIs correlated to 3-D ROI values that encompassed a larger degree of weight-bearing cartilage. Results indicate that single slice 2-D UTE-T2* mapping may be an efficient means to assess the medial femoral cartilage as an imaging marker of pre-osteoarthritis while 3-D assessments provide additional sensitivity to changes in the tibial plateau.

205	15:21	Local associations between intervertebral disc T1rho/T2, muscle health, physical activity, and clinical disability using voxel-based relaxometry
		Claudia Iriondo[1], Valentina Pedoia[2], Jason Talbott[2], William Dillon[2], and Sharmila Majumdar[2]
		[1]UCSF/UC Berkeley Graduate Program in Bioengineering, University of California, San Francisco, San Francisco, CA, United States, [2]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States
		Region of interest based analysis of intervertebral disc composition in low back pain populations is (1) time-consuming and (2) limited in reproducibility, even more so in patients with advanced degeneration. This study applies voxel-based relaxometry (VBR) to investigate the spatial distributions of $T_{1\rho}$ and T_2 in lumbar intervertebral discs, and their association to patient reported outcomes and spinal muscle health. Our results demonstrate the potential to use VBR as a tool to more effectively measure biochemical differences in the intervertebral discs across low back pain subgroups and monitor changes over time.

206	15:33	Quantitative MRI in early intervertebral disc degeneration: T1rho correlates better than T2 and ADC with biomechanics and matrix content
		Cornelis Paul[1], Theodoor Smit[1], Magda de Graaf[2], Roderick Holewijn[2], Arno Bischop[2], Peter van de Ven[3], Margriet Mullender[4], Marco Helder[5], and Gustav Strijkers[6]
		[1]Orthopedic Surgery, Academic Medical Center, Amsterdam, Netherlands, [2]Orthopedic Surgery, VU University Medical Center, Amsterdam, Netherlands, [3]Epidemiology and Biostatistics, VU University Medical Center, Amsterdam, Netherlands, [4]Plastic, Reconstructive and Hand Surgery, VU University Medical Center, Amsterdam, Netherlands, [5]Oral and Maxillofacial Surgery, VU University Medical Center, Amsterdam, Netherlands, [6]Biomedical Engineering and Physics, Academic Medical Center, Amsterdam, Netherlands
		We correlated quantitative T2, T1rho and Apparent Diffusion Coefficient (ADC) values to disc mechanical behavior and gold standard early DDD markers in a graded degenerated lumbar IVD caprine model to assess their potential for early DDD detection. T1rho nucleus values correlate better than T2 and ADC with biomechanical, histological, and GAG changes.

Study Groups

Hyperpolarised Media Business Meeting

W08	Monday 14:45 - 15:45	*(no CME credit)*

Traditional Poster: General Cancer Imaging

Exhibition Hall 1509-1553	Monday 16:15 - 18:15	*(no CME credit)*

Electronic Poster: Molecular Imaging

Exhibition Hall	Monday 16:15 - 17:15	*(no CME credit)*

Electronic Poster: Neuro

Exhibition Hall	Monday 16:15 - 17:15	*(no CME credit)*

Study Groups

Cardiac MR Business Meeting

W07	Monday 16:15 - 17:15	*(no CME credit)*

Study Groups

MR in Drug Research Business Meeting

W08	Monday 16:15 - 17:15	*(no CME credit)*

Member-Initiated Symposium

Safety & Efficacy of Contrast Agents: State of the Art, Future Directions, & Alternative Approaches

Organizers: Peter Caravan, Ira Krefting

N01	Monday 16:15 - 18:15	*Moderators:* Tim Leiner	*(no CME credit)*

	16:15	State of the Art on Gd Deposition: Science, Clinical & Regulatory Reaction
		Henrik Thomsen

	16:30	What Do We Still Need to Know About GBCAs? A Roadmap for Further Studies
		Karen Bleich[1]
		[1]FDA

	16:45	Q & A

	16:55	Can Contrast-Enhanced MR Be Replaced? Non-Contrast Methods, Ultra-Low-Dose Contrast & Where Contrast Is Essential
		Susie Huang[1]
		[1]Massachusetts General Hospital, United States

	17:10	Gadolinium-Based Contrast Agents: State of the Art & Future Directions
		Silvio Aime[1]
		[1]University of Torino, Italy

	17:25	Rust Never Sleeps: Iron as an Alternative to Gadolinium for Contrast-Enhanced Imaging
		Alexander Guimaraes[1]
		[1]Oregon Health Sciences University, United States

	17:40	Metal-Free Contrast Agents
		Peter van Zijl

	17:55	Q & A

Member-Initiated Symposium

Neurophysiological Basis of Resting-State Functional Connectivity: Evidence from Rodents, Monkeys to Humans

Organizers: Shella Keilholz, Hanbing Lu

N02	Monday 16:15 - 18:15	*Moderators:* Shella Keilholz	*(no CME credit)*

	16:15	Infraslow Electrical Activity & BOLD Oscillations
		Anzar Abbas[1]
		[1]Neuroscience, Emory University, Atlanta, GA, United States

	16:39	Contribution of Vigilance Fluctuations to Resting-State fMRI
		Catie Chang[1]
		[1]NINDS, NIH

	17:03	Electrophysiological Brain Networks: Insights from Magnetoencephalography (MEG)

		Matthew Brookes[1]
		[1]University of Nottingham

	17:27	Global Cerebral Glucose Metabolism & the Global Signal from Resting-State fMRI
		Garth Thompson

	17:51	Panel Discussion

Weekday Course

MR Physics & Techniques for Clinicians

Organizers: Marcus Alley, Bernd Jung

S01	Monday 16:15 - 18:15	*Moderators:* Joseph Cheng & Bernd Jung

	16:15	Spin Gymnastics 1 & 2
		Frank Korosec[1]
		[1]University of Wisconsin - Madison, United States
		This educational lecture will provide a general overview of the basic physics of MRI. A broad range of topics will be covered, including magnetization and signal generation, relaxation of magnetization, the spin echo phenomenon, spatial encoding of signal, and a very brief introduction to the concept of k-space. Several of the topics will be introduced in this lecture and will be further elucidated by other presenters in this course.

	17:45	Image Quality
		Matthias Weigel[1,2]
		[1]Division of Radiological Physics, Dept. of Radiology, University Hospital Basel, Basel, Switzerland, [2]Dept. of Biomedical Engineering, University of Basel, Basel, Switzerland

		This educational talk presents an overview of key aspects influencing and quantitatively depicting image quality. Several examples for the different types of image quality aspects are given. The importance of signal-to-noise ratio (SNR) and the "triangle of death" for image quality in MRI is discussed in particular.

	18:15	Adjournment & Meet the Teachers

Weekday Course

Quantitative MRI in MSK: From Acquisition to Application

Organizers: Eric Chang, Garry Gold, Edwin Oei, Philip Robinson

W05/06	Monday 16:15 - 18:15	*Moderators:* Xiaojuan Li & Ashley Williams

	16:15	Relaxation
		Eveliina Lammentausta[1]
		[1]Oulu University Hospital, Finland

	16:40	Standardization, Phantoms
		Kathryn Keenan[1]
		[1]NIST, United States
		This talk will review how to design a phantom for MSK applications, how to develop standardization across platforms, and considerations for reproducibility and reliability studies.

	17:05	Image Processing, Machine Learning and Multimodal Data Analysis
		Valentina Pedoia[1]
		[1]University of California, San Francisco, United States

		In this lecture, we provide an overview on the potential of coupling of cutting edge technologies in quantitative MRI, deep learning and big data analytics fields. The main goal is to show how those techniques can be applied to discover latent feature able to accurately characterize disease status and predict progression. The data-driven extraction of features from relaxation maps and multidimensional analysis of data from various sources can exploit the real potential of quantitative MRI technique, to date still hampered by tedious and time-consuming manual image post-processing pipelines; and deeply underused due to the handcrafting of too simplistic image representations.

	17:30	Common Pitfalls in Quantitative MSK MRI
		Emily McWalter[1]
		[1]University of Saskatchewan, Canada

	17:55	Panel Discussion

	18:20	Adjournment & Meet the Teachers

Power Pitch

Pitch: Pulse Sequence Highlights

Power Pitch Theater A - Exhibition Hall	Monday 16:15 - 17:15	*Moderators:* Oliver Bieri & Mark Chiew	*(no CME credit)*

207	16:15	Maxwell-compensated waveform design for asymmetric diffusion encoding
		Filip Szczepankiewicz[1,2] and Markus Nilsson[1]
		[1]Clinical Sciences, Lund, Lund University, Lund, Sweden, [2]Random Walk Imaging AB, Lund, Sweden

208	16:15	Spin And Field Echo (SAFE) dynamic field correction in 3T fetal EPI
		Lucilio Cordero-Grande[1], Anthony Price[1], Giulio Ferrazzi[2], Jana Hutter[1], Daan Christiaens[1], Emer Hughes[1], and Jo Hajnal[1]
		[1]King's College London, London, United Kingdom, [2]Physikalisch-Technische Bundesanstalt, Braunschweigh and Berlin, Germany

209	16:15	Self-Gated and Real-time Simultaneous Multi-Slice Cardiac MRI from the Same Acquisition
		Sebastian Rosenzweig[1], Hans Christian Martin Holme[1,2], Nick Scholand[1], Robin Niklas Wilke[1,2], and Martin Uecker[1,2]
		[1]Intistut für Diagnostische und Interventionelle Radiologie, University Medical Center Göttingen, Göttingen, Germany, [2]Partner Site Göttingen, German Centre for Cardiovascular Research (DZHK), Göttingen, Germany
210	16:15	Phase Encoded xSPEN: A High-Definition Approach to Volumetric MRI with Unusually High Acceleration Factors
		Zhiyong Zhang[1], Michael Lustig[2], and Lucio Frydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, Berkeley, CA, United States
211	16:15	Accelerated T2-Weighted Imaging of the Abdomen with Self-Calibrating Wave-Encoded 3D Fast Spin Echo Sequences
		Feiyu Chen[1], Valentina Taviani[2], Joseph Y. Cheng[3], John M. Pauly[1], and Shreyas S. Vasanawala[3]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Global MR Applications and Workflow, GE Healthcare, Menlo Park, CA, United States, [3]Radiology, Stanford University, Stanford, CA, United States
212	16:15	Tilted-CAIPI for Highly Accelerated Distortion-Free EPI with Point Spread Function (PSF) Encoding
		Zijing Dong[1], Fuyixue Wang[2,3], Timothy G. Reese[2], Mary Kate Manhard[2], Berkin Bilgic[2], Lawrence L. Wald[2,3], Hua Guo[1], and Kawin Setsompop[2,3]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [3]Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States
213	16:15	Silent MRF : Quantitative scan with reduced noise using the Magnetic Resonance Fingerprinting (MRF) framework
		Dan Ma[1], Bhairav B Mehta[1], and Mark A Griswold[1]

		[1]*Radiology, Case Western Reserve University, Cleveland, OH, United States*
214	16:15	Focused, High-Resolution, Distortion-Free Diffusion Imaging
		Myung-Ho In[1], Yi Sui[1], Joshua D Trzasko[1], Yunhong Shu[1], Shengzhen Tao[1], Erin M Gray[1], John Huston[1], and Matt A Bernstein[1]
		[1]*Department of Radiology, Mayo Clinic, Rochester, MN, United States*
215	16:15	DP-TSE MRF: Rapid and Accurate T2 and ADC Quantification Using Diffusion-Prepared Turbo Spin-echo Magnetic Resonance Fingerprinting
		Zhixing Wang[1,2], Xiaozhi Cao[2], Congyu Liao[2], Huihui Ye[2,3], Hongjian He[2], and Jianhui Zhong[2]
		[1]*Biomedical Engineering, University of Virginia, Charlottesville, VA, United States,* [2]*Center for Brain Imaging Science and Technology, Department of Biomedical Engineering, Zhejiang University, Hangzhou, China,* [3]*State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China*
216	16:15	Shuttered EPI Brain Imaging at 7 Tesla
		Saikat Sengupta[1], Kawin Setsompop[2], and William A Grissom[3]
		[1]*Department of Radiology, Vanderbilt University Institute of Imaging Science, Vanderbilt University Medical Center, Nashville, TN, United States,* [2]*Department of Radiology, A.A. Martinos Center for Biomedical Imaging, Harvard Medical School, Charlestown, MA, United States,* [3]*Department of Biomedical Engineering, Vanderbilt University Institute of Imaging Science, Vanderbilt Univserity, Nashville, TN, United States*
217	16:15	Echo Planar Time-resolved Imaging (EPTI)
		Fuyixue Wang[1,2], Zijing Dong[3], Timothy G. Reese[1], Berkin Bilgic[1], Mary Kate Manhard[1], Lawrence L. Wald[1,2], and Kawin Setsompop[1,2]
		[1]*A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States,* [2]*Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States,* [3]*Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China*

218	16:15	TOPPE: A framework for rapid prototyping of MR pulse sequences
		Jon-Fredrik Nielsen[1] and Douglas C Noll[1]
		[1]Biomedical Engineering, University of Michigan, Ann Arbor, MI, United States

219	16:15	Time-optimal control based RF pulse design under gradient imperfections
		Christoph Stefan Aigner[1], Armin Rund[2], Samy Abo Seada[3], Shaihan Malik[3], Joseph V Hajnal[3], Karl Kunisch[2,4], and Rudolf Stollberger[1]
		[1]Institute of Medical Engineering, Graz University of Technology, Graz, Austria, [2]Institute for Mathematics and Scientific Computing, University of Graz, Graz, Austria, [3]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, [4]Johann Radon Institute for Computational and Applied Mathematics (RICAM), Austrian Academy of Sciences, Linz, Austria

220	16:15	Fast multi-component T1 and T2 correlation measurements using steady-state free precession
		Julian Pfister[1], Felix A. Breuer[1], Peter M. Jakob[2], and Martin Blaimer[1]
		[1]Magnetic Resonance and X-ray Imaging Department, Fraunhofer Development Center X-ray Technology (EZRT), Würzburg, Germany, [2]Experimental Physics 5, University of Würzburg, Würzburg, Germany

221	16:15	MEG-Navigators for Motion Detection and Quality Assurance in MR Elastography
		Christian Guenthner[1] and Sebastian Kozerke[1]
		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland

Power Pitch

Pitch: Psychoradiology: A Potpourri

Power Pitch Theater B - Exhibition Hall	Monday 16:15 - 17:15	*Moderators:* Xiaoqi Huang & Fei Li	*(no CME credit)*

222	16:15	Iron-related gene expression associated with magnetic susceptibility reductions: Application to the pathophysiology of a movement disorder population

		Ahmad Seif Kanaan[1,2], Alfred Anwander[1], Riccardo Metere[1], Andreas Schäfer[3], Torsten Schlumm[1], Jamie Near[4], Berkin Bilgic[5], Kirsten Müller-Vahl[2], and Harald Möller[1]
		[1]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [2]Department of Psychiatry, Hannover Medical School, Hannover, Germany, [3]Siemens Healthcare, Erlangen, Germany, [4]Douglas Mental Health Institute, McGill University, Montreal, QC, Canada, [5]Massachusetts General Hospital, Harvard Medical School, Charlestown, MA, United States
223	16:15	Multimodal ASL/PET/mRNA-expression analysis reveals CBF changes after single dose of antipsychotics depend on dopamine D2 receptor density profiles.
		Pierluigi Selvaggi[1], Mattia Veronese[1], Peter C. T. Hawkins[1], Ottavia Dipasquale[1], Gaia Rizzo[2,3], Juergen Dukart[4], Fabio Sambataro[5], Alessandro Bertolino[6], Steven C.R. Williams[1], Federico E Turkheimer[1], and Mitul A. Mehta[1]
		[1]Department of Neuroimaging, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, [2]Imanova Ltd., Centre for Imaging Sciences, Hammersmith Hospital, London, United Kingdom, [3]Division of Brain Sciences, Department of Medicine, Imperial College London, London, UK, London, United Kingdom, [4]Translational Medicine Neuroscience and Biomarkers, F. Hoffmann-La Roche Ltd, Basel, Switzerland, [5]Department of Experimental and Clinical Medical Sciences, University of Udine, Udine, Italy, [6]Department of Basic Medical Science, Neuroscience and Sense Organs, University of Bari Aldo Moro, Bari, Italy
224	16:15	Impaired modulation of hippocampal glutamate during memory consolidation in schizophrenia: Evidence from ¹H fMRS
		Jeffrey A. Stanley[1], Patricia Thomas[1], Dalal Khatib[1], Asadur Chowdury[1], Usha Rajan[1], Luay Haddad[1], Amirsadri Alireza[1], and Vaibhav A. Diwadkar[1]
		[1]Psychiatry and Behavioral Neurosciences, Wayne State University School of Medicine, Detroit, MI, United States
225	16:15	N-acetyl-cysteine supplementation improves functional connectivity in the cingulate cortex in early psychosis
		Emeline Mullier[1], Timo Roine[1], Alessandra Griffa[2], Philipp Baumann[3], Philippe Conus[4], Kim Q. Do[4], and Patric Hagmann[1]
		[1]Radiology, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [2]Dutch connectome lab, University Medical Center (UMC), Utrecht, Netherlands, [3]Service of General Psychiatry and Center for Psychiatric Neuroscience, Department of Psychiatry, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [4]Department of psychiatry, Lausanne University Hospital (CHUV), Lausanne, Switzerland

226	16:15	Altered Brain Development in Infants and Young Children with at Risk Genetics for Psychiatric Dysfunction
		Justin Remer[1,2], Douglas C. Dean III[3], Muriel Bruchhage[2,4], and Sean C.L. Deoni[2]
		[1]Brown University Warren Alpert School of Medicine, Providence, RI, United States, [2]Memorial Hospital, Brown University, Providence, RI, United States, [3]Waisman Center, University of Wisconsin, Madison, WI, United States, [4]Center for Neuroimaging, King's College, London, United Kingdom
227	16:15	7T MRS in First Episode Psychosis: Neurotransmitter Deficits and Neuronal Impairment
		Anna Min Wang[1,2], Subechhya Pradhan[1,2], Akira Sawa[3], and Peter B. Barker[1,2]
		[1]Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]Kennedy Krieger Institute, Baltimore, MD, United States, [3]Department of Psychiatry, Johns Hopkins University School of Medicine, Baltimore, MD, United States
228	16:15	A DTI connectome and machine learning approach to predict symptom improvement in depressed adolescents with cognitive-behavioral therapy (CBT)
		Olga Tymofiyeva[1], Justin Yuan[1], Colm G Connolly[2], Eva Henje Blom[3], Duan Xu[1], and Tony Yang[1]
		[1]University of California, San Francisco, San Francisco, CA, United States, [2]Florida State University, Tallahassee, FL, United States, [3]Umea University, Umea, Sweden
229	16:15	Neural network classification of ADHD based on white matter connectograms derived from diffusion spectrum imaging
		Chang-Le Chen[1,2], Yung-Chin Hsu[1], Susan Shur-Fen Gau[2,3], and Wen-Yih Isaac Tseng[1,2,4]
		[1]Institute of Medical Device and Imaging, National Taiwan University College of Medicine, Taipei, Taiwan, [2]Graduate Institute of Brain and Mind Sciences, National Taiwan University College of Medicine, Taipei, Taiwan, [3]Department of Psychiatry, National Taiwan University Hospital, Taipei, Taiwan, [4]Molecular Imaging Center, National Taiwan University, Taipei, Taiwan
230	16:15	Hippocampal-subfield Specific Connectivity Alterations in Major Depressive Disorder Patients at 7 Tesla
		John W Rutland[1], Prantik Kundu [1], Patrick R Hof[2], James W Murrough[3], and Priti Balchandani[1]

		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, United States
231	16:15	Reduced Local Segregation in Single-Subject Grey Matter Networks in Adult PTSD
		Running Niu[1], Du Lei[2], and Qiyong Gong[3]
		[1]HMRRC, West China Hospital, Chengdu, China, China, [2]Department of Psychosis Studies, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, London, United Kingdom, [3]uaxi MR Research Center (HMRRC), Department of Radiology, West China Hospital of Sichuan, Chengdu, China
232	16:15	Sertraline treatment modulates salience connectivity in major depressive disorder
		Li-Ming Hsu[1], Changwei W. Wu[1], Chien-Yuan Lin[2], Chi-Yun Liu[1], Timothy Lane[1], Ching-Po Lin[3], Chi-Bin Yeh[4], and Hung-Wen Kao[4]
		[1]Brain and Consciousness Research Center, Taipei Medical University, Taipei, Taiwan, [2]GE Healthcare, Taipei, Taiwan, [3]National Yang-Ming University, Taipei, Taiwan, [4]Department of Radiology, National Defense Medical Center, Taipei, Taiwan
234	16:15	Abnormal Perfusion and Perfusion fluctuation in Bipolar Disorder measured by ASL
		Weiying Dai[1], Mingzhao Chen[1], Li Zhao[2], Nicolas Bolo[3], David C. Alsop[2], and Keshavan Matcheri[3]
		[1]State University of New York at Binghamton, BINGHAMTON, NY, United States, [2]Department of Radiology, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States, [3]Department of Psychiatry, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States
235	16:15	Elevated brain iron in cocaine addiction as indexed by magnetic field correlation imaging
		Vitria Adisetiyo[1], Corinne E. McGill[1], William DeVries[2], Jens H. Jensen[1,3], Colleen A. Hanlon[2], and Joseph A. Helpern[1]
		[1]Neuroscience, Medical University of South Carolina, Charleston, SC, United States, [2]Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, SC, United States, [3]Radiology and Radiological Science, Medical University of South Carolina, Charleston, SC, United States

236	16:15	Deletion of CRTC1 is associated with strong neuroenergetic dysfunctions in a mouse model of mood disorders.
		Antoine Cherix[1], Guillaume Donati[1], Blanca Lizarbe[1], Hongxia Lei[2], Carole Poitry-Yamate[2], Jean-René Cardinaux[3], and Rolf Gruetter[1,4,5]
		[1]Laboratory for Functional and Metabolic Imaging (LIFMET), Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [2]Animal Imaging and Technology Core (AIT), Center for Biomedical Imaging (CIBM), Ecole Polytechnique Fédérale de Lausanne., Lausanne, Switzerland, [3]Center for Psychiatric Neuroscience (CNP), Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland, [4]Department of Radiology, University of Geneva, Geneva, Switzerland, [5]Department of Radiology, University of Lausanne, Lausanne, Switzerland

Combined Educational & Scientific Session

Liver Imaging: What Can We Really Quantify?

Organizers: Kathryn Fowler

S02	Monday 16:15 - 18:15	*Moderators:* Sudhakar Venkatesh & Ralph Sinkus

	16:15	Measuring Liver Function-Technical Aspects
		Steven Sourbron[1]
		[1]Leeds Imaging Biomarkers Group, University of Leeds, United Kingdom
		This talk will provide a broad introduction of MRI methods to measure the function of liver parenchyma, with more in-depth treatment of Dynamic Gadoxetate-Enhanced MRI for the quantification of hepatocellular transporter function. We will also cover some basic facts about the liver, review competing non-MRI techniques for assessing liver function, and present examples of applications in basic science, drug development and clinical practice.

237	16:45	Clinical Assessment of Nonalcoholic Steatohepatitis (NASH) with Multi-parametric MRI
		Jiahui Li[1], Alina Allen[2], Yi Sui[1], Dan Rettmann [3], Ann Shimakawa[4], Glenn Slavin[5], Kevin J. Glaser[1], Sudhakar K. Venkatesh[1], Taofic Mounajjed[6], Vijay Shah[7], Richard L. Ehman[1], and Meng Yin[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States, [2]Gastroenterology, Mayo Clinic, Rochester, MN, United States, [3]GE Healthcare, Waukesha, WI, United States, [4]GE Healthcare, Menlo Park, CA, United States, [5]GE Healthcare, Silver Spring, MD, United States, [6]Anatomic Pathology, Mayo Clinic, Rochester, MN, United States, [7]Gastroenterology and Hepatology, Mayo Clinic, Rochester, MN, United States

		In 27 clinical patients, we performed multi-parametric hepatic MRI, including proton density fat fraction with R2* correction, MR Elastography (MRE), and T1 mapping to characterize nonalcoholic steatohepatitis (NASH). Fat fraction and multiple MRE-assessed mechanical parameters successfully diagnosed NASH ($p<0.05$ for all). Diagnostic abilities of all parameters were evaluated based on steatosis, inflammation and ballooning scores respectively. Spearman correlations were used to analyze the correlations between imaging parameters. We found that T1 relaxation time had a significantly positive correlation ($\rho=0.72$, $p=0.0005$) with fat fraction. In summary, multi-parametric MRI is a potential imaging surrogate for diagnosing NASH.

238	16:57	Implementation of T1 Mapping in Routine Clinical MR Liver Exam For The Detection of Hepatic Fibrosis and Portal Hypertension in Hepatitis C Patients
		Ahmed Hamimi[1], Ronald Ouwerkerk[1], Theo Heller[2], Elliot Levy[3], Jatin Raj Matta[1], Khaled Abd-elmoniem[1], and Ahmed M Gharib[1]
		[1]Biomedical and Metabolic Imaging Branch, National Institute of Diabetes and Digestive and Kidney Diseases, NIH, Bethesda, MD, United States, [2]Liver Diseases Branch, National Institute of Diabetes and Digestive and Kidney Diseases, NIH, Bethesda, MD, United States, [3]Interventional Radiology, Clinical Center, NIH, Bethesda, MD, United States
		Application of two short single breath hold T1 mapping shMOLLI technique (before and after Gadolinium injection) to a routine clinical MRI liver exam can detect both severe fibrosis and portal hypertension in Hepatitis C. The technique was prospectively validated in 29 patients with reference standard clinical methods including liver biopsy and direct portal venous pressure measurements. Utilizing this method would allow for a comprehensive anatomic and functional MRI study in a single session without substantial prolongation of scan time, thereby, allow non-invasive monitoring of therapy and/or progression of disease.

	17:09	Prognosis & Prediction for Liver Tumors
		Ihab Kamel[1]
		[1]Johns Hopkins Hospital, United States

239	17:39	Preoperative Remnant Liver Function Evaluation using a Clinical-Available Gd-EOB-DTPA-Enhanced MR Imaging Protocol in HCC Patients
		Yajie Wang[1], Lin Zhang[2], Jia Ning[1], Xinjing Zhang[3], Xuedong Wang[3], Shizhong Yang[3], Jiahong Dong[3], and Huijun Chen[1]
		[1]Center for Biomedical Imaging Research, School of Medicine, Tsinghua University, Beijing, China, [2]Department of Radiology, Southwest Hospital, Third Military Medical University, Chongqing, China, [3]Beijing Tsinghua Changgung Hospital, School of Medicine, Tsinghua University, Beijing, China

		Accurate evaluating of remnant liver function preoperatively is important for surgery planning and reducing posthepatectomy liver failure (PHLF) rate in hepatocellular carcinoma (HCC) patients. In this study, an accurate remnant liver function evaluation method was proposed using a clinical-available MR imaging protocol. The remnant liver function measured by the proposed method showed significant difference between the patients with and without PHLF. More importantly, ROC analysis showed the proposed method has a larger AUC than remnant liver volume and ICG based parameters in predicting PHLF.

240	17:51	MRI texture features as predictors of histopathologic and genomic characteristics of hepatocellular carcinoma.
		Stefanie Hectors[1], Sara Lewis[1,2], Cecilia Besa[1], Michael King[2], Juan Putra[3], Stephen Ward[3], Takaaki Higashi[4], Swan Thung[3], Yujin Hoshida[4], and Bachir Taouli[1,2]
		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Pathology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [4]Department of Medicine/Division of Liver Diseases, Icahn School of Medicine at Mount Sinai, New York, NY, United States
		The goal of this study was to assess the diagnostic value of texture features measured with MRI compared to qualitative imaging traits for the prediction of histopathologic and genomic characteristics of hepatocellular carcinoma (HCC) lesions. Texture features exhibited additional, complementary correlations with histopathology and genomics compared to qualitative imaging traits, including association with microvascular invasion and expression of immunotherapy target CTLA4. These promising results warrant further investigation of texture features as predictors of histopathologic and genomics measurements in HCC.

241	18:03	Presence of non-hypervacular hypointense nodule on hepatobiliary phase of gadoxetic acid enhanced MR: Risk of tumor recurrence after curative treatment for small single nodular HCC and guidance for selection of treatment option
		Dong Ho Lee[1] and Jeong Min Lee[1]
		[1]Radiology, Seoul National University Hospital, Seoul, Republic of Korea
		Presence of non-hypervascular hypointense nodule on hepatobiliary phase of gadoxetic acid enhanced liver MR can stratify the risk of tumor recurrence after curative treatment for small single nodular HCC equal to or less than 3cm.

	18:15	Adjournment & Meet the Teachers

Oral

Frontiers of Image Reconstruction

N03	Monday 16:15 - 18:15	*Moderators:* Julia Velikina & Sajan Goud Lingala

242	16:15	3D-Patch-Based Low-Rank Reconstruction (PROST) for Highly-Accelerated CMRA Acquisition
		Aurelien Bustin[1], Gastao Cruz[1], Giulia Ginami[1], Teresa Correia[1], Imran Rashid[1], Radhouene Neji[1,2], Rene Botnar[1], and Claudia Prieto[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]MR Research Collaborations, Siemens Healthcare Limited, Frimley, United Kingdom
		Free-breathing coronary MR angiography (CMRA) has shown great potential to visualize coronary stenosis. Three-dimensional (3D) CMRA, however, remains time consuming because a large amount of data is needed to accurately visualize all major coronary arteries. Scan acceleration using compressed sensing (CS) reconstruction has successfully been applied to coronary artery imaging. For high acceleration factors, however, CS-based techniques suffer from residual aliasing artifacts which compromise the diagnostic value of the reconstructed image. We propose a new 3D-patch-based reconstruction that exploits the complex 3D anatomy of the coronary arteries in an effective low-rank framework, which combined with 100% respiratory efficiency enables high-quality isotropic Cartesian CMRA images in ~3 mins.

243	16:27	Kernel low-rank regularization: an efficient approach for recovering dynamic images on a manifold
		Sunrita Poddar[1], Yasir Mohsin[1], Bijoy Thattaliyath[1], Diedra Ansah[1], and Mathews Jacob[1]
		[1]University of Iowa, Iowa City, IA, United States
		The main focus of this abstract is to introduce an efficient algorithm to recover a free breathing and ungated cardiac MR image series from highly undersampled measurements. The main contributions are (i) a kernel low-rank algorithm to estimate the manifold structure (Laplacian) from noisy navigator signals, (ii) a fast algorithm that uses the Laplacian basis functions to recover the data from highly undersampled measurements. The utility of the algorithm is demonstrated on radial acquisitions from patients with congenital heart disease; the results show that the framework is a promising alternative to self-gating methods.

244	16:39	Gradient-Controlled Local Larmor Adjustment (GC-LOLA) for CAIPIRINHA-Accelerated bSSFP Imaging with Improved Banding Behavior
		Daniel Stäb[1,2] and Peter Speier[3]
		[1]The Centre for Advanced Imaging, The University of Queensland, Brisbane, Australia, [2]Department for Diagnostic and Interventional Radiology, University of Würzburg, Würzburg, Germany, [3]Siemens Healthcare, Erlangen, Germany

		The simultaneous multi-slice (SMS) imaging technique CAIPIRINHA has proven to be highly efficient for extending the slice coverage in 2D imaging. When accelerating balanced steady-state free-precession (bSSFP) sequences with SMS-CAIPIRINHA, modulating k-space by means of slice-specific RF phase cycles leads to undesired slice-specific shifts of the bSSFP pass-band structure. Gradient-controlled local Larmor adjustment (GC-LOLA) removes this drawback. By means of slice gradient unbalancing, the Larmor frequency is made slice position dependent, which allows compensating for the pass-band shifts and stabilizes CAIPIRINHA-accelerated bSSFP imaging with respect to B0 field inhomogeneity.

245	16:51	Ultrafast Speech Imaging at High Spatial Resolution using Model-Consistency Condition Reconstruction with Progressive Temporal Basis Learning
		Julia Velikina[1], Andrew Alexander[1], Joseph Salmons[1], Eric Raimy[1], Thomas Purnell[1], Steven Kecskemeti[1], and Alexey Samsonov[1]
		[1]University of Wisconsin - Madison, Madison, WI, United States
		Dynamic MRI holds high potential for real-time imaging of upper airway, which can provide insights into questions of speech science and also have important clinical applications. However, speech imaging places increased demands on spatial and temporal resolution, necessitating image reconstruction from severely undersampled data. Previously reported methods use low-rank constraints with spiral navigators to enable temporal basis estimation, otherwise infeasible with standard learning methods. We propose an alternative solution based on a novel concept of progressive learning, which does not require separate specialized pulse sequences for navigator acquisitions, while providing high 7.4 ms temporal and 1.25x1.25x8 mm spatial resolution.

246	17:03	3D Dynamic Hyperpolarized-13C Parallel MRI of Human Brain using SVD Low-Rank Matrix Completion
		Hsin-Yu Chen[1], Ilwoo Park[2], Peng Cao[1], Robert A. Bok[1], Jeremy W. Gordon[1], Peter J. Shin[1], James B. Slater[1], Mark van Criekinge[1], Lucas Carvajal[1], Adam Autry[1], John Kurhanewicz[1], Peder E.Z. Larson[1], and Daniel B. Vigneron[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Department of Radiology, Chonnam National University Medical School and Hospital, Gwangju, Republic of Korea
		The goal of this feasibility study was to develop and apply new 3D dynamic hyperpolarized ^{13}C combined parallel imaging + compressed sensing MRI methods for human brain studies. The new framework utilizing multichannel coils and low-rank matrix completion reconstruction provided greatly improved coverage as compared to prior 2D acquisitions. Whole-brain coverage was achieved, while maintaining the image quality in terms of spatial distribution, temporal dynamics and quantitative accuracy of the ^{13}C biomarkers. Animal studies and simulations also showed that the pMRI+CS framework provided improved performance over CS alone, and was able better to recover low-SNR peaks.

247	17:15	Reconstruction of Arrhythmic Cardiac Cycles in Patients with Atrial Fibrillation
		Teodora Chitiboi[1], Li Feng[1], Rebecca Ramb[2], Ricardo Otazo[1], and Leon Axel[1]
		[1]New York University School of Medicine, New York, NY, United States, [2]Siemens Healthineers, Erlangen, Germany
		Arrhythmia is often a significant challenge to acquiring diagnostic quality cardiac MRI. While discarding atypical cardiac cycles can exclude short-lived arrhythmic events, such as premature ventricular contractions (PVCs), this fails for atrial fibrillation (Afib), where subjects have an irregular cardiac cycle pattern. Harnessing the potential of the XD-GRASP MRI technique to reconstruct continuously acquired data with cardiac and respiratory phase as extra dimensions, we propose to additionally classify cardiac cycles for Afib patients according to their preload state, and simultaneously reconstruct the different types of arrhythmic cycles in a five-dimensional image space.

248	17:27	Highly Undersampled Kooshball Reconstruction with Low-rank Modeling and Sparsity Constraints for High-resolution T1 Mapping
		Haikun Qi[1], Huiyu Qiao[1], Aiqi Sun[1], Shuo Chen[1], Xihai Zhao[1], Rui Li[1], Chun Yuan[1,2], and Huijun Chen[1]
		[1]Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]Department of Radiology, University of Washington, Seattle, WA, United States
		Highly undersampled 3D radial is very useful for 3D imaging acceleration, and compressed sensing and low-rank can be used for reconstruction of the undersampled kooshball data. In this study, we propose a novel reconstruction method for fast 3D T1 mapping of carotid artery using 3D radial sampling. The reconstruction method is based on low-rank modeling with parallel imaging and sparsity constraints, and is potential to improve the accuracy and precision of T1 estimation. The aim of this study is to evaluate the effectiveness of the proposed method using phantom and in vivo imaging experiments on volunteers and carotid atherosclerosis patients.

249	17:39	Assessing MR image reconstruction quality using the Fourier Radial Error Spectrum plot
		Tae Hyung Kim[1] and Justin P. Haldar[1]
		[1]Electrical Engineering, University of Southern California, Los Angeles, CA, United States

		This work introduces the Fourier radial error spectrum plot (ESP) as a novel approach to quantifying the quality of reconstructed MR images. While conventional error metrics such as normalized root mean squared error (NRMSE) or structural similarity (SSIM) are widely used, they are simple scalar-measures that only provide one-dimensional insight into image quality. In contrast, ESP describes reconstruction quality with a spectrum that provides a quantitative evaluation of image quality at every spatial resolution scale. Our results show that ESP provides more comprehensive information than conventional error metrics, and can guide the design of new and improved image reconstruction approaches.

250	17:51	Complex Image Extraction in Phased-Array Imaging
		Peter J Shin[1] and Daniel B Vigneron[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States
		Phased-array coils are used in MRI to improve signal-to-noise ratio (SNR) or to accelerate data acquisition speed through parallel imaging. It is beneficial to have a phased-array imagery reconstruction method that extracts the complex magnetization information from the multichannel data. In this work, we adopt the fusion frame theory to estimate the magnitude of the underlying magnetization and further employ the matched-filter method to estimate the magnetization phase, thereby reconstructing a complex image that does not have coil sensitivity weightings.

251	18:03	Rapid self-tuning compressed-sensing MRI using projection onto epigraph sets
		Mohammad Shahdloo[1,2], Efe Ilıcak[1,2], Mohammad Tofighi[3], Emine U. Sarıtaş[1,2,4], A. Enis Cetin[1,5], and Tolga Çukur[1,2,4]
		[1]Electrical and Electronics Engineering Department, Bilkent University, Ankara, Turkey, [2]National Magnetic Resonance Research Center (UMRAM), Bilkent University, Ankara, Turkey, [3]Department of Electrical Engineering, Pennsylvania State University, State College, PA, United States, [4]Neuroscience Program, Bilkent University, Ankara, Turkey, [5]Electrical & Computer Engineering Department, University of Illinois at Chicago, Chicago, IL, United States
		Successful compressed-sensing reconstruction often involves tuning one or more regularization weights. However, tuning the regularization weights is a subject-specific, task-dependent and non-trivial task. Recent studies have proposed to determine the weights by minimizing the statistical risk of removing significant coefficients using line searches across a range of parameters. However, the line-search procedures lead to prolonged reconstruction times. Here, we propose a new self-tuning approach generalized for multi-coil, multi-acquisition CS reconstructions that leverage projection onto epigraph sets of l1 and TV balls. The proposed method yields 7 to 9-fold gain in computational efficiency over conventional methods while enabling further improved image quality.

Oral

Microstructure: A Stroll in the q-Space

N04	Monday 16:15 - 18:15	*Moderators:* Noam Shemesh & Ileana Jelescu

252	16:15	Breaking the power law scaling of the dMRI signal on the Connectom scanner reveals its sensitivity to axon diameters
		Jelle Veraart[1], Els Fieremans[1], Umesh Rudrapatna[2], Derek K Jones[2], and Dmitry S Novikov[1]
		[1]Center for Biomedical Imaging, NYU School of Medicine, New York, NY, United States, [2]CUBRIC, Cardiff University, Cardiff, United Kingdom
		We demonstrate that in vivo diffusion MRI becomes sensitive to intra-axonal properties such as the inner axon diameters, when diffusion weightings in the range $$$b\sim7,000-25000\,\mathrm{s/mm^2}$$$ are achieved on the Human Connectom scanner (using gradients of 300mT/m). By analyzing the diffusion-weighted signal in the human white matter as a function of $$$b$$$, we observe significant deviations from the $$$b^{-1/2}$$$ scaling associated with the conventional “stick” model of infinitely-narrow axons. Our estimated effective MR diameters, heavily weighted by the tail of the axon diameter distribution, agree well with those calculated from histology histograms available from literature.

253	16:27	The Dot…wherefore art thou? Search for the isotropic restricted diffusion compartment in the brain with spherical tensor encoding and strong gradients
		Chantal M.W. Tax[1], Filip Szczepankiewicz [2,3], Markus Nilsson[2], and Derek K Jones[1]
		[1]CUBRIC, School of Psychology, Cardiff University, Cardiff, United Kingdom, [2]Clinical sciences, Lund, Lund University, Lund, Sweden, [3]Random Walk Imaging AB, Lund, Sweden
		The accuracy of biophysical models requires that all relevant tissue compartments are modelled. The so-called “dot compartment” is a conjectured compartment that represents small cells with apparent diffusivity approaching zero. We establish an upper limit of the “dot-fraction” across the whole brain in vivo, by using ultra-high gradients and optimized gradient waveforms for spherical tensor encoding. We report a notable signal above the noise floor in the cerebellar gray matter even for an extremely high b-value of 15000 s/mm^2. For cerebral tissue, the dot-fraction seems negligible, and we consider how exchange may have affected this result.

254	16:39	Effect of combining linear with spherical tensor encoding on estimating brain microstructural parameters
		Els Fieremans[1], Jelle Veraart[1], Benjamin Ades-Aron[1], Filip Szczepankiewicz[2,3], Markus Nilsson[2], and Dmitry S Novikov[1]
		[1]Radiology, New York University School of Medicine, New York, NY, United States, [2]Clinical Sciences, Lund University, Lund, Sweden, [3]Random Walk Imaging AB, Lund, Sweden

		The diffusion MRI signal, as measured with conventional linear tensor encoding (LTE), has been shown to have not enough features to fully model the white matter microstructure. Here we investigate whether adding spherical encoding (STE) to LTE makes microstructural parameter estimation more robust. On signal simulations and in in vivo MRI data, we demonstrate that the intra-axonal diffusivity and axonal water fraction are estimated with higher precision, thereby enabling a 20 minute whole brain protocol to extract brain microstructural parameters without imposing constraints or priors.

255	16:51	Unconstrained Estimation of Microstructure by the Combination of Single- and Double-planar diffusion encoding
		Marco Reisert[1], Valerij G. Kiselev[1], and Bibek Dhital[1]
		[1]University Freiburg, Faculty of Medicine, Freiburg, Germany
		Modeling of white matter microstructure using standard diffusion MRI protocols is a poor-conditioned problem. With standard measurements there is a global degeneracy: There are two significantly different microstructural parameter sets explaining experimental data equally well. In this work we use an additional planar double diffusion encoding to resolve the degeneracy, and extend a Bayesian estimation framework to a combination of linear and planar diffusion encoding. This enables us to produce reliable estimates without applying any constraints to the microstructural diffusion model.

256	17:03	A Novel Method for Fast and Efficient Measurement of Diffusion Tensor Size and Shape Distributions
		Grant Yang[1,2] and Jennifer McNab[2]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States
		We demonstrate through simulations and empirical data that it is possible to simultaneously estimate the variance of the voxel-wise diffusion tensor shape and size distributions using efficient isotropic and linear diffusion encodings on a whole-body clinical MRI scanner with whole-brain coverage at 3mm isotropic resolution in under 2 minutes.

257	17:15	The "Magic DIAMOND" method: probing brain microstructure by combining b-tensor encoding and advanced diffusion compartment imaging
		Alexis Reymbaut[1], Benoit Scherrer[2], Guillaume Gilbert[3], Filip Szczepankiewicz[4,5], Markus Nilsson[4], and Maxime Descoteaux[1]

		[1]Université de Sherbrooke, Sherbrooke, QC, Canada, [2]Dept. of Radiology, Boston Children's Hospital, Boston, MA, United States, [3]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada, [4]Department of Clinical Sciences, Lund, Lund University, Lund, Sweden, [5]Random Walk Imaging AB, Lund, Sweden
		Via q-trajectory encoding, b-tensors enable the disentanglement of isotropic and anisotropic diffusion components. Relevant metrics are usually extracted from data acquired with a combination of linear and spherical b-tensors with 1D parametric distributions of diffusivities. Independently, the DIAMOND model proposed an analytic result for a 6D parametric compartmental tensor distribution based on linearly acquired data. In this work, we extend DIAMOND's analyticity to axisymmetric acquisitions. Evaluating this "Magic DIAMOND" approach on in vivo data, we show that it can tease apart isotropic diffusion and diffusivity compartments of crossing fascicles, hereby integrating specific compartments with intra-compartment diffusional variance.

258	17:27	On the magnetic field and echo time dependence of the pseudo-diffusion coefficient
		Andreas Julian Riexinger[1], Andreas Wetscherek[2], Jan Martin[1], Tristan Anselm Kuder[3], Armin Nagel[1], Michael Uder[1], Bernhard Hensel[4], Lars Müller[3,5], and Frederik Bernd Laun[1]
		[1]Institute of Radiology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany, [2]Joint Department of Physics, The Institute of Cancer Research and The Royal Marsden NHS Foundation Trust, London, United Kingdom, [3]Department Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [4]Center for Medical Physics and Engineering, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany, [5]CUBRIC, School of Psychology, Cardiff University, Cardiff, United Kingdom
		It has been reported that a strong echo time dependence of the perfusion fraction *f* exists in liver and pancreas. The purpose of this work is to investigate whether a similar dependence exists for the pseudo-diffusion coefficient *D**. Thereto, the livers of six healthy volunteers were examined at two echo times (TE = 40/80 ms) at two field strengths. In contrast to *f*, *D** shows almost no echo time dependence in the healthy liver and the observed field strength dependence was smaller than the fit uncertainty.

259	17:39	Cell specific anisotropy with double diffusion encoding spectroscopy in the human brain at 7T
		Henrik Lundell[1], Andrew Webb[2], and Itamar Ronen[2]
		[1]Danish Research Centre for Magnetic Resonance, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark, [2]C. J. Gorter Center for High Field MRI, Leiden University Medical Center, Leiden, Netherlands

		The measurement of intracellular metabolite mobility with diffusion weighted spectroscopy (DWS) provides a cell-specific probe for microstructure. Measurements in animals and humans with conventional one dimensional diffusion encoding and model-guided analysis suggest that the main component of the intracellular space of both neurons and astrocytes comprises mainly anisotropic fibrous geometries. In this study we performed double diffusion encoded spectroscopy (DDES) in the human brain as a direct probe of anisotropic intracellular diffusion. As expected, our results support a main fibrous component but the results also suggest a more complex geometry of astrocytes that could include isotropic compartments.

260	17:51	Validity Regimes of the Spherical Mean Technique
		Rafael Neto Henriques[1] and Noam Shemesh[1]
		[1]Champalimaud Research, Champalimaud Centre for the Unknown, Lisbon, Portugal
		The mean spherical technique (SMT) has been proposed as an attempt to disentangle microscopic diffusion properties from the mesoscopic tissue organization. However, it remains unclear under which conditions exactly the technique could still fruitfully deliver its metrics. In this study, SMT's microscopic fractional anisotropy estimates (μFA) are investigated using synthetic and high-quality diffusion data. We find that any compartmental heterogeneity can crucially impact the μFA extracted from SMT. In addition, the b-value ranges where SMT delivers accurate information is specific to the microstructure itself. Our work suggests that SMT-driven μFA should be examined with care.

261	18:03	Non-Invasive Determination of Sodium Pump Activity In Vivo with DWI
		Charles S. Springer[1], Gregory J. Wilson[2], Brendan Moloney[1], Thomas M. Barbara[1], Xin Li[1], William D. Rooney[1], and Jeffrey H. Maki[3]
		[1]Advanced Imaging Research Center, Oregon Health & Science University, Portland, OR, United States, [2]Radiology, University of Washington, Seattle, WA, United States, [3]Radiology, University of Colorado Denver, Aurora, CO, United States
		Using a very simple model, Monte Carlo random walk simulated DWI b-space decays exhibit sensitivity to parameters measuring membrane Na^+,K^+-ATPase activity, cell density, and voxel average cell volume. Furthermore, the simulation matching the literature experimental *in vivo* human cerebral cortex b-space decay has model parameters in near absolute agreement with the most pertinent literature values. The model parameters are: k_{io} = 2 s^{-1}, ρ = 80,400 cells/μL, and V = 9.2 pL. In addition, the ADC of this simulation agrees with published results.

Oral

Parameter Quantification

S03	Monday 16:15 - 18:15	*Moderators:* Tobias Kober & Jürgen Reichenbach

262	16:15	Simultaneous B1 and T1 Mapping Using Spiral Variable-Flip-Angle Acquisitions for Whole-Brain Coverage in Less Than One Minute
		Rahel Heule[1,2,3], Josef Pfeuffer[4], Craig H. Meyer[5], and Oliver Bieri[1,2]
		[1]Division of Radiological Physics, Department of Radiology, University of Basel Hospital, Basel, Switzerland, [2]Department of Biomedical Engineering, University of Basel, Basel, Switzerland, [3]High Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [4]Siemens Healthcare GmbH, Application Development, Erlangen, Germany, [5]Department of Biomedical Engineering, University of Virginia, Charlottesville, VA, United States
		Rapid variable-flip-angle T_1 mapping techniques are frequently applied in clinical settings, but their accuracy is often impaired by incomplete spoiling or flip angle miscalibrations. To eliminate these two error sources simultaneously, a combined B_1 and T_1 mapping method is proposed based on spiral 2D multislice spoiled gradient echo imaging with high spoiling efficiency. The transition to steady state is minimized by an optimized single preparation pulse. A single-shot spiral readout during the preparation module enables ultrafast B_1 mapping and as a result reproducible bias-free T_1 mapping with whole-brain coverage at clinically relevant resolution in less than one minute.

263	16:27	Rapid simultaneous acquisition of QSM and MTV
		Fang Frank Yu[1], Susie Yi Huang[1], Tanguy Duval[2], Julien Cohen-Adad[2], and Berkin Bilgic[3]
		[1]Radiology, Athinoula A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [2]Institute of Biomedical Engineering, Ecole Polytechnique de Montreal, Montreal, QC, Canada, [3]Athinoula A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States
		Quantitative susceptibility mapping (QSM) and macromolecular tissue volume (MTV) represent quantitative methods that improve characterization of neurodegenerative diseases. MTV involves acquisition of 3D-Gradient Echo (GRE) at multiple flip angles with long TR and short TE. High-quality QSM requires 3D-GRE at multiple head orientations with long TE. We exploit (i) unused time due to long TR in MTV to collect additional late echoes that allow QSM processing, (ii) acquire each of the multiple flip angles at a different head orientation. These permit simultaneous acquisition of QSM and MTV, whereby two maps are obtained at the scan time of a single contrast.

264	16:39	Myelin water atlas: a template for myelin distribution in the brain
		Hanwen Liu[1,2], Cristina Rubino[3], Mike Jarrett[4,5], Emil Ljungberg[6], Irene Vavasour[7], Shannon Kolind[1,7,8], Erin Leigh MacMillan[9,10,11], Tony Traboulsee[12], Donna Lang[7], Alex Rauscher[4,7], David Li[7], Alex MacKay[1,7], Lara Boyd[13], John Kramer[2,14], and Cornelia Laule[2,7]

		[1]Physics, University of British Columbia, Vancouver, BC, Canada, [2]International Collaboration on Repair Discoveries, Vancouver, BC, Canada, [3]Rehabilitation Sciences, University of British Columbia, Vancouver, BC, Canada, [4]Pediatrics, University of British Columbia, Vancouver, BC, Canada, [5]UBC MRI Research Centre, University of British Columbia, Vancouver, ON, Canada, [6]IoPPN, King's College London, London, United Kingdom, [7]Radiology, University of British Columbia, Vancouver, BC, Canada, [8]Medicine, University of British Columbia, Vancouver, BC, Canada, [9]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada, [10]UBC MRI Research Centre, University of British Columbia, Vancouver, BC, Canada, [11]ImageTech Lab, Simon Fraser University, Surrey, BC, Canada, [12]University of British Columbia, Vancouver, BC, Canada, [13]Physical Therapy, University of British Columbia, Vancouver, BC, Canada, [14]Kinesiology, University of British Columbia, Vancouver, BC, Canada
		In-vivo information about myelin content in the brain is desirable for studying brain diseases and injuries. Normative information is key for determining what is abnormal when assessing neurological conditions that affect myelin. We used myelin water imaging to create a template specific to myelin, the myelin water atlas, for healthy brains. The resulting atlas shows strong agreement with well-known anatomical features that have demonstrated that different brain regions have distinct amounts of myelin. Our work shows one of the potential applications of using the myelin water atlas as a reference to visualize demyelination in the brain of individual subjects.

265	16:51	Multi-atlas tool for automated magnetic susceptibility quantification in brain nuclei
		Andreia Vasconcellos Faria[1], Lin Chen[2], Kwame Kutten[3], Can Ceritoglu[3], Ningdong Kang[1], Li Pan[4], Ye Qiao[1], Michael Miller[3], Susumu Mori[1], David Yousem[1], Peter C van Zijl[2], and Xu Li[2]
		[1]Radiology, Johns Hopkins University, Baltimore, MD, United States, [2]Kennedy Krieger Institute, Johns Hopkins University, Baltimore, MD, United States, [3]Biomedical Engineering, Johns Hopkins University, Baltimore, MD, United States, [4]Siemens Healthineers, Baltimore, MD, United States
		Quantitative magnetic susceptibility offers a non-invasive measure of important brain tissue molecules, such as iron complexes and myelin, potentially providing significant information about normal and pathological conditions during aging. We developed an automated process to quantify tissue susceptibility in a biologically meaningful set of structures, thereby generating universal and sharable quantitative susceptibility measures. Our susceptibility-based multi-atlas outperformed the single atlas and the T1-weighted multi-atlases. Our tool and normalization algorithm offered consistent measures of magnetic susceptibility over different image protocols and platforms. Automatic and reliable quantitative susceptibility mapping measures will facilitate individual analyses and studies on aging and neurodegeneration.

266	17:03	High-resolution in-vivo multi-parametric MRI using MR-STAT with a highly parallelized, limited-memory reconstruction algorithm
		Oscar van der Heide[1], Alessandro Sbrizzi[1], Peter Luijten[1], and Cornelis van den Berg[1]
		[1]Center for Image Sciences, UMC Utrecht, Utrecht University, Utrecht, Netherlands

		MR-STAT is a framework for obtaining multiple quantitative parameter maps from a very short scan. The parameter maps are obtained by fitting a Bloch-based signal model directly to the time domain data. No Fourier transform is needed. In this work we demonstrate that MR-STAT can obtain excellent high-resolution in-vivo quantitative maps using very short Cartesian acquisitions standardly available on clinical MR systems. The solution of the large-scale reconstruction problem is made possible by a highly parallelized, limited-memory algorithm.

267	17:15	Increased Measurement Efficiency for Fat Quantification Using a Mixed Polarity Bipolar Acquisition Scheme
		Ruitian Song[1], Nathan S. Artz[1], Ralf B. Loeffler[1], and Claudia M. Hillenbrand[1]
		[1]St Jude Children's Research Hospital, Memphis, TN, United States
		A new mixed polarity bipolar GRE sequence is proposed for fat quantification by mixing positive and negative readout polarity in one echo acquisition. Accurate fat fraction maps can be obtained using the proposed method with up to 50% scan time savings compared to a dual shot unipolar GRE method.

268	17:27	Comparison of 3D spoiled-gradient multiple echo with STEAM for proton density fat fraction and fatty acid composition estimation
		Angéline Nemeth[1], Hélène Ratiney[1], Benjamin Leporq[1], Kévin Seyssel[2], Bérénice Segrestin[3], Pierre-Jean Valette[4], Martine Laville[3], and Olivier Beuf[1]
		[1]Univ. Lyon, INSA-Lyon, Université Claude Bernard Lyon 1, UJM-Saint Etienne, CNRS, Inserm, CREATIS UMR 5220, U1206, F69621, VILLEURBANNE, France, Lyon, France, [2]Department of Physiology, Faculty of Biology and Medicine, University of Lausanne, Lausanne, Lausanne, Switzerland, [3]Centre de Recherche en Nutrition Humaine Rhône-Alpes (CRNH-RA), Centre Hospitalier Lyon Sud, Pierre-Bénite, Lyon, France, [4]Hospices Civils de Lyon, Département d'imagerie digestive, CHU Edouard Herriot, Lyon, Lyon, France
		A total of 39 volunteers underwent an imaging and spectroscopy protocol on a 3T Ingenia Philips system with an axial 3D spoiled-gradient multiple echo sequence on abdominal region and a set of three STEAM sequences acquired on subcutaneous adipose tissue, visceral adipose tissue and liver. The quantification of Proton density fat fraction (PDFF), proportion of saturated (SFA), monounsaturated (MUFA) or polyunsaturated (PUFA) fatty acids from both MRI and MRS methods were compared. Good correlation with a little bias was found for the liver PDFF. Values of PUFA, MUFA and SFA from both techniques were poorly correlated.

269	17:39	Quantitative Measurements of Deep Medullary Vein Caliber and Oxygenation Level Using MRI Phase and Complex Images
		Xiaopeng Zong[1] and Weili Lin[1]

		[1]Biomedical Research Imaging Center and Department of Radiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States
		Collagenosis-induced narrowing of deep medullary vein (DMV) caliber has been implicated as one of the main causes of small vessel disease. However, a non-invasive imaging method for monitoring the DMV narrowing is still lacking. We present an MRI method for non-invasive measurement of DMV caliber and oxygenation level base on MRI phase and complex images acquired using a double echo gradient echo sequence at 7 T. The measured DMV caliber distribution agreed well with earlier report. Our approach can serve as an invaluable tool for studying the role of venous lumen narrowing in the pathogenesis of small vessel disease.

270	17:51	Silent T1-Mapping Using the Variable Flip Angle Method with Zero Echo Time
		Emil Ljungberg[1,2], Ana Beatriz Solana Sanchez[2], Tobias C Wood[1], Shannon Kolind[3,4,5], Florian Wiesinger[2], and Gareth J Barker[1]
		[1]Neuroimaging, King's College London, London, United Kingdom, [2]GE Healthcare, Munich, Germany, [3]Medicine, University of British Columbia, Vancouver, BC, Canada, [4]Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada, [5]Radiology, University of British Columbia, Vancouver, BC, Canada
		In this work we present a silent whole brain T_1-mapping technique with zero echo time using a variable flip angle (VFA) scheme with a 3D radial sequence (RUFIS). The technique is compared to a conventional Cartesian gradient-echo based sequence (DESPOT1-HIFI) in a quantitative T_1 phantom as well as in vivo in a single subject. Phantom measurements showed good agreement between techniques with average difference of 28 ms. In vivo T_1 maps showed good correspondence between RUFIS and DESPOT1-HIFI.

271	18:03	Explicit mathematical expression for the Cramér-Rao lower bound for experimental design and parameter estimation in parallel imaging
		Mustapha Bouhrara[1] and Richard G. Spencer[1]
		[1]National Institutes of Health, Baltimore, MD, United States
		The Cramér-Rao lower bound (CRLB) is widely used in the design of magnetic resonance (MR) experiments for parameter estimation. Previous work has considered only Gaussian or Rician noise distributions in this calculation. However, the noise distribution for multiple-coil acquisitions, such as in parallel imaging, obeys the noncentral χ-distribution under many circumstances. Here, we present the general mathematical expression for the CRLB calculation for parameter estimation from multiple-coil acquisitions. Our results indicate that the CRLB calculation must account for the noncentral χ-distribution of noise in multi-coil acquisitions, especially in the low-to-moderate signal-to-noise ratio (SNR) regime.

Oral

Hyperpolarisation: Probe Development & Clinical Application

S04	Monday 16:15 - 18:15	*Moderators:* Kerstin Timm & Jan Henrik Ardenkjær-Larsen

272	16:15	In vivo Imaging of Hyperpolarized Silicon-29 Nanoparticles
		Grzegorz Kwiatkowski[1], Jonas Steinhauser[1], Patrick Wespi[1], Matthias Ernst[2], and Sebastian Kozerke[1]
		[1]Institute for Biomedical Engineering, ETH & University of Zurich, Zurich, Switzerland, [2]Labolatory of Physical Chemistry, ETH Zurich, Zurich, Switzerland
		Hyperpolarized silicon particles exhibit very long T_1 relaxation at room temperature, making them favourable as novel imaging MR probes. It has recently been shown that silicon particles in the nanometer size range can be efficiently polarized and image even after 4 hours upon transfer of the sample to the imaging system. The objective of the present work was to demonstrate the imaging capability of surface functionalized hyperpolarized nanometer size silicon particles in an experimental in-vivo setting.

273	16:27	An in vivo metabolic imaging study of myopathy in transgenic mice using C-13 hyperpolarized pyruvate generated by ParaHydrogen
		Francesca Reineri[1], Eleonora Cavallari[1], Carla Carrera[1], and Silvio Aime[1]
		[1]Molecular Biotechnology and Health Sciences, University of Torino, Torino, Italy
		Hyperpolarized [1-^{13}C]pyruvate has been widely exploited for the in vivo investigation of metabolic processes under normal and diseased conditions. The possibility to obtain it using the cost effective and fast PHIP (ParaHydrogen Induced Polarization) method would allow a widespread application of this powerful diagnostic tool to pre-clinical research and would pave the way to future clinical translation. Here we show the first in vivo studies carried out on genetically modified mice using [1-^{13}C]pyruvate obtained by means of the PHIP-SAH (PHIP-Side Arm Hydrogenation) method. The results obtained from PHIP-SAH hyperpolarized pyruvate are consistent with the pathologic state of the heart tissue.

274	16:39	Hyperpolarized sodium [1-13C]glycerate as a probe for assessing glycolysis in vivo
		Jae Mo Park[1,2,3], Marvin Wu[4], Thomas Hever[1], Xiaodong Wen[1], Daniel M Spielman[5], and Kelvin Billingsley[6]

		[1]Advanced Imaging Research Center, University of Texas Southwestern Medical Center, Dallas, TX, United States, [2]Radiology, University of Texas Southwestern Medical Center, Dallas, TX, United States, [3]Electrical and Computer Engineering, University of Texas at Dallas, Richardson, TX, United States, [4]Chemistry and Biochemistry, San Francisco State University, San Francisco, CA, United States, [5]Stanford University, Stanford, CA, United States, [6]Chemistry and Biochemistry, California State University, Fullerton, Fullerton, CA, United States
		We describe the synthesis, development and *in vivo* application of sodium [1-^{13}C]glycerate as a novel probe for evaluating glycolysis using hyperpolarized ^{13}C MRS. [^{13}C]glycerate displayed a high level of polarization and long spin-lattice relaxation time. *In vivo* spectroscopic studies with hyperpolarized [^{13}C]glycerate in rat liver furnished metabolic products, pyruvate and lactate, originating from glycolysis. The levels of production and relative intensities of these metabolites were directly correlated with the induced glycolytic state (fasted versus fed). This work establishes hyperpolarized [^{13}C]glycerate as a novel agent for clinically relevant ^{13}C MRS studies of energy metabolism and further provides opportunities for evaluating intracellular redox states in biochemical investigations.

275	16:51	Overestimation of cardiac lactate production due to liver metabolism of hyperpolarized [1-13C] pyruvate
		Patrick Wespi[1], Jonas Steinhauser[1], Grzegorz Kwiatkowski [1], and Sebastian Kozerke[1]
		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland
		Spectroscopy is widely used in hyperpolarized metabolic experiments due to its simplicity and robustness. In this work, it is shown that with spectroscopic acquisition in rat hearts, the cardiac lactate production is overestimated due to liver metabolism of [1-13] pyruvate. It is demonstrated that this overestimation can be addressed using spatially resolved data.

276	17:03	Hyperpolarized 13C Metabolic Imaging of Human Hypertrophic Cardiomyopathy
		Angus Z. Lau[1,2], Albert P. Chen[3], Justin Y.C. Lau[1,2], Benjamin J. Geraghty[1,2], William J. Perks[4], Idan Roifman[5], Graham A. Wright[1,2,5], Kim A. Connelly[6], and Charles H. Cunningham[1,2]
		[1]Physical Sciences Platform, Sunnybrook Research Institute, Toronto, ON, Canada, [2]Medical Biophysics, University of Toronto, Toronto, ON, Canada, [3]GE Healthcare, Toronto, ON, Canada, [4]Pharmacy, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [5]Schulich Heart Program, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [6]Cardiology, St. Michael's Hospital, Toronto, ON, Canada

		The feasibility of using hyperpolarized ^{13}C to interrogate in vivo human metabolism in the healthy heart has recently been demonstrated. In this abstract we demonstrate the feasibility of using hyperpolarized ^{13}C imaging to detect metabolic alterations in human hypertrophic cardiomyopathy. Results show significantly elevated ^{13}C-bicarbonate-to-pyruvate ratio near the apex of the heart, corresponding to the known location of disease. The ^{13}C-bicarbonate images also show a different spatial distribution from those observed in healthy volunteers. These results show good prospects for imaging the altered cardiac energetics in the diseased heart using this technology.

277	17:15	Imaging the healthy human brain with hyperpolarized [1-13C] pyruvate
		James T. Grist[1], Mary A. McLean[2], Surrin S. Deen[1], Frank Riemer[1], Charlotte J. Daniels[1], Andrew B. Gill[1], Fulvio Zaccagna[1], Rolf F. Schulte[3], Sarah F. Hilborne[1], Jackie P. Mason[1], James W. McKay[1], Arnaud Comment[4], Anita Chhabra[5], Vicky Fernandes[5], Hannah Loveday[5], Marie-Christine Laurent[1], Ilse Patterson[6], Ronnie Hernandez[6], Rhys A. Slough[6], Tomasz Matys[1], Ian B. Wilkinson[7], Bristi Basu[8], Claire Trumper[9], Damian J. Tyler[9], David J. Lomas[1], Martin J. Graves[1], Alasdair J. Coles[10], Kevin Brindle[2], and Ferdia A. Gallagher[1]
		[1]Radiology, University of Cambridge, Cambridge, United Kingdom, [2]Cancer Research UK Cambridge Institute, University of Cambridge, Cambridge, United Kingdom, [3]Global Research, General Electric, Munich, Germany, [4]Healthcare, General Electric, Cambridge, United Kingdom, [5]Pharmacy, Addenbrooke's Hospital, Cambridge, United Kingdom, [6]MRIS, Addenbrooke's Hospital, Cambridge, United Kingdom, [7]Medicine, University of Cambridge, Cambridge, United Kingdom, [8]Oncology, University of Cambridge, Cambridge, United Kingdom, [9]Physiology, Anatomy and Genetics, University of Oxford, Oxford, United Kingdom, [10]Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom
		Initial results from imaging the healthy human brain with [1-13C] pyruvate are presented. Labelled lactate and bicarbonate formation are seen, as well as differences in gray and white matter perfusion.

278	17:27	Hyperpolarized Carbon-13 Metabolic Imaging of Pediatric Patients with Brain Tumors: Initial Experience
		Ilwoo Park[1], Adam Autry[2], Yiran Chen[2], Jeremy Gordon[2], Lucas Carvajal[2], Hsin-Yu Chen[2], Robert Bok[2], Mark Van Criekinge[2], James Slater[2], Cassie Kline-Nunnally[3], Peder Larson[2], Daniel Vigneron[2], Janine Lupo[2], Duan Xu[2], and Sabine Mueller[4]
		[1]Radiology, Chonnam National University College of Medicine, Gwanju, Republic of Korea, [2]Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [3]Pediatric Hematology-Oncology, University of California San Francisco, San Francisco, CA, United States, [4]Neurology, Neurosurgery and Pediatrics, University of California San Francisco, San Francisco, CA, United States

		This study applied hyperpolarized ^{13}C metabolic imaging in pediatric populations for the first time to our knowledge. Dynamic ^{13}C data were acquired following injection of hyperpolarized [1-^{13}C]pyruvate in the first 3 pediatric patients with brain tumors as part of an ongoing trial (PNOC011,NCT02947373). No adverse effects were observed for these 3 patients. Pyruvate, lactate and bicarbonate signals with high SNR were detected in the pediatric brain. These preliminary results demonstrated the feasibility of using HP [1-^{13}C]pyruvate for assessing in vivo metabolism from pediatric patients with brain tumors and support ongoing investigation of this technology in pediatric patients.

279	17:39	Multimodal Characterization of In Vivo Metabolic Activities with Hyperpolarized 13C MRI, 18F-FDG PET, and EPR Imaging in Pancreatic Ductal Adenocarcinoma Tumors
		Kazutoshi Yamamoto[1], Tomohiro Seki[1], Shun Kishimoto[1], Nallathamby Devasahayam[1], Nobu Oshima[1], Stephen S Adler[1], Elaine Jagoda[1], Keita Saito[1], Jeffrey R Brender[1], Peter L Choyke[1], James B Mitchell[1], and Murali C Krishna[1]
		[1]National Cancer Institute, National Institutes of Health, Bethesda, MD, United States
		Profiling the metabolic and physiologic phenotypes of tumors has become important in treatment planning and response monitoring. Here, multimodal imaging methods, including hyperpolarized ^{13}C MRI, ^{18}F-FDG PET, and EPRI imaging, were used to profile the metabolic and physiologic features of human pancreatic ductal adenocarcinoma (PDAC) tumors, Hs766t, MiaPaCa-2, and SU.86.86. PDACs have some of the worst prognoses of all cancers. Experimental results have demonstrated, for the first time, the feasibility and advantages of multimodal metabolic and physiologic assessment of xenograft tumors. This multimodal imaging approach will complement tumor characterization, lead to better prognostics, and earlier response monitoring in cancer treatment.

280	17:51	The Rate of Hyperpolarized [1-13C] Pyruvate to [1-13C] Lactate Conversion Distinguishes High-Grade Prostate Cancer from Low-Grade Prostate Cancer and Normal Peripheral Zone Tissue in Patients
		Natalie Korn[1,2], Peder EZ Larson[1,2], Hsin-Yu Chen[1,2], Jeremy Gordon[1], Robert A Bok[1], Mark VanCriekinge[1], James Slater[1], Rahul Aggarwal[3], Matthew Cooperberg[3], Romelyn Delos Santos[1], Justin Delos Santos[1], Jeffry Simko[4], Susan M Noworolski[1,2], Daniel B Vigneron[1,2], and John Kurhanewicz[1,2]
		[1]Radiology and Biomedical Imaging, University of California at San Francisco, San Francisco, CA, United States, [2]The Graduate Group in Bioengineering, Universities of California at Berkeley and San Francisco, Berkeley and San Francisco, CA, United States, [3]Urology, University of California at San Francisco, San Francisco, CA, United States, [4]Pathology, University of California at San Francisco, San Francisco, CA, United States

		The accurate discrimination of aggressive from indolent prostate cancer at diagnosis remains a pressing clinical need. High spatial and temporal resolution 3D dynamic hyperpolarized ^{13}C MRSI has previously demonstrated the ability to correlate hyperpolarized (HP) [1-^{13}C]pyruvate to [1-^{13}C]lactate conversion, k_{PL}, with cancer grade in murine models. This initial analysis of patients studies enrolled in a phase II pre-prostatectomy clinical trial demonstrated for the first time that maxmium k_{PL} ($k_{PLmax)}$ is significantly elevated in high-grade prostate cancer versus both normal (p=0.0003) and low-grade disease (p=0.034).

281	18:03	Detection of D-amino acid oxidase using hyperpolarized molecular probes
		Alice Radaelli[1], Hikari Ananda Infinity Yoshihara[1], and Rolf Gruetter[1,2]
		[1]Laboratory for Functional and Metabolic Imaging (LIFMET), EPFL, Lausanne, Switzerland, [2]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland
		D-amino acid oxidase (DAO) is an enzyme that catalyzes the degradation of D-amino acids in the body. Here, we explored the possibility of detecting D-amino acid oxidase activity by monitoring its metabolism in the rat kidney after a bolus injection of hyperpolarized D-[1-^{13}C]alanine. Our data show that D-alanine is readily converted to lactate only when the DAO enzyme is not inhibited, indicating that the observed metabolism is that of DAO.

Oral

Myocardial Tissue Characterisation

S05	Monday 16:15 - 18:15	*Moderators:* Pierre Croisille & Andrew Scott

282	16:15	Magnetic susceptibility of hemorrhagic myocardial infarction: correlation with tissue iron and comparison with relaxation time MRI
		Brianna F. Moon[1], Srikant Kamesh Iyer PhD[2], Michael P. Solomon[1], Anya T. Hall[1], Rishabh Kumar[3], Elizabeth M. Higbee-Dempsey[4], Andrew Tsourkas PhD[1], Akito Imai MD[5], Keitaro Okamoto MD[5], Yoshiaki Saito MD[5], Jerry Zsido II[5], Joseph H. Gorman III MD[5], Robert C. Gorman MD[5], Giovanni Ferrari PhD[6], and Walter R.T. Witschey PhD[2]
		[1]Bioengineering, University of Pennsylvania, Philadelphia, PA, United States, [2]Radiology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States, [3]Biophysics, University of Pennsylvania, Philadelphia, PA, United States, [4]Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA, United States, [5]Surgery, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States, [6]Surgery, Columbia University, New York City, NY, United States

		Hemorrhagic myocardial infarction (MI) is a frequent complication of primary percutaneous coronary intervention and independently associated with impaired LV remodeling, function, and arrhythmias. We demonstrate that cardiac quantitative susceptibility mapping (QSM) shows increased susceptibility in infarcts compared to remote myocardium and correlates with iron content and infarct pathophysiology. QSM is a more specific marker of hemorrhagic MI than relaxation time MRI, susceptibility-weighted imaging, and late gadolinium enhanced (LGE) MRI.

283	16:27	Myocardial T2 mapping using a Black-blood hEart-rate Adaptive T2-prepared bSSFP (BEATS) sequence
		Chengyan Wang[1,2], Jihye Jang[1,3], Ahmed Fahmy[1,4], Jinkyu Kang[1], Beth Goddu[1], Sophie Berg[1], Jue Zhang[2], Xiaoying Wang[2,5], Warren J. Manning[1,6], and Reza Nezafat[1]
		[1]Department of Medicine (Cardiovascular Division), Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States, [2]Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, China, [3]Department of Computer Science, Technical University of Munich, Munich, Germany, [4]Biomedical Engineering Department, Cairo University, Giza, Egypt, [5]Department of Radiology, Peking University First Hospital, Beijing, China, [6]Department of Radiology, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States
		Quantification of T2 in areas bordering myocardium and blood pool is challenging due to partial volume errors. Blood signal suppression would effectively reduce partial volume effects and improve image contrast at the blood-myocardium boundaries. This study proposed a Black-blood hEart-rate Adaptive T2-prepared bSSFP (BEATS) sequence for myocardial T2 mapping to improve blood-myocardial border definition. Both phantom and in vivo studies proved the advantages of BEATS sequence compared to T2prep-bSSFP T2 mapping. The proposed BEATS sequence efficiently suppresses the blood signal, resulting in better definition of blood/myocardium border by reducing the impact of partial volume effect in T2 measurements, which improves the assessment of edema post myocardial infarction.

284	16:39	Assessment of Myocardial Fibre Architecture in Cardiac Amyloidosis Patients using In-Vivo Cardiac Diffusion Tensor Imaging
		Constantin von Deuster[1], Alexander Gotschy[1,2], Robbert J.H. van Gorkum[1], Mareike Gastl[1,2,3], Ella Vintschger[1], Andreas Flammer[2], Robert Manka[1,2], Christian T. Stoeck[1], and Sebastian Kozerke[1]
		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland, [2]Department of Cardiology, University Hospital Zurich, Zurich, Switzerland, [3]Dept. Cardiology, Pneumology and Angiology, Heinrich Heine University, Düsseldorf, Germany

		In-vivo cardiac diffusion tensor imaging (cDTI) allows imaging of alterations in the cardiac fibre architecture in diseased hearts. In this work, changes in the myocardial microstructure in patients with cardiac amyloidosis were assessed using cDTI and T1 mapping. Mean diffusivity and $T1_{native}$ are significantly increased in the patients and the helical fibre configuration is comparable to healthy controls. There is a trend towards higher/lower MD/FA with increased $T1_{native}$, respectively. In agreement with T1 mapping, diffusion results support the presence of myocardial degeneration and emphasize the potential of cDTI as contrast agent free tool for characterizing cardiac involvement in amyloidosis patients.

285	16:51	Cardiac Magnetic Resonance Elastography for the Diagnosis of Patients with Heart Failure with Preserved Ejection Fraction
		Arvin Arani[1], Shivaram P. Arunachalam[1], Phillip J. Rossman[1], Joshua D. Trzasko[1], Kevin Glaser[1], Yi Sui[1], Kiaran McGee[1], Armando Manduca[1], Barry A. Borlaug[1], Richard Ehman[1], and Philip Araoz[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States
		Heart failure with preserved ejection fraction (HFpEF) accounts for half of incident heart failure cases per year. Currently, the diagnostic reference standard is invasive. The objective of this study is to evaluate if cardiac MR elastography (MRE) can measure increased myocardial stiffness in patients with HFpEF. Fifty-eight volunteers and 10 patients were enrolled. The mean left-ventricle myocardial stiffness of HFpEF patients (10.5±1.7 kPa) was significantly higher (p=0.002) than control subjects (8.0±1.2 kPa).This study motivates further investigation into the use of cardiac MRE as a quantitative noninvasive imaging technique to assist in the diagnosis and therapy monitoring of patients with HFpEF.

286	17:03	Cardiac Phase-resolved Late-Gadolinium Enhancement Imaging
		Sebastian Weingärtner[1,2,3], Burhaneddin Yaman[1,2], Chetan Shenoy[4], Marcel Prothmann[5], Felix Wenson[5], Jeanette Schulz-Menger[5,6], and Mehmet Akcakaya[1,2]
		[1]Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States, [2]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [3]Computer Assisted Clincial Medicine, Heidelberg University, Mannheim, Germany, [4]University of Minnesota, Minneapolis, MN, United States, [5]Working Group on Cardiovascular Magnetic Resonance Imaging, Max-Delbrück-Centrum and Charité - Medical University Berlin, Berlin, Germany, [6]Department of Cardiology and Nephrology, HELIOS Klinikum Berlin-Buch, Berlin, Germany
		Late Gadolinium Enhancement (LGE) is commonly acquired during a single end-diastolic phase with inversion-recovery contrast that nulls healthy myocardial tissue. In this work, we propose a method for acquisition of cardiac phase-resolved LGE images based on an ECG triggered Look-Locker experiment with continuous FLASH imaging. Semi-quantitative evaluation of this pulsed-inversion recovery allows synthetization of LGE image contrast for all cardiac phases. Accurate functional depiction with temporal resolution up to 60 ms is obtained in healthy subjects at 3T. Images of 20 patients on a clinical 1.5T scanner show promising depiction of focal scar at a temporal resolution of 80ms.

287	17:15	High resolution in-vivo diffusion tensor cardiovascular magnetic resonance: a comparison of single-shot EPI and interleaved spiral trajectories with motion induced phase correction
		Margarita Gorodezky[1,2], Andrew David Scott[1,2], Pedro F Ferreira[1,2], Sonia Nielles-Vallespin[1,2,3], Peter D Gatehouse[1,2], Dudley J Pennell[1,2], and David N Firmin[1,2]
		[1]Cardiovascular Magnetic Resonance Unit, Royal Brompton Hospital, London, United Kingdom, [2]National Heart and Lung Institute, Imperial College, London, United Kingdom, [3]National Heart, Lung and Blood Institute, National Institutes of Health, Bethesda, MD, United States
		The spatial resolution of DT-CMR STEAM acquisitions was increased by implementing an interleaved variable density spiral readout. Bulk motion during STEAM diffusion encoding is unavoidably encoded in the image phase which can result in signal loss for multi-shot acquisition when the multiple interleaves are combined. A phase correction was implemented using the fully sampled centres of k-space to calculate the differences in phase between interleaves. In 7 volunteers we show improved data quality at 2.0x2.0mm^2 using interleaved spirals compared to single-shot EPI and we obtain similar DT-CMR parameters.
288	17:27	Microvascular obstruction impacts recovery of T1 and T2 relaxation and strain parameters following acute myocardial infarction
		Dipal Patel[1], Venkat Ramanan[1,2], Idan Roifman[2], Mohammad Zia[2], Kim A Connelly[3], Graham A Wright[1,2,4], and Nilesh R Ghugre[1,2,4]
		[1]Physical Sciences Platform, Sunnybrook Research Institute, Toronto, ON, Canada, [2]Schulich Heart Research Program, Sunnybrook Research Institute, Toronto, ON, Canada, [3]Division of Cardiology, St. Michael's Hospital, Toronto, ON, Canada, [4]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada
		Microvascular obstruction (MVO) is a frequent complication in acute myocardial infarction (AMI). A comprehensive regional and serial characterization of tissue response in the presence and absence of MVO will help assess the high-risk patients. In this study, we utilized T1 and T2 relaxation as well as tissue strain properties to evaluate tissue response in STEMI patient's post-AMI. We observed that measures of infarct edema, hemorrhage and strain in patients with MVO fail to recover to remote levels and have significantly lower recovery rates compared to patients without MVO. Remote T2 alterations may further be an early indicator of adverse remodeling. Our study shows that MVO impacts disease progression by hindering the regional myocardial systolic function and edema recovery post-AMI.
289	17:39	The effects of cardiac allograft vasculopathy on intimal coronary artery wall thickness, myocardial fibrosis, and myocardial extracellular volume
		Ruud B van Heeswijk[1,2], Jessica AM Bastiaansen[1], Juan F Iglesias[3], Sophie Degrauwe[3], Samuel Rotman[4], Jérôme Yerly[1,2], Giulia Ginami[1,5], Matthias Stuber[1,2], and Roger Hullin[3]

		[1]Radiology, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [2]Center for BioMedical Imaging (CIBM), Lausanne, Switzerland, [3]Cardiology, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [4]Pathology, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [5]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom
		Cardiac allograft vasculopathy (CAV) occurs with a high prevalence after heart transplantation (HTx) and is a major cause of mid-term to late heart transplant failure. In this study we investigated whether the presence of CAV as diagnosed by x-ray coronary angiography or intima thickness as assessed by optical coherence tomography (OCT) is linked with the myocardial T1 relaxation time, extracellular volume, or interstitial fibrosis as assessed by endomyocardial biopsies (EMB).

290	17:51	The Difference between Extracellular Space Expansion and Diffuse Myocardia Fibrosis in Defferent Severity Distolic Dysfunction (DD) Type 2 Diabetes Mellitus (T2DM) Rhesus Monkeys using Excellelar Volume mapping and Non-contrast T1ρ mapping
		Yu Zhang[1], Li Gong[2], Yushu Chen[1], Wen Zeng[2], Jie Zheng[3], and Fabao Gao[1,2]
		[1]West China Hospital, Sichuan University, Chengdu, China, [2]Sichuan Primed Bio-Tech Group Co., Ltd, Chengdu, China, [3]Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, MO, United States
		In this study, diffuse myocardial fibrosis was quantifitied in type 2 diabetes mellitus (T2DM) rhesus monkeys with different severity diastolic dysfunction (DD) using ECV derived from T1 mapping and mFI derived from non-contrast T1ρ mapping. Different behaviors of ECV and mFI to differentiate HC from T2DM with mild DD was observed. This reflects the difference between extracellular space expansion and collagen content during the process of myocardial fibrosis. This difference is benifite for us to better understand the pathophysiology of DD.

291	18:03	Intravoxel incoherent motion MR imaging: Evaluation of myocardial microcirculation in diabetes patients
		li shi lan [1], li xin[2], li zhi yong[2], song qing wei[1], and liu ai lian[2]
		[1]Radiology, Dalian medical university, Dalian, China, [2]Dalian medical university, Dalian, China
		Because of 80% type 2 diabetic patients died of cardiovascular complications, diabetic microangiopathy in the diabetic cardiomyopathy couldn’t be ignored. At present, we lack simple and accurate methods for assessment of myocardial microcirculation. Intravoxel incoherent motion (IVIM) technology is a new noninvasive method that can be used for quantitatively assessing myocardial microcirculation status.

Oral

MR Safety: PNS & RF Heating

S06	Monday 16:15 - 18:15	*Moderators:* Alon Leeor & Filiz Yetisir

292	16:15	Reduction of Peripheral Nerve Stimulation (PNS) using Pre-Excitation Targeting the Potassium System (PRE-TAPS)
		Mathias Davids[1,2], Bastien Guérin[2,3], Martin Schmelz[4], Lothar R Schad[1], and Lawrence L Wald[2,3,5]
		[1]Computer Assisted Clinical Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany, [2]Martinos Center for Biomedical Imaging, Dept. of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [3]Harvard Medical School, Boston, MA, United States, [4]Department of Anesthesiology Mannheim, Heidelberg University, Mannheim, Germany, [5]Harvard-MIT Division of Health Sciences and Technology, Cambridge, MA, United States
		PNS has become the main limitation of fast MRI using current gradient hardware. We recently presented a novel pipeline to simulate magnetically induced PNS thresholds in arbitrary coil geometries. Now, we use this framework and detailed modeling of ion dynamics and Action Potential (AP) generation to test a new strategy for PNS reduction. The method (which we call “PRE-TAPS”) pre-saturates the nerve membrane by playing gradient pulses prior to the main imaging gradient. Our model suggests that this simple pulse-sequence modification could effectively increase PNS thresholds by up to 30%.

293	16:27	On-line Subject-Specific Local SAR Assessment by Deep Learning
		E.F. Meliado[1,2], A.J.E. Raaijmakers[1,3], M.H.F. Savenije[1], A. Sbrizzi[1], M. Maspero[1], P.R. Luijten[1], and C.A.T. van den Berg[1]
		[1]Center for Image Sciences, University Medical Center Utrecht, Utrecht, Netherlands, [2]MR Code BV, Zaltbommel, Netherlands, [3]Biomedical Image Analysis, Eindhoven University of Technology, Eindhoven, Netherlands
		One of the most critical aspects that limits the application of ultra-high field MRI is the local Specific Absorption Rate (SAR) evaluation. The key aspect is that local SAR information could only be obtained by off-line simulation using generic body models, which hardly match with the patient's body and positioning. In this work we present a first deep learning approach for local SAR assessment. Results, show that the relation between local SAR on the one hand and MR Dixon images and B1-field maps on the other hand, can be accurately and instantaneously mapped by a Convolutional Neural Network (CNN).

294	16:39	NEUROMAN: Reference Computational Human Phantoms for Evaluation of Safety Thresholds for Peripheral Nerve Stimulation
		Bryn A Lloyd[1], Antonino Cassarà[1], Silvia Farcito[1], Esra Neufeld[1], Beom Sun Chung[2], Jin Seo Park[3], Min Suk Chung[2], and Niels Kuster[1,4]

		[1]IT'IS Foundation, Zürich, Switzerland, [2]Department of Anatomy, Ajou University, Suwon, Republic of Korea, [3]Department of Anatomy, Dongguk University, Gyeongju, Republic of Korea, [4]ETH, Zürich, Switzerland
		The trend towards stronger magnetic fields and/or faster gradient switching in magnetic resonance imaging poses safety risks for patients, e.g., due to tissue heating and unwanted neurostimulation. The IEEE-ICES TC95 SC6 was formed to re-evaluate nerve excitation safety thresholds in response to temporal and spatial characteristics of electric fields induced by externally applied fields or implants. To this end, we are developing reference human anatomical models with unprecedented details in the peripheral nervous system, connectivity to organs and muscles, and functionalized with compartmental nerve models to investigate interactions with neuronal electrophysiology. We employ these phantoms to investigate current safety guidelines.

295	16:51	Workflow proposal for defining SAR safety margins in parallel transmission
		Nicolas Boulant[1], Vincent Gras[1], Alexis Amadon[1], Michel Luong[2], Guillaume Ferrand[2], and Alexandre Vignaud[1]
		[1]NeuroSpin, CEA, Saclay, France, [2]Irfu, CEA, Saclay, France
		SAR calculations in parallel transmission (pTx) typically rely on electromagnetic simulations performed on generic models. Uncertainties however often exist due to tolerances in the lumped element values, cable losses, phase offsets and different coupling between transmit elements. Additional uncertainties in SAR evaluation include intersubject variability and exam supervision. In this work, we review a workflow that has been implemented in our laboratory with home-made and commercial pTx coils at 7T. Based on this strategy, nearly 100 healthy volunteers have been scanned with no reported incidents, while still allowing to exploit pTx to mitigate efficiently the RF inhomogeneity problem.

296	17:03	SAR estimation error due to body model mismatch for fetal imaging at 3 Tesla
		Filiz Yetisir[1], Esra Abaci Turk[1], Bastien Guerin[2,3], Borjan Gagoski[1], Natalie Copeland[1], P. Ellen Grant[1], Lawrence L. Wald[2,3,4], and Elfar Adalsteinsson[5,6]
		[1]Fetal-Neonatal Neuroimaging and Developmental Science Center, Boston Children's Hospital, Boston, MA, United States, [2]A.A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [3]Harvard Medical School, Boston, MA, United States, [4]Harvard-MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology, Boston, MA, United States, [5]Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [6]Institute for Medical Engineering and Science, Massachusetts Institute of Technology, Cambridge, MA, United States

		RF safety concerns have been raised for both the mother and the fetus for 3 T fetal MRI. Parallel transmission can address these concerns by reducing the maternal and fetal SAR however it also relies on one or more body models to predict that individual's local SAR. In this work, we assess the range of error incurred when various pregnant or non-pregnant models are used to predict SAR in pregnant patients. We model the degree of over or underestimation of SAR in 56 combinations of model/patient and find a maximum SAR under/over-estimation of 59%/142%.

297	17:15	Optimizing the Topography of Transmit Coils for SAR Management
		Alireza Sadeghi-Tarakameh[1,2], Angel Torrado-Carvajal[3], Cemre Ariyurek[1,2], Ergin Atalar[1,2], Gregor Adriany[4], Gregory J. Metzger[4], Russell L. Lagore[4], Lance DelaBarre[4], Andrea Grant[4], Pierre-Francois Van de Moortele[4], Kamil Ugurbil[4], and Yigitcan Eryaman[4]
		[1]Electrical and Electronics Engineering Department, Bilkent University, Ankara, Turkey, [2]National Magnetic Resonance Research Center (UMRAM), Ankara, Turkey, [3]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Charlestown, MA, United States, [4]Center for Magnetic Resonance Research (CMRR), University of Minnesota, Minneapolis, MN, United States
		Specific absorption rate (SAR) is a significant issue for ultra-high field (UHF, B0≥7T) imaging. In this study, we investigate a strategy based on optimizing the topography of transmit elements in 3D (i.e., adding bumps to a resonant planar structure) in order to reduce the local SAR while keeping B_1^+ efficiency constant inside a region of interest. For proof of concept, we modified three different resonant structures and compared their performance to previous designs with EM simulations. In addition, we built one of the proposed design and experimentally tested it using a whole-body 10.5T scanner.

298	17:27	Magnetic resonance imaging in patients with cardiac implanted electrical devices: single centre two year experience including thoracic imaging and non-MRI conditional devices.
		Joseph Martin[1,2], Anish N Bhuva[3,4], Peter Kellman[5], Redha Boubertakh[1,6], Marc E Miquel[1,6], Matthieu Ruthven[1], Adam Graham Graham[3], Patricia Feuchter[3], Angela Hawkins[3], Richard Schilling[3], James C Moon[3], Martin Lowe Lowe[3], Neha Sekhri[3], and Charlotte Manisty[3,4]
		[1]Clinical Physics, Barts Health NHS Trust, London, United Kingdom, [2]Medical Physics and Engineering, Kings College London, London, United Kingdom, [3]Department of Cardiovascular Imaging, Barts Heart Centre, Barts Health NHS Trust, London, United Kingdom, [4]Institutes for Cardiovascular Science, University College London, London, United Kingdom, [5]National Institutes of Health, Bethesda, MD, United States, [6]William Harvey Research Institute, Queen Mary University of London, London, United Kingdom

		Over a million patients worldwide have cardiac implantable electronic devices (CIEDs), with a 50-75% lifetime MRI requirement. Although conventionally contraindicated, MRI-conditional CIEDs and evidence supporting safer scanning of non-MRI conditional CIEDs are changing practice. We report single center experience of CIED MRI scanning over 24 months. 179 MRI scans were acquired, 31% non-MRI conditional devices, 79% thoracic scans. Clinical impact was high (including cancer diagnosis and treatment planning, suspected cord compression and stroke). All patients were safely scanned with no clinically-significant events or device parameter changes resulting from MRI. These data support increased provision of MRI to CIED patients.

299	17:39	Exploring the impact of nulling currents on a cardiac guidewire in reducing worst case SAR at 1.5T
		J. Nuno Teixeira[1], Felipe Godinez[1], Shaihan Malik[1], and Jo V. Hajnal[1]
		[1]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom
		MRI with non-MR compatible objects, namely wires, poses several challenges as risks of high Local SAR and reduced image quality due to B1 enhancement. In this work we looked at previously proved current nulling techniques and at their relationship with the reduction of worst case SAR scenarios. Results showed that current nulling leads to large reductions in worst case SAR, but that performance varies with coil design and sensor location. The analysis could be used to aid design of experimental setup for maximum safety.

300	17:51	Reduction of the absorbed power around electrode tips in deep brain stimulation patients using pTx: Impact of number and arrangement of channels
		Bastien Guerin[1,2], Darin Dougherty[2,3], and Lawrence L. Wald[1,2]
		[1]Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Psychiatry, Massachusetts General Hospital, Charlestown, MA, United States
		We assess the potential of pTx for reduction of the absorbed power around electrode tips (APAET) in DBS patients using a realistic DBS patient model and electromagnetic field co-simulation. We simulate 5 coils, including a birdcage coil driven in quadrature and as a 2-channel pTx coil as well as four pTx coils with up to 16 channels arranged in up to two rows. We compare magnitude least square pulses with explicit constraints on the APAET and global SAR. We show that pTx, especially using head-only arrays, has the potential to alleviate the safety problem of DBS patients at 3 Tesla.

301	18:03	Comparison between experimental and simulated electric fields near a hip implant in a parallel transmit hip coil
		Aurelien Destruel[1], Miguel Fuentes[1,2], Ewald Weber[1], Kieran O'Brien[3,4], Markus Barth[4], Feng Liu[1], and Stuart Crozier[1]

		[1]School of Information Technology and Electrical Engineering, The University of Queensland, Brisbane, Australia, [2]School of Public Health and Preventive Medicine, Population Health Research on Electromagnetic Energy, Monash University, Australia, [3]Siemens Healthcare Pty Ltd, Brisbane, Australia, [4]Centre for Advanced Imaging, The University of Queensland, Brisbane, Australia
		The high conductivity of metal implants causes them to focus electric fields in tissue, which may increase the local temperature. In the case of parallel transmit (pTx) MRI, careful simulations of the patient and coil are required to predict heating, but validation of the simulations is challenging near metal implants. In this work, direct measurement of E-field near a hip prosthesis is performed inside a pTx hip coil, and results are compared with simulated data with and without considering decoupling. Neglecting decoupling leads to differences of up to 80% with measured data, showing the importance of realistic simulations.

Oral

Arterial Spin Labeling

W03/04	Monday 16:15 - 18:15	*Moderators:* Weiying Dai & David Thomas

302	16:15	Advanced Automatic Planning for Super-Selective Arterial Spin Labeling Flow Territory Mapping
		Michael Helle[1], Fabian Wenzel[1], Kim van de Ven[2], and Peter Boernert[1]
		[1]Philips Research, Hamburg, Germany, [2]Philips Healthcare, Best, Netherlands
		This study presents an advanced fully automated approach based on vessel detection and analysis. It is completely integrated in the scanner console and allows labeling of the major brain feeding vessels in an efficient and robust way. Average processing time to find optimal labeling positions for all major brain feeding arteries is <15 seconds.

303	16:27	Non-contrast assessment of blood-brain-barrier permeability with water-extraction-with-phase-contrast-arterial-spin-tagging (WEPCAST) MRI
		Zixuan Lin[1], Yang Li[1], Pan Su[1], Deng Mao[1], Zhiliang Wei[1], Jay Pillai[1], Abhay Moghekar[2], Matthias van Osch[3], Yulin Ge[4], and Hanzhang Lu[1]
		[1]Department of Radiology, Johns Hopkins University, Baltimore, MD, United States, [2]Department of Neurology, Johns Hopkins University, Baltimore, MD, United States, [3]Department of Radiology, Leiden University Medical Center, Leiden, Netherlands, [4]Department of Radiology, New York University Langone Medical Center, New York, NY, United States

		A new method for non-contrast assessment of blood-brain-barrier (BBB) permeability to water has been proposed: water-extraction-with-phase-contrast-arterial-spin-tagging (WEPCAST) MRI, which allows selective imaging of venous ASL signal. Studies were performed to show proof-of-principle and Look-Locker readout were applied to expedite data acquisition. The results were consistent with previous literature. Mild hypercapnia was also shown to enhance the sensitivity of the technique significantly.

304	16:39	Investigation into water transport mechanisms in the brain using a combination of T2 measurements and crusher gradients with ASL
		Leonie Petitclerc[1], Sophie Schmid[1,2], Wouter M. Teeuwisse[1,2], and Matthias J. P. van Osch[1,2]
		[1]C.J. Gorter Center for High Field MRI, Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Leiden Institute of Brain and Cognition, Leiden, Netherlands
		TRUST and crusher gradients were combined with time-encoded pCASL to examine the transport of water from the vasculature to the tissue in the brain. At early time points, where the intravascular portion of the ASL signal is high, the crusher gradients resulted in a large reduction in the average signal. By comparing the intravascular fraction obtained from crushed signal to T2 measurements, it was observed that the change in T2 is greater in later time points than the change in intravascular fraction. This suggests that T2 methods are more sensitive to alterations in the blood-brain barrier than crusher gradient techniques.

305	16:51	Arterial Spin Labeled Input Function (ASLIF): signal acquisition during pseudo-continuous arterial spin labeling
		Matthias Günther[1,2,3]
		[1]Fraunhofer MEVIS, Bremen, Germany, [2]University Bremen, Bremen, Germany, [3]mediri GmbH, Heidelberg, Germany
		In ASL pseudo-continuous labeling (pCASL) is often used as a labelling scheme due to its increased SNR compared to pulsed variants. After labeling and a subsequent post-labeling delay, the amount of labeled blood in the organ of interest is acquired. In this abstract, we describe a new approach, which allows to measure the blood signal while it is labeled. Results are presented for a four-phase Hadamard-encoded pCASL sequence. This will ultimately allow for a realtime monitoring of the arterial input function in pCASL.

306	17:03	Time-encoded golden angle radial ASL
		Merlijn C.E. van der Plas[1], Sophie Schmid[1], Maarten Versluis[2], and Matthias J.P. van Osch[1]

		[1]C.J. Gorter Center for high field MRI, Department of Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Philips, Best, Netherlands
		The golden angle readout provides a flexible approach to acquire multiple reconstructions, each with a different trade-off between spatial and temporal resolution from the same dataset. In combination with a Hadamard labeling scheme, the golden angle readout can be optimized for reconstructions at multiple spatial resolutions, allowing for multi-slice acquisition. By changing to single-slice acquisition, high temporal resolution angiography and high quality perfusion images can be reconstructed from a single dataset.

307	17:15	Cerebral Blood Volume Mapping using Fourier-Transform based Velocity-Selective Saturation Pulse Trains
		Qin Qin[1,2], Yaoming Qu[3], Wenbo Li[1,2], Dapeng Liu[1,2], Taehoon Shin[4,5], Doris Lin[1], Peter van Zijl[1,2], and Zhibo Wen[3]
		[1]Johns Hopkins University, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Department of Radiology, Zhujiang Hospital, Southern Medical University, Guangzhou, China, [4]Ewha Womans University, Seoul, Republic of Korea, [5]Case Western Reserve University, Cleveland, OH, United States
		A new non-contrast cerebral blood volume (CBV) quantification technique is proposed using Fourier-transform based velocity-selective saturation (FT-VSS) pulse trains. Its utility is assessed for healthy subjects at 3T and compared to a method using conventional flow-dephasing VS pulse trains. FT-VSS showed greater immunity to gradient imperfections and up to 40% higher SNR. The better performance of FT-VSS pulse trains in CBV measurements can be explained by the effective background suppression related to its velocity-selective profile: static tissue signal in the saturation band and flowing spins in the passband, which is opposite from the velocity response of the conventional method.

308	17:27	Robust estimation of quantitative perfusion from multi-phase pseudo-continuous arterial spin labelling
		Michael A Chappell[1], Martin Craig[1], James R Larkin[2], Manon A Simard[2], Nicola R Sibson[2], and Thomas W Okell[3]
		[1]Institute of Biomedical Engineering, University of Oxford, Oxford, United Kingdom, [2]Cancer Research UK & Medical Research Council Oxford Institute for Radiation Oncology, Department of Oncology, University of Oxford, Oxford, United Kingdom, [3]Wellcome Centre for Integrative Neuroimaging, FMRIB, University Oxford, Oxford, United Kingdom
		Multi-phase pcASL has been proposed as a means to achieve accurate perfusion quantification that is robust to imperfect shim in the labelling plane. There exists a previously unrecognised bias in the estimation process that is a function of noise on the data. In this work this boas is addressed, exploiting information common to voxels containing tissue fed by the same artery, identified using clustering methods.

309	17:39	Optimized Scan Design for ASL Fingerprinting and Multiparametric Estimation using Neural Network Regression
		Anish Lahiri[1], Jeffrey A Fessler[1], and Luis Hernandez-Garcia[2]
		[1]Dept of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States, [2]FMRI Laboratory, University of Michigan, Ann Arbor, MI, United States
		We investigate an optimization method for ASL fingerprinting acquisition schemes as well as a neural network framework for estimating hemodynamic parameters from the data.

310	17:51	Improving Perfusion Image Quality and Quantification Accuracy Using Multi-contrast MRI and Deep Convolutional Neural Networks
		Jia Guo[1], Enhao Gong[2], Maged Goubran[1], Audrey P. Fan[1], Mohammad M. Khalighi[3], and Greg Zaharchuk[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering, Stanford University, Stanford, CA, United States, [3]Global Applied Science Lab, GE Healthcare, Menlo Park, CA, United States
		We propose a novel method that uses deep convolutional neural networks (dCNNs) to combine multiple contrasts from MRI, including single- and multi-delay pseudo-continuous arterial spin labeling (PCASL) and structural scans, to synthesize perfusion maps that approach the accuracy of the PET perfusion measurements. The dCNN was trained and tested on both healthy and patient datasets, and demonstrated significant improvement on both image quality (higher structural similarity and lower normalized root mean square error) and quantification accuracy (regional CBF comparable with PET) than either ASL method alone. This method may potentially be generalized to other qualitative/quantitative applications.

311	18:03	Acceleration of arterial spin labeling data acquisition using spatio-temporal total generalized variation (TGV) reconstruction
		Stefan Manfred Spann[1], Christoph Stefan Aigner[1], Matthias Schloegl[1], Andreas Lesch[1], Kristian Bredies[2], Stefan Ropele[3], Daniela Pinter[3], Lukas Pirpamer[3], and Rudolf Stollberger[1,4]
		[1]Institute of Medical Engineering, Graz University of Technology, Graz, Austria, [2]Institute of Mathematics and Scientific Computing, University of Graz, Graz, Austria, [3]Department of Neurology, Medical University of Graz, Graz, Austria, [4]BioTechMed-Graz, Graz, Austria
		3D imaging sequences such as GRASE or RARE-SoSP are the preferable choice for acquiring ASL images. However, a tradeoff between the number of segments and blurring in the images due to the T2 decay has to be chosen. In this study we propose a reconstruction algorithm based on total generalized variation for reducing the number of segments and therefore the acquisition time of one image. We incorporate the averaging procedure in the reconstruction process instead of reconstructing each image individually. This allows exploiting temporal redundancy and spatial similarity for improving the reconstruction quality of ASL images.

Study Groups

MR Flow & Motion Quantitation Business Meeting

W07	Monday 17:15 - 18:15	*(no CME credit)*

Study Groups

Placenta & Fetus Business Meeting

W08	Monday 17:15 - 18:15	*(no CME credit)*

Event

ESMRMB Business Meeting

W03/04	Monday 18:30 - 19:30	*(no CME credit)*

Event

Manuscript Reviewing for ISMRM's Scientific Journals

W05/06	Monday 18:30 - 19:30	*(no CME credit)*

Tuesday, 19 June 2018

Go to top
Sunrise Session

Tractography in the Operating Theatre

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

N03	Tuesday 7:00 - 7:50	*Moderators:* Qiyuan Tian & Chris Clark

7:00	Next-Generation Diffusion Anisotropy Mapping Techniques for Neurosurgery
	Timothy Shepherd

7:25	Using Tractography to Guide Tumor Resections
	Natalie Voets

7:50	Adjournment & Meet the Teachers

Sunrise Session

Go Faster in Clinical Imaging: Multiband Imaging

Organizers: Jongho Lee, Utaroh Motosugi, Yi-Fen Yen

N04	Tuesday 7:00 - 7:50	*Moderators:* Koji Sakai & Yi-Fen Yen

7:00	Basic Physics of Multiband Imaging
	Berkin Bilgic

7:25	Clinical Applications of Multiband Imaging
	Seung Hong Choi

7:50	Adjournment & Meet the Teachers

Sunrise Session

From Diagnosis to Assessing Therapy Response: Gynecological Malignancy

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Tuesday 7:00 - 7:50	*Moderators:* Victoria Chernyak & Jeffrey Brown

7:00	Pre-Treatment
	Andrea Rockall

7:25	Monitoring response to therapy

	Nandita deSouza

7:50	Adjournment & Meet the Teachers

Sunrise Session

Advanced Techniques in Cardiovascular MR: Imaging Cardiac Microstructure & Physiology

Organizers: Sebastian Kozerke, Reza Nezafat

S02	Tuesday 7:00 - 7:50	*Moderators:* Jessica Bastiaansen & Angus Lau

7:00	Imaging Cardiac Metabolism
	Marie Schroeder

7:25	Imaging of Cardiac Microstructure
	Christian Stoeck

7:50	Adjournment & Meet the Teachers

Sunrise Session

Application of Molecular Imaging in Cardiovascular Diseases

Organizers: Guanshu Liu, Natalie Serkova, Damian Tyler

S03	Tuesday 7:00 - 7:50	*Moderators:* Fabao Gao & Damian Tyler

7:00	Recent Technical Developments of Molecular Imaging in Cardiovascular Diseases
	Michal Neeman

7:25	Clinical Translation & Applications of Molecular MRI in Cardiovascular Diseases

	René Botnar

7:50	Adjournment & Meet the Teachers

Sunrise Session

Emerging Methods in MSK MRI: Cartilage

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S04	Tuesday 7:00 - 7:50	*Moderators:* Emily McWalter & Sander Brinkhof

7:00	Physiologic Articular Cartilage Imaging
	Stefan Zbyn

7:25	Clinical Articular Cartilage Imaging with Emerging MR Methods
	Pia Jungmann

7:50	Adjournment & Meet the Teachers

Sunrise Session

Your Brain on Drugs: Brains & Drugs

Organizers: Andre Obenaus, Pia Maly Sundgren

S05	Tuesday 7:00 - 7:50	*Moderators:* Minming Zhang & Christopher Smyser

7:00	Nicotine - Effects in Brain Functional Connectivity
	Victor Vergara

7:25	Imaging of the Developing Brain
	Serena Counsell

7:50	Adjournment & Meet the Teachers

Sunrise Session

Maker: B0

Organizers: Gregor Adriany, Matthias Günther, Michael Hansen, Christoph Juchem, Greig Scott

S06	Tuesday 7:00 - 7:50	*Moderators:* Mary McDougall & Greig Scott

7:00	Techniques for Generating a Field
	Patrick Goodwill

7:25	Magnet-Building Tutorial
	Jason Stockmann

7:50	Adjournment & Meet the Teachers

Traditional Poster: Diffusion

Exhibition Hall 1554-1573	Tuesday 8:15 - 10:15	*(no CME credit)*

Electronic Poster: General Cancer Imaging

Exhibition Hall	Tuesday 8:15 - 9:15	*(no CME credit)*

Electronic Poster: Spectroscopy & Non-Proton MR

Exhibition Hall	Tuesday 8:15 - 9:15	*(no CME credit)*

Member-Initiated Symposium

Peripheral Nerve Stimulation: Have We Hit the Limits?

Organizers: Michael Steckner

S06	Tuesday 8:15 - 10:15	*(no CME credit)*

	8:15	Introduction & Overview
		Michael Steckner[1]
		[1]TMRU

	8:20	PNS Investigations, Unresolved Issues & Novel Solutions
		Blaine Chronik[1]
		[1]University of Western Ontario

	8:43	Exploring the PNS Characteristics of the Connectome Gradients
		Ralph Kimmlingen[1]
		[1]Siemens Healthineers

	9:06	State-of-Art Neuron Models
		Habib Bousleiman

	9:29	A New Neuron Model for MRI Exposures
		Mathias Davids[1]
		[1]Heidelberg University, Mannheim, Germany

	9:52	Cardiac Implant Vendor Understanding of Electric Field Threshold Values Necessary to Stimulate the Heart
		Jonathan Edmonson[1]
		[1]Medtronic, Inc.

Member-Initiated Symposium

How to Make Perfusion Imaging Become a Quantitative Imaging Biomarker

Organizers: Linda Knutsson, Esben Petersen, Sophie Schmid

W03/04	Tuesday 8:15 - 10:15	*Moderators:* Eric Achten & Linda Knutsson	*(no CME credit)*

	8:15	What is QIBA?
		Alexander Guimaraes[1]
		[1]Oregon Health Sciences University, United States

	8:30	What is EIBALL?
		Nandita M deSouza[1]
		[1]Institute of Cancer Research, Surrey, United Kingdom

	8:45	QIBA Profile on DSC
		Ona Wu[1]
		[1]MGH Athinoula A Martinos Center, Charlestown, MA, United States

	9:00	QIBA Profile on DCE
		Caroline Chung

	9:15	QIBA Profile on ASL
		Xavier Golay[1]
		[1]Gold Standard Phantoms Limited

	9:30	QA in Clinical Trials Using Phantoms
		Joshua S. Greer[1]
		[1]Radiology, UT Southwestern Medical Center, Dallas, TX, United States

	9:45	Panel Discussion

Weekday Course

Imaging Metabolism in the Developing Brain

Organizers: Christopher Smyser, Pia Maly Sundgren

S01	Tuesday 8:15 - 10:15	*Moderators:* Christopher Smyser

	8:15	Glucose & the Developing Brain: What Do We Know?
		Manu S. Goyal[1]
		[1]Washington University

	8:45	Effects of Nutrition on Brain Development
		Manon Benders[1]
		[1]University Medical Center Utrecht, Netherlands

	9:15	Using MRI/S to Study Metabolic Signatures of Early Brain Development & Disease
		Noriko Aida[1,2] and Moyoko Tomiyasu[1,2]
		[1]Kanagawa Children's Medical Center, Kanagawa, Japan, [2]National Institute of Radiological Sciences, Chiba, Japan

		In the developing brain, metabolites concentrations such as NAA, choline and myo-inositol show dynamic change. We can use 1H-MRS to measure such metabolite concentrations. It is important to know such signature for the precise evaluation of neonatal brain pathology, particularly in hypoxic-ischemic encephalopathy. 1H-MRS is also a powerful tool for the diagnosis and disease monitoring forpediatric neuro-metabolic diseases.

	9:45	Advanced Neuroimaging Techniques to Study Brain Metabolism in Pediatric Populations
		Stefan Bluml[1,2]
		[1]USC/Childrens Hospital Los Angeles, United States, [2]Rudi Schulte Research Institute, Santa Barbara, CA, United States
		In this presentation, various methods that have been used or could potentially be used to study metabolism in the pediatric brain are presented. Beyond widely available proton (^{1}H) MR spectroscopy, this includes phosphorus (^{31}P) MRS, carbon 13 (^{13}C) MRS methods as well as MR imaging approaches that measure the cerebral metabolic rate of oxygen.

	10:15	Adjournment & Meet the Teachers

Power Pitch

Pitch: Neuro Acquisition: Seeing the CNS Better

Power Pitch Theater A - Exhibition Hall	Tuesday 8:15 - 9:15	*Moderators:* Douglas Noll & Peder Larson	*(no CME credit)*

312	8:15	Imaging of the Thoracic Spinal Cord using Radially Sampled Averaged Magnetization Inversion Recovery Acquisitions (rAMIRA)
		Matthias Weigel[1,2], Tanja Haas[1,3], and Oliver Bieri[1,2]
		[1]Division of Radiological Physics, Dept. of Radiology, University Hospital Basel, Basel, Switzerland, [2]Dept. of Biomedical Engineering, University of Basel, Basel, Switzerland, [3]Dept. of Radiology, University Hospital Basel, Basel, Switzerland

313	8:15	FLAWS imaging improves depiction of the thalamic subregions for DBS planning in epileptic patients

		Elise Bannier[1,2], Giulio Gambarota[3,4], Jean-Christophe Ferré[1,2], Tobias Kober[5,6,7], Anca Nica[8], Stephan Chabardes[9], and Claire Haegelen[3,4,10]
		[1]Radiology, University Hospital of Rennes, Rennes, France, [2]VISAGES ERL U-1228, Univ Rennes, Inria, CNRS, Inserm, IRISA UMR 6074, Rennes, France, [3]LTSI, Université de Rennes 1, Rennes, France, [4]U1099, INSERM, Rennes, France, [5]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [6]Radiology, University Hospital Lausanne (CHUV), Lausanne, Switzerland, [7]Signal Processing Laboratory, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [8]Neurology, University Hospital of Rennes, Rennes, France, [9]Neurosurgery, University Hospital of Grenoble, Grenoble, France, [10]Neurosurgery, University Hospital of Rennes, Rennes, France

314	8:15	Silent T2* Encoding using ZTE Combined with Gradient-Echo Burst (BURZTE)
		Rolf F Schulte[1], Guido Buonincontri[2], Mauro Costagli[2], Anne Menini[3], Florian Wiesinger[1], and Ana Beatriz Solana[1]
		[1]GE Healthcare, Munich, Germany, [2]IMAGO7 Foundation, Pisa, Italy, [3]GE Healthcare, Menlo Park, CA, United States

315	8:15	Using 3D high-resolution MR Fingerprinting (MRF) to assist detection and characterization of epileptic lesions
		Dan Ma[1], Irene Wang[2], Imad Najm[2], Anagha Deshmane[3], Debra McGivney[1], Ken Sakaie[4], Mark Lowe[4], Vikas Gulani[1], Mark Griswold[1], and Stephen Jones[4,5]
		[1]Radiology, Case Western Reserve University, Cleveland, OH, United States, [2]Epilepsy Center, Cleveland Clinic, Cleveland, OH, United States, [3]Magnetic Resonance Center, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [4]Imaging Institute, Cleveland Clinic, Cleveland, OH, United States, [5]Neuroradiology, Cleveland Clinic, Cleveland, OH, United States

316	8:15	An Optimized Single-shot Sequence for Fast T2w Imaging of the Brain
		Mahesh Bharath Keerthivasan[1,2], Blair Winegar[2], Unni Udayasankar[2], Ali Bilgin[1,3], Maria Altbach[2], and Manojkumar Saranathan[2]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Medical Imaging, University of Arizona, Tucson, AZ, United States, [3]Biomedical Engineering, University of Arizona, Tucson, AZ, United States

317	8:15	The UK7T Network – optimized design of a multi-site, multi-vendor travelling heads study.

		William T Clarke[1], Olivier Mougin[2], Ian D Driver[3], Catarina Rua[4], Andrew T Morgan[5], Stuart Clare[1], Susan Francis[2], Richard Wise[3], Adrian Carpenter[4], Keith Muir[5], and Richard Bowtell[2]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom, [3]Cardiff University Brain Research Imaging Centre, School of Psychology, Cardiff University, Cardiff, United Kingdom, [4]Wolfson Brain Imaging Centre, Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom, [5]Institute of Neuroscience & Psychology, University of Glasgow, Glasgow, United Kingdom

318	8:15	Evaluation of a wave-MPRAGE sequence for brain morphometery
		Ross W. Mair[1,2], Jared A. Nielsen[1,3,4], and Randy L. Buckner[1,2,3,4]
		[1]Center for Brain Science, Harvard University, Cambridge, MA, United States, [2]AA Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [3]Department of Psychology, Harvard University, Cambridge, MA, United States, [4]Department of Psychiatry, Massachusetts General Hospital, Charlestown, MA, United States

319	8:15	Methods to accelerate STAGE: Toward 8 min for Twelve 3D images on 1.5T
		Aiqi Sun[1], Feng Huang[1], Yu Wang[1,2], Wei Xu[1], Yiran Wang[1], Hongyu Guo[1], Yongsheng Chen[3,4,5], and Ewart Mark Haccke[2,3,5]
		[1]Neusoft Medical System, Shanghai, China, [2]Shanghai Key Laboratory of Magnetic Resonance, East China Normal University, Shanghai, China, [3]The MRI Institute for Biomedical Research, Detroit, MI, United States, [4]Sino-Dutch Biomedical and Information Engineering School, Northeastern University, Shenyang, China, [5]Department of Radiology, School of Medicine, Wayne State University, Detroit, MI, United States

320	8:15	Accelerated quantitative susceptibility and R2* mapping with flexible k-t-segmented 3D-EPI
		Rüdiger Stirnberg[1], Andreas Deistung[2,3,4], Jürgen Reichenbach[2], and Tony Stöcker[1,5]
		[1]MR Physics, German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany, [2]Medical Physics Group, Institute of Diagnostic and Interventional Radiology, University Hospital Jena, Jena, Germany, [3]Department of Neurology, Essen University Hospital, Essen, Germany, [4]Erwin L. Hahn Institute for Magnetic Resonance Imaging, University Duisburg-Essen, Essen, Germany, [5]Department of Physics and Astronomy, University of Bonn, Bonn, Germany

321	8:15	Myelin Lipid 1H Density Measurements by IR-UTE are Consistent Before and After D2O Exchange
		Alan C Seifert[1,2], Michael J Wilhelm[3], Suzanne L Wehrli[4], and Felix W Wehrli[1]
		[1]Department of Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Chemistry, Temple University, Philadelphia, PA, United States, [4]SAIF Core Facility, Children's Hospital of Philadelphia, Philadelphia, PA, United States

322	8:15	Formalin Tissue Fixation Biases Myelin Density Measurement by Quantitative Magnetization Transfer and Myelin Water Imaging
		Alan C Seifert[1,2,3], Melissa Umphlett[4], Mary Fowkes[4], and Junqian Xu[1,2,3,5]
		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Graduate School of Biomedical Sciences, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [4]Department of Pathology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [5]Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, United States

323	8:15	High Resolution Diffusion Tensor Imaging of the Hippocampus in Temporal Lobe Epilepsy
		Sarah Treit[1], Trevor Steve[2], Tom Nowacki[2], Graham Little[1], Christian Beaulieu[1], and Donald W Gross[2]
		[1]Biomedical Engineering, University of Alberta, Edmonton, AB, Canada, [2]Neurology, University of Alberta, Edmonton, AB, Canada

324	8:15	Repeatability of measuring pulsatile brain tissue motion and volumetric strain with retrospectively-gated DENSE at 7T
		Ayodeji L. Adams[1], Jacob-Jan Sloots[1], Peter R. Luijten[1], and Jaco J. M. Zwanenburg[1]
		[1]Radiology, University Medical Center Utrecht, Utrecht, Netherlands

325	8:15	Isotropic 3D quantification of R1 and R2 relaxation and proton density in 6 minutes scan time
		Marcel Warntjes[1,2], Peter Johansson[1], Anders Tisell[3,4], and Peter Lundberg[3]

		[1]*SyntheticMR, Linköping, Sweden,* [2]*Center for Medical Imaging Science and Visualization (CMIV), Linköping, Sweden,* [3]*Radiation Physics, Linköping, Sweden,* [4]*Center for Medical Imaging Science and Visualization (CMIV), Linkoping, Sweden*

326	8:15	Zero Time of Echo imaging with an Adiabatic Fat Suppression Pulse at 7T
		Mark Symms[1], Mauro Costagli[2,3], Guido Buonincontri[2,3], Florian Wiesinger[4], Doug Kelley[5], Martin A Janich[4], Giacomo Aringhieri[2,6], Massimo Marletta[2,6], Gareth Barker[7], Virna Zampa[2,6], Mirco Cosottini[2,6], and Michela Tosetti[2,3]
		[1]*GE Healthcare, Pisa, Italy,* [2]*Imago7, Pisa, Italy,* [3]*IRCCS Stella Maris, Pisa, Italy,* [4]*GE Healthcare, Munich, Germany,* [5]*GE Healthcare, Waukesha, WI, United States,* [6]*University of Pisa, Pisa, Italy,* [7]*King's College London, London, United Kingdom*

Power Pitch

Pitch: Musculoskeletal Madness

Power Pitch Theater B - Exhibition Hall	Tuesday 8:15 - 9:15	*Moderators:* Eric Sigmund & Karyn Chappell	*(no CME credit)*

327	8:15	Intramuscular variability and sex difference in diffusion properties and 3D architecture of human lower leg muscles assessed with ultra-high-field diffusion tensor imaging and tractography
		Alexandre Fouré[1], Augustin C Ogier[1], Christophe Vilmen[1], Arnaud Le Troter[1], Thorsten Feiweier[2], Maxime Guye[1,3], Julien Gondin[4], Pierre Besson[1], and David Bendahan[1]
		[1]*Aix-Marseille Univ, CNRS, CRMBM, Marseille, France,* [2]*Siemens Healthcare, Erlangen, Germany,* [3]*APHM, Hôpital Universitaire Timone, CEMEREM, Marseille, France,* [4]*Institut NeuroMyoGène, Université Claude Bernard Lyon 1, INSERM, CNRS, Villeurbanne, France*

328	8:15	Time-dependent diffusion and the random permeable barrier model predict muscles fiber dimensions in Duchenne muscular dystrophy mice
		Bauke Kogelman[1], Kevin Adamzek[2], Ernst Suidgeest[1], Gregory Lemberskiy[3], Dmitry S. Novikov[3], Els Fieremans[3], Maaike van Putten[2], and Louise van der Weerd[1,2]
		[1]*Radiology, Leiden University Medical Center, Leiden, Netherlands,* [2]*Human Genetics, Leiden University Medical Center, Leiden, Netherlands,* [3]*Radiology, New York University School of Medicine, New York, NY, United States*

329	8:15	Relationship of paraspinal muscle DTI metrics to isometric strength measurements
		Elisabeth Klupp[1], Barbara Cervantes[2], Sarah Schlaeger[2], Stephanie Inhuber[3], Florian Kreuzpointer[3], Michael Dieckmeyer[2], Friedemann Freitag[2], Ernst J. Rummeny[2], Claus Zimmer[1], Jan S. Kirschke[1], Dimitrios C. Karampinos[2], and Thomas Baum[1]
		[1]Department of Diagnostic and Interventional Neuroradiology, Klinikum rechts der Isar, Technische Universität München, München, Germany, [2]Department of Diagnostic and Interventional Radiology, Klinikum rechts der Isar, Technische Universität München, München, Germany, [3]Department of Sport and Health Sciences, Technische Universität München, München, Germany
330	8:15	Imaging human motor unit activity using MRI.
		Paola Porcari[1], Ian Schofield[2], Roger Whittaker[3], and Andrew M Blamire[4]
		[1]Institute of Genetic Medicine, Newcastle University, Newcastle upon Tyne, United Kingdom, [2]Newcastle University, Newcastle upon Tyne, United Kingdom, [3]Institute of Neuroscience, Newcastle University, Newcastle upon Tyne, United Kingdom, [4]Institute of Cellular Medicine, Newcastle University, Newcastle upon Tyne, United Kingdom
331	8:15	Clinical Feasibility of Isotropic MAVRIC SL Imaging of Total Joint Arthroplasties
		Matthew F. Koff[1], Suryanarayanan Kaushik[2], Parina H. Shah[1], Erin G. Argentieri[1], and Hollis G. Potter[1]
		[1]Hospital for Special Surgery, New York, NY, United States, [2]General Electric Healthcare, Waukesha, WI, United States
332	8:15	Solid-State MRI as a noninvasive alternative to computed tomography for craniofacial imaging
		Hyunyeol Lee[1], Xia Zhao[1], Hee Kwon Song[1], Rosaline Zhang[2], Scott P Bartlett[2], and Felix W Wehrli[1]
		[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Plastic Surgery, University of Pennsylvania, Philadelphia, PA, United States
333	8:15	Subregional bone marrow adipose tissue composition in the proximal femur: Comparison of 3T Chemical Shift Encoded-MRI and Magnetic Resonance Spectroscopy
		Dimitri MARTEL[1], Benjamin LEPORQ[2], Mary BRUNO[1], Stephen HONIG[3], Amit SAXENA[4], H.Michael BELMONT[4], Gabrielle TURYAN[1], Ravinder R. REGATTE[1], and Gregory CHANG[1]

		[1]Radiology, NYU Langone Health, New York, NY, United States, [2]Université de Lyon; CREATIS CNRS UMR 5220, Inserm U1206, INSA-Lyon, UCBL Lyon 1, Villeurbanne, France, [3]Osteoporosis Center, Hospital for Joint Diseases, NYU Langone Health, New York, NY, United States, [4]Department of Rheumatology, NYU Langone Health, New York, NY, United States

334	8:15	Temporal Changes of a Canine Model of Patellar Tendinopathy Using UTE MRI T2* Assessment: A Pilot Study
		Sarah G. Powndner[1], Kei Hayashi[2], Brian G. Caserto[3], Bin Lin[1], Hollis G. Potter[1], and Matthew F. Koff[1]
		[1]Department of Radiology and Imaging - MRI, Hospital for Special Surgery, New York, NY, United States, [2]Cornell University, Ithaca, NY, United States, [3]VetPath Services, Stone Ridge, NY, United States

335	8:15	Knee Cartilage UTE T2* Quantification with Water-Fat Decomposition
		Misung Han[1], Peng Cao[1], Michael Carl[2], Thomas M Link [1], Peder EZ Larson[1,3], and Roland Krug[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Global MR Applications and Workflow, General Electric, San Diego, CA, United States, [3]Joint Graduate Program in Bioengineering, University of California, San Francisco/Berkeley, San Francsico, CA, United States

336	8:15	Strategies for Obtaining Relaxation Rates due to Chemical Exchange from Parameter Free Atomistic Simulations
		Henning Henschel[1], Matti Hanni[1,2], and Miika T. Nieminen[1,2]
		[1]University of Oulu, Oulu, Finland, [2]Oulu University Hospital, Oulu, Finland

337	8:15	Automatic Segmentation of Hip Cartilage with Deep Convolutional Neural Nets for the evaluation of Acetabulum and Femoral T1ρ and T2 relaxation times.
		Michael Girard[1], Valentina Pedoia[2], Berk Norman[2], Jasmine Rossi-Devries[2], and Sharmila Majumdar[2]
		[1]Center for Digital Health Innovation, University of California, San Francisco, San Francisco, CA, United States, [2]Department of Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States

338	8:15	Assessment of the clinical feasibility of routine T2 mapping of the intervertebral disc using highly undersampled k-space data
		Marcus Raudner[1], Markus Schreiner[1,2], Tom Hilbert[3,4,5], Tobias Kober[3,4,5], Vladimir Juras[6], Claudia Kronnerwetter[6], David Stelzeneder[2], and Siegfried Trattnig[1]
		[1]High Field MR Centre, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Department of Orthopaedics, Medical University of Vienna, Vienna, Austria, [3]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [4]Department of Radiology, University Hospital (CHUV), Lausanne, Switzerland, [5]LTS5, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [6]High Field MR Centre of Excellence, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria

339	8:15	Voxel-wise ratios of amide proton transfer (APT) signals and standardized uptake values (SUVs) of fluorodeoxyglucose (FDG) in the differentiation of myxoid-rich soft-tissue tumors with FDG-PET/MR imaging
		Koji Sagiyama[1], Yuji Watanabe[2], Keisuke Ishimatsu[1], Takeshi Kamitani[1], Yuzo Yamasaki[2], Takuya Hino[1], Sungtak Hong[3], Jochen Keupp[4], Yoshihiro Matsumoto[5], and Hiroshi Honda[1]
		[1]Department of Clinical Radiology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan, [2]Department of Molecular Imaging and Diagnosis, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan, [3]Healthcare, Philips Electronics Japan, Tokyo, Japan, [4]Philips Research, Hamburg, Germany, [5]Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

340	8:15	Assessment of early treatment response by multiparametric whole-body MRI as a 1-step approach to prediction of overall response rate in patients with multiple myeloma
		Miyuki Takasu[1], Takayuki Tamura[1], Yuji Akiyama[1], Yoko Kaichi[1], Shota Kondo[1], Chihiro Tani[1], and Kazuo Awai[1]
		[1]Department of Diagnostic Radiology, Hiroshima University Hospital, Hiroshima, Japan

341	8:15	Simultaneous Bilateral Knee MR Imaging
		Feliks Kogan[1], Evan Gregory Levine[1], Akshay Chaudhari[1], Uchechukwuka D. Monu[1], Kevin Epperson[1], Edwin Oei[2], Garry Gold[1], and Brian Hargreaves[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Radiology, Erasmus MC, Rotterdam, Netherlands

Combined Educational & Scientific Session

Prostate Cancer: Current Gaps & Future Directions

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Mustafa Shadi Bashir, Claude Sirlin, Reiko Woodhams

S02	Tuesday 8:15 - 10:15	*Moderators:* Daniel Margolis & Alberto Vargas

	8:15	Prostate Cancer: Defining Clinically Significant Disease
		Peter Choyke[1]
		[1]National Cancer Institute, United States
		The goal of performing MRI in prostate cancer is to help distinguish indolent, low risk prostate cancers from those harboring clinically significant features. This presentation reviews the criteria for clinically significant tumors and underscores the benefits that accrue when using MRI as a gateway for the diagnosis of prostate cancer.

342	8:45	T2-weighted MRI-derived textural features can help the assessment of peripheral zone prostate cancer aggressiveness: results from multi-center data.
		Gabriel Nketiah[1], Mattijs Elschot[1], Tom W Scheenen[2], Marnix C Maas[2], Tone F Bathen[1,3], and Kirsten M Selnæs[1,3]
		[1]Department of Circulation and Medical Imaging, NTNU, Norwegian University of Science and Technology, Trondheim, Norway, [2]Department of Radiology and Nuclear Medicine, Radboud University Medical Center, Nijmegen, Netherlands, [3]St. Olavs Hospital, Trondheim University Hospital, Trondheim, Norway
		The assessment of prostate cancer aggressiveness is currently based on Gleason grading of histological samples obtained by TRUS-guided biopsies, which can lead to substantial underestimations due to sampling errors. We previously showed that textural features derived from T2-weighted MRI could potentially serve as a non-invasive biomarker for prostate cancer aggressiveness. The aim of this work was to validate these preliminary results in a multi-center study. We found that the combination of intensity and textural features could distinguish between low/intermediate and high-grade with an accuracy of 71%, which was significantly higher than intensity (60%) or textural features (68%) alone.

343	8:57	Radiomics measured with mpMRI predicts histopathological and genomics markers of prostate cancer aggressiveness.
		Stefanie Hectors[1], Mathew Cherny[2], Sara Lewis[1,2], Kanika Mahajan[3], Ardeshir Rastinehad[3], Ashutosh Tewari[3], and Bachir Taouli[1,2]

		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Urology, Icahn School of Medicine at Mount Sinai, New York, NY, United States
		The goal of this study was to assess the association of multiparametric MRI (mpMRI) radiomic features with histopathological and genomic markers of prostate cancer (PCa) aggressiveness. mpMRI histogram and texture features showed multiple significant correlations with Gleason score, modified Gleason score Grade Group and genomics Decipher risk score. General linear models showed high accuracy for prediction of the histopathological and genomics features (accuracy range 0.77-0.94). The results indicate that MRI radiomics analysis is promising for noninvasive assessment of PCa aggressiveness on the histopathological and genomics levels.

	9:09	Current State-Of-The-Art Imaging Protocol: Where Are The Gaps?
		Masoom Haider[1]
		[1]Joint Dept of Medical Imaging - MSH, University of Toronto, Canada
		In Pi-Rads v2 there are technical recommendations for performance of multiparametric MRI (mpMRI) of the prostate. When using this protocol there are several issues that lead to suboptimal or non-diagnostic images that remain unaddressed. Some of these can be mitigated through altering patient preparation or a changing of pulse sequence parameters. Further optimization and development of robust pulse sequences and imaging systems to improve prostate MRI image quality is an unmet need that can benefit from further research. A second critical area in need of further development is related to value which goes hand in hand with cost reduction. This is also tied to the growing and controversial concerns related to repeated Gd administration for DCE MRI and the unknown long-term effects of Gd deposition in the brain in an otherwise healthy patient population with long life expectancy. The necessity of DCE MRI and the potential of proton spectroscopy to replace DCE MRI are other potential areas of innovation.

344	9:39	Reduced distortion in prostate DWI by using split echo type TSE-DWI (SPLICE) with MultiVane acquisition
		Yuta Akamine[1], Tomoyuki Okuaki[1], Satoshi Goshima[2], Kimihiro Kajita[2], Masatoshi Honda[1], Masami Yoneyama[1], Makoto Obara[1], and Marc Van Cauteren[3]
		[1]Philips Japan, Shinagawa, Tokyo, Japan, [2]Department of Radiology, Gifu University Hospital, Gifu, Japan, [3]Philips Healthcare, Shinagawa, Tokyo, Japan
		To reduce image distortion in prostate DWI, split-echo type TSE-DWI (SPLICE) was combined with MultiVane (current Philips implementation of PROPELLER) acquisition, named MV-SPLICE. To avoid non-CPMG artifacts in SPLICE, the spin echoes and stimulated echoes were separated by the unbalanced readout gradient and acquired in separate MultiVane k-space for separate reconstruction. ADCs and SNRs in transition zone and peripheral zone, and distortion for DWI and T2W images in the anterior-posterior direction of prostate diameter for MV-SPLICE were compared to conventional EPI and MultiVane TSE-DWI (MV-ALSOP). We demonstrated that MV-SPLICE is insensitive to distortion and can provide comparable ADC measurement.

345	9:51	Accelerated 3D 1 mm isotropic T2w-Imaging of the Prostate in less than 3 min
		Rohini Vidya Shankar[1], Gastao Cruz[1], Radhouene Neji[2], Elisa Roccia[1], René Botnar[1], Vicky Goh[1,3], Claudia Prieto[1], and Isabel Dregely[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]Siemens Healthcare Limited, Frimley, United Kingdom, [3]Cancer Imaging, King's College London, London, United Kingdom
		Three dimensional (3D), isotropic T_2-weighted imaging of the prostate requires a long acquisition time. Here we propose a 3D T_2-prepared multi-shot bSSFP acquisition with a variable density undersampled trajectory and TV-SENSE reconstruction. Results from a healthy volunteer study demonstrate that 3D 1 mm isotropic resolution T_2-weighted images of the prostate can be acquired in 2 min 45 s, with image quality that is comparable to the clinical standard turbo spin echo sequences but only takes 1/3 of the acquisition time.

346	10:03	Targeted Biopsy Validation of Peripheral Zone Prostate Cancer Characterization with MR Fingerprinting and Diffusion Mapping
		Ananya Panda[1], Gregory O'Connor[2], Yun Jiang[1], Alice Yu[3], Shivani Pahwa[4], Sara Dastmalchian[4], Seunghee Margevicius[5], Mark Schluchter[5], Robert Abouassaly[6], Chaitra Badve[1,2,4], Mark Griswold[1,2,4], Lee Ponsky[2,7], and Vikas Gulani[1,2,4]
		[1]Radiology, Case Western Reserve University, Cleveland, OH, United States, [2]School of Medicine, Case Western Reserve University, Cleveland, OH, United States, [3]Radiology, Johns Hopkins University, Baltimore, MD, United States, [4]Radiology, University Hospitals Cleveland Medical Center, Cleveland, OH, United States, [5]Biostatistics, Case Western Reserve University, Cleveland, OH, United States, [6]Urology, Cleveland Clinic, Cleveland, OH, United States, [7]Urology, University Hospitals Cleveland Medical Center, Cleveland, OH, United States
		Targeted biopsy validation is presented for characterization of peripheral zone (PZ) prostate cancer grades and differentiation of prostate cancer from prostatitis, using a quantitative MR protocol comprising of MRF-relaxometry and standard EPI based ADC mapping. Mean T_1, T_2 and ADC in prostate cancer were significantly lower than in NPZ. Mean T_2 and ADC in low-grade cancer were significantly higher than intermediate and high-grade cancer with similar AUCs (0.80) for both for differentiating grades. Mean T_2 and ADC in prostate cancer were significantly lower than prostatitis. T_2 was a significant predictor for prostate cancer over prostatitis while ADC was not significant.

	10:15	Adjournment & Meet the Teachers

Combined Educational & Scientific Session

Studying the Value of MRI

Organizers: Vikas Gulani, James Pipe

S03	Tuesday 8:15 - 10:15	*Moderators:* Vikas Gulani & James Pipe

	8:15	Measuring the Value of MRI: Comparative Effectiveness & Outcomes Research
		Stella Kang[1]
		[1]NYU Medical Center, United States
		With growing emphasis on value in health care, there is a need to assess the effects of MRI use on patient health outcomes. The value, or the health outcomes relative to the cost, can be studied using established comparative effectiveness research and outcomes assessment methods. The synthesis of clinical context with test use also allows for analyses of personalized decision making based on test information. The major methods described will include decision analysis, cost effectiveness, and study of intermediate outcomes. These methods can allow for quantification of population level health benefits, comparison with other tests or interventions, and identification of research priorities based on predicted impact.

	8:37	The Meaning of MR Value to Underserved Populations: Thoughts & Initial Technical Experience
		Sairam Geethanath[1]
		[1]Dayanada Sagar College of Engineering, India

	8:49	Questions

347	8:55	Diagnostic Comparison of Two Rapid Knee MRI Protocols for Comprehensive Whole-Joint Assessment: A Multi-Reader Feasibility Study
		Akshay S Chaudhari[1], Bragi Sveinsson[2], Jeff P Wood[1], Kathryn J Stevens[1], Christopher F Beaulieu[1], Edwin H Oei[3], Jarrett Rosenberg[1], Evan G Levine[1], Feliks Kogan[1], Marcus T Alley[1], Garry E Gold[1], and Brian A Hargreaves[1]
		[1]Radiology, Stanford University, Palo Alto, CA, United States, [2]Harvard Medical School, Stanford, MA, United States, [3]Radiology & Nuclear Medicine, Erasmus Medical Center, Rotterdam, Netherlands

		There were approximately 1.25 million clinical knee magnetic resonance imaging (MRI) scans performed in the US annually. Most knee MRI protocols require approximately 30 minutes of scan time. However, there is interest in expedited imaging protocols, especially under the ISMRM Value Initiative. Through a study involving 35 patients and 5 readers, we have demonstrated the feasibility of (1) a single 5-minute DESS sequence and (2) a 5-minute DESS sequence paired with a 2-minute coronal PDFS sequence, as two potential methods for accurate, rapid, and comprehensive diagnostic whole-joint knee MRI.

348	9:00	How Fast is “Fast MRI” for Breast Cancer Screening?
		Emily F. Conant[1], Arijitt Borthakur[1], Mitchell D. Schnall[1], and Susan P. Weinstein[1]
		[1]Department of Radiology, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, United States
		We compare the scan and total study times from a newly implemented abbreviated MR protocol (AP) for breast cancer screening consisting of localizer, T_2-STIR, and single pair of pre- and post-contrast 3D T_1 sequences to similar times from our full MRI screening protocol. A retrospective analysis was performed using scan time data obtained from image dicom files as well as data from the Radiology Information System (RIS) for technologist activity times to determine the variance between the two protocols. The results of this study will help guide operational value improvements and estimates for appropriate pricing for the newly implemented AP for breast cancer screening.

349	9:05	Benefits and Challenges of Spiral MRI in Routine Clinical Brain Imaging: Early Results
		Melvyn B Ooi[1], Zhiqiang Li[2], Dinghui Wang[2], Ryan K Robison[3], Nick R Zwart[2], Ashley G Anderson[1], Akshay Bakhru[4], Tanya Mathews[4], Suthambhara Nagaraj[4], Silke Hey[5], Jos Koonen[5], Ad Moerland[5], Jonathan Chia[1], Ivan Dimitrov[1], Harry Friel[1], Makoto Obara[6], Indrajit Saha[7], Yi Wang[1], Yansong Zhao[1], Harry H Hu[8], Amber Pokorney[3], Marco Pinho[9], Osamu Togao[10], Tom Chenevert[11], Ashok Srinivasan[11], Juan E Small[12], Mara M Kunst[12], Rakesh Kumar Gupta[13], Jalal B Andre[14], Nandor K Pinter[15], Jeffrey H Miller[3], and James G Pipe[2]
		[1]Philips Healthcare, Gainesville, FL, United States, [2]Barrow Neurological Institute, Phoenix, AZ, United States, [3]Phoenix Children’s Hospital, Phoenix, AZ, United States, [4]Philips Innovation Campus, Bangalore, India, [5]Philips Healthcare, Best, Netherlands, [6]Philips Healthcare, Tokyo, Japan, [7]Philips Healthcare, Gurgaon, India, [8]Nationwide Children’s Hospital, Columbus, OH, United States, [9]University of Texas Southwestern Medical Center, Dallas, TX, United States, [10]Kyushu University Hospital, Fukuoka, Japan, [11]University of Michigan, Ann Arbor, MI, United States, [12]Lahey Hospital & Medical Center, Burlington, MA, United States, [13]Fortis Memorial Research Institute, Gurgaon, India, [14]University of Washington, Seattle, WA, United States, [15]Dent Neurologic Institute, Amherst, NY, United States

		Spiral MRI possesses several advantages vs. Cartesian MRI, due to differences in their k-space trajectories and underlying MR physics, which can be leveraged for added value in routine clinical imaging. A Spiral Neuroimaging Cooperative, consisting of nine clinical sites, was formed for the multi-center evaluation of spiral MRI as an alternative to Cartesian MRI in routine clinical imaging. Post-contrast brain spiral 2DT1SE were compared with Cartesian 2DT1SE or TSE. Spirals demonstrated faster scanning with consistent flow artifact reduction vs. both Cartesian options, and superior overall image quality (T1 contrast, lesion visualization) vs. TSE.

350	9:10	30 brain MRI exams in 1 hour using a multi-contrast EPI sequence
		Stefan Skare[1,2], Tim Sprenger[2,3], Ola Norbeck[1,2], Henric Rydén[1,2], Enrico Avventi[1,2], Lars Blomberg[1], Johan Berglund[1,2], Mikael Skorpil[1], Maria Sandell[1], and Mathias Engström[3]
		[1]Department of Neuroradiology, Karolinska University Hospital, Stockholm, Sweden, [2]Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden, [3]MR Applied Science Laboratory Europe, GE Healthcare, Stockholm, Sweden
		An in-house developed multi-contrast EPI sequence producing six MR contrasts (T1-FLAIR, T2-w, DWI, ADC, T2*-w, and T2-FLAIR) was used as a fast brain MRI protocol. Seven healthy volunteers were scanned repeatedly to investigate how many brain MRI exams that can be performed over the course of one hour. With a net scan time of one minute and an additional minute for table movements and switch of subjects, it was possible to perform 30 brain MRI examinations in 1 h.

351	9:15	Rapid Synthetic MRI of the whole brain using simultaneous multi-slice technique
		Suchandrima Banerjee[1], Graeme McKinnon[2], and Marcel JB Warntjes[3]
		[1]Global MR Applications & Workflow, GE Healthcare, Menlo Park, CA, United States, [2]Global MR Applications & Workflow, GE Healthcare, Waukesha, WI, United States, [3]SyntheticMR, Linköping, Sweden
		Synthetic MRI enables reconstruction of multiple MRI contrasts from a single scan based on voxel-wise computation of relaxation parameters. This can improvement scan productivity and workflow considerably. The utility of synthetic MRI has recently been demonstrated in clinical settings. However in its current implementation whole brain coverage can be achieved within 5 minutes only if a thick slice prescription (~ 4mm) is used, but this might provide insufficient through-plane resolution for certain clinical protocols and can also lead to partial voluming effects. This work explores the simultaneous multislice approach for more efficient through plane coverage with synthetic MRI.

352	9:20	Decision Curve Analysis for Prostate Biopsy using MRI with or without Dynamic Contrast Enhancement
		Vinay Prabhu[1], Andrew B. Rosenkrantz[1], and Stella K. Kang[1]

		[1]Radiology, NYU School of Medicine, New York, NY, United States
		Prostate MRI with dynamic contrast enhancement (DCE) is controversial with growing interest in noncontrast (NC) MRI. Decision curve analyses performed on data from two contemporary studies identified ranges of high grade cancer probability thresholds at which DCE had the highest net benefit. DCE MRI has the most benefit in moderate or moderate-high risk threshold ranges, thought to vary based on the study differences in disease prevalence, reference standard, and the presence or absence of additional DCE reconstruction images. The risk ranges in which NC versus DCE MRI optimize net benefit may help inform the best clinical use of prostate MRI.

353	9:25	Impact of Routine Magnetic Resonance Imaging on Diagnosis and Treatment of Women with Benign Gynecologic Conditions Seen in a Multidisciplinary Fibroid Center
		Kim Nhien Vu[1], Angela Marie Fast[1], Robyn Shaffer[2], Deirdre A. Lum[3], Berta Chen[3], David Hovsepian[1], and Pejman Ghanouni[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Medicine, Stanford University, Stanford, CA, United States, [3]Obstetrics & Gynecology, Stanford University, Stanford, CA, United States
		Pelvic ultrasounds often represent the first and only line of imaging for uterine fibroid evaluation. Our study aims to determine the added value of routine pelvic magnetic resonance imaging (MRI) on diagnosis and treatment of women presenting with symptomatic uterine fibroids. A retrospective review was performed on 569 consecutive women referred to our multidisciplinary fibroid center over a three-year period. Compared to ultrasound alone, MRI affected diagnosis in over a third of patients, which also altered treatment options. These findings justify the use of routine pelvic MRI in women with symptomatic fibroids, particularly those presenting with dysmenorrhea.

354	9:30	Staging hemodynamic failure: BOLD fMRI cerebrovascular reactivity beats [15O]-H2O-PET.
		Marco Piccirelli[1], Christiaan van Niftrik[2], Geoffrey Warnock[3], Susanne Wegener[4], Athina Pangalu[1], Giuseppe Esposito[2], Antonios Valavanis[1], Alfred Buck[5], Andreas Luft[4], Oliver Bozinov[2], Luca Regli[2], and Jorn Fierstra[2]
		[1]Neuroradiology, University Hospital Zurich, Zurich, Switzerland, [2]Neurosurgery, University Hospital Zurich, Zurich, Switzerland, [3]Pharmacology & Toxicology, University Hospital Zurich, Zurich, Switzerland, [4]Neurology, University Hospital Zurich, Zurich, Switzerland, [5]Nuclear Medicine, University Hospital Zurich, Zurich, Switzerland

		The actual gold standard stroke risk assessment is cerebral blood flow (CBF) measured with [15O]-H2O-PET, which is available only in few specialized centers and requires ~1mSv radioactive dose. Otherwise, quantitative CVR measurements derived (with our temporal decomposition iterative algorithm) from Blood-Oxygen-Level-Dependent (BOLD) fMRI with CO2 challenge might apply as a surrogate imaging-marker for hemodynamic failure, as the <7 minutes acquisition can easily be clinically implemented, and has – as proved in this study – twice higher specificity*sensitivity for staging hemodynamic failure in chronic cerebrovascular steno-occlusive diseases than PET. Therefore, BOLD CVR shall be widely implemented for assessing stroke risk.

355	9:35	A solar powered MR spectrometer system Martyn Paley[1,2] *[1]MRI, ISD Ltd, Bradley, United Kingdom, [2]Academic Radiology, University of Sheffield, Sheffield, United Kingdom* Most MRI systems have very high electrical power consumption and require extensive cryogenic support systems. A spectrometer design has been developed for a low cost, low weight and low power specialised MR system capable of 'unplugged' operation for worldwide use in remote locations.

356	9:40	REconstruction of MR images acquired in highly inhOmogeneous fields using DEep Learning (REMODEL) Punith B Venkate Gowda[1], Asha K Kumara Swamy[1], Sachin Jambawalikar[2], Sairam Geethanath[1,2], and Thomas Vaughan[2] *[1]Medical Imaging Research Centre, Dayananda Sagar College of Engineering, Bangalore, India, [2]Dept. of Radiology, Columbia University Medical Center, New York, NY, United States* The aim of this study was to develop and demonstrate a supervised learning algorithm to reconstruct MR images acquired in highly in-homogeneous magnetic fields. Brain images were used to train a deep neural network. This was performed for image sizes of 32 x 32 and 64 x 64. Results obtained demonstrate REMODEL's ability to reconstruct the images obtained in in-homogeneous magnetic fields of up to ±50 kHz with high fidelity. The root-mean-square-error for these reconstructions compared to the uncorrupted ground truth was lesser than 0.15 and significantly lesser than the corrupted images.

357	9:45	Creating Standardized MR Images with Deep Learning to Improve Cross-Vendor Comparability Enhao Gong[1], John Pauly[1], and Greg Zaharchuk[2]

		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States
		A very common task for radiologists is to compare sequential imaging studies that were acquired on different MR hardware systems, which can be difficult and inaccurate because of different designs across scanners and vendors. Cross-vendor standardization and transformation is valuable for more quantitative analysis in clinical exams and trials. With in-vivo multi-vendor datasets, we show that it is possible to achieve accurate cross-vendor transformation using the state-of-art Deep Learning Style-transfer algorithm. The method preserves anatomical information while transferring the vendor specific contrast "style". The usage of unsupervised training enable the method to further train and apply on all existing large scale MRI datasets. This technique can lead to a universal MRI style which benefits patients by improving inter-subject reproducibility, enabling quantifiable comparison and pushing MRI to be more quantitative and standardized.

	9:50	Panel Discussion

	10:15	Adjournment & Meet the Teachers

Oral

Cardiac Function & Myocardial Perfusion

N01	Tuesday 8:15 - 10:15	*Moderators:* Bettina Baessler & Krishna Nayak

358	8:15	Improved 2D cardiac Cine MRI with retrospective gating using Golden-angle Radial acquisition and Angle-Based echo-Sharing (GRABS)
		Qi Liu[1], Yu Ding[1], Jingyuan Lyu[1], Lele Zhao[2], Yanqun Teng[2], and Jian Xu[1]
		[1]UIH America, Inc., Houston, TX, United States, [2]United Imaging Healthcare, Shanghai, China
		Cardiac Cine MRI with retrospective gating using Golden-angle Radial acquisition and Angle-Based echo-Sharing is a promising technique permitting retrospective gating, arbitrary temporal resolution, and arrhythmia data rejection. It is an easy-to-implement and effective technique that features improved image quality by reducing streaking artifacts.

359	8:27	Feasibility of Ultra-high Simultaneous Multi-slice and In-plane Accelerations for Cardiac MRI Using Outer Volume Suppression and Leakage-Blocking Reconstruction

		Sebastian Weingärtner[1,2,3], Steen Moeller[2], and Mehmet Akcakaya[1,2]
		[1]Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States, [2]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [3]Computer Assisted Clincial Medicine, University of Minnesota, Mannheim, Germany
		Simultaneous multi-slice (SMS) imaging has gained increasing interest for enabling high scan-time acceleration at the cost of minimal loss in SNR. However, its applications in cardiac MRI have been limited, as the feasible acceleration is restricted by unfavorable coil geometry. In this study, we investigate the use of outer-volume suppression (OVS) in combination with CAIPIRINHA to promote dissimilarities among the multi-bands. We propose a time and SAR efficient multi-band scheme for OVS and apply these techniques with a leakage blocking reconstruction to increase the feasible acceleration in cardiac cine and perfusion imaging. Combining these techniques, we achieve clinical image quality with 5 fold SMS acceleration in Cine and 16-fold spatial-only acceleration in perfusion MRI.

360	8:39	Feasibility of absolute myocardial blood flow quantification using Simultaneous Multi Slice (SMS) SSFP first-pass myocardial perfusion imaging and iterative reconstruction at 1.5 Tesla.
		Muhummad Sohaib Nazir[1], Radhouene Neji[1,2], Peter Speier[3], Daniel Staeb[4], Michaela Schmidt[3], Christoph Forman[3], Reza Razavi[1], Sven Plein[1], Tevfik Ismail[1], Sebastien Roujol[1], and Amedeo Chiribiri[1]
		[1]Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]MR Research Collaborations, Siemens Healthcare Limited, Frimley, United Kingdom, [3]Siemens Healthcare, Erlangen, Germany, [4]The Centre for Advanced Imaging, The University of Queensland, Brisbane, Australia
		Quantification of myocardial blood flow (MBF) enhances diagnosis and provides prognostic information. Simultaneous Multi Slice (SMS) imaging allows greater spatial coverage of the heart with minimal signal-to-noise penalty and is thus desirable for perfusion imaging. 5 patients underwent two rest perfusion scans using a dual-bolus technique with SMS protocol (6 slices) and iterative reconstruction and standard 3 slice bSSFP sequence. Absolute MBF was quantified with a fermi-constrained deconvolution algorithm. Global and territorial MBF was comparable between the different methods. Future evaluation in patients with stress testing and greater heart coverage may provide clinical utility in patients with coronary artery disease.

361	8:51	Improving compressed sensing reconstructions for myocardial perfusion imaging with residual artifact learning
		Ganesh Adluru[1], Bradley D. Bolster, Jr.[2], Edward DiBella[1], and Brent Wilson[3]
		[1]Radiology & Imaging Sciences, University of Utah, Salt lake city, UT, United States, [2]US MR R&D Collaborations, Siemens Healthineers, Salt Lake City, UT, United States, [3]Cardiology, University of Utah, Salt Lake City, UT, United States

		Compressed sensing/constrained reconstruction methods have been successfully applied to myocardial perfusion imaging for improving in-plane resolution and improving slice coverage without losing temporal resolution. However at high acceleration factors and in the presence of large inter-time frame motion image quality from the CS methods is affected. Here we propose an artifact learning neural network that aims to improve the image quality of spatio-temporal constrained reconstruction methods for gated Cartesian and ungated radial data. Promising results are shown on datasets that were not used in training the neural network.

362	9:03	Beat-by-Beat Dynamic Assessment of Myocardial Oxygenation with Highly Time-Resolved, Free-breathing, Ungated Cardiac T2 BOLD MRI Using a Low-Rank Tensor Formulation
		Hsin-Jung Yang[1], Anthony G. Christodoulou[1], Jane Sykes[2], Xiaoming Bi[3], Ivan Cokic[4], Frank S Prato[2], Debiao Li[4], and Rohan Dharmakumar[4]
		[1]Biomedical Imaging Research Institute, Cedars Sinai Medical Center, Los Angeles, CA, United States, [2]Lawson Research Institute, London, Canada, [3]Siemens Healthineers, Los Angeles, CA, United States, [4]Cedars Sinai Medical Center, Los Angeles, CA, United States
		Coronary vasodilation and the ensuing myocardial hyperemia following the administration of a provocative stressor is a dynamic process. However, established perfusion methods are confounded by contrast accumulation and lack the temporal resolution to accurately evaluate the process. BOLD CMR is an emerging method for monitoring myocardial perfusion without contrast agents, but the current methods are slow. We developed a non-ECG-gated, free breathing, beat-to-beat, cardiac/respiratory phase-resolved, T2-based BOLD CMR sequence at 3T using a low rank tensor framework to enable highly time-resolved assessment of coronary reactivity. We tested the proposed technique in an animal model with and without coronary disease.

363	9:15	Non-invasive pressure-volume loops from cardiovascular magnetic resonance and brachial pressure
		Felicia Seemann[1,2], Per Arvidsson[1], David Nordlund[1], Sascha Kopic[1], Marcus Carlsson[1], Håkan Arheden[1], and Einar Heiberg[1,2]
		[1]Department of Clinical Physiology, Skåne University Hospital, Lund University, Lund, Sweden, [2]Department of Biomedical Engineering, Faculty of Engineering, Lund University, Lund, Sweden
		Cardiac pressure-volume loop analysis provides important information on cardiac function, but is currently not widely utilized clinically since invasive measurements are required. This study aimed to develop and validate a non-invasive method of estimating pressure-volume loops, via a model-based framework using cardiovascular magnetic resonance. The method yields individualized pressure-volume loops computed using time-varying elastance, with left ventricular volume and brachial pressure as input. Experimental validation showed strong agreement to in-vivo measurements, and application to healthy controls and heart failure patients yielded expected results. Hence, the model is a promising method for obtaining pressure-volume loops from magnetic resonance imaging.

364	9:27	Subtle changes in hyperelastic properties of myocardium with cardiotoxicity remodeling from CMR
		Delphine Perie-Curnier[1], Marianna Gamba[1], Marilou Trempe[1], Jenny Wang[2], Martyn Nash[2], Alistair Young[3], and Daniel Curnier[4]
		[1]Mechanical Engineering, Polytechnique Montreal, Montreal, QC, Canada, [2]Biomedical Engineering, University of Auckland, Auckland, New Zealand, [3]Anatomy with Radiology, University of Auckland, Auckland, New Zealand, [4]Kinesiology, University of Montreal, Montreal, QC, Canada
		The aim of this study was to assess subtle changes in 3D geometrical and mechanical properties of left ventricle in childhood acute lymphoblastic leukemia survivors. Global 3D volume or ejection fraction were not sensitive enough while time dependent 3D geometrical parameters over the cardiac cycle showed that early diastole is more affected than systole or late diastole. Smaller hyper-elastic properties were found in the high risk group than in the standard risk, high risk with cardioprotective agent or healthy volunteers group. High temporal resolution and local parameters would improve the detection of these subtle changes.

365	9:39	Self-gated free-breathing cine DENSE imaging by adaptively reducing residual T1-echo energy
		Xiaoying Cai[1] and Frederick H Epstein[1,2]
		[1]Biomedical Engineering, University of Virginia, Charlottesville, VA, United States, [2]Radiology, University of Virginia, Charlottesville, VA, United States
		Cine DENSE is a well-established myocardial strain imaging technique that typically requires breath-holding. In this study, we developed a self-gated free-breathing adaptive acquisition algorithm that reduces free-breathing artifacts by minimizing the residual energy of the phase-cycled T1-relaxation signal. The algorithm adaptively repeats the acquisition of the k-space data with the highest residual T1-echo energy. Evaluation in 7 healthy subjects demonstrated that the method provides high quality free-breathing self-gated cine DENSE images in a clinically-reasonable scan time.

366	9:51	Assessment of Regional Myocardial Velocities by Tissue Phase Mapping and Feature Tracking in Healthy Children and Pediatric Patients with Hypertrophic Cardiomyopathy: A Comparison Study
		Alexander Ruh[1], Arleen Li[2], Joshua D Robinson[1,3,4], Cynthia K Rigsby[1,4,5], and Michael Markl[1,6]
		[1]Department of Radiology, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [2]Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [3]Department of Pediatrics, Division of Pediatric Cardiology, Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, United States, [4]Department of Pediatrics, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [5]Department of Medical Imaging, Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, United States, [6]Department of Biomedical Engineering, McCormick School of Engineering, Northwestern University, Chicago, IL, United States

		In this study, we compare tissue phase mapping (TPM) and feature tracking (FT) of standard cine SSFP images for the assessment of regional myocardial velocities in 15 pediatric patients with hypertrophic cardiomyopathy (HCM) and 20 age-matched healthy controls. Data analysis included the calculation of segmental (AHA 16-segment model) left ventricular radial and long-axis peak velocities in systole and diastole. Both techniques detected significantly decreased diastolic velocities in HCM patients compared to controls, suggesting reduced myocardial relaxation despite normal ejection fraction. Lower temporal resolution of FT derived velocities resulted in systematically lower peak velocities compared to directly measured TPM velocities.

367	10:03	Cardiac Single Breath-hold Balanced SSFP Cine 'Watermark' provides Cardiac Function via Magnitude and 2D Myocardial Strain via Phase
		Ronald J. Beyers[1], Nouha Salibi[1,2], and Thomas S. Denney[1]
		[1]MRI Research Center, Auburn University, Auburn, AL, United States, [2]Siemens Healthineers, Malvern, PA, United States
		Cardiac MRI myocardial tagging enables quantification of myocardial strain. However, tagging remains limited to a research context due to the time-intensive analysis and need to run multiple sequences. CMR sequences must be fast and efficient. We previously developed a FLASH-based cine sequence called Cine 'Watermark' (CWM) that acquires normal cine magnitude images plus 'hidden' (via phase) cardiac strain data for calculating myocardial strain. Here we present a Balanced SSFP (bSSFP) version of CWM that presents improved SNR and scan efficiency. The bSSFP CWM is demonstrated in human subjects at 3T and its performance is compared to conventional Grid-Tagging MRI.

Oral

Application of Neurovascular Methods

N02	Tuesday 8:15 - 10:15	*Moderators:* Luis Hernandez-Garcia & Seong-Gi Kim

368	8:15	Unraveling Cardiac and Respiratory Contributions to Brain Tissue Motion using Single Shot 2D DENSE at 7T MRI.
		Jacob Jan Sloots[1], Ayodeji L. Adams[1], Peter R. Luijten[1], Geert Jan Biessels[2], and Jaco J. M. Zwanenburg[1]
		[1]Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [2]Neurology, University Medical Center Utrecht, Utrecht, Netherlands

		The cardiac cycle and respiration both influence CSF dynamics and therefore the displacement of brain tissue. In this work we unravel their contribution to brain tissue displacement using a single shot 2D cine displacement-encoded imaging method employing stimulated echoes (DENSE) for brain motion measurements. Displacement-encoded data sets in the Feet-to-Head direction of seven volunteers were fitted to a linear model. Consistent trends in displacements were observed. The developed DENSE sequence results showed similar sized contributions to brain tissue displacement. Relating these displacements to contributions to the clearance system remains future work.

369	8:27	Macromolecular proton fraction closely correlates with myelin loss in the rat ischemic stroke model
		Alena A Kisel[1], Marina Yu Khodanovich[1], Dmitriy N Atochin[1,2], Andrey E Akulov[1,3], Lilia R Mustafina[4], Anna V Naumova[1,5], and Vasily L Yarnykh[1,5]
		[1]Research Institute of Biology and Biophysics, Tomsk State University, Tomsk, Russian Federation, [2]Massachusetts General Hospital, Charlestown, MA, United States, [3]Institute of Cytology and Genetics SB RAS, Novosibirsk, Russian Federation, [4]Siberian State Medical University, Tomsk, Russian Federation, [5]Department of Radiology, University of Washington, Seattle, WA, United States
		Non-invasive quantitative assessment of myelin damage in ischemic stroke is currently unavailable. The goal of this study was to evaluate a recently proposed myelin imaging technique, macromolecular proton fraction (MPF) mapping in the rat stroke model and compare it with histological myelin quantitation. MPF decrease in the brain infarct closely correlated ($R = 0.81$, $p<0.001$) with luxol fast blue staining on the 1st, 3rd, and 10th day after stroke. Further improvement in accuracy of myelin quantitation ($R = 0.98$) was achieved with the use of bivariate linear regression model including T_2 to correct errors related to edema.

370	8:39	The effect of breath-hold on cardiovascular pulse in the brain - a multimodal MREG study.
		Lauri Raitamaa[1], Viola Borchardt[1], Niko Huotari[1], Heta Helakari[1], Janne Kananen[1], Vesa Korhonen[1], and Vesa Kiviniemi[1]
		[1]OFNI/Radiology, Oulu University Hospital, Oulu, Finland
		MREG enables critical sampling of human brain physiology. This study reveals novel pulsation changes during repeated breatholds of 32 seconds. Cardiorespiratory control centers in the brain stem show increased pulsation amplitude during the end of the breathold. Also the overall cardiac pulse propagation in the brain alters markedly by breathold, especially when repeated. The findigs show that the MREG data enables spatially accurate estimation of the status of the cardiovascular pulsation which is the primary driver of glymphatic brain clearance.

371	8:51	ASL imaging and 31P/1H-MRS during prolonged breath-hold among experienced freedivers: Insights into cerebrovascular and metabolic responses

		Vera Catharina Keil[1], Henri Jan Mutsaerts[2,3,4], Lars Eichhorn[5], Frank Träber[1], Wolfgang Block[1], Burkhard Mädler[6], Kim van de Ven[7], Jeroen C. Siero[2,8], Bradley J. MacIntosh[3], Jan Petr[9], Hans H. Schild[1], and Elke Hattingen[1]
		[1]Department of Radiology, University Hospital Bonn, Bonn, Germany, [2]Department of Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [3]Sunnybrook Research Institute, University of Toronto, Toronto, ON, Canada, [4]Radiology Department, Amsterdam Medical Center, Amsterdam, Netherlands, [5]Department of Anesthesiology, University Hospital Bonn, Bonn, Germany, [6]Philips Healthcare, Bonn, Germany, [7]Philips Healthcare, Best, Netherlands, [8]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands, [9]Institute of Radiopharmaceutical Cancer Research, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany
		This pCASL and 31P/1H-MRS study explored the cerebrovascular reactivity (CVR) and its efficacy on brain metabolic stability during a five-minute breath-hold in fifteen experienced freedivers. Cerebral blood flow (CBF) increase occurred later than the decrease of the recently discovered arterial transit time correlate, spatial CoV. The latter may thus be an early CVR biomarker. CBF varied between vessel territories, gray and white matter and usually lowered with more experience. MRS showed near stable physiological cerebral pCr, ATP and pH concentrations despite peripheral lactate acidosis. In conclusion, this trial revealed that CVR sufficiently compensates the metabolic challenge of a five minute breath-hold. In conclusion, this trial revealed that cerebral perfusion increase sufficiently compensates the metabolic challenge of a five-minute breath-hold.

372	9:03	Sensitivity and specificity of cerebrovascular reactivity in predicting surgical decisions in Moyamoya patients
		Peiying Liu[1], Babu G Welch[2], Binu P Thomas[2], Yang Li[1], Marco C Pinho[2], Judy Huang[1], and Hanzhang Lu[1]
		[1]Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]University of Texas Southwestern Medical Center, Dallas, TX, United States
		Moyamoya disease (MMD) is characterized by chronic occlusion of the distal intracranial internal carotid arteries and can be treated by revascularization surgery. At present, surgical decisions are primarily based on symptomatology and imaging studies such as DSA and SPECT. However, current procedures are costly, invasive, and qualitative. Here we applied a novel iVas-MRI technique that provides quantitative assessment of multiple hemodynamic parameters in a single scan of 9 minutes, and examined its sensitivity and specificity in predicting surgical decisions. Our results showed that iVas-MRI has an overall accuracy of 0.93 in predicting surgical decisions in MMD.

373	9:15	Baseline Risk Factors Suggestive of Advanced Vascular Disease Predict Differences in Brain CBF Changes After Carotid Revascularization Surgery
		Salil Soman[1], Kyuwon Lee[2], Weiying Dai[3], Elizabeth Hitchner[4], Michael Moseley[4], Greg Zaharchuk[4], Allyson Rosen[4], and Wei Zhou[5]

		[1]HMS / BIDMC, Boston, MA, United States, [2]TUFTS Medical School, Boston, MA, United States, [3]SUNY Binghamton, Binghamton, NY, United States, [4]Stanford School of Medicine, Stanford, CA, United States, [5]University of Arizona, Tucson, AZ, United States
		Carotid stenosis is a risk factor for stroke. A number of risk factors are associated with stroke. Our work shows specific risk factors that predict differences in brain perfusion using ASL MRI technique after carotid revascularization surgery. Specifically elevated systolic blood pressure, chronic renal insufficiency, and history of prior stroke have mpacts on initial baseline to immediately post surgery prefusion increase, and baseline elevated cholesterol and body mass index show differences in 1 day to 6 months post operation. This is in contrast to hypertension, smoking and diabetes, which did not show significant predict relationships. Our work suggests that these risk factors may be more closely related to cerebrovascular dysfunction.

374	9:27	Clinical Feasibility Study of an Accelerated 3D Intracranial Magnetic Resonance Angiography Using Compressed-Sensing Algorithm
		Zhiyong Lin[1], Xiaodong Zhang[1], Ke Wang[1], Yuan Jiang[1], Xiaoyu Hu[1], Yong Huang[1], Shuai Ma[1], Yi Liu[1], Lina Zhu[1], Zhizheng Zhuo[2], Jing Liu[1], and Xiaoying Wang[1]
		[1]Department of Radiology, Peking University First Hospital, Beijing, China, [2]Philips Healthcare, Beijing, China
		Accelerated 3D intracranial magnetic resonance angiography(MRA) using Compressed-Sensing algorithm could be clinically valuable not only for improving the image quality and having almost the same diagnostic performance compared to conventional intracranial MRA, but also for reducing the scanning time which could improve the overall workflow of MRA imaging. It is a feasible protocol in intracranial MRA imaging.

375	9:39	Multiscale multimodal imaging of the mouse cerebral vascular architecture.
		Rukun Hinz[1], Jan R Detrez[2], Lore Peeters[1], Caroline Berghmans[3], Marleen Verhoye[1], Annemie Van der Linden[1], Winnok H De Vos[2], and Georgios A Keliris[1]
		[1]Bio-imaging Lab, University of Antwerp, Wilrijk, Belgium, [2]Laboratory of Cell Biology and Histology, University of Antwerp, Wilrijk, Belgium, [3]Molecular Imaging Center Antwerp, University of Antwerp, Wilrijk, Belgium
		We present a multiscale multimodal atlas of the mouse cerebral vasculature co-registered to the Allen Brain atlas space. To this end, we combined MRI anatomical imaging with the macro vasculature detected with TOF-MRA as well as the micro vasculature acquired from 3D microscopic imaging of a cleared mouse brain. To achieve a better homogeneity, we used a double labeling of the vasculature using isolectin to stain the vascular wall combined with an albumin staining of the blood vessel lumen. The atlas provides a reference space across multiple imaging modalities and a link to other functional, anatomical and genetic information.

376	9:51	Hybrid Vessel Centerline Tracking: Towards Automated Lesion Analysis on 3D Intracranial Vessel Wall MR
		Feng Shi[1], Wenhao Xu[1,2], Haili Wu[1,3], Zixiao Tian[1], Qi Yang[1,4], Debiao Li[1], and Zhaoyang Fan[1]
		[1]Cedars Sinai Medical Center, Los Angeles, CA, United States, [2]Tsinghua University, Beijing, China, [3]Beihang University, Beijing, China, [4]Xuanwu Hospital, Beijing, China
		We proposed a hybrid vessel centerline tracking method on 3D intracranial vessel wall MR. TOF MRA was used as a complementary modality that provides additional information for potential vessel path extraction. Results show high agreement of results from the proposed method and manual rater.

377	10:03	Three Dimensional Intra- and Extra-cranial Arterial Vessel Wall Joint Imaging in Patients with ischemic stroke
		Na Zhang[1], Lin Jia[2], Jinhao Lyu[3], Lei Zhang[1], Wenxiao Jia[2], Hairong Zheng[1], and Xin Liu[1]
		[1]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, shenzhen, China, [2]XinJiang Medical University, Urumchi, China, [3]Department of Radiology, Chinese PLA General Hospital, Beijing, China
		Intracranial and carotid atherosclerotic plaques are responsible for about 75% of ischemic stroke, the leading cause of mortality and morbidity worldwide. A 3D intra- and extra-cranial arterial vessel wall joint imaging was developed for simultaneously evaluating intracranial and carotid arterial plaques. The aim of this study was to assess the clinical potential of the 3D joint imaging technique in a large-scale patients with recent cerebrovascular symptoms. In general, this joint imaging method allows satisfactory image quality and comprehensive evaluation of atherosclerotic disease, and it has great potential to be used for optimizing treatment.

Oral

Signal Encoding & Decoding

N03	Tuesday 8:15 - 10:15	*Moderators:* Daniel Gallichan & Jana Hutter

378	8:15	Chirp-Encoded 3D GRE and MPRAGE sequences
		Kamlesh Pawar[1,2], Zhaolin Chen[1,3], Jingxin Zhang[3,4], N Jon Shah[1,5], and Gary F Egan[1,2]
		[1]Monash Biomedical Imaging, Monash University, Melbourne, Australia, [2]School of Psychological Sciences, Monash University, Melbourne, Australia, [3]Department of Electrical and Computer System Engineering, Monash University, Melbourne, Australia, [4]School of Software and Electrical Engineering, Swinburne University of Technology, Melbourne, Australia, [5]Institute of Medicine, Research Centre Juelich, Juelich, Germany

		Non-Fourier encoding such as random, noiselets and chirp encoding have demonstrated image quality improvement in accelerated compressive sensing (CS) MRI applications. However, implementation of the non-Fourier encoding schemes in 2D spin echo sequence limits its use in practice, due to the fact that spin echo is inherently a slow sequence. In this work, we present a novel implementation of chirp encoding in fast 3D gradient echo (GRE) and MPRAGE sequences. The chirp encoding scheme is compared with conventional Fourier encoding for compressive sensing and susceptibility weighted imaging applications. The evaluation demonstrates that chirp encoding is able to preserve spatial resolution better than the Fourier encoding.

379	8:27	Three Vencs for the Price of Two: Efficient Multi-Venc Phase-Contrast MRI for Improved Velocity Dynamic Range
		Liliana Ma[1,2], Kelvin Chow[1,3], Can Wu[4], Alireza Vali[1], Michael Markl[1,2], and Susanne Schnell[1]
		[1]Department of Radiology, Northwestern University, Chicago, IL, United States, [2]Department of Biomedical Engineering, Northwestern University, Evanston, IL, United States, [3]Cardiovascular MR R&D, Siemens Medical Solutions USA, Inc., Chicago, IL, United States, [4]Philips Healthcare, Gainesville, FL, United States
		Single-venc 4D flow MRI is inherently limited by the need to set a velocity encoding sensitivity (venc), where velocity(v)>venc results in velocity aliasing and v<<venc results in elevated noise. Thus, we propose a novel multi-venc encoding scheme for reconstruction of a triple-venc 4D flow dataset from our previously described 7TR dual-venc sequence. This triple-venc dataset can be used to improve velocity unwrapping without increasing scan time. The aim of this study was to systematically evaluate the utility of 7TR triple-venc velocity encoding to improve velocity dynamic range and further decrease velocity noise beyond the capabilities of current dual-venc methods.

380	8:39	Single-scan multi-spin-echo SPEN for dynamic T2 mapping and for 3D T2 weighted anatomical imaging
		Qingjia Bao[1], Eddy Solomon[1], Gilad Liberman[1], Samuel Cousin[1], and Lucio Fydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel
		SPatiotemporal ENcoding (SPEN) provides single-shot 2D images free from T2* effects, and with enhanced robustness to field distortions. SPEN's acquisition module is relatively short, opening the possibility to combine SPEN with a multi-spin-echo protocol, thus collecting several images in one shot. This work explores this possibility towards two different aims: the single-shot characterization of spatially-resolved T2 maps, and the accelerated acquisition of 3D images incorporating a phase encoding. Both approaches proved successful, as exemplified with real-time T2 mapping of in vivo kidney on a perfused mouse and high resolution volumetric acquisitions on *ex vivo* phantoms and human volunteers.

381	8:51	Fast imaging with ultrahigh isotropic resolution using partition-encoded simultaneous multi-slab (PRISM)
		Wei-Tang Chang[1] and Weili Lin[1]

		[1]BRIC, UNC at Chapel Hill, Chapel Hill, NC, United States
		Fast imaging with ultrahigh isotropic resolution has gained widespread interests but is technically challenging. The simultaneous multi-slice (SMS) and 3D imaging can hardly achieve high isotropic resolution without compromising temporal resolution or imaging contrast that needs long TR. A novel method, Partition-encoded Simultaneous Multi-slab (PRISM) imaging, was proposed to mitigate the physical constraints of thin slice excitation by applying partition encoding onto simultaneous multi-slab acquisition and provide ultrahigh isotropic resolution while maintaining the acceleration capability and TR flexibility. Using the PRISM technique, whole-brain fMRI with spatial resolution of 1mm isotropic and a temporal resolution of 2 seconds has been achieved.

382	9:03	Faster T2 Shuffling with Wave-encoding
		Siddharth Srinivasan Iyer[1,2], Berkin Bilgic[1], and Kawin Setsompop[1]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [2]Department of Electrical Enginerring and Computer Science, Massachussets Institute of Technology, Cambridge, MA, United States
		T_2-shuffling is a recently proposed approach that can reconstruct multiple, sharp T_2-weighted images from a single fast spin-echo (FSE) scan. Wave-CAIPI is a parallel imaging technique that uses additional sinusoidal gradients to spread aliasing in the readout direction, to take full advantage of coil-sensitivity information in highly accelerated rectilinear acquisitions. In this work, we augment T_2-shuffling with wave-encoding and examine the ability of this combined approach in accelerating FSE acquisition that can achieve multiple T_2-weighted images reconstruction. We demonstrate the efficacy of our technique through a 2D simulation, where wave-encoding was shown to provide good reconstruction at 2-3x higher accelerations.

383	9:15	Highspeed Imaging with Sub-millisecond Temporal Resolution of the Vocal Folds Oscillations using EGG-Gated Gradient Echo with Rapid Phase Encoding
		Johannes Fischer[1], Timo Abels[1], Ali Caglar Özen[1,2], Matthias Echternach[3], Bernhard Richter[3], and Michael Bock[1]
		[1]Dept.of Radiology, Medical Physics, Medical Center University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, [2]German Consortium for Translational Cancer Research Freiburg Site, German Cancer Research Center (DKFZ), Heidelberg, Germany, [3]Institute of Musicians' Medicine, Freiburg University Medical Center, Germany Faculty of Medicine, University of Freiburg, Freiburg, Germany
		We present a novel encoding method that allows sampling of one-dimensional periodic motion with sub-millisecond time resolution by applying very short phase encoding gradients along the direction of motion. The technique is applied to the oscillatory motion of the vocal folds during singing, and MR data are gated using an electroglottography synchronisation signal. Dynamic images during vocal fold oscillation were acquired with a temporal resolution of about 690 µs, and closing of the vocal folds was assessed.

384	9:27	Synthetic MP2RAGE: multiple ‘on-demand’ contrasts from a single acquisition
		Aurélien Massire[1,2], Thomas Troalen[3], Olivier M Girard[1,2], Tobias Kober[4,5,6], Bénédicte Maréchal[4,5,6], Maxime Guye[1,2], Jean-Philippe Ranjeva[1,2], and Virginie Callot[1,2]
		[1]Aix-Marseille Univ, CNRS, CRMBM, Marseille, France, [2]APHM, Hôpital Universitaire Timone, CEMEREM, Marseille, France, [3]Siemens Healthcare SAS, Saint-Denis, France, [4]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [5]Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland, [6]Signal Processing Laboratory (LTS 5), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
		MP2RAGE and FLAWS sequences are increasingly used for brain clinical research imaging at ultra-high field. Yet, the ability to provide at the same time an optimal contrast between GM and WM for segmentation, an accurate T_1 mapping and/or the ability to highlight only a single tissue or lesions, is in practice not possible with only one single MP2RAGE acquisition. In this work, we demonstrate that synthetic ‘uniform’ images with ‘on-demand’ clinically relevant contrasts could be generated at 7T from a single MP2RAGE acquisition providing an accurate T_1 map, allowing for instance tissue signal nulling or lesion signal enhancement.

385	9:39	Interleaved SPEN with per-shot correction for high definition human DTI measurements
		Samuel F. Cousin[1], Gilad Liberman[1], Eddy Solomon[1], and Lucio Frydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel
		Sub-mm DTI is of great interest for clinical diagnosis and healthy tissue studies. Segmented imaging is hindered in these applications, due to complications associated to unavoidable motions in-between shots. This work demonstrates the advantages resulting from using interleaved, segmented SPatially ENcoded (SPEN) methods for DTI, thanks to their ability to (i) provide low-resolution but fully sampled images per shot; (ii) compensate for rigid-body motions by simple phase corrections, and (iii) zoom on restricted FOVs without folding complications. All this enables high-resolution diffusion MRI on humans, as shown here by delineating the pons anatomy at a 0.74mm in-plane resolution.

386	9:51	Parallel Transmit Excitation Pulses for Shuttered Echo Planar Imaging
		Zhipeng Cao[1,2], Xinqiang Yan[2,3], and William A. Grissom[1,2,3]
		[1]Biomedical Engineering, Vanderbilt University, Nashville, TN, United States, [2]Institute of Imaging Science, Vanderbilt University, Nashville, TN, United States, [3]Radiology, Vanderbilt University, Nashville, TN, United States
		A parallel transmission based shutter excitation is proposed for multishot EPI that overcomes its sensitivity to motion and dynamic phase changes between shots. The g-factor performance, flip angle error, and SAR are characterized as a function of the number of transmit coils, and compared to ideal single-channel excitation.

387	10:03	An Optimized 3D Stack-of-Stars TSE Pulse Sequence for Simultaneous T2-weighted Imaging and T2 Mapping
		Mahesh Bharath Keerthivasan[1,2], Kevin Johnson[3], Manojkumar Saranathan[2], Craig Weinkauf[4], Diego Martin[2], Ali Bilgin[1,5], and Maria Altbach[2]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Medical Imaging, University of Arizona, Tucson, AZ, United States, [3]Siemens Healthcare, Tucson, AZ, United States, [4]Department of Surgery, University of Arizona, Tucson, AZ, United States, [5]Biomedical Engineering, University of Arizona, Tucson, AZ, United States
		A 3D stack-of-stars Turbo Spin Echo sequence is presented for efficient T2-weighted imaging and T2 mapping. The pulse sequence parameters are optimized for T2 estimation, SNR, and SAR and the view ordering is designed to enable efficient k-space coverage for both non-selective and slab selective acquisitions. The technique provides excellent anatomical coverage within clinically acceptable times. Utility of the sequence is demonstrated in vivo on the knee, brain and for carotid vessel wall imaging.

Oral

Resolving Layers & Columnar Activity

N04	Tuesday 8:15 - 10:15	*Moderators:* David Norris & Rosa Sanchez Panchuelo

388	8:15	Functional Mapping of Body Part Representations across Layers and Columns in Humans
		Laurentius Huber[1], Jozien Goense[2], Pete Molfese[1], Daniel Glen[3], Dave Jangraw[1], Sriranga Kashyap[4], Benedikt A Poser[4], Daniel A Handwerker[1], and Peter A Bandettini[1]
		[1]SFIM, NIMH, Bethesda, MD, United States, [2]University of Glasgow, Glasgow, United Kingdom, [3]NIMH, Bethesda, MD, United States, [4]MBIC, Maastricht, Netherlands
		In this work, we seek to characterize the mesoscopic circuitry of the sensorimotor system across layers, columns and brain areas. We use a blood volume and BOLD signal sensitive fMRI methodology during task and rest with 0.78 mm resolution. We find ‘columnar’-dependent connectivity, representing the same body parts (e.g. digits) across different sensory and motor areas. In the hand knob, we find ‘columnar’ networks with a finer spatial scale than the regime of individual digit representations. Layer-dependent differences of task-induced and resting-state fMRI are indicative of different input-output-driven activity.

389	8:27	Cortical depth dependent resting state fMRI with motion correction
		Ying-Hua Chu[1,2], Pu-Yeh Wu[2], Maxim Zaitsev[1], Yi-Cheng Hsu[1,2], and Fa-Hsuan Lin[2,3]

		[1]Dept. of Radiology, Medical Physics, Medical Center University of Freiburg, Faculty of Medicine, Freiburg, Germany, [2]Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan, [3]Department of Neuroscience and Biomedical Engineering, Aalto University, Espoo, Finland
		We used high resolution EPI (1 mm isotropic), cortical depth dependent analysis, and prospective motion correction (MOCO) to delineate the default mode network. Most sensitive within-subject characterization of the default-mode network was obtained from data at intermediate/superficial cortical depths with MOCO.

390	8:39	Improved spatial specificity of the early positive BOLD response observed with high-resolution fMRI at 3T
		Anna I Blazejewska[1,2], Shahin Nasr[1,2], and Jonathan R Polimeni[1,2,3]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [2]Department of Radiology, Harvard Medical School, Boston, MA, United States, [3]Harvard-MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States
		Previous studies have demonstrated improved spatial specificity of conventional BOLD fMRI when restricting the analysis to the initial dip, however recent evidence suggests that it may be possible to achieve high specificity by restricting the analysis to the early phase of the response. Here we tested this concept by employing a spatial resolution test pattern in the visual cortex and observed the evolution of this pattern over time in signal subjects. We find that the spatial pattern of the early stages of the BOLD response appear to exhibit improved spatial specificity.

391	8:51	Columnar processing of acoustic features in human auditory cortex
		Michelle Moerel[1,2], Federico De Martino[2,3], Kamil Ugurbil[3], Elia Formisano[1,2], and Essa Yacoub[3]
		[1]Maastricht Centre for Systems Biology, Maastricht University, Maastricht, Netherlands, [2]Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, Netherlands, [3]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States
		Using ultra-high field fMRI, we explored the cortical depth dependent stability of acoustic feature preference in human auditory cortex. In accordance with results from invasive recordings in cat auditory cortex, we observed a relatively stable (i.e., columnar) tuning to frequency and temporal modulations, while spectral modulation tuning was less stable throughout the cortical depth. This could represent simpler spectral tuning in middle auditory cortical layers, compared to more complex spectral tuning superficially. Furthermore, results suggest a coding strategy in which tuning to some features is kept stable orthogonal to the cortex, while tuning to other features systematically varies.

392	9:03	Cortical feedback to superficial layers of V1 contains predictive scene information.

		Andrew Morgan[1], Federico De Martino[2], Lucy S. Petro[1], Rainer Goebel[2], and Lars Muckli[1]
		[1]Institute of Neuroscience & Psychology, University of Glasgow, Glasgow, United Kingdom, [2]Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, Netherlands
		A central characteristic of brain function is the ability to merge sensory input with internal representations of the world, but relatively little is known about cortical feedback channels that facilitate internal representations. We blocked feedforward input to subsections of human primary visual cortex by occluding one quarter of the visual field while participants viewed 384 real-world scenes. Using high-resolution 7T fMRI, we show that superficial layers of V1 exhibit predictive response properties unique from those associated with V1 feedforward processing. Our findings suggest that feedback to superficial layers of V1 provides neurons with contextual information not available via feedforward input.

393	9:15	Depth-dependent functional mapping of mental prediction in human somatosensory cortex
		Yinghua Yu[1,2], Laurentius Huber[1], David C Jangraw[1], Peter J Molfese[1], Andrew Hall[1], Daniel A Handwerker[1], Jiajia Yang[1,2], and Peter A Bandettini[1]
		[1]SFIM, NIMH, Bethesda, MD, United States, [2]Cognitive Neuroscience Lab, Division of Medical Bioengineering, Graduate School of Natural Science and Technology, Okayama University, Okayama, Japan
		High-resolution, cortical depth-dependent fMRI allows researchers to address questions about the feed-forward and feed-back driven activity non-invasively. The processing of finger-touching in the sensory cortex is a complex interplay between feed-forward activity from the thalamus and feed-back input from higher-order brain areas representing touching anticipation/prediction. Here we use high-resolution (0.7mm) fMRI at 7T to investigate this interplay in the human brain with BOLD and blood-volume-sensitive fMRI as a function of cortical depth. We find that we can reveal that prediction input in S1 is dominated from superficial layers, while thalamo-cortical feed-forward input is dominant in middle cortical layers, as expected from previous work in animals.

394	9:27	True laminar resolution fMRI of the human visual cortex at 7T
		Sriranga Kashyap[1,2], Dimo Ivanov[1,2], Shubharthi Sengupta[1,2], Benedikt A. Poser[1,2], and Kâmil Uludağ[1,2]
		[1]Department of Cognitive Neuroscience, Maastricht University, Maastricht, Netherlands, [2]Maastricht Brain Imaging Centre (MBIC), Maastricht, Netherlands
		Current laminar BOLD fMRI studies at ultra-high field are typically carried out at sub-millimetre spatial resolution (~0.7mm isotropic), which, however, results in each voxel covering more than one cortical layer. Thus, layer-resolved activation profile can only be obtained if such data is analysed with post-processing tools at super-resolution. In this study, we demonstrate a novel functional mapping approach by acquiring fMRI data at true laminar resolution (100µm) in humans at 7T, compare it to the conventional high-resolution GE-EPI and analyse the depth-dependent BOLD signal change to visual stimulation.

395	9:39	The EPI rs-fMRI signal shows an orientation effect with respect to B0 and phase-encode axis across cortical depth
		Olivia M Viessmann[1], Marta Bianciardi[1], Klaus Scheffler[2], Lawrence L Wald[1,3], and Jonathan R Polimeni[1,3]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Harvard Medical School, Massachusetts General Hospital, Charlestown, MA, United States, [2]Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [3]Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States
		The cortex exhibits a strict vascular architecture and vessel orientation to the B_0 field should impact the local susceptibility and hence the local BOLD signal. Cortical folding could thus lead to local variations in the signal. Here, we used high-resolution 7T EPI rs-fMRI data and found substantial variations of the signal amplitdude's coefficient of variation (σ/μ) with the local cortical orientation to B_0. This effect was measurable throughout cortical depths with a maximised effect of +70% at the surface. We compare this to orientation-dependent blurring effects along the phase-encode axis, which we found to be significant too.
396	9:51	Estimating the Spatial Precision of Multivoxel Pattern of BOLD Response at 7T
		Luca Vizioli[1], Lars Muckli[2], Federico Di Martino[3], and Essa Yacoub[1]
		[1]CMRR, University of Minnesota, Minneapolis, MN, United States, [2]University of Glasgow, Glasgow, United Kingdom, [3]Maastricht University, Maastricht, Netherlands
		fMRI has limited spatial accuracy due to the vascular nature of the signal source. At high fields, sub-millimeter functional images can be acquired with the hopes of investigating cortical columns and/or layers. The efforts to improve the spatial accuracy of the signals tends to be focused on the acquisition side, rather than the analysis side. Here, we explore the use of multi-voxel pattern analysis as a means to circumvent the apparent spatial specificity limits of ultra-high field fMRI.
397	10:03	Hypercapnic and hyperoxic laminar calibrated BOLD: are conventional models adequate?
		Alberto Merola[1], Maria Guidi[1], and Nikolaus Weiskopf [1]
		[1]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

		Several sub-millimetre-resolution fMRI acquisitions have been developed in recent years, however none taken singularly directly reflects neural activity. We use a calibrated BOLD approach combining BOLD and VASO measurements with respiratory manipulations (CO2 and O2) and a motor task to estimate cortical profiles of changes in O2 metabolism, a parameter more tightly related to neuronal function. Calculated hypercapnic calibration parameters are consistent with previous findings, while physiologically implausible estimates of O2 metabolism changes are found with hyperoxic calibration. A possible reason for this is reported, which questions the validity of conventional models for hyperoxic calibration at this resolution.

Oral

Novel Contrast & Targeted Molecular Imaging

S04	Tuesday 8:15 - 10:15	*Moderators:* Luisa Ciobanu & A. Dean Sherry

398	8:15	Intracellular MEMRI signals reflect the frequency of action potentials in Aplysia neurons
		Pavel Svehla[1], Alexis Bedecarrats[2], Caroline Jahn[1], Romuald Nargeot[2], and Luisa Ciobanu[1]
		[1]NeuroSpin/CEA, Gif-sur-Yvette, France, [2]University of Bordeaux, Bordeaux, France
		We show a positive correlation between electrical activity and MEMRI signal intensity in identified neurons in *Aplysia* buccal ganglia and demonstrate that the MEMRI signal reflects mainly fast and high membrane depolarization processes such as action potentials, and it is not sensitive to slow and small membrane depolarization, such as post-synaptic potentials.

399	8:27	Active Targeting of human neutrophil granulocytes by non-invasive 19F MRI
		Pascal Bouvain[1], Bodo Steckel[1], Wolfgang Krämer[2], Rolf Schubert[2], Sebastian Temme[1], and Ulrich Flögel[1]
		[1]Heinrich-Heine University, Düsseldorf, Germany, [2]Albert-Ludwigs-University, Freiburg, Germany
		The purpose of the present study was to target human neutrophils by PFCs to enable their visualization by ^{19}F MRI. We coupled a neutrophil-binding peptide (NG2) to PFCs and showed the specific binding and internalization of NG2-PFCs by ^{19}F MRI, microscopy and FACS. Interestingly, NG2-PFCs show an increased labelling of neutrophils from MI patients and these cells also showed an increased migration into an artificial circulation system which contained an IL-8 doped matrigel placed in a flow chamber. In conclusion, NG2-PFCs are suited to label neutrophil granulocytes after MI and enable their non-invasive visualization by $^{1}H/^{19}F$ MRI.

400	8:39	Layer specific neural interactions in the thalamo-cortical and cortico-cortical networks: An optogenetic manganese-enhanced MRI study
		Karim El Hallaoui[1,2], Eddie C. Wong[1,2], Xunda Wang[1,2], Alex T. L. Leong[1,2], Russell W. Chan[1,2], Celia M. Dong[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China
		The thalamo-cortical projections terminating in the primary somatosensory cortex are anatomically organized into layers. However, the functional layer-specificity of the axonal pathways which comprise the thalamo-cortical circuit remains to be studied. Combining optogenetic stimulation and manganese-enhanced MRI, the present study selectively induces neural activity in the ventral posteromedial nucleus to induce the deposit of manganese in its projections in-vivo. By identifying the cortical regions with increased contrast, using images acquired with the MDEFT MRI experiment, we infer the layer-specific connections from the thalamus to the primary somatosensory cortex.

401	8:51	Noninvasive imaging of transgene expression using CEST-MRI
		Julien Flament[1,2], Jérémy Pépin[1], Marianne Maugard[1], Mylène Gaudin[1], Julien Valette[1], and Gilles Bonvento[1]
		[1]Molecular Imaging Research Center (MIRCen), Commissariat à l'Energie Atomique, Fontenay-aux-Roses, France, [2]US27, Inserm, Fontenay-aux-Roses, France
		Gene therapy often uses viral vectors to insert a therapeutic gene into cells. It is necessary to develop molecular imaging techniques to safely monitor gene expression. We designed a strategy to image expression of a transgene using a genetically engineered CEST reporter. An adeno associated vector encoding for 150 L-arginine residues fused to a fluorophore was produced and injected in the mouse brain. Specific signals were observed in both CEST and fluorescence modalities, demonstrating the possibility to use CEST-based reporter genes to monitor transgene distribution and expression. Such noninvasive imaging modality could be valuable for further developments of gene therapy.

402	9:03	OATP1A1 reporter gene-enhanced magnetic resonance imaging of Triple Negative Breast Cancer in animal models at 3 Tesla
		Nivin N Nyström[1,2], Amanda M Hamilton[1], Francisco FM Martinez[1], Timothy J Scholl[1,2,3], and John A Ronald[1,2]
		[1]Medical Imaging, Robarts Research Institute, London, ON, Canada, [2]Medical Biophysics, University of Western Ontario, London, ON, Canada, [3]Ontario Institute for Cancer Research, Toronto, ON, Canada

		Preclinical cancer models are invaluable for studying oncogenic pathways and assessing therapies. However, precise detection of small tumours with specificity, sensitivity and high resolution remains challenging. A member of the Organic Anion Transporting Polypeptide 1 (OATP1) family of proteins, called OATP1A1, can take up the clinically-approved, liver-specific paramagnetic agent Gd-EOB-DTPA. Significant increases in spin-lattice relaxation rates were exhibited at 3T by triple negative breast cancer (TNBC) cells engineered to express OATP1A1 and pilot data showed enhancement of OATP1A1-expressing orthotopic TNBC tumours in mice. Our data supports the utility of OATP1A1 for improved MR detection of TNBC tumours in animal models.

403	9:15	MR/ fluorescence dual-modality image-guided multifunctional albumin nanoassembies for sonodynamic therapy of glioma
		Qian Wan[1,2], Chao Zou[1], Mengjie Chen[3], Zonghai Sheng[1], Jun Zhou[3], Yanwen Zhu[3], Hairong Zheng[1], and Xin Liu[1]
		[1]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, [2]University of Chinese Academy of Sciences, Beijing, China, [3]The First College of Clinical Medical Sciences，China Three Gorges Unversity, Yichang, China
		Sonodynamic therapy (SDT) is a non-invasive and effective therapeutic modality for solid cancerous tumors. In this study, to improve the effectiveness of SDT, we fabricated a high-performance multifunctional albumin nanoassembies (HSA-Ce6-Mn NCs) having higher cell uptake efficiency and the tumor accumulation. It also exhibited an excellent ability of MR/ fluorescence (FL) dual-modality imaging so that glioma margin and HSA-Ce6-Mn NCs metabolism could be clearly visualized. The SDT has been demonstrated for suppressing the tumor growth in-vivo under a MRI-guided FUS system and it is highly expected to have a great potential in clinical translation.

404	9:27	Multimodality cellular and molecular imaging of the impact of a primary tumor on metastatic growth in a syngeneic mouse model of breast cancer brain metastasis
		Katie Parkins[1], Veronica Dubois[1], Amanda Hamilton[2], Ashley Makela[1], John Ronald[1], and Paula Foster[1]
		[1]Medical Biophysics, Western University, London, ON, Canada, [2]Western University, London, ON, Canada
		The mechanisms that influence metastatic growth rates are poorly understood. One mechanism of interest known as concomitant tumor resistance (CTR) can be defined as the inhibition of metastatic growth by existing tumor mass. Conversely, the presence of a primary tumor has also been shown to increase metastatic outgrowth, termed concomitant tumor enhancement (CTE). The goal of this research was to use conventional and cellular MRI , and bioluminescence imaging to study the impact of a primary tumor on the development of breast cancer brain metastases in a syngeneic mouse model.

405	9:39	Europium(2+/3+) dual mode MRI contrast agents: combining paraCEST and T1w contrast in one oxygen-sensitive agent.
		Alexander Max Funk[1], Veronica Clavijo-Jordan[1], Dean Sherry[1,2], James Ratnakar[1], and Zoltan Kovacs[1]
		[1]UT Southwestern Medical Center, Dallas, TX, United States, [2]University of Texas at Dallas, Dallas, TX, United States
		The ability to determine hypoxia in tumors in vivo could provide useful diagnostic contrast information. MRI contrast agents could provide this information. Eu^{2+} is isoelectronic with Gd^{3+}, and produces T_1w contrast on a similar level, in addition, it is not oxidatively stable. In an aerobic atmosphere, it oxidizes rapidly to Eu^{3+}, which does not produce T_1 contrast, but can belong to a conceptually different class of contrast agents: paraCEST (chemical exchange saturation transfer) agents. A $Eu^{2+/3+}$ agent was tested in different tissues in-vivo to show the correlation between the rate of oxidation and the surrounding oxidative environment of the tissue.

406	9:51	Renal pH Imaging Using Aspirin Analogs and CEST MRI
		KowsalyaDevi Pavuluri[1] and Michael T McMahon[1,2]
		[1]Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Research Institute, Baltimore, MD, United States
		Developing new tools that can be used to detect changes in renal tissue is of great interest for nephrologists. Indeed, standard measurements of blood-urea nitrogen and serum creatinine might not detect kidney injury until a 50% loss in function occurs. As kidneys play a preeminent role in controlling acid-base balance, pH mapping should enable early detection of changes in renal health. Here we propose administration of salicylate based diaCEST MRI agents to map renal pH. As we show, aspirin and three analogs: salicylic acid, 2,4-dihydroxy benzoic acid, 2,5-dihydroxy benzoic acid displayed promise in vitro and in vivo for pH mapping.

407	10:03	Development and Proof of Principle for Free Radical Imaging with the Novel Field-cycling in vivo DNP-MRI
		Hideo Utsumi[1,2], Toshiki Masumizu[1,2], Ryoma Kobayashi[1,3], Utaroh Motosugi[4], Tatsuya Shimizu[4], Tomoko Tahira[1,5], Atsushi Iikura[6], and Hidenori Kajiwara[6]
		[1]Innovation Center for Medical Redox Navigation, Kyushu University, Fukuoka, Japan, [2]Pharmaceutical Sciences, University of Shizuoka, Shizuoka, Japan, [3]Osaka University, Suita, Japan, [4]University of Yamanashi, Yamanashi, Japan, [5]Kinjo Gakuin University, Nagoya, Japan, [6]Fuji Electric Co., Ltd, Tokyo, Japan

In vivo DNP-MRI was reported as a new imaging method for free radical species *in vivo*[1], and the field-cycling was utilized to overcome the large difference between electron and nuclear spin resonances[2,3]. Unfortunately the development of the clinical DNP-MRI has severe difficulties due to less applicability.

Here, we developed the novel field-cycling DNP-MRI for clinical trial by rotating the magnets for MRI (0.3T) and ESR (4.7mT), and the free radicals placed under the palm of volunteers were visualized, superimposed on the anatomical MRI image, and demonstrated the proof of principle for free radical imaging with the newly developed field-cycling DNP-MRI.

Oral

Novel CEST Methods in Cancer & Beyond

S05	Tuesday 8:15 - 10:15	*Moderators:* Xiang Xu & Greg Stanisz

408	8:15	NOE-mediated CEST Imaging of Glioma at 7 Tesla Aids Early Response Evaluation of Patients Undergoing Radio-Chemotherapy
		Jan-Eric Meissner[1], Sebastian Regnery[2], Andreas Korzowski[1], Steffen Goerke[1], Jürgen Debus[2], Heinz-Peter Schlemmer[3], Mark E. Ladd[1], Peter Bachert[1], Sebastian Adeberg[2], and Daniel Paech[3]
		[1]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Radiation Oncology, Medical Faculty, University of Heidelberg, Heidelberg, Germany, [3]Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany
		Reliable biomarkers for an early assessment of treatment response are urgently needed. In this study, we investigated the rNOE-mediated CEST signals in patients undergoing radio- and chemotherapy at three different time points including pre and post treatment. The results were compared to the standard clinical determination of responders and non-responders (RANO criteria) and the relaxation compensated CEST contrast NOE_{AREX} showed a statistically significant difference between the two groups directly after therapy. Hence, NOE_{AREX} might potentially help determining early tumor response to therapy.

409	8:27	CEST-Dixon for human breast cancer characterization at 3T: a preliminary study
		Shu Zhang[1], Stephen Seiler[1], Xinzeng Wang[1], Ananth J Madhuranthakam[1,2], Jochen Keupp[3], Emily Eads[1], Robert E Lenkinski[1,2], and Elena Vinogradov[1,2]
		[1]Department of Radiology, UT Southwestern Medical Center, Dallas, TX, United States, [2]Advanced Imaging Research Center, UT Southwestern Medical Center, Dallas, TX, United States, [3]Philips Research, Hamburg, Germany

		Previous studies have demonstrated the application of CEST to breast malignancies and its potential to aid tumor characterization. However, artifacts can develop in breast CEST imaging due to strong lipid signals. In this work, CEST-Dixon sequence is used for fat free CEST imaging to characterize suspicious lesions in patients. The CEST effects are higher in the ER- IDC than the ER+ IDC, benign and normal groups. The results also indicate positive correlation of CEST with the Ki-67 level. Thus, CEST-Dixon has a potential for improved non-invasive characterization of breast lesions, potentially differentiating more aggressive from less aggressive tumors.

410	8:39	Decoding IDH Genotype in Grade-II and -III Gliomas with Protein-based Amide Proton Transfer-Weighted (APTw) MRI
		Shanshan Jiang[1,2], Qihong Rui[1], Hao Yu[1], Yu Wang[3], Yi Zhang[4], Hye-Young Heo[2], Jinyuan Zhou[2], and Zhibo Wen[1]
		[1]Department of Radiology, Zhujiang Hospital, Southern Medical University, Guangzhou, China, [2]Department of Radiology, Johns Hopkins University, Baltimore, MD, United States, [3]Department of Pathology, Zhujiang Hospital, Southern Medical University, Guangzhou, China, [4]Center for Brain Imaging Science and Technology, Department of Biomedical Engineering, Zhejiang University, Hangzhou, China
		We explored the possibility of using the APTw signal intensity as a surrogate marker to identify IDH mutation status in gliomas. 105 patients with newly diagnosed grade-II/III gliomas were included. APTw histogram data obtained from tumor burden was recorded. The Mean, Peak, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} Percentiles of APTw signal histograms were significantly higher in the IDH-wildtype group than in the IDH-mutant group. The classification for 50^{th} Percentile APTw to differentiate these two glioma groups was 78.1%. Preoperative APTW imaging may assist in predicting the IDH mutation status in gliomas.

411	8:51	Quantifying the glucose CEST Effect in Patients with oropharyngeal squamous cell carcinoma at 3T in vivo using an oxygen challenge
		Alex K. Smith[1], Tessa Greenhalgh[2], Nia Taylor[3], Benjamin Irving[4], Ketan Shah[3], Daniel Bulte[4], Martin Craig[4], Michael Chappell[4], Fergus Gleeson[2], and Brian Burns[2,5]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, University of Oxford, Oxford, United Kingdom, [2]Department of Oncology, University of Oxford, Oxford, United Kingdom, [3]Oxford University Hospitals NHS Foundation Trust, University of Oxford, Oxford, United Kingdom, [4]Institute of Biomedical Engineering, Department of Engineering Science, University of Oxford, Oxford, United Kingdom, [5]MR Applied Sciences Lab, GE Healthcare, Menlo Park, CA, United States
		Characterizing tumor treatment response is an ongoing radiological challenge as both the anatomical and physiological characteristics of the tumor are changing as the treatment course progresses. GlucoCEST imaging may provide an avenue towards understanding the evolving tumor metabolic environment over the course of treatment. In this preliminary assessment, we show that an oxygen challenge can highlight changes in the vasculature of tumors post radiotherapy.

412	9:03	Amide proton transfer (APT) imaging of benign ovarian cystic lesions
		Keisuke Ishimatsu[1], Akihiro Nishie[1], Yukihisa Takayama[1], Yoshiki Asayama[1], Kousei Ishigami[1], Yasuhiro Ushijima[1], Daisuke Kakihara[1], Nobuhiro Fujita[1], Koichiro Morita[1], Seiichiro Takao[1], Osamu Togao[1], Kenzo Sonoda[2], Jochen Keupp[3], and Hiroshi Honda[1]
		[1]Department of Clinical Radiology, Kyushu University, Fukuoka, Japan, [2]Department of Obstetrics and Gynecology, Kyushu University, Fukuoka, Japan, [3]Philips Research, Hamburg, Germany
		It is important to diagnose benign ovarian cystic lesions as early and correctly as possible because some types of lesions have malignant potential. The objective of our study is to investigate whether amide proton transfer (APT) imaging is useful for evaluation of benign ovarian cystic lesions. We compared the APT signal in three different benign ovarian cystic lesions using three different durations of presaturation pulse.

413	9:15	Separation of the contribution of protein concentration and pH to measured APT signal changes in a preclinical model of brain metastases
		Kevin J Ray[1,2], Manon Simard[2], James R Larkin[2], Michael A Chappell[3], and Nicola R Sibson[2]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]CRUK & MRC Oxford Institute for Radiation Oncology, University of Oxford, Oxford, United Kingdom, [3]Institute of Biomedical Engineering, University of Oxford, Oxford, United Kingdom
		Amide proton transfer (APT) studies usually attribute the altered APT signal in tumours to an increased cytosolic protein concentration. However, other concomitant changes in pH, T_1, or water content make absolute quantification of protein concentration or pH from APT signals challenging. In this study, we separate the contributions of protein concentration and pH to APT signal differences in a preclinical model of brain metastases by combining *in vivo* and *ex vivo* measurements. We show that 66% of the observed APT signal difference was caused by protein concentration alterations, with the remaining 34% signal change reflecting an increase in tumour pH.

414	9:27	Deep CEST MRI – 9.4T spectral super-resolution from 3T CEST MRI data
		Moritz Zaiss[1], Anagha Deshmane[1], Kai Herz[1], Max Braun[2], Benjamin Bender[3], Tobias Lindig[3], and Klaus Scheffler[1]
		[1]High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]X, Mountain View, CA, United States, [3]Diagnostic & Interventional Neuroradiology, University Hospital Tuebingen, Tuebingen, Germany

		CEST peaks are easy to detect at ultra-high-field strengths due to high signal and spectral separation. However, spectral coalescence and line broadening makes modeling of CEST effects at clinical field strengths (<=3T) a challenge. In this proof-of-concept study of super-resolution CEST imaging, the underlying spectral features of 3T Z-spectra were predicted using a neural network trained on 9.4T data. Applying the neural network to untrained volunteer and patient data acquired at 3T resulted in the expected contrast in healthy gray and white matter and tumor tissue in Z-spectra and APT, NOE, and MT CEST maps.

415	9:39	NaSA-CEST: MR monitoring of brain inflammation using an aspirin metabolite as contrast agent
		Xiaolei Song[1], Yanrong Chen[1,2], Chenwang Jin[1,3], Chengyan Chu[1], Irina Shats[1], Yuguo Li[1], Yue Yuan[1], Xiaowei He[2], Piotr Walzcak[1], and Jeff W.M Bulte[1]
		[1]Johns Hopkins Univeristy, Baltimore, MD, United States, [2]Northwest University, Xi'an, Shaanxi, China, [3]Xi'an Jiaotong University, Xi'an, Shaanxi, China
		Sodium salicylate (NaSA), a nonsteroidal anti-inflammatory drug and the main metabolite of aspirin, can accumulate specifically in inflamed tissue. We investigated the use of NaSA-enhanced CEST MRI for in vivo mapping of brain inflammation, induced by intrastriatal injection of lipopolysaccharide (LPS). Inflamed mice exhibited an increase of ~8% NaSA-CEST signal on the AUC10-30min images, with signals for the ipsilateral striatum significantly higher than those for the mirrored contralateral regions. While for the non-inflamed sham mice, which received saline instead of LPS, no such NaSA-CEST signal could be observed. Our NaSA-CEST approach could possibly lead to the development of inflammation-specific theranostics.

416	9:51	Multicolor metabolic quantitative CEST (mmqCEST) imaging: possibility and limitations
		Vitaliy Khlebnikov[1], Alex Bhogal[1], Olivier Mougin[2], Vincent Boer[3], Jannie Wijnen[1], Penny Gowland[2], Peter Luijten[1], Jeanine Prompers[1], Hans Hoogduin[1], and Dennis Klomp[1]
		[1]UMC Utrecht, Utrecht, Netherlands, [2]University of Nottingham, Nottingham, United Kingdom, [3]Copenhagen University Hospital Hvidovre, Copenhagen, Denmark
		Multicolor metabolic CEST imaging: possibility and limitations

417	10:03	CEST Fingerprinting: Initial Study in Human Subjects
		Zhengwei Zhou[1], Qi Yang[1,2], Zhaoyang Fan[1], Pei Han[1], and Debiao Li[1,3]

		[1]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [2]Department of Radiology, Xuanwu Hospital, Capital Medical University, Beijing, China, [3]Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA, United States
		CEST fingerprinting was recently proposed to achieve efficient exchange rate quantification for pH mapping. Here we present the initial data of pH mapping in healthy subjects and one acute stroke patient at clinical scanners in an 8-min scan using CEST fingerprinting. The pH maps of the healthy volunteers are homogenous and the values fall in the normal physiological range. The pH map in the patient shows an inhomogenous acidic area. This study shows CEST fingerprinting has the potential to detect acidosis in human subjects.

Oral

Parkinson's Disease

W05/06	Tuesday 8:15 - 10:15	*Moderators:* Shigeki Aoki & Dorothee Auer

418	8:15	Exploring Temporal Dynamics in Resting-State Networks using Co-Activation Pattern Analysis
		Xiaowei Zhuang[1], Ryan R Walsh (co-first)[2], Karthik Sreenivasan[1], Zhengshi Yang[1], Virendra Mishra[1], and Dietmar Cordes[1,3]
		[1]Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States, [2]Barrow Neurological Institute, Phoenix, AZ, United States, [3]University of Colorado, Boulder, CO, United States
		We propose a novel group CAP analysis method to investigate temporal dynamics of specific resting-state networks. Our data-driven method computes less spatially overlapping d-CAPs for each group. We compare network-dynamics between different populations using d-CAP based measurements. Using simulation, we demonstrate that the proposed method is able to determine spatially less overlapping d-CAPs for each group accurately. Using real fMRI data, we find reduced network-dynamics of most networks in PD subjects as hypothesized, which corroborates and expands upon previous electrophysiologic reports.

419	8:27	Findings from SNAP-MRA and PCASL in Patients with Parkinson’s Disease “OFF” and “ON” Levodopa
		Yuhui Xiong[1], Zhangxuan Hu[1], Le He[1], Yu Ma[2], Wenjuan Cai[3], Zhensen Chen[1], and Hua Guo[1]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]Tsinghua University Yuquan Hospital, Beijing, China, [3]Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China

		This study aimed to evaluate the effect of levodopa on cerebral arteries and gray matter cerebral blood flow (CBF) in patients with Parkinson's disease (PD). We scanned 33 PD patients with "OFF" and "ON" levodopa using Simultaneous Non-Contrast Angiography and intraPlaque Hemorrhage (SNAP) MRA and Pseudo-Continuous Arterial Spin Labeling (PCASL), and used multiple statistical methods to analyze the data. Results from the statistical analysis show that after taking levodopa, patient's treatment outcomes are highly correlated with his/her gray matter CBF. The results also suggest that levodopa can dilate cerebral arteries and improve CBF, but only in patients with mild symptoms.

420	8:39	Functional MRI can distinguish between optimal and non-optimal frequencies in PD-DBS
		Radhika Madhavan[1], Suresh Emmanuel Joel[1], Saikat Saha[1], Marisa DiMarziio[2], Eric Fiveland[3], Jeffrey Ashe[3], Michael Gillogly[4], Jennifer Durphy[4], Julia Prusik[2,4], Pilitsis Julie[2,4], and Ileana Hancu[3]
		[1]GE Global Research, Bangalore, India, [2]Department of Neuroscience and Experimental Therapeutics, Albany Medical Center, Albany, NY, United States, [3]GE Global Research, Niskayuna, NY, United States, [4]Department of Neurosurgery, Albany Medical Center, Albany, NY, United States
		Deep Brain Stimulation is an effective treatment for Parkinson's disease symptoms. Despite its success, the underlying principle and the mechanisms are not yet fully understood. In this study, we recorded concurrent DBS-fMRI to 1) elucidate brain regions activated at the clinically optimal settings and, 2) determine the effect of changes in stimulation frequency on whole-brain activation. Optimal DBS frequencies showed activation in the thalamus and motor cortices. Further, there was a significant difference in activation in the sensorimotor cortices between the optimal and non-optimal frequencies, indicating potential use for fMRI as a tool for optimizing DBS parameters.

421	8:51	Early Stage Parkinson's Disease Shows Changes in Energy and Period Content of Resting-State Networks
		Dietmar Cordes[1,2], Muhammad Kaleem[3], Xiaowei Zhuang[1], Karthik Sreenivasan[1], Zhengshi Yang[1], Sarah Banks[1], Brent Bluett[1], Zoltan Mari[1], and Virendra Mishra[1]
		[1]Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States, [2]University of Colorado, Boulder, CO, United States, [3]University of Management & Technology, Lahore, Pakistan
		Low-frequency BOLD fluctuations of major resting-state networks in early Parkinson's disease (PD) were studied and compared with matched normal controls. Empirical Mode Decomposition (EMD) was used to decompose the natural occurring frequency bands of major brain resting-state networks. The novelty of our approach lies in the data-adaptive decomposition of fMRI data using EMD, and identification of resting-state networks based on energy and period (inverse frequency) characteristics of intrinsic mode functions. For most networks studied that showed a large effect size, the frequency content of the associated network time series was found to be significantly reduced in PD.

422	9:03	Resting state functional corticostriatal connectivity in Parkinsonian monkeys

		Joonas A Autio[1], Takayuki Ose[1], Kantaro Nishigori[1], Noboyoshi Tanki[1,2], Jun Takahashi[3], Matthew F Glasser[4,5], and Takuya Hayashi[1]
		[1]Center for Life Science Technologies, RIKEN, Kobe, Japan, [2]Okayama University, Okayama, Japan, [3]Kyoto University, Kyoto, Japan, [4]Department of Neuroscience, Washington University, St. Louis, MO, United States, [5]St. Luke's hospital, St. Louis, MO, United States
		Studies in animal models of Parkinson's disease have established that excessive synchronization of neuronal activity in basal ganglia cortical loops is the hallmark of movement disorders in Parkinson's disease. However, majority of the studies have focused on basal ganglia and motor areas in Parkinson's disease models and it is still unclear how dopamine denervation influences other neocortical areas, which each exhibit distinct corticostriatal and thalamocortical connectivity profiles. To address this issue, we investigate the effects of dopaminergic neuronal loss on functional connectome using resting-state fMRI in anesthetized MPTP-treated monkeys.

423	9:15	MR imaging of neuromelanin-iron cluster within human postmortem substantia nigra
		Hansol Lee[1], Sun-Yong Baek[2], Se Young Chun[3], Jae-Hyeok Lee[4], and HyungJoon Cho[1]
		[1]Department of Biomedical Engineering, Ulsan National Institute of Science and Technology, Ulsan, Republic of Korea, [2]Department of Anatomy, Pusan National University School of Medicine, Yangsan, Republic of Korea, [3]Department of Electrical and Computer Engineering, Ulsan National Institute of Science and Technology, Ulsan, Republic of Korea, [4]Department of Neurology, Pusan National University Yangsan Hospital, Yangsan, Republic of Korea
		The overall goal of this work was to provide a truth of neuromelanin-sensitive T_1 weighted image with magnetization transfer effects and to segment the respective distribution of neuromelanin-iron complex and ferric iron within substantia nigra which are important to monitor Parkinson's disease. Postmortem MR experiment at 7T and histological validation were performed for six normal midbrain samples. The correlation between T_2^*/T_2 and neuromelanin pigments was highest compared to other MR parameters, especially compared to T_2^*, which shows specific distributions of paramagnetic molecules. Iron deposits were highly correlated with iron-sensitive T_2 and T_2^* and the correlation was reduced for T_2^*/T_2.

424	9:27	Lateral-ventral tier nigral iron deposition and neuromelanin depletion in Parkinson's disease
		Jason Langley[1], Daniel E Huddleston[2], Stewart A Factor[2], Bruce Crosson[2], and Xiaoping Hu[1,3]
		[1]Center for Advanced Neuroimaging, University of California Riverside, Riverside, CA, United States, [2]Department of Neurology, Emory University, Atlanta, GA, United States, [3]Department of Bioengineering, University of California Riverside, Riverside, CA, United States

		The substantia nigra, a neuromelanin containing structure in the brainstem, contains a dense distribution of dopaminergic neurons which undergo degeneration in Parkinson's disease. In this abstract, we examine spatial locations of neuromelanin depletion and iron deposition in the substantia nigra after onset of Parkinson's disease. We found the lateral-ventral tier of substantia nigra to exhibit significant neuromelanin depletion whereas iron deposition was observed across the entire substantia nigra. These results accord with prior histological studies examining substantia nigra neuronal loss and may offer insight into the mechanisms behind this loss.

425	9:39	Fractional Anisotropy Within the Subthalamic Nucleus: An Imaging Biomarker for Early Parkinson's Disease? A High-Resolution 7Tesla Magnetic Resonance Imaging Study
		Remi Patriat[1], Jordan Kaplan[1], Jacob Jacob Niederer[1], Sommer Amundsen Huffmaster[2], Matthew Petrucci[2], Noam Harel[1], and Colum MacKinnon[2]
		[1]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [2]Neurology, University of Minnesota, Minneapolis, MN, United States
		In this study, we used high-resolution 7Tesla MRI to study whether subthalamic nucleus (STN) characteristics, such as volume and fractional anisotropy (FA), can be used as a biomarker for Parkinson's Disease (PD). 7Tesla MRI data were acquired for twenty-nine PD patients and twenty-one controls. Right STN volume was significantly lower in PD patients and it was negatively correlated with the UPDRS motor score. The PD group also had significantly decreased FA values in bilateral STN. To our knowledge, this is the first study to report differences in volume and FA of the STN between people with PD and controls.

426	9:51	Disrupted Cortical and Subcortical Effective Connectivity in Early Parkinson's Disease (PD): Insights from Parkinson's Progressive Markers Initiative (PPMI) dataset
		Karthik R Sreenivasan[1], Ece Bayram[1], Virendra Mishra[1], Zhengshi Yang[1], Christopher Bird[1], Xiaowei Zhuang[1], Dietmar Cordes[1,2], and Brent Bluett[1]
		[1]Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States, [2]University of Colorado Boulder, Boulder, CO, United States
		This study utilized resting-state fMRI data to evaluate effective (directional) connectivity in newly diagnosed unmedicated patients with early PD to derive a comprehensive picture of the nature of cortico–striatal–thalamic loop connectivity in PD. We found decreased effective connectivity between the key areas in the cortico–striatal–thalamic loops in unmedicated early stage PD patients . These results were mostly lateralized to the hemisphere opposite the predominant side of parkinsonian symtoms. The findings of this study are mainly important, given the fact that, looking at changes in effective connectivity and its relation to different disease related factors may help us better understand the heterogeneity of PD and more accurately target therapeutic interventions (i.e. deep brain stimulation).

427	10:03	Role of hippocampus in genesis of visual hallucinations in Parkinson's disease: Insights from hippocampal sub-volumetry analysis
		Abhishek Lenka[1], Apurva Shah[2], Jitender Saini[3], Madhura Ingalhalikar[4], and Pramod Kumar Pal[1]
		[1]Neurology, NIMHANS, Bengaluru, India, [2]Symbiosis International University, Pune, India, [3]NIMHANS, Bengaluru, India, [4]Department of Electronics, Symbiosis Institute of Technology, Symbiosis International University, Pune, India
		The neurobiological underpinnings of psychosis, manifested through visual hallucinations (VH) in Parkinson's disease (PD), are not fully elucidated, however, are linked to memory impairment and are associated with alterations in the hippocampus. To obtain profound understanding of the role of hippocampus in VH, a hippocampal subfield volumetric analysis on PD patients with (PD-P) and without psychosis (PD-NP) and healthy controls (HC) was performed. The results demonstrated a clear pattern with lowest volumes in PD-P, followed by PD-NP and the highest in HCs in several subfields. Moreover, the PD-P volumes in multiple sub-fields highly correlated with memory and attention scores.

Study Groups

MR Elastography Business Meeting

W07	Tuesday 9:15 - 10:15	*(no CME credit)*

Study Groups

Diffusion Business Meeting

W08	Tuesday 9:15 - 10:15	*(no CME credit)*

Plenary Session

NIBIB New Horizons Lecture: When Fast Is Not Fast Enough: The Challenging Path Towards Pediatric MRI Without Anesthesia

Plenary Hall (Paris Room)	Tuesday 10:45 - 11:15

10:45	When Fast Is Not Fast Enough: The Challenging Path Towards Pediatric MRI Without Anesthesia

Plenary Session

Challenging the Assumptions of MRI

Organizers: Fernando Boada, Tim Leiner, Chunlei Liu, Stephan Maier, Daniel Sodickson

Plenary Hall (Paris Room)	Tuesday 11:15 - 12:15	*Moderators:* Fernando Boada & Chunlei Liu

11:15	Image Interpretation
	Bram van Ginneken[1]
	[1]Radboud University, Netherlands

11:30	Image Acquisition & Reconstruction
	Mariya Doneva[1]
	[1]Philips Research Hamburg, Germany

11:45	Questioning Dogmas of the Imaging Process
	Maxim Zaitsev[1]
	[1]Dept. of Radiology, Medical Physics, University Medical Centre Freiburg, Freiburg, Germany

12:00	Data Platforms & Architecture
	Kai Tobias Block[1]
	[1]NYU School of Medicine, United States

12:15	Adjournment

Event

Gold Corporate Symposium: Siemens Healthineers

Plenary Hall (Paris Room)	Tuesday 12:30 - 13:30	*(no CME credit)*

Traditional Poster: Engineering

Exhibition Hall 1689-1736	Tuesday 13:45 - 15:45	*(no CME credit)*

Electronic Poster: Interventional MRI

Exhibition Hall	Tuesday 13:45 - 14:45	*(no CME credit)*

Electronic Poster: MR Safety

Exhibition Hall	Tuesday 13:45 - 14:45	*(no CME credit)*

Electronic Poster: Acquisition, Reconstruction & Analysis

Exhibition Hall	Tuesday 13:45 - 14:45	*(no CME credit)*

Study Groups

MR of Cancer Business Meeting

W07	Tuesday 13:45 - 14:45	*(no CME credit)*

Member-Initiated Symposium

From Neurons to Networks: Opportunities & Challenges for Laminar fMRI

Organizers: Kamil Uludag, Essa Yacoub

N04	Tuesday 13:45 - 15:45	*(no CME credit)*

	13:45	Laminar Neural Recordings with Electrophysiology
		Alexander Maier

	14:15	Acquisition Methods for Laminar fMRI
		Peter Koopmans

	14:45	Data Analysis for Laminar fMRI

		Jonathan Rizzo Polimeni[1]
		[1]Massachusetts General Hospital, United States

	15:15	Modeling Vascular Bias in Laminar fMRI
		Martin Havlicek

Member-Initiated Symposium

19F MRI Emerges from the Background

Organizers: Eric Ahrens, Ulrich Flögel

W05/06	Tuesday 13:45 - 15:45	*(no CME credit)*

	13:45	19F MRI for Inflammation & Cytotherapy Detection in Cancer
		Paula Foster[1]
		[1]Robarts Research Institute, Canada

	14:05	Optimized Pulse Sequence Design for 19F MRI
		Ruud B van Heeswijk[1]
		[1]Radiology, Lausanne University Hospital (CHUV), Lausanne, Switzerland

	14:25	Fluorinated Gas MRI for Structural & Functional Imaging of the Airways
		Mitchell Albert[1]
		[1]Lakehead University

	14:45	Boosting 19F MRI Sensitivity by Hyperpolarization

		Markus Plaumann[1]
		[1]Institute for Biometry and Medical Informatics, Otto-von-Guericke University Magdeburg, Medicinal Faculty, Magdeburg, Germany

	15:05	Tracking Immunotherapeutic T Cells Using 19F MRI
		Fanny Chapelin

	15:25	Translating 19F MR Inflammation Imaging to the Clinical Setting
		Maik Rothe

Weekday Course

Radiomics in MRI: Doing It Right

Organizers: Elena Kaye, Viola Rieke

N01	Tuesday 13:45 - 15:45	*Moderators:* Valentina Giannini & Elizabeth Sutton

	13:45	Radiomics in MRI: Getting Started
		Martin Vallières[1]
		[1]Laboratoire de Traitement de l'Information Médicale (LaTIM - INSERM UMR 1101), Brest, France
		Better standardization, transparency and sharing practices are required in the radiomics community to improve the quality and reproducibility of published studies and to achieve faster clinical translation. In this course, emphasis will be put on the presentation of the standardized radiomics workflow defined by the Image Biomarker Standardisation Initiative (IBSI), a group of more than 55 researchers from 19 institutions in 8 countries. Since 2016, the IBSI has put efforts into standardizing both the computation of radiomics features and the image-processing steps required before feature extraction. This standardized workflow along with consensual benchmark values could serve as a calibration tool for future radiomics investigations. Finally, radiomics methods specific to MRI will also be presented in this course.

	14:45	MR-Radiomics in Oncology

		Nabil Elshafeey[1]
		[1]University of Texas, United States

	15:45	Adjournment & Meet the Teachers

Weekday Course

Primer for Ultrahigh Field MRI

Organizers: Gregor Adriany, Christoph Juchem, Mary McDougall, Gregory Metzger

N02	Tuesday 13:45 - 15:45	*Moderators:* Samantha By & Christoph Juchem

	13:45	Ultrahigh Fields: What You Want & What You Don't
		Kamil Ugurbil[1]
		[1]Center for Magnetic Resonance Research (CMRR), University of Minnesota, Minneapolis, MN, United States
		Since the introduction of the first 7 Tesla system in 1999, steady improvements in instrumentation and ever expanding armamentarium of image acquisition and engineering solutions to challenges posed by ultrahigh fields (UHF) has brought UHF imaging to exquisite anatomical detail and biological information content in many organ systems of the human body. However, like all technologies, magnetic resonance applications at UHF have applications-specific advantages and limitations. This lecture will aim to clarify the primary advantages that we should exploit (“what we want”), while avoiding some of the pitfalls that detract from these advantages (“what you don’t want”).

	14:15	System Requirements Beyond 3T
		Cornelis van den Berg[1]
		[1]Centre for Image Sciences, University Medical Center Utrecht, Netherlands
		This educational reviews the system requirements of a modern ultra high field MR system. It describes magnetic and gradient specifications and discusses in more depth RF challenges and solutions for successful UHF MR imaging.

	14:45	Getting What You Want: Managing the Mayhem
		Xiaoping Wu[1]
		[1]CMRR - University of Minnesota, United States
		In this educational lecture, we will review possible strategies that can be used to manage the mayhem of RF non-uniformity and SAR, the two major challenges at ultrahigh field. Specifically, we will start with a brief discussion as to what is possible on a standard system and will then focus on what is possible when parallel transmission is available. In particular, we will discuss the various forms of parallel transmission alongside their demonstrated utility for brain and body imaging at 7 Tesla and above. We will also explain how parallel transmission can be used to reduce or manage SAR. In the end, we will summarize what is learned and will discuss other aspects of parallel transmission that are not covered in this lecture.

	15:15	The Payoff for the Pain
		Mark E. Ladd[1,2]
		[1]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Erwin L. Hahn Institute for MRI, University of Duisburg-Essen, Essen, Germany
		This presentation will emphasize some clinical and scientific applications in human ultra-high field MR that particularly benefit from the changing physical characteristics at high magnetic fields, including susceptibility-weighted imaging and phase contrast techniques, imaging with X-nuclei, MR spectroscopy, and CEST imaging.

	15:45	Adjournment & Meet the Teachers

Power Pitch

Pitch: Machine Learning Unleashed

Power Pitch Theater A - Exhibition Hall	Tuesday 13:45 - 14:45	*Moderators:* Marco Palombo & Leslie Ying	*(no CME credit)*

428	13:45	Deep Learning Method for Non-Cartesian Off-resonance Artifact Correction
		David Y Zeng[1], Jamil Shaikh[2], Dwight G Nishimura[1], Shreyas S Vasanawala[2], and Joseph Y Cheng[2]

		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States
429	13:45	Gibbs-Ringing Artifact Reduction in MRI via Machine Learning Using Convolutional Neural Network
		Qianqian Zhang[1], Guohui Ruan[1], Wei Yang[1], Kaixuan Zhao[1], Ed X. Wu[2,3], and Yanqiu Feng[1]
		[1]Guangdong Provincial Key Laboratory of Medical Image Processing, School of Biomedical Engineering, Southern Medical University, Guangzhou, China, [2]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong SAR, China, [3]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong SAR, China
430	13:45	Simultaneous detection and identification of MR artifact types in whole-body imaging
		Thomas Kuestner[1,2], Ke Liu[2], Annika Liebgott[2,3], Lukas Mauch[2], Petros Martirosian[1], Fabian Bamberg[3], Konstantin Nikolaou[3], Bin Yang[2], Fritz Schick[1], and Sergios Gatidis[3]
		[1]Section on Experimental Radiology, University Hospital of Tuebingen, Tuebingen, Germany, [2]Institute of Signal Processing and System Theory, University of Stuttgart, Stuttgart, Germany, [3]Department of Radiology, University Hospital of Tuebingen, Tuebingen, Germany
431	13:45	Automatic Assessment of MR Image Quality with Deep Learning
		Jifan Li[1], Shuo Chen[1], Qiang Zhang[1], Huiyu Qiao[1], Xihai Zhao[1], Chun Yuan[1,2], and Rui Li[1]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]Vascular Imaging Laboratory, Department of Radiology, University of Washington, Seattle, WA, United States
432	13:45	Automatic detection of cerebral microbleeds using Susceptibility-Weighted Imaging and a 3D deep residual network
		Yicheng Chen[1], Melanie Morrison[2], Javier Villanueva-Meyer[2], and Janine M Lupo[1,2]
		[1]The UC Berkeley-UCSF Graduate Program in Bioengineering, University of California, San Francisco, San Francisco, CA, United States, [2]Department of Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States

433	13:45	Deep learning diffusion fingerprinting to detect brain tumour response to chemotherapy
		Thomas A Roberts[1], Ben Hipwell[1], Giulia Agliardi[1], Valerie Taylor[1], Mark F Lythgoe[1], and Simon Walker-Samuel[1]
		[1]Centre for Advanced Biomedical Imaging, University College London, London, United Kingdom

434	13:45	Machine learning based estimation of axonal permeability: validation on cuprizone treated in-vivo mouse model of axonal demyelination
		Marco Palombo[1], Ioana Hill[1], Mathieu David Santin[2,3], Francesca Branzoli[2,3], Anne-Charlotte Philippe[2,3], Demian Wassermann[4,5], Marie-Stephane Aigrot[2], Bruno Stankoff[2,6], Hui Zhang[1], Stephane Lehericy[2,7,8], Alexandra Petiet[2,7], Daniel C. Alexander[1], and Ivana Drobnjak[1]
		[1]Computer Science Department and Centre for Medical Imaging Computing, University College London, London, United Kingdom, [2]CENIR, ICM, Paris, France, [3]Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06 UMR S 1127, Institut du Cerveau et de la Moelle épinière, ICM, Paris, France, [4]INRIA, Université Côte d'Azur, Sophia-Antipolis, France, [5]Parietal, CEA, INRIA, Saclay, France, [6]AP-HP, Hôpital Saint-Antoine, Paris, France, [7]Hôpital de la Pitié Salpêtrière, Sorbonne Universités, UPMC Paris 06 UMR S 1127, Inserm UMR S 1127, CNRS UMR 7225, Institut du Cerveau et de la Moelle épinière, Paris, France, [8]AP-HP, Hôpital de la Pitié Salpêtrière, Paris, France

435	13:45	Direct and Fast Learning of Fiber Orientation Distribution Function for Tractography
		Ting Gong[1], Hongjian He[1], Zhichao Lin[2], Zhiwei Li[2], Qiqi Tong[1], Yi Sun[3], Feng Yu[2], and Jianhui Zhong[1,4]
		[1]Center for Brain Imaging Science and Technology, Key Laboratory for Biomedical Engineering of Ministry of Education, College of Biomedical Engineering and Instrumental Science, Zhejiang University, Hangzhou, China, [2]Department of Instrument Science & Technology, Zhejiang University, Hangzhou, China, [3]MR Collaboration NE Asia, Siemens Healthcare, Shanghai, China, [4]Department of Imaging Sciences, University of Rochester, Rochester, NY, United States

436	13:45	Predict the slow oscillation of the single-vessel resting-state fMRI signal of rats and humans with echo state networks
		Filip Sobczak[1], Yi He[1], and Xin Yu[1]
		[1]MPI for Biological Cybernetics, Tübingen, Germany

437	13:45	Dynamic Causal Modelling with neuron firing model in Generalized Recurrent Neural Network framework

		Yuan Wang[1], Yao Wang[1], and Yvonne W Lui[2]
		[1]Department of Electrical and Computer Engineering, New York University, Brooklyn, NY, United States, [2]Department of Radiology, New York University, New York, NY, United States
438	13:45	AUTOmated pulse SEQuence generation (AUTOSEQ) using Bayesian reinforcement learning in an MRI physics simulation environment
		Bo Zhu[1,2,3], Jeremiah Liu[4], Neha Koonjoo[1,2,3], Bruce R Rosen[1,2], and Matthew S Rosen[1,2,3]
		[1]Radiology, Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Physics, Harvard University, Cambridge, MA, United States, [4]Department of Biostatistics, Harvard University, Cambridge, MA, United States
439	13:45	Towards a fully Automated Time-context Sensitive Convolutional Neural Network for Common Carotid Artery Lumen Segmentation on Dynamic MRI
		Roberto Souza[1], Mariana Bento[1], Lívia Rodrigues[2], Letícia Rittner[2], Roberto Lotufo[2], and Richard Frayne[1]
		[1]Seaman Family Magnetic Resonance Research Centre, Calgary, AB, Canada, [2]Medical Image Computing Lab, Campinas, Brazil
440	13:45	Artificial neural networks for stiffness estimation in magnetic resonance elastography
		Matthew C Murphy[1], Armando C Manduca[1], Joshua C Trzasko[1], Kevin C Glaser[1], John C Huston[1], and Richard C Ehman[1]
		[1]Mayo Clinic, ROCHESTER, MN, United States
441	13:45	MLS: Self-learned joint manifold geometry and sparsity aware framework for highly accelerated cardiac cine imaging
		Ukash Nakarmi[1], Konstantinos Slavakis[1], Hongyu Li[1], Chaoyi Zhang[1], Peizhou Huang[1], Sunil Gaire[1], and Leslie Ying[1,2]
		[1]Electrical Engineering, University at Buffalo, Buffalo, NY, United States, [2]Biomedical Engineering, University at Buffalo, Buffalo, NY, United States

442	13:45	MoDL: Model Based Deep Learning Architecture for Image Recovery with Prior Information.
		Hemant Kumar Aggarwal[1], Merry Mani[1], and Mathews Jacob[1]
		[1]University of Iowa, Iowa City, IA, United States

Power Pitch

Pitch: Hot Topics in MRS

Power Pitch Theater B - Exhibition Hall	Tuesday 13:45 - 14:45	*Moderators:* Michael Albert Thomas & Rachel Katz-Brull	*(no CME credit)*

443	13:45	Structural Determination Using 129Xe NMR Line-shape in Chemical Shift Imaging
		Stephen Kadlecek[1], Mehrdad Pourfathi[1], Luis Loza[1], Ian Duncan[1], Kai Ruppert[1], Hooman Hamedani[1], Sarmad Siddiqui[1], Yi Xin[1], Faraz Amzajerdian[1], Harrilla Profka[1], Ryan Baron[1], Mary Spencer[1], Tahmina Achekzai[1], Shampa Chatterjee[2], Maurizio Cereda[3], and Rahim R. Rizi[1]
		[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Physiology, University of Pennsylvania, Philadelphia, PA, United States, [3]Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, PA, United States

444	13:45	Standardisation and quantification of 23Na-MRI: repeatability and reproducibility of sodium imaging
		Damien J McHugh[1,2], Frank Riemer[2,3], Daniel Lewis[1], Fulvio Zaccagna[2,3], Ferdia A Gallagher[2,3], and Geoffrey J. M. Parker[1,2,4]
		[1]Informatics, Imaging and Data Sciences, The University of Manchester, Manchester, United Kingdom, [2]CRUK and EPSRC Cancer Imaging Centre in Cambridge and Manchester, United Kingdom, [3]Department of Radiology, University of Cambridge, Cambridge, United Kingdom, [4]Bioxydyn Ltd., Manchester, United Kingdom

445	13:45	Improved Quantification of Hepatic Fatty Acid Metabolism in Nonalcoholic Steatohepatitis: Serum Biochemistry and In vivo Proton MRS Study with Spin-Spin Relaxation Time Correction at 9.4 T
		Kyu-Ho Song[1], Min-Young Lee[1], Song-I Lim[1], Chi-Hyeon Yoo[1], and Bo-Young Choe[1]
		[1]Department of Biomedical Engineering and Research Institute of Biomedical Engineering, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

446	13:45	Assessing metabolism and function of normothermically perfused ex vivo livers by multi-nuclear MR imaging and spectroscopy
		Liam AJ Young[1], Carlo DL Ceresa[2], Jack Miller[3], Ladislav Valkovic[1,4], Daniel Voyce[5], Elizabeth M Tunnicliffe[1], Jane Ellis[1], Damian J Tyler[3], Peter J Friend[2], Constantin C Coussios[6], and Christopher T Rodgers[1,7]
		[1]Oxford Centre for Clinical Magnetic Resonance Research (OCMR), University of Oxford, Oxford, United Kingdom, [2]Nuffield Department of Surgical Sciences, University of Oxford, Oxford, United Kingdom, [3]Department of Physiology, Anatomy and Genetics, University of Oxford, Oxford, United Kingdom, [4]Department of Imaging Methods, Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, Slovakia, [5]OrganOx Ltd, Oxford, United Kingdom, [6]Institute of Biomedical Engineering, University of Oxford, Oxford, United Kingdom, [7]Wolfson Brain Imaging Centre, Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom

447	13:45	Effects of Deuteration on Pyruvate Metabolism in the Isolated Heart
		Alexander Max Funk[1], Nesmine Maptue[1], Chalermchai Khemtong[1], Dean Sherry[1,2], and Craig Malloy[1,3]
		[1]UT Southwestern Medical Center, Dallas, TX, United States, [2]University of Texas at Dallas, Richardson, TX, United States, [3]Veterans Affairs North Texas Healthcare System, Dallas, TX, United States

448	13:45	Oxidative stress measured by in-vivo, longitudinal 1H MRS and ex-vivo ESR spectroscopy in a rat model of chronic Hepatic Encephalopathy
		Katarzyna Pierzchala[1], Veronika Rackayova[1], Olivier Braissant[2], Dario Sessa[3], Stefanita Mitrea[1], Andrzej Sienkiewicz[4], Valérie A. McLin[3], Rolf Gruetter[1], and Cristina Cudalbu[1]
		[1]Center for Biomedical Imaging, EPFL, Lausanne, Switzerland, [2]Service of Biomedicine, CHUV, Lausanne, Switzerland, [3]Swiss Center for Liver Disease in Children, Department of Pediatrics, HUG, Geneva, Switzerland, [4]Laboratory of Physics of Complex Matter, EPFL, Lausanne, Switzerland

449	13:45	NMR spectroscopy based blood test to diagnose brain cancer at early stages
		Shivanand Pudakalakatti[1], Alessandra Audia[2], Anirudh Mukhopadhyay[3], Krishna Bhat[2], and Pratip Bhattacharya[1]
		[1]Cancer Systems Imaging, University of Texas MD Anderson Cancer Center, Houston, TX, United States, [2]Translational Molecular Pathology, University of Texas MD Anderson Cancer Center, Houston, TX, United States, [3]Biochemistry and Cell Biology | Chemistry, Rice University, Houston, TX, United States

450	13:45	Human Glioblastoma Cell Lines Co-oxidize [2,4-13C]betahydroxy-butyrate and [U-13C]-glucose: A 13C NMR Spectroscopic Study
		Omkar B. Ijare[1], Athena Hoppe[1], Cole Holan[1], Martyn A Sharpe[1], David S Baskin[1], and Kumar Pichumani[1]
		[1]Kenneth R. Peak Center, Department of Neurosurgery, Houston Methodist Research Institute, Houston, TX, United States
451	13:45	Patch-based super-resolution of 7 T MRSI of Glioma: Initial results
		Gilbert Hangel[1,2], Saurabh Jain[3,4], Eva Hečková[1,2], Bernhard Strasser[5], Michal Povazan[6,7], Stephan Gruber[1,2], Elisabeth Springer[1,2], Georg Widhalm[8], Matthias Preusser[9], Siegfried Trattnig[1,2], Diana Sima[3,10], Dirk Smeets[3,11], and Wolfgang Bogner[1,2]
		[1]High Feld MR Centre, Medical University of Vienna, Vienna, Austria, [2]Christian Doppler Laboratory for Clinical Molecular MR Imaging, Vienna, Austria, [3]icometrix, R&D, Leuven, Belgium, [4]Diagnostic Image Analysis Group, Radboud University Medical Center, Nijmegen, Netherlands, [5]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [6]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [7]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [8]Department of Neurosurgery, Medical University of Vienna, Vienna, Austria, [9]Department of Medicine 1, Division of Oncology, Medical University of Vienna, Vienna, Austria, [10]Department of Electrical Engineering-ESAT, STADIUS Center for Dynamical Systems, Signal Processing and Data Analytics, KU Leuven, Leuven, Belgium, [11]BioImaging Lab, Universiteit Antwerpen, Antwerp, Belgium
452	13:45	IMPORTANCE OF THE LACTATE SHUTTLE FOR BRAIN ACTIVATION: AN IN VIVO LOCALIZED 1H-MRS AND FUNCTIONAL MRI STUDY DURING WHISKER STIMULATION
		Jordy Blanc[1], Charlotte Jollé[2], Hélène Roumes[1], Nicole Déglon[3], Luc Pellerin[2], and Anne-Karine Bouzier-Sore[1]
		[1]CNRS/Université Bordeaux, Centre de Résonance Magnétique des Systèmes Biologiques UMR 5536, Bordeaux, France, Metropolitan, [2]CH Lausanne, Switzerland, Département de Physiologie, Lausanne, Switzerland, [3]Lausanne University Hospital, Department of Clinical Neurosciences, Laboratory of Cellular and Molecular Neurotherapies (LCMN), Lausanne, Switzerland
453	13:45	Real time observation of shifts in cerebral metabolism caused by cocaine administration via MRS, DNP, and NMR
		Joanna Long[1], Daniel Downes[2], James Collins[2], Marcelo Febo[2], and Bimala Lama[3]

		[1]Box 100245, University of Florida, Gainesville, FL, United States, [2]University of Florida, Gainesville, FL, United States, [3]University of Colorado, Boulder, CO, United States
454	13:45	Evidence for Two T2 Components of N-Acetyl-Aspartate (NAA) In Healthy White Matter
		Erin L. MacMillan[1,2,3], Carina Graf[4,5], Cornelia Laule[4,5,6,7], and Alex L. MacKay[2,4,7]
		[1]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada, [2]UBC MRI Research Centre, University of British Columbia, Vancouver, BC, Canada, [3]ImageTech Lab, Simon Fraser University, Surrey, BC, Canada, [4]Physics & Astronomy, University of British Columbia, Vancouver, BC, Canada, [5]International Collaboration on Repair Discoveries, Vancouver, BC, Canada, [6]Pathology and Laboratory Medicine, University of British Columbia, Vancouver, BC, Canada, [7]Radiology, University of British Columbia, Vancouver, BC, Canada
455	13:45	Elevated brain NAA occurs without loss of neuronal integrity and correlates with increasing Sickle Cell Disease related stress.
		Min-Hui Cui[1], Seetharama A Acharya[2,3], Sandra Suzuka[2], Henny H Billett[2,4,5], and Craig A Branch[1,3]
		[1]Radiology, Albert Einstein College of Medicine, Bronx, NY, United States, [2]Hematology, Albert Einstein College of Medicine, Bronx, NY, United States, [3]Physiology & Biophysics, Albert Einstein College of Medicine, Bronx, NY, United States, [4]Pathology, Albert Einstein College of Medicine, Bronx, NY, United States, [5]Medicine, Albert Einstein College of Medicine, Bronx, NY, United States
456	13:45	Cerebral Metabolite Changes and Sleep Correlates in Obstructive Sleep Apnea
		Manoj K Sarma[1], Paul M Macey[2], Andres Saucedo[1], Maithili Gopalakrishnan[1], Zahra Meghjani[1], Zohaib Iqbal[1], Rajakumar Nagarajan[3], Ravi Aysola[4], Ronald M. Harper[5], and M. Albert Thomas[1]
		[1]Radiological Sciences, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [2]School of Nursing, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [3]Radiological Sciences, UCLA School of Medicine, Los angeles, Los Angeles, CA, United States, [4]Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [5]Neurobiology, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States
457	13:45	Cortical GABA levels correlate with visual search performance in children with autism spectrum disorder
		David A Edmondson[1,2], Pingyu Xia[1], Debra A Patterson[1,2], Brandon Keehn[3], and Ulrike Dydak[1,2,3]

		[1]School of Health Sciences, Purdue University, West Lafayette, IN, United States, [2]Department of Radiology and Imaging Sciences, Indiana University School of Medicine, Indianapolis, IN, United States, [3]Department of Speech, Language, & Hearing Sciences, Purdue University, West Lafayette, IN, United States

Combined Educational & Scientific Session

Osteoarthritis: The (W)Holy Grail

Organizers: Edwin Oei, Jung-Ah Choi, Emily McWalter, Miika Nieminen

S01	Tuesday 13:45 - 15:45	*Moderators:* Miika Nieminen & Jung-Ah Choi

	13:45	Physiology of Joint Tissues in Osteoarthritis
		James MacKay[1]
		[1]University of Cambridge

	14:15	Whole Joint Imaging of Osteoarthritis with Morphological & Quantitative MRI
		Ashley Williams[1,2]
		[1]Stanford University, Stanford, CA, United States, [2]Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, United States
		Imaging tools are needed to detect and stage joint status early enough in the disease process that osteoarthritis modifying interventions might have a chance. The purpose of this talk is to introduce MRI methods for morphologic and quantitative evaluation of osteoarthritis of the knee. Compositional MRI measures of OA will also be discussed.

458	14:45	Three Dimensional Adiabatic T1rho Prepared Ultrashort Echo Time Cones (3D AdiabT1rho UTE-Cones) Sequence for Whole Knee Imaging
		Yajun Ma[1], Michael Carl[2], Adam Searleman [1], Xing Lu[1], Eric Y Chang[1,3], and Jiang Du[1]
		[1]University of California, San Diego, San Diego, CA, United States, [2]GE Healthcare, San Diego, CA, United States, [3]VA San Diego Healthcare System, San Diego, CA, United States

		To propose a combination of a three dimensional ultrashort echo time sequence employing cones trajectories with an AdiabT1rho preparation (3D AdiabT1rho UTE-Cones) for volumetric T1rho assessment of both short and long T2 tissues in the knee joint on a clinical 3T scanner. Simulation, phantom, ex vivo and in vivo studies were carried out in this feasibility study.

459	14:57	Ultrashort Echo Time Imaging of the Osteochondral Junction in Subjects with Knee Osteoarthritis and Age-matched Healthy Volunteers
		James W MacKay[1], Josh Kaggie[1], Alexandra R Morgan[2], Robert L Janiczek[2], Scott Reid[3], Stephen McDonnell[4], Wasim Khan[4], Martin Graves[1], Fiona J Gilbert[1], and Andrew McCaskie[4]
		[1]Radiology, University of Cambridge, Cambridge, United Kingdom, [2]Experimental Medicine Imaging, GlaxoSmithKline, Stevenage, United Kingdom, [3]GE Healthcare, Little Chalfont, United Kingdom, [4]Trauma & Orthopaedics, University of Cambridge, Cambridge, United Kingdom
		We describe *in vivo* translation of ultrashort TE (UTE) imaging of the osteochondral junction (OCJ) at the knee in 9 subjects with osteoarthritis (OA) and 4 age-matched healthy volunteers. The OCJ plays an important role in onset and progression of OA. Our study demonstrates that UTE imaging of the OCJ is repeatable and demonstrates OCJ defects in OA subjects but not in healthy volunteers. Areas of OCJ damage commonly co-locate to other osteochondral pathology (bone marrow lesions and cartilage defects). UTE imaging of the OCJ may be a helpful tool for assessing OCJ damage in clinical studies of OA.

460	15:09	T1ρ and T2 of articular cartilage and medial meniscus at baseline and 6-month can predict the degenerative changes of cartilage at 3 years after ACL reconstruction
		Kenji Mamoto[1,2], Kaipin Xu[1,2], Tomohiro Shimizu[2], Matthew Tanaka[2], Alexander Markes[2], Valentina Pedoia[2], C. Benjamin Ma[3], and Xiaojuan Li[1,2]
		[1]Biomedical Engineering, Cleveland Clinic, Cleveland, OH, United States, [2]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [3]Orthopedic Surgery, University of California, San Francisco, San Francisco, CA, United States
		Patients with anterior cruciate ligament (ACL) injury have a high risk of development of early post-traumatic osteoarthritis (PTOA) even after ACL reconstruction. The aim of this study was to investigate the risk factors that may predict the longitudinal cartilage degeneration by using MR T1ρ/T2 imaging. The first 6-month changes of T1ρ/T2 values of the cartilage and anterior horn of medial meniscus significantly correlated with the 3-year cartilage degenerative change after ACL reconstruction. And also, T2 values of the posterior horn of medial meniscus prior to surgery significantly correlated with the cartilage degeneration of anterior medial tibia 3-year after the reconstruction.

461	15:21	Quantitative Assessment of Disc Biochemical Composition and Vertebral Body Fat in Patients with Low Back Pain
		Roland Krug[1], Misung Han[1], Aaron Fields[2], Gabby Joseph[1], Justin Cheung[1], Maya Mundada[1], Alice Rochette[2], Jeannie Bailey[2], Alexander Ballatori[2], Thomas Link[1], Zachary McCormick[2], Conor O'Neill[2], and Jeffrey Lotz[2]
		[1]Radiology, UCSF, San Francisco, CA, United States, [2]Orthopedic Surgery, UCSF, San Francisco, CA, United States
		We present a cross sectional study of 53 subjects with chronic lower back pain (n=39) and healthy controls (n=14). We have assessed disc biochemical composition (T1rho and T2 mapping) and vertebral bone marrow fat (6-point chemical-shift based imaging) as well as Pfirrmann grading. We have found significant associations between mean and standard-deviation of T1rho and T2 with vertebral bone marrow fat content in the adjacent vertebral body. We have also found strong associations of T1rho and T2 with clinical Pfirrmann grading.

462	15:33	New Diffusion Tensor and Dixon Imaging Results in Human Skeletal Muscle from the GESTALT Longitudinal Study of Aging
		Donnie Cameron[1,2], David A. Reiter[2,3], Fatemeh Adelnia[2], Kenneth W. Fishbein[2], Christopher M. Bergeron[2], Richard G. Spencer[2], and Luigi Ferrucci[2]
		[1]Norwich Medical School, University of East Anglia, Norwich, United Kingdom, [2]National Institute on Aging, National Institutes of Health, Baltimore, MD, United States, [3]Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, GA, United States
		This work investigates how aging influences skeletal muscle diffusion tensor imaging (DTI) measures in a healthy cohort with a broad age range. Sixty participants, from 23-87 years old, were recruited and tract-based DTI indices were calculated in their thigh quadriceps muscles. Through piecewise regression, we identified trends in DTI indices and Dixon fat measures with respect to age, including a previously undocumented decline in fractional anisotropy (FA) in older age, particularly in men (r=-0.46, p=0.06). Our results also show statistically significant differences in FA between quadriceps muscles (p<0.001) that may reflect differences in composition and patterns of use.

	15:45	Adjournment & Meet the Teachers

Oral

Diffusion MRI: Signal Reconstruction & Representation

N03	Tuesday 13:45 - 15:45	*Moderators:* Stamatios Sotiropoulos & David Atkinson

463	13:45	Diffusion Acceleration with Gaussian process Estimated Reconstruction (DAGER)
		Wenchuan Wu[1], Peter J Koopmans[2], Jesper Andersson[1], and Karla L Miller[1]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany
		Diffusion acceleration is a challenging task, particularly when using simultaneous multi-slice (SMS) imaging with in-plane acceleration. In this work, we develop a method termed DAGER: Diffusion Acceleration with Gaussian process Estimated Reconstruction, to improve SMS with in-plane acceleration, achieving a total acceleration factor of 12 (MB=4, R=3). In addition, DAGER reconstruction doesn't cause major degradation of angular resolution, indicating the Gaussian process model used in DAGER can accurately estimating the degree of local smoothness in q-space.

464	13:57	Multi-shell SHARD reconstruction from scattered slice diffusion MRI data in the neonatal brain
		Daan Christiaens[1], Lucilio Cordero-Grande[1], Maximilian Pietsch[1], Jana Hutter[1], A. David Edwards[1], Maria Deprez[1], Joseph V. Hajnal[1], and J-Donald Tournier[1]
		[1]Centre for the Developing Brain, School of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom
		Diffusion MRI (dMRI) offers a unique probe into neural connectivity in the developing brain. However, analysis of neonatal brain imaging data is complicated by inevitable subject motion. Here, we develop a method for reconstructing multi-shell HARDI data from scattered slices, jointly estimating an uncorrupted data representation and per-excitation (slice or multiband package) motion parameters. The reconstruction relies on orthogonal decomposition of multi-shell dMRI data using a bespoke spherical harmonics and radial decomposition (SHARD), together with outlier rejection, distortion, and slice profile correction. We evaluate the method on publicly-released datasets for 40 neonatal subjects from the developing Human Connectome Project.

465	14:09	Joint Virtual Coil Reconstruction with Background Phase Matching for Highly Accelerated Diffusion Echo-Planar Imaging
		Congyu Liao[1,2], Mary Kate Manhard[2], Berkin Bilgic[2], Qiuyun Fan[2], Haifeng Wang[2,3], Sohyun Han[2], Daniel Joseph Park[2], Fuyixue Wang[4], Jianhui Zhong[1], Lawrence L Wald[2], and Kawin Setsompop[2]
		[1]Department of Biomedical Engineering, Zhejiang University, Hangzhou, China, [2]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [3]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, [4]Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States

		We proposed a joint-virtual-coil (VC) acquisition/reconstruction method to improve accelerated single-shot EPI (SS-EPI) in diffusion imaging (DI). A background phase correction scheme for matching the phase of reference training data with accelerated diffusion-weighted data was developed for robust reconstruction. Additional G_y prewinding-blips were added to the EPIs, to create complementary shifted-k_y sampling strategy across TRs, which help better utilizes smooth-phase and joint-information priors in the joint-virtual-coil (jVC) reconstruction. The proposed method was demonstrated in highly-accelerated DI with SS-EPI and extended to generalized slice dithered enhanced resolution (gSlider) acquisition to achieve efficient high-resolution DI.

466	14:21	Magnitude versus complex-valued images for spinal cord diffusion MRI: which one is best?
		Francesco Grussu[1,2], Jelle Veraart[3], Marco Battiston[1], Torben Schneider[4], Julien Cohen-Adad[5,6], Manuel Jorge Cardoso[7,8], Claudia Angela Gandini Wheeler-Kingshott[1,9,10], Els Fieremans[3], Daniel C. Alexander[2], and Dmitry S. Novikov[3]
		[1]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [2]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [3]Center for Biomedical Imaging, Department of Radiology, New York University School of Medicine, New York, NY, United States, [4]Philips UK, Guildford, Surrey, United Kingdom, [5]NeuroPoly Lab, Institute of Biomedical Engineering, Polytechnique Montréal, Montréal, QC, Canada, [6]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montréal, QC, Canada, [7]Centre for Medical Image Computing, Department of Medical Physics and Biomedical Engineering, University College London, London, United Kingdom, [8]Dementia Research Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [9]Brain MRI 3T Research Centre, C. Mondino National Neurological Institute, Pavia, Italy, [10]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy
		Advanced diffusion imaging of the spinal cord is hampered by low signal-to-noise ratio, leading to strong Rician bias in magnitude images. Here, we investigate how to mitigate such bias studying complex-valued 3T diffusion scans of the cervical cord. We test two approaches, based on decorrelated phase (DP) and total variation (TV) filtering, corroborating results with simulations. The DP and TV methods, proposed for the brain, can be applied successfully also in the cord. Moreover, they appear useful pre-processing tools for image denoising, as state-of-the-art noise removal based on Marčenko-Pastur principal component analysis (MP-PCA) performs better on complex-valued as opposed to magnitude data.

467	14:33	Robust estimation of diffusion MRI metrics based on slicewise outlier detection (SOLID)
		Viljami Sairanen[1,2], Alexander Leemans[3], and Chantal M. W. Tax[4]
		[1]Medical Physics, Radiology, Helsinki University Hospital, Helsinki, Finland, [2]Department of Physics, University of Helsinki, Helsinki, Finland, [3]Image Sciences Institute, University Medical Center Utrecht, Utrecht, Netherlands, [4]Cardiff University Brain Research Imaging Centre, School of Psychology, Cardiff University, Cardiff, United Kingdom

		The accurate characterization of diffusion process with MRI is compromised by various artefacts including intensity related errors. If not appropriately accounted for, model estimates can become significantly biased resulting in erroneous metrics. Slicewise intensity errors, in particular, are often handled by excluding the entire image or slice information, or by voxelwise robust estimators that experience difficulties in partial volume regions. In this work, we describe a fast and accurate algorithm to detect slicewise outliers and a framework to incorporate this information as data uncertainty in model estimation algorithms.

468	14:45	Influence of the lipids on the quantification of IVIM parameters in the vertebral bone marrow.
		Caroline Le Ster[1], Jérémy Lasbleiz[1], Hervé Saint-Jalmes[1,2], Raphaël Guillin[3], and Giulio Gambarota[1]
		[1]LTSI, INSERM UMR 1099, Rennes, France, [2]Centre Eugène Marquis, CRLCC, Rennes, France, [3]Department of Imaging, Rennes University Hospital, Rennes, France
		The aim of this study was to assess the effect of the lipids on the quantification of IVIM parameters in the vertebral bone marrow. Diffusion sequences were acquired with and without fat suppression on healthy volunteers. The results of our study show that fat is a confounding factor for the quantification of the diffusion coefficient and perfusion fraction; whereas it has no significant effect on the quantification of the pseudo-diffusion coefficient.

469	14:57	Longitudinal multi-component HARDI atlas of neonatal white matter
		Maximilian Pietsch[1,2], Daan Christiaens[1,2], Jana Hutter[1,2], Lucilio Cordero-Grande[1,2], Anthony N Price[1,2], Emer Hughes[1], A. David Edwards[1], Joseph V. Hajnal[1,2], Serena J Counsell[1], and J-Donald Tournier[1,2]
		[1]Centre for the Developing Brain, School of Bioengineering and Imaging Sciences, King's College London, London, United Kingdom, [2]Department of Biomedical Engineering, School of Bioengineering and Imaging Sciences, King's College London, London, United Kingdom
		We describe a method for creating a longitudinal atlas of developing white matter (WM) of neonates using the multi-shell multi-tissue constrained spherical deconvolution technique and multi-contrast registration on high-quality high angular resolution diffusion imaging (HARDI) data. We present an atlas that consists of one isotropic and two orientationally-resolved components. The atlas reveals fibre-specific patterns of WM maturation that are consistent with regional differences in maturation previously described in histological studies of the developing brain.

470	15:09	Probing microstructural heterogeneity and mild traumatic brain injury-induced gray matter alterations in the rat brain using diffusion kurtosis imaging
		Manisha Aggarwal[1], Isabel San Martin[2], and Alejandra Sierra[2]

		[1]Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]University of Eastern Finland, Kuopio, Finland
		In heterogeneous brain tissue microenvironments, the probability distribution of spin displacements deviates from Gaussianity. Examining the non-Gaussian behavior of the diffusion-encoded signal with diffusion kurtosis imaging (DKI) could potentially allow probing cellular heterogeneity and injury-induced changes that are not discernible in the limited (***q***,t)-regime that pulsed-gradient DTI with conventional *b*-values explores. Here, we investigated the sensitivity of DKI to intrinsic cellular heterogeneity and mild traumatic brain injury (mTBI)-induced gray matter (GM) alterations in the rat brain. The results demonstrate distinct contrasts in mean kurtosis maps reflecting microstructural heterogeneity in GM regions, and detection of region-specific alterations in the cortex and thalamus.

471	15:21	Cross-vendor and Cross-protocol harmonisation of diffusion MRI data: a comparative study
		Chantal MW Tax[1], Francesco Grussu[2,3], Enrico Kaden[3], Lipeng Ning[4], Umesh Rudrapatna[1], John Evans[1], Samuel St-Jean[5], Alexander Leemans[5], Santi Puch[6], Matt Rowe[6], Paulo Rodrigues[6], Vesna Prčkovska[6], Simon Koppers[7,8], Dorit Merhof[8], Aurobrata Ghosh[3], Ryutaro Tanno[3,9], Daniel C Alexander[3], Cyril Charron[1], Slawomir Kusmia[1], David EJ Linden[1], Derek K Jones[1], and Jelle Veraart[10]
		[1]CUBRIC, School of Psychology, Cardiff University, Cardiff, United Kingdom, [2]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [3]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [4]Harvard Medical School, Boston, MA, United States, [5]Image Sciences Institute, Department of Radiology, University Medical Center Utrecht and Utrecht University, Utrecht, Netherlands, [6]Mint Labs Inc, Barcelona, Spain, [7]Department of Radiology, University of Pennsylvania and the Children's Hospital of Philadelphia, Philadelphia, PA, United States, [8]Institute of Imaging & Computer Vision, RWTH Aachen University, Aachen, Germany, [9]Machine Intelligence and Perception group, Microsoft Research Cambridge, Cambridge, United Kingdom, [10]New York University, New York, NY, United States
		We present a comparison of five different methods that estimate mappings between scanners for diffusion MRI data harmonisation. The methods are evaluated on a dedicated dataset of the same subjects acquired on three distinct scanners with ‘standard’ and ‘state-of-the-art’ protocols, with the latter having higher spatial and angular resolution. Our results show that cross-vendor harmonisation and spatial/angular resolution enhancement of single-shell diffusion data sets can be performed reliably, although some challenges remain. The dataset is available upon request and can serve as a useful testbed for future method development in cross-site/cross-hardware and cross-vendor diffusion MRI harmonisation.

472	15:33	Segmentation of the brain using direction averaged signal in DWI images
		Hu Cheng[1], Sharlene Newman[1], and Maryam afzali[1]
		[1]Psychological and Brain Sciences, Indiana University, Bloomington, IN, United States

		A novel segmentation method using the direction-averaged DWI signal is proposed. Two images can be obtained from the fitting of the direction-averaged DWI signal: one with superior contrast between the gray matter and white matter; one with prominent CSF contrast. A pseudo T1 weighted image can be constructed and standard segmentation tools can be applied. The method was tested on the HCP subjects in SPM12 and FSL, and showed good agreement with segmentation using the T1 weighted image with the same resolution.

Oral

Motion Correction: Beyond Gating

S02	Tuesday 13:45 - 15:45	*Moderators:* Freddy Odille & Giulia Ginami

473	13:45	Assessment of respiratory motion-resolved and nonrigid motion-corrected 3D Cartesian coronary MRA
		Teresa M Correia[1], Gastao Cruz[1], Giulia Ginami[1], Imran Rashid[1], Radhouene Neji[2], Rene Botnar[1], and Claudia Prieto[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]MR Research Collaborations, Siemens Healthcare Limited, Frimley, United Kingdom
		Slow acquisitions and susceptibility to respiratory motion artifacts are major challenges in free-breathing 3D whole-heart coronary MR angiography (CMRA). Recently, a respiratory-resolved approach has been proposed to improve scan efficiency and reduce motion artifacts using non-Cartesian acquisitions. However, irregular respirations compromise its suitability for Cartesian imaging. Here, sparsity in a motion-corrected domain is exploited to generate high-quality respiratory-resolved Cartesian images, used to estimate nonrigid motion fields. These are incorporated into a motion-corrected generalized matrix reconstruction, to further improve coronary vessel sharpness. Thus, this approach provides high-quality respiratory-resolved Cartesian CMRA images and a motion-corrected CMRA image at a given respiratory phase.

474	13:57	Nonrigid Motion Correction using 3D iNAVs with Generalized Motion Compensated Reconstruction and Autofocusing
		Srivathsan Prabu Koundinyan[1], Corey Allan Baron[1], Nicholas Dwork[1], Joseph Yitan Cheng[1], and Dwight George Nishimura[1]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States

		We present a novel framework to combine two well-known methods for motion correction: generalized motion compensated reconstruction (GMCR) and autofocusing. In this hybrid technique, 3D image-based navigators (3D iNAVs) are utilized for motion tracking. The beat-to-beat and voxel-by-voxel motion information within the 3D iNAVs are directly inputted into GMCR to mitigate motion artifacts. To reduce computation time, an autofocusing step is incorporated. The overall correction scheme is evaluated in free-breathing coronary magnetic resonance angiography and renal magnetic resonance angiography exams. In all six in vivo studies, images reconstructed with the proposed strategy outperform those generated with beat-to-beat 3D translational correction.

475	14:09	Effects of reconstruction with deformable motion correction on abdominal DCE-MRI images
		Adam Johansson[1], James M Balter[1], and Yue Cao[1,2,3]
		[1]Radiation Oncology, University of Michigan, Ann Arbor, MI, United States, [2]Radiology, University of Michigan, Ann Arbor, MI, United States, [3]Biomedical Engineering, University of Michigan, Ann Arbor, MI, United States
		Image reconstruction with deformable motion correction for dynamic contrast-enhanced (DCE) MRI can counteract artifacts in dynamic images and estimated perfusion maps. In this study, we present the results of applying a reconstruction method with deformable motion correction to 54 DCE-MRI examinations of 31 patients. Deformable motion correction is found to compensate for up to 15 mm of residual motion after rigid-body motion correction. Motion-correction also reduces liver-wide bias caused by motion-distorted input functions and removes localized artifacts at liver edges. Finally, for several cases, motion-correction makes lesion edges sharper in reconstructed images.

476	14:21	3D non-rigid motion-corrected dynamic contrast enhanced MRI of the liver with high isotropic resolution
		Matteo Ippoliti[1], Marcus Makowski[1,2], Tobias Schaeffter[2,3], and Christoph Kolbitsch[2,3]
		[1]Department of Radiology, Charité, Berlin, Germany, [2]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, [3]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig and Berlin, Germany
		Dynamic Contrast Enhanced (DCE) MRI of the liver is an important diagnostic tool. The main challenge is complex respiratory motion of the abdomen. Here we present a motion correction approach for DCE-MRI. Golden Radial Phase Encoding data was acquired continuously in a patient after contrast injection during free-breathing. In a first step, non-rigid respiratory motion was estimated from the data. The motion information was then used to reconstruct 3D motion corrected dynamic images with a temporal resolution of 13s and an isotropic spatial resolution of 1.5mm3. The proposed technique strongly reduced motion artefacts and ensured high image quality.

477	14:33	Cardiac and respiratory motion-corrected whole-heart PET-MR imaging for simultaneous assessment of coronary anatomy, cardiac function and myocardial integrity

Camila Munoz[1], Radhouene Neji[2], Karl P Kunze[3], Imran Rashid[1], Christoph Rischpler[3], Stephan G Nekolla[3], René M Botnar[1], and Claudia Prieto[1]

[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]MR Research Collaborations, Siemens Healthcare, Frimley, United Kingdom, [3]Nuclear Medicine, TU Munich, Munich, Germany

Image degradation due to cardiac and respiratory motion remains a challenge for cardiac PET-MR imaging. Here we propose a simultaneous dual-phase PET and Coronary MR angiography (CMRA) acquisition and reconstruction framework that allows for the visualisation of coronary anatomy, estimation of ventricular function and motion-corrected myocardial PET in a single efficient examination. A validation study in healthy subjects shows that left ventricular ejection fraction can be estimated from dual-phase CMRA images at 3T. Results from patients with cardiovascular disease show improvements in respiratory motion corrected dual-phase CMRA and in PET image quality when applying both cardiac and respiratory motion correction.

478 14:45

Joint PET-MR image registration for cardiac and respiratory motion correction of simultaneous cardiac PET-MR

Christoph Kolbitsch[1,2], Radhouene Neji[2,3], Matthias Fenchel[4], Andreas Schuh[5], Andrew Mallia[2], Paul Marsden[2], and Tobias Schaeffter[1,2]

[1]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig and Berlin, Germany, [2]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, [3]MR Research Collaborations, Siemens Healthcare, Frimley, United Kingdom, [4]MR R&D Collaborations, Siemens Medical Solutions, New York, NY, United States, [5]Biomedical Image Analysis Group, Department of Computing, Imperial College London, London, United Kingdom

Cardiac Positron Emission Tomography (PET) can provide diagnostic information about myocardial perfusion and metabolism with excellent sensitivity. The main challenge is physiological motion of the heart due to breathing and heartbeat. Here we present a joint PET-MR image registration approach which provides non-rigid cardiac and respiratory motion information utilising image data from a simultaneous PET-MR scan of less than 4min. In addition, attenuation correction information is also derived from the MR scan. The motion information is utilised in a motion-corrected PET image reconstruction which improves PET image quality, enhances visualisation of small features and increases measured uptake values by 22±7%.

479 14:57

Improved subsampling trajectory for reliable assessment of cardiac and respiratory motion in 5D MRI for body motion correction

Thomas Küstner[1,2], Martin Schwartz[1,2], Petros Martirosian[1], Konstantin Nikolaou[3], Sergios Gatidis[3], Bin Yang[2], and Fritz Schick[1]

[1]Section on Experimental Radiology, University Hospital of Tuebingen, Tuebingen, Germany, [2]Institute of Signal Processing and System Theory, University of Stuttgart, Stuttgart, Germany, [3]Department of Radiology, University Hospital of Tuebingen, Tuebingen, Germany

		Respiratory and cardiac motion may cause artifacts in body trunk imaging if patients cannot hold their breath or triggered acquisitions are not practical. Retrospective correction strategies cope with motion by fast sequences under free-movement conditions. In the acquisition, a random subsampling with global variable-density scaling is usually applied. Improved sampling efficiency in terms of acquired SNR per sample can be achieved if the underlying energy distribution is considered. An image upscaling via dictionary learning from the localizer with extraction of the energy distribution and local shaping of the hybrid Cartesian subsampling improves the overall image quality and SNR by 45%.

480	15:09	Estimation of a signal-appropriate reference volume to improve registration of high b-value diffusion volumes in the human placenta
		Conrad P Rockel[1], Barbra de Vrijer[2,3], and Charles McKenzie[1,3]
		[1]Medical Biophysics, Western University, London, ON, Canada, [2]Dept of Obstetrics and Gynaecology, Western University, Ontario, ON, Canada, [3]Division of Maternal, Fetal, and Newborn Health, Children's Health Research Institute, London, ON, Canada
		A technique is presented to aid in better motion correction of high *b*-value diffusion images of the human placenta *in utero* for the purposes of quantification using intra-voxel incoherent motion (IVIM). A registration reference volume is calculated with signal intensities and tissue features with similarity to volumes with high diffusion weighting, and produce more successful registrations than when using the *b*=0 volume as a reference.

481	15:21	Off k-space center and spin-history artifacts Self-Navigator Intelligent Filter (SNIF) for quasi-random 3D-radial acquisitions
		Tanguy Boucneau[1,2,3], Brice Fernandez[4], Peder E. Z. Larson[5], Luc Darrasse[1,2,3], and Xavier Maître[1,2,3]
		[1]Laboratoire d'Imagerie par Résonance Magnétique Médicale et Multi-Modalités (IR4M), Université Paris-Sud, Orsay, France, [2]Université Paris-Saclay, Orsay, France, [3]CNRS, Orsay, France, [4]Applications & Workflow, GE Healthcare, Orsay, France, [5]Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States
		For 3D radial acquisitions featuring a quasi-random order of spoke orientations in k-space, implementable in UTE pulse sequences, respiratory and cardiac self-navigators are usually extracted from the assumed k-space center thanks to standard bandpass filters to perform self-gating. To remove more efficiently the background noise, SNIF, Self-Navigator Intelligent Filter, takes into account the underlying physics of the MR acquisition to filter out of the DC signal both off k-space center and spin-history effects. SNIF systematically enhances both respiratory and cardiac self-navigators. It even sometimes reveals their spectral first harmonics, which remained otherwise buried into the background noise.

482	15:33	CAPTURE: Consistently-Acquired Projections for Tuned and Robust Estimation - A Self-Navigated Respiratory Motion Correction Approach
		Cihat Eldeniz[1], Tyler Fraum[1], Amber Salter[1], Yasheng Chen[1], H. Michael Gach[1], Parag J. Parikh[1], Kathryn J. Fowler[1], and Hongyu An[1]
		[1]Washington University in St. Louis, St. Louis, MO, United States
		In this study, we present a fully-automated and robust self-navigated approach to obtain 4D motion-resolved images during free breathing. A 1D navigator was acquired consistently in order to reduce the signal contamination due to system imperfections. The resulting projections were then 'tuned' using complex phase rotation for adapting to scan-to-scan variations, followed by the detection of the respiratory curve. CAPTURE successfully detected respiratory motion in all subjects. A blind radiological review by two radiologists shows the significant quality improvement in motion-corrected images.

Oral

Atherosclerosis & Vessel Wall Imaging

S03	Tuesday 13:45 - 15:45	*Moderators:* Claudia Calcagno & Kevin DeMarco

483	13:45	Relationship between MR characteristics of peripheral artery lesions and difficulty of peripheral endovascular procedures
		James Jiewen Zhou[1], Trisha L. Roy[1,2], Hou-Jou Chen[1,3], Andrew D. Dueck[1,2], and Graham A. Wright[1,3]
		[1]Schulich Heart Program and the Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [2]Division of Vascular Surgery, Department of Surgery, University of Toronto, Toronto, ON, Canada, [3]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada
		The most common mode of failure for percutaneous vascular interventions (PVI) is the inability to cross hard lesions with a guidewire. This study uses magnetic resonance (MR) lesion characterization to predict the difficulty of PVI. Steady state free precession (SSFP) MR angiography and ultrashort echo time imaging were used to categorize lesions as “hard” (e.g. calcium, collagen), or “soft” (thrombus, lipids). 17 patients were imaged prior to PVI. MRI-defined hard lesions required significantly longer time to cross (14.81 min vs 1.61 min) and required stenting more often.

484	13:57	Antibiotic treatment affects vascular elastin remodeling both focally and distally to the site of aortic injury in a murine model
		Begoña Lavin Plaza[1], Alkystis Phinikaridou[1], Marcelo E Andia[2], and René M Botnar[1]

		[1]School of Biomedical Engineering Imaging Sciences, King's College London, London, United Kingdom, [2]Radiology department, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile
		Atherosclerosis is a systemic, inflammatory disease of the large and medium-sized arteries. Although vascular interventions aim at treating focal stenosis, they may trigger systemic responses that accelerate lesions elsewhere. Elastin remodeling plays a crucial role in vessel wall thickening with monocytes and vascular smooth muscle cells (VSMC) being the primary sources of elastin synthesis. In this study, we used an elastin-binding MR contrast agent to assess whether (1) vascular injury in the abdominal aorta accelerates atherosclerosis in the brachiocephalic artery located distally to the site of injury (2), whether antibiotic treatment alters vascular elastin remodeling and (3) whether antibiotic treatment alters VSMC migration and proliferation and monocyte recruitment and polarization.

485	14:09	In Vivo Quantification of Aortic Stiffness in Abdominal Aortic Aneurysm Patients using MR Elastography: A Longitudinal Study
		Huiming Dong[1,2], Brian Raterman[1], Xiaokui Mo[3], Prateek Kalra[1], Richard White[1], and Arunark Kolipaka[1]
		[1]Department of Radiology, The Ohio State University Wexner Medical Center, Columbus, OH, United States, [2]Department of Biomedical Engineering, The Ohio State University, Columbus, OH, United States, [3]Center for Biostatistics, The Ohio State University, Columbus, OH, United States
		Abdominal aortic aneurysm (AAA) rupture causes death in 90% of AAA patients. Clinically, the rupture potential is evaluated using AAA diameter. Aortic stiffness can potentially provide more accurate rupture risk assessment. Therefore, the aim of this study is to use non-invasive MR elastography (MRE) to estimate aortic stiffness in AAA patients, and study the relationship between stiffness and AAA diameter. Results showed that aortic stiffness varied during the serial follow-up, demonstrating (1) no correlation between AAA stiffness and diameter, and (2) AAA diameter may not be an accurate indicator for rupture potential.

486	14:21	Increases in the Prevalence of Subclinical Cerebrovascular Atherosclerosis with Age: A 3.0 T Magnetic Resonance Imaging Study of Community-based Adults
		Xihai Zhao[1], Gaifen Liu[2], Runhua Zhang[2], Xiaoyi Chen[3], Dongye Li[3], Yong Jiang[2], Yilong Wang[2], Yongjun Wang[2], and Chun Yuan[1,4]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University School of Medicine, Beijing, China, [2]Department of Neurology, Beijing Tiantan Hospital, Beijing, China, [3]Center for Brain Disorders Research, Capital Medical University and Beijing Institute for Brain Disorders, Beijing, China, [4]Department of Radiology, University of Washington, Seattle, WA, United States

		It is well established that atherosclerotic diseases occurring in intracranial and extracranial carotid arteries are associated with ischemic cerebrovascular events. It is important to find a surrogate risk factor for subclinical cerebrovascular atherosclerosis in asymptomatic subjects for stroke prevention. This study sought to investigate the association between age and subclinical cerebrovascular atherosclerosis in community-based adults using MR vessel wall imaging. We found that the prevalence of cerebrovascular atherosclerotic plaques increased with age. The association between age and cerebrovascular atherosclerosis suggests that age was an independent indicator for subclinical cerebrovascular atherosclerosis.

487	14:33	Vascular risk factors and intracranial atherosclerosis at 7T vessel wall MRI in Caucasian ischemic stroke and TIA patients
		Arjen Lindenholz[1], Anja G. van der Kolk[1], Irene C. van der Schaaf[1], Bart H. van der Worp[2], Anita A. Harteveld[1], Nikki Dieleman[1], Michiel L. Bots[3], and Jeroen Hendrikse[1]
		[1]Radiology, UMC Utrecht, Utrecht, Netherlands, [2]Neurology, UMC Utrecht, Utrecht, Netherlands, [3]Epidemiology, UMC Utrecht, Utrecht, Netherlands
		There is a lack of knowledge on the association between cardiovascular risk factors and intracranial atherosclerotic lesion burden in the Caucasian population. In this study 105 Caucasian stroke and TIA patients underwent 7T intracranial vessel wall imaging within 3 months after symptom onset. Poisson regression analysis showed that older age, higher systolic blood pressure, diabetes mellitus and a higher SMART risk score (wherein multiple cardiovascular risk factors are combined) were associated with a higher number of vessel wall lesions. Controversially, dyslipidemia and cigarette smoking were not associated with the severity of intracranial vessel wall lesions.

488	14:45	Preliminary study of PET/MR 18F-NaF imaging combined with CATCH sequence of high-risk plaque
		Xiao Bi[1], Wei Dong[2], Yibin Xie[3], Jiajin Liu[1], Xiaojun Zhang[1], Zhiwei Guan[1], Damini Dey[3], Jing An [4], Piotr Slomka[3], Daniel Berman[3], Debiao Li[3], and Baixuan Xu[1]
		[1]Department of Nuclear Medicine, Chinese PLA General Hospital, Beijing, China, [2]Department of Cardiology, Chinese PLA General Hospital, Beijing, China, [3]Cedars Sinai Medical Center, Los Angeles, CA, United States, [4]Siemens Shenzhen Magnetic Resonance Ltd. China, Beijing, China
		This study aimed to investigate the value of PET/MR ^{18}F-NaF combined with CATCH technology in the diagnosis of high-risk plaque preliminarily. We compared if it had the statistical difference of PMR and TBRmax between the culprit vascular plaque and the control,and evaluated if it had correlation between PMR and TBR_{max}. There were higher PMR and TBR_{max} in culprit plaque. PMR and TBR_{max} had a weak correlation. PET/MR ^{18}F-NaF combined with the CATCH technique can noninvasively determine the location of high-risk plaque in coronary artery, and is valuable for the diagnosis of high-risk plaque.

489	14:57	Gender-Related Difference in Atherosclerosis: Magnetic Resonance Coronary Artery Wall Thickness is a Predictor of Coronary Plaque Burden in Asymptomatic Young Women
		Khaled Z Abd-Elmoniem[1], Ahmed M Ghanem[1], Ahmed Hamimi[1], Jatin Raj Matta[1], Reham M Elgarf[1], Ranganath Muniyappa[2], Michael V McConnell[3], Colleen Hadigan[4], and Ahmed M Gharib[1]
		[1]Biomedical and Metabolic Imaging Branch, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, United States, [2]Diabetes, Endocrinology, and Obesity Branch, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, United States, [3]Division of Cardiovascular Medicine, Stanford University School of Medicine, Stanford, CA, United States, [4]Laboratory of Immunoregulation, National Institutes of Allergy and Infectious Diseases, Bethesda, MD, United States
		This study evaluates the potential association of coronary plaque burden with traditional atherosclerosis risk factors and coronary wall thickness (VWT) measured with time-resolved phase-sensitive dual-inversion black-blood TRAPD-MRI. The study demonstrates that there is substantial coronary plaque burden in asymptomatic subjects at low and intermediate Framingham score. In addition, there was evidence of a gender-dimorphic association between the predictors and plaque burden. In women, coronary wall thickness was the strongest and common significant predictor for all plaque burden scores and the presence of calcification. Meanwhile in men, age was the strongest and common predictor of all plaque burden scores and the presence of calcification. This suggests that atherogenesis in women may differ from men and that VWT could supplement traditional risk scores for CAD risk stratification in women. This is in line with the previous studies that demonstrated the impaired utility of these CAD risk score models for women compared to men.

490	15:09	Association between Vulnerability of Carotid Artery Atherosclerotic Plaques and White Matter Lesions in Asymptomatic Elderly Population: A MR Vessel Wall Imaging Study
		Ying Cai[1], Yang Liu[2], Qiang Zhang[3], Weizhong Tian[1], Chun Yuan[3,4], Cheng Li[5], Wei Wang[2], and Xihai Zhao[3]
		[1]Department of Radiology, Taizhou People's Hospital, Taizhou, China, [2]Department of Radiology, Yangzhou First People's Hospital, Yangzhou, China, [3]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [4]Department of Radiology, University of Washington, Seattle, WA, United States, [5]Department of Radiology, Zhongda Hospital, Medical School of Southeast University, Nanjing, China
		This study investigated the relationship between morphological and compositional characteristics of carotid artery atherosclerotic plaques and WML in asymptomatic elderly population using 3D multicontrast MR vessel wall imaging. We found that carotid artery plaque compositional characteristics, especially calcification, intraplaque hemorrhage, and high risk plaque, were significantly associated with the severity of WML, suggesting that vulnerable atherosclerotic plaque in carotid artery might be an independent indicator for cerebral ischemic lesions in asymptomatic elderly adults.

491	15:21	Intraplaque Hemorrhage and Calcification Detection with Quantitative Susceptibility Mapping
		Chaoyue Wang[1], Saifeng Liu[2], Yongsheng Chen[2], Sagar Buch[3], Zhaoyang Fan[4], E. Mark Haacke[2], and Qi Yang[5]

		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]The MRI Institute for Biomedical Research, Detroit, MI, United States, [3]Center for Functional and Metabolic Mapping, Robarts' research institute, Western University, London, ON, Canada, [4]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [5]Xuanwu Hospital, Capital Medical University, Beijing, China
		In carotid atherosclerosis, the vulnerable feature that has drawn the most attention is intraplaque hemorrhage (IPH). Clinically, MPRAGE has been used to detect IPH. However, IPH has several drawbacks. The susceptibility difference between arterial blood, vessel wall and different types of plaque makes QSM a potential tool for carotid plaque imaging. The purpose of this work was to develop an optimized protocol for both intraplaque hemorrhage and calcification imaging using Quantitative Susceptibility Mapping (QSM) and demonstrate initial clinical validation of QSM as a tool for characterizing components of carotid plaque.

492	15:33	Identification of high-risk plaque features in intracranial atherosclerosis: initial experience using high-resolution MRI with a quantitative radiomics approach
		Zhang Shi[1], Chengcheng Zhu[2], Jianping Lu[1], Tao Jiang[1], David Saloner[2], and Qi Liu[1]
		[1]Radiology, Changhai Hospital, Shanghai, China, [2]Radiology, University of California, San Francisco, CA, United States
		This study aims to evaluate a radiomic approach including texture analysis based on HR-MRI to differentiate acute symptomatic plaque from asymptomatic plaque. 94 patients with basilar artery stenosis underwent HR-MRI. The stenosis value, plaque area/burden, lumen area, intraplaque hemorrhage (IPH), contrast enhancement ratio and 94 quantitative radiomic features were extracted. Multivariate logistic analysis and a random forest model were performed. Results: IPH and enhancement ratio were independently associated with acute symptoms. Radiomic features in T1 and CE-T1 images were associated with acute symptoms. The combined T1 and CE-T1 radiomic approach had a significantly higher AUC of 0.940. Conclusion: Radiomic analysis accurately distinguished between acutely symptomatic plaques and asymptomatic plaques.

Oral

Perfusion & Permeability

S04	Tuesday 13:45 - 15:45	*Moderators:* Christopher Quarles & Peiying Liu

493	13:45	Flow Compensation in Dynamic Susceptibility Contrast MRI for an Increase in Arterial Input Function Precision
		Benoît Bourassa-Moreau[1], Réjean Lebel[1], Guillaume Gilbert[2], David Mathieu[3], and Martin Lepage[1]

		[1]Centre d'imagerie moléculaire de Sherbrooke, Département de médecine nucléaire, Université de Sherbrooke, Sherbrooke, QC, Canada, [2]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada, [3]Service de neurochirurgie, Département de chirurgie, Université de Sherbrooke, Sherbrooke, QC, Canada
		Arterial input functions (AIF) measured inside major arteries in perfusion MRI are derived from the contrast agent induced changes in the blood signal. Such signal measurements of flowing blood are prone to (in)flow induced effects. Here, the effects of pulsatile blood flow are studied for AIF measurement in dynamic susceptibility contrast (DSC) with dual-echo single-shot EPI. First moment flow compensation is shown to partially recover the noise attributed to flow effects. The resulting signal-to-noise ratio is increased by a factor of 14 (2) in the middle (internal) carotid artery providing a more precise AIF for cerebral blood flow calculation.

494	13:57	Comparison of Cerebral Blood Volume Estimates using Quantitative Susceptibility Mapping, and R2* relaxometry
		Leonardo A Rivera-Rivera[1], Ante Zhu[1], Timothy Colgan [2], Diego Hernando[1,2], Tilman Schubert[3], Patrick A Turski[1,2], and Kevin M Johnson[1,2]
		[1]Department of Medical Physics, University of Wisconsin-Madison, Madison, WI, United States, [2]Department of Radiology, University of Wisconsin-Madison, Madison, WI, United States, [3]Department of Radiology, Basel University Hospital, Basel, Switzerland
		Intracranial vascularity is modified in a wide array of diseases, including various forms of dementia, cancer, and stroke. When assessment of the vascular architecture is needed, one potential approach is steady state imaging with ferumoxytol to estimate cerebral blood volume (CBV). Building upon recent work, in this study we investigate the correlation between QSM and R2* based CBV estimates. Results from 19 healthy volunteers show that the QSM based CBV estimates demonstrated a high degree of correlation in gray and white matter, but larger variance than R2* based measures.

495	14:09	The effects of diffusion on the tissue orientation dependent gradient echo dynamic susceptibility contrast signal
		Jonathan Doucette[1,2], Enedino Hernández-Torres[1,3], Christian Kames[1,2], Luxi Wei[4], and Alexander Rauscher[1,3,5]
		[1]UBC MRI Research Centre, University of British Columbia, Vancouver, BC, Canada, [2]Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada, [3]Pediatrics, University of British Columbia, Vancouver, BC, Canada, [4]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada, [5]Division of Neurology, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada

		Gradient echo dynamic susceptibility contrast (DSC) imaging of cerebral white matter tissue perfusion exhibits a strong dependency on the angle between white matter fibres and the main magnetic field. Here, we investigate the extent to which the diffusion of spins within the locally magnetically inhomogenous environment affects the orientation dependency of the DSC signal using a numerical model of the transverse magnetization within a voxel containing both isotropic and anisotropic vasculature. We found that diffusion increases the measured change in $$$R_2^*$$$ by up to an average of 3.2% for typical diffusion values, independent of fibre orientation, and further improves the fit between the simulated and measured $$$R_2^*$$$ values.

496	14:21	Accelerated dynamic quantitative perfusion imaging using an optimized simultaneous multi-slice (SMS) spin and gradient echo (SAGE) sequence with joint-virtual coil (JVC) reconstruction
		Mary Kate Manhard[1], Berkin Bilgic[1], Congyu Liao[1,2], SoHyun Han[1], Thomas Witzel[1], Yi-Fen Yen[1], and Kawin Setsompop[1]
		[1]MGH Athinoula A. Martinos Center for Biomedical Imaging, Boston, MA, United States, [2]Department of Biomedical Engineering, Zhejiang University, Hangzhou, China
		A 5-echo spin and gradient echo (SAGE) sequence was implemented with SMS to provide whole brain coverage at a high spatio-temporal resolution during DSC imaging. Complementary k-space sampling between echoes and joint-virtual coil (JVC) reconstruction were used to achieve high quality reconstruction at 9x acceleration, which enabled 1.9x1.9x5 mm whole-brain imaging at a TR of 1.6s. The multi-echo images from this sequence were fit to achieve quantitative R2 and R2* maps for each TR. This has been shown to limit T1 leakage effects and provide more accurate and detailed perfusion measures with the potential to better assess tumor diagnostics and progression.

497	14:33	Quantitative assessment of exercise-stimulated muscle perfusion: a comparison between DCE and DSC imaging
		Jeff L Zhang[1], Christopher C Conlin[1], Stephen Decker[2], Gwenael Layec[2], Jiawei Dong[1], Xiaowan Li[1], Nan Hu[3], Christopher Hanrahan[1], Lillian Khor[4], Michelle Mueller[5], and Vivian S Lee[1]
		[1]Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, United States, [2]Division of Geriatrics, University of Utah, Salt Lake City, UT, United States, [3]Epidemiology, University of Utah, Salt Lake City, UT, United States, [4]Cardiovascular Medicine, University of Utah, Salt Lake City, UT, United States, [5]Vascular Surgery, University of Utah, Salt Lake City, UT, United States
		For one group of healthy subjects, we measured exercise-stimulated perfusion in calf muscles using both DCE and DSC MRI, and found that the muscle perfusion estimates by the two methods were comparable, but the vascular-fraction estimates were not. Without confounding contribution from extravascular signals, DSC data has the potential of characterizing tissue vasculature more precisely. Acquisition of both DCE and DSC data in one exam can be achieved with either two injections of low contrast dose or acquisition techniques of interleaved T_1 and T_2* imaging.

498	14:45	Evaluation of UTE for improved contrast enhanced DCE MRI at 7T
		Naoharu Kobayashi[1], Patrick Bolan[1], and Gregory J. Metzger[1]
		[1]Center for Magnetic Resonance Research, Department of Radiology, University of Minnesota, Minneapolis, MN, United States
		We investigated the feasibility of using an ultrashort echo time (UTE) technique for DCE MRI imaging of prostate cancer patients at 7T to minimize the impact of the increased R_2^* relaxivity on signal enhancement curves and pharmacokinetic parameter assessment. The Gd concentration-time curves and pharmacokinetic parameter maps were compared to clinical DCE MRI at 3T. The proposed method achieved DCE MRI at 7T with a signal time course comparable to 3T DCE MRI but with increased SNR for improved spatial resolution and no R_2^* effects, which are exacerbated with increasing field.
499	14:57	A Multislice TRICKS-Based DCE-MRI Method for Measurement of Murine Kidney Function
		Kai Jiang[1], Prasanna K. Mishra[2], Slobodan I. Macura[2], and Lilach O. Lerman[1]
		[1]Division of Nephrology and Hypertension, Mayo Clinic, Rochester, MN, United States, [2]Department of Biochemistry and Molecular Biology, Mayo Clinic, Rochester, MN, United States
		A multislice method based on time-resolved imaging of contrast kinetics was developed for measurement of murine kidney size and function. A total of eight slices covering both kidneys were imaged with a temporal resolution of 1.23 sec/scan. The estimated kidney volume showed a good agreement with a three-dimensional volume scan. By fitting contrast kinetics using a modified bi-compartment model, renal perfusion and normalized glomerular filtration rate (GFR) were quantified, and subsequently used to calculate renal blood flow and GFR. In conclusion, this method allows simultaneous and reliable measurement of mouse kidney volume, perfusion, blood flow, and GFR.
500	15:09	Improved reliability for mapping water exchange across blood-brain barrier by diffusion prepared three-dimensional pseudo-continuous arterial spin labeling
		Xingfeng Shao[1] and Danny J.J. Wang[1]
		[1]Laboratory of FMRI Technology (LOFT), Mark & Mary Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States

		A 3D diffusion-prepared gradient and spin echo (GRASE) pseudo-continuous ASL (pCASL) sequence was proposed to improve the reliability for mapping water exchange across the BBB non-invasively. The motion sensitive non-CPMG component signal was eliminated by gradients to spread the diffusion weighted signal across 4π before GRASE readout. Based on test-retest scans (~2 weeks apart) in aged subjects (67±8yrs), excellent reproducibility (ICC=0.87) was achieved for water exchange rate (Kw) measured by the proposed 3D sequence. Whole brain Kw was averaged to be 107.7±19.0 min^{-1} and 113.0±17.8 min^{-1} for the proposed 3D and 2D DW-pCASL method, respectively, well matching the literature results.

501	15:21	Demonstrating a novel non-contrast MR perfusion technique: EVM-EPI MR perfusion
		Steven J. Sherry[1], Emanuel Kanal[2], Gregory Walker[3], John E. Kirsch[4], Jonathan Polimeni[4], and H. Benjamin Harvey[1]
		[1]Neuroradiology, Massachusetts General Hospital, Boston, MA, United States, [2]Radiology, University of Pittsburgh Medical Center, Pittsburgh, PA, United States, [3]Neurology, University of Pittsburgh, Pittsburgh, PA, United States, [4]Radiology, Massachusetts General Hospital, Boston, MA, United States
		EVM-EPI MR perfusion is a novel, non-contrast MR perfusion technique, which amplifies latent imperceptible contrast variation in perfused tissue of a T2*-weighted cine acquisition via Fourier methods at frequencies of cardiac perfusion.

502	15:33	Assessment of white matter anisotropy effects in mq-BOLD based mapping of relative Oxygen Extraction Fraction
		Stephan Kaczmarz[1,2], Jens Goettler[1,2], Andreas Hock[3], Dimitrios Karampinos[4], Claus Zimmer[1], Fahmeed Hyder[2,5], and Christine Preibisch[1,6]
		[1]Department of Neuroradiology, Technical University of Munich, Munich, Germany, [2]Department of Radiology & Biomedical Imaging, Yale University, New Haven, CT, United States, [3]Philips Healthcare, Hamburg, Germany, [4]Departement of Radiology, Technical University of Munich, Munich, Germany, [5]School of Engineering & Applied Science, Yale University, New Haven, CT, United States, [6]Clinic for Neurology, Technical University of Munich, Munich, Germany
		Anisotropy effects were proven to strongly affect T_2* and DSC-measurements, however influences on the relative Oxygen Extraction Fraction (rOEF) by multi-parametric quantitative BOLD (mq-BOLD) have not been investigated yet. Therefore, we present a methodolocigal study within healthy elderly. The major aim was to evaluate anisotropy effects on rOEF and all mq-BOLD related parameters at the same time. We found strong orientation dependencies of T_2*, T_2, R_2' and rCBV on the main-nerve-fiber orientation towards B_0 with variations up to 26.6%. However, our results show rather low angle dependency of rOEF with 13.6% as R_2' and rCBV effects show partially counteracting influences.

Oral

Traumatic Brain Injury

S05	Tuesday 13:45 - 15:45	*Moderators:* Andre Obenaus & Guangming Lu

503	13:45	Multi-parametric MRI data fusion reveals acute and persistent brain changes in concussed female varsity rugby players
		Kathryn Y. Manning[1,2], Alberto Llera[3], Robert Bartha[1,2], Gregory A. Dekaban[4,5], Christy Barreira[4], Arthur Brown [4,6], Lisa Fischer[7], Tatiana Jevreomvic[7], Kevin Blackney[4], Timothy J. Doherty[8], Douglas D. Fraser[9], Jeff Holmes[10], Christian F. Beckmann[3,11,12], and Ravi S. Menon[1,2]
		[1]Medical Biophysics, Western University, London, ON, Canada, [2]Centre for Functional and Metabolic Mapping, Robarts Research Institute, London, ON, Canada, [3]Donders Centre for Cognitive Neuroimaging, Radboud University, Nijmegen, Netherlands, [4]Molecular Medicine, Robarts Research Institute, London, ON, Canada, [5]Microbiology and Immunology, Western University, London, ON, Canada, [6]Anatomy and Cell Biology, Western University, London, ON, Canada, [7]Primary Care Sport Medicine, Fowler Kennedy Sport Medicine, London, ON, Canada, [8]Physical Medicine and Rehabilitation, Western University, London, ON, Canada, [9]Paediatrics Critical Care Medicine, London Health Sciences Centre, London, ON, Canada, [10]Occupational Therapy, Western University, London, ON, Canada, [11]Cognitive Neuroscience, Radboud University Medical Centre, Nijmegen, Netherlands, [12]Centre for Functional MRI of the Brain (FMRIB), Oxford University, Oxford, United Kingdom
		Multi-parametric 3T MRI data was acquired in female varsity rugby players during the in- and off-season and compared to concussed teammates acutely (24-72 hours) and longitudinally (3- and 6-months) after a mild traumatic brain injury (mTBI). Using linked independent component analysis, we found acute and prolonged resting state functional connectivity and diffusion white matter microstructure changes that persisted beyond symptomatic recovery and clearance to return to play. These fused components also significantly correlated with aspects of concussion history and were robust and consistent across model orders and within individual concussed athletes longitudinally.

504	13:57	Chronic Neurovascular Dysfunction in a Mouse Model of Repeated Mild Traumatic Brain Injury
		Conner Robert Adams[1], Paolo Bazzigaluppi[2], Tina L Beckett[2], Jossana Bishay[2], Joe Steinman[1,3], Lydiane Hirschler[4,5,6], Jan M Warnking[4,6], Emmanuel L Barbier[4,6], JoAnne McLaurin[2,7], John G Sled[1,3], and Bojana Stefanovic[1,2]
		[1]Medical Biophysics, University of Toronto, Toronto, ON, Canada, [2]Sunnybrook Research Institute, Toronto, ON, Canada, [3]Mouse Imaging Centre, Toronto, ON, Canada, [4]Grenoble Institut des Neurosciences, Université Grenoble Alpes, Grenoble, France, [5]Bruker Biospin MRI, Ettlingen, Germany, [6]Inserm, U1216, Grenoble, France, [7]Department of Laboratory Medicine and Pathobiology, University of Toronto, Toronto, ON, Canada

		In-situ assessments of brain function following repeated mild traumatic brain injury (rmTBI) have yet to be seen. Herein, we report the first functional imaging study in the chronic phase of a mouse model of rmTBI. Pseudo-continuous arterial spin labelling MRI revealed a reduction in basal cerebral blood flow and cerebral reactivity, while electrophysiological recordings of evoked responses were greatly reduced in injured brain. Finally, immunohistochemical analysis of vascular endothelium, astrogliosis, and neurons was performed to investigate cellular populations.

505	14:09	A Weighted Head Accelerator Mechanism (WHAM) for imaging brain tissue deformation during mild head rotation using a tagged MRI sequence
		Ronald G Pratt[1], Greg Lee[1], Aaron S McAllister[2], Greg Myer[3], Thomas Klein[4], Christopher M Ireland[1,5], Wolfgang Loew[1], Matt Lanier[1], and Charles Dumoulin[1]
		[1]Imaging Research Center/Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH 45229, Cincinnati, OH, United States, [2]Radiology, Nationwide Children's Hospital, Columbus, OH, United States, [3]Division of Sports Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [4]Department of Physics, University of Cincinnati, Cincinnati, OH, United States, [5]Department of Biomedical Engineering, University of Cincinnati, Cincinnati, OH, United States
		A new research tool, the Weighted Head Accelerator Mechanism (WHAM), is described. The WHAM, used together with a custom MRI sequence, permits in depth investigations into brain biomechanics during mild head rotations and the evaluation of mild traumatic brain injury mitigating strategies by directly evaluating their effects on brain biomechanics *in vivo.*

506	14:21	Ribbon Tractography Reveals Reorientation of White Matter in the Corpus Callosum Following Severe Traumatic Brain Injury
		Choukri Mekkaoui[1], Brian L Edlow[2], William J Kostis[3], Marcel P Jackowski[4], Kawin Setsompop[1], Thomas Witzel[1], Qiuyun Fan[1], Ned A Ohringer[1], Javier Cabrera[3], Timothy G Reese[1], Ona Wu[1], and Susie Y Huang[1]
		[1]Harvard Medical School - Massachusett General Hospital - Martinos Center for Biomedical Imaging, Boston, MA, United States, [2]Department of Neurology, Massachusetts General Hospital, Boston, MA, United States, [3]Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, United States, [4]University of São Paulo, São Paulo, Brazil
		Traditional streamline tractography does not capture the changes in fiber twisting resulting from traumatic brain injury. We used ribbon tractography to quantify the acute directional changes in white matter tracts in patients with traumatic brain injury. We identified significant changes in the corpus callosum of these patients both as compared to healthy controls and between the acute and follow-up scans of a subset of patients. These findings reveal alterations in the architecture of the corpus callosum within and beyond the area of injury and offer a potential marker for structural changes that are not detected by standard techniques.

507	14:33	The Evolution of White Matter Microstructural Changes after Mild Traumatic Brain Injury: A Longitudinal DTI and NODDI Study
		Eva M Palacios[1], Julia P Owen[2], Esther L Yuh[1,3], Mary Vassar[3,4], Geoffrey T Manley[3,4], and Pratik Mukherjee[1,3,5]
		[1]Radiology & Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [2]Department of Radiology, University of Washington, Seattle, WA, United States, [3]Brain and Spinal Cord Injury Center, San Francisco General Hospital and Trauma Center, San Francisco, CA, United States, [4]Department of Neurological Surgery and Brain and Spinal Injury Center, University of California San Francisco, San Francisco, CA, United States, [5]Department of Bioengineering & Therapeutic Sciences, University of California, San Francisco, San Francisco, CA, United States
		Problem: Mild traumatic brain injury (mTBI) can result in long-term sequelae. Lack of sensitive biomarkers makes diagnosis challenging. Methods: Cross-sectional and longitudinal study of 40 mTBI patients at 2 weeks and 6 months after injury. Diffusion tensor imaging and multishell neurite orientation dispersion and density imaging (NODDI) parameters were assessed. Results: Cross-sectional analysis between patients at 2-weeks and controls revealed a decrease of fractional anisotropy and increase of mean diffusivity in the patient group together with elevated free water values. Longitudinally, after mTBI, a decline in neurite density was observed. Conclusions: NODDI measurements are sensitive imaging biomarkers for the subtle underlying white matter pathology after mTBI.

508	14:45	5-Year Arterial Spin Labeling MR Perfusion sequelae of concussive blast traumatic brain injury
		Swati Rane[1], Jalal B Andre[1], Jason Barber[1], Nancy Temkin[1], and Christine MacDonald[1]
		[1]University of Washington Medical Center, Seattle, WA, United States
		Concussive blast traumatic brain injury (cbTBI) may benefit from evaluation with advanced MR imaging techniques. Here we report the results of a 5-year follow-up prospective, observational, longitudinal human cohort study evaluating cbTBI using arterial spin labeling, correlated with durable measures of long term outcome taken from an extensive battery of neurobehavioral, neuropsychological, and psychiatric evaluations. Specifically, service members who sustained combat-related cbTBI exhibited significant, regional hypoperfusion 5 years post-injury compared to combat-deployed controls, associated with measures of long term outcome.

509	14:57	Redundancy and resiliency of arousal mechanisms in traumatic coma patients
		Marta Bianciardi[1], Saef Izzy[2], Bruce R Rosen[1], Lawrence L Wald[1], and Brian L Edlow[3]
		[1]Department of Radiology, A.A. Martinos Center for Biomedical Imaging, MGH and Harvard Medical School, Boston, MA, United States, [2]Department of Neurology, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States, [3]Department of Neurology, A. A. Martinos Center for Biomedical Imaging, MGH and Harvard Medical School, Boston, MA, United States

		Traumatic brain injury to brainstem/thalamic/hypothalamic/basal-forebrain arousal nuclei is implicated in the pathogenesis of coma. However, due to difficulty in localizing these nuclei with conventional MRI, it is unknown which lesioned nuclei cause coma, and which are compatible with recovery of arousal/consciousness. We mapped our recently developed brainstem arousal-nuclei atlases and current thalamic/hypothalamic/basal-forebrain atlases to 3Tesla susceptibility-weighted-images in twelve acute traumatic-coma patients, who recovered full arousal/consciousness within six-months. We identified multiple combinations of injured brainstem/thalamic arousal-nuclei that cause acute coma, yet are compatible with a full recovery of arousal/consciousness. Thus, there is redundancy and resiliency of arousal mechanisms in traumatic coma.

510	15:09	Assessing Mild Traumatic Brain Injury (TBI) Induced Optic Neuropathy in Novel Closed-head Injury Mouse Model Using Diffusion Basis Spectrum Imaging (DBSI)
		Tsen-Hsuan (Abby) Lin[1], Andrew D Sauerbeck[2], Terrance T Kummer[2,3], and Sheng-Kwei Song[1,3,4]
		[1]Radiology, Washington University School of Medicine, St Louis, MO, United States, [2]Neurology, Washington University School of Medicine, St Louis, MO, United States, [3]Hope Center for Neurological Disorders, Washington University School of Medicine, St Louis, MO, United States, [4]Biomedical Engineering, Washington Univerisyt is St. Louis, St Louis, MO, United States
		Traumatic brain injury (TBI) is a major cause of death and disability worldwide, and mild TBI (mTBI) is the most common type injury. TBI-induced optic neuropathy (ON) has recently raised attention due to subjective complaints of visual impairment. Currently, non-invasive and longitudinal direct assessment in TBI-induced ON is still limited. In the current study, we applied diffusion basis spectrum imaging (DBSI) to a novel surgery-free and closed-head impact model of TBI called modCHIMERA at 3 days post-injury to study TBI-induced ON with histological validation on our imaging metrics.

511	15:21	Association Between Concussion-induced Dizziness and Damage of Thalamo-cortical Connectivity after mild Traumatic Brain Injury
		Chia-Feng Lu[1,2,3], Yu-Chieh Jill Kao[1,4], Li-Chun Hsieh[1,4,5], Sho-Jen Cheng[1,5], Ho-Fang Huang[1,6], Wen-Jin Hsieh[1,5], Fei-Ting Hsu[1,4], Ping-Huei Tsai[1,4], and Cheng-Yu Chen[1,4,5]
		[1]Research Center of Translational Imaging, College of Medicine, Taipei Medical University, Taipei, Taiwan, [2]Department of Anatomy and Cell Biology, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan, [3]Department of Biomedical Imaging and Radiological Sciences, National Yang-Ming University, Taipei, Taiwan, [4]Department of Radiology, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan, [5]Department of Medical Imaging, Taipei Medical University Hospital, Taipei, Taiwan, [6]Department of Medical Research, Taipei Medical University Hospital, Taipei, Taiwan

		Dizziness is a frequent symptom of concussion, however neuroimaging evidence that supports clinical symptoms after mTBI was less explored. This study demonstrated the post-concussion damages of thalamo-cortical networks revealed by the axonal injuries of specific fiber tracts and the altered functional connectivity. The estimates of Dizziness Handicap Inventory significantly correlated to the functional connectivity of thalamic nuclei.

512	15:33	Metabolic concentrations in normal appearing brain tissue: 3 month after severe pediatric TBI.
		Petr Menshchikov[1,2], Natalia Semenova[1,2,3], Andrei Manzhurtsev[2,3], Maxim Ublinskii[2,3], Ilya Melnikov[2], and Tolib Akhadov[2]
		[1]Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow, Russian Federation, [2]Clinical and Research Institute of Emergency Pediatric Surgery and Trauma, Moscow, Russian Federation, [3]Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Moscow, Russian Federation
		In this study for the first time cerebral NAA, Asp and Glu concentrations of major inhibitory were simultaneously estimated in patients severe TBI . This work revealed significant reduction NAA and Asp concentrations in frontal lobe (on 65 and 61% respectively) in patients with severe TBI as compare to control group. At the same time, there was no significant change in Glu concentration. Our findings indicate that the main reason for the [NAA] reduction in the chronic severe TBI is caused by a decrease in [Asp]. Precursor of synthesis [NAA]. [Asp] reduction along with an unchanged Glu level may be caused by the dysfunction of one of the most important metabolic regulation systems - the malate-aspartate shuttle (MAS).

Oral

Hepatobiliary: Diffuse Liver Disease, Part 1

S06	Tuesday 13:45 - 15:45	*Moderators:* Reena Jha & Jeong Hee Yoon

513	13:45	Noninvasive Staging of Liver Fibrosis using Magnetic Resonance, Ultrasound, and Transient Elastography: a Comparison with Liver Biopsy
		Thierry Lefebvre[1], André Ilinca[1], Claire Wartelle-Bladou[2], Giada Sebastiani[3], Hélène Castel[2], Bich Ngoc Nguyen[4,5], Jessica Murphy-Lavallée[6], Damien Olivié[6], Guillaume Gilbert[6,7], and An Tang[1,6]
		[1]Centre de recherche du centre hospitalier de l'Université de Montréal (CRCHUM), Montreal, QC, Canada, [2]Department of Gastroentology and Hepatology, Université de Montréal, Montreal, QC, Canada, [3]Department of Medicine, Division of Gastroenterology, McGill University Health Centre (MUHC), Montreal, QC, Canada, [4]Department of Pathology, Centre hospitalier de l'Université de Montréal (CHUM), Montréal, QC, Canada, [5]Department of Pathology and Cellular Biology, Université de Montréal, Montreal, QC, Canada, [6]Department of Radiology, Radio-Oncology and Nuclear Medicine, Université de Montréal, Montreal, QC, Canada, [7]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada

		Elastographic techniques measure liver stiffness as surrogate biomarker of liver fibrosis. We performed paired comparisons of MRE, pSWE, and TE for staging liver fibrosis. For classification of dichotomized fibrosis stages F0 vs. ≥ F1, ≤ F1 vs. ≥ F2, ≤ F2 vs. ≥ F3, and ≤ F3 vs. F4, the AUCs were respectively 0.92, 0.84, 0.89, 0.89 for MRE; 0.76, 0.83, 0.80, 0.75 for pSWE; and 0.75, 0.70, 0.77, 0.84 for TE. Overall, MRE provided a diagnostic accuracy similar or higher than ultrasound-based elastographic techniques.

514	13:57	Liver R2* as a Biomarker of Liver Iron Concentration: Interim Results from a Multi-Center, Multi-Vendor Reproducibility Study at 1.5T and 3T
		Diego Hernando[1,2], Ruiyang Zhao[1,2], Valentina Taviani[3], Mounes Aliyari Ghasabeh[4], Li Pan[5], Qing Yuan[6], Stefan Ruschke[7], Dimitrios C. Karampinos[7], Xiaodong Zhong[8], Ryan J. Mattison[9], Ihab R. Kamel[4], Ivan Pedrosa[6], Shreyas Vasanawala[10], Takeshi Yokoo[6,11], and Scott B. Reeder[1,2,9,12,13]
		[1]Radiology, University of Wisconsin-Madison, Madison, WI, United States, [2]Medical Physics, University of Wisconsin-Madison, Madison, WI, United States, [3]Global MR Applications & Workflow, GE Healthcare, Menlo Park, CA, United States, [4]Radiology, The Johns Hopkins University, Baltimore, MD, United States, [5]Siemens Healthineers, Baltimore, MD, United States, [6]Radiology, University of Texas Southwestern Medical Center, Dallas, TX, United States, [7]Radiology, Technical University of Munich, Munich, Germany, [8]Siemens Healthineers, Los Angeles, CA, United States, [9]Medicine, University of Wisconsin-Madison, Madison, WI, United States, [10]Radiology, Stanford University, Stanford, CA, United States, [11]Advanced Imaging Research Center, University of Texas Southwestern Medical Center, Dallas, TX, United States, [12]Biomedical Engineering, University of Wisconsin-Madison, Madison, WI, United States, [13]Emergency Medicine, University of Wisconsin-Madison, Madison, WI, United States
		R2* is a promising biomarker of liver iron concentration (LIC), with application in the assessment of iron overload. Previous works have demonstrated the high correlation of liver R2* with biopsy-determined LIC. Although R2* measurements may be affected by multiple confounding factors, including the presence of fat and noise bias, confounder-corrected R2* mapping has been shown to be highly insensitive to the presence of these confounding factors. However, the multi-center reproducibility of confounder-corrected R2* for liver iron quantification remains unknown. This abstract demonstrates excellent reproducibility of R2* for liver iron quantification in a multi-center, multi-vendor study at both 1.5T and 3T.

515	14:09	Estimating Liver Water and Fat T1 and T2, and PDFF using Flip Angle Corrected Multi-TR, Multi-TE 1H MRS
		Gavin Hamilton[1], Alexandra N Schlein[1], Rohit Loomba[2], and Claude B Sirlin[1]
		[1]Liver Imaging Group, Department of Radiology, University of California, San Diego, La Jolla, CA, United States, [2]NAFLD Research Center, Division of Gastroenterology, Department of Medicine, University of California, San Diego, La Jolla, CA, United States

		Multi-TR, multi-TE (MTRTE) ^{1}H MRS estimates T1 and T2 of fat and water and liver proton density fat fraction (PDFF) in a single breath-hold by assuming a perfect 90° pulse, which is not guaranteed *in vivo* and may introduce bias. We introduce a flip angle corrected multi-TR, multi-TE (FAC MTRTE) ^{1}H MRS sequence based on a non-steady state approach and compare the T1, T2, and PDFF given by MTRTE and FAC MTRTE MRS. T1 estimates given by MTRTE MRS and FAC MTRTE MRS were significantly different, due to the MTRTE sequence not being acquired with a perfect 90° flip.

516	14:21	Rapid multi-slice abdominal T1 mapping with high spatial and temporal resolution using an inversion recovery radial steady-state free precession (IR-radSSFP) technique
		Zhitao Li[1,2], Ali Bilgin[1,2,3], Kevin Johnson[4], Jean-Philippe Galons[2], Manoj Saranathan[2,3], Diego R Martin[2,3], and Maria I Altbach[2,3]
		[1]Electrical and Computer Engineering, The University of Arizona, Tucson, AZ, United States, [2]Department of Medical Imaging, The University of Arizona, Tucson, AZ, United States, [3]Biomedical Engineering, The University of Arizona, Tucson, AZ, United States, [4]Siemens Healthcare, Tucson, AZ, United States
		A radial IR steady-state free precession technique combined with a principal component based iterative algorithm are demonstrated for rapid high-resolution abdominal T_1 mapping. This method yields high quality T_1 maps for 10 slices with spatial resolution as high as of 0.83x0.83x3mm from data acquired in a breath-hold or a short free-breathing scan. The method is a significant improvement over existing abdominal T_1 mapping techniques.

517	14:33	Evaluation of Four T1 Mapping Sequences for Obtaining the Extracellular Volume Fraction in Abdominal Imaging
		Temel Tirkes[1], Chen Lin[2], Xuandong Zhao[3], Dominik Nickel[4], Kelvin Chow[5], Alex J Stuckey[3], Robert Grimm[4], and Shivraman Giri[6]
		[1]Radiology and Imaging Sciences, Indiana University School of Medicine, Indianapolis, IN, United States, [2]Indiana University School of Medicine, Indianapolis, IN, United States, [3]Radiology and Clinical Sciences, Indiana University School of Medicine, Indianapolis, IN, United States, [4]MR Application Predevelopment, Siemens Healthcare, Erlangen, Germany, [5]MR R&D Collaborations, Siemens Medical Solutions USA, Inc, Chicago, IL, United States, [6]Siemens Medical Solutions, USA Inc, Chicago, IL, United States
		Many different T1 mapping sequences and extracellular volume (ECV) fraction have proven to be useful tools for evaluation of tissue fibrosis, however their potential has not been explored in abdominal imaging. We evaluated 4 different T1 mapping techniques; Dual-flip angle VIBE (DFA VIBE), MOLLI, SASHA and IR-SNAPSHOT and obtained similar ECV fractions of the liver and pancreas. DFA VIBE has the highest spatial coverage in 1 breath hold but suffers from inhomogeneous T1 in the aortic blood. IR-SNAPSHOT has advantage of not requiring cardiac gating and provides the most homogenous T1 of the blood within the aorta.

518	14:45	Automated liver-segment localization and segmental hepatic proton-density fat fraction measurement

		Kang Wang[1], Adrija Mamidipalli[1], Kevin William Blansit[2], Jonathan Charles Hooker[1], Claude B. Sirlin[1], and Albert Hsiao[1]
		[1]Radiology, University of California, San Diego, La Jolla, CA, United States, [2]Biomedical Informatic, University of California, San Diego, La Jolla, CA, United States
		Hepatic proton-density fat fraction (PDFF) has emerged as an imaging biomarker for liver fat content in non-alcoholic fatty liver disease. To account for the spatial heterogeneity of liver fat, one approach is to manually place a region of interest (ROI) and estimate the PDFF in each hepatic Couinaud segment separately. We trained a convolutional neural network to automatically locate each liver segment and calculate segmental PDFF values. We show that segmental PDFF measurement based on our automated approach closely matches those based on manual placement by a trained image analyst, demonstrating the feasibility of utilizing CNNs to automatically extract clinically valuable quantitative information from source images.

519	14:57	Assessment of hepatic fibrosis and steatosis in pediatric non-alcoholic fatty liver disease using multifrequency MR elastography
		Jing Guo[1], Christian Hudert[2], Heiko Tzschätzsch[1], Jürgen Braun[3], and Ingolf Sack[1]
		[1]Radiology, Charité - Universitätsmedizin Berlin, Berlin, Germany, [2]2Center for Chronically Sick Children, Charité - Universitätsmedizin Berlin, Berlin, Germany, [3]Medical Informatics, Charité - Universitätsmedizin Berlin, Berlin, Germany
		Multifrequency MR elastography MRE was applied to detect fibrosis and steatosis, two pathological features associated with pediatric non-alcoholic fatty liver disease (NAFLD). Shear wave speed (c) obtained from MRE is a measure of tissue stiffness and can differentiate moderate from advanced fibrosis. Penetration rate (a) as another MRE parameter is able to detect moderate steatosis and is negatively correlated with hepatic fat fraction. Both MRE derived mechanical parameters c and a are independently responsive to fibrosis and steatosis and could be used in the future as imaging markers for the noninvasive assessment of prediatric NAFLD.

520	15:09	Can Negligible Hepatic Steatosis Determined by MRI-Proton Density Fat Fraction Obviate the Need for Liver Biopsy in Potential Liver Donors?
		Kartik Jhaveri[1], Janakan Satkunasingham[1], Hooman Hosseini Nik[1], Sandra Fischer[1], Ravi Menezes[1], Nazia Selzner[1], Mark Cattral[1], and David Grant[1]
		[1]UHN, Toronto, ON, Canada

		Hepatic steatosis in potential liver donor candidates has important implications towards outcomes of liver transplant recipients and donor safety. Hepatic steatosis in potential donors in excess of established but varying institutional thresholds are considered as grounds for donor ineligibility. However, negiblible/absent hepatic steatosis (<5%) is considered acceptable universally. Currently Liver biopsy is regarded as reference standard. We show in our study that MR-PDFF has very high NPV for excluding significant hepatic steatosis (>10%). Thus MRI-PDFF can be utilized for liver donor screening and obviates the need for liver biopsy when MRI-PDFF values are <5%

521	15:21	Intravoxel Incoherent Motion Diffusion-weighted MRI for Assessing Necroinflammation in Patients with Chronic Liver Disease
		Thierry Lefebvre[1], Guillaume Gilbert[2,3], Claire Wartelle-Bladou[4], Giada Sebastiani[5], Hélène Castel[4], Bich Ngoc Nguyen[6,7], Damien Olivié[3], and An Tang[1,3]
		[1]Centre de recherche du centre hospitalier de l'Université de Montréal (CRCHUM), Montreal, QC, Canada, [2]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada, [3]Department of Radiology, Radio-Oncology and Nuclear Medicine, Université de Montréal, Montreal, QC, Canada, [4]Department of Gastroentology and Hepatology, Université de Montréal, Montreal, QC, Canada, [5]Department of Medicine, Division of Gastroenterology, McGill University Health Centre (MUHC), Montreal, QC, Canada, [6]Department of Pathology, Centre hospitalier de l'Université de Montréal (CHUM), Montréal, QC, Canada, [7]Department of Pathology and Cellular Biology, Université de Montréal, Montreal, QC, Canada
		Necroinflammation is a hallmark feature in several causes of chronic liver disease. Because it has multiple tissue contrast mechanisms, MRI is ideally suited for characterization of histopathological changes (i.e. inflammation, fat, iron, and fibrosis) that may occur concomitantly in chronic liver disease. We evaluated intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI) MRI for assessment of necroinflammation. Perfusion fractions were significantly correlated with necroinflammation grades (ρ = 0.49, P < 0.0001) and could discriminate grades ≤ A1 vs. ≥ A2 and ≤ A2 vs. A3 with good accuracy (AUC: 0.81 and 0.80, respectively). Our results suggest that perfusion fraction may be used for assessing liver necroinflammation.

522	15:33	Free-Breathing Hepatic Fat Quantification in Children and Infants Using a 3D Stack-Of-Radial Technique: Assessment of Accuracy and Repeatability
		Tess Armstrong[1,2], Karrie V. Ly[3], Yu Wang[1,4], Thomas Martin[1,2], Shahnaz Ghahremani[1], Kyunghyun Sung[1,2], Kara L. Calkins[3], and Holden H. Wu[1,2]
		[1]Radiological Sciences, University of California Los Angeles, Los Angeles, CA, United States, [2]Physics and Biology in Medicine, University of California Los Angeles, Los Angeles, CA, United States, [3]Pediatrics, Division of Neonatology, David Geffen School of Medicine, University of California Los Angeles, Mattel Children's Hospital, Los Angeles, CA, United States, [4]Biomedical Engineering, Tsinghua University, Beijing, China

		Non-alcoholic fatty liver disease (NAFLD) has increasing prevalence in children and early risk factors for NAFLD may be present during infancy. MRI can non-invasively quantify hepatic fat, but current techniques require breath-holding (BH), which is not possible in many children and infants. In this study, a novel free-breathing (FB) 3D stack-of-radial fat quantification technique was developed and evaluated in children and infants. The proposed FB technique achieved accurate and repeatable hepatic fat quantification and improved image quality compared to conventional BH techniques. This FB technique can potentially improve the diagnosis and monitoring of NAFLD in children and infants.

Oral

Normal Pediatric Brain Development

W03/04	Tuesday 13:45 - 15:45	*Moderators:* Serena Counsell & Claire Kelly

523	13:45	Emerging Metabolic Trajectories in the Developing Fetal Brain
		Subechhya Pradhan[1,2,3], Kushal Kapse[1], Reka Kovacs[1], Linda White[1], and Catherine Limperopoulos[1,2,3]
		[1]Developing Brain Research Laboratory, Children's National Health System, Washington, DC, United States, [2]Diagnostic Imaging and Radiology, Children's National Health System, Washington, DC, United States, [3]Pediatrics, The George Washington University School of Medicine, Washington, DC, United States
		Knowledge of metabolite changes in the fetal brain will provide insight into the biochemical changes in the developing brain. Findings from measurement of metabolite concentration as a function of increasing GA are reported. Significant increases in NAA, Cr, Cho and scyllo-Inositol with increasing GA in the fetal brain was observed in this study. Changes in myo-Inositol with GA did not reach significance.

524	13:57	Developmental Score of the Neonatal Brains: Characterizing Diffusion MRI Changes in the Term- and Preterm-born Infants
		Dan Wu[1], Linda Chang[2], Thomas Ernst[2], Jon Skranes[3], and Kenichi Oishi[1]
		[1]Radiology, Johns Hopkins University School of Medicine, BALTIMORE, MD, United States, [2]Diagnostic Radiology and Nuclear Medicine, University of Maryland School of Medicine, BALTIMORE, MD, United States, [3]Laboratory Medicine, Children’s and Women’s Health, Norwegian University of Science and Technology, Trondheim, Norway

		Postmenstrual age (PMA) is used as a time-scale to evaluate brain development, but it contains inaccuracy with regards to the estimated time of conception because the duration from the last menstrual period to conception varies. To address this variation, we designed a developmental score (DevS) that aligned individuals with similar development patterns together, and provides a linear trajectory of DTI-measurement as a function of an underlying brain developmental index. Compared to PMA, DevS showed an improved the regression with DTI-measurements, and it better separated the developmental differences between term- and preterm-born infants.

525	14:09	Quantitative assessment of pediatric brain myelination in a clinical setting using macromolecular proton fraction
		Vasily L. Yarnykh[1,2], Nina V. Knipenberg [3], and Olga L. Tereshchenkova[3]
		[1]Radiology, University of Washington, Seattle, WA, United States, [2]Research Institute of Biology and Biophysics, Tomsk State University, Tomsk, Russian Federation, [3]Radiology, First Children's Hospital, Tomsk, Russian Federation
		The fast macromolecular proton fraction (MPF) mapping method has been implemented as a part of a clinical pediatric MRI protocol for a 1.5T MRI scanner. 3D MPF maps were obtained from 31 pediatric patients aged from 2 weeks to 7 years without abnormal brain findings. MPF maps allowed robust quantitation of age-related changes in the myelin content. Temporal trajectories of regional brain myelination were analyzed using the general logistic model that enabled the formal description of distinctions in the onset and speed of myelination across a range of white and gray matter structures.

526	14:21	MR Fingerprinting enables quantitative measures of brain tissue relaxation times and myelin water fraction in early brain development
		Yong Chen[1], Meng-Hsiang Chen[2], Weili Lin[1], and UNC/UMN Baby Connectome Project Consortium[1]
		[1]Radiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Chang Gung University College of Medicine, Kaohsiung, Taiwan
		In this study, a high-resolution MR Fingerprinting technique was developed for rapid and simultaneous quantification of T1, T2 and myelin water fraction in pediatric neuroimaging. The method was applied to five subjects from 3 months to 52 months old and high quality quantitative maps were obtained from all subjects without evident motion artifacts. Our preliminary results also show a trend of decrease in T1/T2 and increase of myelin water fraction with age, which are consistent with finding in literature.

527	14:33	Patterns of subcortical gray matter and white matter myelination from 4.5 months to 1 year-old: an observational study comparing the whole brain T1w/T2w ratio myelin mapping technique and an autopsy infant myelin-staining study

		Joseph Yuan-Mou Yang[1,2,3], Jian Chen[1], Michelle Hao Wu[4], Simone Mandelstam[4,5,6,7], Richard Leventer[2,8], Bonnie Yuan-Mou Alexander[1,9], Deanne Thompson[1,9], Marc Seal[1,5], and Richard Beare[1,10]
		[1]Developmental Imaging, Murdoch Children's Research Institute, Melbourne, Australia, [2]Neuroscience Research, Murdoch Children's Research Institute, Melbourne, Australia, [3]Neurosurgery, The Royal Children's Hospital, Melbourne, Australia, [4]Medical Imaging, The Royal Children's Hospital, Melbourne, Australia, [5]Paediatrics, University of Melbourne, Melbourne, Australia, [6]Radiology, University of Melbourne, Melbourne, Australia, [7]Epilepsy, Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, [8]Neurology, The Royal Children's Hospital, Melbourne, Australia, [9]Victorian Infant Brain Study (VIBeS), Murdoch Children's Research Institute, Melbourne, Australia, [10]Medicine, Monash University, Melbourne, Australia
		The whole brain T1w/T2w ratio technique enables in vivo quantitative myelin mapping using clinically acquired MRI sequences, which is potentially useful when investigating developmental myelination trajectories. Post-mortem infant myelin-staining studies provide useful references. This study characterizes myelination trajectories of 27 subcortical brain regions in typically developing 4.5 months to 1 year-old children using the T1w/T2w ratio technique and compared the patterns with those demonstrated by an autopsy infant myelin-staining study. Similar myelination trajectory patterns were observed in the structures that commenced myelination before birth. This highlights the T1w/T2w ratio as potential myelin imaging biomarker for these structures during this period.

528	14:45	Profiling myelin maturation with quantitative susceptibility mapping (QSM) in pediatric brains
		Lijia Zhang[1] and Allen Song[1]
		[1]Brain Imaging and Analysis Center, Duke University, Durham, NC, United States
		Quantitative susceptibility mapping (QSM) has been increasingly used to access brain development, especially white matter myelination. In this study, diffusion tensor imaging (DTI) has been used to delineate the corpus callosum in the pediatric brains, followed by tract-based QSM analysis to accurately derive the baseline susceptibility across subjects. The baseline susceptibility is then used to evaluate white matter and myelin development.

529	14:57	Neonate functional brain networks and distinctive intra-network connectivity
		Qinmu Peng[1,2], Ouyang Minhui[1,2], Jiaojian Wang[1,2], Qinlin Yu[1,2], Chenying Zhao[3], Slinger Michelle[1], Hongming Li[2], Yong Fan[2], Bo Hong[4], and Hao Huang[1,2]
		[1]Department of Radiology, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [2]Department of Radiology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States, [3]Department of Bioengineering, School of Engineering and Applied Science, University of Pennsylvania, Philadelphia, PA, United States, [4]Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China

		Little is known on the network organization in the neonatal brain. Here, we used a novel parcellation method, called regularized-Ncut (RNcut), to parcellate the neonate brain into functional networks with resting-state fMRI. RNcut effectively delineates the neonatal functional networks including the primary sensorimotor and higher-order networks. Based on RNcut parcellation of functional networks, intra-network connectivity was quantified. Distinctive intra-network connectivity was revealed for the first time. We found that the primary sensorimotor network has the highest intra-network connectivity while higher-order fronto-parietal network has lower intra-network connectivity. The distinctive intra-network connectivity pattern underlies heterogeneous emergence of early brain functional systems.

530	15:09	Prenatal Maternal Cortisol Response Predicts One-month Infant White Matter Microstructure
		Douglas C Dean[1], Elizabeth M Planalp[1,2], William Wooten[3], Nagesh Adluru[1], H Hill Goldsmith[1,2], Andrew L Alexander[1,4,5], and Richard J Davidson[1,2,3,4]
		[1]Waisman Center, University of Wisconsin Madison, Madison, WI, United States, [2]Psychology, University of Wisconsin Madison, Madison, WI, United States, [3]Center for Healthy Minds, University of Wisconsin Madison, Madison, WI, United States, [4]Psychiatry, University of Wisconsin Madison, Madison, WI, United States, [5]Medical Physics, University of Wisconsin Madison, Madison, WI, United States
		Exposure to differing concentrations of cortisol likely has a significant impact on brain development in childhood and adolescence; however, little is known about the time immediately following birth. Using multi-shell diffusion imaging data, we examined the associations between prenatal maternal diurnal cortisol patterns and infant white matter microstructure. Infant measures were associated with the slope of the maternal cortisol response across white matter, suggesting variations of cortisol within the intrauterine environment may have a significant influence on processes of early brain development.

531	15:21	Influence of Infant Feeding on Longitudinal Brain and Cognitive Development
		Sean Deoni[1], Douglas Dean[2], and Viren D'Sa[3]
		[1]Pediatrics, Brown University, Providence, RI, United States, [2]6Waisman Center, University of Wisconsin, Madison, WI, United States, [3]Pediatrics, Memorial Hospital of Rhode Island, Providence, RI, United States
		Infancy and early childhood are sensitive and rapid periods of brain growth that coincide with the emergence of nearly all cognitive, behavioral, and social-emotional functions. Brain growth, including myelination, is modulated modulated by neural activity and are responsive to environmental, genetic, hormonal, and other influences, including nutrition. He we use longitudinal neuroimaging to examine the influence of early infant nutrition, specifically breastfeeding, on brain and cognitive development.

532	15:33	Early specific connections of the Visual Word Form Area during the first year of reading instruction: a longitudinal MRI study in children

Eric Moulton[1], Florence Bouhali[2], Karla Monzalvo[1], Cyril Poupon[3], Hui Zhang[4], Stanislas Dehaene[1,5], Ghislaine Dehaene-Lambertz[1,6], and Jessica Dubois[1]

[1]INSERM, Gif-sur-Yvette, France, [2]INSERM, Paris, France, [3]CEA, Gif-sur-Yvette, France, [4]University College London, London, United Kingdom, [5]College de France, Paris, France, [6]CNRS, Gif-sur-Yvette, France

Specialized in word recognition, the visual word form area (VWFA) is located in the posterior fusiform gyrus of the left hemisphere, regardless of one's writing system. To test the hypothesis that this consistent location is determined by specific connections to linguistic regions, we studied 6-7year old children throughout the process of learning to read. Using diffusion and functional MRI, we analysed the white-matter connectivity of cortical regions processing visual categories (words, houses, faces, tools). We showed that the emerging VWFA has specific and stable connections to the inferior-dorsal parietal cortex, and these connections exhibit microstructural maturation related to reading improvement.

Study Groups

White Matter Business Meeting

W07	Tuesday 14:45 - 15:45	*(no CME credit)*

Study Groups

Electro-Magnetic Tissue Properties Business Meeting

W08	Tuesday 14:45 - 15:45	*(no CME credit)*

Traditional Poster: Neuro

Exhibition Hall 1765-1802	Tuesday 16:15 - 18:15	*(no CME credit)*

Electronic Poster: Engineering

Exhibition Hall	Tuesday 16:15 - 17:15	*(no CME credit)*

Electronic Poster: Body: Breast, Chest, Abdomen, Pelvis

Exhibition Hall	Tuesday 16:15 - 17:15	*(no CME credit)*

Member-Initiated Symposium

Advances in Quantitative Diffusion MRI Techniques & Their Potential Clinical Application to Both Healthy & Disease-Affected Populations

Organizers: Maxime Descoteaux, Ivana Drobnjak, Shawna Farquharson, Andrada Ianus

N04	Tuesday 16:15 - 18:15	*Moderators:* Tim Dyrby	*(no CME credit)*

16:15	Clinical Power Pitch: The Role of Diffusion MRI in Diagnosing & Monitoring Multiple Sclerosis
	Klaus Schmierer

16:23	Clinical Power Pitch: The Challenges of Neurosurgical Intervention for Tumour Management
	TBD

16:31	Clinical Power Pitch: The Challenges of the First 1000 Days of Life & Role of DWI in the Assessment of the Developing Brain
	Patricia Grant[1]
	[1]Boston Children's Hospital, United States

16:39	Clinical Power Pitch: The Role of Diffusion MRI in Quantifying Tumour Microstucture
	TBD

16:47	Clinical Power Pitch: The Importance & Challenges of Neuroimaging in Dementia
	TBD

16:55	MR Scientist Power Pitch: The Advantages of Using AFD to Study Neurodegeneration in Clinical Populations
	Donald Tournier

17:03	MR Scientist Power Pitch: Multi-Dimensional Diffusion for Brain Imaging
	Markus Nilsson[1]

		[1]*Clinical Sciences Lund, Radiology, Lund University, Lund, Sweden*

	17:11	MR Scientist Power Pitch: The Potential of G-Ratio Mapping in MS
		Jennifer Campbell[1]
		[1]*McGill University, Canada*

	17:19	MR Scientist Power Pitch: Imaging of Cancer Cell Size & Cellularity Using Temporal Diffusion Spectroscopy
		Xiaoyu Jiang[1]
		[1]*Vanderbilt University*

	17:27	MR Scientist Power Pitch: White Matter Tract Integrity Modelling & Its Applications
		Jelle Veraart[1]
		[1]*Radiology, NYU School of Medicine, New York, NY, United States*

	17:35	Discussion

Member-Initiated Symposium

The Future of Cardiac MRI: Rapidly Addressing the Unmet Clinical Needs

Organizers: Giulia Ginami, Tim Leiner, Michael Salerno

S05	Tuesday 16:15 - 18:15	*(no CME credit)*

	16:15	Past, Present & Future of Cardiac MRI: Clinical Insights
		Jeanette Schulz-Menger

	16:40	Speeding Up: Acceleration Techniques for Cardiac MRI
		Mehmet Akcakaya[1]
		[1]ECE, University of Minnesota, Minneapolis, MN, United States

	17:00	Sharpening: Motion Correction in Cardiac MRI
		Claudia Prieto[1]
		[1]King's College London

	17:20	Quantifying 1: Tissue Characterization: Novel Approaches to Cardiac MRI Relaxometry
		Anthony G Christodoulou[1]
		[1]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States

	17:40	Quantifying 2: Tissue Characterization: Cardiac Magnetic Resonance Fingerprinting
		Nicole Seiberlich[1]
		[1]Case Western Reserve University, United States

	18:00	Panel Discussion

Weekday Course

MR Physics & Techniques for Clinicians

Organizers: Marcus Alley, Bernd Jung

S01	Tuesday 16:15 - 18:15	*Moderators:* Bernd Jung & Matthias Weigel

	16:15	Spin Echo Imaging

		Valentina Taviani[1]
		[1]GE Healthcare, United States

	17:15	Gradient Echo Imaging
		Armin Michael Nagel[1]
		[1]Institute of Radiology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany
		Magnetic resonance imaging (MRI) techniques can usually be classified into spin-echo (SE) and gradient-echo (GRE) pulse sequences. In this presentation, the basic physical principles of GRE imaging, as well as different mechanisms to generate image contrast will be explained. Differences between SE and GRE MRI will be discussed. Additionally, the influence of different pulse sequence parameters (e.g. echo time, repetition time, flip angle; as well as spoiling techniques and preparation pulses) on the image contrast will be covered. Clinical applications of GRE imaging techniques will be shown exemplarily.

	18:15	Adjournment & Meet the Teachers

Weekday Course

Hybrid MR Imaging in MSK

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S03	Tuesday 16:15 - 18:15	*Moderators:* Jenny Bencardino & James Linklater

	16:15	MR-US Fusion in MSK Interventions
		Ronald Adler
		The basic principles of MR-US fusion and potential applications to the musculoskeletal system will be discussed. Development of a simple phantom for training will be described. Examples of injections performed to date will be shown to illustrate potential applications and challenges in obtaining adequate registration.

	16:55	MR-Guided Focused Ultrasound: Musculoskeletal Applications and Research Highlights

		Matthew Bucknor[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, United States
		Overview of clinical indications, research highlights, and future directions of musculoskeletal applications of magnetic resonance-guided focused ultrasound.

	17:35	Non-Oncologic MSK PET-MR
		Feliks Kogan[1]
		[1]Stanford University, United States
		New PET-MRI systems promise to combine high-resolution morphologic MR imaging with simultaneous functional information from PET to potentially provide a complete imaging modality for studying musculoskeletal disease. This educational talk will discuss emerging applications of PET-MRI in non-oncologic musculoskeletal disease and comparative advantages of PET-MRI over hybrid PET-computed tomography (PET/CT) systems or MRI alone. Technical considerations and challenges as they specifically relate to PET-MRI of musculoskeletal disease will also be discussed.

	18:15	Adjournment & Meet the Teachers

Power Pitch

Pitch: Conductivity, Relaxation, Water-Fat & Beyond

Power Pitch Theater A - Exhibition Hall	Tuesday 16:15 - 17:15	*Moderators:* Chunlei Liu & Samuel Hurley	*(no CME credit)*

533	16:15	On the Sensitivity of Bone Marrow Magnetic Susceptibility and R2* on Trabecular Bone Microstructure
		Maximilian N. Diefenbach[1], Anh Van[2], Jakob Meineke[3], Jan S. Kirschke[4], Benedikt Schwaiger[1], Thomas Baum[4], Alexandra Gersing[1], and Dimitrios C. Karampinos[1]
		[1]Diagnostic and Interventional Radiology, Technical Univeristy of Munich, Munich, Germany, [2]Institute of Medical Engineering, Technical University of Munich, Munich, Germany, [3]Philips Research Laboratory, Hamburg, Germany, [4]Department of Diagnostic and Interventional Neuroradiology, Technical University of Munich, Munich, Germany

534	16:15	Pushing the limits of short-T2 MRI: 200 mT/m gradient strength and 2 MHz bandwidth
		Romain Froidevaux[1], Markus Weiger[1], Manuela Barbara Rösler[1], David Otto Brunner[1], Bertram Wilm[1], Benjamin Dietrich[1], Jonas Reber[1], and Klaas Paul Pruessmann[1]
		[1]Institute for Biomedical Engineering, ETH Zurich and University of Zurich, Zurich, Switzerland

535	16:15	New post-processing methods for simultaneous measurement of R2, R2', R2*, QSM, positive and negative susceptibility maps using mGESFIDE acquisition
		Dongmyung Shin[1], Se-Hong Oh[2], Doohee Lee[1], Jingu Lee[1], and Jongho Lee[1]
		[1]Department of electrical and computer engineering, Seoul National University, Seoul, Republic of Korea, [2]Department of Biomedical Engineering, Hankuk University of Foreign Studies, Gyeonggi-do, Republic of Korea

536	16:15	Repeatability and Reproducibility of a New Method for Quantifying Triglyceride Saturation Using Bipolar Multi-Echo MRI
		Manuel Schneider[1], Felix Lugauer[1], Gemini Janas[2,3], Dominik Nickel[4], Brian M Dale[5], Berthold Kiefer[4], Andreas Maier[1], and Mustafa R Bashir[2,3]
		[1]Pattern Recognition Lab, Department of Computer Science, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany, [2]Radiology, Duke University Medical Center, Durham, NC, United States, [3]Center for Advanced Magnetic Resonance Development, Duke University Medical Center, Durham, NC, United States, [4]MR Application Predevelopment, Siemens Healthcare GmbH, Erlangen, Germany, [5]MR R&D Collaborations, Siemens Healthineers, Cary, NC, United States

537	16:15	Calibrating variable flip angle (VFA)-based T1 maps: when and why a simple scaling factor is justified
		Sofia Chavez[1]
		[1]CAMH, Toronto, ON, Canada

538	16:15	“In vivo” Field-Cycling relaxometry of tumours. Evidence for the role of the intracellular water lifetime as tumour biomarker.
		Simonetta Geninatti Crich[1], Simona Baroni[2], Maria Rosaria Ruggiero[1], Stefania Pezzana[1], Gianni Ferrante[3], and Silvio Aime[1]

		[1]*University of Torino, Torino, Italy,* [2]*University of torino, Torino, Italy,* [3]*Stelar srl, Mede (PV), Italy*
539	16:15	In-vivo Vagus Nerve to Central Nervous System Tracing using Manganese Enhanced Magnetic Resonance Imaging
		Steven Oleson[1], Kun-Han Lu[2], Jiayue Cao[1], and Zhongming Liu[1]
		[1]*Biomedical Engineering, Purdue University, West Lafayette, IN, United States,* [2]*Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States*
540	16:15	Fat Quantification Using A High-Resolution Bipolar Gradient Water-Fat Sequence
		Alireza Akbari[1,2], Lanette J Friesen-Waldner[1], Timothy RH Regnault[3,4], and Charles A McKenzie[1,2]
		[1]*Medical Biophysics, Western University, London, ON, Canada,* [2]*Robarts Research Institute, Western University, London, ON, Canada,* [3]*Obstetrics and Gynaecology, Western University, London, ON, Canada,* [4]*Physiology and Pharmacology, Western University, London, ON, Canada*
541	16:15	Robust Fat-water Separation using Binary Decision Tree Algorithm
		Hao Peng[1,2], Chao Zou[2], Wenzhong Liu[1], Chuanli Cheng[2,3], Yangzi Qiao[2], Qian Wan[2,3], Changjun Tie[2], Xin Liu[2], and Hairong Zheng[2]
		[1]*Huazhong University of Science and Technology, Wuhan, China,* [2]*Shenzhen Institutes of Advanced Technology,Chinese Academy of Sciences, Shen Zhen, China,* [3]*University of Chinese Academy of Sciences, Beijing, China*
542	16:15	Human In-vivo Brain MR Current Density Imaging (MRCDI) based on Steady-state Free Precession Free Induction Decay (SSFP-FID)
		Cihan Göksu[1,2], Lars G. Hanson[1,2], Hartwig R. Siebner[2,3], Philipp Ehses[4,5], Klaus Scheffler[4,6], and Axel Thielscher[1,2]

		[1]Center for Magnetic Resonance, DTU Elektro, Technical University of Denmark, Kgs. Lyngby, Denmark, [2]Danish Research Centre for Magnetic Resonance, Centre for Functional and Diagnostic Imaging and Research, Copenhagen University Hospital, Hvidovre, Denmark, [3]Department of Neurology, Copenhagen University Hospital, Bispebjerg, Denmark, [4]High-Field Magnetic Resonance Center, Max-Planck-Institute for Biological Cybernetics, Tübingen, Germany, [5]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany, [6]Department of Biomedical Magnetic Resonance, University of Tübingen, Tübingen, Germany

543	16:15	Multi-receiver coil combination for breast phase-based Electrical Property Tomography Using B1- estimation
		Jun-Hyeong Kim[1], Jaewook Shin[1], Soo-Yeon Kim[2], and Dong-Hyun Kim[1]
		[1]electrical electronic engineering, Yonsei University, seoul, Republic of Korea, [2]Department of Radiology, Seoul National University Hospital, Seoul, Republic of Korea

544	16:15	Electrical permittivity imaging at 3T: a precision and accuracy study of three $$$ \it{B_1^+}$$$ mapping techniques
		Soraya Gavazzi[1], Cornelis AT van den Berg[1,2], Alessandro Sbrizzi[2], Mick Bennis[3], Lukas JA Stalpers[3], Jan JW Lagendijk[1], Hans Crezee[3], and Astrid LHMW van Lier[1]
		[1]Department of Radiotherapy, University Medical Center Utrecht, Utrecht, Netherlands, [2]Center for Image Sciences, University Medical Center Utrecht, Utrecht, Netherlands, [3]Department of Radiation Oncology, Academic Medical Center Amsterdam, Amsterdam, Netherlands

545	16:15	Multi-frequency MREIT Demonstrated using Semipermeable Membrane Models
		Munish Chauhan[1], Andrew Xi[2], Neeta Ashok Kumar[1], Fanrui Fu[1], and Rosalind J Sadleir[1]
		[1]SBHSE, Arizona State University, Tempe, AZ, United States, [2]ECEE, Arizona State University, Tempe, AZ, United States

546	16:15	The impact of CSF pulsation on reconstructed brain conductivity
		Ulrich Katscher[1], Christian Stehning[1], and Khin Khin Tha[2]
		[1]Philips Research Europe, Hamburg, Germany, [2]Hokkaido University Hospital, Sapporo, Japan

547	16:15	In Vivo Conductivity Imaging of Tissue Response after Radiation Therapy	
		In Ok Ko[1], Bup Kyung Choi[2], Nitish Katoch[2], Ji Ae Park[1], Jin Woong Kim[3], Hyung Joong Kim[2], Oh In Kwon[4], and Eung Je Woo[2]	
		[1]Division of RI Convergence Research, Korea Institute of Radiological and Medical Sciences, Seoul, Republic of Korea, [2]Biomedical Engineering, Kyung Hee University, Seoul, Republic of Korea, [3]Radiology, Chonnam National University Medical School, Gwangju, Republic of Korea, [4]Konkuk University, Seoul, Republic of Korea	

Power Pitch

Pitch: Advances in Contrast: MT, CEST & Perfusion

Power Pitch Theater B - Exhibition Hall	Tuesday 16:15 - 17:15	*Moderators:* Manus Donahue & Ji Eun Park	*(no CME credit)*

548	16:15	Rethinking vascular artifacts: testing the sensitivity of ASL vascular signal as a biomarker of disease
		Zachary Mulhollan[1], Henk-Jan Mutsaerts[1], Jan Petr[1,2], Ronald S Lazar[3], Randolph S Marshall[4], and Iris Asllani[1]
		[1]Rochester Institute of Technology, Rochester, NY, United States, [2]Helmholtz-Zentrum Dresden-Rossendorf Institut für Radiopharmazeutische Krebsforschung PET-Zentrum, Dresden, Germany, [3]The University of Alabama at Birmingham, Birmingham, AL, United States, [4]Columbia University Medical Center, New York, NY, United States

549	16:15	Exploiting small fluctuations in labeling efficiency in pseudo-continuous arterial spin labeling for combined flow-territory determination and CBF-mapping
		Thijs W. van Harten[1] and Matthias J.P. van Osch[1]
		[1]Department of Radiology, Leiden University Medical Center, Leiden, Netherlands

550	16:15	The Influence of the cardiac cycle on velocity-selective and acceleration-selective Arterial Spin Labeling
		Suzanne L. Franklin[1,2], Sophie Schmid[1], Clemens Bos[2], and Matthias J.P. van Osch[1]
		[1]C.J. Gorter Center for High Field MRI, Leiden University Medical Center, Leiden, Netherlands, [2]Imaging Division, University Medical Center Utrecht, Utrecht, Netherlands

551	16:15	Improving Arterial Spin Labeling using Deep Learning
		Ki Hwan Kim[1], Seung Hong Choi[2], and Sung-Hong Park[1]
		[1]Department of Bio and Brain Engineering, Korea Advanced Institute of Science & Technology (KAIST), Daejeon, Republic of Korea, [2]Department of Radiology, Seoul National University College of Medicine, Seoul, Korea, Democratic People's Republic of

552	16:15	Contrast Enhancement for Early Tumor Detection by Active-Feedback Field Locking and Refocusing
		Fang-Chu Lin[1], Chao-Hsiung Hsu[1], and Yung-Ya Lin[1]
		[1]Chemistry & Biochemistry, University of California, Los Angeles, Los Angeles, CA, United States

553	16:15	Measurement of artifact-free arterial input functions for T1-weighted dynamic contrast-enhanced MRI: Inter- and intra-patient variability
		Leonidas Georgiou[1,2], Daniel J Wilson[3], Nisha Sharma[4], and David L Buckley[1]
		[1]Department of Biomedical Imaging Science, University of Leeds, Leeds, United Kingdom, [2]Department of Medical Physics, German Oncology Centre, Limassol, Cyprus, [3]Department of Medical Physics & Engineering, Leeds Teaching Hospitals NHS Trust, Leeds, United Kingdom, [4]Department of Radiology, Leeds Teaching Hospitals NHS Trust, Leeds, United Kingdom

554	16:15	Estimation of Pharmacokinetic Parameters in Dynamic Contrast Enhanced MRI via Random Forest Regression
		Cagdas Ulas[1], Michael J. Thrippleton[2], Ian Marshall[3], Mike Davies[4], Paul A. Armitage[5], Stephen D. Makin[2], Joanna M. Wardlaw[2], and Bjoern H. Menze[1]
		[1]Computer Science, Technical University of Munich, Munich, Germany, [2]Neuroimaging Sciences, University of Edinburgh, Edinburgh, United Kingdom, [3]Centre for Clinical Brain Sciences, University of Edinburgh, Edinburgh, United Kingdom, [4]Institute for Digital Communication, University of Edinburgh, Edinburgh, United Kingdom, [5]Cardiovascular Science, University of Sheffield, Sheffield, United Kingdom

555	16:15	Influence of whole-brain DCE-MRI (k,t) sampling strategies on variance of pharmaco-kinetic parameter estimates
		Yannick Bliesener[1], Sajan G. Lingala[1], Justin P. Haldar[1], and Krishna S. Nayak[1]

		[1]*Electrical Engineering Department, University of Southern California, Los Angeles, CA, United States*
556	16:15	Characterization of Breast Lesion using T1-perfusion MRI: Semi- Quantitative Vs Quantitative Analysis
		Snekha Thakran[1], Anup Singh[1,2], Pradeep Kumar Gupta[3], Vedant Kabra[3], and Rakesh Kumar Gupta[3]
		[1]*Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi, India,* [2]*Department of Biomedical Engineering, AIIMS Delhi, New Delhi, India,* [3]*Department of Radiology and Imaging, Fortis Memorial Research Institute, Gurgaon, New Delhi, India*
557	16:15	Manganese-enhanced MRI: comparison of agents in the rat pancreas
		Lucy Elizabeth Kershaw[1], David Lilburn[1], Maurits Jansen[1], Pilar Jimenez-Royo[2], Antonella Napolitano Rosen[2], Philip Murphy[2], Alexandra Morgan[2], Rob Janiczek[2], Shareen Forbes[3,4], and Scott Semple[1,4]
		[1]*Edinburgh Imaging, The University of Edinburgh, Edinburgh, United Kingdom,* [2]*Experimental Medicine Imaging, GlaxoSmithKline, London, United Kingdom,* [3]*Endocrinology Unit, The University of Edinburgh, Edinburgh, United Kingdom,* [4]*BHF/University of Edinburgh Centre for Cardiovascular Sciences, The University of Edinburgh, Edinburgh, United Kingdom*
558	16:15	Novel contrasts at +2.7 ppm, +1.2 ppm, and -1.7 ppm investigated in vivo with high spectral resolution CEST MRI in the human brain at 9.4T
		Mark Schuppert[1], Kai Herz[1], Anagha Deshmane[1], and Moritz Zaiss[1]
		[1]*High-field Magnetic Resonance Center, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany*
559	16:15	A Novel MR Fingerprinting Approach for Fast Quantitative Chemical Exchange Saturation Transfer MRI Analysis by Subgrouping Proton Exchange Models (CEST-SPEM)
		Hye-Young Heo[1,2], Shanshan Jiang[1], Peter C.M. van Zijl[1,2], and Jinyuan Zhou[1,2]
		[1]*Russell H Morgan Department of Radiology and Radiological Science, Johns Hopkins University, Baltimore, MD, United States,* [2]*F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States*

560	16:15	Evaluating Feasibility of Creatine-weighted CEST MRI in Human Brain at 7T using Z-spectral Fitting Approach
		Anup Singh[1,2], Mohammad Haris[3], Ayan Debnath[1], Kejia Cai[4], Hari Hariharan[5], Puneet Bagga[5], and Ravinder Reddy[5]
		[1]Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi, India, [2]Biomedical Engineering, AIIMS Delhi, New Delhi, India, [3]Sidra Medical and Research Center, DOHA, Qatar, [4]Radiology, University of Illinois at Chicago, Chicago, IL, United States, [5]Radiology, University of Pennsylvania, Philadelphia, PA, United States

561	16:15	CO2 induced pHi changes in the brain of polar fish: a TauCEST application
		Felizitas Charlotte Wermter[1,2], Bastian Maus[2], Hans-Otto Pörtner[2], Wolfgang Dreher[1], and Christian Bock[2]
		[1]University of Bremen, Bremen, Germany, [2]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany

562	16:15	Characterizing the sensitivity of ihMT for various dipolar relaxation times (T1D) at high RF power using frequency-alternated and cosine-modulated RF pulses for dual frequency-offset saturation
		Guillaume Duhamel[1,2], Samira Mchinda[1,2], Valentin H. Prevost[1,2], Victor Carvalho[1,2], Gopal Varma[3], David Alsop[3], and Olivier M. Girard[1,2]
		[1]Aix-Marseille Univ, CNRS, CRMBM, Marseille, France, [2]APHM, Hôpital Universitaire Timone, CEMEREM, Marseille, France, [3]Radiology, Division of MR Research, Beth Israel Deaconess Medical Center, Harvard Medical Schooll, Boston, MA, United States

Combined Educational & Scientific Session

Cardiovascular Imaging Biomarkers

Organizers: Reza Nezafat, Tim Leiner

S02	Tuesday 16:15 - 18:15	*Moderators:* René Botnar & Zahi Fayad

	16:15	MRI of Atherosclerosis of Various Vascular Beds in the Era of Artificial Intelligence
		Chun Yuan[1]
		[1]University of Washington, United States

	16:45	Towards 3D & 4D Comprehensive CMR
		Matthias Stuber[1]
		[1]University Hospital Lausanne, Switzerland
		Imaging of the heart remains time consuming, operator dependent, and inefficient. New paradigms that combine modern image acquisition and reconstruction strategies promise significantly improved ease-of-use and time efficiency. These are critical ingredient for a more wide-spread adoption and improved clinical impact of cardiac MR in general.

563	17:15	LGE-CMR derived texture features reflect poor prognosis in hypertrophic cardiomyopathy patients with systolic dysfunction: preliminary results
		Sainan Cheng[1], Mengjie Fang[2], Di Dong[2], Jie Tian[2], and Shihua Zhao[1]
		[1]Peking Union Medical College, Beijng, China, [2]CAS Key Laboratory of Molecular Imaging, Institute of Automation, Chinese Academy of Sciences, Beijing, China
		In this study, we evaluated the prognostic value of texture features based on late gadolinium enhancement cardiac magnetic resonance (LGE-CMR) images in hypertrophic cardiomyopathy (HCM) patients with systolic dysfunction. 1.5 T CMR cine and LGE images were performed on 67 HCM patients with systolic dysfunction. Texture features were extracted from LGE images. Cox proportional hazard analysis and Kaplan-Meier analysis were used to determine the association of texture features with event free survival. The result showed that increased LGE heterogeneity (higher X0_GLRLM_energy, higher X1_H_uniformity, lower X0_H_skewness and lower X0_GLCM_cluster_tendency) was associated with adverse events in HCM patients with systolic dysfunction.

564	17:27	Cardiac MRI measured left atrial function can identify patient with pulmonary hypertension due to left heart disease.
		Christopher S Johns[1], James M Wild[1], Pankaj Garg[1], Calum Sowden[1], Ibrahim Mahmoud[1], Smitha Rajaram[2], Charlie Elliot[3], Robin A Condliffe[3], Athanasios Charalampopoulos[3], David G Kiely[3], and Andrew J Swift[1]
		[1]Academic Radiology, The University of Sheffield, Sheffield, United Kingdom, [2]Radiology, Sheffield Teaching Hospitals, Sheffield, United Kingdom, [3]Sheffield Pulmonary Vascular Disease Unit, Sheffield Teaching Hospitals, Sheffield, United Kingdom

		Patients with left heart disease commonly develop pulmonary hypertension (PH) [1], initially due to passive backward transmission of high left ventricular filling pressures through the pulmonary circulation. Assessment of left atrial reservoir and pump function using changes in left atrial area over time are useful to differentiate patients with left heart disease from other cases of suspected pulmonary hypertension (Mann-Whitney u test p-value 0.0015 and 0.0067 respectively).

565	17:39	All-In-One MRI of Atherosclerosis: Towards Higher Clinical Value
		Yibin Xie[1], Anthony Christodoulou[1], Nan Wang[1,2], Zixin Deng[1,2], Bill Zhou[1,3], Wei Yu[4], and Debiao Li[1,2]
		[1]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [2]Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA, United States, [3]Department of Medicine, University of California, Los Angeles, Los Angeles, CA, United States, [4]Department of Radiology, Anzhen Hospital, Capital Medical University, Beijing, China
		Multi-contrast MRI is a promising yet under-utilized imaging modality for evaluating the disease status of atherosclerosis. Major drawbacks of conventional protocols include long complex scan procedures and variability in image interpretation due to the qualitative nature of the images. In this work we propose a highly efficient MRI technique, qMATCH, which allows for all-in-one quantitative evaluation of carotid atherosclerosis. Preliminary results in phantom, normal subjects, and patients with known carotid atherosclerosis are reported.

566	17:51	MR Imaging Biomarkers of Cardiac Function and Rotational Mechanics in Boys with Duchenne Muscular Dystrophy
		Patrick Magrath[1], Pierangelo Renella[2], Nancy Halnon[3], Subha Raman[4,5], and Daniel B. Ennis[1,2]
		[1]Department of Bioengineering, University of California, Los Angeles, CA, United States, [2]Department of Radiology, University of California, Los Angeles, CA, United States, [3]Department of Medicine (Cardiology), University of California, Los Angeles, CA, United States, [4]Department of Internal Medicine/Division of Cardiovascular Medicine, The Ohio State University, Columbus, OH, United States, [5]Dorothy M. Davis Heart and Lung Research Institute, The Ohio State University, Columbus, OH, United States
		Duchenne Muscular Dystrophy (DMD) severely impacts heart health. Decreasing LV ejection fraction (EF) is a late and highly variable outcome in this cohort. Earlier indications of cardiac involvement would improve patient management and provide insight into the utility of emerging therapy. Boys with DMD (N=25) and healthy volunteers (N=8) underwent cardiac MRI exams including short-axis tagged images. EF, peak LV twist, and peak mid-wall circumferential strain (E_{cc}) were estimated. E_{cc} and twist were significantly reduced in patients (9.3° ±4.3° vs. 14.8°±3.6°, p< 0.004) and (-15.8±5.8% vs. -18.5±3.2%, p<0.02). Whereas, EF was not significantly different between groups. ~50% of DMD patients with normal EF had reduced twist and E_{cc}. Reduced peak LV twist and mid-wall E_{cc} measured by MR tagging may be earlier and more sensitive indicators of cardiac involvement in boys with DMD.

567	18:03	Assessment Pre- and Post-Ablation Energetics and Vortex Size Alterations of Left Atrial Hemodynamics in Patients with Paroxysmal Atrial Fibrillation: 4D flow MRI Study
		Julio Garcia[1], Mohammed S.M. Elbaz[2], Carmen Lydell[2], Andrew G. Howarth[2], Frank S. Prato[3], Maria Drangova[3], Rebecca Thornhill[4], Pablo Nery[5], Stephen Wilton[2], Allan Skanes[3], Faramarz F. Samavati[2], and James A. White[1]
		[1]Cardiac Sciences - Stephenson Cardiac Imaging Centre, University of Calgary, Calgary, AB, Canada, [2]University of Calgary, Calgary, AB, Canada, [3]Western University, London, ON, Canada, [4]Carleton University, Ottawa, ON, Canada, [5]University of Ottawa, Ottawa, ON, Canada
		This study may be of interest for clinicians and researchers who study left atrial diseases and arrhythmias. This study demonstrated a significant decrease of flow energetics and vortex size in patients with history of atrial fibrillation.

	18:15	Adjournment & Meet the Teachers

Oral

Deep Learning for Image Reconstruction

N01	Tuesday 16:15 - 18:15	*Moderators:* Shanshan Wang & Florian Knoll

568	16:15	A Multi-scale Deep ResNet for Radial MR Parameter Mapping
		Zhiyang Fu[1], Sagar Mandava[1], Mahesh Bharath Keerthivasan[1], Diego R Martin[2], Maria I Altbach[2], and Ali Bilgin[1,2,3]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Department of Medical Imaging, University of Arizona, Tucson, AZ, United States, [3]Biomedical Engineering, University of Arizona, Tucson, AZ, United States
		Quantitative mapping of MR parameters has shown great potential for tissue characterization but long acquisition times required by conventional techniques limit their widespread adoption in the clinic. Recently, model-based compressive sensing (CS) reconstructions that produce accurate parameter maps from a limited amount of data have been proposed but these techniques require long reconstruction times making them impractical for routine clinical use. In this work, we propose a multi-scale deep ResNet for MR parameter mapping. Experimental results illustrate that the proposed method achieves reconstruction quality comparable to model-based CS approaches with orders of magnitude faster reconstruction times.

569	16:27	Transfer learning for reconstruction of accelerated MRI acquisitions via neural networks

Salman Ul Hassan Dar[1,2] and Tolga Çukur[1,2,3]

[1]Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey, [2]National Magnetic Resonance Research Center (UMRAM), Bilkent University, Ankara, Turkey, [3]Neuroscience Graduate Program, Bilkent University, Ankara, Turkey

Neural network architectures have recently been proposed for reconstruction of undersampled MR acquisitions. These networks contain a large number of free parameters that typically have to be trained on orders-of-magnitude larger sets of fully-sampled MRI data. In practice, however, large datasets comprising thousands of images are rare. Here, we propose a transfer-learning approach to address the problem of data scarcity in training deep networks for accelerated MRI. Results show that networks obtained via transfer-learning using only tens of images in the testing domain achieve nearly identical performance to networks trained directly in the testing domain using thousands of MR images.

570 16:39

DeepSPIRiT: Generalized Parallel Imaging using Deep Convolutional Neural Networks

Joseph Y. Cheng[1], Morteza Mardani[2], Marcus T. Alley[1], John M. Pauly[2], and Shreyas S. Vasanawala[1]

[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering, Stanford University, Stanford, CA, United States

A parallel-imaging algorithm is proposed based on deep convolutional neural networks. This approach eliminates the need to collect calibration data and the need to estimate sensitivity maps or k-space interpolation kernels. The proposed network is applied entirely in the k-space domain to exploit known properties. Coil compression is introduced to generalize the method to different hardware configurations. Separate networks are trained for different k-space regions to account for the highly non-uniform energy. The network was trained and tested on both knee and abdomen volumetric Cartesian datasets. Results were comparable to L2-ESPIRiT and L1-ESPIRiT which required calibration data from the ground truth.

571 16:51

Inception-CS: Deep Learning For Sparse MR Reconstruction in Glioma Patients

Peter D Chang[1], Michael Z Liu[2], Daniel S Chow[3], Melissa Khy[3], Christopher G Filippi[4], Janine Lupo[1], and Christopher Hess[1]

[1]University of California San Francisco, San Francisco, CA, United States, [2]Columbia University Medical Center, New York, NY, United States, [3]University of California Irvine, Irvine, CA, United States, [4]Hofstra Northwell School of Medicine, Manhasset, NY, United States

		Sparse MR image reconstruction through deep learning represents a promising novel solution with early results suggesting improved performance compared to standard techniques. However, given that neural networks reconstruct using a learned manifold of rich image priors, it is unclear how the algorithm will perform when exposed to pathology not present during network training. In this study we: (1) present a novel Inception-CS architecture for reconstruction using extensive residual Inception-v4 modules; (2) demonstrate state-of-the-art reconstruction performance in glioma patients however only when representative pathology is available during algorithm training.

572	17:03	Deep learning MR reconstruction with Automated Transform by Manifold Approximation (AUTOMAP) in real-world acquisitions with imperfect training
		Bo Zhu[1,2], Berkin Bilgic[1], Congyu Liao[1], Bruce R. Rosen[1], and Matthew S Rosen[1,2]
		[1]A.A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [2]Department of Physics, Harvard University, Cambridge, MA, United States
		Automated Transform by Manifold Approximation (AUTOMAP) is a generalized MR image reconstruction framework based on supervised manifold learning and universal function approximation implemented with a deep neural network architecture. Here we investigate the effect of significant sampling trajectory error in spiral acquisitions, where mismatch between training and runtime scanner trajectories may result in unpredictable reconstruction artifacts. We demonstrate through Monte Carlo analysis that the error in AUTOMAP reconstruction increases smoothly as a function of trajectory error, demonstrating reasonable robustness to trajectory deviation. We find these simulation results are consistent with reconstruction performance on real scanner data acquired from human subjects.

573	17:15	Deep Generative Adversarial Neural Networks for Compressed Sensing (GANCS) Automates MRI
		Morteza Mardani[1], Enhao Gong[2], Joseph Cheng[3], Shreyas Vasanawala[4], Greg Zaharchuk[4], Lei Xing[1,5], and John Pauly[6]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Electrical Engineering, Stanford University, stanford, CA, United States, [3]Stanford University, stanford, CA, United States, [4]Radiology, Stanford University, Stanford, CA, United States, [5]Radiation Oncology, Stanford University, Stanford, CA, United States, [6]Stanford University, Stanford, CA, United States
		MRI suffers from aliasing artifacts when undersampled for real-time imaging. Conventional compressed sensing (CS) is not however cognizant of image diagnostic quality, and substantially trade-off accuracy for speed in real-time imaging. To cope with these challenges we put forth a novel CS framework that permeates benefits from generative adversarial networks (GAN) to modeling a manifold of MR images from historical patients. Evaluations on a large abdominal MRI dataset of pediatric patients by expert radiologists corroborate that GANCS retrieves improved images with finer details relative to CS-MRI and deep learning schemes with pixel-wise costs, at 100 times faster speed than CS-MRI.

574	17:27	ReconNet: A Deep Learning Framework for Transforming Image Reconstruction into Pixel Classification
		Kamlesh Pawar[1,2], Zhaolin Chen[1,3], N Jon Shah[1,4], and Gary F Egan[1,2]
		[1]Monash Biomedical Imaging, Monash University, Melbourne, Australia, [2]School of Psychological Sciences, Monash University, Melbourne, Australia, [3]Department of Electrical and Computer System Engineering, Monash University, Melbourne, Australia, [4]Institute of Medicine, Research Centre Juelich, Juelich, Germany
		A deep learning framework is presented that transforms the image reconstruction problem from under-sampled k-space data into pixel classification. The underlying target image is represented by a quantized image, which makes it possible to design a network that classifies each pixel to a quantized level. We have compared two deep learning encoder-decoder networks with the same complexity: one is a classification network and the other is a regression network. Even though the complexity of both the networks is the same, the images reconstructed using the classifier network have resulted in a six times improvement in the mean squared error compared to the regression network.

575	17:39	Deep convolutional framelet neural network for reference-free EPI ghost correction
		Juyoung Lee[1] and Jong Chul Ye[1]
		[1]KAIST, Daejeon, Republic of Korea
		Annihilating filter-based low rank Hankel matrix approach (ALOHA) was recently used as a reference-free ghost artifact correction method. Inspired by another discovery that convolutional neural network can be represented by Hankel matrix decomposition, here we propose a deep CNN for reference-free EPI ghost correction. Using real EPI experiments, we demonstrate that the proposed method effectively removes the ghost artifacts with much faster reconstruction time compared to the existing reference-free approaches.

576	17:51	Scan-specific Robust Artificial-neural-networks for k-space Interpolation (RAKI): Database-free Deep Learning Reconstruction for Fast Imaging
		Mehmet Akçakaya[1,2], Steen Moeller[2], Sebastian Weingärtner[1,2,3], and Kâmil Uğurbil[2]
		[1]Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States, [2]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [3]Computer Assisted Clinical Medicine, University Medical Center Mannheim, Heidelberg University, Mannheim, Germany

		Long scan times remain a limiting factor in MRI. Accelerated imaging is commonly required, with parallel imaging being the most clinically used approach. Recently, machine learning has also been applied to accelerated MRI reconstruction, where the focus has been on training regularizers on large datasets. In this work, we develop a scan-specific deep learning k-space method for reconstruction of undersampled data. The proposed method, Robust Artificial-neural-networks for k-space Interpolation (RAKI) learns a non-linear convolutional neural network from limited autocalibration signal. Phantom, cardiac and brain data show that RAKI improves upon the reconstruction quality of linear k-space interpolation-based parallel imaging methods.

577	18:03	Application of a Scan-Specific Deep Learning Reconstruction to Multiband/SMS Imaging
		Steen Moeller[1], Sebastian Weingärtner[1,2,3], Kamil Ugurbil[1], and Mehmet Akcakaya[1,3]
		[1]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [2]Computer Assisted Clinical Medicine, University Medical Center Mannheim, Heidelberg University, Mannheim, Germany, [3]Department of Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States
		The use of convolutional neural networks (RAKI (Robust Artifical-neural-networks for k-space Interpolation)) trained for a scan specific acquisition is applied to Multiband/Simultaneous MultiSlice aliased k-space. With CNN's of similar size as the RO-SENSE-GRAPPA kernels, reduced signal aliasing is obtained.

Oral

Neuro at Ultra-High Field

N02	Tuesday 16:15 - 18:15	*Moderators:* Priti Balchandani & Pratik Mukherjee

578	16:15	High-resolution T2*-weighted imaging of subcortical brain enhanced by motion and field compensation
		Alexander Aranovitch[1], Laetitia Vionnet[1], Simon Gross[1], Benjamin Dietrich[1], Lars Kasper[1], Bertram Wilm[1], Thomas Schmid[1], David Brunner[1], and Klaas Pruessmann[1]
		[1]Institute for Biomedical Engineering, ETH Zurich & University of Zurich, Zurich, Switzerland
		We apply field control and prospective motion correction simultaneously to obtain a high-quality and high-resolution (0.3mm x 0.3mm x 1mm) T2* weighted depiction of subcortical brain structure which is a notoriously difficult region for T2* weighted scans at high field due to physiological field fluctuations. The combined approach of field control and motion correction achieved superior imaging results in the studied scenario.

579	16:27	7T MRI allows detection of disturbed cortical layers in medial temporal lobe in patients with Alzheimer's disease

		Boyd Kenkhuis[1,2], Laura Jonkman[3], Marjolein Bulk[1,2,4], Mathijs Buijs[1], Jeroen J. Geurts[3], Wilma D.J. van de Berg[3], and Louise van der Weerd[1,2]
		[1]Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Human Genetics, Leiden University Medical Center, Leiden, Netherlands, [3]Anatomy and Neurosciences, Amsterdam Neuroscience, VU University Medical Center, Amsterdam, Netherlands, [4]Percuros BV, Leiden, Netherlands
		Using 7T T2*-w imaging, we scanned post-mortem hemispheres of aged controls and patients with Alzheimer's disease (AD) to assess the potential of MRI for anatomical cortical parcellation of the medial temporal lobe based on myelo- and cytoarchitectural contrast. Segmentation was possible in both controls and AD scans and distortions in cortical lamination of AD patients could be observed in specific regions of the medial temporal lobe. Observed contrast correlated highly with myelination patterns on histology. 7T MRI may therefore detect pathogenic cortical laminar distortions and provide new information on involved neuroanatomical structures and layers in AD.

580	16:39	GABA concentration in sensorimotor area correlates with observed inhibitory response measured by magnetoencephalography.
		Lucrezia Liuzzi[1], Bernard Lanz[1], Chen Chen[1], Gillian Roberts[1], Ryan Hill[1], Markus Bauer[2], Peter Morris[1], and Matthew Brookes[1]
		[1]Sir Peter Mansfield Imaging Centre, University of Nottingham, Nottingham, United Kingdom, [2]School of Psychology, University of Nottingham, Nottingham, United Kingdom
		Electrophysiological imaging suggests that task induced change in beta oscillations (13-30Hz) modulates with attention, and reflects synaptic inhibitory responses. GABA is known to mediate synaptic inhibition and hence may relate to these electrophysiological dynamics. Here, we determined GABA concentration in primary sensorimotor cortex, using MRS at 7T, and measured the electrophysiological response to a sensory attention task, using MEG, in the same region. We correlated the post-stimulus synchronisation in beta in the left sensory-motor cortex with GABA concentration detected using a STEAM sequence. Results show significant correlation (R = 0.48; p 0.010) across 28 participants.

581	16:51	Ultra-high resolution MR spectroscopic imaging at 7 Tesla in Multiple Sclerosis: Initial results and comparison with clinical MR imaging
		Wolfgang Bogner[1,2], Eva Heckova[1], Bernhard Strasser[3], Gilbert Hangel[1], Assunta Dal-Bianco[4], Elisabeth Springer[1], Michal Povazan[5,6], Petra Hnilicova[7], Paulus Rommer[8], Fritz Leutmetzer[8], Siegfried Trattnig[1,2], and Stephan Gruber[1]

		[1]High-field MR Center, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Christian Doppler Laboratory for Clinical Molecular MR Imaging, Vienna, Austria, [3]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [4]Center for Brain Research, Medical University of Vienna, Vienna, Austria, [5]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [6]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [7]Comenius University in Bratislava, Martin, Slovakia, [8]Department of Neurology, Medical University of Vienna, Vienna, Austria
		Conventional T1/T2-weighted MRI has become indispensable for Multiple Sclerosis(MS) diagnosis and treatment monitoring, although it reflects only general macroscopic tissue damage. MRSI allows the additional mapping of pathological processes in MS on a biochemical level. In 39 relapsing-remitting MS patients and an age/sex-matched control group(n=10), we show that clinically feasible ultra-high resolution (100x100 matrix) FID-MRSI in ~6min reveals even well-delineated (sub-)cortical MS lesions down to ~3mm in regions inconspicuous on conventional MRI. Regions of mIns were often larger than on FLAIR and NAA maps, suggesting that mIns increase may be an earlier imaging biomarker for neuroinflammation/lesion development than conventional MRI.

582	17:03	Contrast-enhanced MR microscopy of amyloid plaques in five mouse models of Alzheimer’s disease: comparison with amyloid plaques detection in human brains.
		Clémence Dudeffant [1], Matthias Vandesquille[1], Kelly Herbert[1], Sandro Alves[2], Emmanuel Comoy[3], Fanny Petit[1], and Marc Dhenain[1]
		[1]Molecular Imaging Research Center (MIRCen), Commissariat à l'énergie atomique et aux énergies alternatives (CEA), Fontenay aux Roses, France, [2]INSERM U986, Université Paris-Sud, Fontenay-aux-Roses, France, [3]Institut des Maladies Emergentes et des Therapies Innovantes (IMETI), Commissariat à l'énergie atomique et aux énergies alternatives (CEA), Fontenay aux Roses, France
		Gadolinium(Gd)-stained MRI is based on Gd-contrast agent administration into the brain. This method significantly improves the detection of amyloid plaques, one of the lesions of Alzheimer's disease and a potential biomarker for its diagnosis. Here, we aimed to better understand the origin of contrast induced by amyloid plaques by determining critical parameters required for their detection using five mouse models of amyloidosis presenting with different plaque typologies. Then, we showed for the first time that Gd-stained MRI can detect amyloid plaques in *postmortem* human brain tissues and compared the detection achieved in mice with those obtained in human samples.

583	17:15	$^{31}$P MRSI of asymptomatic C9orf72 carriers and non-carriers at 7 Tesla
		Graziella Donatelli[1,2], Henk-Jan Westeneng[3], Kevin van Veenhuijzen[3], Harold H.G. Tan[3], Peter R. Luijten[2], Dennis W.J. Klomp[2], Leonard H. van den Berg[3], and Jannie P Wijnen[2]

		[1]Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy, [2]Radiology/Centre for Image Sciences, University Medical Centre Utrecht, Utrecht, Netherlands, [3]Neurology, Brain Center Rudolf Magnus, University Medical Centre Utrecht, Utrecht, Netherlands
		Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease with a largely unknown pathogenesis. The most common gene mutation in both familial and sporadic ALS is the C9orf72 repeat expansion. Investigating asymptomatic carriers of this mutation might give more insight into possible preclinical brain alterations. Using whole brain ^{31}P MRSI at 7T, glycerophosphoethanolamine-to-phosphocreatine ratio (GPE/PCr) and uridine diphosphoglucose-to-phosphocreatine ratio (UDPG/PCr) were found to be higher in a number of brain regions in asymptomatic carriers compared with asymptomatic non-carriers. The increased GPE/PCr and UDPG/PCR might respectively indicate an increased catabolism of the cell membranes and an imbalance of energy metabolism.

584	17:27	Interpreting fast and slow 23Na relaxation rates in human brain: comparisons with tissue microstructure at 7 Tesla.
		Scott Kolbe[1], Yasmin Blunck[1], Rebecca Glarin[1], Syeda Warda Taqdees[1], Bradford A Moffat[1], Roger Ordidge[1], Leigh Johnston[1], and Jon Cleary[1]
		[1]University of Melbourne, Melbourne, Australia
		^{23}Na, a quadrupolar nucleus, exhibits bi-exponential relaxation in brain tissue. This study aimed to compare fast and slow sodium T2* relaxation times obtained using a 3D multi-echo radial sequence, to measures of tissue microstructure derived from advanced diffusion MRI and proton T1 mapping at 7T. We observed significant correlations between sodium T2* relaxation times and all measures of fibre and cellular density and T1. The results suggest that relative contribution of quadrupolar and dipolar relaxation pathways are related to the underlying tissue microstructure.

585	17:39	Whole Brain FLAIR Imaging at 7T Employing Universal Pulses
		Eberhard Pracht[1], Vincent Gras[2], Nicolas Boulant[2], and Tony Stöcker[1,3]
		[1]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany, [2]NeuroSpin, CEA, Saclay, France, [3]Department of Physics and Astronomy, University of Bonn, Bonn, Germany
		In this work, we present a fluid suppressed Turbo-Spin-Echo sequence for ultra-high-field application. To obtain images comparable in contrast and homogeneity with 3T results, we replaced all RF pulses with universal parallel transmit k_T-point pulses. During the imaging session, no pulse calculations or complex B_1 shimming procedures are necessary, making this approach a promising tool for clinical application.

586	17:51	Parallel transmission kT-points and CAIPIRIHNA accelerated MP2RAGE for ultra-high field anatomical imaging
		Valentin G. Kemper[1,2], Federico De Martino[1,2,3], Elia Formisano[1,2], Tobias Kober[4,5,6], and Benedikt A. Poser[1,2]
		[1]Cognitive Neuroscience, Maastricht University, Maastricht, Netherlands, [2]MBIC - Maastricht Brain Imaging Center, Maastricht University, Maastricht, Netherlands, [3]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [4]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [5]Department of Radiology, University Hospital of Lausanne, Lausanne, Switzerland, [6]LTS5, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
		The MP2RAGE imaging sequence is widely used for T1 weighted anatomical imaging, especially at 7T, where B1 inhomogeneity may degrade the image quality. This study demonstrates an improved MP2RAGE sequence featuring kT-points parallel transmission excitation and CAIPIRINHA 2D acceleration for improved T1 weighted anatomical images of the living human brain at 7 T and 9.4 T. High resolution (0.6 mm and 0.45 mm isotropic) data with high contrast-to-noise ratio allow for improved cortical segmentation, e.g. for cortical laminar investigations. We further demonstrate a 6-fold accelerated whole brain CAIPIRINHA acquisition at 0.6 mm resolution in only 4:10 min.

587	18:03	Compartmental brain sodium concentrations in human brain tissues in white matter and grey matter: a multi-echo ultra-high field 23Na-MRI study
		Ben Ridley[1,2], Armin M. Nagel[3,4], Mark Bydder[1,2], Adil Maarouf[1,2], Jan-Patrick Stellmann[1,2], Soraya Gherib[1,2], Jeremy Verneuil[1,2], Patrick Viout[1,2], Maxime Guye[1,2], Jean-Philippe Ranjeva[1,2], and Wafaa Zaaraoui[1,2]
		[1]CRMBM, Aix-Marseille University, Marseille, France, [2]CEMEREM, APHM Hôpitaux de la Timone, Marseille, France, [3]Institute of Radiology, University Hospital Erlangen, Erlangen, Germany, [4]German Cancer Research Centre, Division of Medical Physics in Radiology, Heidelberg, Germany
		Using multi-echo ^{23}Na-MRI at 7T acquired in 13 healthy subjects and modelling the relationship between signal and reference concentration and applying it to *in vivo* ^{23}Na-MRI signal, we quantify both T2* decay times and concentrations associated with short and long components for the first time. Relaxation times and concentrations differed between grey and white matter and subregions of differing tissues, suggesting sensitivity of ^{23}Na toward features of tissue composition. As such, these results raise the prospect of multi-echo ^{23}Na-MRI as an adjunct source of information on biochemical mechanisms in both physiological and pathophysiological states.

Oral

fMRI: Neurodevelopment & Clinical Applications

N03	Tuesday 16:15 - 18:15	*Moderators:* Moriah Thomason & Tomoki Arichi

588	16:15	Short-range functional connections at birth predict neurodevelopmental outcome at 2 years of age

		Minhui Ouyang[1], Qinmu Peng[1,2], Michelle Slinger[1], and Hao Huang[1,2]
		[1]Radiology, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [2]Radiology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States
		Short-range functional connectivity (FC) is the major contributor to overall significant FC increases around birth. With critical role of short-range FC in neonate brain maturation, we hypothesized that short-range FC at birth predicts the neurodevelopmental outcome at 2 years of age. We measured short-range FC with neonatal resting-state fMRI and used support vector regression (SVR) to predict cognitive scores at 2 years of age. A highly predictive model was achieved with inhomogeneous feature contribution pattern across cortical areas. Significant correlation was found between short-range FC strength in widespread brain regions at birth and cognitive scores at 2 years of age.

589	16:27	“Multi-Layer Connectome” for Robust Multi-Subject Brain Network Analysis and its Application to Baby Connectome Development Study
		Han Zhang[1], Weili Lin[1], and Dinggang Shen[1,2]
		[1]University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Brain and Cognitive Engineering, Korea University, Seoul, Republic of Korea
		We propose a multi-layer connectome analysis method that extends the existing majority of single-layer brain network studies. In this method, multiple subjects’ connectome constitutes a multi-layer hyper-network with hyper-edges across layers. Result from applying this method to delineating neonatal brain development indicates that our method can capture robust group-level modules while keeping meaningful individual variability. The “increasing functional segregation/integration” model is further refined by us with a “consistent large-scale functional segregation/integration” with “rewiring-induced module refinement”, as well as an invert-U-shaped subject variability in modular structure in the first two years of life.

590	16:39	Resting-state functional connectivity alterations in adolescents with fetal alcohol spectrum disorders
		Jia Fan[1,2], Joseph L. Jacobson[2,3,4], Christopher D. Molteno[4], Sandra W. Jacobson[2,3,4], and Ernesta M. Meintjes[1,2]
		[1]MRC/UCT Medical Imaging Research Unit, Division of Biomedical Engineering, University of Cape Town, Cape Town, South Africa, [2]Department of Human Biology, University of Cape Town, Cape Town, South Africa, [3]Department of Psychiatry and Behavioral Neurosciences, Wayne State University School of Medicine, Detroit, MI, United States, [4]Department of Psychiatry and Mental Health, University of Cape Town, Cape Town, South Africa

		In a study of children with fetal alcohol spectrum disorders (FASD) and community controls assessed at age 11 years, alcohol-exposed children showed localised dose-dependent reductions in resting state functional connectivity (FC) in 5 gray matter regions within 5 resting state networks. Here we present data from a follow-up study of these children at age 15 years to examine whether these FC deficits persist or resolve.

591	16:51	Early Development of Modular Organization in Brain Functional Networks at Multiple Scales
		Xuyun Wen[1], Han Zhang[2], Jun Zhang[3], Gang Li[2], Weili Lin[2], and Dinggang Shen[2]
		[1]Sun Yat-Sen University, Guangzhou, China, [2]University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [3]South China University of Technology, Guangzhou, China
		Increasing studies focus on delineating the development of brain networks of infants by detecting the corresponding modular organization. However, in these papers, the adopted module detection method, i.e., maximizing modularity, has a resolution limit, such that modular structures could only be investigated at a particular scale. To address this issue, by leveraging a novel multi-resolution modularity detection method, we explored the development of modular organization of human brain functional networks in the first 2 postnatal years at multiple scales. Our results showed that, different scales can uncover different developmental patterns of brain networks from different perspectives.

592	17:03	Integrated structural and functional connectivity analysis to characterize abnormalities in ADHD
		Lipeng Ning[1,2], Sarina Karmacharya[1], Hesham Hamoda[3], Gloria McAnulty[3], Deborah Waber[3], and Yogesh Rathi[1,2]
		[1]Brigham and Women's Hospital, Boston, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Boston Children's Hospital, Boston, MA, United States
		We introduce a novel approach for integrating novel diffusion MRI (dMRI) derived microstructural properties and resting state functional MRI (rsfMRI) derived functional measures to obtain a comprehensive understanding of brain abnormalities in neuropsychiatric disorders. We applied this methodology to study abnormalities in children with attention-deficit hyperactivity disorder (ADHD), providing a probabilistic view of the abnormal connections, thus accounting for the heterogeneity in the presentation of ADHD. We further show that the integrated analysis is significantly more sensitive than separate dMRI and rsfMRI analyses. Apart from known connections reported to be abnormal in the literature, we find several new abnormal connections in ADHD subjects with high probability.

593	17:15	Finding the baby in the bath water – evidence for task-specific changes in resting state functional connectivity evoked by training
		Cibu Thomas[1], Adam Steel[1], Aaron Trefler[1], Gang Chen[1], and Chris Baker[1]

		[1]National Institute of Mental Health, Bethesda, MD, United States
		Resting-state fMRI (rsFMRI) has been used for studying training-related changes in brain function during the offline period of skill learning. However, the lack of experimental control during “rest” makes it difficult to separate the impact of training from technical artifacts and experimental confounds like time-of-day (TOD) related changes in MRI signal. Here, by using multiple tasks (rest, visuo-spatial training, motor sequence training), we mapped out the spatial topography of changes in rsFC evoked by TOD and by training. Our findings suggest that task-specific changes in rsFC due to visuo-spatial and motor-sequence learning are dissociable from changes due to TOD.

594	17:27	A connectome-wide investigation of the longitudinal effect of real-time fMRI amygdala neurofeedback emotional training on resting-state connectivity in combat veterans with PTSD
		Masaya Misaki[1], Raquel Phillips[1], Vadim Zotev[1], Chung-Ki Wong[1], Brent E Wurfel[1,2], Frank Krueger[3], Matthew Feldner[4], and Jerzy Bodurka[1,5]
		[1]Laureate Institute for Brain Research, Tulsa, OK, United States, [2]Laureate Psychiatric Clinic and Hospital, Tulsa, OK, United States, [3]George Mason University, Fairfax, VA, United States, [4]University of Arkansas, Fayetteville, AR, United States, [5]University of Oklahoma, Norman, OK, United States
		We introduced a longitudinal Multivariate Distance Matrix Regression (LMDMR) analysis for a connectome-wide study of the longitudinal effect on resting-state fMRI functional connectivity (rsfMRI-fc) without a priori seed definition. We applied this analysis to investigate the effect of real-time fMRI amygdala neurofeedback training in combat veterans with PTSD. The analysis revealed a significant interaction between a decrease in hyperarousal symptom and an increase in rsfMRI-fc between the precuneus and the left superior frontal region. This result suggests that enhanced regulation of emotional memory retrieval helped reduce PTSD symptoms.

595	17:39	Intra-operative acquisition of sensorimotor fMRI during glioma resection: evaluation of feasibility and clinical applicability.
		Adam Kenji Yamamoto[1], Joerg Magerkurth[2], Laura Mancini[1,3], Mark J White[1,4], Samira M Kazan[5], Anna Miserocchi[6], Andrew W McEvoy[6], Ian Appleby[7], John Thornton[1,3], Cathy J Price[5], Nikolaus Weiskopf[5,8], and Tarek A Yousry[1,3]
		[1]Neuroradiological Academic Unit, UCL Institute of Neurology, London, United Kingdom, [2]Psychology and Language Sciences, Birkbeck-UCL Centre for Neuroimaging, London, United Kingdom, [3]Lysholm Department of Neuroradiology, National Hospital for Neurology and Neurosurgery, London, United Kingdom, [4]Medical Physics and Biomedical Engineering, University College London Hospital, London, United Kingdom, [5]Wellcome Trust Centre for Neuroimaging, UCL Institute of Neurology, London, United Kingdom, [6]Department of Neurosurgery, National Hospital for Neurology and Neurosurgery, London, United Kingdom, [7]Department of Neuroanaesthesia, National Hospital for Neurology and Neurosurgery, London, United Kingdom, [8]Department of Neurophysics, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

		Intra-operative fMRI has the potential to improve neurosurgical outcomes and we have previously shown that the task-related BOLD signal can be acquired under general anaesthesia. Our next goal was to acquire fMRI intra-operatively with the skull open. In 12 patients, we performed 24 acquisitions of a passive sensorimotor paradigm during the resection of their brain tumour. The fMRI data were evaluated by neuroradiologists, assessing its applicability for the provision of a clinical report on the location of sensorimotor activation to the neurosurgeon. 17/24 acquisitions were scored as useful. We conclude that intra-operative fMRI is feasible and produces clinically useful data.

596	17:51	Real-Time Resting-state fMRI for Presurgical Mapping in Patients with Brain Tumors
		Kishore Vakamudi[1], Mohammad Omar Chohan[2], Howard Yonas[2], Mona D Chaney[3], and Stefan Posse[1]
		[1]Neurology, Physics and Astronomy, University of New Mexico, Albuquerque, NM, United States, [2]Neurosurgery, University of New Mexico, Albuquerque, NM, United States, [3]Neurology, University of New Mexico, Albuquerque, NM, United States
		We investigated the feasibility of presurgical mapping in patients with brain tumors using real-time rsfMRI analysis methodology in combination with high-speed multi-band EPI. The objective was to map sensorimotor and language resting state networks in the vicinity of brain tumors and to monitor data quality online. We validated this approach in comparison with tfMRI and intra-operative electrocorticography (ECog). The data in patients show a high degree of consistency between resting state connectivity, task-based activation and ECS localization of motor cortex and Broca's area. Localization of Wernicke's area was more variable, both in rsfMRI and tfMRI.

597	18:03	Association between Tremor Severity Improvement and Functional Connectivity Changes after Magnetic Resonance Guided Focused Ultrasonic Thalamotomy Treatment in Essential Tremor Patients
		Li Jiang[1], Jiachen Zhuo[1], Dheeraj Gandhi[1], Charlene Aldrich[2], Howard Eisenberg[2], Paul Fishman[3], Elias Melhem[1], and Rao Gullapalli[1]
		[1]Department of Diagnostic Radiology & Nuclear Medicine, University of Maryland Baltimore, Baltimore, MD, United States, [2]Department of Neurosurgery, University of Maryland Baltimore, Baltimore, MD, United States, [3]Department of Neurology, University of Maryland Baltimore, Baltimore, MD, United States

		Essential tremor (ET) is the most common movement disorder and often characterized by a slowly progressive involuntary posture and/or kinetic tremor, usually affecting both upper extremities. Ablation of the ventral intermediate nucleus (VIM) of the thalamus with MRgFUS is an effective and FDA-approved treatment for medication refractory ET patients. However, very little is known regarding brain functional changes before and after the treatment and even less about its association with the tremor severity changes after treatment. This study aimed at investigating the longitudinal tremor improvement and its association with the changes of Functional connectivity of left VIM at 1-year post-treatment.

Oral

MR-Guided Intervention (Not Thermo nor HIFU)

S04	Tuesday 16:15 - 18:15	*Moderators:* Rob Tijssen & Graham Wright

598	16:15	Real-time acquisition, reconstruction, and mixed-reality display system for 2D and 3D cardiac MRI
		Dominique Franson[1], Andrew Dupuis[1], Vikas Gulani[1,2], Mark Griswold[1,2], and Nicole Seiberlich[1,2]
		[1]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [2]Department of Radiology, School of Medicine, Case Western Reserve University, Cleveland, OH, United States
		Cardiac images suitable for 3D visualization are acquired, reconstructed, and displayed in real-time using the Microsoft HoloLens. This system could be used for guiding cardiac (or other) interventions, or be used to view time-resolved 2D or 3D datasets to facilitate the visualization of anatomical changes through time.

599	16:27	Initial results for MRI-guided catheterization in children and young adults with congenital heart disease using the partial saturation (pSAT) sequence
		Mari Nieves Velasco Forte[1,2], Sébastien Roujol[3], Bram Ruijsink[3], Isra Valverde[4], Phuoc Duong[4], Sascha Krueger[5], Tobias Schaeffter[6], Steffen Weiss[7], Surendranath Veeram Reddy[8], Tarique Hussain[8], Kuberan Pushparajah[4], and Reza Razavi[4]
		[1]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, [2]Paediatric Cardiology, Queen Elizabeth University Hospital, Glasgow, United Kingdom, [3]Division of Imaging and Biomedical Engineering, King's College London, London, United Kingdom, [4]King's College London, London, United Kingdom, [5]Philips, Hamburg, Germany, [6]Physikalisch-Technische Bundesanstalt, Berlin, Germany, [7]Philips Research Laboratories, Hamburg, Germany, [8]UT Southwestern Medical Center, Dallas, TX, United States

		CMR is a promising alternative to x-ray fluoroscopy for the guidance of cardiac catheterization procedures. We have recently developed a partial saturation (pSAT) sequence which enables passive tracking of balloon-wedge catheters with positive contrast, using a dilution containing gadolinium. 23 patients from 2 different centres were recruited. MRI-guidance was performed using the pSAT sequence applied in the iSuite platform® or an interactive imaging mode. During real-time MRI catheterization the balloon was visualized during 64±19% of the scanning time. pSAT angle was 30-50° in all patients. Mean subjective image quality scores were 3.7 out of 5 for heart visualisation and 4.6/5 for balloon/blood contrast.

600	16:39	MRI-guided right heart catheterization using a commercial nitinol guidewire: Experience in 6 patients
		Adrienne E Campbell-Washburn[1], Toby Rogers[1], Jaffar Khan[1], Rajiv Ramasawmy[1], Daniel A Herzka[1], Elena K Grant[1], Delaney McGuirt[1], Jonathan R Mazal[1], William H Schenke[1], Laurie P Grant[1], Annette M Stine[1], and Robert J Lederman[1]
		[1]National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, MD, United States
		We have performed MRI-guided right heart catheterization in patients with a commercial nitinol guidewire for the first time. MRI-guided cardiovascular interventions have been limited by the unavailability of an guidewire that is safe and visible. Here, we use real-time spiral gradient echo imaging to reduce RF-induced heating on a commercial nitinol 150cm *Glidewire*. The *Glidewire* was found to generate <0.2°C in the ASTM-2182 phantom in all configurations. With IRB approval, the guidewire catheterization was performed on six patients. Blood biomarkers remained normal and the reported clinical benefits were increased shaft conspicuity, increased shaft stiffness, and ability to track to chambers.

601	16:51	Fully MR-Guided Implantation of a Bioresorbable Scaffold in the Left Coronary Artery of a Pig at 3T
		Simon Reiss[1], Timo Heidt[2], Thomas Lottner[1], Ali Caglar Özen[1], Axel Joachim Krafft[1], Klaus Düring[3], Constantin von zur Mühlen[2], and Michael Bock[1]
		[1]Dept. of Radiology, Medical Physics, Medical Center University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, [2]Dept. of Cardiology and Angiology I, University Heart Center, Freiburg, Germany, [3]MaRVis Interventional GmbH, Frechen, Germany
		MR-guided cardiovascular interventions do not use ionizing radiation, provide excellent soft tissue contrast, and enable functional measurements. The feasibility of MR-guided percutaneous coronary intervention has been demonstrated in animal trials using metallic stents. Recently, bio-resorbable vascular scaffolds have been introduced for stenting of coronary arteries. These scaffolds enable artifact-free MR imaging of the coronary artery segment that the result of the intervention can be readily assessed via MR imaging. We show the first fully MR-guided PCI with a bioresorbable scaffold in the LCA of a pig at 3T using dedicated active guiding catheters, an MR-safe guidewire and BVS delivery system.

602	17:03	Assessing MR-guided catheter contact with the myocardium using device motion: A feasibility study
		Philippa Krahn[1,2], Labonny Biswas[2], Venkat Ramanan[2], Sebastian Ferguson[2], Jennifer Barry[2], Mihaela Pop[1,2], and Graham A. Wright[1,2]
		[1]Medical Biophysics, University of Toronto, Toronto, ON, Canada, [2]Sunnybrook Research Institute, Toronto, ON, Canada
		Assessing contact of the catheter tip with the endocardial wall remains challenging during MR-guided electroanatomic voltage mapping (EAVM) of the heart. In this study we investigated whether the synchronicity of catheter motion with the beating heart can serve as an indicator of catheter-endocardium contact. The results from this study show that that synchronicity could potentially provide an indirect measure of endocardial contact and could serve a metric by which quality of EAVM data can be evaluated.

603	17:15	Real-time MRI endoscopy at up to 10 frames/sec
		Xiaoyang Liu[1,2], Parag Karmarkar[2], Dirk Voit[3], Jens Frahm[3], and Paul Bottomley[1,2]
		[1]Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, United States, [2]Russell H. Morgan Dept. of Radiology, Johns Hopkins University, Baltimore, MD, United States, [3]Biomedizinishe NMR Forschungs GmbH, Max-Plank-Institut fur biophysikalische Chemie, Gottingen, Germany
		Mininally-invasive intravascular MRI at 3T and above is capable of providing high resolution imaging from within blood vessels and identifying atherosclerosis using miniaturized detectors ~2mm in diameter. Endoscopic MRI is a technique that employs the miniature probe itself to localize the MRI signal to a sensitive disk, and provide images from the view-point of the probe itself. At 3T, acquisition speed has been limited to 2 frames/sec at 300μm resolution, which although fast, is not truly real-time. Here we report a truly real-time MRI endoscope with fully integrated real-time continuous MRI visualization at up to 10 frames/sec.

604	17:27	Real-time MR Brain Infusion Monitoring Enables Accurate Prediction of End Drug Distribution
		Martin Brady[1], Raghu Raghavan[1], Peng Wang[2], Miles Olsen[3], Ethan K. Brodsky[2], Terrence Oakes[2], Andrew L Alexander[2,4,5], and Walter F. Block[2,4,6,7]
		[1]Therataxis, LLC, Baltimore, MD, United States, [2]TherVoyant, Madison, WI, United States, [3]Medical Physics, Madison, Madison, WI, United States, [4]Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [5]Psychiatry, University of Wisconsin - Madison, Madison, WI, United States, [6]Biomedical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [7]Radiology, University of Wisconsin- Madison, Madison, WI, United States

		The hetergeneity of the brain makes designing a desired end drug distribution through pressurized catheters difficult. We present a method to utilize real-time MR monitoring of a co-infused Gd tracer during initial stages of the infusion to derive a real-time 3D estimate of the velocity front. We demonstrate considerable improvement in predicting the actual drug distribution using the MR real-time data in four cases using a large animal surgical model.

605	17:39	Real-time MRI-guided endovascular model of cerebral ischemia in swine
		Dominika Golubczyk[1], Izabela Malysz-Cymborska[1], Lukasz Kalkowski[1], Michal Zawadzki[2], Piotr Holak[3], Joanna Glodek[3], Kamila Milewska[1], Marek Bogacki[4], Mirosław Janowski[5,6,7], Zbigniew Adamiak[3], Wojciech Maksymowicz[1], and Piotr Walczak[1,6,7]
		[1]Department of Neurology and Neurosurgery, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland, [2]Central Clinical Hospital of Ministry of the Interior and Administration in Warsaw, Warsaw, Poland, [3]Department of Surgery and Roentgenology with the Clinic, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland, [4]Department of Gamete and Embryo Biology, Institute of Animal Reproduction and Food Research of the Polish Academy of Sciences, Olsztyn, Poland, [5]NeuroRepair Department, Mossakowski Medical Research Centre Polish Academy of Sciences, Warsaw, Poland, [6]Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [7]Institute for Cell Engineering, The Johns Hopkins University School of Medicine, Baltimore, MD, United States
		Animal models of stroke are essential for developing therapies. Rodent models of stroke are widely used but they lack clinical relevance. Endovascular models in large animals are most desired, but till now they were available in expensive and hard-to-access dogs and primates. Swine is preferred model but till now stroke modeling was through surgical craniotomy, a highly invasive procedure inflicting unrelated morbidity. Endovascular modeling was not possible due to vascular rete preventing catheter access to cerebral vessels. We circumvented this obstacle by intra-arterially injecting SPIO-labeled pro-coagulant thrombin under real-time MRI, which was instrumental to fine-tune injection to occlude cerebral arteries.

606	17:51	PET-MRI Quantification of 89Zr-Iron Oxide Nanoparticles for Targeted Magnetic Drug Therapy
		Caroline D. Jordan[1], Misung Han[1], Sravani Kondapavulur[1,2], Denis Beckford Vera[1], Kiel D. Neumann[1], Carol Stillson[1], Teri Moore[1], Roland Krug[1], Spencer Behr[1], Youngho Seo[1], Henry F. VanBrocklin[1], Peder E. Z. Larson[1], Mark W. Wilson[1], Alastair J. Martin[1], and Steven W. Hetts[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Bioengineering, University of California, Berkeley, Berkeley, CA, United States

		One recent application of magnetic nanoparticles is to deploy an endovascular magnetic device to selectively remove magnetically-linked chemotherapy during an intra-arterial treatment procedure. In order to measure the device's efficacy, ^{89}Zr-iron oxide nanoparticles could be imaged using PET-MR. We measured quantitative susceptibility values ($\Delta\chi$), R_2*, and ^{89}Zr-PET uptake of increasing concentrations of ^{89}Zr-IONP in vitro, and in liver in vivo by acquiring a multi-echo UTE GRE sequence and time-of-flight PET. Phantom evaluations demonstrated linear correlation between $\Delta\chi$, R_2*, and ^{89}Zr-IONP uptake. In vivo, substantial increase was observed after ^{89}Zr-IONP infusion. This approach shows promise tracking the biodistribution of radiolabelled magnetic nanoparticles.

607	18:03	Perceptual Accuracy of a Mixed-Reality System for MR-Guided Breast Surgical Planning in the Operating Room
		Stephanie L Perkins[1,2], Michael A Lin[3], Subashini Srinivasan[1], Amanda J Wheeler[4], Brian A Hargreaves[1,2,5], and Bruce L Daniel[1,2]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Bioengineering, Stanford University, Stanford, CA, United States, [3]Mechanical Engineering, Stanford University, Stanford, CA, United States, [4]Surgery, Stanford University, Stanford, CA, United States, [5]Electrical Engineering, Stanford University, Stanford, CA, United States
		One quarter of women who undergo lumpectomy to treat early-stage breast cancer in the United States undergo repeat surgery due to concerns that residual tumor was left behind. We have developed a supine breast MRI protocol and a system that projects a 3D "hologram" of the MR data onto a patient using the Microsoft HoloLens. The goal is to reduce the number of repeated surgeries by improving surgeons' ability to determine tumor extent. We are conducting a pilot study in patients with palpable tumors that tests a surgeon's ability to accurately identify tumor location via mixed-reality visualization during surgical planning.

Oral

Hepatobiliary: Diffuse Liver Disease, Part 2

S06	Tuesday 16:15 - 18:15	*Moderators:* Takeshi Yokoo & Mi-Suk Park

608	16:15	Dietary intervention can induce changes in hepatic fat content during the day detectable by MR spectroscopy
		Monika Dezortova[1], Tereza Blahova[1], Miloslav Drobny[1], Petr Sedivy[1], Jan Kovar[1], and Milan Hajek[1]
		[1]MR-Unit, Dept. Diagnostic and Interventional Radiology, Institute for Clinical and Experimental Medicine, Prague, Czech Republic

		We analyzed in vivo hepatic fat content changes during the day under different dietary interventions (fasting, fat alone, fat + fructose, fat + glucose, and glucose alone). Single voxel ^{1}H MR spectroscopy of the liver in ten healthy volunteers was used at 3T MR system. We demonstrated that it is possible to induce the hepatic fat content changes by appropriately chosen dietary interventions and that such changes can be detected noninvasively by ^{1}H MR spectroscopy.

609	16:27	Dynamics of adipose tissue and liver fat: Effects of acute exercise
		Jesper Lundbom[1], Maria Apostolopoulou[1], Martin Röhling[1], Julia Szendrödi[1], and Michael Roden[1]
		[1]German Diabetes Center Düsseldorf, Düsseldorf, Germany
		Impaired adipose tissue fat uptake may lead to liver fat accumulation. Acute exercise releases adipose tissue fat, which also increases liver fat. Here we examine how a single bout of HIIT exercise affects the dynamics of adipose tissue and liver fat by MRS and an insulin clamp. Subjecting participants to a single bout of HIIT resulted in an improved response to insulin in both adipose tissue and liver. These results suggest that adipose tissue sequesters harmful saturated fats that otherwise would accumulate in the liver and that exercise improves the uptake of these fats thereby leading to long-term health effects.

610	16:39	A Novel Analysis Strategy for Assessing Liver Lipid Composition with Magnetic Resonance Spectroscopy
		Patrick John Bolan[1], Malgorzata Marjanska[1], Aaron S Kelly[2], and Justin R Ryder[2]
		[1]Radiology, University of Minnesota, Minneapolis, MN, United States, [2]Pediatrics, University of Minnesota, Minneapolis, MN, United States
		Measuring lipid composition (e.g., saturation levels) with MRS requires analysis of small lipid resonances in addition to the 1.3 ppm methylene peak. This is straightforward in adipose tissue but difficult in the liver due to lower concentration and greater spectral linewidths. In this work we propose a new fitting method that models the full lipid spectrum from 3 parameters and fits a multi-TE array of spectra simultaneously. This approach produces repeatable and physically reasonable estimations of liver fat composition in a wide range of fat factions.

611	16:51	Gd-EOB-DTPA-enhanced T1ρ Imaging vs. Diffusion Metrics for Assessment Liver Inflammation and Early Stage Fibrosis of Nonalcoholic Steatohepatitis in Rabbits
		Xie Yuanliang[1,2], Wang Xiang[3], Zhang Hongfeng[4], Wang Xiaoqi[5], Jin Chaolin[3], and Xu Yikai[6]

		[1]Radiology, Southern Medical University, Guangzhou, China, [2]Radiology, Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [3]Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [4]Pathology, Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [5]Philips Healthcare, Beijing, China, [6]Southern Medical University, Guangzhou, China
		This study is to evaluate applications of T1ρ, T1ρ on hepatobiliary phase (HBP, with Gd-EOB-DTPA enhancement) and IVIM in assessing of early-stage NASH in rabbits model. Results show that T1ρ (HBP) after Gd-EOB-DTPA administration is a more sensitive method for assessment of NAFLD activity, while a combination of T1ρ(HBP) and IVIM showed highest diagnostic value.

612	17:03	Assessment of Portal Hypertension with Multi-parametric Hepatic MR Elastography in Mouse Models
		Jiahui Li[1], Moira B Hilscher[2], Kevin J. Glaser[1], Douglas A. Simonetto[2], Vijay Shah[2], Richard L. Ehman[1], and Meng Yin[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States, [2]Gastroenterology and Hepatology, Mayo Clinic, Rochester, MN, United States
		We used multi-parametric hepatic MR Elastography (MRE) in two different mouse models with congestion and cirrhosis-induced portal hypertension, respectively. Spearman correlation was used to analyze the relationships between the MRE-assessed liver stiffness, damping ratio, volumetric strain, stiffness frequency dispersion, and the portal pressure directly measuared in vivo. We found that volumetric strain and damping ratio had negative correlations (ρ=-0.7515, ρ=-0.5528 respectively), while shear stiffness had a positive correlation (ρ=0.6983) with portal pressure. Additionally, damping ratio changes differently in portal hypertension induced by congestion and cirrhosis. In summary, multi-parametric MRE has potential to differentiate and quantify congestion and cirrhosis-induced portal hypertension.

613	17:15	Staging of rat liver fibrosis using monoexponential, stretched exponential and diffusion kurtosis models with diffusion weighted imaging- magnetic resonance
		Genwen Hu[1], Jianmin Xu[1], Xianyue Quan[2], Liangping Luo[3], and Yingjie Mei[4]
		[1]Department of Radiology, The Second Clinical Medical College of Jinan University, Shenzhen People's Hospital, Shenzhen, China, [2]Zhujiang Hospital, Southern Medical University, Guangzhou, China, [3]The First Affiliated Hospital of Jinan University, Guangzhou, China, [4]MR Clinical Science, Philips Healthcare, Guangzhou, China
		Non-Gaussian DWI in Various Stages of Liver Fibrosis

614	17:27	Observed MRI changes following Directly-Acting Antiviral Therapy in Hepatitis-C virus patients

		Chris Bradley[1,2], Rob Scott[2], Eleanor F Cox[1,2], Naaventhan Palaniyappan[2], Neil Guha[2], Guru P Aithal[2], and Susan T Francis[1,2]
		[1]Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom, [2]NIHR Nottingham Biomedical Research Centre, University of Nottingham, Nottingham, United Kingdom
		Hepatitis C Virus (HCV) is globally the largest viral cause of mortality. Directly Acting Antiviral (DAA) therapy achieves >90% sustained virological response in HCV patients. We used multiparametric MRI to assess changes in hepatic angio-architecture after patients had DAA therapy. The time window between pre- and post-treatment scans was of 3-6 months. We observed changes in hepatic microstructure indicated by a reduction in liver T_1 (35±4ms), T_2 (2.5±0.8ms) and T_2* (3.0±0.7ms) which we suggest are linked to reduced pro-inflammatory milieu, including interstitial oedema, within the liver. No changes were observed in hepatic/splanchnic blood flow or perfusion.

615	17:39	Quantitative Characterization of the Motion Sensitivity of Stimulated Echo Diffusion-weighted Imaging in the Liver
		Yuxin Zhang[1,2], James Holmes[2], Kevin Johnson[1,2], Ty Cashen[3], and Diego Hernando[1,2]
		[1]Medical Physics, University of Wisconsin Madison, Madison, WI, United States, [2]Radiology, University of Wisconsin Madison, Madison, WI, United States, [3]Global MR Applications & Workflow, GE Healthcare, Madison, WI, United States
		STimulated Echo (STE) DWI is able to provide high b values with moderate echo times by increasing the mixing time (TM). However, long TM in STE-DWI also lead to increased sensitivity to bulk motion. To understand the tradeoff between SNR and motion sensitivity of STE DWI, this study assessed the quantitative relationship between TE, TM, and motion sensitivity in the liver with simulation and in-vivo experiments. As a result, the SNR and high motion sensitivity present an important trade-off with STE-DWI. In addition, when moment-nulling is used to compensate motion, the advantage of decreased TE from STE will be lost.

616	17:51	Golden Angle Radial Reconstruction Using Partial Separability for High Spatiotemporal Resolution Liver Dynamic Contrast-Enhanced Imaging
		Guanhua Wang[1], Haikun Qi[1], Yajie Wang[1], and Huijun Chen[1]
		[1]Center for Biomedical Imaging Research, Tsinghua University, Beijing, China
		Dynamic Contrast-Enhanced imaging is an important tool in diagnosing hepatic diseases. Improving spatiotemporal resolution is of great significance for clinical purpose. In this work we introduce the partial separability constraint to the reconstruction of stack-of-stars golden angle radial data. Both in-vivo and stimulated liver experiment were conducted and the proposed method (PS+S) showed better reconstruction quality compared to the existing methods without partial separability constraint.

617	18:03	Improving Variable-Density Single-Shot Fast Spin Echo with Deep-Learning Reconstruction Using Variational Networks
		Feiyu Chen[1], Valentina Taviani[2], Itzik Malkiel[3], Joseph Y. Cheng[4], Jamil Shaikh[4], Stephanie Chang[4], Christopher J. Hardy[5], John M. Pauly[1], and Shreyas S. Vasanawala[4]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Global MR Applications and Workflow, GE Healthcare, Menlo Park, CA, United States, [3]GE Global Research Centre, GE Healthcare, Herzliya, Israel, [4]Radiology, Stanford University, Stanford, CA, United States, [5]GE Global Research Centre, GE Healthcare, Niskayuna, NY, United States
		In this work, a deep-learning-based reconstruction approach using a variational network (VN) was developed to accelerate the variable density single-shot fast spin echo (VD SSFSE) reconstruction. The image quality of this approach was clinically evaluated compared to standard parallel imaging and compressed sensing (PICS). The VN approach achieves improved image quality with higher perceived signal-to-noise ratio and sharpness. It also allows real-time image reconstruction of VD SSFSE sequences for practical clinical deployment.

Oral

Human MRS/MRI at Ultra-High Field

W03/04	Tuesday 16:15 - 18:15	*Moderators:* Anke Henning & Christopher Rodgers

618	16:15	Towards Full-Brain FID-MRSI At 7T With 3D Concentric Circle Readout Trajectories
		Lukas Hingerl[1], Bernhard Strasser[2], Philipp Moser[1,3], Michal Považan[4,5], Gilbert Hangel[1], Eva Heckova[1], Stephan Gruber[1], Siegfried Trattnig[1,3], and Wolfgang Bogner[1]
		[1]High Field MR Centre, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Athinoula A. Martinos Center for Biomedical Imaging, Boston, MA, United States, [3]Christian Doppler Laboratory for Clinical Molecular MR Imaging, Vienna, Austria, [4]The Johns Hopkins University School of Medicine, Russell H. Morgan Department of Radiology and Radiological Science, Baltimore, MD, United States, [5]Kennedy Krieger Institute, F. M. Kirby Research Center for Functional Brain Imaging, Baltimore, MD, United States
		Proton magnetic resonance spectroscopic imaging is a powerful technique for clinical diagnosis; however, low spatial resolutions together with long scan times and SNR-per-time inefficiency prevent its wide spread application. The already proposed 2D-CONCEPT (concentric circle echo planar trajectories) sequence overcomes this issue by capitalizing most efficiently on the hardware constraints of the gradient system. The purpose of this abstract is to present first preliminary results of an extension to 3D-CONCEPT for full-brain 3D-FID-MRSI at 7T for a 64x64x31 matrix acquired within 23 minutes.

619	16:27	Whole Brain High Resolution Metabolite Mapping Using 1H FID MRSI with Slice-wise B0 Shim Updating at 9.4T
		Sahar Nassirpour[1,2], Paul Chang[1,2], and Anke Henning[1,3]
		[1]Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]IMPRS for Cognitive and Systems Neuroscience, Eberhard-Karls University of Tuebingen, Tuebingen, Germany, [3]Institute of Physics, Ernst-Moritz-Arndt University Greifswald, Greifswald, Germany
		In this work, we present high resolution whole-brain metabolite maps acquired at 9.4T for the first time. By combining a robust acceleration method with dynamic B_0 slice-wise shim updating, we achieved high quality metabolite maps from 10 slices of the brain with a nominal voxel size of ~80μL in ~25 minutes.

620	16:39	Prospective motion and B_0 shim correction for MRS at 7 Tesla
		Dinesh K Deelchand[1], James M Joers[1], Edward J Auerbach[1], and Pierre-Gilles Henry[1]
		[1]University of Minnesota, Minneapolis, MN, United States
		The goal of this study was to demonstrate the feasibility of prospective motion and shim correction for MRS at 7 Tesla. We combined an optical tracking system for motion correction and a shim navigator for first-order B_0 shim correction into a semi-LASER sequence. The new sequence was validated in the prefrontal cortex, a region sensitive to motion due to susceptibility effects induced by the proximity of the nasal cavity. Results show excellent performance, with similar spectral quality (signal-to-noise ratio and linewidth) before, during, and after motion when both motion and shim navigators are used.

621	16:51	Reproducibility of cardiac 31P MRS at 7 T
		Jane Ellis[1], Ladislav Valkovic[1,2], Lucian A. B. Purvis[1], William T. Clarke[1,3], and Christopher T. Rodgers[1,4]
		[1]OCMR, RDM Cardiovascular Medicine, University of Oxford, Oxford, United Kingdom, [2]Department of Imaging Methods, Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, Slovakia, [3]Wellcome Centre for Intergrative Neuroimaging, University of Oxford, Oxford, United Kingdom, [4]Wolfson Brain Imaging Centre, Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom
		Cardiac PCr/ATP ratios measured by ^{31}P MRS change in cardiovascular disease giving them value as a biomarker. We scanned 13 healthy volunteers at 7T, assessing their PCr/ATP with 6 ½ min ^{31}P CSI scans. These data have better reproducibility than a 30min 3T protocol previously published by our centre. Repeated PCr/ATP measurements from subjects in this study were not significantly (P=0.83) different. Measurements were significantly different (P<0.001) from DCM patient data acquired in a previous 7T study using the same coil and pulse sequence. This data will allow us to plan future 7T ^{31}P-MRS clinical studies.

622	17:03	Creatine Kinase Rate Constant in the Human Heart at 7T: A Novel Superfast Magnetization Saturation Transfer Method
		Adil Bashir[1], Jianyi Zhang[2], Nouha Salibi[3], Ronald Beyers[4], and Thomas Denney[1]
		[1]Department of Electrical and Computer Engineering, Auburn University, Auburn, AL, United States, [2]Department of Biomedical Engineering, University of Alabama Birmingham, Birmingham, AL, United States, [3]Siemens Healthineers and AUMRI Center, Auburn, AL, United States, [4]Auburn University, Auburn, AL, United States
		Changes in Creatine Kinase (CK) system are observed in heart failure and measurement of CK reaction rate constant (kf) can be useful to monitor pathology. 7T MR scanner offers improved signal to noise and spectral resolution and has potential for robust measurements. In this study we demonstrate novel superfast saturation transfer method (T1nom – method) to measure ATP production rate via CK forward reaction in human hearts at 7T. Spatial localization was achieved by GOIA-1D-ISIS/2D-CSI approach. Our measured kf values were consistent with literature.

623	17:15	Large FOV phosphor MR Spectroscopic imaging with multi-transmit proton MR imaging in the liver at 7 Tesla
		Quincy van Houtum[1], Dimitri Welting[1], Mark Gosselink[1], Christopher Rodgers[2], Wybe van der Kemp[1], and Dennis W.J. Klomp[1]
		[1]University Medical Center Utrecht, Utrecht, Netherlands, [2]University of Oxford Centre for Clinical Magnetic Resonance Research (OCMR), Oxford, United Kingdom
		We combined 1H MRI and 31P MRSI in the liver by integrating a 31P RF body coil in a 7T MR system with a 16 channel 31P receive array merged with 1H fractionated dipole antennas The setup facilitates uniform 31P excitation by the body coil with high sensitivity from the receiver array, while providing B1 shimmed proton imaging with a dipole array.

624	17:27	Dynamic perfusion and T2*-weighted 1H MRI interleaved with multivoxel 31P MRS of exercising human calf at 7T
		Fabian Niess[1,2], Albrecht Schmid[1,3], Georg Bernd Fiedler[1,2], Roberta Frass[1,2], Wolfgang Bogner[2,4], Alfredo Lopez Kolkovsky[5], Pierre Carlier[5], Ewald Moser[1,2], and Martin Meyerspeer[1,2]
		[1]Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Vienna, Austria, [2]MR Center of Excellence, Medical University of Vienna, Vienna, Austria, [3]Centre for Clinical Magnetic Resonance Research, University of Oxford, Oxford, United Kingdom, [4]Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [5]NMR laboratory, Institute of Myology, Paris, France

		To quantify perfusion and high-energy metabolite time courses of exercising gastrocnemius and soleus muscles in one time-resolved acquisition, ^{1}H arterial spin labeling with multislice EPI was interleaved with multivoxel semi-LASER ^{31}P-MRS. Perfusion mapping and T_2* weighted MRI yielded reasonable time courses and were less sensitive to motion, compared to single slice acquisitions. Spectroscopic time courses of phosphocreatine, inorganic phosphate and pH with fitted PCr recovery time constants were consistent with literature in both GM and SOL. A significant ^{31}P SNR increase was found when the VOI perceived adiabatic ^{1}H inversion which can be explained by NOE.

625	17:39	Metabolic Rate of Oxygen Consumption in Brain Tumors: A Pilot 17O-MRI Study
		Sebastian C. Niesporek[1], Armin M. Nagel[1,2], Reiner Umathum[1], Nicolas G.R. Behl[1], Mark E. Ladd[1], Heinz-Peter Schlemmer[3], and Daniel Paech[3]
		[1]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Institute of Radiology, University Hospital Erlangen, Erlangen, Germany, [3]Division of Radiology, German Cancer Research Center (DKFZ), Heidelverg, Germany
		The cerebral metabolic rate of oxygen ($CMRO_2$) is an interesting biomarker and can be used as a diagnostic parameter in various neurodegenerative diseases or tumors. A dynamic ^{17}O MRI inhalation method was optimized for application in a clinical setting and employed in two patient examinations to investigate $CMRO_2$ in human brain tumors as part of an ongoing pilot study. In tumor tissue, a decrease in oxygen consumption was detected, which is in consistent with the *Warburg effect*. To our knowledge, the presented work includes the first patient study with dynamic ^{17}O MRI.

626	17:51	In vivo investigation of lithium brain distribution in bipolar patients using 7Li MRI
		Jacques Andrew Stout[1], Arthur Coste[1], Franz Hozer[1,2,3], Franck Mauconduit[4], Sandro Romanzetti[5], Edouard Duchesnay[1], Cécile Lerman[1], Josselin Houenou[1,2,3], Frank Bellivier[2,3,6], and Fawzi Boumezbeur[1]
		[1]NeuroSpin, CEA, Gif-sur-Yvette, France, [2]Hôpital Fernand Widal, Paris, France, [3]Hôpital Albert Chenevrier, Créteil, France, [4]Siemens Healthineers, Saint-Denis, France, [5]Neurology, RWTH Aachen University Hospital, Aachen, Germany, [6]INSERM UMRS-1144, Paris, France
		As an effective but poorly understood treatment for the prevalent bipolar disorder, studies focused on investigating the cerebral distribution of lithium are of important clinical interest. Here, we report our preliminary results obtained from 5 euthymic bipolar patients using ^{7}Li MRI at 7T. Using a 3D SSFP sequence with ultra-short TE and Twisted Projection Imaging k-space sampling, we can confirm the heterogeneity of lithium brain distribution, as demonstrated by the individual and average concentration values in seven large regions-of-interest.

627	18:03	Dynamic 23Na-Imaging of the Human Lung with Fully Flexible Intrinsic Respiratory Gating

		Nicolas G.R. Behl[1], Armin M. Nagel[1,2], Reiner Umathum[1], Florian Maier[1], Mark E. Ladd[1], Mark O. Wielpütz[3], Hans-Ulrich Kauczor[3], and Tanja Platt[1]
		[1]Division of Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Institute of Radiology, University Hospital Erlangen, Erlangen, Germany, [3]Diagnostic and Interventional Radiology, University Hospital of Heidelberg, Heidelberg, Germany
		^{23}Na lung MRI is a potential tool e.g. for investigating tumor viability and treatment response. The acquired data is, however, influenced by respiratory motion since breath-hold acquisitions are not possible due to the long measurement times. Here, we present a method for full flexibility in retrospective gating of 3D-radial data, combined with a Compressed-Sensing reconstruction. Up to 14 frames could be reconstructed from one in-vivo dataset, corresponding to a temporal resolution of 0.27 s. The temporal resolution of ^{23}Na lung MRI could potentially lead to a more accurate quantification of the Tissue Sodium Concentration in the human torso.

Oral

Tumour Microenvironment

W05/06	Tuesday 16:15 - 18:15	*Moderators:* Natarajan Raghunand

628	16:15	Radiated Brain Microenvironment Enhances Glioma Growth and Blunts Immunotherapy
		Joel Richard Garbow[1], Joseph Ackerman[1], Chong Duan[1], Liya Yuan[1], John Engelbach[1], Christina Tsien[1], and Keith Rich[1]
		[1]Washington University in St. Louis, Saint Louis, MO, United States
		Glioblastoma (GBM) is a highly aggressive, malignant, primary brain tumor. Despite state-of-the-art standard-of-care treatment (surgery, chemotherapy, radiation), GBM inevitably recurs, usually in the peritumoral irradiated tumor/brain interface within two centimeters of the margins of the resection cavity. Anti-PD-L1 (immune checkpoint) inhibitors represent an important new class of cancer treatments, but have shown little efficacy in GBM. In a mouse glioma model, we demonstrate that late evolving effects of radiation blunt the therapeutic effectiveness of anti-PD-L1. Carbogen/O2 gas challenge experiments in these mice six weeks post-irradiation demonstrate that the brain microenvironment is physiologically modified, consistent with the observed blunting of immunotherapy.

629	16:27	Collagen is a major determinant of the viscoelastic properties of stromal-dense tumours: insights from pre-clinical MRE
		Jin Li[1], Konstantinos Zormpas-Petridis[1], Andreas Heindl[2], Jessica K.R. Boult[1], Craig Cummings[1], Jeffrey C. Bamber[1], Yinyin Yuan[2], Ralph Sinkus[3], Yann Jamin[1], and Simon P. Robinson[1]

		[1]Division of Radiotherapy & Imaging, The Institute of Cancer Research, London, United Kingdom, [2]Division of Molecular Pathology, The Institute of Cancer Research, London, United Kingdom, [3]Division of Imaging Sciences and Biomedical Engineering, King's College London, King's Health Partners, St. Thomas' Hospital, London, United Kingdom
		The relationship of magnetic resonance elastography-derived viscoelasticity quantified *in vivo* in nine pre-clinical tumour models exhibiting varying degrees of stromal density was compared with histological assessments of cellularity, collagen and vessel density. Both cellularity and collagen deposition were identified as important determinants of the relative tumour stiffness.

630	16:39	Pre-existing inflammation in the brain promotes metastases invasion
		Dina Sikpa[1], Lisa Whittingstall[1], Jérémie P. Fouquet[1], Luc Tremblay[1], Réjean Lebel[1], and Martin Lepage[1]
		[1]Université de Sherbrooke, Sherbrooke, QC, Canada
		We studied the effect of pre-existing inflammation on the genesis of brain metastases using MRI. Molecular MRI enhanced with VCAM-1 targeted microparticles of iron oxide enable the assessment of pre-existing vascular inflammation and then of metastasis implantation. The occurrence of brain metastases was increased by 2 fold when inflammation was present; this could be blocked with VCAM-1 antibody. This underlies the key role of VCAM-1 in tumor seeding to the brain, and suggests that preventive inflammation targeted treatment in cancer patients may minimize risks of brain metastasis.

631	16:51	Imaging the Interplay of Tumor Vascularity, Hypoxia, pHe, and Lactate
		Ellen Ackerstaff[1], Natalia Kruchevsky[1], Ekaterina Moroz[1], H. Carl LeKaye[1], Kristen L. Zakian[1], SoHyun Han[2], HyungJoon Cho[2], Radka Stoyanova[3], Nirilanto Ramamonjisoa[1], Inna S. Serganova[1], Vladimir Ponomarev[1], Ronald G. Blasberg[1], and Jason A. Koutcher[1]
		[1]Memorial Sloan Kettering Cancer Center, New York, NY, United States, [2]Ulsan National Institute of Science and Technology, Ulsan, Republic of Korea, [3]Sylverster Comprehensive Cancer Center, Miller School of Medicine University of Miami, Miami, FL, United States
		We characterized tumor vascularity, extracellular pH (pHe), and tumor lactate in various tumor models, focusing on prostate cancer. Spatial mapping demonstrated that vascular blood flow and permeability varied significantly in well-vascularized regions across tumor models and that the fraction of tumor necrosis was higher in the human than the murine models. The spatially most heterogeneous tumor type was characterized by the lowest lactate, a pHe of ~7.1 in well-vascularized regions, with lower pHe in less vascularized regions, and increasing lactate with decreasing vascular blood flow and permeability.

632	17:03	Assessing Tumor Hypoxia Based on Hypoxic Gas Breathing
		Donghan Mo Yang[1], James W Campbell III[1], Jenifer L Gerberich[1], Heling Zhou[1], and Ralph P Mason[1]
		[1]Radiology, UT Southwestern Medical Center, Dallas, TX, United States
		Tumor response to hypoxic gas breathing challenge was explored using oxygen-sensitive MRI in rat 13762NF breast tumors and compared with the more conventional hyperoxic gas breathing challenge. In viable tumor regions, blood oxygenation decreased with 16% O_2 breathing (demonstrated by an increase in R_2*). A unique "on-and-off" pattern in T_1-weighted signal intensity, which was closely related to tumor hypoxia level, was triggered by 16% O_2 breathing but not 100% O_2 breathing. When combined with hypoxic gas breathing, oxygen-sensitive MRI may reveal tumor hypoxia threshold, which is important for assessing the efficacy of hypoxia-activated prodrugs.
633	17:15	Magnetic Resonance Angiography Reveals Increased Arterial Blood Supply and Tumorigenesis Following High Fat Feeding in a Mouse Model of Triple-negative Breast Cancer
		Devkumar Mustafi[1], Rebecca Valek[1], Michael Fitch[1], Victoria Werner[1], Xiaobing Fan[1], Erica Markiewicz[1], Sully Fernandez[2], Marta Zamora[1], Jeffrey Mueller[3], Suzanne D Conzen[4], Matthew J Brady[2], and Gregory S Karczmar[1]
		[1]Radiology, The University of Chicago, Chicago, IL, United States, [2]Medicine, Section of Adult and Pediatric Endocrinology, Diabetes and Metabolism, The University of Chicago, Chicago, IL, United States, [3]Pathology, The University of Chicago, Chicago, IL, United States, [4]Medicine, the Section of Hematology and Oncology, The University of Chicago, Chicago, IL, United States
		Breast cancer is the most commonly diagnosed malignancy among women in the US. Epidemiology shows that a high animal fat diet increases risk of triple-negative breast cancer (TNBC). Our previous work examined the effect of pre-pubertal exposure to high dietary animal fat in the SV40Tag mouse model of TNBC. We showed that a high animal fat diet changes mammary fat composition and increases incidence and aggressiveness of mammary cancers in this model. Here, we demonstrate using MR angiography that changes in fat composition and cancer incidence are paralleled by increases in vascular density in the mammary gland.
634	17:27	Mapping of Glioma Metabolism Using In Vivo Deuterium Metabolic Imaging (DMI)
		Henk M. De Feyter[1], Kevin L. Behar[2], Peter B. Brown[1], Douglas L. Rothman[1,3], and Robin A. de Graaf[1,3]
		[1]Department of Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States, [2]Department of Psychiatry, Yale University, New Haven, CT, United States, [3]Department of Biomedical Engineering, Yale University, New Haven, CT, United States

		Deuterium Metabolic Imaging (DMI) is a novel approach providing high 3D spatial resolution metabolic data from both animal models and human subjects. DMI relies on ^{2}H MRSI in combination with administration of ^{2}H-labeled substrates. In a rat glioma model we show how DMI combined with administration of [6,6'-$^{2}H_2$]-glucose and [$^{2}H_3$]-acetate allowed spatial mapping of differences in metabolism between normal brain and glioma. DMI data after infusion of ^{2}H-labeled glucose revealed high glucose uptake and lactate production but limited glucose oxidation in glioma. Furthermore, DMI revealed acute therapeutic effects of a drug (dichloroacetate) targeting glucose oxidation.

635	17:39	COX-2 Alters the Metabolic Secretome in Triple Negative Human Breast Cancer Xenografts
		Santosh Kumar Bharti[1], Paul T Winnard Jr.[1], Yelena Mironchik[1], Louis Dore-Savard[2], Balaji Kirshnamachary[1], and Zaver M Bhujwalla[1,3]
		[1]Division of Cancer Imaging Research, Department of Radiology, Johns Hopkins University, School of Medicine, Baltimore, MD, United States, [2]McGill University Health Centre and RI-MUHC, Montreal, QC, Canada, [3]Department of Oncology, Johns Hopkins University, School of Medicine, Baltimore, MD, United States
		Tumor interstitial fluid (TIF) contains the tumor secretome and forms a critical component of the tumor microenvironment. Cyclooxygenase-2 (COX2) mediates the inflammatory response of cells and is upregulated in cancers. In cancers, COX-2 expression has been related to increased invasion and metastasis. Here, for the first time, using 1H MR spectroscopy we characterized changes in the metabolic patterns of TIF in tumors derived from triple negative SUM-149 human breast cancer cells with COX-2 overexpressed. COX-2 overexpression significantly altered several fundamental metabolic pathways. These data provide new insights into the role of COX-2 in tumor aggressiveness, and identify new metabolic targets.

636	17:51	PI3K/mTOR inhibition of IDH1 mutant glioma leads to reduced 2HG production that is associated with increased survival
		Georgios Batsios[1], Pavithra Viswanath[1], Anne Marie Gillespie[1], Elavarasan Subramani[1], Joanna J Phillips[2], Russell O Pieper [2], and Sabrina M Ronen[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Neurological Surgery, University of California, San Francisco, San Francisco, CA, United States
		Mutant IDH1 produces the oncometabolite 2HG, which drives tumorigenesis in low-grade gliomas. One potential therapeutic option for such gliomas is treatment with a PI3K/mTOR inhibitor. Using cell models genetically-engineered to express mutant IDH1, we observed that PI3K/mTOR inhibition induced a reduction in 2HG levels in treated cells and tumors, that was associated with reduced cell proliferation and enhanced animal survival. The drop in 2HG was due to a reduction in its synthesis from both glucose and glutamine. Our study identifies MRS-detectable metabolic alterations that could serve as indicators of response for mutant IDH1 glioma patients undergoing treatment with PI3K/mTOR inhibitors.

637	18:03	Ketone measurement in human glioma following an Atkins-based diet
		Adam Berrington[1,2], Karisa C Schreck[3], Christopher T Whitlow[4], Roy E Strowd[5], and Peter B Barker[1,2]
		[1]Russell H. Morgan Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]F. M. Kirby Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [4]Department of Radiology, Wake Forest School of Medicine, Winston, NC, United States, [5]Departments of Neurology and Oncology, Wake Forest School of Medicine, Winston, NC, United States
		Recent studies have focused on the use of ketogenic diet (KD) in the treatment of glioma since tumor cells are heavily glucose-dependent. Here, we assess the ability of MRS to monitor KD-therapy in glioma patients. Using a semi-LASER sequence at 3 T, with fully simulated basis for spectral fitting, we measured increases in acetone and β-hydroxybutyrate after KD in tumor and contralateral brain. NAA concentration decreased in contralateral brain and there was an observed elevation of β-hydroxybutyrate in IDH-mutated gliomas; potentially indicating differential response to KD. These results indicate a potential for MRS in monitoring KD-based therapy in glioma.

Study Groups

Quantitative MRI Business Meeting

W07	Tuesday 17:15 - 18:15	*(no CME credit)*

Event

Bronze Corporate Evening Symposium: Bracco

S02	Tuesday 18:30 - 20:30	*(no CME credit)*

Event

Bronze Corporate Evening Symposium: Hitachi Medical Systems

W05/06	Tuesday 18:30 - 20:30	*(no CME credit)*

Wednesday, 20 June 2018

Go to top
Sunrise Session

Diffusion Tensor Imaging Outside the Brain

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

N03	Wednesday 7:00 - 7:50	*Moderators:* Bruce Damon

7:00	Heart
	Martijn Froeling

7:25	Skeletal Muscle
	José Raya

7:50	Adjournment & Meet the Teachers

Sunrise Session

Go Faster in Clinical Imaging: Fingerprinting

Organizers: Jongho Lee, Utaroh Motosugi, Yi-Fen Yen

N04	Wednesday 7:00 - 7:50	*Moderators:* Utaroh Motosugi & Yi-Fen Yen

7:00	Basic Physics of Fingerprinting
	Dan Ma

7:25	Clinical Applications of Fingerprinting
	Jeffrey Sunshine

7:50	Adjournment & Meet the Teachers

Sunrise Session

From Diagnosis to Assessing Therapy Response: Breast Cancer

Organizers: Kathryn Fowler, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Wednesday 7:00 - 7:50	*Moderators:* Peter Gibbs & Reiko Woodhams

7:00	Pre-Treatment Breast Imaging
	Francesco Sardanelli

7:25	Monitoring Response
	Amy Fowler

7:50	Adjournment & Meet the Teachers

Sunrise Session

Advanced Techniques in Cardiovascular MR: Tissue Perfusion

Organizers: James Carr, Bernd Wintersperger

S02	Wednesday 7:00 - 7:50	*Moderators:* Amedeo Chiribiri & Phillip Young

7:00	Acquisition Strategies: Contrast-Enhanced & NCE Approaches
	Krishna Nayak

7:25	Understanding Contrast Mechanisms, Contrast Agents & Perfusion Models
	Smita Sampath

7:50	Adjournment & Meet the Teachers

Sunrise Session

Application of Molecular Imaging in Neurodegenerative Diseases

Organizers: Guanshu Liu, Natalie Serkova, Damian Tyler

S03	Wednesday 7:00 - 7:50	*Moderators:* Christin Sander & Natalie Serkova

7:00	Recent Technical Developments of Molecular Imaging for Neurodegenerative Diseases Youssef Wadghiri

7:25	Clinical Translation & Applications of Molecular MRI in Neurodegenerative Diseases Robia Pautler

7:50	Adjournment & Meet the Teachers

Sunrise Session

Emerging Methods in MSK MRI: Bone

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S04	Wednesday 7:00 - 7:50	*Moderators:* James MacKay & Mary Kate Manhard

7:00	MRI of Bone Microarchitecture Chamith Rajapakse

7:25	MRI of Bone in the Clinic Gregory Chang

7:50	Adjournment & Meet the Teachers

Sunrise Session

Your Brain on Drugs: Cannabis

Organizers: Andre Obenaus, Pia Maly Sundgren

S05	Wednesday 7:00 - 7:50	*Moderators:* Norbert Campeau

7:00	Cannabis - Functional MRI & Cannabis

	Christopher Whitlow

7:25	Adolescents & Developing Reward Circuitry
	Matthew Wall

7:50	Adjournment & Meet the Teachers

Sunrise Session

Maker: Microcontroller

Organizers: Gregor Adriany, Matthias Günther, Michael Hansen, Christoph Juchem, Greig Scott

S06	Wednesday 7:00 - 7:50	*Moderators:* Christoph Juchem & Greig Scott

7:00	Consumer-Grade Microcontrollers and Considerations for MRI Console Development
	Sergei Obruchkov

7:25	Waveform Generator Tutorial: RF Vector Modulator
	Natalia Gudino

7:50	Adjournment & Meet the Teachers

Traditional Poster: Contrast Mechanisms

Exhibition Hall 2158-2189	Wednesday 8:15 - 10:15	*(no CME credit)*

Electronic Poster: fMRI

Exhibition Hall	Wednesday 8:15 - 9:15	*(no CME credit)*

Electronic Poster: Body: Breast, Chest, Abdomen, Pelvis

Exhibition Hall	Wednesday 8:15 - 9:15	*(no CME credit)*

Study Groups

PET/MR Business Meeting

W07	Wednesday 8:15 - 9:15	*(no CME credit)*

Member-Initiated Symposium

Magnetic Particle Imaging & Its Synergies with MRI Technology & Applications

Organizers: Jeff Bulte, Steven Conolly, Lawrence Wald

S01	Wednesday 8:15 - 10:15	*Moderators:* Jeff Bulte & Lawrence Wald	*(no CME credit)*

	8:15	Basic Physics & Principles of MPI
		Jochen Franke[1]
		[1]Preclinical Imaging, Bruker BioSpin MRI GmbH, Ettlingen, Germany

	8:45	Towards Functional Magnetic Particle Imaging (fMPI): A Rodent Hypercapnia Cerebral Blood Volume Study
		Clarissa Cooley[1]
		[1]Massachusetts General Hospital, United States

	9:00	MPI Cell Tracking: How Does It Compare to MRI?
		Miroslaw Janowski[1]
		[1]Johns Hopkins University, Baltimore, MD, United States

	9:15	Advanced MPI Hardware with 1 Micromolar Sensitivity & Early MPI Preclinical Imaging Applications
		Patrick Goodwill[1]
		[1]Magnetic Insight

	9:30	MRI Meets MPI: How to Build a Hybrid Scanner
		Volker Behr

	9:45	Panel Discussion

Member-Initiated Symposium

Hot Topics in Breast MRI

Organizers: Linda Moy

W05/06	Wednesday 8:15 - 10:15	*(no CME credit)*

	8:15	Ultrafast & Non-Contrast Breast Screening
		Ritse Mann

	8:45	Preoperative & WB Staging with MRI & PET/MRI
		Pascal Baltzer[1]
		[1]Medizinische Universität Wien

	9:15	7T & Advanced Breast Spectroscopy
		Dennis Klomp[1]
		[1]University Medical Center Utrecht, Netherlands

	9:45	Radiogenomics in Breast Cancer: New Approaches Towards Diagnosis & Treatment
		Katja Pinker-Domenig[1]
		[1]Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States

Weekday Course

Multinuclear Imaging & Spectroscopy: Methods & Applications

Organizers: Wolfgang Bogner, Gregory Metzger

S03	Wednesday 8:15 - 10:15	*Moderators:* Wolfgang Bogner & Greg Metzger

	8:15	Basic Principles for Imaging Non-Proton Nuclei
		Guillaume Madelin[1]
		[1]NYU Langone Medical Center, United States
		Non-proton MRI (X-nuclei MRI) can provide new information on living tissues that is not available with proton (^{1}H) MRI. Certain X-nuclei such as sodium (^{23}Na), phosphorus (^{31}P), oxygen (^{17}O), potassium (^{39}K), Chlorine (^{35}Cl), and others, play an important role in the body metabolism (such as ion homeostasis, propagation of action potential, energy metabolism) and can also be detected with magnetic resonance imaging.

	8:40	Sodium (23Na) & Imaging Membrane Potential
		Armin Michael Nagel[1]
		[1]Institute of Radiology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany
		Ions such as sodium (Na^+), chlorine (Cl^-) and potassium (K^+) play an important role in many cellular physiological processes. In healthy tissue, the extracellular concentration of Na^+ is approximately ten-fold higher than the intracellular concentration. A breakdown of this concentration gradient or an increase of the intracellular Na^+ content can be used as an early marker in many disease processes. In this presentation, the focus will be on musculoskeletal and brain-related applications of Na^+ MRI. In addition, the required hardware, as well as image acquisition and post-processing techniques that are suitable for Na^+, K^+, and Cl^- MRI will be discussed.

	9:05	Multinuclear Spectroscopy & Imaging of 31P & 13C
		Chris Boesch[1]
		[1]University Bern, Switzerland

		Early in history of MR, the enormous added value of multinuclear MRI/MRS has been recognized; however, the technical challenges (low sensitivity, difficult volume selection, need for extra hardware, no generally available internal concentration standards, etc.) limited the applications considerably. In particular ^{13}C and ^{31}P can serve as reporters in many metabolic pathways and increased membrane turnover in tumor biology. Ultrahigh field strengths and hyperpolarized ^{13}C substances overcome now many of the obstacles and foster new applications. The lecture shall emphasize the added value, summarize the methodological limitations, and list some representative applications of ^{13}C- and ^{31}P-MRI/MRS.

	9:30	Exploring Metabolism with 17O
		Xiao-Hong Zhu[1]
		[1]University of Minnesota, United States
		In recent years, with technology advancement and increasing availability of the high/ultrahigh field MR scanners, *in vivo* ^{17}O MR spectroscopy & imaging has emerged as a valuable tool for noninvasively exploring metabolism in living organ or tissue because of the greatly improved ^{17}O MR sensitivity at higher field. Quantifying regional cerebral metabolic rate of oxygen ($CMRO_2$) and its changes in animal or human brains may be the most important use of ^{17}O MR. In this talk, I will present an overview of the ^{17}O MRS/MRI technique, including the key aspects of the methodology and examples of potential applications.

	9:55	Panel Discussion

	10:20	Adjournment & Meet the Teachers

Weekday Course

Peripheral Nerve Imaging: Ryder Cup

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

W03/04	Wednesday 8:15 - 10:15	*Moderators:* Kimberly Amrami & Richard Hodgson

	8:15	Upper-Extremity Peripheral Nerve Imaging with US: European Perspective
		Carlo Martinoli[1], Federico Zaottini[1], Riccardo Picasso[1], and Federico Pistoia[1]

		[1]University of Genova, Italy
		The value of US to assess the most common disorders affecting peripheral nerves in the upper extremity, including compressive neuropathies, polyneuropathies, traumatic injuries, tumours and tumour-like lesions, will be discussed. A careful US approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding such kind of examination. US can provide a low-cost and noninvasive imaging, speed of performance, and important advantages over MR imaging, including higher spatial resolution and ability to explore long segments of nerve trunks in a single study and to examine tissues in both static and dynamic states with real time scanning.

	8:40	Upper-Extremity Peripheral Nerve Imaging with MRI: European Perspective
		Gustav Andreisek[1]
		[1]Spital Thurgau AG, Switzerland
		MR neurography has become the modality of choice to image the peripheral nerves of the upper extremity. This talk will provide a comprehensive overview from a European perspective.

	9:05	Lower-Extremity Peripheral Nerve Imaging with US: American Perspective
		Karen Chen[1]
		[1]Univ. of San Diego, VA Medical Center, United States

	9:30	Lower-Extremity Peripheral Nerve Imaging with MRI: American Perspective
		Jenny Bencardino[1]
		[1]Radiology, NYU School of Medicine, United States
		Entrapment neuropathies present a challenge to clinicians and radiologists alike. MR neurography has proven a reliable, non invasive, diagnostic method to identify that exact site of nerve entrapment and the associated direct and indirect MR signs of neuropathy.

	9:55	Panel Discussion

	10:20	Adjournment & Meet the Teachers

Power Pitch

Pitch: Interventional & RF: Safety & Solutions

Power Pitch Theater A - Exhibition Hall	Wednesday 8:15 - 9:15	*Moderators:* Ergin Atalar & Shaihan Malik	*(no CME credit)*

638	8:15	Reducing Radiofrequency-induced Heating in Realistic Deep Brain Stimulation Lead Trajectories using Parallel Transmission
		Pei-Shan Wei[1], Benson Yang[1], Clare E. McElcheran[2], Laleh Golestanirad[3], and Simon J. Graham[1,4]
		[1]Physical Sciences, Sunnybrook Research Institue, Toronto, ON, Canada, [2]Baylis Medical, Mississauga, ON, Canada, [3]Massachusetts General Hospital, Boston, MA, United States, [4]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada
639	8:15	Electrical lengthening to improve electromagnetic simulations and SAR calculations of meandered body dipole elements at 7T
		Stephen Bawden[1,2], Richard Bowtell[1], Penny Gowland[1], and Paul Glover[1]
		[1]Sir Peter Mansfield Imaging Centre, University of Nottingham, Nottingham, United Kingdom, [2]National Institute for Health Research (NIHR) Nottingham Biomedical Research Centre, Nottingham University Hospitals NHS Trust, University of Nottingham, Nottingham, United Kingdom
640	8:15	SAR Calculations in Transmit-Only-Receive-Only RF systems: A Comparison of Detuning Methods for Rx Array Coils and their Implementation in EM Simulations
		Matthias Malzacher[1], Jorge Chacon-Caldera[1], Mathias Davids[1], and Lothar R. Schad[1]
		[1]Computer Assisted Clinical Medicine,Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
641	8:15	Sensitivity analysis of Peripheral Nerve Stimulation modeling: Which model parameters actually matter?
		Valerie Klein[1], Mathias Davids[1,2], Bastien Guérin[2,3], Lothar R. Schad[1], and Lawrence L. Wald[2,3,4]

		[1]Computer Assisted Clinical Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany, [2]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [3]Harvard Medical School, Boston, MA, United States, [4]Harvard-MIT Division of Health Sciences and Technology, Cambridge, MA, United States

642	8:15	Validating and Measuring Transfer Functions of Straight Wires using a Combination of an Electro-optic Field Sensor and Simulation
		Thomas Lottner[1], Simon Reiss[1], Ali Caglar Özen[1,2], Michael Bock[1], and Andreas Bitzer[1,3]
		[1]Department of Radiology, Medical Physics, Medical Center - University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, [2]German Consortium of Translational Cancer Research Freiburg Site, German Cancer Research Center (DKFZ), Heidelberg, Germany, [3]BIOLAB Technology AG, Zürich, Switzerland

643	8:15	Imaging Conditions and Image Quality for Patients with MR-conditional Implantable Medical Devices: Normal Volunteer Study
		Kagayaki Kuroda[1], Saeko Sunohara[1], Satoshi Yatsushiro[2], Toshiki Saito[3], Nao Kajiwara[3], Tomohiko Horie[3], Toshiki Kazama[3], Tetsu Niwa[3], and Yutaka Imai[3]
		[1]Course of Electric and Electronic Engineering, Graduate School of Engineering, Tokai University, Hiratsuka, Japan, [2]Graduate School of Science and Technology, Tokai University, Hiratsuka, Japan, [3]Department of Radiology, School of Medicine, Tokai University, Isehara, Japan

644	8:15	Wireless MR-Compatibility Control of Active Implantable Medical Devices
		Berk Silemek[1], Volkan Açıkel[2], Uğur Yılmaz[1], and Ergin Atalar[1,3]
		[1]National Magnetic Resonance Research Center (UMRAM), Bilkent University, Ankara, Turkey, [2]REHIS Power Amplifier Technologies, Aselsan, Ankara, Turkey, [3]Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey

645	8:15	Experimental implementation of test-field diversity method for RF-induced heating assessment of medical implants
		Earl Zastrow[1], Aiping Yao[1,2], and Niels Kuster[1,2]
		[1]IT'IS Foundation, Zurich, Switzerland, [2]ETH-Zurich, Zurich, Switzerland

646	8:15	SMART tracking: SiMultaneous Anatomical imaging and Real-Time needle tracking
		Frank Zijlstra[1] and Peter R Seevinck[1]
		[1]Image Sciences Institute, UMC Utrecht, Utrecht, Netherlands

647	8:15	MRI Safety Assessment of Orthopedic Implants on the Bone Surface via the Induced Tangential E-Fields
		Manuel Murbach[1], Earl Zastrow[1], Esra Neufeld[1], Theodoros Samaras[2], Wolfgang Kainz[3], and Niels Kuster[1,4]
		[1]ITIS Foundation, Zurich, Switzerland, [2]Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, [3]Center for Devices and Radiological Health (CDRH), US Food and Drug Administration (FDA), Silver Spring, MD, United States, [4]Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

648	8:15	A Reproducible and Lower-Cost Thermo-Acoustic Ultrasound System for Detection of RF-Induced Lead Tip Heating in MRI
		Neerav Dixit[1], Pascal Stang[2], John Pauly[1], and Greig Scott[1]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Procyon Engineering, San Jose, CA, United States

649	8:15	An Aerosol-Deposited Wireless Resonant Marker for Catheter Tracking in Interventional MRI
		Caroline D. Jordan[1], Bradford R. H. Thorne[1], Arjun Wadhwa[2], Vincent Fratello[2], Alastair J. Martin[1], Xiaoliang Zhang[1,3], and Steven W. Hetts[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Quest Integrated, LLC, Kent, WA, United States, [3]UC Berkeley-UCSF Graduate Program in Bioengineering, University of California, Berkeley, Berkeley, CA, United States

650	8:15	Actively-tracked metallic electrophysiology catheters and guidewires with miniature floating radio-frequency traps: Theory, Design and Validation
		Ehud J Schmidt[1], Eric S Meyer[1], Ronald D Watkins[2], Hassan Elahi[1], Wolfgang Loew[3], Jeffrey Schweitzer[4], Gregory Olson[4], Aravindan Kolandaivelu[1], and Henry R Halperin[1]

		[1]Cardiology, Johns Hopkins University, Baltimore, MD, United States, [2]Radiology, Stanford University, Stanford, CA, United States, [3]Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [4]Abbott Inc., Saint Paul, MN, United States

651	8:15	AN ACTIVE BIOPSY NEEDLE DESIGN FOR MRI GUIDED PROSTATE BIOPSY
		Korel Dursun YILDIRIM[1], Ibrahim Davut MAHCICEK[1], and Ozgur KOCATURK[1]
		[1]Biomedical Engineering, Institute of Biomedical Engineering, Bogazici University, Istanbul, Turkey

652	8:15	MRI-guided robotic arm (MgRA) drives optogenetic activation of the rat corpus callosum
		Yi Chen[1,2], Pais Roldán Patricia[1,2], Xuming Chen[1], and Xin Yu[1,3]
		[1]Research Group of Translational Neuroimaging and Neural Control, High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]Graduate Training Centre of Neuroscience, University of Tuebingen, Tuebingen, Germany, [3]The Werner Reichardt Centre for Integrative Neuroscience, University of Tuebingen, Tuebingen, Germany

Power Pitch

Pitch: Motion & Image Analysis Highlights

Power Pitch Theater B - Exhibition Hall	Wednesday 8:15 - 9:15	*Moderators:* Aaron Hess & Daniel Hoinkiss	*(no CME credit)*

653	8:15	The spatial distribution of arterial and venous vessels in the human brain
		Michaël Bernier[1], Stephen C Cunnane[2], and Kevin Whittingstall[3]
		[1]Nuclear medecine and radiobiology, Université de Sherbrooke, Sherbrooke, QC, Canada, [2]Medecine, Université de Sherbrooke, Sherbrooke, QC, Canada, [3]Diagnostic radiology, Université de Sherbrooke, Sherbrooke, QC, Canada

654	8:15	A spatiotemporal fetal MRI atlas for multi-organ segmentation and growth analysis
		Tong Zhang[1], Maria Deprez[1], Paul Aljabar[1], Robert Wright[1], Alice Davidson[1], Mary Rutherford[1], Jo V. Hajnal[1], and Julia A. Schnabel[1]

		[1]*School of Biomedical Engineering & Imaging Sciences, King's College London, London, United Kingdom*
655	8:15	Accelerated high b-value diffusion-weighted MRI for higher-order diffusion analysis using a phase-constrained low-rank tensor model
		Lianli Liu[1], Adam Johansson[2], James M. Balter[2], Jeffrey A. Fessler[1], and Yue Cao[2]
		[1]Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States, [2]Radiation Oncology, University of Michigan, Ann Arbor, MI, United States
656	8:15	Construction of Spatiotemporal Infant Cortical Surface Atlas of Rhesus Macaque
		Fan Wang[1], Chunfeng Lian[1], Jing Xia[1], Zhengwang Wu[1], Dingna Duan[1], Li Wang[1], Dinggang Shen[1], and Gang Li[1]
		[1]Department of Radiology and BRIC, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States
657	8:15	Efficient Super-Resolution in Intracranial Vessel Wall Magnetic Resonance Imaging using 3D Deep Densely Connected Neural Networks
		Yuhua Chen[1,2], Zhaoyang Fan[2], Feng Shi[2], Zixiao Tian[2], Anthony Christodoulou[2], Yibin Xie[2], and Debiao Li[2]
		[1]Department of Bioengineering, UCLA, Los Angeles, CA, United States, [2]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States
658	8:15	Simultaneous Relaxometry and Segmentation of Human Brain through a Deep Neural Network
		Peng Cao[1], Jing Liu[1], Shuyu Tang[1], Andrew Leynes[1], and Peder Larson[1]
		[1]Department of Radiology and Biomedical Imaging, University of California at San Francisco, San Francisco, CA, United States
659	8:15	Combining Multi-Site/Study MRI Data: A Novel Linked-ICA Denoising Method for Removing Scanner and Site Variability from Multi-Modal MRI Data
		Huanjie Li[1,2], Staci Gruber[1], Stephen M Smith[3], Scott E Lukas[1], Marisa Silveri[1], Kevin P Hill[4], William D. S Killgore[5], and Lisa D Nickerson[1]

		[1]Imaging Center, Harvard Medical School, McLean Hospital, Belmont, MA, United States, [2]Dalian University of Technology, Dalian, China, [3]Oxford University, Oxford, United Kingdom, [4]Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, MA, United States, [5]University of Arizona, Tucson, AZ, United States
660	8:15	Real-time simultaneous shim and motion measurement and correction in CEST MRI using Double volumetric Navigators (DvNavs)
		Gizeaddis L. Simegn[1], Andre J.W. Van der Kouwe[1,2,3], Borjan Gagoski[3,4], Frances Robertson[1,5], Ernesta Meintjes[1,5], and Ali Alhamud[1,5]
		[1]MRC/UCT Medical Imaging Research Unit, Division of Biomedical Engineering, Department of Human Biology, University of Cape Town, Cape Town, South Africa, [2]Athinoula A. Martinos Center for Biomedical imaging/MGH, Charlestown, MA, United States, [3]Department of Radiology, Harvard Medical School, Boston, MA, United States, [4]Fetal Neonatal Neuroimaging and Developmental Science Center, Boston Children's Hospital, Boston, MA, United States, [5]Cape Universities Body Imaging Centre (CUBIC-UCT), Cape Town, South Africa
661	8:15	Real-time motion and dynamic transmit/receive B1 correction of CEST in the human brain at 7T
		Sami Auno[1,2], Esau Poblador Rodriguez[1,3], Philipp Moser[1,3], Andre v.d.Kouwe[4], Stephan Gruber[1], Siegfried Trattnig[1,3], and Wolfgang Bogner[1]
		[1]High-Field MR Center, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Department of Physics, University of Helsinki, Helsinki, Finland, [3]Christian Doppler Laboratory for Clinical Molecular MR Imaging, Vienna, Austria, [4]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States
662	8:15	Brainstem abnormalities in structural MRI of young children with Autism Spectrum Disorder: evaluation of inter-method agreement.
		Paolo Bosco[1], Alessia Giuliano[1], Jonathan Delafield-Butt[2], Filippo Muratori[3], Sara Calderoni[3], and Alessandra Retico[1]
		[1]INFN, Pisa, Italy, [2]Humanities and Social Science, University of Strathclyde, Glasgow, United Kingdom, [3]IRCCS Stella Maris, Pisa, Italy
663	8:15	Automatic Segmentation of 3D Perivascular Spaces in 7T MR Images Using Multi-Channel Fully Convolutional Network

		Chunfeng Lian[1], Mingxia Liu[1], Jun Zhang[1], Xiaopeng Zong[1], Weili Lin[1], and Dinggang Shen[1]
		[1]Department of Radiology and BRIC, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States

664	8:15	Motion artifact quantification and localization for whole-body MRI
		Thomas Kuestner[1,2], Marvin Jandt[2], Annika Liebgott[2,3], Lukas Mauch[2], Petros Martirosian[1], Fabian Bamberg[3], Konstantin Nikolaou[3], Sergios Gatidis[3], Bin Yang[2], and Fritz Schick[1]
		[1]Section on Experimental Radiology, University Hospital of Tuebingen, Tuebingen, Germany, [2]Institute of Signal Processing and System Theory, University of Stuttgart, Stuttgart, Germany, [3]Department of Radiology, University Hospital of Tuebingen, Tuebingen, Germany

665	8:15	Tract-Based Cluster Analysis
		Pedro Angel Luque Laguna[1,2], Francisco de Santiago Requejo[1,2], Steven Williams[2], Laura H. Goldstein[3], Marco Catani[1], and Flavio Dell'Acqua[1,2,4]
		[1]Natbrainlab, Forensic and Neurodevelopmental Science, King's College London, London, United Kingdom, [2]Department of Neuroimaging, King's College London, London, United Kingdom, [3]Department of Psychology, King's College London, London, United Kingdom, [4]The Sackler Institute for Translational Neurodevelopment, King's College London, London, United Kingdom

666	8:15	SEGUE: a Speedy rEgion-Growing algorithm for Unwrapping Estimated phase
		Anita Karsa[1] and Karin Shmueli[1]
		[1]Department of Medical Physics and Biomedical Engineering, University College London, London, United Kingdom

667	8:15	The Role of Partial Volume Modelling in Longitudinal Automated Multiple Sclerosis Lesion Segmentation
		Mário João Fartaria[1,2,3], Tobias Kober[1,2,3], Cristina Granziera[4,5,6], and Meritxell Bach Cuadra[2,3,7]

		[1]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [2]Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [3]Signal Processing Laboratory (LTS 5), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [4]Martinos Center for Biomedical Imaging, Massachusetts General Hospital and Harvard Medical School, Boston, MA, United States, [5]Neuroimmunology Unit, Neurology, Department of Clinical Neurosciences, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [6]Neurology Department and Neuroimaging Laboratory, Basel University Hospital, Basel, Switzerland, [7]Medical Image Analysis Laboratory (MIAL), Centre d'Imagerie BioMédicale (CIBM), Lausanne, Switzerland

Combined Educational & Scientific Session

Spinal Cord MR

Organizers: Andre Obenaus, Elna-Marie Larsson

S02	Wednesday 8:15 - 10:15	*Moderators:* Andre Obenaus & Elna-Marie Larsson

	8:15	How to Optimise Spinal Cord MR Acquisitions
		Seth Smith[1,2]
		[1]Radiology, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Vanderbilt Univeristy Institute of Imaging Science, Vanderbilt University Medical Center, Nashville, TN, United States
		The goal of this educational presentation is to develop an understanding of where spinal cord MRI is, its optimization, and impediments to future optimization. We will study what spinal cord optimization means and how improvements can have a real, sustained impact on the radiological and scientific community. We will identify needs, both patient and research centered, that could be addressed with improved spinal cord imaging methods. We will close by asking, “if we know what we need to have, and can identify some of the impediments to those needs, how do we optimize a spinal cord examination for maximal impact?”

668	8:45	In vivo visualization of white and gray matter sub-structures using fast quantitative T1 mapping of the human spinal cord at 7T with 300-µm in-plane resolution
		Aurélien Massire[1,2,3], Henitsoa Rasoanandrianina[1,2,3], Manuel Taso[1,2,3,4], Arnaud Le Troter[1,3], Maxime Guye[1,3], Jean-Philippe Ranjeva[1,2,3], and Virginie Callot[1,2,3]
		[1]Aix-Marseille Univ, CNRS, CRMBM, Marseille, France, [2]iLab-Spine - Laboratoire international - Imagerie et Biomécanique du rachis, Marseille, France, [3]APHM, Hôpital Universitaire Timone, CEMEREM, Marseille, France, [4]Division of MRI Research, Department of Radiology, Beth Israel Deaconess Medical Center & Harvard Medical School, Boston, MA, United States

		T_1 mapping of the cervical spinal cord at 7T with a 300-µm in-plane resolution using the MP2RAGE sequence is presented. A semi-automated post-processing pipeline enabled group studies (n=10 healthy subjects) with quantitative evaluation within small spinal cord sub-structures from C1 to C7, explored for the first time using T_1 mapping. This work lays the groundwork for improved characterization of spinal cord degeneration using 7T MRI, by allowing investigation within particular relevant regions such as the anterior/posterior gray matter horns and ventromedial white matter tracts. It also offers new perspectives to build dedicated spinal cord substructures templates.

669	8:57	Spinal cord MRI and fMRI at 16.4 T during spinal cord stimulation in rats: initial experience
		Hanne Laakso[1,2], Lauri J Lehto[1], Carlos Cuellar[3], Igor Lavrov[3], John Osborn[4], Shalom Michaeli[1], and Silvia Mangia[1]
		[1]Center for Magnetic Resonance in Research, University of Minnesota, Minneapolis, MN, United States, [2]A.I. Virtanen Institute for Molecular Sciences, University of Eastern Finland, Kuopio, Finland, [3]Neural Engineering Laboratory, Mayo Clinic, Rochester, MN, United States, [4]Department of Integrative Biology and Physiology, University of Minnesota, Minneapolis, MN, United States
		This study aims at paving the way for spinal cord MRI and fMRI during spinal cord stimulation (SCS) in rats, with the goal of providing an experimental framework for assessing the impact of SCS on neuroplasticity and functional circuitry. MRI and fMRI of the spinal cord during SCS are extremely challenging due to motion and electrode-induced susceptibility artefacts. Here we demonstrated that high quality MRI and fMRI images of the spinal cord could be obtained at 16.4T during SCS with recently developed MB-SWIFT. This is the first study that attempts spinal cord fMRI during SCS in rats.

	9:09	Clinical Applications of Spinal Cord MR
		Majda Thurnher[1]
		[1]Medical University of Vienna, Austria

670	9:39	Spinal Cord MRS Biomarkers of Clinical Impairment in Chronic Spinal Cord Injury
		Patrik O. Wyss[1,2,3], Eveline Huber[4], Patrick Freund[4,5,6,7], and Anke Henning[1,3,8]

		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland, [2]Department of Radiology, Swiss Paraplegic Centre, Nottwil, Switzerland, [3]Max-Planck-Institute for Biological Cybernetics, Tuebingen, Germany, [4]Spinal Cord Injury Center, University Hospital Balgrist, University of Zurich, Zurich, Switzerland, [5]Department of Brain Repair and Rehabilitation, UCL Institute of Neurology, University College London, London, United Kingdom, [6]Wellcome Trust Centre for Neuroimaging, UCL Institute of Neurology, University College London, London, United Kingdom, [7]Department of Neurophysics, Max-Planck-Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [8]Institute of Physics, Ernst-Moritz-Arndt University Greifswald, Greifswald, Germany
		Remote neurodegenerative changes above the level of injury are present following traumatic spinal cord injury (SCI), resulting in atrophy of the cervical cord of up to 30%. This study investigates the underlying biochemical changes at the cellular and molecular level which may subtend the development of atrophy using latest magnetic resonance spectroscopy in the spinal cord in healthy controls and SCI patients. Furthermore, we screen for potential MRS biomarkers investigating the association of biochemical changes and clinical outcome.

671	9:51	Comparison of cervical cord results from a quantitative 3D multi-parameter mapping (MPM) protocol of the whole brain with a dedicated cervical cord protocol
		Rebecca Sara Samson[1], Marco Battiston[1], Maryam Seif[2,3], Julien Cohen-Adad[4,5], Patrick Freund[2,3,6], and Claudia Angela Gandini Wheeler-Kingshott[1,7,8]
		[1]Queen Square MS Centre, University College London, London, United Kingdom, [2]Spinal Cord Injury Center Balgrist, University of Zurich, Zurich, Switzerland, [3]Neurophysics Department, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [4]NeuroPoly Lab, Institute of Biomedical Engineering, Polytechnique Montreal, Montreal, QC, Canada, [5]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montreal, QC, Canada, [6]Wellcome Trust Centre for Neuroimaging, UCL Institute of Neurology, University College London, London, United Kingdom, [7]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [8]Brain MRI 3T Centre, C. Mondino National Neurological Institute, Pavia, Italy
		We present a comparison of cervical cord metrics obtained using both a whole brain and dedicated cord implementation of a recently introduced quantitative multi-parametric MRI protocol which provides apparent proton density, R_1, magnetisation transfer saturation (MT_{sat}) and R_2* maps sensitive to microstructural tissue changes in brain and spinal cord. Similar whole cervical cord (levels C1-C5) parameters were obtained using either protocol, and inter-subject variation was low, however in order to investigate tissue-specific cord parameters the dedicated cord protocol with higher in-plane resolution would be desirable.

672	10:03	^{1}H-[^{13}C]-NMR Investigations of Neuronal and Astroglial Metabolic Activity in Spinal Cord and Brain in Amyotrophic Lateral Sclerosis
		Anant Bahadur Patel[1], Madhuri Puvvada[1], and TK Sampath Kumar [1]
		[1]NMR Microimaging and Spectroscopy, Centre for Cellular and Molecular Biology, Hyderabad, India

		Amyotrophic lateral sclerosis (ALS) is neurodegenerative disorder resulting from selective loss of both upper and lower motor neurons leading to progressive muscle weakness and paralysis. In the present study, we have used ^{1}H-[^{13}C]-NMR spectroscopy in conjunction with infusion of [1,6-$^{13}C_2$]glucose to evaluate neurometabolic activity in SOD1^{G37R} mouse model of ALS. Our finding suggest reduced levels of glutamate, NAA, NAAG, and increased concentration of myo-inositol in spinal cord. More interestingly, the metabolic activity of glutamatergic and GABAergic neurons is decreased in the spinal cord, while it was increased in the cerebral cortex indicating strikingly different pathology in spinal cord and brain.

	10:15	Adjournment & Meet the Teachers

Oral

Advances in MR Fingerprinting

N01	Wednesday 8:15 - 10:15	*Moderators:* Sairam Geethanath & Nicole Seiberlich

673	8:15	Game of Learning Bloch Equation Simulations for MR Fingerprinting
		Mingrui Yang[1], Yun Jiang[1], Dan Ma[1], Bhairav Bipin Mehta[1], and Mark Alan Griswold[1]
		[1]Department of Radiology, Case Western Reserve University, Cleveland, OH, United States
		An MR fingerprinting (MRF) dictionary can be difficult to generate, especially when the dictionary calculation involves complicated physics. We present a new method, named MRF-GAN, based on the generative adversarial network (GAN) to create MR fingerprints. We demonstrate that MRF-GAN can generate accurate MRF fingerprints and the associated in vivo MRF maps comparing to the conventional MRF dictionary. Moreover, it can significantly reduce the dictionary generation time which opens the door to rapid calculation and optimization of MRF dictionaries with more complex physics.

674	8:27	Optimal Experiment Design for Magnetic Resonance Fingerprinting: New Insights and Further Improvements
		Bo Zhao[1,2], Justin P. Haldar[3], Congyu Liao[1], Dan Ma[4], Mark A. Griswold[4], Kawin Setsompop[1,2], and Lawrence L. Wald[1,2]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Chalestown, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Electrical Engineering, University of Southern California, Los Angeles, CA, United States, [4]Radiology, Case Western Reserve University, Cleveland, OH, United States

		The Cramer-Rao bound (CRB) based experiment design was previously described to optimize the SNR efficiency of MRF experiments. Here we revisit such a problem and provide new insights. Specifically, we present a new CRB-based experiment design approach, which introduces an additional set of constraints on the variation of flip angles to enforce the smoothness of the magnetization evolution. We demonstrate that the proposed approach is advantageous for highly-undersampled MRF experiments. We evaluated the effectiveness of the proposed approach with both simulations and phantom experiments.

675	8:39	Cardiac Magnetic Resonance Fingerprinting in Heart Transplant Recipients
		Andrew J Coristine[1,2], Jesse Hamilton[2], Ruud B van Heeswijk[1,3], Roger Hullin[1], and Nicole Seiberlich[2]
		[1]University Hospital (CHUV) / University of Lausanne (UNIL), Lausanne, Switzerland, [2]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [3]Centre for BioMedical Imaging (CIBM), Lausanne, Switzerland
		Cardiac MRF (cMRF) has recently emerged as a method of rapidly characterizing myocardial tissue. It has been shown to be robust to different and varying heart rates with high reproducibility in T_1 and T_2 regardless of the length and regularity of the cardiac cycle. While these techniques have been validated in healthy volunteers, patient studies have yet to be performed. Therefore, in this abstract, we present the first use of cMRF in a patient population - heart transplant recipients - and show initial results.

676	8:51	Learning Contrast Synthesis from MR Fingerprinting
		Patrick Virtue[1,2], Jonathan I Tamir[1], Mariya Doneva[3], Stella X Yu[1,2], and Michael Lustig[1]
		[1]Electrical Engineering and Computer Sciences, University of California, Berkeley, Berkeley, CA, United States, [2]International Computer Science Institute, Berkeley, CA, United States, [3]Philips Research Europe, Hamburg, Germany
		MR fingerprinting provides quantitative parameter maps from a single acquisition, but it also has the potential to reduce exam times by replacing traditional protocol sequences with synthetic contrast-weighted images. We present an **empirical "artifact noise" model** that makes it possible to train neural networks that successfully transform noisy and aliased MRF signals into parameter maps, which are then used to synthesize contrast-weighted images. We also demonstrate that a trained neural network can **directly synthesize** contrast-weighted images, bypassing incomplete simulation models and their associated artifacts.

677	9:03	MR Fingerprinting for High Resolution Metabolic Imaging of Hyperpolarized [1-^{13}C]Pyruvate
		Cornelius von Morze[1], Eugene Milshteyn[1], Peder E. Larson[1], Galen D. Reed[2], John M. Pauly[3], Duan Xu[1], and Daniel B. Vigneron[1]

		[1]Department of Radiology & Biomedical Imaging, UCSF, San Francisco, CA, United States, [2]GE Healthcare, San Francisco, CA, United States, [3]Department of Electrical Engineering, Stanford University, Stanford, CA, United States
		The purpose of this study was to investigate a new application of MR fingerprinting (MRF) methods for hyperpolarized ^{13}C MRI. We show that introducing randomization of pulse parameters into a ^{13}C SSFP acquisition train facilitates efficient extraction of individual hyperpolarized ^{13}C metabolite levels based on their transient signal responses (i.e. "fingerprints"), in simulations as well as phantom and in vivo experiments. Application of MRF methods in this multi-spectral SSFP framework enables exploitation of the long T_2 relaxation times of ^{13}C nuclei for increased sensitivity and spatial resolution in hyperpolarized MRI. Initial results show that MRF approaches have great potential for application to hyperpolarized ^{13}C metabolic imaging.

678	9:15	MR Vascular Fingerprinting during Gas Challenges
		Thomas Christen[1], Wendi W. Ni[1], Jia Guo[1], Audrey P. Fan[1], Michael M. Moseley[1], and Greg Zaharchuk[1]
		[1]Radiology, Stanford University, Stanford, CA, United States
		The MR vascular fingerprinting (MRvF) approach extends the concept of MR fingerprinting to the study of microvascular properties and functions. Encouraging results have been obtained in healthy human volunteers as well as in stroke and tumor models in rats. However, it has been suggested that the method has a low sensitivity to blood oxygenation measurements. In this study, we tested the MRvF approach in healthy volunteers while breathing different gas mixtures (Hyperoxia (100%O_2), Normoxia (21%O_2), hypoxia (14%O_2)) and examined the results when different types of fingerprints are considered.

679	9:27	Correlation of MR fingerprinting with whole mount histopathology reveals epithelial and stromal density drive T1, T2 measurements in regions of prostatitis and prostate cancer: Preliminary findings
		Rakesh Shiradkar[1], Ananya Panda[2], Shivani Pahwa[3], Lin Li[1], Patrick Leo[1], Nafiseh Janaki[4], Lee Ponsky[5], Robin Elliott[4], Vikas Gulani[2,3], and Anant Madabhushi[1]
		[1]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [2]Radiology, Case Western Reserve University, Cleveland, OH, United States, [3]Radiology, University Hospitals, Cleveland, OH, United States, [4]Pathology, University Hospitals, Cleveland, OH, United States, [5]Urology, University Hospitals, Cleveland, OH, United States
		Magnetic Resonance Fingerprinting (MRF) is a new technology aimed at generating quantitative T1 and T2 maps. In this study, histo-morphometric attributes that may be driving the MRF measurements of cancerous and prostatitis regions are explored via correlation of *in vivo* MRF maps with post surgical *ex vivo* histopathology. Our results suggest that epithelial density may be driving T1 and T2 MRF measurements in prostatitis regions while stromal density may be driving the T1 MRF signals within cancerous regions.

680	9:39	Quantification of Long and Ultra-short Relaxation Times in Tissues with Ultra-short TE MR Fingerprinting (UTE-MRF)
		Qing Li[1], Xiaozhi Cao[1], Huihui Ye[1,2], Congyu Liao[1], Hongjian He[1], and Jianhui Zhong[1]
		[1]Center for Brain Imaging Science and Technology, Key Laboratory for Biomedical Engineering of Ministry of Education, College of Biomedical Engineering and Instrumental Science, Zhejiang University, Hangzhou, China, [2]State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China
		Magnetic resonance fingerprinting (MRF) has been combined with ultra-short echo time technique (UTE-MRF) to enable the quantification of ultra-short T_2/T_2* tissues. A TE sinusoidal variation pattern is introduced to UTE-MRF acquisition to improve the ultra-short T_2 detection accuracy to sub-millisecond. With the golden angle spiral acquisition and sliding window reconstruction, quantitative T_1 and T_2 maps of regular and ultra-short T_2/T_2* tissue components are acquired at 14s per slice. Since the B_0 induced phase variation has been encoded into the signal evolution with variable TE, the B_0 map is simultaneously obtained.
681	9:51	Water-Fat Separation in Spiral Magnetic Resonance Fingerprinting using Conjugate Phase Reconstruction
		Kirsten Koolstra[1], Andrew Webb[1], Peter Koken[2], Kay Nehrke[2], and Peter Börnert[1,2]
		[1]Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Philips Research Hamburg, Hamburg, Germany
		Water-fat separation can improve the quality of tissue parameter maps in quantitative imaging methods such as Magnetic Resonance Fingerprinting (MRF). We propose such a technique that uses the B_0 map as prior information for spiral off-resonance correction through conjugate phase reconstruction, enabling efficient water-fat separation with only two echo points per frame, implemented in a single run MRF approach. With this technique, accurate tissue parameter maps can be produced in the presence of fat.
682	10:03	Repeatability of 2D FISP MR Fingerprinting in the Brain at 1.5T and 3.0 T
		Guido Buonincontri[1,2], Laura Biagi[1,3], Alessandra Retico[2], Michela Tosetti[1,3], Paolo Cecchi[4], Mirco Cosottini[1,4,5], Pedro A Gómez[6], Rolf F Schulte[7], Mary McLean[8], Frank Riemer[9], Ferdia Gallagher[9], Martin J Graves[9], and Joshua D Kaggie[9]
		[1]IMAGO7 Foundation, Pisa, Italy, [2]National Institute for Nuclear Physics, Pisa, Italy, [3]IRCCS Fondazione Stella Maris, Pisa, Italy, [4]Unit of Neuroradiology, AOUP, Pisa, Italy, [5]Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy, [6]Department of Computer Science, Technische Universitat Munchen, Munich, Germany, [7]GE Healthcare, Munich, Germany, [8]Cancer Research UK Cambridge Institute, University of Cambridge, UK, Cambridge, United Kingdom, [9]Department of Radiology, University of Cambridge, Cambridge, United Kingdom

		MR Fingerprinting is a new multi-contrast imaging method that is appealing for its ability to acquire multiple quantitative maps efficiently when compared to other repeated acquisitions varying a single parameter at a time. This work shows our first demonstration of MRF in vivo repeatability through test/re-test imaging of seven healthy human volunteers at 1.5T and 3.0T. We found the group root-mean-square-difference (NRMSD) of MRF-SSFP T1 measurements to be 5-6% in grey and white matter at 1.5T and 4-5% at 3.0T, T2 NRMSD to be 6-9% at 1.5T and 11-13% at 3.0T, and PD NRMSD to be 2-3% at 1.5T and 2-3% at 3.0T.

Oral

Velocity & Flow

N02	Wednesday 8:15 - 10:15	*Moderators:* Emilie Bollache & Alejandro Roldan-Alzate

683	8:15	Comprenhensive analysis of Hemodynamics parameters in patients with bicuspid aortic valve using 4D flow data and a finite element method.
		Julio Sotelo[1,2], Lydia Dux-Santoy[3], Andrea Guala[3], Aroa Ruiz-Muñoz[3], Arturo Evangelista[3], Joaquín Mura[1], Daniel E Hurtado[4,5], José Rodríguez-Palomares[3], and Sergio Uribe[1,4,6]
		[1]Biomedical Imaging Center, Pontificia Universidad Católica de Chile, Santiago, Chile, [2]Department of Electrical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [3]Department of Cardiology, Hospital Universitari Vall d´Hebron, Vall d´Hebron Institut de Recerca (VHIR), Universitat Autònoma de Barcelona, Barcelona, Spain, [4]Institute for Biological and Medical Engineering, Schools of Engineering, Medicine and Biological Sciences, Pontificia Universidad Católica de Chile, Santiago, Chile, [5]Department of Structural and Geotechnical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [6]Department of Radiology, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile
		Bicuspid aortic valve (BAV) is the most common congenital cardiac defect. Current criteria to support surgical decision in BAV patients has been recently questioned, which motivates the development of better biomarkers to assess the disease stage of development. In this work, we extensively analyze several hemodynamics parameters in volunteers and BAV patients from 4D flow MRI using a finite-element-based quantification framework. We found that the backward velocity fraction, the circumferential WSS, and turbulence parameters, can be used together with the diameters of the vessel as a new risk marker, as it can strongly discriminate subjects from BAV patients.

684	8:27	Accelerated abdominal 4D flow MRI using 3D golden-angle cones trajectory
		Christopher M. Sandino[1], Joseph Y. Cheng[2], Marcus T. Alley[2], Michael Carl[3], and Shreyas S. Vasanawala[2]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States, [3]Applied Sciences Laboratory, GE Healthcare, San Diego, CA, United States

		4D flow MRI enables comprehensive abdominal evaluation, but long acquisition times and motion corruption limit its clinical applicability. To address these limitations, we present a 4D flow sequence with a 3D golden-angle reordered cones sampling trajectory. Cones has high sampling efficiency to allow for vastly accelerated scan times, and excellent aliasing properties that diffuse respiratory and bowel motion artifacts. To further improve motion-robustness, respiratory signals are estimated from each cone readout, and then used to suppress motion during reconstruction. We show that these techniques can be combined to achieve high quality abdominal 4D flow renderings in under 5 minutes.

685	8:39	PC-MRI with Phase Recovery from Multiple Wrapped Measurements (PRoM) Shen Zhao[1], Lee C Potter[1], Ning Jin[2], Yingmin Liu[3], Orlando P Simonetti[4], and Rizwan Ahmad[5] *[1]Electrical and Computer Engineering, The Ohio State University, Columbus, OH, United States, [2]Cardiac MR R&D, Siemens Medical Solutions USA, Inc., Columbus, OH, United States, [3]Richard M. Ross Heart Hospital, The Ohio State University, Columbus, OH, United States, [4]Internal Medicine, The Ohio State University, Columbus, OH, United States, [5]Biomedical Engineering, The Ohio State University, Columbus, OH, United States* In traditional phase-contrast MRI (PC-MRI), the strength of velocity encoding gradient (VENC) offers a tradeoff between the velocity-to-noise ratio (VNR) and the extent of phase wrapping. In contrast, dual-VENC (DV) acquisition achieves the VNR associated with lower of the two VENCs, with higher VENC measurement solely used to perform phase unwrapping[1]. Here, we demonstrate that the phase unwrapping can be more effective from two low-VENC measurements, where both VENC values are below the peak velocity. The proposed method, called Phase Recovery from Multiple wrapped measurements (PRoM), enables computationally simple yet near-optimal estimation of unwrapped phase (velocity) from multiple wrapped measurements.

686	8:51	Inefficient Right Heart Function in Preterm Adults as shown with 4D Flow MRI Jacob A Macdonald[1], Greg Barton[2], Arij G Beshish[2], Kara N Goss[2], Marlowe W Eldridge[2], Christopher J Francois[3], and Oliver Wieben[1,3] *[1]Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [2]Pediatrics, University of Wisconsin - Madison, Madison, WI, United States, [3]Radiology, University of Wisconsin - Madison, Madison, WI, United States* Infants born preterm often have impaired pulmonary function, but little is known regarding long-term implications on right-heart function as these patients reach adulthood. We performed 4D flow MRI during rest and exercise in young adults born preterm and age-matched controls to compare their right heart function and efficiency. While flow and velocity in the pulmonary artery appeared similar in both groups, preterm subjects demonstrated increased kinetic energy in the right ventricle (RV) per unit of ejected blood. Pathline visualizations in the right ventricle suggested less structured filling during diastole. These data suggests decreased RV efficiency in preterm adults.

687	9:03	Highly accelerated 4D flow in the aorta with compressed sensing, respiratory controlled adaptive k-space reordering and inline reconstruction
		Ning Jin[1], Liliana Ma[2,3], Kelvin Chow[2,4], Christoph Forman[5], Andreas Greiser[5], Susanne Schnell[2], Alex Barker[2], and Michael Markl[2,3]
		[1]Cardiovascular MR R&D, Siemens Medical Solutions USA, Inc., Columbus, OH, United States, [2]Department of Radiology, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [3]Department of Biomedical Engineering, Northwestern University, Chicago, IL, United States, [4]Cardiovascular MR R&D, Siemens Medical Solutions USA, Inc., Chicago, IL, United States, [5]Siemens Healthcare, Erlangen, Germany
		The clinical application of 4D flow is limited by its long acquisition time. Recently, sparse sampling and compressed sensing (CS) reconstruction have been combined with 4D flow to speed up the image acquisition. However, most of CS reconstructions are implemented offline with long reconstruction times, making them infeasible for use in clinical settings. We developed a highly accelerated 4D flow with CS and Respiratory Controlled Adaptive k-space Reordering (ReCAR) acquisition to enable a 3-minute aortic protocol with isotropic 2.5mm voxels and fast 5-minute inline reconstruction. Initial volunteer tests show a good match of flow quantification results with the conventional technique.

688	9:15	Real-time and self-gated flow using a golden-angle spiral trajectory
		Rajiv Ramasawmy[1], Adrienne E. Campbell-Washburn[2], Robert J. Lederman[1], and Daniel Herzka[1]
		[1]Cardiovascular Interventions Program, National Heart, Lung & Blood Institute, Bethesda, DC, United States, [2]Biochemistry and Biophysics Center, National Heart, Lung & Blood Institute, Bethesda, DC, United States
		Beat-to-beat measurements of cardiac output have been demonstrated as a valuable diagnostic tool during interventional cardiovascular MR procedures with physiological provocations such as exercise. This preliminary study investigates the potential of golden-angle spiral imaging for combined real-time and retrospectively-binned flow measurements at rest and during exercise. In flow phantoms and human subjects, good agreement was observed between reference Cartesian measurements and self-gated spiral acquisitions at rest. During exercise, real-time and self-gated spiral imaging measured an increase in cardiac output, demonstrating this technique's potential application to interventional MRI.

689	9:27	Multi-vendor validation and reproducibility of 4D flow MRI using 4-fold parallel imaging acceleration with and without respiratory gating
		Johannes Töger[1], Jelena Bock[1], Sebastian Bidhult[1,2], Karin Markenroth Bloch[3,4], Mikael Kanski[1], Håkan Arheden[1], Frederik Testud[5], Andreas Greiser[6], Einar Heiberg[1,2], and Marcus Carlsson[1]

		[1]Clinical Physiology, Department of Clinical Sciences, Skane University Hospital, Lund University, Lund, Sweden, [2]Department of Biomedical Engineering, Faculty of Engineering, Lund University, Lund, Sweden, [3]Lund University Bioimaging Center, Lund University, Lund, Sweden, [4]Philips Healthcare, Lund, Sweden, [5]Siemens Healthcare AB, Malmö, Sweden, [6]Siemens Healthcare GmbH, Erlangen, Germany
		4D-flow sequences on two 1.5T scanners from different vendors (Philips Achieva dStream and Siemens MAGNETOM Aera) were validated head-to-head. 4D-flow in a pulsatile flow phantom showed high accuracy and precision compared to reference laser particle image velocimetry for both scanners. 2D-flows in ascending and descending aorta and pulmonary trunk were compared to 57 4D-flow scans in 10 subjects. Lower bias for flow volumes was found on Aera (-4.7±12.5%) compared to Achieva (-18.0±20.1%). Kinetic energy showed lower bias for repeated examinations at the same scanner compared to different scanners the same day. 4D-flow without respiratory gating on Aera showed acceptable quality.

690	9:39	Hemodynamic Assessment of the Post-Myocardial Infarction Left Ventricle with 4D Flow MRI
		Philip A Corrado[1], Niti R Aggarwal[2], Jacob A Macdonald[1], Jonathan W Weinsaft[3,4], Christopher J Francois[2,5], and Oliver Wieben[1,5]
		[1]Medical Physics, University of Wisconsin-Madison, Madison, WI, United States, [2]Medicine, University of Wisconsin-Madison, Madison, WI, United States, [3]Medicine, Weill Cornell Medical College, New York, NY, United States, [4]Radiology, Weill Cornell Medical College, New York, NY, United States, [5]Radiology, University of Wisconsin-Madison, Madison, WI, United States
		This work employed high resolution time resolved (4D) flow cardiac MRI (CMR) to characterize altered left ventricular (LV) flow physiology after anterior myocardial infarction (MI). 4D Flow CMR was used to quantify LV velocity (parallel to the LV long axis) at pre-specified landmarks in the basal, mid, and apical LV. Post-MI patients with impaired global LV function had reduced peak systolic velocity in all regions compared to age-matched controls ($p<0.05$). A difference in flow patterns between the LV base and apex was also discerned in post-MI patients, characterized by a marked reduction and prolongation of forward flow in the apex.

691	9:51	4D flow MRI Improves Dissection Flap Fenestration Detection in Type B Aorta Dissection
		Bradley D Allen [1], Amir Ali Rahsepar[1], Alex J Barker[1], James C Carr[1], Jeremy D Collins[1], and Michael Markl[1,2]
		[1]Radiology, Northwestern University, Chicago, IL, United States, [2]Biomedical Engineering, Northwestern University, Chicago, IL, United States

		Type B aortic dissections involve the aortic arch/descending aorta with false lumen patency/thrombosis, and size of entry tears identified as predictors of adverse events. These parameters suggest a complex hemodynamic environment that is poorly assessed by current diagnostic tools. The presence of additional fenestrations in the dissection flap likely also alters false lumen hemodynamics. 4D flow MRI offers a comprehensive assessment of 3D aortic hemodynamics in type B dissection. Our results demonstrate that 4D flow can detect nearly two-times the number of dissection flap fenestrations relative to time-resolved MRA, suggesting the potential for improved hemodynamic characterization of these patients.

692	10:03	Comprehensive 3D flow characterization in patients with Dilated Cardiomyopathy from 4D flow MRI data using a finite element method and 17-Segment Bullseyes
		Pamela Alejandra Franco[1,2], Julio Sotelo[1,2], Bram Ruijsink3[3], David Nordsletten[3], Eric Kerfoot[3], Joaquín Mura[4], Daniel Hurtado[5], and Sergio Uribe[2,6]
		[1]Department of Electrical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [2]Biomedical Imaging Center, Pontificia Universidad Católica de Chile, Santiago, Chile, [3]Department of Biomedical Engineering, King's College London, London, United Kingdom, [4]Pontificia Universidad Católica de Chile, Santiago, Chile, [5]Department of Structural and Geotechnical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [6]Department of Radiology, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile
		Dilated Cardiomyopathy (DCM) is a disease of the heart muscle characterized by the enlargement of the left ventricle and systolic/ diastolic dysfunction. Cardiac Magnetic resonance (CMR) is the gold standard to measure cardiac function using b-SSFP CINE images1. However, hemodynamic parameters within the ventricles have received less attention. In this work, we present a method that allows a comprehensive assessment of different flow parameters in the left ventricle of DCM patients using a finite element framework over 4D flow data sets.

Oral

Segmentation & Parcellation in the Brain

N03	Wednesday 8:15 - 10:15	*Moderators:* Anders Dale & Timothy Shepherd

693	8:15	Self-Organising Maps Enable Global Searching For Patch Based Segmentations
		Lee B Reid[1], Alex Pagnozzi[1], Suzannah V Cooper[1], Stephen E Rose[1], and Jurgen Fripp[1]
		[1]The Australian e-Health Research Centre, Commonwealth Science and Industrial Research Organisation, Brisbane, Australia

		Most automated MRI tissue-segmentation techniques require whole-brain atlases, which are extremely time-consuming to manually delineate. This inhibits utilisation of complementary structural sequences during segmentation as matching atlases rarely exist. We demonstrate a means of reducing the computational complexity of patch-based segmentation using self-organising maps. This overcomes the need for local-only searching of matching patches and, in turn, the need for complete atlases. We demonstrate this technique's ability to perform registration-free tissue-segmentation of target images using an atlas that is less than 2% complete. The technique may be used as-is, or for rapidly generating novel whole-brain atlases for other techniques.

694	8:27	Bayesian Deep Learning for Uncertainty Generation in MR Image Segmentation
		Gengyan Zhao[1], Fang Liu[2], Mary E. Meyerand[1,3], and Rasmus M. Birn[1,4]
		[1]Department of Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [2]Department of Radiology, University of Wisconsin - Madison, Madison, WI, United States, [3]Department of Biomedical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [4]Department of Psychiatry, University of Wisconsin - Madison, Madison, WI, United States
		The ability of generating model uncertainty for a predictive system on each prediction is crucial for decision-making, especially in the field of medicine, but it has been a missing part in conventional deep learning models. We propose the utilization of Bayesian deep learning, which combines Monte Carlo dropout layers with the original deep neural network at testing time to enable model uncertainty generation. Its prediction accuracy and the behavior of uncertainty were studied on MRI brain extraction. Its segmentation accuracy outperforms 6 popular methods, and the uncertainty's reactions to different training set sizes and inconsistent training labels meet the expectation well.

695	8:39	Automated Segmentation of Cerebellar Nuclei from Ultra-High-Field Quantitative Susceptibility Maps with Multi-Atlas Shape Fusion
		Pierre-Louis Bazin[1,2,3], Andreas Deistung[4], Andreas Schäfer[5], Robert Turner[1,3], Jürgen Reichenbach[4], and Dagmar Timmann[6]
		[1]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands, [2]Netherlands Institute for Neuroscience, Amsterdam, Netherlands, [3]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [4]Medical Physics Group, Jena University Hospital, Jena, Germany, [5]Siemens Healthcare GmbH, Erlangen, Germany, [6]Department of Neurology, Essen University Hospital, University of Duisburg-Essen, Essen, Germany
		Multi-atlas segmentation techniques fail to properly represent very small nuclei because of their low overlap in the fusion stage. We present a shape modeling approach that recovers more accurately such small structures, which we apply to the segmentation of the deep cerebellar nuclei.

696	8:51	Automatic MS lesion segmentation in the spinal cord using deep learning

Charley Gros[1], Atef Badji[1,2], Josefina Maranzano[3], Ren Zhuoquiong[4], Yaou Liu[4,5], Elise Bannier[6,7], Anne Kerbrat[7,8], Gilles Edan[8], Pierre Labauge[9], Virginie Callot[10,11], Jean Pelletier[11,12], Bernard Audoin[11,12], Henitsoa Rasoanandrianina[10,11], Paola Valsasina[13], Massimo Filippi[13], Rohit Bakshi[14], Shahamat Tauhid[14], Ferran Prados[15], Marios Yiannakas[15], Hugh Kearney[15], Olga Ciccarelli[15], Sridar Narayanan[3], and Julien Cohen-Adad[1,16]

[1]NeuroPoly Lab, Polytechnique Montreal, Montréal, QC, Canada, [2]Faculty of Medicine, University of Montreal, Montreal, QC, Canada, [3]Montreal Neurological Institute, Montreal, QC, Canada, [4]Department of Radiology, Beijing Tiantan Hospital, Capital Medical University, Beijing, China, [5]Department of Radiology, Xuanwu Hospital, Capital Medical University, Beijing, China, [6]Department of Radiology, University Hospital of Rennes, Rennes, France, [7]Univ Rennes, Inria, CNRS, Inserm, IRISA UMR 6074, VISAGES ERL U-1228, F-35000, Rennes, France, [8]Department of Neurology, University Hospital of Rennes, Rennes, France, [9]University Hospital of Montpellier, Montpellier, France, [10]CRMBM, CNRS, Aix-Marseille University, Marseille, France, [11]CEMEREM, Hôpital de la Timone, AP-HM, Marseille, France, [12]Department of Neurology, CHU Timone, APHM, Marseille, France, [13]Neuroimaging Research Unit, INSPE, Division of Neuroscience, San Raffaele Scientific Institute, Vita-Salute San Raffaele University, Milan, Italy, [14]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States, [15]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [16]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montreal, QC, Canada

Detection of multiple sclerosis (MS) lesions in the spinal cord is clinically important for diagnosis and disease progression assessment. Although several automatic segmentation methods have been proposed for brain lesions, these methods cannot be directly applied to spinal lesions. We propose a fully automatic pipeline based on deep learning to segment the spinal cord and spinal MS lesions, and validate it against a dataset of T_2-w images (265 patients from 5 centers). The proposed cord segmentation achieved better results than the current state-of-the-art, and lesion segmentation yielded a median Dice of 63.4%. The pipeline will be available as open-source.

697 9:03 Automated segmentation of calibration regions for pediatric whole brain T1- and T2-weighted ratio myelin mapping

Jian Chen[1], Joseph Yuan-Mou Yang[1,2,3], Michelle Hao Wu[4], Simone Mandelstam[4,5,6,7], Richard Leventer[2,8], Deanne Thompson[1,9,10], Bonnie Alexander[1,9], Michael Kean[1,4], Peter J Anderson[9,11], Marc L Seal[1,5], and Richard Beare[1,12]

[1]Developmental Imaging, Murdoch Children's Research Institute, Melbourne, Australia, [2]Neuroscience Research, Murdoch Children's Research Institute, Melbourne, Australia, [3]Neurosurgery, The Royal Children's Hospital, Melbourne, Australia, [4]Medical Imaging, The Royal Children's Hospital, Melbourne, Australia, [5]Paediatrics, University of Melbourne, Melbourne, Australia, [6]Radiology, University of Melbourne, Melbourne, Australia, [7]Epilepsy, Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, [8]Neurology, The Royal Children's Hospital, Melbourne, Australia, [9]Victorian Infant Brain Study (VIBeS), Murdoch Children's Research Institute, Melbourne, Australia, [10]Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, [11]School of Psychological Sciences, Monash University/Monash Institute of Cognitive and Clinical Neurosciences, Melbourne, Australia, [12]Medicine, Monash University, Melbourne, Australia

		Delineation of calibration regions is a key component of the T1w/T2w ratio myelin mapping approach. The existing method implemented in *SPM* was not designed for pediatric MRI application. We have developed an automated approach that is able to reliably segment appropriate calibration regions in the pediatric populations- the CSF and scalp fat layer. Using two pediatric MRI datasets, we demonstrated reliability of our segmentation method and the low variance of regional T1w/T2w ratios than the existing method. Our proposed calibration method has potential to be implemented in pediatric myelination studies using the whole brain T1w/T2w ratio technique.

698	9:15	Brain Tissue Segmentation and Subcortical Parcellation: How Reliable Are Different Tools?
		Ariane Fillmer[1], Andre Kuehne[2], Laura Goeschel[3], Theresa Köbe[3], Agnes Flöel[3,4], and Bernd Ittermann[1]
		[1]Physikalisch-Technische Bundesanstalt (PTB), Berlin, Germany, [2]MRI.Tools GmbH, Berlin, Germany, [3]Department of Neurology, Charité - Universitätsmedizin Berlin, Berlin, Germany, [4]Department of Neurology, University Medicine Greifswald, Greifswald, Germany
		Volume based morphometry is a well-established tool to investigate changes of brain structures in neurodegenerative diseases, and a variety of implementations is available. With MRI investigations as an indispensable instrument for diagnosis and disease progress monitoring, the question about reliability and robustness of these tools arises. This work examines the accuracy of CAT 12 and FreeSurfer by comparing a selection of their calculated subcortical volumes to a ground truth.

699	9:27	A novel strategy for automated near-real-time segmentation of the ventral-intermediate (VIM) nucleus for deep brain stimulation (DBS) surgery
		Francis Tyson Thomas[1], Willard Kasoff[2], and Manojkumar Saranathan[3]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Surgery, University of Arizona, Tucson, AZ, United States, [3]Medical Imaging, University of Arizona, Tucson, AZ, United States
		Direct visualization of thalamic nuclei using MRI has been challenging for applications such as Deep Brain Stimulation (DBS) surgery for treatment of essential tremor, where the ventral intermediate (VIM) nucleus is targeted. Current methods are mainly based on Diffusion Tensor Imaging (DTI) which is limited by low spatial resolution and distortion of EPI as well as manual post processing such as seeding specific areas to identify the cerebro thalamic tract. We have developed a novel strategy that combines a white-matter nulled MPRAGE sequence followed by fast near-real time automated segmentation of thalamic nuclei, which can be tailored for each patient for accurate targeting of the VIM nucleus.

700	9:39	Convolutional neural network based segmentation of the the spinal cord and intramedullary injury in acute blunt spinal cord trauma
		David B McCoy[1,2], Sara M Dupont[1], Charley Gros[3], Jared Narvid[1], Julien Cohen-Adad[3], and Jason F Talbott[1,2]

		[1]Radiology and Biomedical Imaging, Zuckerberg San Francisco General Hospital and UCSF, San Francisco, CA, United States, [2]Brain and Spinal Injury Center, San Francisco, CA, United States, [3]Institute of Biomedical Imaging, NeuroPoly Lab, Polytechnique Montreal, Montreal, QC, Canada
		This study aims to develop and validate a convolutional neural network for automatic segmentation of the spinal cord (SC) and intramedullary injury in acute blunt SC trauma patients. Using image augmentation of the axial slice cross section and U-net architecture, we were able to achieve a dice coefficient for SC segmentation of 0.92. The same network architecture was also able to identify areas of intramedullary injury. This is the first study to accurately segment the acute blunt trauma SC. Automatic segmentation of the SC in this population makes automatic biomarker analysis and quantitative prognostication of outcomes possible for SC injury.

701	9:51	High resolution T1-weighted brain imaging and segmentation at 7T: a travelling head study
		Olivier E. Mougin[1], William T Clarke[2], Ian Driver[3], Catarina Rua[4], Adrian Carpenter[4], Susan Francis[1], Keith Muir[5], Richard Wise[3], Stuart Clare[2], and Richard Bowtell[1]
		[1]School of Physics and Astronomy, University of Nottingham, Sir Peter Mansfield Imaging Centre, Nottingham, United Kingdom, [2]Nuffield Department of Clinical Neurosciences, University of Oxford, Wellcome Centre for Integrative Neuroimaging (FMRIB), Oxford, United Kingdom, [3]School of Psychology, Cardiff University, Cardiff University Brain Research Imaging Centre, Cardiff, United Kingdom, [4]Department of Clinical Neurosciences, University of Cambridge, Wolfson Brain Imaging Centre, Cambridge, United Kingdom, [5]University of Glasgow, Institute of Neuroscience & Psychology, Glasgow, United Kingdom
		Ultra-high magnetic field (7T) MRI scanners can provide high spatial resolution images and excellent contrast for classifying brain tissue in vivo, but imaging reproducibility and tissue segmentation between sites is key for multi-site studies. Here, we present a travelling-head study focusing on the harmonized acquisition and segmentation of T_1-weighted images acquired on three subjects at 0.7mm^3 isotropic resolution at four different 7T sites. The aim of the study is to assess the harmonisation and robustness of the MPRAGE and MP$_2$RAGE sequence across sites, by focusing on segmentation reproducibility and T_1 estimation.

702	10:03	First Application of Automated Hippocampal Subfield Segmentation using 7T MRI in Patients with Major Depressive Disorder
		Judy Alper[1,2], Rui Feng[3], Hadrien Dyvorne[1], Long Xie[4], Marin Kautz[5], Hung-Mo Lin[6], Bradley N Delman[7], Patrick Hof[8], James Murrough[5,8], and Priti Balchandani[1]
		[1]Radiology, Icahn School of Medicine At Mount Sinai, New York, NY, United States, [2]Biomedical Engineering, City College of New York, New York, NY, United States, [3]Neurosurgery, Icahn School of Medicine At Mount Sinai, New York, NY, United States, [4]Biomedical Engineering, University of Pennsylvania, Philadelphia, PA, United States, [5]Psychiatry, Icahn School of Medicine At Mount Sinai, New York, NY, United States, [6]Population Health Science and Policy Department, Icahn School of Medicine At Mount Sinai, New York, NY, United States, [7]Radiology, Mount Sinai Medical Center, New York, NY, United States, [8]Neuroscience, Icahn School of Medicine At Mount Sinai, New York, NY, United States

		Major depressive disorder (MDD) is a debilitating illness, which is widely prevalent. There is a need to elucidate MDD pathophysiology to better target treatment. Studies have shown association between hippocampal subfield volumes and MDD, making the subfields potential biomarkers. We use high-resolution 7T-MRI to perform effective subfield delineations and evaluate subfield volume differences between sixteen patients and sixteen controls. Using automatic segmentation of hippocampal subfields software revealed a trend towards reduced right-CA1 and right-DG subfield volumes in patients compared to controls. Identifying hippocampal subfield volumes as imaging biomarkers for MDD may help design more targeted treatments for the disease.

Oral

Cutting-Edge Acquisition Methods in fMRI

N04	Wednesday 8:15 - 10:15	*Moderators:* Luis Hernandez-Garcia & Nadine Graedel

703	8:15	A Novel Method for Direct Detection and Spatial Mapping of Neuronal Activity
		Jeongtaek Lee[1], Seung-Kyun Lee[1,2], and Jang-Yeon Park[1,2]
		[1]Department of Biomedical Engineering, Sungkyunkwan University, Suwon, Republic of Korea, [2]Center for Neuroscience Imaging Research, Institute for Basic Science (IBS), Suwon, Republic of Korea
		Although BOLD-fMRI is widely used for in-vivo functional brain mapping, there has been continuing interest in the possibility of using MRI to directly detect the neuronal activity. However, previous works failed to reach a clear consensus on that possibility. Here, we proposed a novel method for direct detection and spatial mapping of neuronal activity with temporal resolution on the order of the action-potential duration(4~5ms). We demonstrated its feasibility using an ex-vivo squid axon and an insulated copper-wire in an event-related electrical-stimulation paradigm. The results are very exciting and promising, although the underlying contrast mechanism needs to be elucidated.

704	8:27	Mapping Neural Circuitry at High Speed (10Hz) using functional Magnetic Resonance Elastography (fMRE)
		Samuel Patz[1,2], Daniel Fovargue[3], Katharina Schregel[1,2,4], Navid Nazari[5], Miklos Palotai[1,2], Paul E. Barbone[6], Ben Fabry[7], Alexander Hammers[3], Sverre Holm[8], Sebastian Kozerke[9], David Nordsletten[3], and Ralph Sinkus[3]
		[1]Radiology, Brigham & Women's Hospital, Boston, MA, United States, [2]Radiology, Harvard Medical School, Boston, MA, United States, [3]Imaging Sciences and Biomedical Engineering, Kings College London, London, United Kingdom, [4]Neuroradiology, University Medical Center Goettingen, Goettingen, Germany, [5]Biomedical Engineering, Boston University, Boston, MA, United States, [6]Mechanical Engineering, Boston University, Boston, MA, United States, [7]Physics, University of Erlangen, Erlangen, Germany, [8]Informatics, University of Oslo, Oslo, Norway, [9]Biomedical Engineering, ETH, Zurich, Switzerland

		Using MR elastography, the shear modulus of a mouse brain was monitored during noxious stimulation. Localized changes in tissue elasticity of >10% were observed in previously identified regions associated with noxious stimuli. The observed mechanical response persists over two decades of stimulus frequencies from 0.1-10 Hz. This demonstrates the mechanism behind the change in stiffness is not of vascular origin, which has a much slower response than 10Hz. but rather is either directly related to, or tightly coupled to primary neuronal activity. This opens a new window to explore the spatio-temporal processing of signals in the brain.

705	8:39	Hypercapnia-induced vasodilatation increases brain stiffness
		Stefan Hetzer[1,2], Karl Bormann[1], Florian Dittmann[3], Philipp Sonnenschein[1,2], Sebastian Hirsch[1,2], Jürgen Braun[4], and Ingolf Sack[3]
		[1]Berlin Center for Advanced Neuroimaging, Charité - Universitätsmedizin Berlin, Berlin, Germany, [2]Bernstein Center for Computational Neuroscience, Berlin, Germany, [3]Institute of Radiology, Charité - Universitätsmedizin Berlin, Berlin, Germany, [4]Institute of Medical Informatics, Charité - Universitätsmedizin Berlin, Berlin, Germany
		Cerebral MR elastography paired with arterial spin labelling was applied to a group of healthy male subjects during a hypercapnia challenge to analyze the interrelation between cerebral blood flow and mechanical properties of brain tissue in vivo. Hypercapnia-induced vasodilation and the associated increase in blood perfusion was accompanied by a highly significant increase in global cerebral stiffness by 3% (p<0.0001).

706	8:51	High resolution single-vessel fMRI with the radial encoding method
		Yuanyuan Jiang[1], Patricia Pais[1,2], Rolf Pohmann[1], and Xin Yu[1]
		[1]Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [2]Graduate Training Centre of Neuroscience, Tübingen, Germany
		A golden angle radial encoding (GARE) method was implemented to map BOLD signal from individual venules penetrating the rat somatosensory cortex with 50 μm spatial resolution. This real-time acquisition method makes it possible to detect the hemodynamic signal from individual vessel with much finer spatial scale than previously reported methods. It also provides high flexibility to define the field of view to only focus on the activated brain regions and increase the sampling rate for fMRI imaging. This GARE method improves the existing single vessel fMRI method with higher spatiotemporal resolution.

707	9:03	Functional sodium (23Na) MRI at 7T - Extracellular sodium decreases during cortical activation in the Human brain
		Jean-Philippe RANJEVA[1,2], Mark BYDDER[1], Benjamin RIDLEY[1], Manon SOUBRIER[1], Marie BERTINETTI[1], Maxime GUYE[1], Lothar SCHAD[3], and Wafaa ZAARAOUI[1]

		[1]Aix-Marseille Univ, CNRS, CRMBM, Marseille, France, [2]AP-HM, Timone Uinv Hospital, CEMEREM, Marseille, France, [3]Computer Assisted Clinical Medicine, Centre for Biomedicine and Medical Technology Mannheim, Heidelberg University, Mannheim, Germany
		Using dynamic multiecho 3D ^{23}Na MRI with a temporal resolution of 25s, we demonstrated that functional ^{23}Na MRI at 7T was sensitive enough to observe non-invasively in the Human brain, sodium signal variations during a conventional hand motor task. This acquisition performed at 3 different TEs showed that the closest spatial pattern of sodium signal changes relative to BOLD activation was the decrease of ^{23}Na signal at long TE (19ms) assuming to mostly reflect the extracellular sodium changes. This work opens a new ear to better understand normal and abnormal activity-dependent metabolic coupling in the neuro-glia-vasculature ensemble.

708	9:15	BOLD fMRI with 0.5 mm isotropic voxel size and minimal in-plane distortion using 3D planes-on-a-paddlewheel (POP) EPI at 7 Tesla
		Saskia Bollmann[1], Daniel Staeb[1], and Markus Barth[1]
		[1]Centre for Advanced Imaging, The University of Queensland, Brisbane, Australia
		High spatial resolution is essential for blood oxygenation level dependent fMRI of laminar or columnar structures and a voxel size of 0.5 mm would be desirable. With common 2D EPI acquisitions this leads to prohibitively long readout trains, echo times and high in-plane distortions. We therefore propose a 3D POP EPI with minimal in-plane distortion and an echo time dependent on the number of slices that can achieve 0.5 mm isotropic resolution. We further investigate analysis methods based on classical and Bayesian statistical inference for this high-resolution data and show the gained sensitivity when using the Bayesian inference scheme.

709	9:27	Blood-volume imaging using GRASE-VASO at ultra-high field for layer specific fMRI in human brain
		Tetiana Dadakova[1], Alexander Beckett[1], An Thanh Vu[2], Jonathan Polimeni[3,4,5], and David Feinberg[1,6]
		[1]Helen Wills Neuroscience Institute, University of California, Berkeley, Berkeley, CA, United States, [2]Center for Imaging of Neurodegenerative Diseases, Veteran Affairs Health Care System, San Francisco, CA, United States, [3]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [4]Department of Radiology, Harvard Medical School, Boston, MA, United States, [5]Harvard-MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States, [6]Advanced MRI Technologies, LLC, Sebastopol, CA, United States

		Cortical layer-dependent fMRI opens new possibilities for studying neuronal circuitry. Gradient-echo BOLD contrast, which is commonly used for fMRI, suffers from decreased spatial specificity due to BOLD contrast arising in large draining veins. Vascular space occupancy (VASO) and gradient and spin echo (GRASE) acquisition techniques were shown to improve spatial specificity. Here, the technique to acquire BOLD-corrected GRASE-VASO images and its application to fMRI in human motor cortex at 7T are presented. The results suggest increased spatial specificity as compared to EPI-VASO, which could be beneficial for layer-dependent fMRI applications.

710	9:39	Turbo VSASL: slice- and velocity-selective ASL for high temporal resolution functional CBF mapping
		Divya S Bolar[1,2], Jonathan Polimeni[1,2], Ned Ohringer[1,2], Elfar Adalsteinsson[3], and Bruce R Rosen[1,2]
		[1]MGH/HST Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [2]Radiology, Massachusetts General Hospital, Boston, MA, United States, [3]Electrical Engineering and Computer Science, MIT, Cambridge, MA, United States
		Velocity selective (VS) ASL theoretically allows high temporal resolution functional CBF mapping, since the arterial tag is immediately delivered to target microvascultature. This is in contrast to conventional ASL, which suffers from transit delays that limit minimum TR to about one second. VSASL, however, employs a nonselective VS tagging scheme, resulting in incomplete T1 recovery of tagged blood away from the imaging slice, and subsequent signal loss at low TRs. In this study, we introduce a slice-selective VS tag to mitigate T1 recovery effects, and for the first time demonstrate subsecond functional CBF mapping of the visual cortex. The approach is dubbed “Turbo VSASL”.

711	9:51	Band-free whole-brain alternating SSFP fMRI provides distortion-free activation maps in the visual cortex at 7T
		Olivier Reynaud[1], Ileana Ozana Jelescu[1], and Rolf Gruetter[1]
		[1]Center for Biomedical Imaging (CIBM), EPFL, Lausanne, Switzerland
		Although the potential of bSSFP for fMRI has been previously demonstrated, the use of bSSFP remains limited at high field due to the presence of banding artefacts. We demonstrate here that a modified bSSFP sequence with alternating phase cycles (0/180°) can provide distortion-free and band-free fMRI images at 7 Tesla with a wide coverage (72 mm), and temporal / spatial resolution that match that of conventional EPI (2 mm isotropic, TRvolume=1.7 s), by combining water-selective spectro-spatial pulses and very high undersampling (12-fold) coupled with controlled aliasing (CAIPIRINHA).

712	10:03	Simultaneous Acquisition reveals Functional Connectivity in Brain and Spinal Cord
		Christine S Law[1], Ken Weber[1], Haisam Islam[1], Sean Mackey[1], and Gary Glover[1]

		[1]Stanford University, Palo Alto, CA, United States
		We investigate resting-state brain and spinal cord functional connectivity of four healthy volunteers by means of a novel dynamic per slice shimming approach. Functional connectivity, between brain and spinal cord, reveals localization to corresponding sensory and motor areas. Our results are consistent with task-based brain-spinal cord activation results using a motor task , suggesting a strong connection of descending and ascending signals with the brain.

Oral

Prostate

S04	Wednesday 8:15 - 10:15	*Moderators:* Winfried Willinek & Valeria Panebianco

713	8:15	Four-dimensional T2-weighted imaging in prostate MRI with T2 shuffling
		Albert T Roh[1], Jonathan I Tamir[2], Jamil Shaikh[1], Kim Nhien Vu[1], Valentina Taviani[3], Michael Lustig[2], and Shreyas S Vasanawala[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering and Computer Sciences, University of California, Berkeley, Berkeley, CA, United States, [3]Applications and Workflow, GE Healthcare, Menlo Park, CA, United States
		High-quality T2-weighted imaging is critical in the evaluation of the prostatic transition zone for cancer. We adapted an acquisition technique currently used mostly in musculoskeletal MRI termed T2 Shuffling (T2Sh) by incorporating outer volume suppression (OVS) and optimizing it for the prostate. Our retrospective review of 20 patients assessed T2Sh in the evaluation of the prostate. The overall image quality of T2Sh was comparable to that of 2D T2 FSE with water-fat separation and superior to that of 3D T2 FSE with OVS and water-fat separation.

714	8:27	Added value of magnetic resonance spectroscopic imaging to multiparametric MRI for detection of prostate cancer using PIRADS version 2
		Virendra Kumar[1], Vivek Lanka[2], Sanjay Sharma[2], Rishi Nayyar[3], and Chandan J Das[2]
		[1]Department of NMR and MRI Facility, All India Institute of Medical Sciences, New Delhi, India, [2]Department of Radiodiagnosis, All India Institute of Medical Sciences, New Delhi, India, [3]Department of Urology, All India Institute of Medical Sciences, New Delhi, India

		We report increase in sensitivity, specificity and accuracy of PIRADSv2 by addition of MRSI to mpMRI protocol for detection of cancer of prostate (CaP). 26 patients having a biopsy-proven CaP, were investigated at 3.0T using mpMRI including MRSI, followed by radical prostatectomy within 1 month. PIRADSv2 score for mpMRI, PIRADSv1 score for MRSI and Gleason grade group from radical prostatectomy specimens were determined. ROC curve analysis was used to determine the accuracy for cut-offs. A combination of MRSI PIRADSv1 cut-off ≥4 and PIRADSv2 cut-off ≥3 showed the best accuracy (96.2%) for CaP detection. When MRSI was added to PIRADSv2 scoring we found an improvement from 71.4% sensitivity and 91.9% specificity of PIRADSv2 to 91.8% sensitivity and 98% specificity for detecting CaP.

715	8:39	Gleason Probability Maps: A Radiomics Tool for Mapping Tumor Likelihood in MRI Space
		Sean D McGarry[1], Sarah L Hurrell[2], Mark Hohenwalter[2], Petar Duvnjak[2], Michael Griffin[2], Kenneth A Iczkowski[3], Kenneth Jacobsohn[4], Andrew Nencka[2], and Peter LaViolette[2]
		[1]Biophysics, Medical College of Wisconsin, Wawautosa, WI, United States, [2]Radiology, Medical College of Wisconsin, Wawautosa, WI, United States, [3]Pathology, Medical College of Wisconsin, Wawautosa, WI, United States, [4]Urologic Surgery, Medical College of Wisconsin, Wawautosa, WI, United States
		Intra and intertumoral heterogeneities are well recognized in prostate cancer. These differences affect the macroscopic imaging contrast characteristics of tumor and surrounding tissue. This study aims to generate three new, interpretable image contrasts by combining radiomic profiling with annotated, whole mount pathology. We show that these new image contrasts, Gleason probability maps, are indicative of prostate cancer in naïve data.

716	8:51	A Patch-Based Convolutional Neural Network Model for the Diagnosis of Prostate Cancer using Multi-Parametric Magnetic Resonance Images
		Yang Song[1], Yu-Dong Zhang[2], Xu Yan[3], Bingwen Hu[1], and Guang Yang[1]
		[1]Shanghai Key Laboratory of Magnetic Resonance, East China Normal University, Shanghai, China, [2]Department of Radiology, the First Affiliated Hospital with Nanjing Medical University, Nanjing, China, [3]MR Scientific Marketing, Siemens Healthcare, Shanghai, China
		We proposed a patch-based convolutional neural network (CNN) model to distinguish prostate cancer using multi-parametric magnetic resonance images (mp-MRI). Our CNN model was trained in 182 patients including 193 cancerous (CA) vs. 259 normal (NC) regions, and tested independently in 21 patients including 21 CA vs 31 NC regions. The model produced an area under the receiver operating characteristic curve of 0.869, sensitivity of 90.5% and specificity of 67.7% for the differentiation of CA from normal regions, showing its potential for the diagnosis of prostate cancer in clinical application.

717	9:03	Delineation accuracy of prostate cancer for focal therapy: comparison of MR imaging and histopathology characteristics

		Petra J van Houdt[1], Ghazaleh Ghobadi[1], Stijn W Heijmink[2], Ivo Schoots[2], Jeroen de Jong[3], Iris Walraven[1], Henk G van der Poel[4], Floris J Pos[1], Susanne Rylander[5], Lise N Bentzen[6], Karin Haustermans[7], and Uulke A van der Heide[1]
		[1]Radiation Oncology, the Netherlands Cancer Institute, Amsterdam, Netherlands, [2]Radiology, the Netherlands Cancer Institute, Amsterdam, Netherlands, [3]Pathology, the Netherlands Cancer Institute, Amsterdam, Netherlands, [4]Urology, the Netherlands Cancer Institute, Amsterdam, Netherlands, [5]Medical Physics, Aarhus University Hospital, Aarhus, Denmark, [6]Oncology, Aarhus University Hospital, Aarhus, Denmark, [7]Radiation Oncology, University Hospitals Leuven, Leuven, Belgium
		The success of any focal therapy for prostate cancer relies on accurate tumor detection and delineation. Currently there are no guidelines for delineation of prostate tumors. In this study we showed that radiologists are better in delineating parts of tumors with Gleason pattern 4 and 5 than Gleason pattern 3, but still the sensitivity (0.56) needs to be improved for focal therapy and volume estimation.

718	9:15	Measurement using 3D-FSE-T2WI is useful in predicting early recovery of continence following radical prostatectomy in patients with prostate carcinoma.
		Tatsuya Shimizu[1], Utaroh Motosugi[1], Satoshi Funayama[1], Takahiko Mitsui[2], Masayuki Takeda[2], and Hiroshi Onishi[1]
		[1]Radiology, University of Yamanashi Hospital, Chuo-shi, Japan, [2]Urology, University of Yamanashi Hospital, Chuo-shi, Japan
		We conducted a prospective study to examine if preoperative anatomical evaluation of the urethra using 3D-FSE-T2WI is useful in predicting early recovery of continence following total prostatectomy in patients with prostate carcinoma. The length of the membranous urethra (8.4±1.7 mm vs. 5.7±0.6 mm, p=0.005) and the thickness of the pelvic diaphragm (10.8±1.4 mm vs. 8.8±0.5 mm, p=0.01) were significantly different between the patients who achieved continence and those who did not achieve continence 1 month after surgery. A longer membranous urethra and thicker pelvic diaphragm measured using 3D-FSE-T2WI are correlated to earlier recovery of continence following radical prostatectomy.

719	9:27	How to improve the equivocal category PI-RADS score 3? Quantitative multiparametric MRI assessment of prostate cancerous and non-cancerous areas using correlative histopathology.
		Giovanni Barchetti[1], Martina Pecoraro[1], Isabella Ceravolo[1], Maurizio Del Monte[1], Carlo Catalano[1], and Valeria Panebianco[1]
		[1]Department of Radiology, Sapienza University, Policlinico Umberto I, Rome, Italy

		To stratify patients with PI-RADSv2 category 3 to define the correct diagnostic work-up (biopsy or follow-up), quantitatively analyzing mpMRI parameters (ADC, k-trans, K-ep and ve). Among 1272 men who underwent mpMRI, we retrospectively enrolled 98 patients treated with radical prostatectomy. Furthermore, we selected 100 negative patients. The 198 mpMRI exams were randomly, blindly reviewed by two radiologists. 95 PI-RADSv2 category 3 were found and quantitatively analyzed. ROC and AUC were determined to identify a cut-off value to define which PI-RADS 3 lesion should be biopsied. Quantitative imaging represents a tool to objectively stratify patients classified as PI-RADSv2 category 3.

720	9:39	Patient-Specific 3D Printed and Augmented Reality Prostate Cancer Models Derived from MRI Data: Initial Results from Prospective Clinical Study
		Nicole Wake[1], Andrew B. Rosenkrantz[1], William C. Huang[2], Samir S. Taneja[2], James S. Wysock[2], Marc A. Bjurlin[2], Richard Huang[2], Daniel K. Sodickson[1], and Hersh Chandarana[1]
		[1]Center for Advanced Imaging Innovation and Research (CAI2R) and Bernard and Irene Schwartz Center for Biomedical Imaging, Department of Radiology, NYU School of Medicine, New York, NY, United States, [2]Division of Urologic Oncology, Department of Urology, NYU School of Medicine, New York, NY, United States
		The objective of this study was to determine whether patient-specific 3D printed and augmented reality prostate cancer models derived from multi-parametric MRI data can influence pre-surgical planning and patient outcomes for patients undergoing robotic assisted radical prostatectomy. Initial results from our prospective study are presented.

721	9:51	Quantitative mDixon Fat Fraction can differentiate metastatic nodes from benign nodes in prostate cancer patients.
		Mrishta Brizmohun Appayya[1], James O'Callaghan[1], Arash Latifoltojar[1], Edward W Johnston[1], Harbir S Sidhu[1], Abdulrhman Alnaim[2], Asim Afaq[2], Jamshed Bomanji[2], Alan Bainbridge[3], and Shonit Punwani[4]
		[1]Centre of Medical Imaging, UCL, London, United Kingdom, [2]Nuclear Medicine, UCLH, London, United Kingdom, [3]Physics, UCL, London, United Kingdom, [4]Centre for Medical Imaging, UCL, London, United Kingdom
		Metastatic nodes in prostate cancer are associated with poor prognosis. Conventional MRI, relying on short-axis diameter (SAD) suffers from poor accuracy in identifying metastatic nodes. In this study, we compare fat fraction signal from MRI mDixon acquisitions (FF) with apparent diffusion coefficients of nodes and quantitative contrast-enhanced two-point mDixon T1 images (CE-mDixon), in discriminating between benign and metastatic nodes using 18F-Choline PET-CT as reference standard. We showed that FF and CE-mDixon discriminate benign from involved lymph nodes that are small in size unlike SAD or ADC of nodes; FF, not necessitating contrast agents, holds promise as a clinical tool.

722	10:03	Diffusion MRI Detects and Differentiates Inflammation from Cancer Cells in Prostate Cancer Patients

		Zezhong Ye[1], Qingsong Yang[2], Joshua Lin[1], Jeff Viox[1], Peng Sun[1], Joesph Ippolito [1], Jianping Lu[2], and Sheng-Kwei Song[1]
		[1]Radiology, Washington University School of Medicine, St. Louis, MO, United States, [2]Radiology, Changhai Hospital, Shanghai, China
		Recent consensus suggested PCa detection based on mpMRI lacks necessary sensitivity or specificity to differentiate prostatitis from PCa, which results in over-diagnosis and over-treatment. Our novel method, diffusion MRI histology (D-Histo), demonstrated its ability to accurately localize, quantify and distinguish between PCa and prostatitis. D-Histo's improved diagnosis accuracy could more effectively guide treatment planning and assess treatment efficacy.

Oral

MRI in Alzheimer's Disease

S05	Wednesday 8:15 - 10:15	*Moderators:* Qiyong Gong & Mark Meadowcroft

723	8:15	Reversal of Behavioral and Metabolic Deficit with Withania Somnifera in Alzheimer's Disease Mice: A ^{1}H-[^{13}C]-NMR Study
		Kamal Saba[1], Nunna Haritha[1], and Anant Bahadur Patel[1]
		[1]NMR Microimaging and Spectroscopy, Centre for Cellular and Molecular Biology, Hyderabad, India
		Alzheimer's disease (AD) is a degenerative disorder and the most common cause of dementia. The hallmark of AD is the accumulation of Aβ-plaque in the subject brain. At present there is no treatment for AD. Extracts of Withania somnifera (WS) roots has been shown to promote neurite outgrowth and improve learning and memory in AD mice. The current study examine the effects of WS on neurometabolism in AβPP-PS1 mouse model of AD by using ^{1}H-[^{13}C]-NMR spectroscopy in conjunction with infusion of [1,6-$^{13}C_2$]glucose. Our findings indicate that WS improved learning and memory, and ameliorate the neurometabolism in AβPPPS1 mice.

724	8:27	Imaging disruption of blood-brain-barrier (BBB) in Mild Cognitive Impairment without using contrast agent
		Zixuan Lin[1], Sandeepa Sur[1], Peiying Liu[1], Jill De Vis[1], Yang Li[1], Pan Su[1], Jay Pillai[1], Sevil Yasar[2], Paul Rosenberg[3], Marilyn Albert[2], Abhay Moghekar[2], and Hanzhang Lu[1]
		[1]Department of Radiology, Johns Hopkins University, Baltimore, MD, United States, [2]Department of Neurology, Johns Hopkins University, Baltimore, MD, United States, [3]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University, Baltimore, MD, United States

		Disruption of BBB in AD has received increasing attention due to its potential role in amyloid accumulation and clearance. However, measurement of BBB leakage in AD has been proven challenging, especially when using non-contrast techniques. In this study, we measured BBB permeability to water in MCI patients using a novel technique that does not require any contrast agent. It was found that MCI patients have a higher permeability-surface-area-product (PS), i.e. leaky BBB, compared to elderly controls. Individuals with higher PS values had poorer cognitive performance and more severe vascular inflammation. These findings support the role of BBB disruption in AD.

725	8:39	Increased BBB leakage to water but not gadolinium in a rat model of Alzheimer's disease
		Ben R Dickie[1], José Ulloa[2], Hervé Boutin[1], Laura M Parkes[1], and Geoff JM Parker[3]
		[1]Division of Neuroscience and Experimental Psychology, The University of Manchester, Manchester, United Kingdom, [2]Bioxydyn Ltd, The University of Manchester, Manchester, United Kingdom, [3]Bioxydyn Ltd & Division of Informatics, Imaging, and Data Sciences, The University of Manchester, Manchester, United Kingdom
		The presence of blood-brain barrier (BBB) dysfunction in patients with Alzheimer's disease (AD) is unclear. This study uses a novel MRI approach to study AD and age-related alterations in BBB leakage to water (PS_w) and gadolinium (K^{trans}) in a transgenic rat model of AD. We show PS_w is increased in transgenic animals relative to wild-types but that K^{trans} is independent of genotype. This study demonstrates the benefit of probing the BBB with molecules of different sizes, and suggests measurements of BBB permeability to water are more sensitive to AD-related BBB alterations than estimates of gadolinium leakage.

726	8:51	Non-invasive Assessment of Glymphatic Inflow: Measurement of Perivascular Fluid Movement using Diffusion Tensor MRI
		Jack A Wells[1], Ian F Harrison [1], Bernard A Siow[2], Aisha B Akilo[1], Phoebe Evans[1], Ozama Ismail[1], Yolanda Ohene[1], Payam Nahavandi[1], David L Thomas[3,4], and Mark F Lythgoe[1]
		[1]Centre for Advanced Biomedical Imaging, University College London, London, United Kingdom, [2]Francis Crick Institute, London, United Kingdom, [3]Neuroradiological Academic Unit, Department of Brain Repair and Rehabilitation, University College London, London, United Kingdom, [4]Leonard Wolfson Experimental Neurology Centre, UCL Institute of Neurology, University College London, London, United Kingdom
		The glymphatic system may play a critical role in the parenchymal clearance of amyloid beta, a leading molecular candidate to initiate Alzheimer's disease. Clinical investigation, however, is currently hindered by an absence of non-invasive techniques for assessment. The movement of fluid in the perivascular space represents a central component of the glymphatic pathway. Here, we present the first non-invasive evaluation of glymphatic function by using an ultra-long echo-time, low b-value, diffusion-tensor sequence targeted to the perivascular space of the rat brain. We demonstrate that this novel technique is sensitive to the fluid movement along perivascular channels that drives glymphatic inflow.

727	9:03	Multinuclear MR and PET for Studying Energetic Adaptations in Individuals at Increased Risk for Alzheimer's Disease
		Prodromos Parasoglou[1], Lisa Mosconi[2], Oleksandr Khegai[1], Margo Miller[3], Seena Dehkharghani[1], Antonio Convit[3], Ricardo S Osorio[3], and Ryan Brown[1]
		[1]Department of Radiology, NYU School of Medicine, New York, NY, United States, [2]Department of Neurology, Weill Cornell Medical College, New York, NY, United States, [3]Department of Psychiatry, NYU School of Medicine, New York, NY, United States
		^{31}P-MRS directly assesses metabolites linked to cellular metabolism, which may be altered at the early stages of Alzheimer's disease (AD). A major challenge for ^{31}P-MRS is the low sensitivity of the ^{31}P nucleus. Therefore, ^{31}P-MRS has only been used sporadically in AD research. To address this, we built a highly-sensitive dual-nuclei (^{31}P/1H) radio frequency coil array and acquired whole-brain ^{31}P-MRS data from cognitive normal subjects at increased risk for AD, who had previously received FDG and amyloid-PET evaluations. Our goal was to detect energetic abnormalities in this pre-clinical population and compare ^{31}P-MRS findings with established PET-based biomarkers of AD.
728	9:15	Brain 1H-MRS and volumetric changes predict conversion from Mild Cognitive Impairment to Alzheimer's disease: a follow-up study
		Micaela Mitolo[1,2], Michelangelo Stanzani-Maserati[3], Stefania Evangelisti[1,2], Lia Talozzi[1,2], Federico Oppi[3], Roberto Poda[3], Claudio Bianchini[1,2], Lorenzo Cirignotta[1,2], Luisa Sambati[2], David Neil Manners[1,2], Claudia Testa[1,2], Sabina Capellari[2,3], Roberto Gallassi[3], Rocco Liguori[2,3], Raffaele Lodi[1,2], and Caterina Tonon[1,2]
		[1]Functional MR Unit, Policlinico S.Orsola - Malpighi, Bologna, Italy, [2]Department of Biomedical and NeuroMotor Sciences, University of Bologna, Bologna, Italy, [3]IRCCS Institute of Neurological Sciences, Bologna, Italy
		Predicting the possible evolution from the prodromal MCI stage to dementia is a great challenge for both clinic practice and research. We investigated the predictive role of magnetic resonance spectroscopy and brain volumetry in the progression from Mild Cognitive Impairment (MCI) to Alzheimer's Disease (AD). The (NAA+NAAG)/ml ratio in the Posterior Cingulate Cortex (PCC) discriminates at baseline MCI converters from non-converters with an accuracy of 79% after a mean follow-up of 28 months. Volumetric reduction of the parahippocampal gyrus and fusiform gyrus was also found to be an accurate marker of progression to AD (Accuracy 84.2% and 73.6% respectively).
729	9:27	Elevated cerebral blood flow in amyloid-positive elderly cognitively normal controls
		Sudipto Dolui[1,2], Zhengjun Li[1], Duygu Tosun[3], Michael W. Weiner[3], David A. Wolk[2], and John A. Detre[1,2]
		[1]Department of Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Department of Neurology, University of Pennsylvania, Philadelphia, PA, United States, [3]Department of Radiology and Biomedical Imaging, University of California – San Francisco, San Francisco, CA, United States

		We evaluated the effects of [18F]-Florbetapir PET-derived amyloid (A$$$\beta$$$) status on regional cerebral blood flow (CBF) measured using pulsed arterial spin labeling (PASL) in control subjects from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Mean CBF in whole grey matter, posterior cingulate and precuneus showed significantly higher CBF in amyloid positive (A$$$\beta$$$+) group compared to the amyloid negative (A$$$\beta$$$-) group after eliminating subjects with poor PASL data quality as assessed by an automated algorithm. Subjects with higher CBF in the A$$$\beta$$$- group also demonstrated better episodic memory whereas a reverse trend was observed in the A$$$\beta$$$+ group.

730	9:39	Intrinsic Visual Attention Networks and Their Structural Connectivity Reveal Structure-Function Changes of the Visual-Attention System in Subjective Cognitive Decline and Mild Cognitive Impairment
		Pin-Yu Chen[1], Yung-Chin Hsu[1], Chang-Le Chen[1], Yu-Ling Chang[2], Ming-Jang Chiu[2,3,4,5], and Wen-Yih Tseng[1,4,5]
		[1]Institute of Medical Device and Imaging, National Taiwan University College of Medicine, Taipei, Taiwan, [2]Department of Psychology, National Taiwan University, Taipei, Taiwan, [3]Department of Neurology, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan, [4]Molecular Imaging Center, National Taiwan University, Taipei, Taiwan, [5]Graduate Institute of Brain and Mind Sciences, College of Medicine, National Taiwan University, Taipei, Taiwan
		In addition to the memory problems, older adults with mild cognitive impairment (MCI) may suffer from visual-attention problems. We speculated that even at the very early stage such as subjective cognitive decline (SCD), visual-attention function may be affected. We investigated the control, SCD and MCI groups' functional connectivity of the attention and visual networks and the five association fiber tracts responsible for long-range dorsal and ventral pathways. The ventral attention and ventral visual networks exhibit significant group differences in all functional, structural connectivity and cortical thickness. Our findings suggest that in contrast to the top-down goal-directed dorsal attention and the object location of dorsal visual functions, the ventral attention and ventral visual functions for processing unfamiliar stimuli and object recognition may be changed in SCD and MCI. In summary, the visual-attention functions may be affected in SCD and MCI.

731	9:51	Development of advanced multiparametric MRI biomarkers of Alzheimer's disease
		Ashley M. Stokes[1], Zhiqiang Li[2], James G. Pipe[2], Richard J. Caselli[3], Marwan N. Sabbagh[4], and Leslie C. Baxter[5]
		[1]Translational Bioimaging Group, Barrow Neurological Institute, Phoenix, AZ, United States, [2]Magnetic Resonance Technology Design Group, Barrow Neurological Institute, Phoenix, AZ, United States, [3]Mayo Clinic - Arizona, Scottsdale, AZ, United States, [4]Neurology, Alzheimer's and Memory Disorders, Barrow Neurological Institute, Phoenix, AZ, United States, [5]Human Brain Mapping Laboratory, Barrow Neurological Institute, Phoenix, AZ, United States

		The goal of this project is to establish advanced MRI signatures of each stage of Alzheimer's disease (AD), including preclinical, mild cognitive impairment (MCI), and dementia stages. These advanced imaging methods will allow us to non-invasively investigate the underlying neurobiological changes that precede cognitive impairment. While structural MRI is known to change with disease progression, advanced MR imaging may provide more specific signatures of disease progression. The asymptomatic and MCI phases represent a clear potential for early intervention, and the non-invasive methods developed here may identify patients along the clinical trajectory of AD.

732	10:03	Lower oxygenation in the peripheral subarachnoid space reflects decreased cerebral blood flow in dementia-related brain structures
		Lisa A. van der Kleij[1], Ilse M.J. Kant[2], Geert Jan Biessels[2], Jeroen Hendrikse[2], Esben T. Petersen[3], and Jill B. De Vis[4]
		[1]Radiology, UMC Utrecht, Utrecht, Netherlands, [2]UMC Utrecht, Utrecht, Netherlands, [3]2Danish Research Center for Magnetic Resonance, Center for Functional and Diagnostic Imaging and Research, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark, [4]Department of Radiology, MR Research, John Hopkins Medical Center, Baltimore, MD, United States
		We evaluated the relationship between cerebral blood flow (CBF) and T_2 of peripheral CSF. The rationale behind this hypothesized association is the presumed dependency of T_2 on oxygenation. The T_2 of CSF was related to CBF and cognition in a group with cognitive decline. In contrast, no relationship was found between the T_2 and CBF in a healthy aging cohort suggesting no relation between the T_2 of CSF and oxygenation. Further investigation regarding the relation between T_2 of CSF and cognition in the healthy aging cohort are ongoing and could shed light on the value of T_2 as a biomarker.

Oral

Diffusion: Validation

S06	Wednesday 8:15 - 10:15	*Moderators:* Els Fieremans Fieremans & Andrada Ianus

733	8:15	SYNCHROTRON X-RAY PHASE-CONTRAST IMAGING TO SIMULATE DIFFUSION TENSOR MRI: APPLICATION TO TRACTOGRAPHY
		Timothée Jacquesson[1], Justine Bosc[1], Hugo Rositi[2], Marlène Wiart[3], Fabien Chauveau[4], Françoise Peyrin[1], David Rousseau[5], and Carole Frindel[1]
		[1]CREATIS UMR 5220, U1206, University of Lyon, Lyon, France, [2]Institut Pascal UMR 6602, Université Clermont Auvergne, Le Puy en Velay, France, [3]Laboratoire CarMeN, University of Lyon, Lyon, France, [4]Lyon Neuroscience Research Center, Lyon, France, [5]LARIS, UMR INRA IRHS, Université d'Angers, Angers, France

		As it provides the only method for mapping neural tracts in vivo, diffusion MRI tractography is gaining importance in clinical and neuroscience research. However, the precision of tractography results is influenced by many factors. In this study, we propose a highly realistic simulator based on real data acquired by synchrotron x-ray phase-contrast imaging. This imaging technique with histology-like resolution is demonstrated to reveal adequately the mouse brain in 3D by comparison with classical histology, which loses continuity along the sectioning axis. We expect that our simulator may serve as a tool for the validation and optimization of tractography algorithms.

734	8:27	Validation of diffusion MRI models and tractography algorithms using chemical tracing
		Giorgia Grisot[1,2], Suzanne N. Haber[3,4], and Anastasia Yendiki[2]
		[1]Harvard-MIT Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States, [2]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital and Harvard Medical School, Charlestown, MA, United States, [3]University of Rochester School of Medicine, Rochester, NY, United States, [4]McLean Hospital, Belmont, MA, United States
		Brain circuitry is still poorly understood, posing a challenge to the validation of diffusion MRI (dMRI) tractography. Many aspects of tractography algorithms, such as their choice of diffusion model or deterministic vs. probabilistic approach, can impact on their performance. Therefore, beyond a qualitative validation, we need quantitative metrics for comparing and optimizing these algorithms. In this work we perform a systematic evaluation of different diffusion models and tractography algorithms by assessing their accuracy with respect to chemical tracing in macaques. We find that the combination of probabilistic tractography and GQI/DSI model yields the best results, and that accuracy does not always improve with higher angular resolution.

735	8:39	The existence of the inferior fronto-occipital fasciculus (IFOF) revealed in the non-human primate by ex-vivo diffusion-weighted tractography and blunt dissection.
		Laurent Petit[1], Silvio Sarubbo[2], Alessandro De Benedictis[3], Franco Chioffi[2], Maurice Ptito[4,5], and Tim B Dyrby[6,7]
		[1]Groupe d'Imagerie Neurofonctionnelle, Institut des Maladies Neurodégénératives (GIN-IMN) - UMR 5293, CNRS, CEA Université de Bordeaux, Bordeaux, France, [2]Division of Neurosurgery, Structural and Functional Connectivity Lab, Azienda Provinciale per i Servizi Sanitari (APSS), Trento, Italy, [3]Neurosurgery Unit, Department of Neuroscience and Neurorehabilitation, Bambino Gesù Children Hospital, IRCCS, Rome, Italy, [4]École d'optometrie, Université de Montréal, Montreal, QC, Canada, [5]Laboratory of Neuropsychiatry and Psychiatric Centre Copenhagen, University of Copenhagen, Copenhagen, Denmark, [6]Danish Research Centre for Magnetic Resonance, Center for Functional and Diagnostic Imaging and Research, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark, [7]Department of Applied Mathematics and Computer Science, Technical University of Denmark, Kongens Lyngby, Denmark

		The existence of a ventral fronto-occipital association pathway in non-human primates similar to the inferior fronto-occipital fasciculus (IFOF) in humans, is nowadays still largely debated. In this study, we elucidate the existence, course and terminations of such a pathway using in the same non-human primate (vervet monkey) both *ex-vivo* diffusion-weighted tractography and blunt microdissection. From a methodological point of view, it allows an unprecedented anatomical validation of advanced tractography with microdissection for the first time in the same specimen.

736	8:51	Post-mortem mapping of cortical layers using combined multicompartmental relaxometry and diffusometry at ultra-high field (7T and 11.7T)
		Justine Beaujoin[1,2,3], Christophe Destrieux[4], Fabrice Poupon[5], Ilyess ZEMMOURA[4], Jean-François Mangin[2,3,5,6], and Cyril Poupon[1,2,3]
		[1]UNIRS, CEA/DRF/Neurospin, Gif-sur-Yvette, France, [2]Université Paris-Saclay, Orsay, France, [3]FLI / Noeud Paris-Sud, Orsay, France, [4]Université François-Rabelais de Tours, INSERM, Imagerie et Cerveau UMR 930, Tours, France, [5]UNATI, CEA/DRF/Neurospin, Gif-sur-Yvette, France, [6]http://cati- neuroimaging.com/, Gif-sur-Yvette, France
		The human cerebral cortex has a laminar structure presenting distinct cell organization and myelination. In this work, we compare the lamination observed from multicompartmental quantitative relaxometry- or diffusometry-based microstructural ultra-high field MRI on a post-mortem human brain visual cortex sample. This study reveals that the quantitative intra-neuritic volume fraction map provides a better delineation of the line of Gennari in the primary visual cortex whereas multicompartment T1 relaxometry provides a better segmentation of the superfical layers. Thus, this study strongly plays in favour of a combination of relaxometry and diffusometry methods to robustly map the cortex lamination in humans.

737	9:03	A tunable permeability phantom for validating time-dependent diffusion models
		Antonios Papaioannou[1], Dmitry Novikov[1], and Els Fieremans[1]
		[1]Center For Biomedical Imaging, New York University Medical Center, New York, NY, United States
		Well characterized phantoms are essential for time-dependent diffusion model validations. Here we introduce a phantom made of permeable barriers with highly tunable micro-structural characteristics such as pore size, pore density and permeability and perform time-dependent diffusion measurements using three NMR and MRI systems. Our experimental results agree with the theory of time-dependent diffusion in disordered systems, making the phantom suitable for model validations in clinical and preclinical systems.

738	9:15	A new computational framework for complex numerical simulation of diffusion-weighted NMR signal in brain tissue
		Marco Palombo[1], Daniel C. Alexander[1], and Hui Zhang[1]

		[1]*Computer Science Department and Centre for Medical Imaging Computing, University College London, London, United Kingdom*
		In this work, we introduce a new framework that we developed to use numerical simulations to investigate the complexity of brain tissue at a microscopic level with a detail never realised before. Directly inspired by the advances in computational neuroscience for modelling brain cells, the proposed toolbox enables numerical simulation of molecular diffusion within realistic digitalised brain cells, such as neurons and glia. Here we show a select set of examples offered by this new toolbox to demonstrate its versatility and potentiality. Further development is ongoing, which will support even more realistic conditions and fully digitalised tissues.

739	9:27	Monte Carlo simulations of diffusion in mouse corpus callosum reconstructed from 3-d electron microscopy validate the time-dependence along axons
		Hong-Hsi Lee[1], Dmitry S Novikov[1], and Els Fieremans[1]
		[1]*Center for Biomedical Imaging, New York University, New York, NY, United States*
		We present a numerical framework for validation of diffusion models applied to biological tissues. By performing Monte Carlo simulations in a geometry created by automated segmentation of 3-dimensional mouse brain electron-microscopy images, we study the time-dependence of the diffusion coefficient and kurtosis along individual white matter axons, with or without orientation dispersion. Simulation results, together with the analysis of spatial correlations of axonal cross-section variations along axons, point at the short-range disorder in restrictions to diffusion, and agree with theoretical predictions. Our results are consistent with diffusion time-dependence observed in *in vivo* human brain data.

740	9:39	Joint modelling of diffusion MRI and histology
		Amy Howard[1], Jeroen Mollink[1,2], Michiel Kleinnijenhuis[1], Menuka Pallebage Gamarallage[3], Matteo Bastiani[1], Karla L Miller[1], and Saad Jbabdi[1]
		[1]*Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom,* [2]*Department of Anatomy, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Centre (Radboudumc), Nijmegen, Netherlands,* [3]*Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom*
		Constrained spherical deconvolution determines the orientation of white matter fibres from the diffusion MRI signal. To do so, the diffusion profile of a single fibre is estimated and assumed constant across the sample. However, the diffusion signal is dependent on microstructural properties such as axonal diameter, packing and myelination, which questions the assumption of a single-fibre response function. This multimodal study combines diffusion MRI with histology from the same tissue sample, to test the validity of a ‘brain-wide’ fibre response function. Preliminary results indicate that in practice the fibre response function is indeed dependent on local anatomy.

741	9:51	Validation of Diffusion Spectrum Imaging of the Human Tongue with Histology
		Nahla M H Elsaid[1], Adam C Puche[2], Maureen Stone[3], Jerry L Prince[4], Steven Roys[1], Rao P Gullapalli[1], and Jiachen Zhuo[1]
		[1]Diagnostic Radiology, University of Maryland School of Medicine, Baltimore, MD, United States, [2]Anatomy and Neurobiology, University of Maryland School of Medicine, Baltimore, MD, United States, [3]Neural and Pain Sciences and Orthodontics, University of Maryland School of Dentistry, Baltimore, MD, United States, [4]Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, United States
		In this study provides validation procedure for DSI anisotropy measures versus the histological analysis of the aligned tongue muscles. A fresh *ex-vivo* sample of the tongue is scanned using DSI multi-shell acquisition then the sample is fixed for further histological analysis and comparison with the fiber tracts using DSI reconstruction. The DSI delineation of muscle fibers is matching the histology images of the same region.

742	10:03	Histologically-derived fiber response functions for diffusion MRI data reveal systematic differences from model-based deconvolution kernels
		Kurt Schilling[1], Vaibhav Janve[1], Yurui Gao[1], Iwona Stepniewska[2], Bennett Landman[3], and Adam Anderson[1]
		[1]Biomedical Engineering, Vanderbilt University, Nashville, TN, United States, [2]Vanderbilt University, Nashville, TN, United States, [3]Electrical Engineering and Computer Science, Vanderbilt University, Nashville, TN, United States
		Spherical deconvolution for diffusion MRI requires a response function in order to accurately reconstruct the underlying voxel-wise fiber orientation distribution (FOD). Here, using 3D histologically-defined fiber orientation distributions and the corresponding diffusion signal, we derive the ground-truth fiber response functions. We show that there is significant variation in these response functions across the brain. We find that the current methods to estimate this function do not match the histological results, which leads to differences in fiber volume fractions. This is important because the wrong response function can amplify spurious peaks in the FOD and lead to inaccurate tractography.

Study Groups

Reproducible Research Business Meeting

W07	Wednesday 9:15 - 10:15	*(no CME credit)*

Plenary Session

Presidential Lecture: When the Right Thing to Do Is Also the Smart Thing to Do: Research & Results on Diversity in Research Organizations

Plenary Hall (Paris Room)	Wednesday 10:45 - 11:15

10:45	When the Right Thing to Do Is Also the Smart Thing to Do: Research & Results on Diversity in Research Organizations

Plenary Session

Point-of-Care Diagnostics: MR's Friend or Foe?

Organizers: Catherine Hines, Garry Gold, Arvind Pathak, Kelvin Lim

Plenary Hall (Paris Room)	Wednesday 11:15 - 12:15	*Moderators:* Catherine Hines & Arvind Pathak

11:15	Competition: Point of Care (POC) Diagnostics
	Nimmi Ramanujam[1]
	[1]Duke University, United States

11:35	Sustainable Low-field MRI for Point of Care Diagnostics
	Steven J. Schiff[1]
	[1]Center for Neural Engineering, Penn State University, University Park, PA, United States

11:55	Complement: Implementing MR into the POC Pipeline
	Edwin J.R. van Beek[1]
	[1]Edinburgh Imaging, Dr., Edinburgh, United Kingdom

12:15	Adjournment

Event

Gold Corporate Symposium: GE Healthcare

Plenary Hall (Paris Room)	Wednesday 12:30 - 13:30	*(no CME credit)*

Traditional Poster: fMRI

Exhibition Hall 2298-2321	Wednesday 13:45 - 15:45	*(no CME credit)*

Electronic Poster: Cardiovascular

Exhibition Hall	Wednesday 13:45 - 14:45	*(no CME credit)*

Electronic Poster: Neuro

Exhibition Hall	Wednesday 13:45 - 14:45	*(no CME credit)*

Study Groups

Detection & Correction of Motion in MRI & MRS Business Meeting

W07	Wednesday 13:45 - 14:45	*(no CME credit)*

Member-Initiated Symposium

Portable MRI Systems for Point-of-Care & Mobile Applications

Organizers: Krishna Nayak, Lawrence Wald, Andrew Webb

N04	Wednesday 13:45 - 15:45	*(no CME credit)*

	13:45	Development of a Highly Compact 1.5 T Functional MRI System with Minimal Infrastructural Requirements
		Ben Parkinson[1]
		[1]Victoria University of Wellington, New Zealand

	14:09	Optimization of Permanent Magnet Array for a Portable MR Imager
		Shaoying Huang[1]
		[1]8 Somapah Road, Singapore University of Technology and Design, Singapore, Singapore

	14:33	Single-Side NMR Systems & Their Uses in Biomedical Applications
		Sergei Obruchkov[1]
		[1]Robinson Research Institute, Victoria University of Wellington, Wellington, New Zealand

	14:57	Imaging with Non-Uniform Field Using a Rotating Halbach Magnet
		Clarissa Cooley[1]
		[1]Massachusetts General Hospital, United States

	15:21	Millitesla MRI: Improving Signal & Reducing Noise
		Matthew S Rosen[1]
		[1]Radiology, MGH/Martinos Center for Biomedical Imaging

Member-Initiated Symposium

Breaking the Spatiotemporal Limits of MRSI

Organizers: Fan Lam, Chao Ma, Tom Scheenen

W05/06	Wednesday 13:45 - 15:45	*Moderators:* Fan Lam & Chao Ma	*(no CME credit)*

	13:45	Fast, High-SNR Spectroscopy of Tissue Compartments with SLAM
		Paul Arthur Bottomley[1]
		[1]Radiology, Johns Hopkins University, Baltimore, MD, United States

	14:02	Ultrafast MRSI: Recent Advances & Potential Applications
		Zhi-Pei Liang[1]

		[1]*Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States*

	14:19	On Spatial-Spectral Resolution in Echo-Planar MR Spectroscopic Imaging
		Stefan Posse

	14:36	Parallel Imaging & Spatial-Spectral Encoding Accelerated FID-MRSI at 7T
		Wolfgang Bogner[1]
		[1]*Medical University of Vienna, Vienna, Austria*

	14:53	Accelerated Multi-Dimensional MR Spectroscopic Imaging: 2D Spectral+2D/3D Spatial Encoding
		Michael Albert Thomas[1]
		[1]*Radiology, UCLA Geffen School of Medicine, Lo Angeles, CA, United States*

	15:10	Spectral Quality in Ultrafast MRSI
		Jullie W. Pan[1]
		[1]*University of Pittsburgh, Pittsburgh, PA, United States*

	15:27	Spectroscopic Imaging Considerations for Hyperpolarized 13C
		Daniel Spielman[1]
		[1]*Radiology, Stanford University, Stanford, CA, United States*

Weekday Course

Junior Fellow Symposium: Finding Value in MRI

Organizers: Aikaterini Kotrotsou, Christopher Nguyen

N02	Wednesday 13:45 - 15:45	*Moderators:* Dan Ma & Christopher Nguyen

	13:45	Can MRI Provide More Clinical Value? Increasing Utility & Reducing Cost
		Rivka R Colen[1]
		[1]MD Anderson Cancer Center, United States

	14:05	Low Field & Portable MR Hardware
		Klaas Pruessmann[1]
		[1]University and ETH Zürich, Switzerland

	14:25	Faster Comprehensive Scans
		Mark Griswold[1]
		[1]Case Western Reserve University, United States

	14:45	Panel Discussion: Industry Perspective to increasing value of MRI
		Anja Brau[1]
		[1]GE Healthcare, United States

	14:45	Panel Discussion: Industry Perspective to Increasing Value of MRI
		Paul Harvey[1]
		[1]Philips Healthcare, Netherlands

		This presentation examines a possible definition of "value in MRI" and offers a non-limiting interpretation from one of multiple possible perspectives of an industrial vendor and research collaborator. The seemingly simple equation defining value, like the Larmor equation, hides a considerable complexity with respect to the paths and dimensions to increasing value. We will examine the components that make up one version of the value equation and offer examples of the technologies, disciplines and strategies that are considered as part of an industrial investment in the development of tools that could increase value when embraced by healthcare professionals and organizations.

	14:45	Panel Discussion: Industry Perspective to increasing value of MRI
		ajit shankaranarayanan[1]
		[1]HealthLytix, San Diego, CA, United States
		MRI has been proven to be an extremely important imaging modality for clinical diagnosis, prognosis and monitoring perspective. However, it is also very complicated first from the interface between hardware and software and the variability it generates across different vendor platforms and secondly the abundance of different imaging contrasts leading to ever lengthening of the imaging protocols. My talk will address the current status of MR imaging from a technology, platform & applications perspective and how industry can help & partner with academic institutions to increase value of MRI.

	14:45	Panel Discussion: Industry Perspective to Increasing Value of MRI
		Gunnar Krueger[1]
		[1]Siemens Medical Solutions USA, United States

	15:45	Adjournment & Meet the Teachers

Power Pitch

Pitch: Applications of Diffusion MRI

Power Pitch Theater A - Exhibition Hall	Wednesday 13:45 - 14:45	*Moderators:* Toshiaki Taoka & Mami Iima	*(no CME credit)*

743	13:45	Building a probabilistic atlas of the human corticospinal tract from 410 healthy participants by using enhanced bundle-specific tractography.

		Chenot Quentin[1], Nathalie Tzourio-Mazoyer[1], François Rheault[2], Maxime Descoteaux[2], and Laurent Petit[1]
		[1]Groupe d'Imagerie Neurofonctionnelle, Institut des Maladies Neurodégénératives (GIN-IMN) - UMR 5293, CNRS, CEA Université de Bordeaux, Bordeaux, France, [2]Sherbrooke Connectivity Imaging Lab (SCIL), Université de Sherbrooke, Sherbrooke, QC, Canada
744	13:45	Validation of dentato-rubro-thalamic tract in squirrel monkey brain
		Yurui Gao[1,2], Kurt Schilling[1,2], Iwona Stepniewska[3], Guozhen Luo[4,5], Bennett Landman[2,6], Hong Yu[7], Daniel Claassen[8], Benoit Dawant[6], and Adam Anderson[1,2]
		[1]Biomedical Engineering, Vanderbilt University, Nashville, TN, United States, [2]Institute of Imaging Science, Vanderbilt University, Nashville, TN, United States, [3]Psychology, Vanderbilt University, Nashville, TN, United States, [4]Physics and Astronomy, Vanderbilt University, Nashville, TN, United States, [5]Radiation Oncology, Vanderbilt University Medical Center, Nashville, TN, United States, [6]Electrical Engineering and Computer Science, Vanderbilt University, Nashville, TN, United States, [7]Neurological Surgery, Vanderbilt University Medical Center, Nashville, TN, United States, [8]Neurology, Vanderbilt University Medical Center, Nashville, TN, United States
745	13:45	Assessing the asynchronous macrostructural changes in white matter tracts of the developing brain
		Elinor Thompson[1], Matteo Bastiani[2], Matthew Brookes[1], Saad Jbabdi[2], and Stamatios N. Sotiropoulos[1,2]
		[1]Sir Peter Mansfield Imaging Centre, School of Medicine, University of Nottingham, Nottingham, United Kingdom, [2]Wellcome Centre for Integrative Neuroscience - Oxford Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB), University of Oxford, Oxford, United Kingdom
746	13:45	An accurate and efficient infarction segmentation method for diffusion weighted images using a deep convolutional neural network
		Hanjing Kong[1], Fei Gao[2], Wenjian Huang[1], Weihai Xu[3], Yining Huang[4], and Jue Zhang[1,2]
		[1]Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, China, [2]College of Engineering, Peking University, Beijing, China, [3]Department of Neurology, Peking Union Medical College Hospital, Beijing, China, [4]Department of Neurology, Peking University First Hospital, Beijing, China
747	13:45	Selective degeneration of crossing fibres and its relationship with fractional anisotropy
		Jordan A. Chad[1,2], Ofer Pasternak[3], David H. Salat[4], and J. Jean Chen[1,2]

		[1]Rotman Research Institute, Baycrest Health Sciences, Toronto, ON, Canada, [2]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada, [3]Departments of Psychiatry and Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States, [4]MGH/HST Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School, Charlestown, MA, United States

748	13:45	Quantifying diameter overestimation of undulating axons from synthetic DW-MRI
		Alonso Ramirez-Manzanares[1], Mario Ocampo-Pineda[2], Jonathan Rafael-Patiño[3], Giorgio Innocenti[3,4,5], Jean-Philippe Thiran[3], and Alessandro Daducci[2,3,6]
		[1]Computer Science, Centro de Investigación en Matemáticas A.C., Guanajuato, Mexico, [2]University of Verona, Verona, Italy, [3]Signal Processing Lab (LTS5), École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [4]Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden, [5]Brain and Mind Institute, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [6]University Hospital Center (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland

749	13:45	Diffusion Anisotropy of the Extra-Axonal Environment is Linked to Axon Alignment
		Emilie T. McKinnon[1,2,3], Jens H. Jensen[1,3], and Joseph A. Helpern[1,3]
		[1]Department of Neuroscience, Medical University of South Carolina, Charleston, SC, United States, [2]Department of Neurology, Medical University of South Carolina, Charleston, SC, United States, [3]Center for Biomedical Imaging, Medical University of South Carolina, Charleston, SC, United States

750	13:45	Multishot high-resolution brain diffusion-weighted imaging using phase regularized reconstruction
		Yuxin Hu[1,2], Xiaole Wang[3], Evan G. Levine[1,2], Qiyuan Tian[1,2], Valentina Taviani[4], Frank Ong[5], Shreyas Vasanawala[1], Jennifer A McNab[1], Bruce L. Daniel[1,6], and Brian Hargreaves[1,2,6]
		[1]Department of Radiology, Stanford University, Stanford, CA, United States, [2]Department of Electrical Engineering, Stanford University, Stanford, CA, United States, [3]Biomedical Engineering, Tsinghua University, Beijing, China, [4]GE Healthcare, Menlo Park, CA, United States, [5]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA, United States, [6]Department of Bioengineering, Stanford University, Stanford, CA, United States

751	13:45	Reversible white matter restricted diffusion in patients with cerebral malaria via ADC measurement on a 0.35T MR scanner

		Yuchuan Zhuang[1], Sarah Mohajeri Moghaddam [2], Samuel D Kampondeni [2,3], Madalina Tivarus [2], Gretchen L Birbeck [4], Michael J Potchen [2], and Jianhui Zhong[2]
		[1]Electrical and Computer Engineering, University of Rochester, Rochester, NY, United States, [2]Department of Imaging Sciences, University of Rochester, Rochester, NY, United States, [3]Malawi MRI Center, Queen Elizabeth Central Hospital, Blantyre, Malawi, [4]Department of Neurology, University of Rochester, Rochester, NY, United States

752	13:45	Evaluation of Standardized and Study-Specific Diffusion Tensor Imaging Templates of the Adult Human Brain
		Shengwei Zhang[1] and Konstantinos Arfanakis[1]
		[1]Biomedical Engineering, Illinois Institute of Technology, Chicago, IL, United States

753	13:45	Characterization of Axonal Pathology Independent of Fiber Crossings in Multiple Sclerosis Using High-Gradient Diffusion MRI
		Qiuyun Fan[1], Aapo Nummenmaa[1], Thomas Witzel[1], Ned Ohringer[1], Lawrence L Wald[1], Eric Klawiter[2], and Susie Y Huang[1]
		[1]Massachusetts General Hospital, Boston, MA, United States, [2]Neurology, Massachusetts General Hospital, Boston, MA, United States

754	13:45	Anatomy-constrained automated fiber tract reconstruction for surgery planning: a validation study in language-related white matter tracts
		Matteo Mancini[1,2], Sjoerd Vos[1,2,3], Vejay Vakharia[2,4], Rachel Sparks[1,2], Karin Trimmel[4], Gavin P. Winston[3,4,5], John Duncan[2,3,4], and Sebastian Ourselin[1,2,4,6]
		[1]Translational Imaging Group, University College London, London, United Kingdom, [2]Wellcome EPSRC Centre for Interventional and Surgical Sciences (WEISS), University College London, London, United Kingdom, [3]Epilepsy Society MRI Unit, Chalfont St Peter, United Kingdom, [4]Department of Clinical and Experimental Epilepsy, University College London, London, United Kingdom, [5]Neuroimaging of Epilepsy Laboratory, Montreal Neurological Institute, McGill University, Montreal, Canada, [6]Dementia Research Centre, University College London, London, United Kingdom

755	13:45	Rapid Single Shot Whole Lung Acquisition of for Hyperpolarized Gas MRI Biomarkers of Airspace Enlargement.
		Alexei Ouriadov[1,2], Dante PI Capaldi[1,2], David McCormack[3], and Grace Parraga[1,2,3]

		[1]Robarts Research Institute, London, ON, Canada, [2]Department of Medical Biophysics, Western University, London, ON, Canada, [3]Division of Respirology, Department of Medicine, Western University, London, ON, Canada

756	13:45	The intracellular component of VERDICT (Vascular, Extracellular, and Restricted Diffusion for Cytometry in Tumors) MRI distinguishes Gleason 4 pattern better than Apparent Diffusion Coefficient
		Mrishta Brizmohun Appayya[1], Edward W Johnston[1], Arash Latifoltojar[1], James O'Callaghan[1], Elisenda Bonnet-Carne[2], Hayley Pye[3], Dominic Patel[3], Susan Heavey[3], Alistair Grey[4], Sebastien Ourselin[3], David Hawkes[3], Caroline Moore[4], Hayley Whitaker[3], Alexander Freeman[4], David Atkinson[3], Daniel Alexander[3], Eleftheria Panagiotaki[3], and Shonit Punwani[2]
		[1]Centre of Medical Imaging, UCL, London, United Kingdom, [2]Centre for Medical Imaging, UCL, London, United Kingdom, [3]UCL, London, United Kingdom, [4]UCLH, London, United Kingdom

757	13:45	Validation of the VERDICT MRI Framework using a Novel Computational Model of Diffusion and Flow in Real-World Tumours.
		Ben Hipwell[1], Tom Roberts[1], Paul Sweeney[2], Morium Ali[2], Angela D'Esposito[3], Eleftheria Panagiotaki[2], Mark Lythgoe[2], Daniel Alexander[2], Rebecca Shipley[2], and Simon Walker-Samuel[2]
		[1]Centre for Advanced Biomedical Imaging, University College London, London, United Kingdom, [2]University College London, London, United Kingdom, [3]University of Bologna, Bologna, Italy

Power Pitch

Pitch: CV PowerBeat: Part 2

Power Pitch Theater B - Exhibition Hall	Wednesday 13:45 - 14:45	*(no CME credit)*

758	13:45	Double DANTE: an improved method for high-resolution intracranial vessel wall imaging
		Bram F Coolen[1], Jasper Schoormans[1], Ernst S Kooreman[1,2], Qinwei Zhang[3], Olivia Viessmann[4], Gustav J Strijkers[1], Aart J Nederveen[3], Guillaume Gilbert[5], and Jeroen CW Siero[6,7]

		[1]Department of Biomedical Engineering & Physics, Academic Medical Center, Amsterdam, Netherlands, [2]Department of Radiation Oncology, The Netherlands Cancer Institute, Amsterdam, Netherlands, [3]Department of Radiology, Academic Medical Center, Amsterdam, Netherlands, [4]A.A. Martinos Center for Biomedical Imaging, MGH, Harvard Medical School, Boston, MA, United States, [5]MR Clinical Science, Philips Healthcare, Markham, ON, Canada, [6]Department of Radiology, Utrecht Medical Center, Utrecht, Netherlands, [7]Spinoza Centre for Neuroimaging, Amsterdam, Netherlands

759	13:45	Clinical value of dark-blood late gadolinium enhancement without additional magnetization preparation
		Robert J. Holtackers[1,2], Caroline M. van de Heyning[2,3,4], Muhummad S. Nazir[2,3], Imran Rashid[2,3], Ioannis Ntalas[2,3], Haseeb Rahman[3,5], René M. Botnar[2,6], and Amedeo Chiribiri[2]
		[1]Department of Radiology, Maastricht University Medical Centre, Maastricht, Netherlands, [2]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [3]Department of Cardiology, St Thomas' Hospital, London, United Kingdom, [4]Department of Cardiology, Antwerp University Hospital, Antwerp, Belgium, [5]British Heart Foundation Centre of Excellence, King's College London, London, United Kingdom, [6]Pontificia Universidad Católica de Chile, Escuela de Ingeniería, Santiago, Chile

760	13:45	Feasibility of Free-Breathing Fetal Cine Cardiac MRI based on Doppler Ultrasound, Compressed Sensing and Motion Compensation
		Kostas Haris[1,2], Erik Hedström[1,3], Fabian Kording[4,5], Sebastian Bidhult[1,6], Frederik Testud[7], Katarina Steding-Ehrenborg[1,8], Christian Ruprecht[4,5], Einar Heiberg[1,6], Håkan Arheden[1], and Anthony Aletras[1,2]
		[1]Lund University, Skåne University Hospital, Department of Clinical Sciences Lund, Clinical Physiology, Lund, Sweden, [2]Laboratory of Computing, Medical Informatics and Biomedical-Imaging Technologies, School of Medicine, Aristotle University, Thessaloniki, Greece, [3]Lund University, Skåne University Hospital, Department of Clinical Sciences Lund, Diagnostic Radiology, Lund, Sweden, [4]Department of Diagnostic and Interventional Radiology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [5]North medical GmbHMartinistraße 52, 20246, Hamburg, Germany, [6]Faculty of Engineering, Lund University, Department of Biomedical Engineering, Lund, Sweden, [7]Siemens Healthcare AB, Malmö, Sweden, [8]Lund University, Department of Health Sciences, Physiotherapy, Lund, Sweden

761	13:45	Geometrical Characterization of Marfan and Bicuspid Aortic Valve Patients Using Finite Element Methods
		Julio Sotelo[1,2], Andrea Guala[3], Lydia Dux-Santoy[3], Aroa Ruiz-Muñoz[3], Arturo Evangelista[3], Joaquín Mura[1], Cristian Tejos[1,2,4], Daniel E Hurtado[4,5], José Rodríguez-Palomares[3], and Sergio Uribe[1,4,6]

		[1]Biomedical Imaging Center, Pontificia Universidad Católica de Chile, Santiago, Chile, [2]Department of Electrical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [3]Department of Cardiology, Hospital Universitari Vall d´Hebron, Vall d´Hebron Institut de Recerca (VHIR), Universitat Autònoma de Barcelona, Barcelona, Spain, [4]Institute for Biological and Medical Engineering, Schools of Engineering, Medicine and Biological Sciences, Pontificia Universidad Católica de Chile, Santiago, Chile, [5]Department of Structural and Geotechnical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile, [6]Department of Radiology, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile
762	13:45	Myocardial T1 And T2 Mapping Using MR Fingerprinting: Comparison to clinical standards
		Shivani Pahwa[1], Jesse Hamilton[2], Joseph Adedigba[3], Sanjay Sridaran[4], Satyam Ghodasara[5], Rahul Thomas[6], Sadeer G Al-Kindi[6], Gregory O'Connor[5], Sanjay Rajagopalan[6], Mark Griswold[3], Vikas Gulani[1], and Nicole Seiberlich[3]
		[1]Radiology, University Hospitals Cleveland Medical Center, Cleveland, OH, United States, [2]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [3]Case Western Reserve University, Cleveland, OH, United States, [4]Case Western Reserve University School of Medicine, Cleveland, OH, United States, [5]Case Western Reserve University School of Medcine, Cleveland, OH, United States, [6]Cardiology, University Hospitals Cleveland Medical Center, Cleveland, OH, United States
763	13:45	Pericardial Enhancement in Recurrent and Constrictive Pericarditis: Correlation with Pathology in 52 Patients
		James Glockner[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States
764	13:45	Quantitative myocardial perfusion using multi-echo Dixon for respiratory motion correction and arterial input function estimation
		Markus Henningsson[1], Alexandre Farias[1,2,3], Adriana Dolores Maria Villa[1], Cian Scannell[1], Torben Schneider[4], and Amedeo Chiribiri[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]Federal University of Minas Gerais, Belo Horizonte, Brazil, [3]Federal Center for Technological Education of Minas Gerais, Belo Horizonte, Brazil, [4]Philips Healt Systems, London, United Kingdom
765	13:45	Automated 4D Flow Conservation Utilizing Adjacency Matrices
		Carson Anthony Hoffman[1], Oliver Wieben[1,2], and Gabe Shaughnessy[1]

		[1]Medical Physics, University of Wisconsin Madison, Madison, WI, United States, [2]Radiology, University of Wisconsin Madison, Madison, WI, United States
766	13:45	Rapid Carotid Artery T2 and T1 Mapping Using a Radial TSE and IR-FLASH Approach
		Maria I Altbach[1,2], Sagar Mandava[3], Kevin J Johnson[4], Zhitao Li[3], Mahesh B Keerthivasan[3], Jennifer Becker[1], Ali Bilgin[1,2,3], and Craig Weinkauf[5]
		[1]Department of Medical Imaging, University of Arizona, Tucson, AZ, United States, [2]Department of Biomedical Engineering, University of Arizona, Tucson, AZ, United States, [3]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [4]Siemens Medical Solutions, Tucson, AZ, United States, [5]Department of Surgery, University of Arizona, Tucson, AZ, United States
767	13:45	Improved phase unwrapping algorithm for automatic cine DENSE strain analysis using phase predictions and region growing
		Daniel Auger[1], Xiaoying Cai[1], Changyu Sun[1], and Frederick Epstein[1,2]
		[1]Biomedical Engineering, University of Virginia, Charlottesville, VA, United States, [2]Radiology, University of Virginia, Charlottesville, VA, United States
768	13:45	Myocardial Edema Imaging – A Comparison of Three Techniques
		Yanjie Zhu[1,2], Lixian Zou[1], Yucheng Chen[3], Dong Liang[1], Xin Liu[1], and Yiu-Cho Chung[4]
		[1]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, [2]Department of Medicine (Cardiovascular Division), Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States, [3]Department of Cardiology, West China Hospital, Chengdu, China, [4]Siemens Healthcare Pte Ltd., Singapore, Singapore
769	13:45	Prediction for development of cerebral hyperperfusion after carotid endarterectomy using cerebral oxygen extraction fraction map based on quantitative susceptibility mapping at 7T
		Jun-ichi Nomura[1], Ikuko Uwano[2], Makoto Sasaki[2], Kohsuke Kudo[3], Fumio Yamashita[2], Kenji Ito[2], Shunrou Fujiwara[1], Yoshiyasu Matsumoto[1], Kohki Oikawa[1], Kohei Chida[1], Kazunori Terasaki[4], Masakazu Kobayashi[1], Kenji Yoshida[1], and Kuniaki Ogasawara[1]

		[1]Neurosurgery, Iwate Medical university, Morioka, Japan, [2]Ultrahigh Field MRI, Institute for Biomedical Sciences, Iwate Medical university, Yahaba, Japan, [3]Diagnostic and Interventional Radiology, Hokkaido University Hospital, Sapporo, Japan, [4]Cyclotron Reserch Center, Iwate Medical university, Takizawa, Japan

770	13:45	Investigating the use of non-contrast enhanced Magnetic Resonance Multi-Sequence Thrombus Imaging (MSTI) to direct therapy in patients with acute iliofemoral Deep Vein Thrombosis
		Justinas Silickas[1], Prakash Saha[1], Alberto Smith[1], Stephen Black[2], Adam Gwozdz[1], Marcelo Andia Kohnenkampf[3], Ashish Patel[1], Bijan Modarai[1], Rene Botnar[4], and Alkystis Phinikaridou[4]
		[1]Academic Department of Vascular Surgery, King's College London, London, United Kingdom, [2]Vascular Surgery Department, Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom, [3]School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile, [4]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom

771	13:45	Strain Measurements from 3D Isotropic Cine MRI: Relation with Fibrosis in a Duchenne Patient Population
		Freddy Odille[1,2], Shufang Liu[1,3], Bailiang Chen[2], Aurélien Bustin[1,3], Jacques Felblinger[1,2], and Laurent Bonnemains[1,4]
		[1]IADI, INSERM U947 & Université de Lorraine, Nancy, France, [2]CIC-IT 1433, INSERM, Université de Lorraine and CHRU Nancy, Nancy, France, [3]Compter Science Department, Technical University Munich, Munich, Germany, [4]Department of Cardiothoracic Surgery, CHU Strasbourg and University of Strasbourg, Strasbourg, France

772	13:45	Optimized respiratory-resolved motion-compensated 3D Cartesian coronary MRA
		Teresa M Correia[1], Giulia Ginami[1], Radhouene Neji[2], Gastao Cruz[1], Rene Botnar[1], and Claudia Prieto[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]MR Research Collaborations, Siemens Healthcare Limited, Frimley, United Kingdom

Combined Educational & Scientific Session

Machine Learning for Magnetic Resonance in Medicine

Organizers: Michael Lustig, Demian Wassermann

N01	Wednesday 13:45 - 15:45	*Moderators:* Leslie Ying & Demian Wassermann

	13:45	Introduction to Machine Learning in MR Imaging
		Gael Varoquaux[1]
		[1]INRIA Parietal, United States
		Machine learning builds predictive models from the data. It is massive used on medical images these days, for a variety of applications ranging from segmentation to diagnosis.I will give an introductory tutorial to machine learning from a statistical point of view. I will introduce the methodology, the concepts behind the central models, the validation framework and a variety of caveats to look for.I will also discuss some applications to drawing conclusions from brain imaging, and use these applications to highlight various technical issues to have in mind when running machine learning models and interpreting their results.

	14:15	Machine Learning for Image Analysis
		Ben Glocker[1]
		[1]Imperial College London

773	14:45	Progressively Distribution-based Rician Noise Removal for Magnetic Resonance Imaging
		Qiegen Liu[1], Sanqian Li[1], Jiujie Lv[1], and Dong Liang[2]
		[1]Department of Electronic Information Engineering, Nanchang University, nanchang, China, [2]Lauterbur Research Centre for Biomedical Imaging, Shenzhen Key Laboratory for MRI, Shenzhen Institutes of Advanced Technology, Shenzhen, China
		Different from the existing MRI denoising methods that utilizing the spatial neighbor information around the pixels or patches, this work turns to capture the pixel-level distribution information by means of supervised network learning. A wide and progressive network learning strategy is proposed, via fitting the distribution at pixel-level and feature-level with large convolutional filters. The whole network is trained in a two-stage fashion, consisting of the residual network in pixel domain with batch normalization layer and in feature domain without batch normalization layer. Experiments demonstrate its great potential with substantially improved SNR and preserved edges and structures.

774	14:57	Deep neural network based framework for in-vivo axonal permeability estimation
		Ioana Diana Hill[1], Marco Palombo[1], Mathieu David Santin[2,3], Francesca Branzoli[2,3], Anne-Charlotte Philippe[2,3], Demian Wassermann[4,5], Marie-Stephane Aigrot[2], Bruno Stankoff[2,6], Hui Zhang[1], Stephane Lehericy[2,7,8], Alexandra Petiet[2,7], Daniel C. Alexander[1], Olga Ciccarelli[9], and Ivana Drobnjak[1]

		[1]Centre for Medical Image Computing and Dept of Computer Science, University College London, London, United Kingdom, [2]CENIR, ICM, Paris, France, [3]Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06 UMR S 1127, Institut du Cerveau et de la Moelle épinière, ICM, Paris, France, [4]INRIA, Université Côte d'Azur, Sophia-Antipolis, France, [5]Parietal, CEA, INRIA, Saclay, Sophia-Antipolis, France, [6]AP-HP, Hôpital Saint-Antoine, Paris, France, [7]Hôpital de la Pitié Salpêtrière, Sorbonne Universités, UPMC Paris 06 UMR S 1127, Inserm UMR S 1127, CNRS UMR 7225, Institut du Cerveau et de la Moelle épinière, Paris, France, [8]AP-HP, Hôpital de la Pitié Salpêtrière, Paris, France, [9]Department of Brain Repair and Rehabilitation, Institute of Neurology, University College London, London, United Kingdom
		This study introduces a novel framework for estimating permeability from diffusion-weighted MRI data using deep learning. Recent work introduced a random forest (RF) regressor model that outperforms approximate mathematical models (Kärger model). Motivated by recent developments in machine learning, we propose a deep neural network (NN) approach to estimate the permeability associated with the water residence time. We show in simulations and in in-vivo mouse brain data that the NN outperforms the RF method. We further show that the performance of either ML method is unaffected by the choice of training data, i.e. raw diffusion signals or signal-derived features yield the same results.

775	15:09	Predictive Cytological Topography (PiCT): a Radio-Pathomics Approach to Mapping Prostate Cancer
		Sean D McGarry[1], Sarah L Hurrell[2], Kenneth A Iczkowski[3], Amy Kaczmarowski[2], Anjishnu Banerjee[4], Tucker Keuter[4], Kenneth Jacobsohn[5], William Hall[6], Marja Nevalainen[3], Mark Hohenwalter[2], William See[5], Andrew Nencka[2], and Peter LaViolette[2]
		[1]Biophysics, Medical College of Wisconsin, Wawautosa, WI, United States, [2]Radiology, Medical College of Wisconsin, Wawautosa, WI, United States, [3]Pathology, Medical College of Wisconsin, Wawautosa, WI, United States, [4]Biostatistics, Medical College of Wisconsin, Wawautosa, WI, United States, [5]Urologic Surgery, Medical College of Wisconsin, Wawautosa, WI, United States, [6]Radiation Oncology, Medical College of Wisconsin, Wawautosa, WI, United States
		We present a machine learning technique for mapping prostate cancer cellular features into MRI space. 39 patients were prospectively recruited for imaging prior to prostaectomy. Tissue was aligned with the MRI using a non-linear control point warping technique. Pathologist annotations were likewise transformed into MRI space. A partial least squares regression (PLS) algorithm was trained on two sets of 10 patients and applied to 19 test patients, using MRI values as the input to predict epithelial and lumen density. The output maps are new interpretable image contrasts predictive of prostate cancer presence.

776	15:21	Common pitfalls in machine learning applications to multi-center data: tests on the ABIDE I and ABIDE II collections
		Elisa Ferrari[1,2], Paolo Bosco[2], Giovanna Spera[2], Maria Evelina Fantacci[1,2], and Alessandra Retico[2]
		[1]Physics, University of Pisa, Pisa, Italy, [2]National Institute for Nuclear Physics, Pisa, Italy

		Applying Machine Learning (ML) techniques on neuroanatomical MRI data, is becoming widespread for studying psychiatric disorders. However, such instruments require some precautions that, if not applied, may lead to inconsistent results that depend on the procedural choices made in the analysis. In this work, taking neuroimaging studies on Autism Spectrum Disorders as a reference, it is demonstrated that the strong dependency of the cerebral quantities extracted with the segmentation software FreeSurfer 6.0 on the MRI acquisition parameters can, in a multivariate analysis based on ML, obscure the differences due to medical conditions and give inconsistent and meaningless results.

777	15:33	Quantitative Mapping by Data-Driven Signal-Model Learning
		Tom Hilbert[1,2,3], Jean-Philippe Thiran[2,3], Reto Meuli[2], and Tobias Kober[1,2,3]
		[1]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [2]Department of Radiology, University Hospital (CHUV), Lausanne, Switzerland, [3]LTS5, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
		In quantitative MRI, tissue properties are typically estimated by fitting a signal model onto the acquired data. These models are derived from the underlying MR physics describing the signal behavior. The accuracy of the quantitative values heavily depends on the correctness of this model which is usually validated using gold-standard sequences with long acquisition times. Here, we suggest learning the signal model based on the values obtained from the gold-standard sequence with machine learning methods instead. The feasibility of the idea is shown using quantitative T2-mapping with a multi-echo spin-echo sequence and a classical single spin-echo as the gold standard.

	15:45	Adjournment & Meet the Teachers

Combined Educational & Scientific Session

From Molecular Biomarker to Clinical Quantification

Organizers: Arvind Pathak, Kannie WY Chan, Damian Tyler

S01	Wednesday 13:45 - 15:45	*Moderators:* Arvind Pathak & Kannie WY Chan

	13:45	Technical Aspects of Biomarker Development & Application
		Peter Caravan[1]
		[1]Massachusetts General Hospital, United States

	14:20	Clinical Translation & Utility of Biomarkers
		Pek-Lan Khong[1]
		[1]The University of Hong Kong, Hong Kong
		Molecular imaging biomarkers hold the promise to provideunparalleled opportunities for elucidating disease phenotypes, understanding pathophysiology, facilitating development of targeted therapies and driving personalised medicine. To realise the full potential of imaging biomarkers, our scientific community is compelled to translate them into clinical research and practice. This talk will present the current and emerging imaging biomarkers in clinical practice, including MRI and hybrid-PET imaging biomarkers, and describe the applications, strategies, opportunities and challenges in clinical translation.

778	14:55	Tropoelastin: A novel marker for atherosclerotic plaque instability
		Alkystis Phinikaridou[1], Sara Lacerda[2], Begoña Lavin[1], Marcelo Andia[3], Alberto Smith[4], Prakash Saha[4], and René M Botnar[1]
		[1]Biomedical Engineering, King's College London, London, United Kingdom, [2]Centre de Biophysique Moléculaire, CNRS, Orleans, France, [3]Radiology, Pontificia Universidad Católica de Chile, Santiago, Chile, [4]Academic Department of Vascular Surgery, King's College London, London, United Kingdom
		Elastolysis and ineffective elastogenesis favour the accumulation of tropoelastin, rather than cross-linked elastin, in atherosclerotic plaques and could provide a new marker for plaque progression and instability. We developed a novel tropoelastin-binding gadolinium-based MRI contrast agent and demonstrated the feasibility of molecular imaging of tropoelastin in rabbits. Rupture-prone plaques had significantly higher uptake of the contrast agent compared with stable plaques and quantitive assessment of tropoelastin allowed detection of rupture-prone plaques with high sensitivity, specificity, positive and negative predictive values. Ex vivo analyses confirmed the MRI findings and showed that uptake of the contrast agent was specific for tropoelastin.

779	15:05	Quantitative 3D Deuterium MRS Imaging of Glucose Metabolisms in the Rat Brain
		Ming Lu[1], Xiao-Hong Zhu[1], Yi Zhang[1], and Wei Chen[1]
		[1]Center for Magnetic Resonance Research, Department of Radiology, University of Minnesota, Minneapolis, MN, United States

		Assessment of metabolic coupling between glycolysis and oxidation is crucial for understanding neuroenergetics. Based on our recently developed *in vivo* Deuterium (^{2}H) MR (DMR) spectroscopic approach, we further developed a quantitative DMR imaging method for simultaneous measuring the glucose consumption rate (CMR_{glc}) and TCA cycle flux (V_{TCA}) in rat brain at 16.4 T. Regional metabolic rates were quantified and compared between two brain conditions. The metabolite images were also generated. This work demonstrates the feasibility and reliability of *in vivo* DMR imaging for assessing glucose metabolisms, which makes it possible to image CMR_{glc} and V_{TCA} in brains under different states.

780	15:15	Hyperpolarized 13C β-hydroxybutyrate/acetoacetate as a biomarker for non-invasive monitoring of NAD+/NADH status in glioblastoma
		Chloe Najac[1], Marina Radoul[1], Lydia M Le Page[1,2], Georgios Batsios[1], Pavithra Viswanath[1], Anne Marie Gillespie[1], and Sabrina M Ronen[1]
		[1]Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [2]Department of Physical Therapy and Rehabilitation Science, University of California San Francisco, San Francisco, CA, United States
		Conversion of acetoacetate (AcAc) to β-hydroxybutyrate (β-HB) by the mitochondrial enzyme β-hydroxybutyrate dehydrogenase depends upon NADH availability. Previous studies have shown the potential of β-HB-to-AcAc ratio to reflect the redox state in rat hearts and lymphoma cells. Here, we assessed the value of HP [1,3-^{13}C]-AcAc in brain. We demonstrated the potential to probe AcAc to β-HB conversion in normal mice and mice with glioblastoma. Significantly higher levels of [1-^{13}C]-β-AcAc and [1-^{13}C]-β-HB were observed in tumor-bearing mice compared to control mice. Consistent with lower levels of NADH measured in tumors, the [1-^{13}C]-β-HB-to-[1-^{13}C]-β-AcAc ratio trended towards a decrease compared to normal brain.

781	15:25	CEST MRI detection of Deoxycytidine Kinase activity using natural deoxycytidine
		Zheng Han[1], Jia Zhang[1], Yuguo Li[1], Jing Liu[1], Peter van Zijl[1], and Guanshu Liu[1,2]
		[1]Radiology, Johns Hopkins University, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States
		To assess the activity of deoxycytidine kinase (dCK), a drug-resistance-determining enzyme, we developed a new CEST MRI approach, in which the natural substrate, deoxycytidine (dC), is directly used as a CEST MRI reporter. Both *in vitro* and *in vivo* results showed that, upon the incubation or injection of dC, dCK(+) tumor cells have significantly higher CEST contrast at 2 ppm than dCK(-) cells, attributed to the accumulation of phosphorylated dC by dCK activity. Because dC is a clinically available agent, this ‘natural” MR molecular imaging method has great potential to be quickly translated to the clinic for patient stratification.

782	15:35	PET-MR multiparametric imaging biomarkers for differentiating between progression and radionecrosis of brain tumors
		Nadya Pyatigorskaya[1,2,3], Marc Bertaux[4], Brian Sgard[4], Lydia Yahia-cherif[3], Marine Soret[4], Marie-Odile Habert[4], Didier Dormont[1], Damien Galanaud[1], and Aurelie Kas[4]
		[1]Neuroradiology, Pitié Salpêtrière Hospital, APHP, Paris, France, [2]UMR S 1127, CNRS UMR 7225, ICM, UPMC Univ Paris 06, Paris, France, [3]Centre de NeuroImagerie de Recherche – CENIR, ICM, Paris, France, [4]Nuclear Medecine, Pitié Salpêtrière Hospital, APHP, Paris, France
		The aim of this work was evaluating the diagnostic accuracy of PET-MRI in difficult cases of differentiating between tumor progression and radionecrosis in neuro-oncology. For each lesion, PET (SUVmax, SUV mean, SUVpeak) and MRI (ADC, CBV, CBF, pCASL CBF) biomarkers were extracted. The combination of PET and MRI biomarkers allowed to improve the diagnostic accuracy. The logistic regression model has shown that 94% cases were correctly classified using the combination of SUVpeak and pCASL rCBF. Excellent diagnostic accuracy was achieved for both qualitative and quantitative evaluation by means of combined analysis of morphological, functional and metabolic imaging markers.

	15:45	Adjournment & Meet the Teachers

Oral

Techniques for Myelin & Microstructure Imaging

N03	Wednesday 13:45 - 15:45	*Moderators:* Alex MacKay & Se-Hong Oh

783	13:45	Multidimensional T1 Relaxation-T2 Relaxation Correlation Spectroscopic Imaging (RR-CSI) for In Vivo Imaging of Microstructure
		Daeun Kim[1], Jessica L. Wisnowski[2], Christopher T. Nguyen[3], and Justin P. Haldar[1]
		[1]Electrical Engineering, University of Southern California, Los Angeles, CA, United States, [2]Radiology, Children's Hospital Los Angeles, Los Angeles, CA, United States, [3]Cardiology, Massachusetts General Hospital, Boston, MA, United States

		We propose a new multidimensional MRI experiment called T_1 Relaxation-T_2 Relaxation Correlation Spectroscopic Imaging (RR-CSI) for probing microstructure. RR-CSI acquires imaging data with two-dimensional relaxation contrast encoding and estimates a high-dimensional spectroscopic image by using spatially-constrained reconstruction. The spectroscopic image comprises a full 2D T_1-T_2 spectrum at every voxel. The distinct peaks in these spectra correspond to different microscopic tissue compartments, which enables spatial mapping of microstructure. Compared to conventional methods, RR-CSI has improved capabilities for resolving tissue microenvironments with similar relaxation parameters. RR-CSI is demonstrated with real MRI data, including the first in vivo human brain results.

784	13:57	Comparison of Inhomogeneous Magnetization Transfer and Myelin Water Fraction Ex-Vivo at 7T
		Michelle H. Lam[1,2], Andrew Yung[2], Alan P. Manning[1], Cornelia Laule[1,2,3,4,5], G.R. Wayne Moore[3,4,6], Anastasia Smolina[1,2,7], Irene M. Vavasour[2,5], Erin L. MacMillan[2,8,9], Carl Michal[1], Alex L. Mackay[1,2,5], and Piotr Kozlowski[1,2,3,5]
		[1]Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada, [2]UBC MRI Research Centre, University of British Columbia, Vancouver, BC, Canada, [3]International Collaboration on Repair Discoveries, Vancouver, BC, Canada, [4]Pathology & Laboratory Medicine, University of British Columbia, Vancouver, BC, Canada, [5]Radiology, University of British Columbia, Vancouver, BC, Canada, [6]Medicine, Division of Neurology, University of British Columbia, Vancouver, BC, Canada, [7]Physics and Astronomy, McMaster University, Hamilton, ON, Canada, [8]MR Clinical Science, Phillips Healthcare Canada, Markham, ON, Canada, [9]ImageTech Lab, Faculty of Applied Sciences, Simon Fraser University, Surrey, BC, Canada
		Inhomogeneous magnetization transfer (ihMT) shows promise as a myelin specific MR technique. This specificity is thought to emerge from ihMT's sensitivity to dipolar relaxation times, which can differ dramatically between lipids (which are the main component of myelin) and other brain constituents. We compared both ihMT and conventional MT to myelin water imaging using ex-vivo normal and multiple sclerosis brain tissue, to determine how the white matter and grey matter signal intensities vary across these three proposed myelin specific techniques.

785	14:09	A Sequence for High Quality Gradient Echo Myelin Water Imaging (GRE-MWI) at 3T and 7T
		Hyeong-Geol Shin[1], Se-Hong Oh[2], Masaki Fukunaga[3], Doohee Lee[1], Yoonho Nam[4], Sooyeon Ji[1], Woojin Jung[1], and Jongho Lee[1]
		[1]Electrical Engineering and Computer Science, Seoul National University, Seoul, Republic of Korea, [2]Biomedical Engineering, Hankuk University of Foreign Studies, Seoul, Republic of Korea, [3]Division of Cerebral Integration, National Institute for Physiological Sciences, Okazaki, Japan, [4]Department of Radiology, Seoul St.Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea
		In this study, we propose an eddy current compensated 2D GRE-MWI sequence and demonstrate that the sequence is robust to physiological noises. The resulting myelin water fraction maps at 3T and 7T shows high quality images at high resolution (2 × 2 × 2 mm^3 at 3T and 1.5 × 1.5 × 2 mm^3 at 7T).

786	14:21	Whole brain inhomogeneous Magnetization Transfer (ihMT) imaging at 3T: concentrating RF power to mitigate RF inhomogeneities effects
		Samira Mchinda[1], Gopal Varma[2], Robin Draveny[1,3], Arnaud Le Troter[1], Victor Carvalho[1], Valentin H. Prevost[1], Maxime Guye[1,4], Jean Pelletier[1,5], Jean-philippe Ranjeva[1], David C. Alsop[2], Guillaume Duhamel[1], and Olivier M. Girard[1]
		[1]Aix Marseille Univ, CNRS, CRMBM, Marseille, France, [2]BIDMC, Harvard Medical School, Boston, MA, United States, [3]Phelma, INPG, Grenoble, France, [4]Aix Marseille Univ, APHM, Hôpital de La Timone, Pôle d'Imagerie Médicale, CEMEREM, Marseille, France, [5]Aix Marseille Univ, APHM, Hôpital de La Timone, Pôle de Neurosciences Cliniques, Service de Neurologie, APHM, Marseille, France
		Inhomogeneous magnetization transfer (ihMT) is a new MRI modality that provides strong sensitivity to myelinated tissues. Previously, a 3D whole brain ihMT sequence, based on GRE readouts interleaved with bursts of MT saturation pulses, was developed and optimized at 1.5T. In this work we demonstrate that concentrating the MT pulse energy can mitigate the sensitivity of ihMT to RF inhomogeneities encountered in high field systems. Overall, this allows for 1.5mm^3 resolution ihMTR maps to be acquired at 3T, with a reduced B1-induced bias and strong signal within the whole brain, allowing robust clinical applications of ihMT at 3T.

787	14:33	Towards short dipolar relaxation time, T1D, MRI
		Gopal Varma[1], Patricia Coutinho de Souza[1], Valentin H Prevost[2], Olivier M Girard[2], Victor Carvalho[2], Samira Mchinda[2], Leo Tsai[1], Guillaume Duhamel[2], Aaron K Grant[1], and David C Alsop[1]
		[1]Division of MR Research, Radiology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, United States, [2]CNRS, CRMBM, UMR 7339, Aix Marseille Universite, Marseille, France
		The inhomogeneous magnetization transfer (ihMT) technique has shown myelin sensitivity, and is understood to be dependent on power and the dipolar relaxation time parameter, T_{1D}, which is longer in myelinated tissues. Implementation of ihMT can be adapted to provide a smaller, but non-negligible signal from other, relatively short T_{1D} tissues. Simulations showed a measurable ihMT signal, achieved from fixed low duty cycle MT preparations with high B_1 pulses, decayed with pulse width at a rate dependent on T_{1D}. Thus short, high B_1 pulses were implemented to acquire ihMT data from ex-vivo samples of rat heart, kidney, and tail tendon, demonstrating the feasibility of short T_{1D} imaging.

788	14:45	MT-Based Detection of Semi-Solids without Background Water Signal.
		Peter van Gelderen[1], Jacco A de Zwart[1], and Jeff H Duyn[1]
		[1]AMRI, LFMI, NINDS, NIH, Bethesda, MD, United States

		Brain tissue can be modeled as a system with a water pool and an invisible pool of semi-solids. The exchange between these pools can be measured by saturating the semi-solids and observing the decrease in water signal after exchange. This requires making a differential measurement, comparing data with and without saturation. Here we present a variation of the STEAM sequence, adding water suppression, which allows for observation of exchanging spins in a single acquisition without a water background signal. The method was demonstrated in both a phantom and human subject at 3 T.

789	14:57	Elliptical Magnetization Transfer: Calculating MT Parameters from the bSSFP Signal Ellipse
		Tobias C Wood[1], Anna Combes[1], and Shaihan Malik[2]
		[1]Neuroimaging, King's College London, London, United Kingdom, [2]Biomedical Engineering, King's College London, London, United Kingdom
		Balanced Steady-State Free-Precession images are sensitive to T1, T2, off-resonance and Magnetization Transfer effects. Previously, Gloor et al extracted MT parameters from SSFP data, but required external T1 & B1 maps and did not account for off-resonance effects. Here we show that by incorporating the elliptical method of Shcherbakova et al, B0 can be measured and the need for an external T1 map removed. We present results covering the whole brain at 1.5mm isotropic voxel size acquired in 20 minutes. We also discuss an interesting asymmetry seen in the SSFP ellipse at low flip-angles.

790	15:09	3D microscopy with CLARITY on human brain tissue: a tool for informing and validating MRI-based histology
		Markus Morawski[1], Evgeniya Kirilina[2,3], Nico Scherf[2], Carsten Jäger[2], Katja Reimann[1], Robert Trampel[2], Filippos Gavriilidis[2], Stefan Geyer[2], Bernd Biedermann[1], Thomas Arendt[1], and Nikolaus Weiskopf[2]
		[1]Paul Flechsig Institute for Brain Research, University of Leipzig, Leipzig, Germany, [2]Department of Neurophysics, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [3]Center for Cognitive Neuroscience Berlin, Free University Berlin, Berlin, Germany
		Recent developments of methods for mapping tissue microstructure with MRI require histological 3D data for validation. Here, CLARITY on post mortem human brain was adapted for this purpose. We demonstrated clearing of up to 8 mm thick samples, 3D microscopy of up to 5 mm thick samples, and the application of multiple stains including markers for neurons, glia, and fibers. The result is a detailed histology-based characterization of cyto- and myelo-architectonics within a volume corresponding to a typical MRI voxel. This approach promises to help integrate MRI-based histology and optical microscopy in 3D, and enable the further development and validation of in vivo histology using MRI.

791	15:21	Disentangling the contributions of brain tissue fraction and composition to quantitative MRI
		Shir Filo[1], Oshrat Shtangel[1], and Aviv Mezer[1]

		[1]The Edmond and Lily Safra Center for Brain Science, The Hebrew University of Jerusalem, Jerusalem, Israel
		In-vivo quantitative MRI (qMRI) aims at characterizing the biological properties of brain tissue. However, qMRI parameters are sensitive both to the molecular tissue properties and to the water content within each voxel. We introduce a novel approach that disentangles these two contributions to qMRI parameters and provides tissue-specific measurements. This is achieved by evaluating the dependency of qMRI parameters on the non-water fraction. Using phantoms, we show that this dependency changes as a function of molecular composition. In the human brain, our method reveals unique tissue signatures for different brain regions, along with region-specific age-related changes.

792	15:33	Longitudinal assessment of adolescent brain myelination using a pulsed magnetization transfer approach
		Erika P Raven[1,2], Peter van Gelderen[1], Diana H Fishbein[3], John W VanMeter[2], and Jeff H Duyn[1]
		[1]Advanced MRI, LFMI, NINDS, NIH, Bethesda, MD, United States, [2]Georgetown Center for Functional and Molecular Imaging, Washington, DC, United States, [3]Program for Translational Research on Adversity and Neurodevelopment, The Pennsylvania State University, University Park, MD, United States
		The spatiotemporal growth trajectories of white matter, and in particular myelin, are an important part of cognitive development during adolescence. Quantitative magnetization transfer (qMT) imaging can be used to measure the fraction of non-water protons (f_{MT}) as an estimate of myelin *in vivo*. Here we used a recently developed, time-efficient pulsed MT approach to extract f_{MT} from white matter regions at different stages of development in a community-based cohort of adolescents. We tested the sensitivity of this approach for detecting region-specific change in f_{MT} in repeated scans that covered a period of 18 months.

Oral

Quantitative Neuroimaging

S02	Wednesday 13:45 - 15:45	*Moderators:* Hongyu An

793	13:45	Quantitative T1 and T2 Brain Atlases for the Detection of Abnormal Relaxation Times
		Gian Franco Piredda[1,2], Tom Hilbert[1,3,4], Cristina Granziera[5,6], Guillaume Bonnier[6], Reto Meuli[3], Filippo Molinari[2], Jean-Philippe Thiran[3,4], and Tobias Kober[1,3,4]

		[1]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [2]Biolab - Department of Electronics and Telecommunications, Polytechnic University of Turin, Turin, Italy, [3]Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland, [4]LTS5, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [5]Neuroimaging Laboratory and Neurology Department, Basel University Hospital, Basel, Switzerland, [6]Department of Clinical Neurosciences, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland
		This work aims at the detection of abnormal relaxation times in the human brain. To that end, a pipeline for creating normative atlases was established. High-resolution atlases of normative T1 and T2 values were created based on mapping data from 52 healthy subjects. A regression model including gender and age was introduced and z-score maps calculated to compare T1 and T2 maps of a single-subject to the derived norms. Initial results based on multiple sclerosis patient data detect not only lesional tissue but also presumably altered normal-appearing white matter regions.

794	13:57	Assessment of the total iron mass using Quantitative Susceptibility Mapping (QSM): Deep gray matter iron depletion in multiple sclerosis?
		Ferdinand Schweser[1,2], Jesper Hagemeier[1], Michael G Dwyer[1], Niels P Bergsland[1,3], Akshay V Dhamankar[1], Bianca Weinstock-Guttman[4], and Robert Zivadinov[1,2]
		[1]Buffalo Neuroimaging Analysis Center, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York, Buffalo, NY, United States, [2]Center for Biomedical Imaging, Clinical and Translational Science Institute, University at Buffalo, The State University of New York, Buffalo, NY, United States, [3]MR Research Laboratory, IRCCS, Don Gnocchi Foundation ONLUS, Milan, Italy, [4]BairdMS Center, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York, Buffalo, NY, United States
		It is often overlooked that iron concentrations, as determined, e.g., via Quantitative Susceptibility Mapping (QSM), reflect the mass of iron per unit volume. Consequently, structural atrophy alone (i.e. decreased volume) increases the tissue iron concentration if the total mass of iron remains constant. In this work, we present a technique to assess the mass of regional tissue iron in milligrams (mg). We retrospectively applied the technique to data from a recently published 2-year longitudinal study, in which we had investigated iron concentration changes in Multiple Sclerosis (MS).

795	14:09	MRI2MRI: A deep convolutional network that accurately transforms between brain MRI contrasts
		Sa Xiao[1], Yue Wu[1], Aaron Y Lee[1], and Ariel Rokem[2]
		[1]Ophthalmology, The University of Washington, Seattle, WA, United States, [2]eScience Institute, The University of Washington, Seattle, WA, United States

		Different brain MRI contrasts represent different tissue properties and are sensitive to different artifacts. The relationship between different contrasts is therefore complex and nonlinear. We developed a deep convolutional network that learns the mapping between different MRI contrasts. Using a publicly available dataset, we demonstrate that this algorithm accurately transforms between T1- and T2-weighted images, proton density images, time-of-flight angiograms, and diffusion MRI images. We demonstrate that these transformed images can be used to improve spatial registration between MR images of different contrasts.

796	14:21	Absolute Cerebral Blood Flow Derived from Low GBCA Dose DCE-MRI in Patients with Type 2 Neurofibromatosis
		Ka-Loh Li[1], Daniel Lewis[1,2], Xiaoping Zhu[1], and Alan Jackson[1]
		[1]Division of Informatics, Imaging and Data Science, University of Manchester, Manchester, United Kingdom, [2]Department of Neurosurgery, Salford Royal NHS Foundation Trust, Manchester, United Kingdom
		A newly developed low dose T1W-DCE-MRI method, ACcomb, was used to estimate the absolute CBF of vestibular schwannomas (VS) and normal appearing brain tissue in a group of 12 consecutive type 2 neurofibromatosis (NF2) patients, undergoing anti-angiogenic bevacizumab treatment. This new method consistently displayed excellent gray-white matter flow contrast and produced mean GM and WM CBF estimates consistent with previous literature values. Use of this new method showed that at 90 days post bevacizumab treatment, there was increased positive correlation between CBF and estimated plasma volume within the VS, and a significant increase in CBF within normal appearing white matter.

797	14:33	Comparison of the Tofts and the Shutter Speed Model for DCE-MRI in patients with Brain Glioma
		Marianna Inglese[1,2], Lesley Honeyfield[3], Eric Aboagye[1], Adam D Waldman[4,5], and Matthew Grech-Sollars[1,3]
		[1]Department of Surgery and Cancer, Imperial College London, London, United Kingdom, [2]Department of Computer, Control and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Rome, Italy, [3]Department of Imaging, Imperial College Healthcare NHS Trust, London, United Kingdom, [4]Department of Medicine, Imperial College London, London, United Kingdom, [5]Centre for Clinical Brain Sciences, The University of Edinburgh, Edinburgh, United Kingdom
		DCE-MRI allows interrogation of patho-physiological insular micro-environments through the passage of contrast agents and model-based pharmacokinetic analysis. In this study, we analysed data from 14 patients with suspected primary glioma who underwent DCE-MRI. Using both the Tofts model and the shutter speed model (SSM), we evaluated the performance and variability of each extracted parameter. We then analysed the ability of the two models to discriminate between tumour and healthy tissue to test the differences between the two methods. Results showed higher performance for the SSM, with a high robustness for the mean capillary water molecule lifetime τ_i.

798	14:45	Multicenter and multiscanner reproducibility of Magnetic Resonance Fingerprinting relaxometry in the brain
		Gregor Körzdörfer[1,2], Rainer Kirsch[1], Kecheng Liu[3], Josef Pfeuffer[1], Bernhard Hensel[2], Yun Jiang[4], Dan Ma[4], Mark Griswold[4,5], Vikas Gulani[4,5], and Mathias Nittka[1]
		[1]Siemens Healthcare GmbH, Erlangen, Germany, [2]Max Schaldach-Stiftungsprofessur für Biomedizinische Technik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany, [3]Siemens Medical Solutions USA Inc., Malvern, PA, United States, [4]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [5]Radiology, Case Western Reserve University, Cleveland, OH, United States
		Magnetic Resonance Fingerprinting (MRF) is a technique for generating tissue property maps by matching pseudo randomly varying MR signal time courses in each voxel with a precalculated dictionary of possible evolutions. In this study, the repeatability of MRF results on the same scanner as well as the reproducibility on different scanners is evaluated for the human brain.

799	14:57	Consensus acquisition protocol for quantitative MRI of the cervical spinal cord at 3T
		Stephanie Alley[1], Guillaume Gilbert[2], Claudia A.M. Gandini Wheeler-Kingshott[3,4,5], Rebecca S. Samson[3], Francesco Grussu[3,6], Allan Martin[7], Elise Bannier[8,9], Virginie Callot[10], Seth A. Smith[11], Junqian Xu[12], Blake Dewey[13], Kenneth A. Weber II[14], Todd Parrish[15], Donald McLaren[16], Gareth J. Barker[17], Nico Papinutto[18], Maryam Seif[19,20], Patrick Freund[20,21,22], Robert L. Barry[23], Samantha By[2], Sridar Narayanan[24], and Julien Cohen-Adad[1,25]
		[1]NeuroPoly Lab, Polytechnique Montreal, Montreal, QC, Canada, [2]MR Clinical Science, Philips Healthcare, Gainesville, FL, United States, [3]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [4]Brain MRI 3T Research Centre, C. Mondino National Neurological Institute, Pavia, Italy, [5]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [6]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [7]Department of Surgery, University of Toronto, Toronto, ON, Canada, [8]VisAGeS team, INRIA (INSERM, CNRS, Rennes 1 University), Rennes, France, [9]Department of Radiology, Rennes University Hospital, Rennes, France, [10]Centre de Résonance Magnétique Biologique et Médicale (CRMBM), UMR 7339, CNRS Aix-Marseille Université, Marseille, France, [11]Vanderbilt University Institute of Imaging Science, Vanderbilt University Medical Center, Nashville, TN, United States, [12]Translational and Molecular Imaging Institute, Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [13]Department of Electrical and Computer Engineering, The Johns Hopkins University, Baltimore, MD, United States, [14]Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Palo Alto, CA, United States, [15]Department of Radiology, Northwestern Feinberg School of Medicine, Chicago, IL, United States, [16]Biospective, Inc., Montreal, QC, Canada, [17]Department of Neuroimaging, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, [18]Department of Neurology, University of California San Francisco, San Francisco, CA, United States, [19]Department of Neurophysics, Max Planck Institute, Leipzig, Germany, [20]Spinal Cord Injury Center Balgrist, Balgrist University Hospital, Zurich, Switzerland, [21]Wellcome Trust Centre for Neuroimaging, UCL Institute of Neurology, University College London, London, United Kingdom, [22]Department of Brain Repair and Rehabilitation, UCL Institute of Neurology, University College London, London, United Kingdom, [23]Harvard-MGH Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [24]Montreal Neurological Institute, McGill University, Montreal, QC, Canada, [25]Functional Neuroimaging Unit, CRIUGM, University of Montreal, Montreal, QC, Canada

		We present a consensus recommendation for best practices in high quality data acquisition of quantitative MRI (qMRI) of the cervical spinal cord at 3T. We propose protocols for computing cross-sectional area (CSA), magnetization transfer ratio (MTR) and diffusion tensor imaging (DTI) from three main vendors. We demonstrate these protocols by repeated scans of a single subject, from which the data and analysis scripts are made available. We hope harmonized and publicly-available spinal cord imaging protocols will promote reproducibility and thus accelerate the progress for spinal cord measurements to be more widely accepted as MRI biomarkers in multicenter studies.

800	15:09	Quantitative Magnetic Resonance Imaging of the Human Brain with White Matter Hyperintensities: a New Approach towards Understanding the Underlying Pathology
		Elene Iordanishvili[1], Melissa Schall[1], Ricardo Loucao[1], Svenja Caspers[2], Ketevan Kotetishvili[3], Jon Shah[1,4], and Ana-Maria Oros-Peusquens[1]
		[1]Institute of Neuroscience and Medicine - 4 (INM-4), Research Centre Juelich, Juelich, Germany, [2]Institute of Neuroscience and Medicine - 1 (INM-1), Research Centre Juelich, Juelich, Germany, [3]Georgian Technical University (GTU), Tbilisi, Georgia, [4]Jülich Aachen Research Alliance (JARA), Juelich, Germany
		The interest in white matter hyperintensities (WMHs) has increased recently as they have been associated with various clinical disorders such as stroke and dementia. Although postmortem histopathological studies reported various underlying pathophysiological mechanisms, in vivo studies have not been specific enough to conform those results. We attempted to fill this gap with quantitative MRI of water content, T1, T2*, and MT parameters. These parameters were analyzed for white and grey matter globally and for manually segmented WMHs. Based on the changes identified for WMHs and their trend with WMH load, we were able to complement histopathological findings.

801	15:21	Robust diffusion parametric mapping of motion-corrupted data using a deep-learning-based method
		Ting Gong[1], Hongjian He[1], Zhiwei Li[2], Qiqi Tong[1], Zhichao Lin[2], Yi Sun[3], Feng Yu[2], and Jianhui Zhong[1,4]
		[1]Center for Brain Imaging Science and Technology, Key Laboratory for Biomedical Engineering of Ministry of Education, College of Biomedical Engineering and Instrumental Science, Zhejiang University, Hangzhou, China, [2]Department of Instrument Science & Technology, Zhejiang University, Hangzhou, China, [3]MR Collaboration NE Asia, Siemens Healthcare, Shanghai, China, [4]Department of Imaging Sciences, University of Rochester, Rochester, NY, United States

		Motion occurring during the acquisition of diffusion-weighted image volumes is inevitable. Deficient accuracy of volumetric realignment and within-volume movements cause the quality of diffusion model reconstruction to deteriorate, particularly for uncooperative subjects. Taking advantage of the strong inference ability of neural networks, we reconstructed diffusion parametric maps with remaining volumes after the motion-corrupted data removed. Compared to conventional model fitting, our method is minimally sensitive to motion effects and generates results comparable to the gold standard, with as few as eight volumes retained from the motion-contaminated data. This method shows great potential in exploiting some valuable but motion-corrupted DWI data.

802	15:33	Crosstalk of atrophic trigeminal nerve to abnormal brain structure in idiopathic trigeminal neuralgia
		Yuan Wang[1], Bethany Remeniuk[2], David Seminowicz[3], and Ming Zhang[1]
		[1]Department of Medical Imaging, First affiliated hospital of Xi'an Jiaotong University, Xi'an, China, [2]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [3]Department of Neural and Pain Sciences, School of Dentistry, University of Maryland Baltimore, Baltimore, MD, United States
		Idiopathic trigeminal neuralgia (ITN) is characterized by intermittent, lancinating attacks in the branches of the trigeminal nerve (TGN). 40 ITN patients and 40 matched controls underwent MRI sessions and clinical pain assessment. TGN volume of cisternal segment and whole brain grey matter volume (GMV) were evaluated using voxel-based morphometry, ect. Reduced GMV was found in the insula, dorsal anterior cingulate cortex, precuneus, and several areas of the temporal lobe in ITN subjects. Correlation analysis revealed that decreased GMV of the left insula and decreased TGN volume were associated with increased pain ratings, providing new insight into pathophysiology of the disease.

Oral

Imaging Response to Therapy

S03	Wednesday 13:45 - 15:45	*Moderators:* Peter Caravan & Guanshu Liu

803	13:45	Glycerophosphocholine increase is a reliable surrogate marker of chemotherapy response for various cancer drug treatments in triple-negative breast cancer cells
		Menglin Cheng[1], Vinay Ayyappan[1], Ruoqing Cai[1], Caitlin M. Tressler[1], and Kristine Glunde[1]
		[1]Radiology, The Johns Hopkins University School of Medicine, Baltimore, MD, United States

		MRS-detected total choline is a promising noninvasive surrogate marker of chemotherapy response in breast cancer. We have utilized six widely clinically used cancer chemotherapeutic drugs to treat triple-negative breast cancer cells to elucidate their molecular effects on choline phospholipid metabolism. We employed high-resolution ^{1}H MRS to detect changes in cellular choline metabolites combined with molecular approaches. Glycerophosphocholine increased in triple-negative breast cancer cells following all six types of chemotherapeutic treatment compared to vehicle control, while phosphocholine decreased, increased, or remained stable depending on the specific drug used, making glycerophosphocholine the most reliable surrogate marker of chemotherapy response in our study.

804	13:57	Parametric Response Mapping of Normalized FLAIR MR Images Provides Early Indication of Recurrence Risk in Glioblastoma
		Benjamin A. Hoff[1], Craig J. Galbán[2], Thomas L. Chenevert[2], Gary D. Luker[2], Benjamin Lemasson[3], Timothy D. Johnson[4], and Brian D. Ross[2]
		[1]University of Michigan, Ann Arbor, MI, United States, [2]Radiology, University of Michigan, Ann Arbor, MI, United States, [3]Grenoble Institut des Neurosciences, GIN, Universite Grenoble Alpes, Grenoble, France, [4]Biostatistics, University of Michigan, Ann Arbor, MI, United States
		Glioblastoma is a particularly malevolent disease, with median expected survival around 14 months. Standard protocols for treatment assessment and recurrence rely on morphological approximations of tumor burden. Recently included by the RANO criteria, T2/FLAIR is now standard in imaging protocols, highlighting edema, presumed to be associated with tumor cell infiltration and critical for accurate description of tumor burden and radiation treatment planning. Advanced methods for early detection of change are underutilized. Application of the Parametric Response Map technique provides greater sensitivity to FLAIR signal changes indicative of tumor progression prior to those detectable by morphological analysis alone.

805	14:09	Dynamic contrast enhanced MRI detects pancreatic cancer responses to stroma-directed therapy
		Jianbo Cao[1], Stephen Pickup[1], Cynthia Clendenin[2,3], Barbara Blouw[4], David Kang[4], Peter O'Dwyer[2,3], and Rong Zhou[1,3]
		[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Pancreatic Cancer Research Center, University of Pennsylvania, Philadelphia, PA, United States, [3]Abramson Cancer Center, University of Pennsylvania, philadelphia, PA, United States, [4]Halozyme Therapeutics, San Diego, CA, United States
		Stroma-targeted treatments of pancreatic ductal carcinoma (PDA) has been widely investigated, but there is no imaging method that has been validated for early and noninvasive monitoring of the tumor responses to stroma-directed treatments. Here we treated murine PDA models with an investigational drug, PEGPH20, which removes a stroma component called hyaluronan. We examined whether DCE-MRI can characterize the treat responses. Our results demonstrated that this technique can detect stromal changes as early as 24 h post treatment, and the MRI results are corroborated with HA-staining. Further validation and potential clinical translation are warranted.

806	14:21	In vivo monitoring of intracellular pO2 in response to CAR T cell immunotherapy against glioma
		Fanny Chapelin[1], Wenlian Zhu[2], Hideho Okada[3], and Eric Ahrens[2]
		[1]Bioengineering, UCSD, La Jolla, CA, United States, [2]Radiology, UCSD, La Jolla, CA, United States, [3]Neurological Surgery, UCSF, San Francisco, CA, United States
		We explore the temporal dynamics of tumor intracellular partial pressure of oxygen (pO_2) in a murine glioma model receiving human chimeric antigen receptor (CAR) T cell immunotherapy. Tumor cells were intracellularly labeled with perfluoro-crown-ether (PCE) nanoemulsion *ex vivo* before flank injection in mouse. The spin-lattice relaxation rate (R_1) of PCE is linearly proportional to the local oxygen concentration, enabling longitudinal *in vivo* measurement of absolute pO_2 values. Our results indicate that CAR T cell therapy induces significant tumor pO_2 increase peaking three days post-intravenous injection and correlates to tumor growth reduction.
807	14:33	Hyperpolarized-13C Imaging of Treatment Responses on Prostate Cancer Patients using 3D Dynamic CS-EPSI Techniques
		Hsin-Yu Chen[1], Peder E.Z. Larson[1], Jeremy W. Gordon[1], Robert A. Bok[1], Marcus Ferrone[2], Mark van Criekinge[1], Lucas Carvajal[1], Natalie Korn[1], Rahul Aggarwal[3], Pamela N. Munster[3], Sarah J. Nelson[1], John Kurhanewicz[1], and Daniel B. Vigneron[1]
		[1]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Department of Clinical Pharmacy, University of California, San Francisco, San Francisco, CA, United States, [3]School of Medicine, University of California, San Francisco, San Francisco, CA, United States
		Two unmet clinical needs facing the management of prostate cancer are to determine the best treatment for individual patients and to evaluate therapy response. In this study, we applied 3D dynamic imaging technique using hyperpolarized ^{13}C nuclei to non-invasively probe prostate cancer metabolism. Pyruvate-to-lactate conversion k_{PL} correlated well with biopsy and histological finding in pre-surgery prostate cancer patients. k_{PL} values dramatically decreased in a patient 6 weeks into androgen-deprivation therapy with associated PSA decrease, indicating early treatment response. A non-responder patient with castration-resistant cancer exhibited high k_{PL} one month after treatment that correlated with clinical progression.
808	14:45	Amide chemical exchange saturation transfer at 7T: A possible biomarker for detecting early response to neoadjuvant chemotherapy in breast cancer patients
		Erwin Krikken[1], Vitaliy Khlebnikov[1], Moritz Zaiss[2], Rajni Aarti Jibodh[3], Paul J van Diest[4], Peter R Luijten[1], Dennis W.J. Klomp[1], Hanneke W.M. van Laarhoven[3], and Jannie P Wijnen[1]
		[1]Radiology, UMC Utrecht, Utrecht, Netherlands, [2]Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [3]Medical Oncology, Academic Medical Centre Amsterdam, Amsterdam, Netherlands, [4]Pathology, UMC Utrecht, Utrecht, Netherlands

		Neoadjuvant chemotherapy (NAC) has an important role in the treatment of breast cancer and the need for early detection of treatment response is high. Therefore we investigated the feasibility of using APT CEST at 7T as a biomarker for this purpose. Ten lesions were included and APT signal before and after the first cycle of NAC were correlated to the pathological response. Significant differences were found in APT signal corresponding with the pathological response. These results suggest that APT CEST may be used to predict the response to NAC treatment in an early stage.

809	14:57	Hyperpolarized 13C MRSI monitoring of response to HDAC inhibition in glioblastoma
		Marina Radoul[1], Myriam M. Chaumeil[2], Pia Eriksson[1], Chloe Najac[1], Pavithra Viswanath[1], Mark Kelly[3], Anne Marie Gillespie[1], Joydeep Mukherjee[4], Russell O. Pieper[4], and Sabrina M. Ronen[1]
		[1]Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [2]Physical Therapy and Rehabilitation Science/Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [3]Pharmaceutical Chemistry, University of California San Francisco, San Francisco, CA, United States, [4]Neurological Surgery, University of California San Francisco, San Francisco, CA, United States
		Treatment of glioblastoma (GBM) is comprised of maximum safe surgical resection, radiotherapy and chemotherapy with Temozolomide. Nonetheless, the median survival of GBM patients is only 15 months with five-year survival rate of only 5.5%. Vorinostat, the clinically relevant histone deacetylase (HDAC) inhibitor, is a novel drug that inhibits cell proliferation and induces apoptosis in solid tumors. Following Vorinostat treatment, we show a significant decrease in hyperpolarized [1-^{13}C] lactate-to-pyruvate ratio that was associated with enhanced survival of glioblastoma-bearing mice. This highlights the potential of hyperpolarized ^{13}C MRSI for monitoring response to a type of anticancer therapy previously unexplored in GBM patients.

810	15:09	Efficacy of oral CKD-516 in combination with sorafenib on hepatocellular carcinoma using MRI and optical imaging
		Su Jung Ham[1], Jeeheon Kang[1], Yoonseok Choi[2], Keun Ho Ryu[3], Soo Jin Kim[3], Sang-Tae Kim[4], Jinil Kim[1], Chul Woong Woo[4], Ho-jin Kim[1], Jaeim Kwon[1], Do-Wan Lee[1], Seul-I Lee[1], Dong Cheol Woo[1], and Kyung Won Kim[1]
		[1]Radiology, Asan medical Center, Seoul, Republic of Korea, [2]GangNeung Asan Medical Center, Gangneung, Republic of Korea, [3]Chong Kun Dang Research, Seoul, Republic of Korea, [4]MR Core Laboratory, Asan medical Center, Seoul, Republic of Korea
		We used an oral form of CKD-516 and designed a combination experiment with sorafenib. BLI tumor viability measurement showed CKD-516 was effective in combination with sorafenib, but there was only a slight improvement when treated alone. By MRI, the CKD-516 group showed notable intratumoral hemorrhage and central necrosis from the early stage of treatment. By IHC, CKD-516 was advantageous in collapsing blood vessels in tumor tissue, and was more effective when treated in combination with sorafenib. Therefore, oral CKD-516 was advantageous over sorafenib in terms of vascular disrupting ability, and combination of CKD-516 with sorafenib reduced the rebound phenomenon.

811	15:21	Effect of lonidamine on response to temozolomide in a human glioma model
		Kavindra Nath[1], Jeffrey Roman[1], Lili Guo[1], David Nelson[1], Mary Putt[1], Stepan Orlovskiy[1], Ewere Azagidi[1], Violet Tu[1], Dennis Leeper[2], Marco Paggi[3], Yancey Gallespie[4], Corinne Griguer[4], Ian Blair[1], and Jerry Glickson[1]
		[1]University of Pennsylvania, Philadelphia, PA, United States, [2]Thomas Jefferson University, Philadelphia, PA, United States, [3]Regina Elena National Cancer Institute, IRCCS, Rome, Italy, [4]University of Alabama, Birmingham, AL, United States
		The treatment of glioblastoma multiforme (GBM) includes temozolomide (TMZ) chemotherapy concurrent with radiotherapy. Lonidamine (LND), an inhibitor of monocarboxylate transporters 1&4, the mitochondrial pyruvate carrier, and complex II, is shown here to potentiate TMZ-induced growth inhibition of U251 glioma cells. Through LC-Mass Spectrometry of cells and ^{31}P and ^{1}H MRS of U251 xenografts, we identified mechanisms of this potentiation, including tumor-selective inhibition of bioenergetics (βNTP/Pi) and simultaneous acidification (intracellular pH and lactate) which may inhibit enzymes contributing to TMZ resistance such as glutathione-S-transferase and O^6-methylguanine DNA methyltransferase (MGMT). LND may improve the current care of glioma patients and potentially overcome TMZ resistance.

812	15:33	Evaluating Therapeutic Response of Glioblastoma (GBM) with Chemical Exchange Saturation Transfer (CEST)
		Hatef Mehrabian[1,2], Sten Myrehaug[3], Hany Soliman[3], Arjun Sahgal[3], and Greg J Stanisz[1]
		[1]Physical Sciences, Sunnybrook Research Institute, Toronto, ON, Canada, [2]Radiology & Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [3]Radiation Oncology, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
		Early assessment of glioblastoma (GBM) response to standard 6-week chemo-radiation enables changing or adjusting therapy in patients with progressive tumors. Chemical Exchange Saturation Transfer (CEST) probes the concentration and exchange of labile proteins and peptides in ht tumor and is more sensitive to treatment-induced effects. CEST was capable of differentiating progressors from non-progressors as early as two weeks into the treatment. Moreover, certain CEST metrics (i.e. MTR_{NOE}, MTR_{Amide}, $CEST_{NOE}$) were capable of characterizing GBM aggressiveness even before the start of the treatment.

Oral

It Takes a Muscle

S04	Wednesday 13:45 - 15:45	*Moderators:* Jung-Ah Choi & Charles Hutchinson

813	13:45	Elastography, T2-mapping, and Dixon MRI of the gluteus maximus muscle in spinal cord injured and able-bodied subjects

Jules Laurent Nelissen[1,2,3], Dorien Verschuren[1], Maurits Sloots[4], Larry de Graaf[1], Jitsha Monte[3], Sandra van den Berg[3], Kevin Moerman[5], Klaas Nicolay[1], Mario Maas[3], Sicco Bus[6], Ralph Sinkus[7], Jurgen Runge[3,7], Christof Smit[4], Thomas Janssen[4,8], Cees Oomens[1], Gustav Strijkers[2], and Aart Nederveen[3]

[1]Biomedical Engineering, Eindhoven University of Technology, Eindhoven, Netherlands, [2]Biomedical Engineering and Physics, Academic Medical Center, Amsterdam, Netherlands, [3]Radiology and Nuclear Medicine, Academic Medical Center, Amsterdam, Netherlands, [4]Reade, Centre for Rehabilitation and Rheumatology, Amsterdam, Netherlands, [5]Center for Extreme Bionics, Media lab, MIT, Cambridge, MA, United States, [6]Department of Rehabilitation, Academic Medical Center, Amsterdam Movement Sciences, Amsterdam, Netherlands, [7]Image Sciences & Biomedical Engineering, King's College London, London, United Kingdom, [8]Human Movement Sciences, VU University, Amsterdam, Netherlands

Gluteus maximus biomechanical properties and composition are altered in spinal cord injured (SCI) subjects and increase the risk of deep tissue injury type of pressure ulcers. For this purpose, a multi-parametric MRI study of the gluteus maximus of SCI and able-bodied subjects was performed. The protocol consisted of MRE, T_2-mapping, and Dixon. The gluteus maximus of SCI subjects had a lower stiffness, which was accompanied by a higher fat fraction, as compared to the able-bodied subjects. The proposed protocol has great potential in providing personalized information on deep tissue injury risk.

814 13:57

3D-T1rho mapping of upper arm muscles in post-stroke patients

Rajiv G Menon[1], Preeti Raghavan[2], and Ravinder R Regatte[1]

[1]Center for Biomedical Imaging, New York University School of Medicine, New York, NY, United States, [2]Rusk Rehabilitation, New York University School of Medicine, New York, NY, United States

In this study, we evaluate the use of 3D-T1rho (T1ρ) relaxation mapping of the upper arm muscle glycosaminoglycan (GAG) content in healthy controls, and post stroke patients with pre and post hyaluronidase injections. Healthy controls (n=5) and post-stroke patients (n=5, pre and post treatment) were recruited. Dixon based water-fat imaging and T1ρ mapping were performed. Mono- and bi-exponential modeling was used to process the data. While water-fat distributions were not significantly different between the two groups, significant differences were noted in T1ρ values using mono- and bi-exponential analysis. T1ρ imaging shows significant changes that reflect the reduction of GAG's following the treatment with hyaluronidase injection.

815 14:09

Water T2 mapping in fatty infiltrated thigh muscles of patients with neuromuscular diseases using a T2-prepared 3D TSE with SPAIR

Sarah Schlaeger[1,2], Dominik Weidlich[1], Elisabeth Klupp[2], Federica Montagnese[3], Marcus Deschauer[4], Benedikt Schoser[3], Sarah Bublitz[4], Claus Zimmer[2], Ernst J. Rummeny[1], Jan S. Kirschke[2], and Dimitrios C. Karampinos[1]

		[1]Department of Diagnostic and Interventional Radiology, Technical University of Munich, Munich, Germany, [2]Department of Diagnostic and Interventional Neuroradiology, Technical University of Munich, Munich, Germany, [3]Friedrich-Baur-Institut, Ludwig Maximilian University, Munich, Germany, [4]Department of Neurology, Technical University of Munich, Munich, Germany
		In patients with neuromuscular diseases muscle water T2 is an important biomarker to monitor disease activity and therapy effectiveness. Especially, the thigh is of interest showing disease-characteristic patterns of involvement. Different T2 mapping approaches, routinely based on MESE, have been developed to minimize the effect of confounding factors. An alternative method is the T2Prep 3D-TSE combined with SPAIR. However, it remains unknown, how T2Prep 3D-TSE performs in the presence of fat. This work simulates the effect of SPAIR and T2preparation on the 3D-TSE readout in the presence of fat and compares T2Prep 3D-TSE and 2D-MESE to MRS in 34 patients.

816	14:21	Multi-parametric MR shows increased T2 heterogeneity in fat infiltrated muscles in Becker Muscular Dystrophy
		M.T. Hooijmans[1], C. Baligand[2], M. Froeling[3], J.J.G.M Verschuuren[4], A.G. Webb[2], E.H. Niks[4], and H.E. Kan[2]
		[1]Radiology, Amsterdam Medical Center, Amsterdam, Netherlands, [2]Radiology; C.J. Gorter Center for High Field MRI, Leiden University Medical Center, Leiden, Netherlands, [3]Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [4]Neurology, Leiden University Medical Center, Leiden, Netherlands
		Quantitative MR is increasingly used to assess muscle damage in muscular dystrophies, including BMD. Early markers that reflect changes in muscle tissue are becoming increasingly important with therapies aimed at preserving muscle tissue. This study used a multi-modal MR approach to examine diffusion properties, the average water T2 and SD of the water T2 in non-fat-infiltrated and fat-infiltrated muscles in BMD. Our results indicate that none of the proposed measures are sensitive to muscle tissue changes prior to the replacement of muscle tissue by fat and that only T2 heterogeneity is sensitive to muscle tissue changes in the presence of fat in patients with BMD.

817	14:33	Increased T1Rho relaxation in a Duchenne muscular dystrophy mouse model with increased muscle fibrosis
		Bauke Kogelman[1], Kevin Adamzek[2], Ernst Suidgeest[1], Gustav Strijkers[3], Maaike van Putten[2], and Louise van der Weerd[1,2]
		[1]Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Human Genetics, Leiden University Medical Center, Leiden, Netherlands, [3]Preclinical and Translational MRI, Academic Medical Center, Amsterdam, Netherlands

		A T1Rho sequence was used in a Duchenne Muscular Dystrophy mouse model characterized by increased muscle fibrosis. Significantly higher T1Rho relaxation times were found compared to wild-type mice in which fibrosis was absent. Although both T1Rho and T2 values were increased, the increase was more pronounced for T1Rho than for T2 (14.2% vs 3.6%), indicating that T1Rho is affected by other processes than those resulting in increased T2 values. These data demonstrate the potential of T1Rho to assess muscle fibrosis in vivo.

818	14:45	Quantification of water T1 and fat fraction in skeletal muscle tissue using an optimal MR fingerprinting radial sequence (MRF-WF)
		Benjamin Marty[1,2] and Pierre G Carlier[1,2]
		[1]NMR Laboratory, Institute of Myology, Paris, France, [2]NMR Laboratory, CEA, DRF, IBFJ, MIRCen, Paris, France
		Quantitative T1-mapping might represent an efficient tool to monitor inflammation, necrosis or fibrosis processes in skeletal muscle tissues affected by neuromuscular disorders. However, standard T1-mapping sequences cannot separate the contribution of water and fat protons. If directly applied to fatty infiltrated skeletal muscles, a “global” T1 value would mainly reflect the degree of intramuscular fat and the other underlying processes would largely be hidden. Here, we proposed an optimal sequence allowing simultaneous estimation of water T1 and fat fraction. It was validated in phantom and in vivo acquisitions were performed on several subjects suffering from different neuromuscular diseases.

819	14:57	Quantitative T2 mapping of the thigh muscles and its correlation with the ADC: a feasibility study in assessing inflammatory myopathy
		Fengdan Wang[1], Qian Wang[2], Haiping Zhang[1], Dong Liu[1], Tobias Kober[3], Tom Hilbert[3], Yi Sun[4], Yan Zhang[1], and Zhengyu Jin[1]
		[1]Radiology, Peking Union Medical College Hospital, Beijing, China, [2]Rheumatology, Peking Union Medical College Hospital, Beijing, China, [3]Advanced Clinical Imaging Technology, Siemens Healthcare, AG, Switzerland, [4]MR Collaboration NE Asia, Siemens Healthcare, Shanghai, China
		We investigated the use of the T2 mapping technique to quantitatively evaluate the thigh muscles of 18 dermatomyositis (DM)/polymyositis (PM) patients and 10 healthy control subjects. Moreover, the correlation of T2 values with apparent diffusion coefficient (ADC) values was also studied. The results showed significantly elevated T2 values with edematous muscles and increased T2 values with unaffected muscles (normal appearing in conventional MRI) in DM/PM patients, compared to the control group. The T2 values of the edematous muscles were found to be closely correlated with the ADC. This study demonstrated that T2 mapping may be successfully used in the quantitative evaluation of inflammatory myopathy.

820	15:09	Magnetic resonance measurements of fat content and water diffusion in muscles of glucocorticoid-treated patients with polymyalgia rheumatica compared with healthy volunteers.

		John D Biglands[1], Steven F Tanner[1], Ai Lyn Tan[1,2], Sarah L Mackie[1,2], Elizabeth M A Hensor[1,2], John P Ridgway[1], Paul Emery[1,2], Thorsten Feiweier[3], Emma Harris[4], Paul M Stewart[5], and Andrew Grainger[1]
		[1]NIHR Musculoskeletal Biomedical Research Centre, Leeds, United Kingdom, [2]Leeds Institute of Rheumatic and Musculoskeletal Medicine, Leeds, United Kingdom, [3]Siemens Healthcare GmbH, Erlangen, Germany, [4]School of Human and Health Science, University of Huddersfield, Huddersfield, United Kingdom, [5]School of Medicine, University of Leeds, Leeds, United Kingdom
		The purpose of this study was to assess differences in fat fraction and water diffusion between muscles in the healthy thigh and to assess differences between glucocorticoid treated patients with polymyalgia rheumatic (PMR) and healthy controls. Twenty five healthy volunteers and sixteen patients with PMR undergoing glucocorticoid treatment underwent MRI to assess muscle fat fraction and diffusion. The study found that the hamstrings have greater fat fraction and reduced diffusion compared to quadriceps in healthy individuals. Furthermore, alterations in fat fraction and diffusion parameters associated with glucocorticoid-treated PMR are more readily detectable in the hamstrings than the quadriceps.

821	15:21	Both oxygen supply and phosphocreatine recovery rate show proximo-distal gradients along the human tibialis anterior after exercise
		Linda Heskamp[1], Franciska Lebbink[1], Mark Jacobus van Uden[1], Marnix Christiaan Maas[1], Jurgen Claassen[2], Andreas Boss[1], and Arend Heerschap[1]
		[1]Radiology and Nuclear Medicine, Radboud university medical center, Nijmegen, Netherlands, [2]Geriatrics, Radboud university medical center, Nijmegen, Netherlands
		Since the rate of phosphocreatine recovery after exercise varied substantially within the tibialis anterior, we wondered if O_2 supply also varied along this muscle. Therefore, we applied near infra-red spectroscopy to study the dynamic equilibrium of O_2 supply and O_2 utilization, intravoxel incoherent motion imaging for muscle perfusion and ^{31}P-MRS during and after isometric exercise of the tibialis anterior. We observed higher post-exercise perfusion and faster phosphocreatine and oxyhemoglobin recovery proximally than distally in the tibialis anterior, indicating a proximo-distal gradient in O_2 supply. This may be an adaptation to a higher proximal energy requirement.

822	15:33	Work dependence of calf muscle DTI exercise response from dynamic imaging
		Eric Sigmund[1,2], Steven Baete[1,2], Mary Bruno[1,2], David Stoffel[1], and Jenny Bencardino[3]
		[1]Bernard and Irene Schwartz Center for Biomedical Imaging, NYU Langone Medical Center, New York, NY, United States, [2]Center for Advanced Imaging and Innovation (CAI2R), NYU Langone Medical Center, New York, NY, United States, [3]Department of Radiology, NYU Langone Medical Center, New York, NY, United States

		We describe measurement of work dependence of exercise response of diffusion contrast in calf muscle with a multiple echo diffusion tensor imaging (MEDITI) in a clinical 3 T scanner. With radial imaging, accelerated diffusion encoding, and compressed sensing reconstruction, spatial resolution of 3.7 mm and temporal resolution of 16 s was achieved. Using an MR-compatible ergometer with pneumatic resistance and force/displacement monitoring, post-exercise recovery of T2 and DTI metrics following plantarflexion in gastrocnemius muscle were monitored as a function of total normalized work. Exercise response showed significant anisotropy, and trends of higher response with work were observed.

Oral

Pancreas/GI

S05	Wednesday 13:45 - 15:45

823	13:45	MR elastography and multiparametric MRI of chronic pancreatitis reversal after bariatric surgery in obese rats
		Philippe Garteiser[1], Vinciane Rebours[1,2], Sabrina Doblas[1], Gwenael Pagé[1], André Bado[1], Valérie Paradis[1,3], Maude Le Gall[1], Anne Couvelard[1,4], and Bernard E Van Beers[1,5]
		[1]UMR 1149 Center For Research on Inflammation, Inserm, Paris, France, [2]Beaujon Hospital, Pancreatology, AP-HP, Clichy, France, [3]Beaujon Hospital, Pathology, AP-HP, Clichy, France, [4]Bichat Hospital, Pathology, AP-HP, Paris, France, [5]Beaujon Hospital, Radiology, AP-HP, Clichy, France
		In obesity, pancreas is affected by fatty infiltration and fibrosis. Bariatric surgery is one of the only therapies which demonstrably improves pancreas status in obesity. In the present work we investigated the mechanical properties at several frequencies, the PDFF and the T2* of pancreatic explants in an obese rat model of bariatric surgery. Bariatric surgery reversed the MRI parameters to values not significantly different than controls. MRI parameters closely matched the reference histology observations. MRE and multiparametric MRI may be used to monitor pancreatic status and treatment response in an obese rat model of bariatric surgery.

824	13:57	T1 Mapping and MR Elastography (MRE) for the Diagnosis of Mild Chronic Pancreatitis
		Yu Shi[1], Min Wang[1], Xiaoqi Wang[2], Yanqing Liu[1], Ruoyun Ji[1], Lizhuo Cang[1], and Qiyong Guo[1]
		[1]Shengjing Hospital of China Medical University, Shen Yang, China, [2]Philips Healthcare, Beijing, China
		We have investigated the value of both MR elastography (MRE) and T1 mapping for early detection of Mild Chronic pancreatitis(CP). Our study found that both MRE and T1 mapping had good diagnostic performance for detecting mild CP, with MRE slightly outperforming T1 mapping.

825	14:09	Differentiation of Mass-forming Focal Pancreatitis (MFFP) from Pancreatic Cancer (CP): Added Value of Magnetic Resonance Elastography (MRE) to Dynamic Contrast-enhanced Magnetic Resonance Imaging (DCE-MRI)
		Yu Shi[1], Yanqing Liu[1], Xiaoqi Wang[2], Min Wang[1], Ruoyun Ji[1], Lizhuo Cang[1], and Qiyong Guo[1]
		[1]Shengjing Hospital of China Medical University, ShenYang, China, [2]Philips Healthcare China, Beijing, China
		The differential diagnosis of mass-forming focal pancreatitis (MFFP) and pancreatic cancer (PC) is clinically important. Our study shows that combined assessment of magnetic resonance elastography (MRE) with dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) is a promising technique with improved specificity of diagnosing PC from MFFP cases, when comparing with DCE-MRI.

826	14:21	T1 mapping of the pancreas: correlation with HbA1c values
		Yoshifumi Noda[1], Satoshi Goshima[1], Yusuke Tsuji[2], Kimihiro Kajta[1], Yuta Akamine[3], Tomoyuki Okuaki[3], Masatoshi Honda[3], Hiroshi Kadohara[3], Hiroshi Kawada[1], Nobuyuki Kawai[1], Yukichi Tanahashi[1], and Masayuki Matsuo[1]
		[1]Gifu University, Gifu, Japan, [2]Kyoto Prefectural University of Medicine, Kyoto, Japan, [3]Philips Healthcare, Tokyo, Japan
		The presence of pancreatic fibrosis is a representative feature of the pancreas in patients with impaired glucose tolerance (IGT). The T1 signal intensity of the pancreas is reported to be associated with pancreatic fibrosis and HbA1c values. In this study, we evaluated the feasibility of T1 mapping of the pancreas for the assessment of HbA1c values. Our results showed that increased T1 values of the pancreas was significantly correlated with HbA1c values, so the T1 values of the pancreas could serve as a potential imaging biomarker for the assessment of patients with IGT.

827	14:33	Pancreas perfusion and transit-time measurement using pseudo-continuous ASL
		Manuel Taso[1], Arnaud Guidon[2], Li Zhao[1], Koenraad J. Mortele[1], and David C. Alsop[1]
		[1]Division of MRI Research, department of Radiology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, United States, [2]Global MR Applications and Workflow, GE Healthcare, Boston, MA, United States

		While there are strong interests in non-contrast pancreatic perfusion measurement, reports of ASL use for this purpose are rare due to several challenges. In this work, we investigate the robustness of background-suppressed-pCASL for pancreatic perfusion, with an emphasis on quantifying blood-flow (PBF) and transit-time (ATT) using multiple-delays ASL. Robust ASL signal was obtained in all volunteers, and ATT was measured to be 1029±89ms. Measured ATT-corrected PBF was 162±12mL/100g.min. Evidence of heterogeneity in ATT and PBF was found, potentially linked to the complex vascular supply and different exocrine/endocrine functions. Hence, pCASL PBF measurement is feasible and holds promise for clinical studies.

828	14:45	Comparison of T2WI and DWI qualitative assessment and T2W-based radiomic features for predicting complete response in patients with rectal cancer after neoadjuvant chemoradiotherapy
		Natally Horvat[1], Harini Veeraraghavan[1], Monika Khan[1], Ivana Blazic[1], Junting Zheng[1], Marinela Capanu[1], Evis Sala[1], Julio Garcia-Aguilar[1], Marc J Gollub[1], and Iva Petkovska[1]
		[1]Memorial Sloan Kettering Cancer Center, New York, NY, United States
		Radiomics is a novel science that encompasses a computer-based extraction of quantitative features from images. Some studies have demonstrated that radiomics may help distinguishing malignant from benign diseases. We hypothesize that radiomics extracted from T2WI may improve qualitative MRI assessment in the evaluating of complete response in patient with locally advanced rectal cancer after neoadjuvant chemoradiotherapy.

829	14:57	Machine Learning for Prediction of Chemoradiation Therapy Response in Patients with Locally-Advanced Rectal Cancer (LARC) Using Pre- and Early-Treatment Follow-up Multiparametric MRI
		Yang Zhang[1], Liming Shi[2], Xiaonan Sun[2], Tianye Niu[2], Ning Yue[3], Tiffany Kwong[1,3], Peter Chang[4], Melissa Khy[1], Daniel Chow[1], Min-Ying Su[1], and Ke Nie[3]
		[1]Department of Radiological Sciences, University of California, Irvine, CA, United States, [2]Department of Radiation Oncology, Sir Run Run Shaw Hospital, Zhejiang University School of Medicine, Hangzhou, China, [3]Department of Radiation Oncology, Rutgers-The State University of New Jersey, New Brunswick, NJ, United States, [4]Department of Radiology, University of California, San Francisco, CA, United States
		A convolutional neural network (CNN) was implemented to predict the response of LARC patients receiving neoadjuvant chemoradiation therapy. The pre-treatment MRI, and the early-treatment follow-up MRI done at 2-3 weeks after the initiation of radiation were used. The MRI protocol included T2, DWI and DCE. A total of 41 patients were studied, with 8 pCR, 27 Tumor Regression Grade 1, and 9 TRG 2+3. The prediction accuracy was 0.71-0.89 for pCR vs. non-pCR; 0.70-0.77 for TRG(0+1) vs. TRG(2+3), not very good due to the limitations of a relatively small dataset. Using manually extracted tumor features in conjunction with neural network classifiers may achieve a higher accuracy.

830	15:09	Multiparametric evaluation of inflammation and fibrosis in a radiation-induced murine model of colitis
		Sabrina Doblas[1], Magaly Zappa[1,2,3], Dominique Cazals-Hatem[2,4], Fabien Milliat[5], Philippe Garteiser[1], Eric Ogier-Denis[2], and Bernard E Van Beers[1,3]
		[1]Laboratory of Imaging Biomarkers, CRI-UMR1149, Inserm, Paris, France, [2]Laboratory of Intestinal Inflammation, CRI-UMR1149, Inserm, Paris, France, [3]Department of Radiology, Beaujon University Hospital, Clichy, France, [4]Department of Pathology, Beaujon University Hospital, Clichy, France, [5]Research Laboratory in Radiobiology and Radiopathology, IRSN, Fontenay-aux-Roses, France
		The evaluation of fibrosis severity in Crohn’s disease is essential for patient management and prognosis, albeit seldom investigated. We validated a MR approach including diffusion-weighted imaging, magnetization transfer and FAIR perfusion to distinguish between moderate and severe forms of fibrosis in a radiation-induced murine model of colitis. The presence of fibrotic tissue and its accompanying vascular alterations induced a decrease in apparent diffusion coefficient and in perfusion, and an increase in the magnetization transfer ratio. This approach could be applied for diagnosis and assessment of intestinal fibrosis in patients.

831	15:21	MRI predicts histopathologic composition of ileal Crohn's disease.
		Mathilde Wagner[1,2], Mabel Huaibin Ko[3], Manjil Chatterji[4], Cecilia Besa[4], Joana Torres[5], Xiaofei Zhang[3], Hinaben Panchal[5], Judy Cho[5], Jean-Frederic Colombel[5], Noam Harpaz[3], and Bachir Taouli[2,4]
		[1]Radiology, Pitié Salpêtrière Hospital, UPMC, Paris, France, [2]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [3]Pathology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [4]Radiology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [5]Gastroenterology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States
		The aim of our study was to assess the value of MRI for the characterization of histopathologic tissue composition of small bowel Crohn’s disease (CD), including assessment of inflammation, fibrosis and smooth muscle hypertrophy. Our results showed that MRI-based parameters including ADC, MaRIA score and layered pattern of enhancement can predict the degree of bowel inflammation. We also showed that wall thickness measured on T2WI can distinguish prominent muscle hypertrophy from prominent fibrosis in ileal CD.

832	15:33	MRI of whole gut transit time in newly diagnosed coeliac disease.
		Carolyn Costigan[1], Nina R Lewis[1], Robin C Spiller[1], Paul S Morgan[2], Jennifer Price[3], Carolina Ciacci[4], Paola Iovino[4], Caroline Hoad[1], Penny Gowland[1], and Luca Marciani[1]

		[1]Nottingham Digestive Diseases Centre and NIHR Nottingham Biomedical Research Centre, Nottingham University Hospitals NHS Trust and University of Nottingham, Nottingham, United Kingdom, [2]Medical Physics and Clinical Engineering, Nottingham University Hospitals, Queen's Medical Centre, Nottingham, United Kingdom, [3]Nottingham NHS Treatment Centre, Nottingham University Hospitals, Queen's Medical Centre Campus, Nottingham, United Kingdom, [4]Department of Medicine and Surgery, Scuola Medica Salernitana Università di Salerno, Salerno, Italy
		Coeliac disease (CD) is an autoimmune disease which affects 1 in 100 people. There is no cure and the only treatment is a lifelong gluten free diet. This study aims to improve our understanding of the functional motility disorder associated with CD using MRI. Whole gut transit time (WGTT), measured using MRI transit markers, was significantly delayed in the coeliac patients compared to helathy controls ($p<0.04$). The MRI gut transit test is quick and is acceptable to patients and could help long term monitoring and follow up, complementing existing more invasive techniques.

Oral

Field Management & Shimming

S06	Wednesday 13:45 - 15:45	*Moderators:* Jason Stockmann & Anke Henning

833	13:45	Dynamic B0 Shimming for Multi-Slice Metabolite Mapping at Ultra-High Field in the Human Brain: Very High Order Spherical Harmonics vs. Multi-Coil
		Paul Chang[1,2], Sahar Nassirpour[1,2], Ali Aghaeifar[1], Klaus Scheffler[1,3], and Anke Henning[1,4]
		[1]Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]IMPRS for Cognitive and Systems Neuroscience, Eberhard-Karls University of Tuebingen, Tuebingen, Germany, [3]Department of Biomedical Magnetic Resonance, Eberhard-Karls University of Tuebingen, Tuebingen, Germany, [4]Department of Physics, Ernst-Moritz-Arndt University Greifswald, Greifswald, Germany
		In this work, we evaluated the performance of two B_0 shimming approaches (i.e. a very high order spherical harmonic shim system versus a multi-coil shim setup), for dynamic shimming in the context of high resolution and multi-slice metabolite mapping of the human brain at 9.4T.

834	13:57	Integrated ΔB0/Rx coil array for improved spinal cord imaging at 3T
		Ryan Topfer[1], Alexandru Foias[1], Nibardo Lopez Rios[1], Angel Chauffray[1,2], Grégoire Germain[1], Nick Arango[3], Lawrence L. Wald[4,5], Jason P. Stockmann[4,5], and Julien Cohen-Adad[1,6]

		[1]NeuroPoly Lab, Institute of Biomedical Engineering, Polytechnique Montreal, Montreal, QC, Canada, [2]École polytechnique fédérale de Lausanne, Lausanne, Switzerland, [3]Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [4]A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [5]Harvard Medical School, Boston, MA, United States, [6]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montreal, QC, Canada
		Spinal cord imaging is hampered by static and respiration-induced dynamic variations of B0, causing serious issues for EPI-based protocols and spectroscopy. Integrated ΔB0/Rx arrays could provide an effective means to further compensate small-scale variations, complementary to the existing spherical harmonic coils. Here, we designed, built and tested in a human subject an 8-channel integrated ΔB0/Rx coil for the cervical spinal cord. Results showed improvements for correcting static field variations as well as respiratory-induced variations. Future studies will investigate dynamic and real time shimming applications for the spinal cord.

835	14:09	Regularized Second-order Dynamic Shimming
		Yuhang Shi[1], S. Johanna Vannesjo[1], and Stuart Clare[1]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, University of Oxford, Oxford, United Kingdom
		The implementation of dynamic shimming relies on determining robust and accurate shim currents. This work presents a novel, analytical, and fully automated regularized shim determination technique to solve ill-conditioned least-square problems and regularize current constraint challenges for dynamic shimming applications. The method is based on the Tikhonov regularization whereby the L-curve method is utilized to search for an optimal shim solution. The method improves shim current use efficiency and conditioning of the shim determination problem, outperforming the truncated singular value decomposition regularization based least-square method.

836	14:21	Inter-slice current constrained B0 shim optimization for high order dynamic shim updating with strongly reduced eddy currents
		Michael Schwerter[1], Chan Hong Moon[2], Hoby Hetherington[2], Jullie Pan[2], Lutz Tellmann[1], Jörg Felder[1], and N. Jon Shah[1,3]
		[1]Institute of Neuroscience and Medicine, Medical Imaging Physics (INM-4), Forschungszentrum Jülich, Jülich, Germany, [2]Department of Radiology, University of Pittsburgh, Pittsburgh, PA, United States, [3]Faculty of Medicine, Department of Neurology, RWTH Aachen University, Aachen, Germany

		Dynamic shim updating using spherical harmonics is an effective B_0 shim technique, but known to induce eddy currents which degrades the achievable shim quality. Current DSU implementations therefore use pre-emphasis which requires additional hardware and time-consuming system calibrations. To reduce eddy current generation, we have implemented an optimization algorithm which limits the maximum inter-slice shim current change. It is based on the assumption that a smooth variation of shim currents with small current steps will substantially reduce eddy currents. Simulations and initial experiments have shown that eddy currents can be drastically reduced without significant impact on the achievable shim quality.

837	14:33	The orthogonal shim coil at 3-Tesla Jiazheng Zhou[1,2], Jason Stockmann[3,4], Nicolas Arango[5], Klaus Scheffler[1], Lawrence L Wald[3,4], and Fa-Hsuan Lin[6,7] *[1]High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [2]Graduate Training Center of Neuroscience, IMPRS, University of Tübingen, Tübingen, Germany, [3]A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [4]Harvard Medical School, Boston, MA, United States, [5]Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [6]Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan, [7]Department of Neuroscience and Biomedical Engineering, Alto University, Espoo, Finland* We purpose an integrated RF-shim coil array, where the shimming current path and the RF receiving coil are arranged on two orthogonal planes to minimize the mutual coupling. This design was implemented as an array consisting of seven shim coils and a 32-channel RF-shim array. The 39-channel RF-shim coil array has marginal SNR loss and improved the global shimming by 9%, compared to the 32-channel RF-shim array.

838	14:45	Application of Integrated Parallel Reception, Excitation, and Shimming (iPRES) for Signal Loss Recovery in fMRI Devin A Willey[1,2], Dean Darnell[1], Allen W Song[1,2], and Trong-Kha Truong[1,2] *[1]Brain Imaging and Analysis Center, Duke University, Durham, NC, United States, [2]Medical Physics Graduate Program, Duke University, Durham, NC, United States* Integrated parallel reception, excitation, and shimming (iPRES) coil arrays enable simultaneous image acquisition and localized B_0 shimming with a single coil array. We propose to apply this novel technology to recover signal loss in fMRI by using a new shim optimization algorithm. Simulations and *in vivo* experiments performed with a 32-channel iPRES head coil array demonstrate that the proposed method can reduce both the B_0 inhomogeneity and the signal loss in gradient-echo EPI images, particularly in the inferior frontal brain region, resulting in more activation in that region in a breath-holding fMRI experiment.

839	14:57	MAGNUS: An ultra-high efficiency head-only gradient coil for imaging the brain microstructure

Thomas Foo[1], Dominic Graziani[1], Yihe Hua[1], Ye Bai[1], Justin Ricci[1], Christina Vasil[1], Naveenan Thiagarajan[1], Eric Fiveland[1], Alex Kagan[1], Joseph Piel[1], Ek Tsoon Tan[1], Mark Vermilyea[1], Charles Helms[2], Franklyn Snell[2], Derek Seeber[2], William Einziger[2], David Lee[2], Peter Roemer[2], Jean-Baptiste Mathieu[2], Maureen N Hood[3], Heechin Chae[4], and Vincent B Ho[3]

[1]GE Global Research, Niskayuna, NY, United States, [2]GE Healthcare, Florence, SC, United States, [3]Uniformed Services University of the Health Sciences, Bethesda, MD, United States, [4]Ft. Belvoir Community Hospital, Ft. Belvoir, VA, United States

An ultra-high gain asymmetric gradient coil design for imaging the brain microstructure is described. This design has greater than 4 times the gain of existing whole-body gradient coils and 3x that of the Compact 3T gradient coil with similar inner diameter. With a 1 MVA driver, this gradient coil is designed to deliver 200 mT/m at a maximum slew rate of 500 T/m/s.

840 15:09

Constrained Optimization for Static and Dynamic B0 Shimming

Chan Hong Moon[1], Michael Schwerter[2], Jullie W. Pan[1], N Jon Shah[2], and Hoby Hetherington[1]

[1]MRRC, Dept. of Radiology, University of Pittsburgh, Pittsburgh, PA, United States, [2]Medical Imaging Physics (INM-4), Institute of Neuroscience and Medicine, Jülich, Germany

Dynamic shimming compared to global shimming improves B_0 homogeneity over whole brain. However, typical shim optimization could result in high currents, particularly for small volume, e.g. small slab or slice. To address this we investigated the extent to which large reductions in aggregate shim current could be achieved through constrained optimization at 7T. We also investigated the extent to which alternate imaging orientation could improve homogeneity. The results show constrained optimization can provide robust shimming at substantially reduced aggregate current values, and angulated imaging improved shimming condition. The proposed methods enhanced multi-slice imaging by reducing both susceptibility-induced signal losses and distortions.

841 15:21

Towards Real-time MRI Guided Cancer Therapy: Development of a high field Inline MRI-Linac

Gary Liney[1], Bin Dong[1], Kevin Zhang[1], Urszula Jelen[1], Jarrad Begg[2], Amy Walker[2], Robba Rai[2], Ewald Weber[3], Ricky O'Brien[4], Michael Barton[1], Stuart Crozier[3], and Paul Keall[4]

[1]Ingham Institute, Liverpool, Australia, [2]Liverpool Cancer Therapy Centre, Liverpool, Australia, [3]University of Queensland, Brisbane, Australia, [4]University of Sydney, Sydney, Australia

This study describes the progress that has been made using a dedicated split bore 1.0 Tesla magnet to provide an MRI-guided radiotherapy system. This magnet design has a number of advantages including patient entry in two orientations to investigate competing magnetic field-beam configurations. A number of beam and imaging experiments, including first in vivo results, are described which show the efficacy of the system as an integrated inline MRI-Linac.

842	15:33	Integrated Parallel Reception, Excitation, and Shimming (iPRES) Breast Coil Array for Simultaneous MR Image Acquisition and Localized B_0 Shimming
		Yixin Ma[1,2], Dean Darnell[1], Huimin Zhang[1,3], Fraser J Robb[4], Allen Song[1], and Trong-Kha Truong[1,2,3]
		[1]Brain Imaging and Analysis Center, Duke University, Durham, NC, United States, [2]Medical Physics Graduate Program, Duke University, Durham, NC, United States, [3]Medical Physics Graduate Program, Duke Kunshan University, Kunshan, China, [4]GE Healthcare, Aurora, OH, United States
		In breast imaging, the image quality is severely degraded by susceptibility-induced B_0 inhomogeneities. Here, we apply the novel integrated parallel reception, excitation, and shimming (iPRES) technology to enable simultaneous image acquisition and localized B_0 shimming of the breasts with the same coil array. Proof-of-concept in vivo experiments with only four iPRES(1) breast coil elements already show up to 43.3% reduction in B_0 root-mean-square error with no SNR compromise. Simulations show that the shimming can be further improved by implementing more complex iPRES(N) geometries with N smaller shim loops per RF coil element.

Oral

Pediatric Neuropathology & Neurodevelopmental Disorders

W03/04	Wednesday 13:45 - 15:45	*Moderators:* Nadine Girard & Sean Deoni

843	13:45	Fixel-based analysis of white matter fibre density and morphology in the preterm brain.
		Diliana Pecheva[1], Jacques-Donald Tournier[1], Maximilian Pietsch[1], Daan Christiaens[1], Dafnis Batalle[1], Daniel C. Alexander[2], Mary A. Rutherford[1], Joseph V. Hajnal[1], A. David Edwards[1], Hui Zhang[2], and Serena J. Counsell[1]
		[1]Centre for the Developing Brain, King's College London, London, United Kingdom, [2]Centre for Medical Image Computing, University College London, London, United Kingdom
		Fixel-based analysis (FBA) provides measures of fibre cross-section (FC) and fibre density (FD) for individual fibre populations within voxels containing crossing fibres, overcoming the limitations of the diffusion tensor model. FBA was applied to a preterm neonatal cohort to assess the effects of perinatal risk factors on white matter, identifying decreases in FD and FC in distinct fibre populations associated with increased prematurity, low birthweight, respiratory support and parenteral nutrition. We show that aberrant white matter development previously attributed to microstructural changes may be related to alterations in the cross-sectional area of specific fibre bundles at the macroscopic scale.

844	13:57	Caffeine and brain development in preterm children

Claire Kelly[1,2], Wenn Lynn Ooi[1,2], Joseph Yuan-Mou Yang[2,3,4], Jian Chen[2,5], Chris Adamson[2], Katherine Lee[6,7], Jeanie Cheong[1,8,9], Peter Anderson[1,7,10], Lex Doyle[1,7,8,9], and Deanne Thompson[1,2,7,11]

[1]Victorian Infant Brain Studies, Murdoch Children's Research Institute, Melbourne, Australia, [2]Developmental Imaging, Murdoch Children's Research Institute, Melbourne, Australia, [3]Department of Neurosurgery, The Royal Children's Hospital, Melbourne, Australia, [4]Neuroscience research, Murdoch Children's Research Institute, Melbourne, Australia, [5]Department of Medicine, Monash Medical Centre, Monash University, Melbourne, Australia, [6]Clinical Epidemiology and Biostatistics Unit, Murdoch Children's Research Institute, Melbourne, Australia, [7]Department of Paediatrics, The University of Melbourne, Melbourne, Australia, [8]Newborn research, The Royal Women's Hospital, Melbourne, Australia, [9]Department of Obstetrics and Gynaecology, The University of Melbourne, Melbourne, Australia, [10]Monash Institute of Cognitive and Clinical Neurosciences, Monash University, Melbourne, Australia, [11]Florey Institute of Neuroscience and Mental Health, Melbourne, Australia

We investigated effects of neonatal caffeine treatment on brain structure and longitudinal development in a subset of preterm children from a randomized, placebo-controlled trial. Children had MRI at age 11 years (*n*=118; 64 received caffeine, 54 received placebo), of whom 43 (21 caffeine, 22 placebo) had MRI at term-equivalent age. Global and regional brain volumes, cortical morphometry and white matter microstructure were similar between treatment groups at age 11 years, as was brain development from term-equivalent age to 11 years of age. Any benefits of caffeine on brain structure weaken over time and were not apparent at age 11 years.

845 14:09

Early postnatal music intervention in preterm birth reorganizes salience network interactions

Djalel-Eddine Meskaldji[1,2], Lara Lordier[1,3], Frédéric Grouiller[4], Marie P. Pittet[1], Lana Vasung[1], François Lazeyras[5], Didier Grandjean[3], Dimitri Van De Ville[5,6], and Petra S Hüppi[1]

[1]Division of Development and Growth, Department of Pediatrics, University of Geneva, Geneva, Switzerland, [2]Institute of mathematics, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [3]Neuroscience of Emotion and Affective Dynamics Lab, Department of psychology and educational sciences, University of Geneva, Geneva, Switzerland, [4]4 Swiss center for affective neurosciences, University of Geneva, Geneva, Switzerland, [5]Department of Radiology and Medical Informatics, University of Geneva, Geneva, Switzerland, [6]Institute of Bioengineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

The aim of this study is to characterize the preterm brain functional connectivity and to test the effectiveness of an early postnatal music intervention on preterm newborn’s functional brain development. We explored functional connectivity by resting state fMRI in 16 full-term 1 to 4 days old newborns and 29 preterm infants (born < 32weeks) at term equivalent age (TEA) randomly assigned to either music intervention (14 newborns) or control group. We identified a network of interest that represents resting state functional connectivity decrease in preterm control compared to full-term newborns. We found salience network functional connectivity to be especially altered by a premature birth but music intervention significantly increased its connectivity. To the best of our knowledge, this study is the first one to observe music effects on brain development in the preterm newborns.

846 14:21

Cortical microstructures at birth predict neurodevelopmental outcome at 2 years of age

Minhui Ouyang[1], Qinmu Peng[1,2], Michelle Slinger[1], and Hao Huang[1,2]

		[1]Radiology, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [2]Radiology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States
		Cortical microstructural architecture in preterm brain, quantitatively delineated with DTI fractional anisotropy (FA), is characterized by various levels of dendritic arborization. With cortical FA an important indicator of cortical maturational level, we hypothesized that cortical FA at birth predicts neurodevelopmental outcome at 2 years of age. We used FA across cortical regions of neonate brains to predict their Bayley scores at 2 years of age with machine learning algorithms. A highly predictive model was achieved with inhomogeneous pattern across cortical areas. Significant correlation was found between FA values in widespread cortical regions at birth and cognitive scores at 2 years.

847	14:33	Connectome of the Extremely Preterm Brain at Adolescence and Measures of Cognitive Functioning: Early Experience with White Matter Fibrography (WMF)
		Hernan Jara[1], Osamu Sakai[1], Stephan W Anderson[1], Timothy Heeren[1], Karl CK Kuban[1], and Thomas M O'Shea[2]
		[1]Boston University, Boston, MA, United States, [2]University of North Carolina Children's Hospital, Chapel Hill, NC, United States
		Purpose: To analyze the fiber bundle architecture via white matter connectomes of extremely preterm (EP) born adolescents generated by Synthetic-MRI based white matter fibrography, and to study associations with summary measures of intelligence quotient (IQ) and executive function (EF). Methods: Eleven EP adolescents were scanned the tri-turbo spin echo pulse sequence, which is the concatenation of dual-echo TSE and single-echo TSE pulse sequences, both acquired with same geometry and scanner settings. Results: Connectome were successfully created for all subjects. Conclusion: White matter fibrography is a direct and reliable method for generating whole-brain white matter connectomes in adolescents born EP, and appears to have clinical relevance.

848	14:45	Long term Brain Functional Connectivity changes after Neonatal Arterial Ischemic Stroke (NAIS): A resting state fMRI study
		Lucie Hertz-Pannier[1], Dhaif Bekha[1], Victor Delattre[1], David Germanaud[1], Laure Drutel[2], Edouard Duchesnay[3], Marion Noulhiane[1], Cyrille Renaud[4], Manoelle Kossorotoff[5], Mickael Dinomais[2], Stephane Chabrier[4], and Sylvie N Guyen The Tich[6]
		[1]Institute Joliot/DRF/CEA, U1129/UNIACT, Neurospin, CEA-Saclay, Gif sur Yvette, France, [2]Département de SSR pédiatrique, CHU Angers, Angers, France, [3]Institute Joliot/DRF/CEA, UNATI, Neurospin, CEA-Saclay, Gif sur Yvette, France, [4]Departement de Rééducation Fonctionnelle, CHU Saint Etienne, Saint Etienne, France, [5]University Hospital Necker-Enfants Malades, Paris, France, [6]CHU Lille, Lille, France

		Resting state fMRI enables the study of plastic inter- and intra- hemispheric connectivity changes after early brain lesions. We studied 38 7yo children having suffered an arterial ischemic stroke in the neonatal period (NAIS) and 29 age-matched controls, with rs-fMRI, and language fMRI. Preprocessing took into account various sources of spurious signals (motion, lesion, interdependency of correlation measures, etc…). Tangent metric appeared the most accurate to classify groups of subjects and highlighted mostly a reduced inter-hemispheric connectivity in the auditory, language, and attentional networks, especially in patients with atypical clinical or fMRI language profiles, but with little evidence for intra-hemispheric changes.

849	14:57	Macroscopic Hyperdynamic CSF and Ciliary Motion Dysfunction Predict Executive Dysfunction in Children and Adolescents with Congenital Heart Disease
		Vincent Kyu Lee[1,2], Rebecca Hartog[3], William T. Reynolds[1], Nancy Beluk[1], Omar Khalifa[4], Daryaneh Badaly[5], Maliha Zahid[4], Rafael Ceschin[6], Cecilia W Lo[4], and Ashok Panigrahy[1,2]
		[1]Radiology, University of Pittsburgh, Pittsburgh, PA, United States, [2]Radiology, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA, United States, [3]Pediatrics Internal Medicine, Children's Hospital of Pittsburgh UPMC, Pittsburgh, PA, United States, [4]Developmental Biology, University of Pittsburgh, Pittsburgh, PA, United States, [5]Department of Physical Medicine & Rehabilitation, Children's Hospital of Pittsburgh UPMC, Pittsburgh, PA, United States, [6]Biomedical Informatics, University of Pittsburgh, Pittsburgh, PA, United States
		An important role for cilia in congenital heart disease (CHD) pathogenesis has been seen in mouse model of CHD. There is a high prevalence of motile respiratory cilia dysfunction in human CHD patients. In this study, we investigate whether abnormal respiratory cilia motion in preadolescent CHD patients may be correlated with alterations in macroscopic CSF flow dynamics and poor executive cognitive function using phase contrast imaging. We show disturbance of CSF flow dynamics is significantly correlated with neurocognitive impairment in CHD subjects.

850	15:09	Reduced Nasal Nitric Oxide Predicts Mis-matched Alterations in Regional Cerebral Perfusion and Functional Brain Connectivity in Older Children with Congenital Heart Disease
		Vincent Jerome Schmithorst[1], Philip Adams[2], Vince Lee[2], Cecilia Lo[2], and Ashok Panigrahy[2]
		[1]Radiology, Children's Hospital of Pittsburgh, Pittsburgh, PA, United States, [2]Children's Hospital of Pittsburgh, Pittsburgh, PA, United States
		We investigate the relationship between congenital heart disease (CHD), regional CBF, functional connectivity, and nasal nitric oxide (nNO) levels in older children. Low nNO is associated with poor cardiac function in CHD although the precise mechanism is unknown. Results show that, in CHD patients, reduced nNO is associated with reduced regional CBF in the salience and default mode networks as well as reduced segregation globally (modularity) and regionally (frontally, parietally, and subcortically); these relationships are not present in normal controls. These results suggest intrinsic brain deficits (more so than impaired substrate delivery) may underlie neurocognitive deficits in CHD patients.

851	15:21	Thalamic Lac/NAA threshold of 0.39 on proton MRS predicts outcome following therapeutic hypothermia in neonatal hypoxic ischemic encephalopathy
		Subhabrata Mitra[1], Giles Kendal[1], Cristina Uria-Avellanal[1], Alan Bainbridge[1], Magdalena Sokolska[1], David Price[1], Xavier Golay[2], and Nikki Robertson[1]
		[1]University College Hospital, London, United Kingdom, [2]University College London, London, United Kingdom
		Perinatal hypoxic ischemic brain injury remains a significant cause of neonatal morbidity and mortality. Accurate prediction of neurodevelopmental outcome following HIE is important for parental counselling and directing care towards optimised treatments. Proton MRS derived thalamic Lactate/N-acetylaspartate (Lac/NAA) peak area ratio at 1.5T was a robust MR outcome biomarker in the pre-cooling era; a cut off Lac/NAA of 0.29 accurately predicted outcome. The aim of this work is to identify the cut off threshold of thalamic Lac/NAA at 3T in the cooling era for outcome prediction.

852	15:33	GABA levels in children with Autism and typically developing children differentially relate to social gesture performance
		Nicolaas A Puts[1,2], Ashley D Harris[3], Georg Oeltzschner[1,2], Mark Mikkelsen[1,2], Stewart H Mostofsky[4,5], and Richard A.E. Edden[1,2]
		[1]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Department of Radiology, University of Calgary, Calgary, AB, Canada, [4]Department of Neurology, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [5]Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, United States
		Children with Autism (ASD) often suffer from motor abnormalities and the main inhibitory neurotransmitter GABA has been linked to ASD. We measure GABA in the primary sensorimotor cortex using MRS and measure praxis (social gesturing) in children with ASD and healthy children (TDC). We show that GABA is differentially related to social gestures in children with and without ASD. This suggests a complex relation between inhibition and gesture function. Reduced GABA levels may impair the performance of gestures with a communicative purpose, contributing to autistic phenotypes. Understanding the GABA system in ASD is important for developing patient-specific treatment in ASD.

Traditional Poster: Body: Breast, Chest, Abdomen, Pelvis

Exhibition Hall 2418-2432	Wednesday 16:15 - 18:15	*(no CME credit)*

Electronic Poster: Contrast Mechanisms

Exhibition Hall	Wednesday 16:15 - 17:15	*(no CME credit)*

Electronic Poster: Musculoskeletal

Exhibition Hall	Wednesday 16:15 - 17:15	*(no CME credit)*

Study Groups

Molecular & Cellular Imaging Business Meeting

W07	Wednesday 16:15 - 17:15	*(no CME credit)*

Member-Initiated Symposium

RESONATE: Discussion on Scientific & Social Biases Within ISMRM

Organizers: Udunna Anazodo, Esther Warnert

N03	Wednesday 16:15 - 18:15	*Moderators:* Daniel Gallichan & Penny Gowland	*(no CME credit)*

	16:15	Prologue: Why RESONATE in ISMRM?
		Udunna C Anazodo[1]
		[1]Lawson Health Research Institute, London, ON, Canada

	16:20	Monologue (Localizer #1): Towards Inclusiveness in ISMRM: Science in a Time of Growing Individualism
		Ravi Menon[1]
		[1]The University of Western Ontario, Canada

	16:30	Monologue (Localizer #2): The Journey to Awareness of Social Bias in Science
		Krishna Nayak[1]
		[1]University of Southern California, United States

	16:40	Monologue (Localizer #3): The DTI of Social Implicit Bias in Science I
		Curt Rice[1]

		[1]*Oslo Metropolitan University*

	16:50	Monologue (Localizer #4): Towards RESONATE: Preventing & Reducing Biases Within ISMRM
		Pia Maly Sundgren[1]
		[1]*Radiology, Clinical Sciences, Lund University*

	17:00	Dialogue (Scan): An Open-Guided Discussion on Localizers

	18:10	Epilogue (Recon): Summary, RESONATE In-phase
		Esther Warnert[1]
		[1]*Radiology & Nuclear Medicine, Erasmus MC, Rotterdam, Netherlands*

Member-Initiated Symposium

Connectomes Related to Psychiatric Diseases

Organizers: Ulrike Dydak, Uzay Emir, Qiyong Gong

N04	Wednesday 16:15 - 18:15	*Moderators:* Uzay Emir	*(no CME credit)*

	16:15	Functional Magnetic Resonance Spectroscopy for Cognitive Neuroscience & Psychiatry Research
		Eric Woodcock[1]
		[1]*Psychiatry and Radiology, Yale University School of Medicine, New Haven, CT, United States*

	16:45	Connectomic Insights into Anxiety & Depression
		Susan Gabrieli[1]
		[1]*Massachusetts Institute of Technology*

	17:15	Linking Connectomics to Biochemical Trajectories of Aging: How the Human Brain Ages Differentially in Key Regions of the Default Mode
		Melissa Terpstra

	17:45	Connectome Dysfunctions & Treatment Modulations in Major Depressive Disorder
		Yong He[1]
		[1]Beijing Normal University, China

Weekday Course

MR Physics & Techniques for Clinicians

Organizers: Marcus Alley, Bernd Jung

S01	Wednesday 16:15 - 18:15	*Moderators:* Geon-Ho Jahng & Nicole Seiberlich

	16:15	Diffusion & Perfusion Weighted Imaging
		Samantha J Holdsworth[1]
		[1]Department of Anatomy and Medical Imaging, School of Medical Sciences, The University of Auckland, New Zealand
		This lecture is devoted to the basic technological aspects of diffusion-weighted imaging (DWI) and perfusion-weighted imaging (PWI) approaches used in MRI, using neuroimaging applications as examples, and with the concepts explained with minimal use of equations. PWI approaches covered are: dynamic susceptibility contrast (DSC) perfusion, dynamic contrast enhanced (DCE) perfusion, Arterial Spin Labeling (ASL), and the Intravoxel Incoherent Motion (IVIM) method.

	16:55	Parallel Imaging
		Felix Breuer[1]
		[1]Fraunhofer IIS/MRB, Germany

		In this presentation the basics of parallel Imaging are layed out. The talk will give a brief overview of the history of parallel MRI and the basic concept of multi-coil acquisition and reconstructions. Limitations and clinically most relevant applications will be duscussed.

	17:35	MR Angiography
		Oliver Wieben[1]
		[1]Depts. of Medical Physics & Radiology, University of Wisconsin - Madison, United States

	18:15	Adjournment & Meet the Teachers

Power Pitch

Pitch: Techniques & Applications of Microcirculation Imaging

Power Pitch Theater A - Exhibition Hall	Wednesday 16:15 - 17:15	*Moderators:* Audrey Fan & Hirohiko Kimura	*(no CME credit)*

853	16:15	Simultaneous measurements of global cerebral blood flow with 2D pseudo-continuous multi-TI arterial spin labeling and 15O-H2O PET in a hybrid PET/MR system
		Oriol Puig Calvo[1], Ulrich Lindberg[1], Mark B Vestergaard[1], Egill Rostrup[1], Adam E Hansen[1], Henrik B.W. Larsson[1], Ian Law[1], and Otto M Henriksen[1]
		[1]Department of Clinical Physiology, Nuclear Medicine and PET, Rigshospitalet, University of Copenhagen, Copenhagen, Denmark

854	16:15	Advanced lesion symptom mapping analyses and implementation as BCBtoolkit
		Chris Foulon[1], Leonardo Cerliani[1], Serge Kinkingnéhun[1], Richard Levy[2], Charlotte Rosso[3], Marika Urbanski[1], Emmanuelle Volle[1], and Michel Thiebaut de Schotten[1]
		[1]BCBlab, Paris, France, [2]Frontlab, Institut du Cerveau et de la Moelle épinière, Paris, France, [3]Centre de Neuroimagerie de Recherche CENIR, Paris, France

855	16:15	Validation of Cerebrovascular Reactivity by Arterial Spin Labeling MRI in Moyamoya Disease with Simultaneously Measured 15O-PET and Phase-contrast MRI
		Yosuke Ishii[1,2], Thoralf Thamm[1], Jia Guo[1], Mohammad Mehdi Khalighi[3], Mirwais Wardak[1], Dawn Holley[1], Harsh Gandhi[1], Jun Hyung Park[1], Bin Shen[1], Gary K Steinberg[4], Fred T Chin[1], Greg Zaharchuk[1], and Audrey Peiwen Fan[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Neurosurgery, Tokyo Medical and Dental University, Tokyo, Japan, [3]Applied Science Lab, GE Healthcare, Menlo Park, CA, United States, [4]Neurosurgery, Stanford University, Stanford, CA, United States
856	16:15	Adaptations in cerebral physiology due to chronic anaemia measured with Turbo-QUASAR ASL
		Lena Vaclavu[1], Moss Y Zhao[2], Esben Thade Petersen[3], John C Wood[4], Henk JMM Mutsaerts[1,5,6], Charles B Majoie[1], Ed T vanBavel[7], Bart J Biemond[8], Michaell A Chappell[2], and Aart J Nederveen[1]
		[1]Radiology & Nuclear Medicine, Academic Medical Center, Amsterdam, Netherlands, [2]Institute of Biomedical Engineering, University of Oxford, Oxford, United Kingdom, [3]Danish Research Centre for Magnetic Resonance, Centre for Functional and Diagnostic Imaging and Research, Copenhagen University Hospital Hvidovre, Copenhagen, Denmark, [4]Cardiology and Radiology, Children's Hospital of Los Angeles, Los Angeles, CA, United States, [5]Kate Gleason College of Engineering, Rochester Institute of Technology, Rochester, NY, United States, [6]Department of Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [7]Department of Biomedical Engineering and Physics, Academic Medical Center, Amsterdam, Netherlands, [8]Haematology, Internal Medicine, Academic Medical Center, Amsterdam, Netherlands
857	16:15	Noninvasive MRI measurements of oxygen extraction fraction reduction in response to blood transfusion in adults with sickle cell anemia
		Meher Juttukonda[1], Lori C Jordan[2], Larry T Davis[1], Chelsea A Lee[2], Niral J Patel[2], Sumit Pruthi[1], and Manus J Donahue[1]
		[1]Radiology and Radiological Sciences, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Pediatrics - Division of Pediatric Neurology, Vanderbilt University Medical Center, Nashville, TN, United States
858	16:15	Relationship between the Degree of Unilateral Intracranial Artery Stenosis and Cerebral Perfusion: a High-resolution Intracranial Vessel Wall Imaging Study
		Song Liu[1,2], Tianyi Qian[3], Jinxia Zhu[3], Wen Shen[2], and Shuang Xia[2]
		[1]First Clinical College,Tianjin Medical University, Tianjin, China, [2]Department of Radiology,Tianjin First Central Hospital, Tianjin, China, [3]Siemens Healthcare,MR Collaborations NE Asia, Beijing, China

859	16:15	Identifying ischemic zone patterns and origins using multi-delay arterial spin labeling in vasospasm
		Swati Rane[1], Daniel Hippe[1], Michael Levitt[1], Louis Kim[1], and Jalal B Andre[1]
		[1]University of Washington Medical Center, Seattle, WA, United States
860	16:15	Non-contrast fingerprinting perfusion imaging reveals hemodynamic deficits in cerebrovascular diseases
		Pan Su[1,2], Peiying Liu[1], Yang Li[1,2], Zixuan Lin[1,3], Lynsey Keator[4], Ye Qiao[1], Judy Huang[5], Argye E. Hillis[4,6,7], and Hanzhang Lu[1]
		[1]The Russell H. Morgan Department of Radiology & Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]Graduate School of Biomedical Sciences, University of Texas Southwestern Medical Center, Dallas, TX, United States, [3]Department of Biomedical Engineering, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [4]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [5]Department of Neurosurgery, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [6]Physical Medicine and Rehabilitation, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [7]Cognitive Science, Johns Hopkins University, Baltimore, MD, United States
861	16:15	High-Resolution, Non-contrast Pseudo-Continuous Arterial Spin-Labeling (PCASL) MR-Angiography compared to standard clinical MRI in the detection of intracranial vessel pathologies with emphasis on intracranial arteriovenous shunts.
		Tilman Schubert[1], oliver Wieben[2], Patrick Turski[2], Huimin Wu[3], and Kevin Johnson[2]
		[1]Radiology, Basel University Hospital, Basel, Switzerland, [2]University of Wisconsin Madison, Madison, WI, United States, [3]William Beaumont Hospital, Royal Oak, MI, United States
862	16:15	Characteristics of Plaques and Lenticulostriate Arteries in Stroke Patients by Whole-Brain Vessel Wall Magnetic Resonance Imaging
		Fang Wu[1], Zhaoyang Fan[2], Tianyi Qian[3], Qi Yang[1], and Debiao Li[2]
		[1]Department of Radiology, Xuanwu Hospital, Capital Medical University, Beijing, China, [2]Biomedical Imaging Research Institute, Cedars Sinai Medical Center, Los Angeles, CA, United States, [3]MR Collaboration NEA, Siemens Healthcare, Beijing, China

863	16:15	Comparison of velocity-selective and pulsed ASL perfusion MRI in patients with suspected cerebral cortical ischemia
		Divya S Bolar[1,2], Bruce R Rosen[1,2], and Pamela W. Schaefer[1]
		[1]Radiology, Massachusetts General Hospital, Boston, MA, United States, [2]MGH/HST Martinos Center for Biomedical Imaging, Charlestown, MA, United States
864	16:15	Intravoxel Incoherent Motion (IVIM) Perfusion Imaging in Hyperacute Stroke: Initial Results
		Christian Federau[1], Max Wintermark[2], Soren Christensen[3], David Marcellus[2], Guangming Zhu[2], Maarten Lansberg[3], Gregory Albers[3], and Jeremy Heit[2]
		[1]University Hospital Basel, Basel, Switzerland, [2]Neuroradiology, Stanford University, Stanford, CA, United States, [3]Neurology, Stanford University, Stanford, CA, United States
865	16:15	Superselective 4D MR Angiography with Pseudo-Continuous Arterial Spin Labelling Combined with CENTRA-Keyhole (SS-4D-PACK) Used to Visualize Brain Arteriovenous Malformations
		Osamu Togao[1], Akio Hiwatashi[1], Makoto Obara[2], Michael Helle[3], Koji Yamashita[1], Daichi Momosaka[1], Tatsuhiro Wada[4], Hiroo Murazaki[4], Marc Van Cauteren[2], and Hiroshi Honda[1]
		[1]Clinical Radiology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan, [2]Philips Japan, Tokyo, Japan, [3]Philips Research, Hamburg, Germany, [4]Division of Radiology, Department of Medical Technology, Kyushu University Hospital, Fukuoka, Japan
866	16:15	Impaired cerebrovascular reactivity assessed by BOLD hypercapnic fMRI is associated with increased risk of stroke in patients with symptomatic intracranial atherosclerotic stenosis
		Jeremy Papassin[1], Olivier Heck[2], Naila BOUDIAF[3], Eric CONDAMINE[4], Johan PIETRAS[4], Florence TAHON[2], Olivier DETANTE[1], and Alexandre KRAINIK[2,3,4]
		[1]Department of Neurology, University Hospital Grenoble Alpes, Grenoble, France, [2]Neuroradiology, University Hospital of Grenoble Alpes, Grenoble, France, [3]Univ. Grenoble Alpes, Inserm, Grenoble Institute of Neurosciences, Grenoble, France, [4]Univ. Grenoble Alpes, Inserm, CNRS, University Hospital Grenoble Alpes, IRMaGe, Grenoble, France
867	16:15	Resting-State BOLD MRI for Evaluating Cerebrovascular Reserve in Stroke Patients

		Kamil Taneja[1], Hanzhang Lu[1], Argye Beth Hillis[2], and Peiying Liu[1]	
		[1]Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, United States	

Power Pitch

Pitch: fMRI: Signal Characteristics & Analysis

Power Pitch Theater B - Exhibition Hall	Wednesday 16:15 - 17:15	*Moderators:* Thomas Liu & Molly Bright	*(no CME credit)*

868	16:15	Blood pressure correlated fluctuations of BOLD origin in fMRI signals: A multi-echo 7T study.
		Joseph Whittaker[1], Ian Driver[2], Marcello Venzi[1], and Kevin Murphy[1]
		[1]School of Physics and Astronomy, Cardiff University Brain Research imaging Centre (CUBRIC), Cardiff University, Cardiff, United Kingdom, [2]School of Psychology, Caridiff University Brain Research Imaging Centre (CUBRIC), Cardiff University, Cardiff, United Kingdom

869	16:15	Determination of white matter cerebrovascular reactivity (CVR) and CVR compliance time responses to surgical revascularization using time regression analysis of hypercapnic BOLD fMRI data
		Sarah K Lants[1], Meher R Juttukonda[1], Spencer L Waddle[2], Jennifer M Watchmaker[3], Lori C Jordan[4], Larry T Davis[1], Matthew R Fusco[5], and Manus J Donahue[1]
		[1]Dept. of Radiology & Radiological Sciences, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Quantitative and Physical Biology Program, Vanderbilt University Medical Center, Nashville, TN, United States, [3]Vanderbilt University School of Medicine, Vanderbilt University Medical Center, Nashville, TN, United States, [4]Dept. of Neurology, Division of Pediatric Neurology, Vanderbilt University Medical Center, Nashville, TN, United States, [5]Dept. of Neurological Surgery, Vanderbilt University Medical Center, Nashville, TN, United States

870	16:15	Differentiating neural and non-neural fMRI signals using CBV-BOLD fMRI
		Laurentius Huber[1], Daniel A Handwerker[2], Sean Marrett[2], Javier Gonzalez-Castillo[1], Anrew Hall[1], Dimo Ivanov[3], Maria Guidi[4], and Peter A Bandettini[1]
		[1]SFIM, NIMH, Bethesda, MD, United States, [2]FMRIF, NIMH, Bethesda, MD, United States, [3]MBIC, Maastricht, Netherlands, [4]MPI-CBS, Leipzig, Germany

871	16:15	Local neuronal synchronization and global functional disconnection are signatures of propofol-induced unconsciousness
		Anthony G Hudetz[1], Zirui Huang[1], Xiaolin Liu[2], and George A Mashour[1]
		[1]University of Michigan, Ann Arbor, MI, United States, [2]Medical College of Wisconsin, Milwaukee, WI, United States
872	16:15	Absolute quantification of resting oxygen metabolism and cerebral physiology following acute exposure to repeated sub-concussive collisions: A calibrated MRI approach
		ALLEN A. CHAMPAGNE[1], NICOLE S. COVERDALE[1], MIKE GERMUSKA[2], and DOUGLAS J. COOK[1,3]
		[1]Centre of Neuroscience studies at Queen's University, Kingston, ON, Canada, [2]Cardiff University Brain Research Imaging Centre, Cardiff, United Kingdom, [3]Department of Surgery at Queen's University, Kingston, ON, Canada
873	16:15	Evaluation of task-induced δCMRO2 with a simultaneous acquisition of CBV, CBF and BOLD signals during normoxia and hypoxia conditions
		Yaoyu Zhang[1,2], Yayan Yin[1,3], Long Qian[1], Yang Fan[4], Bing Wu[1,4], and Jia-Hong Gao[1,3]
		[1]Center for MRI Research, Peking University, Beijing, China, [2]Peking-Tsinghua Center for Life Sciences, Peking University, Beijing, China, [3]Beijing City Key Lab for Medical Physics and Engineering, Peking University, Beijing, China, [4]MR Research China, GE Healthcare, Beijing, China
874	16:15	Using measured Haemodynamic Response Functions in Population Receptive Field mapping at 7 T
		Michael Asghar[1], Denis Schluppeck[2], and Susan Francis[2]
		[1]SPMIC, University of Nottingham, Nottingham, United Kingdom, [2]University of Nottingham, Nottingham, United Kingdom
875	16:15	Visual temporal frequency preference shows a distinct cortical architecture using fMRI
		Yuhui Chai[1], Daniel Handwerker[1], Sean Marrett[1], Andrew Hall[1], Javier Gonzalez-Castillo[1], Peter Molfese[1], and Peter Bandettini[1]

		[1]National Institute of Mental Health, National Institutes of Health, Bethesda, MD, United States

876	16:15	A Probabilistic Atlas of Digit Somatotopy in the Human Primary Somatosensory Cortex
		Ayan Sengupta[1], Denis Schluppeck[2], Eleanor Barrat[1], Julien Besle[3], Susan Francis[1], and Rosa Sanchez Panchuelo[1]
		[1]Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom, [2]School of Psychology, University of Nottingham, Nottingham, United Kingdom, [3]Department of Psychology, American University of Beirut, Beirut, Lebanon

877	16:15	Modeling Motor Task Activation from Task-free fMRI with Machine Learning: Predictions and Accuracy in Individual Subjects
		Elizabeth Zakszewski[1], Alexander Cohen[1], Chen Niu[2], Xiao Ling[2], Oiwi Parker Jones[3], Saad Jbabdi[3], Ming Zhang[2], Maode Wang[2], and Yang Wang[1]
		[1]Medical College of Wisconsin, Milwaukee, WI, United States, [2]First Affiliated Hospital of Xi'An Jiaotong University, Shaanxi Xi'an, China, [3]Oxford Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB), University of Oxford, Oxford, United Kingdom

878	16:15	Performing Sparse Regularization and Dimension Reduction Simultaneously in CCA-Based Data Fusion
		Zhengshi Yang[1], Xiaowei Zhuang[1], Christopher Bird[1], Karthik Sreenivasan[1], Virendra Mishra[1], Sarah J Banks[1], and Dietmar Cordes[1,2]
		[1]Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States, [2]University of Colorado, Boulder, CO, United States

879	16:15	Evidence of Dense Functional Connectivity in the Human Brain
		Ankita Saha[1], Ishaan Batta[2], and Rahul Garg[1]
		[1]Department of Computer Science and Engineering, Indian Institute of Technology Delhi, New Delhi, India, [2]Center for Biomedical Image Computing and Analytics, University of Pennsylvania, Philadelphia, PA, United States

880	16:15	Matrix Tri-Factorization for BOLD-fMRI
		Michael Hütel[1], Andrew Melbourne[1], and Sebastien Ourselin[1]
		[1]UCL, London, United Kingdom

881	16:15	Effect size and result overlap between individual and group results in fMRI studies
		Peter Van Schuerbeek[1], Chris Baeken[2,3], and Johan De Mey[4]
		[1]Radiology, UZ Brussel (VUB), Brussels, Belgium, [2]Psychiatry, UZ Brussel, Brussel, Belgium, [3]Psychiatry and Medical Psychology, UGent, Ghent, Belgium, [4]Radiology, UZ Brussel, Brussels, Belgium

882	16:15	Cross-vendor harmonization of T2-Relaxation-Under-Spin-Tagging (TRUST) MRI for the assessment of cerebral venous oxygenation
		Dengrong Jiang[1], Peiying Liu[2], Yang Li[2,3], Deng Mao[2,3], Cuimei Xu[2], and Hanzhang Lu[1,2,4]
		[1]Department of Biomedical Engineering, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]The Russell H. Morgan Department of Radiology & Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [3]Graduate School of Biomedical Sciences, University of Texas Southwestern Medical Center, Dallas, TX, United States, [4]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Research Institute, Baltimore, MD, United States

Oral

Microstructure: Moving Through Time

N01	Wednesday 16:15 - 18:15	*Moderators:* Dmitry Novikov & Ileana Jelescu

883	16:15	Including diffusion frequency dependence in the extra-axonal space to improve axonal diameter mapping using trapezoidal OGSE sequences
		Kevin GINSBURGER[1], Fabrice POUPON[2], Felix MATUSCHKE[3], Jean-François MANGIN[2], Markus AXER[3], and Cyril POUPON[1]
		[1]UNIRS, CEA/ISVFJ/Neurospin, Gif-sur-Yvette, France, [2]UNATI, CEA/ISVFJ/Neurospin, Gif-sur-Yvette, France, [3]INM-1 Forschungszentrum Jülich, Jülich, Germany

		We performed Monte-Carlo simulations of the diffusion process in 3D biomimetic geometries accounting for the angular dispersion and tortuosity present in white matter. Diffusion MRI data synthesis using clinically plausible trapezoidal OGSE sequences was then performed and an extra-axonal linear-in-frequency dependence of the perpendicular diffusivity transverse to axons was observed over a wide range of axon diameter values. Simulated data was fed into an ActiveAx trapezoidal OGSE model accounting for this frequency-dependence. The estimation of axonal diameter is improved by this correction.

884	16:27	LEMONADE(t): Exact relation of time-dependent diffusion signal moments to neuronal microstructure
		Hong-Hsi Lee[1], Els Fieremans[1], and Dmitry S Novikov[1]
		[1]Center for Biomedical Imaging, New York University, New York, NY, United States
		The purpose of this work is to solve the two complementary problems: (i) Estimate the time-dependent (non-Gaussian) signatures of intra- and extra-neurite tissue compartments separately, irrespective of neurite orientational dispersion; and (ii) cure the notorious degeneracy in parameter estimation of multi-compartment models. We derive exact relations between time-dependent 2nd- and 4th-order signal moments, and all relevant time-dependent diffusion parameters in the intra- and extra-neurite space. Remarkably, the temporal dimension lifts the degeneracy in parameter estimation: The relations are formally invertible, multiple "branches" of solutions do not appear, and time-dependent DKI is enough to estimate all parameters. Precision, though, remains a challenge.

885	16:39	Diffusion Time Dependence of NODDI in in vivo Human White Matter
		Masaaki Hori[1], Kouhei Kamiya[2], Katsutoshi Murata[3], Thorsten Feiweier[4], Issei Fukunaga[1], Akifumi Hagiwara[1,2], Ryusuke Irie[1,2], Christina Andica[1], Tomoko Maekawa[1,2], Saori Koshino[1,2], Koji Kamagata[1], Kanako Kunishima Kumamaru[1], Michimasa Suzuki[1], Akihiko Wada[1], and Shigeki Aoki[1]
		[1]Radiology, Juntendo University School of Medicine, Tokyo, Japan, [2]Radiology, The University of Tokyo Graduate School of Medicine, Tokyo, Japan, [3]Siemens Japan K.K., Tokyo, Japan, [4]Siemens Healthcare GmbH, Erlangen, Germany
		We investigated the diffusion time dependency of diffusion metrics, especially ICVF and INVF, compared with ADC using an oscillating gradient spin-echo sequence in *in vivo* human white matter at 3T. Our results show that the change ratio of both ICVF and INVF indicate similar tendency in the same white matter locations, with or without diffusivity calculation. Moreover, with higher oscillating frequency, ICVF decreased but ISOVF stayed almost unchanged, indicating that the rate of ICVF and the extra-cellular component may change with oscillating frequency beside the unchanged isotropic water component.

886	16:51	Implications of nongaussian diffusion on the interpretation of multidimensional diffusion measurements

		Sune Nørhøj Jespersen[1,2], Jonas Lynge Olesen[1,2], Andrada Ianus[3,4], and Noam Shemesh[3]
		[1]CFIN/MINDLab, Aarhus University, Aarhus C, Denmark, [2]Dep. Physics and Astronomy, Aarhus University, Aarhus C, Denmark, [3]Champalimaud Neuroscience Programme, Champalimaud Centre for the Unknown, Lisbon, Portugal, [4]Center for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom
		Multidimensional diffusion weighting, such as magic angle spinning of the q-vector (q-MAS), relies on the assumption of multiple Gaussian compartments (MGC). Then the kurtosis measured with q-MAS can be fully ascribed to ensemble variance of isotropic diffusivity. However, in compartments with nongaussian diffusion, anisotropic time dependence of the diffusion tensor imparts orientation dependence on the q-MAS measured mean diffusivity, which in the presence of orientation dispersion leads to additional contributions to kurtosis. Yet another contribution arises from intracompartmental kurtosis. Using simulations and experiments we demonstrate that q-MAS derived diffusion kurtosis conflates variance in isotropic diffusivity with dispersion and intracompartmental kurtosis.

887	17:03	Spectral anisotropy in multidimensional diffusion encoding
		Henrik Lundell[1], Markus Nilsson[2], Carl-Fredrik Westin[3], Daniel Topgaard[4], and Samo Lasič[5]
		[1]Danish Research Centre for Magnetic Resonance, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark, [2]Clinical Sciences Lund, Radiology, Lund University, Lund, Sweden, [3]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States, [4]Department of Chemistry, Lund University, Lund, Sweden, [5]Random Walk Imaging AB, Lund, Sweden
		To account for time-dependent diffusion in multidimensional diffusion encoding (MDE), the relevant temporal characteristics of encoding waveforms need to be identified and controlled. Based on the frequency domain analysis, we suggest a framework for analyzing the spectral content in MDE, which is useful to experimentally disentangle the effects of time-dependent diffusion. We introduce a novel concept of spectral anisotropy and demonstrate how differentiated temporal characteristics along orthogonal encoding axes may be used to isolate time-dependent diffusion in anisotropic domains, which is not possible with existing approaches without a priori model assumption.

888	17:15	On the vanishing of the t-term in the short-time expansion of the diffusion coefficient for oscillating gradients in diffusion NMR
		Frederik Bernd Laun[1], Kerstin Demberg[2], Michael Uder[1], Armin Michael Nagel[1], and Tristan Anselm Kuder[2]
		[1]Institute of Radiology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany, [2]Medical Physics in Radiology, German Cancer Research Center, Heidelberg, Germany

		The short-time expansion of the diffusion coefficient in powers of $t^{1/2}$ is universally connected to structural parameters of the boundaries restricting the diffusive motion. The $t^{1/2}$-term is proportional to the surface-to-volume ratio. The t-term is related to permeability and curvature. The short-time expansion can be measured by application of oscillating gradients of long total duration. For oscillating gradients, the inverse of the oscillation frequency becomes the relevant time scale. The purpose of this work is to show that the oscillating gradient approach is blind to the t-term. Thus, the t-term does not bias the determination of the $t^{1/2}$-term in experiments.

889	17:27	Towards new modalities for probing the microstructure at very high b-values
		Denis Grebenkov[1]
		[1]Laboratory of Condensed Matter Physics, CNRS, Palaiseau, France
		Modern clinical and animal scanners offer versatile options for diffusion MRI, including very high b-values, at which the conventional perturbative description and related model are not applicable. We demonstrate this failure for any nontrivial domain with a boundary, regardless its shape and permeability. Since the magnetization is localized near boundaries, the signal becomes more sensitive to the microstructure. Even the signal from the extracellular diffusion is shown to be non-Gaussian at high b-values. These non-Gaussian features offer new imaging modalities at ordinary gradients accessible on most MRI scanners but, if unnoticed, they may result in misleading biomedical interpretations.

890	17:39	Imaging Microscopic Background Gradient Variations in the Mouse Brain
		Choong Heon Lee[1], Piotr Walczak[2], Lindsay K. Hill[1], Youssef Zaim Wadghiri[1], and Jiangyang Zhang[1]
		[1]Dept. of Radiology, New York University School of Medicine, New York, NY, United States, [2]Dept. of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States
		Microstructures in biological tissues can produce susceptibility related microscopic background gradient (μBG). Mapping the spatial distributions of μBG can help us infer tissue microstructure. In this study, we reported an improved diffusion MRI based method to detect μBG and evaluated the method using a phantom as well as normal and dysmyelinated mouse brains. We found that 3D spatial variations of μBG were greater in white matter tracts than in gray matter structures. The contrast based on μBG spatial variations was able to distinguish white matter tracts in normal and dysmyelinated mouse brains. The method may be used to study myelin injury.

891	17:51	In-vivo diffusion-fMRI using Incomplete Initial Nutation Diffusion Imaging (INDI)
		Daniel Nunes[1], Andrada Ianus[1,2], and Noam Shemesh[1]

		[1]Champalimaud Research, Champalimaud Centre for the Unknown, Lisbon, Portugal, [2]Department of Computer Science, University College London, London, United Kingdom
		Diffusion functional-MRI (dfMRI) aims to capture microstructural changes occurring with neural activity. One of the confounding factors for dfMRI is that zero and nonzero b-values need to be acquired to deliver accurate changes in diffusivity, and those images are typically separated by at least one repetition time. Recently, Incomplete initial Nutation Diffusion Imaging (IDNI) was proposed for mapping the two images with a separation of <50ms. Here, we performed the first INDI-fMRI experiments using forepaw-stimulated rats. Functional signals are captured well both in ROI and voxel-wise analyses, enabling a more direct comparison of each signal's time course.

892	18:03	Abundance of cell bodies can explain the stick model's failure in grey matter at high b-value
		Marco Palombo[1], Noam Shemesh[2], Andrada Ianus[1,2], Daniel C. Alexander[1], and Hui Zhang[1]
		[1]Computer Science Department and Centre for Medical Imaging Computing, University College London, London, United Kingdom, [2]Champalimaud Neuroscience Programme, Champalimaud Centre for the Unknown, Lisbon, Portugal
		This work investigates the validity of the stick model used in diffusion-weighted MRI for modelling cellular projections in brain tissue. We hypothesize that the model will fail to describe the signals from grey matter due to an abundance of cell bodies. Using high b-value (≥3 ms/μm^2) data from rat and human brain, we show that the assumption fails for grey matter. Using diffusion simulation in realistic digital models of neurons/glia, we demonstrate the breakdown of the assumption can be explained by the presence of cell bodies. Our findings suggest that high b-value data may be used to probe cell bodies.

Oral

Machine Learning in Neuroimaging

N02	Wednesday 16:15 - 18:15	*Moderators:* Dinggang Shen & Greg Zaharchuk

893	16:15	Classification of Dense Tumor, Tumor Necrosis and Tumor Infiltration in Glioma: Machine Learning and Diffusion MRI
		Zezhong Ye[1], Xiran Liu[2], Joshua Lin[1], Liang Wang[2], Richard Price[3], Peng Sun[1], Jeff Viox[1], Sonika Dahiya[4,5], Albert Kim[3], Jr-Shin Li[2], and Sheng-Kwei Song[1]

		[1]Radiology, Washington University School of Medicine, St. Louis, MO, United States, [2]Electrical & System Engineering, Washington University in St. Louis, St. Louis, MO, United States, [3]Neurological Surgery, Washington University School of Medicine, St. Louis, MO, United States, [4]Pathology and Immunology, Washington University School of Medicine, St. Louis, MO, United States, [5]Immunology and Pathology, Washington University School of Medicine, St. Louis, MO, United States
		Here we introduce a diffusion MR-based imaging technique - Diffusion MRI Histology (D-Histo), to detect and differentiate various co-existing tumor pathologies including high-cellularity tumor (tumor), tumor necrosis (necrosis) and tumor infiltration (infiltration) within high grade glioma. We incorporated a support vector machine algorithm to generate an automation framework to predict locations of tumor lesion, necrosis and infiltration. The mean predictive accuracy of the D-Histo SVM classifier for tumor lesion, necrosis and infiltration were 91.9%, 93.7% and 87.8%. DTI-based prediction under the same framework resulted in 44.4%, 56.0% and 43.0% accuracy for the three pathologies.

894	16:27	Machine learning with amide proton transfer and magnetization transfer MRI for predicting IDH mutation status in diffuse gliomas
		Shanshan Jiang[1,2], Hye-Young Heo[1], Qihong Rui[2], Hao Yu[2], Yu Wang[3], Charles Eberhart[4], Peter Van Zijl[1,5], Zhibo Wen[2], and Jinyuan Zhou[1]
		[1]Department of Radiology, Johns Hopkins University, Baltimore, MD, United States, [2]Department of Radiology, Zhujiang Hospital, Southern Medical University, Guangzhou, China, [3]Department of Pathology, Zhujiang Hospital, Southern Medical University, Guangzhou, China, [4]Department of Pathology, Johns Hopkins University, Baltimore, MD, United States, [5]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States
		The current diagnostic criterion for IDH mutation status is based on lab tests via surgical tissue samples. APTw and MT imaging contrast mechanisms can detect low-concentration mobile proteins and semi-solid macromolecules, respectively. We implemented a support vector machine (SVM)-based method to predict IDH1/2 genotype in gliomas using APTw and MT MRI features. 105 WHO Grade II and III glioma patients with complete imaging and genetic data were enrolled. Within the supervised classification framework, our results suggest that the use of APTw and MT features enabled the SVM to reach the accurate diagnosis of the IDH genotype in gliomas.

895	16:39	Biomarkers for CTE diagnosis in retired NFL player using Machine learning
		Marcia Louis[1], Michael Alosco[2], Benjamin Rowland[3], Huijin Liao[3], Joseph Wang[4], Ajay Joshi[4], Robert Stern[2], and Alexander Lin[3]
		[1]Electrical and Computer Engineering, Boston University, Boston, MA, United States, [2]Department of Neurology, Boston University, Boston, MA, United States, [3]Center for Clinical Spectroscopy, Brigham and Women's hospital, Boston, MA, United States, [4]Boston University, Boston, MA, United States

		Multiple concussions have the potential to develop Chronic Traumatic Encephalopathy (CTE), a neurodegenerative disease that is currently diagnosed only in postmortem by tau protein deposition in the brain. Since repetitive head trauma alters brain morphology and metabolism, magnetic resonance imaging and spectroscopy could be suitable candidates for CTE diagnosis. Therefore, we propose machine learning-based approach to identify CTE-related biomarkers. The model achieves 80% prediction accuracy with AUC of 0.72 using creatine, macromolecules and brain volume as features for the machine learning model.

896	16:51	Prediction of Tumor Progression Time Interval in Malignant Glioma Using Textural Information derived from FLAIR and T1c MR-images and Machine Learning
		Johannes Slotboom[1], Urspeter Knecht[1], Nuno Pedrosa de Barros[1], Timo Nannen[2], Martin Zbinden[1], Ekkehard Hewer[3], Erik Vassella[3], Alessia Pica[4], Philippe Schucht[5], Jürgen Beck[5], Andreas Raabe[5], Jan Gralla[1], Roland Wiest[1], and Marwan El-Koussy[1]
		[1]Institute for Diagnostic and Interventional Neuroradiology, University Hosiptal Bern, Bern, Switzerland, [2]Institute of Radiooncology, University Hosiptal Bern, Bern, Switzerland, [3]Institute of Pathology, University Bern, Bern, Switzerland, [4]Center for Proton Therapy, Paul Scherrer Institute, Villigen, Switzerland, [5]Neurosurgery, University Hosiptal Bern, Bern, Switzerland
		Glioma-patients get regular neuroradiological MRI-follow-ups to evaluate the tumor-progression-status. In this study it was investigated whether it is possible to *predict* tumor progression *within* the next follow-up period, from progression on a *longer* time-scale. The T_{1c}- and FLAIR-images of two times 20 patients were investigated; one group having stable-disease at two subsequent follow-ups (**ST-ST**), the second group showed stable-disease during the first but progressive-disease during the second follow-up (**ST-PR**). By applying machine-learning (random-forests) on textural MRI-information, short-term progression could be predicted with an accuracy of 77.5%. This novel type of information can have an impact on improved personalized-treatment of glioma-patients.

897	17:03	Radiogenomics of 154 WHO grade 2 and 3 gliomas via machine learning and the impact of texture analysis
		Manabu Kinoshita[1,2], Hideyuki Arita[2], Atsushi Kawaguchi[3], Masamichi Takahashi[4], Yoshitaka Narita[4], Yuzo Terakawa[2], Naohiro Tsuyuguchi[2], Yoshiko Okita[2], Masahiro Nonaka[2], Shusuke Moriuchi[2], Junya Fukai[2], Shuichi Izumoto[2], Kenichi Ishibashi[2], Yoshinori Kodama[2], Kanji Mori[2], Koichi Ichimura[5], and Yonehiro Kanemura[2,6]
		[1]Osaka International Cancer Institute, Osaka, Japan, [2]Kansai Molecular Diagnosis Network for CNS Tumors, Osaka, Japan, [3]Saga University, Saga, Japan, [4]National Cancer Center Hospital, Tokyo, Japan, [5]National Cancer Center Research Institute, Tokyo, Japan, [6]Osaka National Hospital, Osaka, Japan
		In this research, the authors performed radiomics for 154 LrGG and attempted to build a MRI based predictive model to classify clinically relevant 3 LrGG subgroups using machine learning algorithm. The impact of texture analysis such as GLCM and GLRLM on building the model was also investigated. Accuracy for predicting 3 molecular subgroups were 0.587 without and 0.546 with texture analysis. Although radiomics was shown to be a powerful tool to identify genetic subgroups of LrGG, little improvement is expected from texture analysis.

898	17:15	Identifying Individual Motor Function Using Machine Learning Predication Based on Resting-State fMRI for Presurgical Mapping in Patients with Brain Tumor
		Chen Niu[1], Elizabeth Zakszewski[2], Alexander Cohen[2], Xiao Ling[1], Ming Zhang[1], Maode Wang[1], and Yang Wang[2]
		[1]First Affiliated Hospital of Xi'An Jiaotong University, Shaanxi Xi'an, China, [2]Medical College of Wisconsin, Milwaukee, WI, United States
		A novel machine learning model was developed using resting-state and task fMRI on healthy subjects. This study applied this novel model to clinical patients. Preliminary data on 25 patients with space-occupying brain tumors suggested our approach could accurately predict hand functional area at the individual level in patients with brain tumors, even in cases where patients had displacement of brain tissue and reorganization of brain motor functional network. Our methods implicated the great potential for clinical application of presurgical mapping.

899	17:27	Machine learning and rapid multi-parametric relaxometry can differentiate demyelinating disorders with high accuracy
		Gabriel Mangeat[1,2], Russell Ouellette[2,3,4], Maxime Wabartha[1], Virginija Danylaité Karrenbauer[3,5], Nikola Stikov[1], Marcel Warntjes[6,7], Nikola Stikov[1,8], Caterina Mainero[2,9], Julien Cohen-Adad[1,10], and Tobias Granberg[2,3,4,9]
		[1]NeuroPoly Lab, Institute of Biomedical Engineering, Polytechnique Montreal, Montreal, QC, Canada, [2]Athinoula A. Martinos Center for Biomedical Imaging, MGH, Charlestown, MA, United States, [3]Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden, [4]Department of Radiology, Division of Neuroradiology, Karolinska University Hospital, Stockholm, Sweden, [5]Department of Neurology, Karolinska University Hospital, Stockholm, Sweden, [6]Center for Medical Imaging Science and Visualization, CMIV, Linköping, Sweden, [7]SyntheticMR, Linköping, Sweden, [8]Montreal Health Institute, Montreal, QC, Canada, [9]Harvard Medical School, Boston, MA, United States, [10]Functional Neuroimaging Unit, CRIUGM, Université de Montréal, Montreal, QC, Canada
		Hereditary diffuse leukoencephalopathy with spheroids (HDLS) and multiple sclerosis (MS) are both demyelinating and neurodegenerative disorders that can be hard to distinguish clinically and radiologically. Here, we present a machine learning method that relies on rapid multi-parametric relaxometry and volumetry to achieve a robust classification of HDLS vs. MS. Linear discriminant analysis was shown to be a favorable approach compared to non-linear options. A leave-one-out cross-validation show a detection rate of 100% and 0% false positives for both conditions, which suggests that computer-assistance maybe helpful in accurately diagnosing these disorders.

900	17:39	Early Prediction of Language Deficits in Very Preterm Infants Using Functional Connectome Data and Machine Learning
		Lili He[1,2,3], Hailong Li[1,3], and Nehal Parikh[1,2,3]

		[1]Perinatal Institute, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [2]Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, United States, [3]Pediatric Neuroimaging Research Consortium, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States
		Children who are born prematurely are at an increased risk for impaired neurodevelopmental outcomes, including language deficits. Earlier identification, soon after birth, of infants who are experiencing difficulties with complex language function is urgently needed to take advantage of critical windows of brain development so that targeted delivery of Early Intervention therapies can be undertaken during this optimal period. We propose to develop a robust machine learning framework that can analyze functional brain connectome data obtained at term corrected age to make an individual-level prediction about language outcomes at two years corrected age in very preterm infants.

901	17:51	Machine learning classification of Parkinson's disease using brainstem MRI and demographic features
		Daniel E. Huddleston[1], Babak Mahmoudi[2], Jason Langley[3], Mark Connolly[4], Stewart A. Factor[1], Bruce Crosson[1], and Xiaoping P. Hu[5]
		[1]Neurology, Emory University School of Medicine, Atlanta, GA, United States, [2]Biomedical Informatics, Emory University School of Medicine, Atlanta, GA, United States, [3]Center for Advanced Neuroimaging, University of California Riverside, Riverside, CA, United States, [4]Biomedical Engineering, Emory University School of Medicine, Atlanta, GA, United States, [5]Bioengineering, University of California Riverside, Riverside, CA, United States
		Objective biomarkers for Parkinson's disease (PD) are needed, and a PD MRI diagnostic could have high impact in clinical and research applications. 3T MRI sequences sensitive to neuromelanin loss and iron accumulation in substantia nigra pars compacta and locus coeruleus robustly detect PD effects. We hypothesized that a multivariate MRI classifier can differentiate PD from controls with high accuracy. A machine learning classifier was developed using data from PD and controls (n=67) with brainstem MRI and demographic features as model inputs. Using 5-fold cross-validation the model demonstrated 86% accuracy, which is in a clinically useful range and warrants further development.

902	18:03	Improved Prediction of the Final Infarct from Acute Stroke Neuroimaging Using Deep Learning
		Yilin Niu[1], Enhao Gong[2], Junshen Xu[1], Thoralf Thamm[2], John Pauly[2], and Greg Zaharchuk[2]
		[1]Tsinghua University, Beijing, China, [2]Stanford University, Stanford, CA, United States

		Magnetic Resonance Imaging (MRI) is a widely-used technique for clinics. Its advantages in providing multiple complimentary contrasts make it the best image tool for detecting presenting lesions in the brain. A lot methods have been proposed for lesion detection and segmentations using machine learning techniques. It is more sophisticated than common computer vision tasks since the estimation of treatment outcomes are not merely determined by lesions captured by current MR images. We targeted to develop an algorithm, based on 3D Convolutional Neural Network, to predict the final lesion shown on day-90 scans by processing the day-0 acute stroke images.

Oral

Non-Proton MRS/MRI

S02	Wednesday 16:15 - 18:15	*Moderators:* Jens Rosenberg & Monique Bernard

903	16:15	A Continuum of Components: Robust Parameter Mapping in Sodium MRI
		Warda Taqdees Syeda[1,2], Yasmin Blunck[1,2], Amanda C.L. Ng[1,2], Jon Cleary[2], and Leigh Johnston[1,2]
		[1]Dept. of Biomedical Engineering, The University of Melbourne, Melbourne, Australia, [2]Melbourne Brain Centre Imaging Unit, The University of Melbourne, Melbourne, Australia
		Bi-exponential models of T2*-weighted sodium data are prone to producing noisy parameter maps and low contrast between brain tissue types. Further, inherently low SNR has, to this point, necessitated a constant fast fraction weight. Here, a continuum model of sodium T2*-decay is introduced and applied to in vivo human multi-echo 7T data, producing high quality, high contrast parameter maps, and informative voxelwise estimates of the relative weighting between fast and slow decay components.

904	16:27	High Field Hyperpolarized C-13 Dynamic Diffusion Weighted Imaging Based on Slice Selective Double Spin Echo Sequence
		Xucheng Zhu[1,2], Jeremy W. Gordon[2], Robert Bok[2], and Peder E.Z. Larson[1,2]
		[1]Bioengineering, UCSF & UC Berkeley, San Francisco, CA, United States, [2]Department of Radiology and Biomedical Imaging, UCSF, San Francisco, CA, United States
		We designed and optimized a dynamic double spin echo (DSE) acquisition scheme for hyperpolarized(HP) ^{13}C metabolites dynamic diffusion weighted imaging(DWI). Compared to traditional DSE sequence, our sequence could provide higher SNR for longer dynamic imaging duration. Our studies on TRAMP mice indicate a dynamic change of HP lactate ADC over time, which might have potential to improve the assessment of aggressive cancers.

905	16:39	PET by MRI: Glucose Imaging by 13C MRS by Noise Suppression through Tensor Decomposition Rank Reduction
		Jeffrey R Brender[1], Shun Kishimoto[1], Hellmut Merkle[2], Galen Reed[3], Ralph E Hurd[4], Albert P Chen[5], Jan Henrik Ardenkjaer-Larsen[6], Jeeva Munasinghe[2], Keita Saito[1], Tomohiro Seki[1], Nobu Oshima[1], Kazu Yamamoto[1], James Mitchell[1], and Murali C. Krishna[1]
		[1]Radiation Biology, NIH/NCI, Washington DC, DC, United States, [2]NIH/NINDS, Bethesda, MD, United States, [3]GE HealthCare, Dallas, TX, United States, [4]Applied Science Laboratory, GE HealthCare, Menlo Park, CA, United States, [5]GE HealthCare, Toronto, ON, Canada, [6]Technical University of Denmark, Lyngby, Denmark
		We show here a new method of imaging glucose metabolism *in vivo* by ^{13}C MRS without DNP that relies on a simple but efficient postprocessing procedure using the higher dimensional analogue of SVD, tensor decomposition. Using this procedure, without sacrificing accuracy, we achieve an order of magnitude increase in SNR in both DNP and non-hyperpolarized single voxel experiments. In CSI imaging experiments, we see an approximately 30 fold increase in SNR, enough that the glucose to lactate conversions can be imaged with a time resolution of 12 seconds and an overall spatial resolution that compares favorably to 18F-FDG PET.

906	16:51	Deuterium Metabolic Imaging (DMI) of Human Brain Glucose Metabolism
		Henk M. De Feyter[1], Kevin L. Behar[2], Peter B. Brown[1], Scott McIntyre[1], Terence W. Nixon[1], Douglas L. Rothman[1,3], and Robin A. de Graaf[1,3]
		[1]Department of Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States, [2]Department of Psychiatry, Yale University, New Haven, CT, United States, [3]Department of Biomedical Engineering, Yale University, New Haven, CT, United States
		Deuterium Metabolic Imaging (DMI) is a novel approach providing high 3D spatial resolution metabolic data from both animal models and human subjects. DMI relies on ^{2}H MRSI in combination with administration of ^{2}H-labeled substrates. We show how DMI combined with administration of [6,6'-$^{2}H_2$]-glucose can image glucose uptake and metabolism at high spatial resolution in human brain at 4T. We provide longitudinal and transverse relaxation times of ^{2}H-labeled brain metabolites at 4T and 11.7T to support further development and optimization of DMI applications.

907	17:03	A Pilot Study for In Vivo Measurement and Quantification of Brain Glucose Metabolic Rates using Oral Uptake of Deuterated Glucose
		Ming Lu[1], Xiao-Hong Zhu[1], Yi Zhang[1], and Wei Chen[1]
		[1]Center for Magnetic Resonance Research, Department of Radiology, University of Minnesota, Minneapolis, MN, United States

		Recently, we developed a novel Deuterium MRS (DMRS) approach for simultaneously measuring cerebral glucose consumption rate and TCA cycle flux in rat brains at 16.4 T. Instead of using a clamp protocol in ^{13}C MRS studies, our DMRS approach utilizes a brief i.v. infusion of glucose isotope. In this work, we aimed to establish a completely noninvasive delivery of the tracer into brain. By using oral uptake, DMRS detection sensitivity was evaluated and metabolic rates were quantified. Our results demonstrated the feasibility of using oral uptake for DMRS applications, which makes it highly suitable and promising for translation to patients.

908	17:15	Compressed Sensing Improves Detection of Fluorine-19 Nanoparticles in a Mouse Model of Neuroinflammation
		Ludger Starke[1], Sonia Waiczies[1], Thoralf Niendorf[1,2], and Andreas Pohlmann[1]
		[1]Berlin Ultrahigh Field Facility (B.U.F.F.), Max Delbrueck Center for Molecular Medicine in the Helmholtz Association, Berlin, Germany, [2]Experimental and Clinical Research Center (ECRC), Charité Campus Buch, Berlin, Germany
		Low sensitivity remains a major challenge on the way to utilizing the full potential of ^{19}F-MRI, despite its unique detection specificity for imaging inflammation. Compressed sensing allows the reconstruction of high quality images from severely undersampled data by relying on prior statistical knowledge. We show that investing the gained acquisition speed into increased averaging improves the detection of ^{19}F-nanoparticles in an EAE mouse model. Thus compressed sensing helps to improve the sensitivity of ^{19}F-MRI. This paves the way to enhanced spatial and temporal resolution for future *in vivo* studies.

909	17:27	Systemic Inflammation Adversely Affects Mitochondrial Function as Assessed by 31P MRS of Thigh Muscle with Exercise
		Nicholas A. Brennan[1], Kenneth W. Fishbein[1], David A. Reiter[2], Richard G. Spencer[1], and Luigi Ferrucci[3]
		[1]Laboratory of Clinical Investigation, National Institute on Aging, National Institutes of Health, Baltimore, MD, United States, [2]Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, GA, United States, [3]Longitudinal Studies Section, National Institute on Aging, National Institutes of Health, Baltimore, MD, United States
		Systemic inflammation has been shown to play a role in both the aging process and disease progression. However, the effect of inflammation on mitochondrial function has not been fully elucidated. We hypothesized that increased systemic inflammation, assessed through measurement of conventional markers of inflammation, would be accompanied by a decrease in mitochondrial function, as assessed by ^{31}P MRS of leg muscle. Our results suggest that increased systemic inflammation may adversely affect mitochondrial function.

910	17:39	Mapping of Creatine Kinase Reaction Rate in Rat Hindlimb by 31P Magnetic Resonance Fingerprinting

		Charlie Yi Wang[1], Yuchi Liu[1], Yuning Gu[1], Sherry Huang[1], Mark Alan Griswold[1,2], Nicole Seiberlich[1,2], and Xin Yu[1,2]
		[1]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [2]Radiology, Case Western Reserve University, Cleveland, OH, United States
		Magnetic Resonance Fingerprinting (MRF) allows the quantification of multiple tissue parameters with high efficiency. Previously, we developed an MRF based ^{31}P spectroscopic method for fast and robust measurement of ATP synthesis via creatine kinase (CK). In the current study, we explored the potential of combining the CK-MRF method with fast imaging for metabolic mapping of the CK reaction rate in small laboratory animals. CK-MRF imaging was performed in the hindlimb of four rats. CK rates of different muscle compartments were compared.

911	17:51	Accelerating Low-Rank Tensor Model Based Dynamic 31P-MRSI of Ischemia-Reperfusion in Rat at 9.4T
		Bryan Clifford[1,2], Yuning Gu[3,4], Yudu Li[1,2], Yuchi Liu[3,4], Fan Lam[2], Zhi-Pei Liang[1,2], and Xin Yu[3,4,5,6]
		[1]Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [3]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [4]Case Center for Imaging Research, Case Western Reserve University, Cleveland, OH, United States, [5]Department of Radiology, Case Western Reserve University, Cleveland, OH, United States, [6]Department of Physiology and Biophysics, Case Western Reserve University, Cleveland, OH, United States
		Dynamic 31P-MRS/MRSI is often used to assess mitochondrial oxidative capacity in skeletal muscle by monitoring the depletion and recovery of the phosphocreatine concentration during ischemia-reperfusion experiments. In animal models, standard methods are unable to provide the spatiotemporal resolution needed to discern spatial heterogeneity of the recovery process ($$$<$$$10 s/frame, $$$\approx$$$1 mm^3 per voxel). To address this problem, we have improved a recently proposed low-rank tensor based method for accelerated high-resolution dynamic 31P-MRSI to provide in vivo results with 1.5x1.5x2 mm^3 nominal spatial resolution, 36 ppm spectral bandwidth, 0.14 ppm spectral resolution, and 5.1 s temporal resolution.

912	18:03	Down-regulation of phospholipid biosynthesis is a unique metabolic feature of mutant IDH1 gliomas mediated by autophagy of the endoplasmic reticulum
		Pavithra Viswanath[1], Russell O Pieper[2], Joanna J Phillips[2], and Sabrina M Ronen[1]
		[1]Radiology, University of California San Francisco, San Francisco, CA, United States, [2]Neurosurgery, University of California San Francisco, San Francisco, CA, United States

		Virtually every cancer studied so far shows elevated choline and ethanolamine phospholipid metabolism, which has emerged as a metabolic hallmark of cancer. Here, we show that, unusually, low-grade gliomas carrying a mutation in isocitrate dehydrogenase 1 (IDHmut) down-regulate phosphatidylcholine and phosphatidylethanolamine biosynthesis and steady-state levels. Mechanistically, this down-regulation is mediated via autophagic degradation of the endoplasmic reticulum, the site of phospholipid biosynthesis. Importantly, the autophagy inhibitor chloroquine restores phospholipid levels and abrogates IDHmut tumor growth, identifying a potential therapeutic opportunity. Thus, our study demonstrates that IDHmut gliomas uniquely down-regulate phospholipid biosynthesis and that this phenomenon can be exploited for therapy.

Oral

Contrast-Enhanced & Non-Contrast-Enhanced MR Angiography

S03	Wednesday 16:15 - 18:15	*Moderators:* Dariusch Hadizadeh Kharrazi & Ruth Lim

913	16:15	Highly Accelerated Steady State Ferumoxytol Abdominal MRA using Compressed Sensing
		Chengcheng Zhu[1], Joseph Leach[1], Sinyeob Ahn[2], Peter Speier[3], Michaela Schmidt[3], Christoph Forman[3], Gerhard Laub[2], David Saloner[1], and Michael D Hope[1]
		[1]Radiology, University of California, San Francisco, San Francisco, CA, United States, [2]Siemens Healthcare, San Francisco, CA, United States, [3]Siemens Healthcare, Erlangen, Germany
		Clinical CE-MRA of the abdomen is limited in spatial resolution/coverage, or is excessively time consuming. We implemented a compressed sensing (CS) steady state MRA technique with an acceleration factor of 25, achievable in a 15 second breath hold, with 0.8mm isotropic resolution and a large 48cm coverage. In an investigation on 13 patients, we found CS-MRA had higher image quality scores and vessel sharpness compared with free breathing high-resolution MRA and clinical breath hold low-resolution MRA, with a reduced scan time. Our proposed CS-MRA technique is promising for the evaluation of abdominal vessels.

914	16:27	Ferumoxytol-Enhanced 4D MUSIC: Early Multi-Center Experience on Value-Added Magnetic Resonance Imaging in Pediatric Congenital Heart Disease
		Kim-Lien Nguyen[1], Cynthia K. Rigsby[2], Kevin K. Whitehead[3], Mark L. Fogel[3], Peng Hu[4], and J. Paul Finn[5]
		[1]Department of Radiological Sciences and Medicine, David Geffen School of Medicine at UCLA and VA Greater Los Angeles Healthcare System, Los Angeles, CA, United States, [2]Department of Medical Imaging, Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, United States, [3]Division of Cardiology, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [4]Department of Radiological Sciences, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States, [5]Department of Radiological Sciences and Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States

		The value of MRI in congenital heart disease (CHD) is well-recognized. However, high time overhead and the requirement for expert oversight of image acquisition impede its more widespread use. Ferumoxytol-enhanced 4-dimensional multiphase imaging with contrast (4D-MUSIC) is a cardiac phase-resolved MR technique that generates highly detailed images under controlled ventilation. Our early multi-center experience demonstrates that 4D-MUSIC provides value-added imaging in CHD by shortening the examination time, simplifying the imaging protocol, and providing reliable, gadolinium-free, high spatial resolution, cardiac phase-resolved images. When combined with locally available velocity mapping, 4D-MUSIC enables comprehensive imaging of complex CHD in less than 40 minutes.

915	16:39	Lipid-insensitive 4D motion-resolved free breathing coronary MRA in heart transplant recipients at 3T
		Jessica A.M. Bastiaansen[1], Lorenzo Di Sopra[1], Giulia Ginami[2], Hugues Vinzant[1], Juan F Iglesias[3], Sophie Degrauwe[3], Samuel Rotman[3], Davide Piccini[1,4], Ruud B Van Heeswijk[1,5], Roger Hullin[3], Jérôme Yerly[1,5], and Matthias Stuber[1,5]
		[1]Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [2]School of Biomedical Engineering and Imaging Sciences, King's College London, Lausanne, Switzerland, [3]Cardiology Service, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [4]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [5]Center for Biomedical Imaging, Lausanne University Hospital (CHUV), Lausanne, Switzerland
		The purpose of this study was to investigate coronary magnetic resonance angiography (MRA) at 3T as a possible alternative to invasive X-ray coronary angiography for the visualization of proximal and mid segments of the coronary arterial system in heart transplant recipients. Therefore, a lipid-insensitive binomial off-resonance excitation (LIBRE) pulse was optimized and combined with a 3D radial whole-heart sequence. Respiratory-self-navigated MRA was performed at 3T in heart transplant recipients during and after Gd infusion, and was compared with respiratory-motion compensation using compressed sensing (CS) to define the preferred acquisition and reconstruction protocol in this patient group.

916	16:51	Iterative Reconstruction for Dynamic Contrast-Enhanced MR Angiography of the Thoracic Aorta: Quantitative Assessment of SI Parameters and Impact on Quantitative Vessel Characteristics
		Luigia D'Errico[1], Jens Wetzl[2], Michaela Schmidt[2], Aurelien F. Stalder[2], Christoph Forman[2], and Bernd J. Wintersperger[1]
		[1]Department of Medical Imaging, University of Toronto, Toronto, ON, Canada, [2]Siemens Healthcare, Erlangen, Germany
		Iterative reconstruction methods can improve vessel depiction in thoracic contrast-enhanced MR angiography, particularly in small vasculature. This improvement can be ascribed to the reduced temporal footprint for iterative reconstruction compared to view sharing for standard reconstruction. An investigation of the effects of this new reconstruction on quantitative vessel characteristics found no bias in vessel diameter measurements compared to the reference.

917	17:03	Time-resolved dynamic contrast enhanced MR imaging of the pulmonary vasculatures and parenchyma using Fat-sat DISCO with Gadobutrol
		Takayuki Masui[1], Motoyuki Katayama[1], Mitsuteru Tsuchiya[1], Masako Sasaki[1], Kenshi Kawamura[1], Yuki Hayashi[1], Takahiro Yamada[1], Naoyuki Takei[2], Yuji Iwadate[2], and Kang Wang[3]
		[1]Radiology, Seirei Hamamatsu General Hospital, Hamamatsu, Japan, [2]Global MR Applications and Workflow, GE Healthcare, Hino, Japan, [3]Global MR Applications and Workflow, GE Healthcare, Madison, Japan
		Fat-sat DISCO is modified version of DISCO, based on LAVA with view-sharing, which can be used for dynamic contrast MR imaging with high temporal resolutions. Gadobutrol has higher concentration of Gadolinium and its single bolus injection might induce T2 shorting effects. Simultaneous bolus injection of Gadobutrol and saline may suppress T2 shorting effects and will facilitate enhancement on T1-weighted imaging. Using fat-sat DISCO with simultaneous bolus injection of Gadobutrol and saline, dynamic contrast MR imaging of the lung can steadily provide selective visualization of pulmonary vasculatures and parenchymal enhancement.

918	17:15	Whole-Heart Cartesian Coronary MRA with Sub-Millimeter Isotropic Resolution in Four-Minute Acquisition
		Aurelien Bustin[1], Giulia Ginami[1], Imran Rashid[1], Teresa Correia[1], Tevfik Ismail[1], Radhouene Neji[1,2], Rene Botnar[1], and Claudia Prieto[1]
		[1]Biomedical Engineering Department, King's College London, London, United Kingdom, [2]Siemens Healthcare Limited, Frimley, United Kingdom
		Whole-heart coronary magnetic resonance angiography (CMRA) with isotropic resolution allows reformatting in any desired imaging plane without loss of resolution. However, achieving sub-millimeter isotropic resolution with a conventional 1D diaphragmatic navigator gated CMRA is very challenging due to long and unpredictable scan times. In this study, we sought to achieve sub-millimeter CMRA by combining 2D image-based navigator motion correction with highly accelerated compressed sensing reconstruction in concert with variable density Cartesian spiral-like k-space sampling to significantly accelerate the scan. The proposed technique enables CMRA acquisitions with 0.9mm isotropic spatial resolution in about 4 minutes. Ultimately, this technique might be useful for rapid screening of the coronaries in patients with suspected coronary artery disease.

919	17:27	Automated Coil Ranking using a Neural Network for Image Quality Assessment: An Explorative Study in Coronary MRI
		John Heerfordt[1,2], Robin Demesmaeker[2,3], Jérôme Yerly[1,4], Tobias Kober[1,2,5], Matthias Stuber[1,4], and Davide Piccini[1,2,5]

		[1]Department of Radiology, University Hospital (CHUV) and University of Lausanne, Lausanne, Switzerland, [2]Advanced Clinical Imaging Technology, Siemens Healthcare AG, Lausanne, Switzerland, [3]Institute of Bioengineering/Center for Neuroprosthetics, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [4]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [5]LTS5, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
		A novel method that uses a neural network to rank individual coil elements of phased arrays based on their image quality is proposed. With a ranking of the coil elements, the specific subset of coils that leads to the best image reconstruction can be selected. Alternatively, the contribution of coils with high levels of artifacts and noise to the final image can be reduced. We show that both selection and weighting of coil elements can reduce the level of image artifacts while maintaining a high signal intensity in the region of the examined organ.

920	17:39	Improved Design and Reconstruction of 3D Image Based Navigators for Coronary MR Angiography
		Mario O. Malavé[1], Srivathsan P. Koundinyan[1], Christopher M. Sandino[1,2], Joseph Y. Cheng[1,2], and Dwight G. Nishimura[1]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Palo Alto, CA, United States
		We present a novel method to acquire whole-heart 3D image-based navigators (iNAVs) for tracking and correction of localized motion in free-breathing coronary angiography. More specifically, a variable-density, phyllotaxis-based trajectory is utilized for homogeneous sampling of the desired k-space extent. To reconstruct the 3D iNAVs, a locally low rank regularized iterative scheme is implemented. Across all volunteer studies, compared to 3D iNAVs generated with prior design and reconstruction strategies, the proposed 3D iNAVs provide superior delineation of the structures of interest. Application of the proposed 3D iNAVs for motion correction in volunteer studies yields improved depiction of the coronary arteries.

921	17:51	Accuracy of ECG-triggered Non-contrast Enhanced MRA (TRANCE) versus CT Angiography for diagnosis of peripheral artery disease: Comparison with DSA
		Lan Zhang[1] and Zhi Zheng Zhuo[2]
		[1]MRI, The 1st affiliated hospital of Henan University of TCM, Zhengzhou, China, [2]PHILIPS Healthcare, Beijing, China
		There is an increasing clinical need for implementing a Non-contrast enhanced MRI technique for patients with PAD or contraindications for the use of contrast medium, especially patients with renal insufficiency. We optimized TRANCE with best performance at 3.0T and compared image quality and diagnostic accuracy versus CTA and DSA for evaluation of low extremity PAD.

922	18:03	An optimised subtraction approach for subtractive NCE-MRA techniques based on principal component analysis
		Hao Li[1], Shuo Wang[1], Andrew Nicholas Priest[1], Martin John Graves[1], and David John Lomas[1]
		[1]Department of Radiology, University of Cambridge, Cambridge, United Kingdom
		An optimised subtraction approach is developed to improve the background signal suppression in subtractive Non-Contrast-Enhanced MR Angiography (NCE-MRA) and Venography (NCE-MRV) techniques. Principal component analysis (PCA) is used to correct the intensity difference of background tissue in dark-blood images (DBIs) and bright-blood images (BBIs). Compared with the direct subtraction operation, the proposed approach significantly improved the background signal suppression in all the evaluated cases including femoral Fresh Blood Imaging (FBI)-MRA, iliac Flow-Sensitive Dephasing (FSD)-MRV and FSD-MRA for the thoracic central veins.

Oral

Myelin Imaging: Applications

S04	Wednesday 16:15 - 18:15	*Moderators:* Valentin Prevost & Jeffrey Stanley

923	16:15	Correlations between quantiative myelin imaging using macromolecular proton fraction, neurogenesis, and oligodendrogenesis in the murine model of cuprizone-induced demyelination
		Marina Khodanovich[1], Anna Pishchelko[1], Valentina Glazacheva[1], Edgar Pan[1], Andrey Akulov[1,2], and Vasily Yarnykh[1,3]
		[1]Research Institute of Biology and Biophysics, Laboratory of Neurobiology, Tomsk State University, Tomsk, Russian Federation, [2]Institute of Cytology and Genetics SB RAS, Novosibirsk, Russian Federation, [3]Dapartment of Radiology, University of Washington, Seattle, WA, United States
		This study aimed to identify associations between neurogenesis in the neurogenic niches, oligodendrogenesis, and myelination in the murine cuprizone demyelination/remyelination model. Myelination was quantified by the recently proposed macromolecular proton fraction (MPF) mapping method. Neurogenesis and oligodendrogenesis were assessed by immunohistology. Negative correlations were found between oligodendrogenesis and neurogenesis in both the subventricular zone and dentate gyrus. Correlation between MPF and oligodendrogenesis was also negative, whereas correlation between MPF and neurogenesis was positive. Associations between MPF and neurogenesis/oligodendrogenesis reveal the feasibility of using MPF as a surrogate marker of reparative processes in demyelinating diseases.

924	16:27	Neurochemical signature of the metabolic mechanisms underlying de- & re-myelination in the mouse’s cerebellum

		Georges Hankov[1,2,3,4], Aline Seuwen[1,3], Giovanna D. Ielacqua[1,3], Anna E. Mechling[2], Eva Mracsko[2], Andreas Bruns[2], Basil Künnecke[2], Markus von Kienlin[2], Markus Rudin[1,3,4], and Thomas Mueggler[2]
		[1]Institute for Biomedical Engineering, ETH and University of Zurich, Zurich, Switzerland, [2]NORD Discovery & Translational Area, Pharmaceutical research and Early Development, Roche Innovation Center Basel, F. Hoffmann-La Roche Ltd, Basel, Switzerland, [3]Institute of Pharmacology and Toxicology, University of Zurich, Zurich, Switzerland, [4]Neuroscience Center Zurich, Zurich, Switzerland
		Because of an increasing therapeutic need to understand the underlying mechanism of myelin damage and repair in pathologies such as multiple sclerosis (MS), we used 1H-MRS to longitudinally characterize the metabolic changes in the cerebellum associated with de- and re-myelination in the cuprizone mouse model. Our results, in line with similar findings in the corpus callosum, suggest that a group of metabolites provide a unique neurochemical signature of cuprizone induced de- and re-myelination. Additionally, we observe a reversible and robust increase of GABA levels upon cuprizone feeding that goes in contradiction with current trends in clinical studies of MS patients.

925	16:39	A comparison of magnetization transfer, diffusion tensor imaging and ultrashort TE measurements in a murine model of demyelination
		Lucas Soustelle[1], Cristina Antal[1], Julien Lamy[1], François Rousseau[2], Jean-Paul Armspach[1], and Paulo Loureiro de Sousa[1]
		[1]Université de Strasbourg, CNRS, ICube, FMTS, Strasbourg, France, [2]Institut Mines Télécom Atlantique, INSERM, LaTIM, Brest, France
		Exploration of myelin content in the brain and spinal cord is essential for monitoring pathologies such as multiple sclerosis. Quantitative MRI methods such as diffusion tensor imaging (DTI) and quantitative magnetization transfer imaging (qMT) already demonstrated efficiency in characterizing demyelination. Ultrashort echo time sequences were previously investigated for myelin characterization within long-T2 suppression condition. In this work, we propose to compare parameters from DTI, qMT, and Diff-UTE in ex-vivo brains, using a murine model of demyelination.

926	16:51	Inhomogeneous Magnetization Transfer (ihMT) sensitivity to myelin impairments in cuprizone mouse model
		Valentin H Prevost[1], Myriam Cayre[2], Victor N D Carvalho[1], Samira Mchinda[1], Gopal Varma[3], Jean Philippe Ranjeva[1], Jean Pelletier[4], David C Alsop[3], Pascale Durbec[2], Olivier M Girard[1], and Guillaume Duhamel[1]
		[1]Aix Marseille Univ, CNRS, CRMBM, UMR 7339, Marseille, France, [2]Aix Marseille Univ, CNRS, IBDM, UMR 7288, Marseille, France, [3]Division of MR Research, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, United States, [4]Aix Marseille Univ, APHM, Hôpital de La Timone, Pôle de Neurosciences Cliniques, Service de Neurologie, Marseille, France

		Inhomogeneous magnetization transfer (ihMT) is a new MR imaging modality weighted by the dipolar relaxation time (T_{1D}), which has demonstrated a strong linear correlation with myelin-specific fluorescence signal measured in genetically-modified mice, hence validating the technique as a myelin biomarker. In the current study, the ihMT sensitivity has been evaluated on a cuprizone mouse model, a widely used model of de- and remyelination. A longitudinal analysis has been performed *in vivo* and quantitative signal was compared to myelin amount measured by GFP quantification at remarkable time points in order to evaluate the ihMT sensitivity for monitoring *in vivo* myelin state.

927	17:03	Are we seeing any better? A comprehensive comparison of myelin biomarkers in the healthy and multiple sclerosis post mortem spinal cord
		Marco Battiston[1], Torben Schneider[2], Francesco Grussu[1,3], Geert J Schenk[4], Stig Wergeland[4,5], Mohamed Tachrount[6], Marios C Yiannakas[1], Carmen Tur[1], Jeroen J G Geurts[4], Claudia Angela Wheeler-Kingshott[1,7,8], and Rebecca Sara Samson[1]
		[1]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [2]Philips UK, Surrey, United Kingdom, [3]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [4]Department of Anatomy and Neurosciences, VU University medical centre, Amsterdam, Netherlands, [5]Department of Neurology, Haukeland University Hospital, Bergen, Norway, [6]Cardiff University Brain Research Imaging Centre, Cardiff University, Cardiff, United Kingdom, [7]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [8]Brain MRI 3T Research Centre, C. Mondino National Neurological Institute, Pavia, Italy
		Conventional MRI of the multiple sclerosis (MS) spinal cord offers low specificity to underlying pathological processes taking place. Quantitative MRI metrics able to characterize damage at the microstructural level are required. Of particular interest are those known to be sensitive to myelin content, which can be generated via various different contrast mechanisms. It is important to assess the specificity of such prospective myelin biomarkers to MS spinal cord pathology and validation studies comparing MRI with histological findings are essential for this purpose. Here a comparison of myelin-sensitive quantitative MRI metrics measured in MS and healthy ex vivo cord are presented.

928	17:15	Evaluation of recovery in myelin water signal after acute ischemic stroke
		Joon Yul Choi[1], Do Yeon Kim[2], Jongho Lee[1], and Seung-Hoon Lee[2]
		[1]Laboratory for Imaging Science and Technology,Department of Electrical and Computer Engineering, Seoul National University, Seoul, Republic of Korea, [2]Department of Neurology, Seoul National University Hospital, Seoul, Republic of Korea
		This study investigated the recovery in myelin water signals after acute ischemic stroke. The results showed an increase of myelin water signals in acute lesions after 3 months of treatment. Furthermore, mild stroke patients recovered more than severe stroke patients when comparing measures of myelin water signals in acute lesions.

929	17:27	Neuroplastic Changes of Myelin Microstructure With Video Game Play
		Douglas C Dean[1], Austin M Patrick[1,2], Thomas Gorman[1,3], C Shawn Green[3], and Andrew L Alexander[1,2,4]
		[1]Waisman Center, University of Wisconsin Madison, Madison, WI, United States, [2]Medical Physics, University of Wisconsin Madison, Madison, WI, United States, [3]Psychology, University of Wisconsin Madison, Madison, WI, United States, [4]Psychiatry, University of Wisconsin Madison, Madison, WI, United States
		Mounting evidence suggests that changes in the brain can occur within hours, however, the mechanisms underlying these changes remain unknown. In this work, we utilized multicomponent relaxometry (mcDESPOT) to examine the effects of both short and long term video game playing on myelinated white matter. Short and long term changes in quantitative longitudinal relaxation times as well as long term changes of myelin water fraction were observed. These results add to the growing literature that neuroplastic effects can take place over the short term while also suggesting long term changes may involve mechanisms of myelination.

930	17:39	Evidence of altered myelination in adolescents with Attention-Deficit/Hyperactivity Disorder: A multi-echo T2 imaging study
		Jennifer Losiowski[1], Phil Easter[1], David R. Rosenberg[1], and Jeffrey A. Stanley[1]
		[1]Psychiatry and Behavioral Neurosciences, Wayne State University School of Medicine, Detroit, MI, United States
		Attention-deficit/hyperactivity disorder (ADHD) is a highly prevalent childhood disorder with considerable evidence of a developmental basis for the etiology of ADHD. Structural neuroimaging studies, though limited in its interpretation, have implicated cortical and subcortical white matter in ADHD. Here we examine myelin content and axonal size/packing density in adolescents with ADHD in six white matter tracts using multi-echo T_2 (ME-T_2) imaging. Results show reduced myelin content as well as smaller axonal size (increased axonal packing density), which is suggestive of a lack of progressive myelination in commissural and projection tracts in ADHD.

931	17:51	Myelin water fraction, diffusion tensor imaging, and g-ratio measurements characterize myelin changes in normative aging, mild cognitive impairment, and dementia
		Mustapha Bouhrara[1], Abinand C. Rejimon[1], Diana Y. Lee[1], and Richard G. Spencer[1]
		[1]National Institutes of Health, Baltimore, MD, United States

		In previous work, we showed evidence of myelin loss with mild cognitive impairment (MCI) using a direct and specific MRI measure of myelin water fraction, a surrogate for myelin content. Here, we extend this by investigating changes in myelin content in normative aging, MCI, and dementia using myelin content, diffusion tensor imaging, and g-ratio measurements. Our results showed decrease in myelin content in several brain regions of the subjects diagnosed with MCI or dementia in comparison with the old healthy subjects. Higher myelin content in middle-aged subjects was also observed, in agreement with the literature.

932	18:03	Myelin digestion during multiple sclerosis lesion formation contributes to increase on QSM
		Kofi Deh[1], Gerald Ponath[2], Zaki Molvi[1], Gian-Carlo Toriano Parel[1], Kelly M. Gillen [1], Shun Zhang[1], Thanh Nguyen [1], Pascal Spincemaille[1], Yinghua Ma [1], Ajay Gupta [1], Susan Gauthier [1], David Pitt[2], and Yi Wang[1]
		[1]Weill Cornell Medicine, New York, NY, United States, [2]Yale School of Medicine, New Haven, CT, United States
		During the initial processes in the formation of MS lesions, myelin is immediately digested in macrophages after phacocytosis. Chemical bond breakdown in myelin basic proteins (MBP) and among lipid bilayers (LB) can increase magnetic susceptibility. Here we measure susceptibility increase in phantom experiments of MBP breakdown and myelin LB breakdown. We investigate myelin degradation in the first few weeks of MS lesion formation by performing histology on MS brain samples and by in vivo imaging of enhancing lesions in MS patients.

Oral

Off the Cartesian Grid

S05	Wednesday 16:15 - 18:15	*Moderators:* Corey Baron & Maria Altbach

933	16:15	Radial streaking artifact reduction using phased array beamforming
		Sagar Mandava[1], Mahesh B Keerthivasan[1], Diego R Martin[2], Maria I Altbach[2], and Ali Bilgin[1,2]
		[1]Electrical and Computer Engineering, University of Arizona, Tucson, AZ, United States, [2]Department of Medical Imaging, University of Arizona, Tucson, AZ, United States

		Streaking artifacts can occur in radial MR imaging especially in applications that require large FOVs. In abdomen MRI, the common sources of streaking are unsuppressed fat and the arms with the latter being a particularly problematic source of streaking. The standard approach to mitigate streaking is to identify, either manually or automatically, the subset of coils that are heavily contaminated by streaking artifacts and discard them prior to coil-combination. We present a simple approach to mitigate streaking artifacts that leverages phased array beamforming (spatial filtering) and demonstrate its performance on radial fast spin echo data.

934	16:27	k-space Diagonal Preconditioner: Speeding Up Iterative Reconstruction For Variable Density Sampled Acquisitions Without Compromises
		Frank Ong[1], Martin Uecker[2,3], and Michael Lustig[1]
		[1]University of California, Berkeley, Berkeley, CA, United States, [2]Institute for Diagnostic and Interventional Radiology, University Medical Center Göttingen, Göttingen, Germany, [3]German Centre for Cardiovascular Research (DZHK), Gottingen, Germany
		Variable density sampling is now commonly used in advanced imaging methods. However, due to ill conditioning, reconstruction can take hundreds of iterations, limiting its clinical application. One effective heuristic to accelerate convergence is the use of density compensation, but it is known to increase reconstruction error. An alternative is to use preconditioners, but existing preconditioners increase computation by performing additional image convolutions. Our goal here is to accelerate iterative reconstruction convergence without compromises. We propose a k-space diagonal preconditioner, without compromising reconstruction error, or computation. We demonstrate on datasets that reconstructions with the proposed preconditioner converge at around 10 iterations.

935	16:39	Accelerated Spiral imaging for Real-time Cardiac MRI
		Zhixing Wang[1], Xue Feng[1], Quan Dou[1], and Craig H. Meyer[1]
		[1]Department of Biomedical Engineering, University of Virginia, Charlottesville, VA, United States
		This study proposes two spiral-based (spiral-out and spiral-in/out) bSSFP pulse sequences combined with two reconstruction methods for accelerated real-time cardiac imaging. Based on a comparison to fully-sampled data reconstructed using gridding, a low rank plus sparse (L&S) method performs better than a CG-SPIRiT method on both spiral trajectories. The spiral-in/out sequence achieved higher SNR and fewer artifacts than the spiral-out sequence. Thus, a spiral-in/out bSSFP sequence with L&S reconstruction is a promising method for real-time cardiac MRI with high image quality and excellent temporal resolution.

936	16:51	Spiral Imaging on a Compact 3T Scanner with High Performance Gradients
		Shengzhen Tao[1], Yunhong Shu[1], Joshua Trzasko[1], Myung-Ho In[1], Erin Gray[1], John Huston III[1], and Matt Bernstein[1]

		[1]Radiology, Mayo Clinic, Rochester, MN, United States
		Recently, a low-cryogen, compact 3T MRI system optimized for brain, extremity and infant imaging was developed. The system is equipped with a high slew rate gradient capable of 80 mT/m maximum gradient amplitude and 700 T/m/s slew rate. Due to its reduced imaging volume (26-cm diameter-spherical-volume), the high gradient amplitude and slew rate can be achieved simultaneously on this system with substantially less peripheral nerve stimulation. Here, we investigate the benefit of performing spiral imaging using high gradient performance available on this system. We demonstrated that the high slew-rate can significantly reduce spiral readout time and therefore reduce off-resonance-induced blurring.

937	17:03	Highly-accelerated volumetric brain protocol using optimized Wave-CAIPI encoding
		Daniel Polak[1,2,3], Stephen F. Cauley[2,4], Susie Y. Huang[2,4,5,6], Maria Gabriela Longo[2], Berkin Bilgic[2,4], Esther Raithel[3], Lawrence L. Wald[2,4,5], and Kawin Setsompop[2,4,5]
		[1]Department of Physics and Astronomy, Heidelberg University, Heidelberg, Germany, [2]Department of Radiology, A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States, [3]Siemens Healthcare GmbH, Erlangen, Germany, [4]Harvard Medical School, Boston, MA, United States, [5]Harvard-MIT Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States, [6]Department of Radiology, Massachusetts General Hospital, Boston, MA, United States
		We introduce an optimized six-minute high-resolution whole-brain protocol of 3D, mainly isotropic acquisitions for T2w SPACE, FLAIR (3D), T1w MPRAGE and T2*w SWI; all acquired at 9-fold acceleration using Wave-CAIPI encoding. Design strategies were developed to optimize wave-encoding parameter selection, coil sensitivity computation, and data-driven automated gradient trajectory error estimation. We validated our exam on five volunteers on a 3T MRI scanner and achieved good SNR with negligible g-factor noise and good image contrast despite the 9-fold acceleration. Our fast high-resolution neurological exam should benefit several clinical and research applications and help mitigate patient compliance issues and motion artifacts.

938	17:15	GRAPPA Reconstructed 3D Wave-CAIPI TSE at 7 Tesla
		Jolanda Melissa Schwarz[1], Eberhard Daniel Pracht[1], and Tony Stoecker[1,2]
		[1]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany, [2]Department of Physics and Astronomy, University of Bonn, Bonn, Germany
		In this work, wave-CAIPI sampling is incorporated in a 3D variable flip angle turbo spin echo (TSE) sequence optimized for ultra high field applications. The acquired wave-CAIPI data are reconstructed with a GRAPPA-based wave-CAIPI reconstruction algorithm using multiple reconstruction kernels. Highly accelerated wave-CAIPI TSE images with 1 mm^3 resolution and whole brain coverage are acquired at a 7 Tesla scanner. A clear SNR improvement compared to Cartesian CAIPIRINHA is shown.

939	17:27	Self-calibrating Wave-encoded 3D Turbo Spin Echo Imaging using Subspace Model based Autofocus
		Zechen Zhou[1], Chun Yuan[2,3], and Peter Börnert[4]
		[1]Philips Research North America, Cambridge, MA, United States, [2]Vascular Imaging Lab, Department of Radiology, University of Washington, Seattle, WA, United States, [3]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [4]Philips Research Hamburg, Hamburg, Germany
		Wave-encoding techniques can better utilize the three-dimensional (3D) encoding power of parallel imaging (PI) during acquisition and image reconstruction, but proper calibration of wave point spread function (PSF) and coil sensitivities are required. In this study, a self-calibrating wave PSF and PI kernel approach from subsampled wave-encoded k-space is proposed using subspace model based autofocus estimation. Its performance is evaluated for 3D wave encoded turbo spin echo (TSE) imaging. The preliminary results on phantom has demonstrated the calibration accuracy of self-calibrated wave PSF and improved PI performance in comparison to Cartesian based PI for 3D TSE imaging.

940	17:39	Joint SENSE Reconstruction for Faster Multi-Contrast Wave Encoding
		Berkin Bilgic[1], Stephen F Cauley[1], Lawrence L Wald[1], and Kawin Setsompop[1]
		[1]Martinos Center for Biomedical Imaging, Charlestown, MA, United States
		We introduce Joint SENSE acquisition/reconstruction to provide higher acceleration in multi-contrast acquisitions with improved image quality. We employ a complementary sampling strategy by shifting the k-space sampling patterns across the contrasts, which induces phase ramps in image space. By harnessing these ramps as additional coil sensitivity variations, we improve reconstruction error and g-factor performance by >2x compared to standard SENSE reconstruction. Further, we combine Joint SENSE with Wave encoding to exploit 4-dimensional sensitivity encoding, 3D across space + 1D across contrasts, to provide rapid multi-contrast acquisition with high quality.

941	17:51	Trajectory correction for a 3D-Ultrashort Echo Time (UTE) sequence using the gradient system transfer function
		Manuel Stich[1,2], Lenon Mendes Pereira [1], Tobias Wech[1], Andreas Max Weng[1], Ralf Ringler[2], Thorsten A. Bley[1], and Herbert Köstler[1]
		[1]Department of Diagnostic and Interventional Radiology, University Hospital of Würzburg, Würzburg, Germany, [2]X-Ray and Molecular Imaging Laboratory, Ostbayerische Technische Hochschule Amberg-Weiden, Weiden, Germany

		3D-Ultrashort Echo Time (UTE) sequences with 3D-kossh ball trajectory suffer from k-space trajectory deviations and ghosting artifacts due to hardware imperfections. The gradient system transfer function (GSTF), completely characterizes the gradient system as a linear and time-invariant (LTI) system. In this study, the GSTF was measured only using standard scanner hardware and was used to correct deviated trajectories in image reconstruction. This results in diminished ghosting artifacts and improve image quality.

942	18:03	Cross Term and Higher Order Gradient Impulse Response Function Characterization using a Phantom-based Measurement
		Jürgen Rahmer[1], Peter Mazurkewitz[1], Peter Börnert[1], and Tim Nielsen[1]
		[1]Philips GmbH Innovative Technologies Research Laboratories Hamburg, Hamburg, Germany
		Characterization of the 3D field response of an MRI gradient system is important for proper system calibration. A powerful approach to 3D characterization is the acquisition of the gradient impulse response function (GIRF) using a set of distributed MRI probes. An alternative approach is the phantom-based measurement of the GIRF using a thin slice method. However, this method currently only delivers 0^{th} order information (ΔB_0) and 1^{st} order direct terms (G_{xx}, G_{yy}, G_{zz}), but no cross terms (e.g. G_{xy}) or higher order information. We present an extension of the thin slice method by adding phase encoding for characterization of 1^{st} order cross terms as well as higher order spatial components. Experimental results on the respective gradient modulation transfer functions (GMTFs) of a clinical system are presented.

Oral

Novel MR & MR-Compatible Technology

S06	Wednesday 16:15 - 18:15	*Moderators:* Michael Garwood & Clarissa Cooley

943	16:15	A 6.3kg Single-Sided Magnet for 3D, Point-of-Care Brain Imaging
		Patrick C McDaniel[1,2], Clarissa Z Cooley[2], Jason P Stockmann[2], and Lawrence L Wald[2,3]
		[1]Massachusetts Institute of Technology, Cambridge, MA, United States, [2]Athinoula A Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [3]Harvard Medical School, Boston, MA, United States
		MRI, as currently used, requires transporting the patient to the scanner. A truly point-of-care MRI device, possibly even hand-held, could increase the utility of MRI extending its reach and enabling new applications, such as continuous bedside monitoring. In this work, we design and construct a light-weight (6.3kg), single-sided permanent magnet designed to image the cortical region it is positioned over (~8cm x 8cm x 3cm ROI). We describe the magnet optimization and compare the predicted and measured B0 field pattern and validate its imaging potential by acquiring 1D depth profiles in a phantom.

944	16:27	Rotatable Main Field MRI Scanner for Angle Sensitive Imaging
		John Mario Vincent McGinley[1], Mihailo Ristic[1], and Ian Robert Young[2]
		[1]Mechanical Engineering, Imperial College London, London, United Kingdom, [2]Electrical Engineering, Imperial College London, London, United Kingdom
		Anisotropies with respect to the main field direction in collagen-rich tissues may be exploited to provide new information about the tissue microstructures. However this requires the field to be oriented at various oblique angles relative to the subject. This is usually difficult and often impossible using conventional MRI magnet configurations. We have developed an entirely new open magnet concept which can be rotated about two motorised axes to achieve a wide range of orientations. The design of the magnet and the gradients posed special challenges. The new MRI system is suitable for imaging of extremities, particularly the knee.

945	16:39	MRI Compatible Hypobaric Chamber to study Early Aeromedical Evacuation Following Traumatic Brain Injury
		Su Xu[1], Sijia Guo[1], Steven Roys[1], Julie L Proctor[2], Gary Fiskum[2], and Rao Gullapalli[1]
		[1]Diagnostic Radiology and Nuclear Medicine, University of Maryland School of Medicine, Baltimore, MD, United States, [2]Department of Anesthesiology and the Center for Shock Trauma and Anesthesiology Research, University of Maryland School of Medicine, Baltimore, MD, United States
		Combat-related TBI leads to significant mortality and morbidity. In our previous research, we have demonstrated that simulated aeromedical evacuation (AE), or hypobaria, worsens neurological outcomes after TBI and suggests that early AE of TBI patients contributes to secondary insults. To study the effects of such hypobaric exposure during early stage of injury we have constructed a MRI compatible hypobaric chamber that allows us to evaluate changes in metabolism, perfusion, and functional status in a preclinical model of brain injury. Here we demonstrate our initial experiences with the hypobaric chamber in the MRI to obtain in vivo imaging and spectroscopic data.

946	16:51	Joint dynamic shimming using the scanner’s spherical harmonic shim combined with a local multi-coil shim array
		Ali Aghaeifar[1,2], Christian Mirkes[3], and Klaus Scheffler[1,4]
		[1]Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]IMPRS for Cognitive and Systems Neuroscience, University of Tuebingen, Tuebingen, Germany, [3]Skope Magnetic Resonance Technologies AG, Zurich, Switzerland, [4]Department of Biomedical Magnetic Resonance, University of Tuebingen, Tuebingen, Germany

		In this work, we combined scanner's spherical harmonic shim coils with a local multi-coil shim array to work in parallel for dynamic shimming of the human brain at 9.4 T. Performance of the combined method is compared with global shimming with scanner's built-in shim setup, global shimming with multi-coil and dynamic shimming with multi-coil.

947	17:03	Direct Generation of MR Images in a Divergent Coordinate System for MRI Radiotherapy Hybrids
		Keith Wachowicz[1,2], Brad Murray[1,2], and B Gino Fallone[1,2]
		[1]Medical Physics, Oncology, University of Alberta, Edmonton, AB, Canada, [2]Medical Physics, Cross Cancer Institute, Edmonton, AB, Canada
		The direct generation of images in a divergent coordinate system may be important to some applications of MR imaging in MRI-radiotherapy hybrids. Specifically, in the circumstance where 2D images are being used for real-time therapy beam guidance, image generation in a divergent coordinate system that matches that of the treatment beam (which originates from a single source point) will reduce targeting errors and inadvertent dosing of critical structures. This work presents a theoretical hardware solution to a variety of MRI-radiotherapy implementations which involve the replacement or augmentation of conventional linear gradients. An experimental and simulated verification is presented.

948	17:15	A low-cost (<$500 USD) FPGA-based console capable of real-time control
		Suma Anand[1], Jason P. Stockmann[2,3], Lawrence L. Wald[2,3], and Thomas Witzel[2,3]
		[1]Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]A. A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States
		Conventional MRI consoles are high-cost and difficult to customize, typically using a proprietary language for creating pulse sequences. Recently, FPGAs have become the tool of choice in designing custom MRI consoles for their flexibility and speed. In this work, we describe a low-cost, open source, FPGA-based console using an off-the-shelf board that provides flexibility in pulse-sequence programming, robust timing, and excellent signal stability. Our goal is to facilitate the development of custom acquisition methods and provide a useful console for MR education and low-cost systems. We demonstrate its function by acquiring a 2D spin-echo image on an MIT/Martinos Tabletop scanner.

949	17:27	Ex vivo continuous Overhauser nuclear dynamic polarization in a SQUID-based ultralow field magnetic resonance imaging system
		Paul Fehling[1], Rebekka Bernard[1], Rolf Pohmann[1], Matthias Rudolph[1,2], Dieter Kölle[2], Reinhold Kleiner[2], Klaus Scheffler[1], and Kai Buckenmaier[1]

		[1]High-field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [2]Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Eberhard Karls Universität, Tübingen, Germany
		Overhauser Dynamic Nuclear Polarization (ODNP) is a method to achieve continuous hyperpolarization in MR measurements. Here, the polarization of free radicals is transferred to 1H using High Frequency (HF) pulses at the electron Larmor frequency. At UltraLow Fields (ULF) the frequency of the HF pulse lies in the range of several 100 MHz and is able to penetrate large sample volumes, making continuous in vivo ODNP measurements possible. Since conventional Faraday coils are not sensitive enough at ULF, a Superconducting QUantum Interference Device (SQUID) based detector is employed. First ex vivo images using ODNP enhanced MR have been acquired successfully.

950	17:39	Advanced Gradient Driver Design with Silicon Carbide MOSFETs
		Ruxi Wang[1], Juan Sabate[1], Viswanathan Kanakasabai[2], Yash Singh[3], Jayanti Ganesh[2], and Huan Hu[3]
		[1]GE Global Research Center, Niskayuna, NY, United States, [2]GE Global Research, Bangalore, India, [3]GE Global Research, Niskayuna, NY, United States
		In a MRI system, gradient driver is a switching power supply which is composed of power semiconductor devices, such as insulated gate bipolar transistors (IGBTs), power metal oxide semiconductor field effect transistor (MOSFET), etc. To control an electrical power that can be transferred by the gradient driver, the power semiconductor devices are usually operated in a pulse width modulation (PWM) method with high voltage, high current and high switching frequency [1-4]. With advanced semiconductor devices like silicon carbide devices, each module could sustain higher voltage which will simplify the power supply architecture. Meanwhile, the fast switching capability of Silicon Carbide (SiC) devices make the gradient amplifier more efficient than silicon version. This paper presented a high performance modular solution gradient amplifier system with advanced wide-band gap SiC devices. Image test with the advanced gradient driver was demonstrated in this paper.

951	17:51	High-performance portable spin-exchange optical pumping polarizer for hyperpolarized ^{129}Xe MRI
		Graham Norquay[1], Guilhem J Collier[1], Oliver I Rodgers[1], and Jim M Wild[1]
		[1]University of Sheffield, Sheffield, United Kingdom
		There is increasing interest in hyperpolarized (HP) ^{129}Xe MRI for research and clinical imaging questions in the lungs and other organs where dissolved xenon can be used to assess tissue perfusion. With the motivation of increasing the availability of HP ^{129}Xe technology we undertook to design and build a portable ^{129}Xe polarizer. We demonstrate here a compact portable ^{129}Xe polarizer capable of generating ^{129}Xe polarized to ~35% at a production rate of 1.8 L/h. The polarizer is entirely self-contained, requiring only mains electricity at the site of interest.

952	18:03	Multiscale measurement of the effects of glucose starvation on 4T1 murine breast cancer cells using an MRI and optical microscopy compatible bioreactor
		Benjamin L Cox[1,2,3], Sarah Erickson-Bhatt[2,3,4], Joseph M Szulczewski[3,4], Kai D Ludwig[1], Erin B Adamson[1], Robert A Swader[2], Suzanne M Ponik[4], Kevin W Eliceiri[1,2,3,5], and Sean B Fain[1,6]
		[1]Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [2]Morgridge Institute for Research, Madison, WI, United States, [3]Laboratory for Optical and Computational Instrumentation (LOCI), University of Wisconsin - Madison, Madison, WI, United States, [4]Cell and Regenerative Biology, University of Wisconsin - Madison, Madison, WI, United States, [5]Biomedical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [6]Radiology, University of Wisconsin - Madison, Madison, WI, United States
		The design and application of a novel bioreactor capable of facilitating both magnetic resonance spectroscopy (MRS) and optical fluorescence microscopy for complementary metabolic information is described. Fluorescence lifetime imaging (FLIM) of nicotinamide adenine dinucleotide (NADH) and hyperpolarized [1-^{13}C] pyruvic acid (PA) MRS were performed on 3D cell cultures of 4T1 murine breast cancer cells to study the effects of glucose starvation across cellular and population scales. The system provides a novel test-bed for simulating cell-matrix and cell-cell interactions in a 3D microenvironment for investigating multi-scale cellular metabolism *in vitro*.

Oral

Brain Tumours: Pre-Treatment

W03/04	Wednesday 16:15 - 18:15	*Moderators:* Meiyun Wang & Sammy Badr

953	16:15	Selective Size Imaging using Filters via diffusion Times (SSIFT): A new contrast-free highly-specific MR cancer imaging method
		Junzhong Xu[1], Albert Attia[2], Lori R Arlinghaus[1], Austin N Kirschner[2], Evan C Osmundson[2], Hakmook Kang[3], and Guozhen Luo[2]
		[1]radiology and radiological sciences, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Radiation Oncology, Vanderbilt University Medical Center, Nashville, TN, United States, [3]Biostatistics, Vanderbilt University Medical Center, Nashville, TN, United States
		We propose a novel, exogenous-agent-free, highly-specific, and high-resolution cancer imaging technique termed SSIFT. Based on different diffusion time dependence on length scales, SSIFT creates filters via appropriately chosen diffusion times to selectively enhance detection sensitivity to cancer cells with simultaneous suppression of sensitivity to normal brain cells, vasogenic edema, and cystic fluid. In the first applications in metastatic brain cancer patients, SSIFT is capable of significantly enhancing tumor conspicuity and delineation, and more importantly capable of differentiating tumor recurrence from radionecrosis, which is not reliably achievable by current MRI methods.

954	16:27	Tumor microenvironment (TME) mapping: MRI of intratumoral heterogeneity of oxygen metabolism and neovascularization uncovers two survival relevant subgroups of IDH1 wild-type glioblastoma
		Andreas Stadlbauer[1,2], Max Zimmermann[1], Arnd Dörfler[3], Roland Coras[4], Stefan Oberndorfer[5], Michael Buchfelder[1], and Karl Rössler[1]
		[1]Department of Neurosurgery, University of Erlangen-Nürnberg, Erlangen, Germany, [2]Institute of Medical Radiology, University Clinic of St. Pölten, St. Pölten, Austria, [3]Department of Neuroradiology, University of Erlangen-Nürnberg, Erlangen, Germany, [4]Department of Neuropathology, University of Erlangen-Nürnberg, Erlangen, Germany, [5]Department of Neurology, University Clinic of St. Pölten, St. Pölten, Austria
		The dismal prognosis of glioblastoma is largely attributed to hypoxic and perivascular niches in the tumor microenvironment (TME) which are essential for elucidation of pathophysiological mechanisms behind therapy resistance and recurrence. Here, we combined MRI biomarkers for oxygen metabolism and neovascularization with an automatic classification strategy for localization of hypoxic and vascular niches within the heterogeneously structured TME. Correlation with the metabolic pathway for energy production uncovered two different phenotypes for glioblastoma IDH1wt: A glycolytic phenotype with stable functional neovasculature, and a necrotic/hypoxic phenotype with defective neovasculature and a more aggressive tumor behavior. The glycolytic phenotype showed longer progression-free survival.

955	16:39	Magnetic Resonance Spectroscopic Differences of Diffuse Glioma Groups Classified by IDH and TERT Promoter Mutations at 3T
		Esin Ozturk-Isik[1], Sevim Cengiz[1], Alpay Ozcan[2,3], Cengiz Yakicier[4], M. Necmettin Pamir[3,5], Koray Ozduman[3,5], and Alp Dincer[3,6]
		[1]Institute of Biomedical Engineering, Bogazici University, Istanbul, Turkey, [2]Department of Medical Engineering, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey, [3]Neuroradiology Research Center, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey, [4]Department of Molecular Biology and Genetics, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey, [5]Department of Neurosurgery, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey, [6]Department of Radiology, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey
		Overall survival of gliomas has been reported to be highly associated with the presence of isocitrate dehydrogenase (IDH) and telomerase reverse transcriptase (TERT) promoter mutations. The aim of this study is to define MR spectroscopic (MRS) differences of diffuse glioma subgroups classified by IDH and TERT promoter mutations at 3T. TERT-only mutated and TERT wild type IDH wild type (TW-IDHW) gliomas had similar metabolic profiles. Besides well-reported 2HG, our study indicated the importance of glycine, glutathione, glutamate, and glutamine in identification of IDH-mutant gliomas. TERT-only gliomas had the highest glutamate and glutathione, which might be indicators of poor overall survival.

956	16:51	Magnetic Resonance Spectroscopy markers of survival in paediatric brain tumours: A 3T Multi-Centre investigation

		Ben Babourina-Brooks[1,2], Lesley MacPherson[2], Laurence J Abernethy[3], Theodoros N Arvanitis[2,4], Simon Bailey[5], Nigel P Davies[1,2,6], Daniel Rodriguez Gutierrez [7,8,9], Tim Jaspan [7,10], Dipayan Mitra[11], Paul S Morgan[7,9,10], Barry Pizer [12], Richard G. Grundy [7], Dorothee P Auer[7,8,10], and Andrew C Peet[1,2]
		[1]University of Birmingham, Birmingham, United Kingdom, [2]Birmingham children's hospital, Birmingham, United Kingdom, [3]Department of Radiology, Alder Hey Children's NHS Foundation Trust, Liverpool, United Kingdom, [4]Institute of Digital Healthcare, WMG, University of Warwick, Coventry, United Kingdom, [5]Paediatric Oncology Department, Great North Children's Hospital, Newcastle upon Tyne, United Kingdom, [6]Department of Imaging and Medical Physics, University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom, [7]The Children's Brain Tumour Research Centre, University of Nottingham, Nottingham, United Kingdom, [8]Radiological Sciences, Department of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom, [9]Medical Physics, Nottingham University Hospital, Queen's Medical Centre, Nottingham, United Kingdom, [10]Neuroradiology, Nottingham University Hospital, Queen's Medical Centre, Nottingham, United Kingdom, [11]Neuroradiology Department, Newcastle upon Tyne Hospitals, Newcastle upon Tyne, United Kingdom, [12]Department of Paediatric Oncology, Alder Hey Children's NHS Foundation Trust, Liverpool, United Kingdom
		Brain tumours have a high mortality rate and are the most common solid tumour of childhood. The non-invasive imaging technique, MRS, measures tumour metabolites which can provide additional prognostic information to aid in clinical management. MRS metabolites Glycine, Scyllo-Inositol, NAA and Lipids have been associated with prognosis for pediatric brain tumour patients in a single centre 1.5T study. This study aimed to validate these MRS survival markers in a 3T multicentre setting. In this preliminary study Lipids were validated as a survival marker across childhood brain tumours.

957	17:03	RADIOMIC ANALYSIS OF 3D MR FINGERPRINTING IN ADULT BRAIN TUMORS
		Louisa Onyewadume[1], Ozden Kilinc[1], Satyam Ghodasara[1], Debra McGivney[1], Samuel Frankel[1], Dan Ma[2], Sara Dastmalchian[2], Jeffrey Sunshine[1,2], Marta Couce[1,2], Mark Griswold[1,2], Vikas Gulani[1,2], Jill Barnholtz-Sloan[1], Andrew E. Sloan[1,2], and Chaitra Badve[1,2]
		[1]Case Western Reserve University, Cleveland, OH, United States, [2]University Hospitals Cleveland Medical Center, Cleveland, OH, United States
		Though conventional and advanced MR imaging studies such as perfusion and MR spectroscopy are useful for evaluating brain tumors, there remains a need for a rapid, quantitative, and non-invasive method. Magnetic Resonance Fingerprinting (MRF) utilizes pseudo-randomized acquisition parameters to simultaneously quantify multiple tissue properties including T1 and T2 relaxation times. A previous 2D MRF study quantitatively differentiated between solid tumor and peri-tumoral white matter regions of various brain tumors. In this ongoing study we demonstrate the capability of volumetric 3D MRF to improve lesion characterization between adult intra-axial brain neoplasms using first- and second- order radiomic analysis.

958	17:15	Whole-Tumor Histogram and Texture Analyses of Diffusion Tensor Imaging for Evaluation of IDH1 Mutation and 1p/19q Codeletion Status in WHO grade II gliomas

		Yae Won Park[1], Kyunghwa Han[2], Sung Soo Ahn[2], Sohi Bae[2], Yoon Seong Choi[2], Jong Hee Chang[2], Se Hoon Kim[2], Seok-Gu Kang[2], Eui Hyun Kim[2], and Seung-Koo Lee[2]
		[1]Radiology, Ewha Womans University College of Medicine, Seoul, Republic of Korea, [2]Yonsei University College of Medicine, Seoul, Republic of Korea
		We analyzed the histogram and texture features of apparent diffusion coefficient (ADC) and fractional anisotropy (FA) based on entire tumor to determine isocitrate dehydrogenase 1 (IDH1) mutation and 1p/19q codeletion status in WHO grade II gliomas. Regions of interest were drawn on ADC and FA maps of 93 grade II gliomas. Histogram and texture analyses were performed. The areas under the curve (AUC) for IDH1-wildtype prediction was 0.853, and AUC for 1p/19q codeletion prediction was 0.807. The whole-tumor histogram and texture features of ADC and FA maps are useful in predicting the molecular status in WHO grade II gliomas.

959	17:27	Integrated vascular (iVas) MRI in brain tumors
		Yang Li[1,2], Peiying Liu[1], Shruti Agarwal[1,3], Xirui Hou[1], Sherry Shen[1], Jay J. Pillai[1,3], and Hanzhang Lu[1]
		[1]Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]Graduate School of Biomedical Sciences, UT Southwestern Medical Center, Dallas, TX, United States, [3]Department of Neurosurgery, Johns Hopkins University School of Medicine, Baltimore, MD, United States
		Perfusion and functional MRI, yielding markers such as cerebral blood volume, cerebrovascular reactivity, and functional connectivity, play an important role in the diagnosis and treatment of brain tumors. However, a major limitation is that collection of all this information requires separate scans and, in some cases, separate visits. Here we applied a novel iVas-MRI technique that provides quantitative assessment of multiple hemodynamic parameters and functional connectivity in a single scan of 9 minutes. It was found that the multi-parametric maps can reliably differentiate tumor from normal tissue and can further predict tumor grade.

960	17:39	Radiomics utilizing Fractional Anisotropy in Peritumoral Nonenhancing Region Predicts Local Progression and Overall Survival in Patients with Glioblastoma
		Eun-Jung Choi[1], Min Jae Yoon[2], Ho Sung Kim[2], Jongho Lee[1], and Ji Eun Park[2]
		[1]Laboratory for Imaging Science and Technology, Department of Electrical and Computer Engineering, Seoul National University, Seoul, Republic of Korea, [2]Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Republic of Korea

		We explored the radiomic features of peritumoral nonenhancing lesion in newly diagnosed glioblastoma patients to predict local progression and overall survival using fractional anisotropy (FA) at 3 Tesla. Among 1618 extracted radiomic features, 8 FA features were significantly associated with 6-month progression and overall survival (OS). The cross-validated area under the ROC curve (AUC) for 6-month progression was 0.71 and C-index for OS was 0.75. FA radiomics in nonenhancing lesion has the potential for predicting local progression and overall survival in glioblastoma.

961	17:51	Simultaneous pH- and oxygen-weighted metabolic MRI of human gliomas at 3T using multi-echo amine proton chemical exchange saturation transfer spin-and-gradient-echo echoplanar imaging (CEST-SAGE-EPI)
		Benjamin M Ellingson[1], Jingwen Yao[1], Ararat Chakhoyan[1], Phioanh L Nghiemphu[2], Albert Lai[2], Whitney B Pope[1], Linda Liau[3], and Timothy F Cloughesy[2]
		[1]Radiological Sciences, University of California Los Angeles, Los Angeles, CA, United States, [2]Neurology, University of California Los Angeles, Los Angeles, CA, United States, [3]Neurosurgery, University of California Los Angeles, Los Angeles, CA, United States
		Glycolysis is enhanced in cancers, even in the presence of abundant oxygen, leading to accumulation of lactic acid. We present a technique for fast pH- and oxygen-weighted MR imaging using multi-echo amine proton chemical exchange saturation transfer echo spin-and-gradient echoplanar imaging (CEST-SAGE-EPI) on a clinical 3T MRI system. In phantom and human experiments, we investigate the ability to simultaneously measure MTRasym at 3ppm, a measure dependent on pH, and R2', which is sensitive to oxygen extraction. Results suggest T2 hyperintense tumor is acidic, but not hypoxic; whereas contrast enhancing tumor is acidic and hypoxic, consistent with known cancer biology.

962	18:03	Grading Brain Tumor Using ADC as a Marker of Cellularity: Fact or Fiction
		Zezhong Ye[1], Joshua Lin[1], Richard Price[2], Jeff Viox[1], Michael Wallendorf[3], Sonika Dahiya[4], Albert H. Kim[2], and Sheng-Kwei Song[1]
		[1]Radiology, Washington University School of Medicine, St. Louis, MO, United States, [2]Neurological Surgery, Washington University School of Medicine, St. Louis, MO, United States, [3]Biostatistics, Washington University School of Medicine, St. Louis, MO, United States, [4]Pathology and Immunology, Washington University School of Medicine, St. Louis, MO, United States
		Here we demonstrate that ADC is not a reliable imaging biomarker of tumor cellularity in high grade glioma since ADC does not consistently correlate with histology determined tumor cellularity. In contrast, diffusion MRI Histology (D-Histo) derived restricted isotropic diffusion fraction demonstrated a significantly positive correlation with histology determined cellularity in high grade glioma.

Oral

Imaging More Than the Boltzmann Distribution: Hyperpolarised Gas Imaging

W05/06	Wednesday 16:15 - 18:15	*Moderators:* Talissa Altes & Sean Fain

963	16:15	Spectroscopic Imaging of Dissolved-phase 129Xe in the Lungs Using a 3-Resonance Model
		Jeff Kammerman[1], Andrew D Hahn[1], Elianna Bier[2], Bastiaan Driehuys[3], and Sean B Fain[1]
		[1]Department of Medical Physics, University of Wisconsin, Madison, Madison, WI, United States, [2]Department of Radiology, Duke University Medical Center, Durham, NC, United States, [3]Department of Biomedical Engineering, Duke University, Durham, NC, United States
		Spectroscopic imaging of the hyperpolarized xenon-129 dissolved in the pulmonary tissues and blood can probe regional gas exchange within the lung. Recent work in whole lung spectroscopy has identified a new, third resonance in the dissolved-phase spectrum. In this work, we develop an iterative, model based reconstruction to separately image the three dissolved-phase components. Regional maps of the three dissolved-phase components are compared in healthy subjects and patients with idiopathic pulmonary fibrosis.

964	16:27	Hyperpolarized 129Xe Multiple Breath Washout MRI in Pediatric Cystic Fibrosis
		Marcus J. Couch[1,2], Felipe Morgado[1,2], Nikhil Kanhere[1], Krzysztof Kowalik[1], Jonathan Rayment[3], Felix Ratjen[1,3], and Giles Santyr[1,2]
		[1]Translational Medicine, The Hospital for Sick Children, Toronto, ON, Canada, [2]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada, [3]Division of Respiratory Medicine, The Hospital for Sick Children, Toronto, ON, Canada
		The lung clearance index, measured using N_2 multiple breath washout (MBW), provides an indicator of ventilation heterogeneity but lacks regional information. The combination of MBW and hyperpolarized ^{129}Xe MRI can potentially provide measurements of ventilation heterogeneity that include both spatial and temporal information. MBW imaging was performed following an initial ^{129}Xe inhalation and during multiple breath-holds of room air to measure the ^{129}Xe washout. Fractional ventilation and coefficient of variation maps measured in pediatric cystic fibrosis participants show elevated ventilation heterogeneity compared to age-matched healthy controls.

965	16:39	Emphysema Index based on Hyperpolarized He-3 and Xe-129 ADC
		Sina Tafti[1], William J Garrison[2], John P Mugler[2,3], Y Michael Shim[4], Talissa A Altes[3,5], Jaime F Mata[3], Nicholas J Tustison[3], Kun Qing[3], Eduard E de Lange[3], Gordon D Cates[1,3], and G Wilson Miller[2,3]

		[1]Physics, University of Virginia, Charlottesville, VA, United States, [2]Biomedical Engineering, University of Virginia, Charlottesville, VA, United States, [3]Radiology and Medical Imaging, University of Virginia, Charlottesville, VA, United States, [4]Medicine, University of Virginia, Charlottesville, VA, United States, [5]Radiology, University of Missouri, Columbia, MO, United States
		Emphysema index (EI) based on CT provides a quantitative measure of emphysema burden in patients with chronic obstructive pulmonary disease (COPD). Diffusion-weighted MRI of inhaled hyperpolarized gases also provides a method for detecting emphysema, as elevated ADC values indicate airspace enlargement due to emphysematous destruction of alveolar walls. We propose an alternative formulation of EI based on He-3 or Xe-129 ADC measurements and compare their performance in characterizing emphysema severity with that of CT-EI. Our results suggest that ADC-EI may provide a useful quantitative measure of emphysema burden in patients with COPD that is more sensitive to early stages of emphysema than CT-EI.

966	16:51	Hyperpolarized 129Xe MR spectroscopy detects short-term changes in lung gas exchange efficiency in idiopathic pulmonary fibrosis
		Nicholas David Weatherley[1], Neil Stewart[1], Graham Norquay[1], Ho-Fung Chan[1], Oliver Rodgers[1], Madhwesha Rao[1], Guilhem Collier [1], Helen Marshall[1], Matthew Austin[1,2], Laurie Smith[1,3], Stephen Renshaw[1], Stephen Bianchi[2], and Jim Wild[1]
		[1]University of Sheffield, Sheffield, United Kingdom, [2]Sheffield Teaching Hospitals, Sheffield, United Kingdom, [3]Sheffield Children's Hospital NHS Foundation Trust, Sheffield, United Kingdom
		Idiopathic pulmonary fibrosis (IPF), once thought of as an orphan lung disease, is now a frontrunner in respiratory research. However, progress is hampered by a lack of sensitive biomarkers. Hyperpolarized xenon MR spectroscopy has demonstrated sensitivity to gas exchange in IPF and is emerging as a feasible imaging biomarker of disease. Here, we demonstrate that this methodology has high reproducibility in the disease state, correlates with clinical outcomes and demonstrates a decline in gas transfer efficiency in the lung over six months in spite of static pulmonary function test metrics.

967	17:03	Hyperpolarized ^{129}Xe Gas Exchange MRI: The Transition from 1.5 to 3 Tesla
		Ziyi Wang[1], Mu He[2], Elianna Bier[3], Brian Soher[4], Joseph Mammarappallil[4], Sudarshan Rajagopal[5], Yuh-Chin Huang[6], and Bastiaan Driehuys[1,3,4]
		[1]Biomedical Engineering, Duke University, Durham, NC, United States, [2]Electrical and Computer Engineering, Duke University, Durham, NC, United States, [3]Medical Physics Graduate Program, Duke University, Durham, NC, United States, [4]Radiology, Duke University Medical Center, Durham, NC, United States, [5]Division of Cardiology, Duke University Medical Center, Durham, NC, United States, [6]Division of Pulmonary, Allergy and Critical Care, Duke University Medical Center, Durham, NC, United States

		Hyperpolarized ^{129}Xe is uniquely suited to imaging pulmonary functions by virtue of its solubility and abundant chemical shifts. Previous efforts established single-breath 3D imaging of ^{129}Xe ventilation, barrier uptake and RBC transfer at 1.5 Tesla. As MR vendors are increasingly transitioning their multinuclear platforms to 3 Tesla, it becomes important to enable ^{129}Xe gas exchange MRI at higher field strengths. Here we demonstrate that by careful measurement of spectral properties and optimization of RF and readout, short T2* can be overcome, and ^{129}Xe gas exchange MRI with quantitative workflow is feasible and robust at 3 Tesla.

968	17:15	Measurements of human brown adipose tissue temperature during cold exposure by hyperpolarized xenon MR thermometry
		Rosa Tamara Branca[1,2], Le Zhang[2,3], Alex Burant[1,2], Michael Antonacci[1,2], Andrew McCallister[1,2], and Laurence Katz[4]
		[1]Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Biomedical Research Imaging Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [3]Applied Physical Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [4]Dept of Emergency Medicine, Exercise and Sports Science, University of North Carolina school of medicine, Chapel Hill, NC, United States
		While temperature measurement represents the most direct way to measure BAT thermogenic function, temperature measurements by proton-based MR methods are confounded by magnetic susceptibility effects, which cannot be corrected for at the microscopic level. Here we report our first measurements of absolute BAT temperature in adult humans during cold exposure by hyperpolarized xenon gas MRI. These measurements represent the most direct way to measure thermogenic function in BAT.

969	17:27	Correlating ^{129}Xe Gas Exchange MRI with ^{99m}Tc Perfusion Scintigraphy
		Ziyi Wang[1], Leith Rankine[2], Joseph Mammarappallil[3], Sudarshan Rajagopal[4], and Bastiaan Driehuys[1,2,3]
		[1]Biomedical Engineering, Duke University, Durham, NC, United States, [2]Medical Physics Graduate Program, Duke University, Durham, NC, United States, [3]Radiology, Duke University Medical Center, Durham, NC, United States, [4]Division of Cardiology, Duke University Medical Center, Durham, NC, United States
		Hyperpolarized ^{129}Xe MRI is emerging as a unique means of imaging pulmonary gas exchange, enabling separate 3D encoding of ^{129}Xe in the gas-phase, interstitial barrier, and red blood cells (RBC). In patients where diffusion limitation is not significant, defects in RBC transfer and perfusion deficits should more closely reflect diminished capillary blood volume or perfusion limitation. Here we establish an initial approach to correlate RBC transfer images against an accepted perfusion imaging reference— ^{99m}Tc scintigraphy. We demonstrate in patients with pulmonary arterial hypertension and COPD that RBC transfer projections compare both qualitatively and quantitatively with ^{99m}Tc scintigraphy.

970	17:39	An integrated preclinical platform for high-resolution 3D hyperpolarized 129Xe MRI at high field
		Rohan S. Virgincar[1,2], Bastiaan Driehuys[1,2,3], Jerry Dahlke[2], Scott H. Robertson[2], Nathann C. Morand[2], Yi Qi[2,3], Simone Degan[2], and John Nouls[2,3]
		[1]Biomedical Engineering, Duke University, Durham, NC, United States, [2]Center for In Vivo Microscopy, Duke University Medical Center, Durham, NC, United States, [3]Radiology, Duke University Medical Center, Durham, NC, United States
		Hyperpolarized (HP) ^{129}Xe MR imaging of lung function is beginning to find clinical application. This must be supported by preclinical imaging in well-characterized animal models. However, this capability is limited to a few sites, often involves only 2D projections, and is often done at non-standard, low field strengths. This work demonstrates the feasibility of preclinical ^{129}Xe MRI at 7T, using an integrated gas delivery and physiological monitoring system and customized 3D radial acquisitions. We characterize the spectral structure of ^{129}Xe in rats and demonstrate that despite the short T2* at high field strength, 3D gas exchange imaging should be feasible.
971	17:51	In Vivo Hyperpolarized 129Xe Diffusion Morphometry of the Mouse Lung
		Matthew S. Freeman[1], Teckla G. Akinyi[1,2], Jinbang Guo[1], Cory B. Davis[1,3], James D. Quirk[4], Brian M. Varisco[5], Jason C. Woods[1,4], and Zackary I. Cleveland[1,2]
		[1]Center for Pulmonary Imaging Research, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [2]Department of Biomedical Engineering, University of Cincinnati, Cincinnati, OH, United States, [3]Department of Physics, West Texas A&M University, Canyon, TX, United States, [4]Department of Radiology, Washington University School of Medicine, St. Louis, MO, United States, [5]Division of Critical Care Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States
		Hyperpolarized ^{129}Xe diffusion morphometry allows the microstructural dimensions of the lungs to be measured noninvasively, providing a means to quantify normal alveolar growth and disease progression in disorders such as emphysema. In the preclinical setting, ^{129}Xe diffusion morphometry holds the potential to provide insights into fundamental pulmonary biology and to assess the efficacy of potential therapies. However, to have the greatest impact on pulmonary biomedicine, this approach must be applied reliably to mouse models, where tools to investigate disease mechanisms are most highly developed. Here, we demonstrate the feasibility of high-resolution, ^{129}Xe diffusion morphometry in living mice.
972	18:03	Dependence of the Chemical Shift of 129Xe Dissolved in Red Blood Cells on Transit Time from the Lung Gas Exchange Region in Rats
		Yonni Friedlander[1,2], Brandon Zanette[1,2], Elaine Stirrat[1], Marcus Couch[1,2], Andrea Kassner[1,3], and Giles Santyr[1,2]
		[1]Translational Medicine, Hospital for Sick Children, Toronto, ON, Canada, [2]Medical Biophysics, University of Toronto, Toronto, ON, Canada, [3]Medical Imaging, University of Toronto, Toronto, ON, Canada

		The chemical shift of ^{129}Xe dissolved in red blood cells was measured at increasing transit times from the gas exchange region of the lungs of healthy rats and rats exposed to hyperoxia/hypoxia, a model of bronchopulmonary dysplasia. The results show that the chemical shift decreased with increasing transit times. Furthermore, the chemical shift was different between the healthy and exposed cohorts. A possible mechanism for this phenomenon based on changes in bulk magnetic susceptibility distal to the lungs is proposed.

Study Groups

Perfusion Business Meeting

W07	Wednesday 17:15 - 18:15	*(no CME credit)*

Event

ISMRM Business Meeting

W05/06	Wednesday 18:30 - 19:30	*(no CME credit)*

Event

Forum on Bias, sponsored by WISMRM

N03	Wednesday 19:30 - 21:30	*(no CME credit)*

Thursday, 21 June 2018

Go to top
Sunrise Session

Diffusion at Ultra-High Field

Organizers: Stephan Maier, Jennifer McNab, Noam Shemesh

N03	Thursday 7:00 - 7:50	*Moderators:* Rebecca Feldman & Grant Yang

7:00	Human Diffusion Imaging at UHF
	Daniel Gallichan

7:25	Animal Diffusion Imaging UHF Hao Huang

7:50	Adjournment & Meet the Teachers

Sunrise Session

Go Faster in Clinical Imaging: Synthetic MR

Organizers: Jongho Lee, Utaroh Motosugi, Yi-Fen Yen

N04	Thursday 7:00 - 7:50	*Moderators:* Utaroh Motosugi & Yi-Fen Yen

7:00	An introduction to Synthetic MRI Marcel Warntjes

7:25	Clinical Applications of Synthetic MR Masaaki Hori

7:50	Adjournment & Meet the Teachers

Sunrise Session

Assessing Response in Liver Tumours: Primary & Metastatic

Organizers: Kathryn Fowler, Kartik Jhaveri, Catherine Hines, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Thursday 7:00 - 7:50	*Moderators:* Byung Choi & Vikas Gulani

7:00	Primary Liver Cancer Response Richard Do

7:25	Metastatic Disease Response

	Dow-Mu Koh

7:50	Adjournment & Meet the Teachers

Sunrise Session

Advanced Techniques in Cardiovascular MR: Advanced Applications of Flow

Organizers: Sebastian Kozerke, Reza Nezafat

S02	Thursday 7:00 - 7:50	*Moderators:* Emilie Bollache & Jennifer Steeden

7:00	Intracardiac flow - where we are and where we want to be
	Malenka Bissell

7:25	Probing Flow Energetics
	Belén Casas

7:50	Adjournment & Meet the Teachers

Sunrise Session

Application of Molecular Imaging in Body

Organizers: Guanshu Liu, Natalie Serkova, Damian Tyler

S03	Thursday 7:00 - 7:50	*Moderators:* Guanshu Liu & Damian Tyler

7:00	Recent Technical Developments of Molecular Imaging for Body Imaging
	Kevin Bennett

7:25	Clinical Translation & Applications of Molecular MRI in Body Imaging
	Tone Bathen

7:50	Adjournment & Meet the Teachers

Sunrise Session

Emerging Methods in MSK MRI: Tendons, Ligaments, Menisci

Organizers: Eric Chang, Garry Gold, Emily McWalter, Edwin Oei, Philip Robinson

S04	Thursday 7:00 - 7:50	*Moderators:* Martijn Froeling & Kimberly Amrami

7:00	UTE MRI of Tendons, Ligaments & Meniscus
	Akshay Chaudhari

7:25	Clinical Imaging of Tendons, Ligaments, Meniscus with Emerging MR Methods
	Richard Hodgson

7:50	Adjournment & Meet the Teachers

Sunrise Session

Your Brain on Drugs: Nicotine & Ecstasy

Organizers: Andre Obenaus, Pia Maly Sundgren

S05	Thursday 7:00 - 7:50	*Moderators:* Patricia Grant & Robert Witte

7:00	Nicotine & the Brain
	Minming Zhang

7:25	Your Brain on Drugs : Neuroimaging of Illicit Substance Abuse
	Cheng-Yu Chen

7:50	Adjournment & Meet the Teachers

Sunrise Session

Maker: Software

Organizers: Gregor Adriany, Matthias Günther, Michael Hansen, Christoph Juchem, Greig Scott

S06	Thursday 7:00 - 7:50	*Moderators:* Christoph Juchem & Greig Scott

7:00	Making Quality Software
	William Overall

7:25	Open Source Acquisition & Reconstruction Software
	Stefan Kroboth

7:50	Adjournment & Meet the Teachers

Traditional Poster: MR Value

Exhibition Hall 2627-2647	Thursday 8:00 - 10:00	*(no CME credit)*

Traditional Poster: Acquisition, Reconstruction & Analysis

Exhibition Hall 2648-2660	Thursday 8:00 - 10:00	*(no CME credit)*

Electronic Poster: Diffusion

Exhibition Hall	Thursday 8:00 - 9:00	*(no CME credit)*

Electronic Poster: Neuro

Exhibition Hall	Thursday 8:00 - 9:00	*(no CME credit)*

Study Groups

MR Engineering Business Meeting

W07	Thursday 8:00 - 9:00	*(no CME credit)*

Member-Initiated Symposium

Recent Development of Preclinical PET/MR: From Hardware to Applications

Organizers: Simon Cherry, Willy Gsell, Bernd Pichler

S04	Thursday 8:00 - 10:00	*Moderators:* Willy Gsell	*(no CME credit)*

	8:00	Simultaneous PET-MRI for Ultra-High Small-Bore MRIs
		Volkmar Schulz

	8:24	Design & Performance of Continuous Crystal PET Inserts for Preclinical High-Field PET/MR Imaging
		Sven Junge

	8:48	Imaging Tumor Heterogeneity
		Jonathan Dissehorst

	9:12	Application of PET/MRI for Brain Function
		Christin Y Sander[1]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States

	9:36	MRI-Based Motion Correction for Retrospective Gating of PET Cardiac Imaging
		Uwe Himmelreich[1]
		[1]University of Leuven

Member-Initiated Symposium

MRI in Radiation Therapy

Organizers: Mark Ladd, Rob Tijssen, Cornelis van den Berg

W03/04	Thursday 8:00 - 10:00	*(no CME credit)*

	8:00	Welcome
		Rob Tijssen[1]
		[1]UMC Utrecht

	8:05	MR-Based Treatment Planning
		Neelam Tyagi[1]
		[1]Memorial Sloan-Kettering Cancer Center

	8:20	4D- & 5D-Motion-Compensated Reconstruction
		Marc Kachelreiss[1]
		[1]Deutsches Krebsforschungszentrum

	8:35	fMRI for Therapy Assessment
		Uulke van der Heide

	8:50	MR-RT System: Real-Time Motion Management
		Markus Glitzner[1]
		[1]UMC Utrecht

	9:05	MR-RT System: Clinical Implementation

		Anna Bruynzeel

	9:20	Future Outlook: MR Methods with High Value for RT
		Hersh Chandarana[1]
		[1]NYU Langone Medical Center, United States

	9:35	Panel Discussion

Weekday Course

What You Need to Know About Neuroinflammation & the Glymphatic System

Organizers: Pia Maly Sundgren, Kei Yamada

N01	Thursday 8:00 - 10:00	*Moderators:* Pek-Lan Khong & Danielle van Westen

	8:00	The Glymphatic & Cerebral Small Vessel Disease
		Mark van Buchem[1]
		[1]Leiden University Medical Center, Netherlands

	8:30	Vasculitis & Neuroinflammation in HIV
		Hans Rolf Jäger[1]
		[1]UCL, Institute of Neurology, United Kingdom

	9:00	Human Glymphatics Assessed with Intrathecal Gd
		Geir Andre Ringstad[1]
		[1]Radiology, Oslo University Hospital, Norway

		Glymphatic MRI (gMRI), utilizing intrathecal Gd as CSF tracer, may demonstrate the capacity for brain clearance of toxic interstitial waste products, such as amyloid-β and tau, which are aggregated in Alzheimer`s disease. There seem to exist important differences between human subjects and previous observations in animal studies. Both glymphatic and brain lymphatic clearance is much slower in man. In iNPH dementia, glymphatic clearance was demonstrated to be reduced.

	9:30	Diffusion Images for Assessing Glymphatic System
		Toshiaki Taoka[1]
		[1]Nagoya University, Japan
		Recently introduced “glymphatic system” is a coined word that combines “gl” for glia and “lymphatic” system. In this hypothesis, the perivascular space functions as a conduit for flowing cerebrospinal fluid into brain parenchyma. Activity of the glymphatic system may be evaluated with diffusion images. Lower diffusivity along the perivascular space seems to reflect impairment of the glymphatic system. Diffusion method may be feasible for evaluating the activity of the glymphatic system.

	10:00	Adjournment & Meet the Teachers

Power Pitch

Pitch: Neurodegeneration

Power Pitch Theater A - Exhibition Hall	Thursday 8:00 - 9:00	*Moderators:* Yukio Miki & Yae Won Park	*(no CME credit)*

973	8:00	Data-driven modelling of diffusion MRI changes in Amyotrophic Lateral Sclerosis (ALS) indicates evolution of distal prior to proximal corticospinal tract pathology
		Matt C Gabel[1], Stella Tsermentseli[2], Laura H Goldstein[3], Ammar Al-Chalabi[3], Alexandra L Young[4], Daniel C Alexander[4], Nigel Leigh[5], and Mara Cercignani[1]
		[1]Clinical Imaging Sciences Centre, Brighton and Sussex Medical School, Brighton, United Kingdom, [2]Department of Psychology, Social Work and Counselling, University of Greenwich, London, United Kingdom, [3]Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, [4]Centre for Medical Image Computing, University College London, London, United Kingdom, [5]Trafford Centre for Biomedical Research, Brighton and Sussex Medical School, Brighton, United Kingdom

974	8:00	Progressive Cortical Thinning in Specific Motor Regions in Different Clinical Stages of Patients with Amyotrophic Lateral Sclerosis
		Haining Li[1], Qiuli Zhang[1], Xiao Ling[1], Guirong Zhang[1], Ling Yang[1], and Ming Zhang[1]
		[1]Department of Medical Imaging, The First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, China

975	8:00	Increased brain entropy in supplementary motor area and precuneus in amyotrophic lateral sclerosis
		Liqin Yang[1], Yifang Bao[1], Yuxin Li[1], and Daoying Geng[1]
		[1]Huashan Hospital, Fudan University, Shanghai, China

976	8:00	Impaired oxygen metabolism in the brain during visual stimulation in premanifest Huntington's Disease patients detected by 3D-TRIP MRI at 7T
		Peter Klinkmueller[1,2,3], Martin Kronenbuerger[4,5], Xinyuan Miao[2,3], Russell L. Margolis[5], Peter C. M. van Zijl[2,3], Christopher A. Ross[4,5,6], and Jun Hua[2,3]
		[1]Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Division of MRI Research, Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [4]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [5]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [6]Department of Neuroscience and Pharmacology, Johns Hopkins University School of Medicine, Baltimore, MD, United States

977	8:00	The Impact of Leukoencephalopathy on the White Matter Tracts of Long-Term Survivors of Childhood Acute Lymphoblastic Leukemia Treated with Chemotherapy Only
		Noah D. Sabin[1], Yin Ting Cheung[2], Wilburn E. Reddick[1], Deepa Bhojwani[3], Wei Liu[4], John O. Glass[1], Tara M. Brinkman[2], Scott N. Hwang[1], Deokumar Srivastava[4], Ching-Hon Pui[5], Leslie L. Robison[2], Melissa M. Hudson[2], and Kevin R. Krull[2]
		[1]Diagnostic Imaging, St. Jude Children's Research Hospital, Memphis, TN, United States, [2]Epidemiology & Cancer Control, St. Jude Children's Research Hospital, Memphis, TN, United States, [3]Children's Center for Cancer and Blood Diseases, Children's Hospital Los Angeles, Los Angeles, CA, United States, [4]Biostatistics, St. Jude Children's Research Hospital, Memphis, TN, United States, [5]Oncology, St. Jude Children's Research Hospital, Memphis, TN, United States

978	8:00	CO2-challenge measured with dual echo arterial spin labeling as a whole brain biomarker to assess the effect of amyloid deposition in HCHWA-D on the cerebrovascular reactivity.
		Sophie Schmid[1,2], Jasper Verbree[1], Merlijn C.E. van der Plas[1,2], Ellis S. van Etten[3], Ingeborg Rasing[3], Pauline H. Croll[4], Madeline Redelijkheid[2,4], Gerda Labadie[4], Gisela M. Terwindt[3], Marieke J.H. Wermer[3], Mark A. van Buchem[4], and Matthias J.P. van Osch[1,2]
		[1]C.J. Gorter Center, Radiology, Leiden University Medical Center, Leiden, Netherlands, [2]Leiden Institute of Brain and Cognition (LIBC), Leiden, Netherlands, [3]Neurology, Leiden University Medical Center, Leiden, Netherlands, [4]Radiology, Leiden University Medical Center, Leiden, Netherlands

979	8:00	Connectomics Correlates of Neurocognitive Deficits in Gulf War Illness Patients: A Resting State fMRI Study
		Kaundinya Gopinath[1], Unal Sakoglu[2], Bruce Crosson[3,4], and Robert Haley[5]
		[1]Department of Radiology, Emory University, Atlanta, GA, United States, [2]University of Houston Clear-Lake, Houston, TX, United States, [3]VA RR&D Center of Excellence, Atlanta VAMC, Decatur, GA, United States, [4]Department of Neurology, Emory University, Atlanta, GA, United States, [5]Department of Internal Medicine, UT Southwestern Medical Center, Dallas, TX, United States

980	8:00	Interaction of vascular and glymphatic systems in brain waste clearance after diabetes
		Quan Jiang[1,2,3], Hiani Hu[4], Guangliang Ding[1], Esmaeil Davoodi-Bojd[1], Yimin Shen[4], Li Zhang[1], Lian Li[1], Qingjiang Li[1], Michael Chopp[1,2,3], and Zhenggang Zhang[1,2,3]
		[1]Neurology, Henry Ford Health System, Detroit, MI, United States, [2]Physics, Oakland University, Rochester, MI, United States, [3]Neurology, Wayne State University, Detroit, MI, United States, [4]Radiology, Wayne State University, Detroit, MI, United States

981	8:00	Detection of Medication-Induced Changes in Thalamic GABA in Patients with Parkinson’s Disease Using J-Edited Spectroscopy
		Paula Trujillo[1], Ya-Chen Lin[2], Nelleke van Wouwe[1], Kalen Petersen[1], Adam J. Stark[1], Nivedita Kukreti[1], Hakmook Kang[2], Manus J. Donahue[1,3], and Daniel O. Claassen[1]
		[1]Neurology, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Biostatistics, Vanderbilt University, Nashville, TN, United States, [3]Radiology, Vanderbilt University Medical Center, Nashville, TN, United States

982	8:00	Environmental Paraquat and HFE genetics as factors in the development of Parkinson's disease
		Miranda A Salvo[1], Carson J Purnell[1], Qing X Yang[2], James R Connor[1], and Mark D Meadowcroft[1,2]
		[1]Neurosurgery, The Pennsylvania State University - College of Medicine, Hershey, PA, United States, [2]Radiology, The Pennsylvania State University - College of Medicine, Hershey, PA, United States
983	8:00	Magnetic resonance spectroscopic imaging based biomarkers of Parkinson's disease with mild cognitive impairment registered to MNI152 brain atlas after chemical shift correction
		Sevim Cengiz[1], Dilek Betul Arslan[1], Ani Kicik[2], Emel Erdogdu[3], Muhammed Yildirim[1], Zeynep Tufekcioglu[4], Basar Bilgic[4], Hasmet Hanagasi[4], Aziz Mufit Ulug[1], Hakan Gurvit[4], Tamer Demiralp[2,5], and Esin Ozturk-Isik[1]
		[1]Biomedical Engineering Institute, Bogazici University, Istanbul, Turkey, [2]Hulusi Behcet Life Sciences Research Center, Istanbul University, Istanbul, Turkey, [3]Psychology and Cognition Research Institute, Bremen University, Bremen, Germany, [4]Department of Neurology, Istanbul University, Istanbul, Turkey, [5]Department of Physiology, Istanbul University, Istanbul, Turkey
984	8:00	Disrupted Grey Matter Network Morphology in Parkinson's Disease
		Xueling Suo[1], Du Lei[2], Nannan Li[3], Lan Cheng[3], Fuqin Chen[1], Running Niu[1], Rong Peng[3], and Qiyong Gong[1]
		[1]Huaxi MR Research Center (HMRRC), Department of Radiology, West China Hospital of Sichuan University, Chengdu, China, [2]Department of Psychosis Studies, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, [3]Department of Neurology, West China Hospital of Sichuan University, Chengdu, China
985	8:00	Altered brain network structure during urethane-induced sleep states in a rat model of early-stage Parkinson's disease
		Ekaterina Zhurakovskaya[1], Jaakko Paasonen[1], Juuso Leikas[2], Aaro Jalkanen[2], Tiina Pirttimäki[1], Rubin Aliev[3,4], Heikki Tanila[1], Markus Forsberg[2], and Olli Gröhn[1]
		[1]A.I.Virtanen Institute, University of Eastern Finland, Kuopio, Finland, [2]School of Pharmacy, University of Eastern Finland, Kuopio, Finland, [3]Moscow Institute of Physics and Technology, Moscow, Russian Federation, [4]Institute of Theoretical and Experimental Biophysics, Pushchino, Russian Federation
986	8:00	Effect of motor planning and dopaminergic medication on cerebellar network connectivity during dual motor tasking in Parkinson's disease

		Silvina G Horovitz[1], David Benninger[2], Traian Popa[1], Valerie Voon[3], Mark Hallett[1], and Cecile Gallea[1,4]
		[1]HMCS, NINDS - NIH, Bethesda, MD, United States, [2]Neurologie, CHUV, Lausanne, Switzerland, [3]Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, [4]ICM-CRICM, UPMC/INSERM, UMR_975, CNRS 7225, Paris, France

987	8:00	Multimodal quantitative MRI biomarkers: identification of the specific damage in Progressive Supranuclear Palsy versus Parkinson's disease
		Nadya Pyatigorskaya[1,2,3], Rahul Gaurav[1], Lydia Yahia-cherif[1], Claire Ewenczyk[4], Cecile Gallea[1], Romain Valabregue[1], Fatma Gargouri[1], Eric Bardinet[1], Isabelle Arnulf[3,5], Cyril Poupon[6], Marie Vidailhet[3,4], and Stephane Lehericy[1,2,3]
		[1]Centre de NeuroImagerie de Recherche – CENIR, ICM, Paris, France, [2]Neuroradiology department, APHP, Pitié-Salpêtrière hospital, Paris, France, [3]UMR S 1127, CNRS UMR 7225, ICM, UPMC Univ Paris, Paris, France, [4]Clinique des mouvements anormaux, Département des Maladies du Système Nerveux, Hôpital Pitié-Salpêtrière, PARIS, France, [5]Service des pathologies du Sommeil, Hôpital Pitié-Salpêtrière, APHP, Paris, France, [6]NeuroSpin, CEA, Gif-Sur-Yvette, France

Power Pitch

Pitch: Body: Power Potpourri

Power Pitch Theater B - Exhibition Hall	Thursday 8:00 - 9:00	*Moderators:* Luca Saba & Ferdia Gallagher	*(no CME credit)*

988	8:00	Imaging collateral ventilation in patients with advanced Chronic Obstructive Pulmonary Disease – relative sensitivity of 3He and 129Xe MRI
		Helen Marshall[1], Guilhem J Collier[1], Chris S Johns[1], Ho-Fung Chan[1], Graham Norquay[1], Rod A Lawson[1], and Jim M Wild[1]
		[1]University of Sheffield, Sheffield, United Kingdom

989	8:00	Quantitative geometric assessment of regional airway collapse in neonates via retrospectively respiratory-gated 1H UTE MRI
		Nara S. Higano[1,2], Alister J. Bates[1,3], Erik B. Hysinger[4], Robert J. Fleck[5], Andrew D. Hahn[6], Sean B. Fain[6,7], Paul S. Kingma[8], and Jason C. Woods[1,2,4,5]

		[1]Center for Pulmonary Imaging Research, Cincinnati Children's Hospital, Cincinnati, OH, United States, [2]Physics, Washington University in St. Louis, St. Louis, MO, United States, [3]Upper Airway Center, Cincinnati Children's Hospital, Cincinnati, OH, United States, [4]Pulmonary Medicine, Cincinnati Children's Hospital, Cincinnati, OH, United States, [5]Radiology, Cincinnati Children's Hospital, Cincinnati, OH, United States, [6]Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [7]Radiology, University of Wisconsin - Madison, Madison, WI, United States, [8]Neonatology and Pulmonary Biology, Cincinnati Children's Hospital, Cincinnati, OH, United States

990	8:00	Hyperpolarized [1-13C]Pyruvate Magnetic Resonance Imaging of Placentae Associated With Intrauterine Growth Restriction
		Lanette J Friesen-Waldner[1], Conrad P Rockel[1], Kevin J Sinclair[1], Trevor P Wade[1,2], Lauren Smith[1], Mohamed Moselhy[1], Cheryl Vander Tuin[3], Albert P Chen[4], Barbra de Vrijer[5,6,7], Timothy RH Regnault[3,5,6,7], and Charles A McKenzie[1,2,6,7]
		[1]Medical Biophysics, Western University, London, ON, Canada, [2]Robarts Research Institute, London, ON, Canada, [3]Physiology and Pharmacology, Western University, London, ON, Canada, [4]GE Healthcare, Toronto, ON, Canada, [5]Obstetrics and Gynaecology, Western University, London, ON, Canada, [6]Children's Health Research Institute, London, ON, Canada, [7]Lawson Research Institute, London, ON, Canada

991	8:00	Glycogen Synthesis Mapping Using In Vivo Deuterium Metabolic Imaging (DMI)
		Henk M. De Feyter[1], Peter B. Brown[1], Kevin L. Behar[2], Douglas L. Rothman[1,3], and Robin A. de Graaf[1,3]
		[1]Department of Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States, [2]Department of Psychiatry, Yale University, New Haven, CT, United States, [3]Department of Biomedical Engineering, Yale University, New Haven, CT, United States

992	8:00	High-Resolution Multishot Diffusion-Weighted Body and Breast MRI using Locally Low-rank regularization
		Yuxin Hu[1,2], Evan G. Levine[1,2], Catherine J. Moran[1], Valentina Taviani[3], Shreyas Vasanawala[1], Bruce L. Daniel[1,4], and Brian Hargreaves[1,2,4]
		[1]Department of Radiology, Stanford University, Stanford, CA, United States, [2]Department of Electrical Engineering, Stanford University, Stanford, CA, United States, [3]GE Healthcare, Menlo Park, CA, United States, [4]Department of Bioengineering, Stanford University, Stanford, CA, United States

993	8:00	Prediction of Breast Cancer Molecular Subtypes Using Conventional Feature Extraction and Two Machine Learning Architectures Based on DCE-MRI

		Yang Zhang[1], Siwa Chan[2], Jeon-Hor Chen[1,3], Daniel Chow[1], Peter Chang[4], Melissa Khy[1], Dah-Cherng Yeh[2], Xinxin Wang[1], and Min-Ying Su[1]
		[1]Department of Radiological Sciences, University of California, Irvine, CA, United States, [2]Tzu-Chi General Hospital, Taichung, Taiwan, [3]E-Da Hospital and I-Shou University, Kaohsiung, Taiwan, [4]Department of Radiology, University of California, San Francisco, CA, United States

994	8:00	A diffusion MRI based computer-guided assistance approach for the diagnosis of breast lesions with high accuracy and without the need for contrast agents.
		Mariko Goto[1], Denis Le Bihan[1,2], Koji Sakai[1], and Kei Yamada[1]
		[1]Radiology, Kyoto prefectural university of medicine, Kyoto, Japan, [2]NeuroSpin, Gif-sur-Yvette, France

995	8:00	Changes in Pancreatic Stiffness in Obese Adults Receiving an Oral Glucose Load, as Measured by Magnetic Resonance Elastography
		Ruoyun Ji[1], Yu Shi[1], Yanqing Liu[1], Lizhuo Cang[1], Min Wang[1], and Qiyong Guo[1]
		[1]Shengjing Hospital of China Medical University, Shen Yang, China

996	8:00	L-Carnitine Shows Beneficial Effects on Cardiac Metabolism and Function: A Hyperpolarized MRS and Langendorff Perfusion Study
		Dragana Savic[1], Vicky Ball[1], Kerstin Timm[1], Lisa C. Heather[1], and Damian J. Tyler[1]
		[1]University of Oxford, Oxford, United Kingdom

997	8:00	MRI Cine-Tagging of Cardiac-Induced Motion: Diagnostic Performance for Noninvasive Staging of Liver Fibrosis
		Thierry Lefebvre[1], Léonie Petitclerc[1,2,3], Laurent Bilodeau[1,3], Giada Sebastiani[4], Hélène Castel[5], Claire Wartelle-Bladou[5], Bich Ngoc Nguyen[6,7], Guillaume Gilbert[3,8], and An Tang[1,3]

		[1]Centre de recherche du centre hospitalier de l'Université de Montréal (CRCHUM), Montreal, QC, Canada, [2]Leiden University Medical Centre (LUMC), Leiden, Netherlands, [3]Department of Radiology, Radio-Oncology and Nuclear Medicine, Université de Montréal, Montreal, QC, Canada, [4]Department of Medicine, Division of Gastroenterology, McGill University Health Centre (MUHC), Montreal, QC, Canada, [5]Department of Gastroentology and Hepatology, Université de Montréal, Montreal, QC, Canada, [6]Department of Pathology, Centre hospitalier de l'Université de Montréal (CHUM), Montréal, QC, Canada, [7]Department of Pathology and Cellular Biology, Université de Montréal, Montreal, QC, Canada, [8]MR Clinical Science, Philips Healthcare Canada, Markham, ON, Canada

998	8:00	Improved Speed and Image Quality for Imaging of Liver Lesions with Auto-calibrated Wave Encoded Variable Density Single-Shot Fast Spin Echo.
		Jamil Shaikh[1], Feiyu S. Chen[2], Valentina S. Taviani[3], Kim Nhien Vu[1], and Shreyas S. Vasanawala[1]
		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering and Radiology, Stanford University, Stanford, CA, United States, [3]Global MR Applications and Workflow, GE Healthcare, Menlo Park, CA, United States

999	8:00	A Fully Convolutional Neural Network for 3D Volumetric Liver Lesion Segmentation
		Sean Sall[1], Anitha Krishnan[1], Jesse Lieman-Sifry[1], Felix Lau[1], Matthieu Le[1], Matt DiDonato[1], Albert Hsiao[2], Claude Sirlin[2], John Axerio-Cilies[1], and Daniel Golden[1]
		[1]Arterys, San Francisco, CA, United States, [2]Radiology, UC San Diego Health, La Jolla, CA, United States

1000	8:00	High spatial and temporal free breathing T1 contrast enhanced imaging using a novel 4D variable density, elliptical centric radial stack-of-stars sharing approach
		Gabriele M. Beck[1], Suthambhara Nagaraj[2], Joao Silva Canaveira Tourais[3], Jan Hendrik Wuelbern[4], and Johannes M. Peeters[1]
		[1]Philips Healthcare, Best, Netherlands, [2]Philips Healthcare, Bangalore, India, [3]Technical University Eindhoven, Eindhoven, Netherlands, [4]Philips Research Europe, Hamburg, Germany

1001	8:00	Higher-Resolution Prostate Diffusion MRI with Minimized Echo Time using Eddy Current Nulled Convex Optimized Diffusion Encoding (ENCODE)
		Zhaohuan Zhang[1,2], Kevin Moulin[1], Eric Aliotta[1], Sepideh Shakeri[1], Sohrab A. Mirak[1], Daniel B. Ennis[1,2], and Holden H. Wu[1,2]

		[1]*Department of Radiological Sciences, University of California, Los Angeles, Los Angeles, CA, United States,* [2]*Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA, United States*

1002	8:00	Evaluating the Accuracy of Multi-component T2 and Fractions for Luminal Water Imaging of the Prostate using 3D GRASE with Inner Volume Selection
		Rachel W. Chan[1], Angus Z. Lau[1,2], Garry Detzler[1], Vivekanandan Thayalasuthan[1], Robert K. Nam[3], and Masoom A. Haider[1]
		[1]*Sunnybrook Research Institute, Toronto, ON, Canada,* [2]*Medical Biophysics, University of Toronto, Toronto, ON, Canada,* [3]*Division of Urology, Sunnybrook Health Sciences Centre, Toronto, ON, Canada*

Combined Educational & Scientific Session

Does Motion Still Matter? New Methods for Handling Motion

Organizers: Edward DiBella, Mary McDougall

S01	Thursday 8:00 - 10:00	*Moderators:* Li Feng & Shreyas Vasanawala

	8:00	Hardware Methods for Handling Motion: Basic Ideas & Current Methods
		Maxim Zaitsev[1]
		[1]*Dept. of Radiology, Medical Physics, University Medical Centre Freiburg, Freiburg, Germany*
		Motion during MR image encoding produces inconsistencies in the acquired k-space data, which results in well-known motion artifacts. In clinical settings patient motion during MRI examinations renders a significant fraction of scans non-diagnostic. Recently, due to the increased availability of ultra-high filed imagers of 7T and above capable of sub-millimeter resolution in vivo, it became apparent that even in normal subjects involuntarily motion of about a millimeter may limit significantly the achievable image quality. Motion correction based on additional motion tracking hardware has demonstrated its ability of achieving excellent image quality both in clinical and research settings.

	8:30	Software Methods for Handling Motion: Basic Ideas & Current Methods
		Debiao Li[1]
		[1]*Cedars-Sinai Medical Center, United States*

1003	9:00	Hybrid motion sensing with a wireless device, self-synchronized to the imaging pulse sequence.
		Adam M.J. van Niekerk[1], Andre J. W. van der Kouwe[1,2,3], and Ernesta M. Meintjes[1]
		[1]Human Biology, University of Cape Town, Cape Town, South Africa, [2]Massachusetts General Hospital, Athinoula A. Martinos Center, Boston, MA, United States, [3]Radiology, Harvard Medical School, Boston, MA, United States
		Here we combine an accelerometer, angular rate sensor, magnetometer, pickup coil and active marker in a (single) small wireless device. The active marker is used to detect radio frequency pulses, enabling synchronisation to the imaging pulse sequence to within 1 µs accuracy. Sinusoidal waveforms inserted into the imaging pulse sequence (lasting 920 µs) are then measured using the onboard pickup coil to allow real-time position and ADC-gradient timing offsets in all 3 axes. Preliminary results suggest that sub-mm accuracy is possible with very low noise (<0.3 mm) in the raw data captured. The new hardware layout has the potential to enable full prospective motion correction from a single small device that fits on the bridge of the subject's nose.

1004	9:15	Ultrasound-based sensors for physiological motion monitoring
		Bruno Madore[1], Cheng-Chieh Cheng[1], Pei-Hsin Wu[1], and Frank Preiswerk[1]
		[1]Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States
		A small ultrasound-based sensor was developed for use in MRI. It is about 3x3x1cm in size, can be fixed to the skin, readily fits under imaging coils, and provides up to 20,000 data points in a 0.2ms period. A switching circuit was developed allowing up to four such sensors to be used at a time. Examples are show where a sensor was attached over a carotid artery, over the heart or below the ribs, providing information about blood influx to the brain, cardiac motion or breathing, respectively. These devices and associated processing may prove especially useful at high field, where ECG detection proves ineffective.

1005	9:30	3D ultrasound based motion tracking combined with rapid multislice MR-thermometry for MR guided HIFU on mobile organs.
		Pierre Bour[1,2,3,4], Valéry Ozenne[1,2,3], Fabrice Marquet[1,2,3], Baudouin Denis de Senneville[5], Erik Dumont[4], and Bruno Quesson [1,2,3]
		[1]IHU-LIRYC, PESSAC, France, [2]Univ. Bordeaux, Centre de recherche Cardio-Thoracique de Bordeaux, Bordeaux, France, [3]INSERM U1045, Bordeaux, France, [4]Image Guided Therapy, Pessac, France, [5]Institute of Mathematics of Bordeaux, Bordeaux, France

		MRI-guided High Intensity Focused Ultrasound treatment of mobile organs remain challenging in terms of therapy effectiveness (target tracking) and precision of temperature monitoring (motion and related susceptibility artifacts). In this study, we propose to use some elements of the HIFU transducer in reception for a standalone motion correction of the focus position, allowing full flexibility on the MR-Thermometry sequence. The method is validated in vitro on a mobile gel and in vivo in the liver of pig during breathing, with a 10Hz update of the HIFU focus position under rapid and volumetric MR-thermometry.

1006	9:45	Monitoring the Complete Scattering Matrix of a Parallel Transmit Coil during Image Acquisition for Retrospective Cardiac Gating at 7T MRI
		Sven Jaeschke[1], Matthew D. Robson[1], and Aaron T Hess[1]
		[1]University of Oxford Centre for Magnetic Resonance Research, Oxford University, Oxford, United Kingdom
		We propose a new monitoring scheme that enables simultaneous measurements of the complete scattering matrix of a pTx coil during image acquisition by modifying the RF-pulse without prolonging the image sequence and without spin distortion. We show that the use of this monitoring schemes and the measured scattering matrix enable a higher SNR in the estimated cardiac scattering signal, than using RF-reflection of the normal imaging pulse as in previous work. Preliminary results in 7T MRI are shown with successfully, retrospectively gated 2D-CINE images using the proposed method.

	10:00	Adjournment & Meet the Teachers

Oral

Cutting-Edge Multimodal fMRI Techniques

N02	Thursday 8:00 - 10:00	*Moderators:* Noam Shemesh & Alex Tze Lun Leong

1007	8:00	Simultaneous fMRI and multispectral fiber-photometry reveals neurovascular coupling during somatosensory, optogenetic, and chemogenetic stimulation of S1 principle neurons
		Tzu-Hao Harry Chao[1], Weiting Zhang[1], Brittany Katz[1], Esteban Oyarzabal[1], Sung-Ho Lee[1], Guohong Cui[2], and Yen-Yu Ian Shih[1]
		[1]Biomedical Research Imaging Center and Department of Neurology, The University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Neurobiology Laboratory, National Institute of Environmental Health Sciences, NIH, Durham, NC, United States

		In this study, we establish an experimental platform to simultaneously measure: a) genetically encoded calcium indicators (GCaMP) expressing on the excitatory neurons using fiber-photometry, b) cerebral blood volume (CBV) using fiber-photometry, and c) CBV using fMRI. By this platform, we assess neurovascular coupling (GCaMP and CBV comparisons) under chemogenetic stimulation of S1 excitatory neurons in a group of freely moving rats, and demonstrate this platform for concurrent GCaMP, photometry-CBV, and fMRI-CBV measurements with chemogenetic manipulation.

1008	8:12	Fiber optic mediated extracellular glutamate and intracellular calcium recording with simultaneous fMRI
		Yuanyuan Jiang[1], Xuming Chen[1,2], and Xin Yu[1]
		[1]Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [2]University of Tübingen, Tübingen, Germany
		Genetically encoded fluorescent reporter iGluSnFR for extracellular glutamate (Glu) sensing and genetically encoded calcium indicator GCaMP6f for calcium sensing are applied with two channel fiber optic recording system in combination with BOLD fMRI. The intracellular calcium signal from both neurons and astrocytes, as well as the extracellular glutamate signal, were recorded with concurrent BOLD fMRI signal from both hemispheres of anesthetized rats, showing unique temporal dynamic pattern. This multi-modal fMRI platform allows us to specify the neurovascular signaling through the neuro-glial-vascular network and provide better understanding on the cellular and molecular interaction underlying the BOLD fMRI signal.

1009	8:24	Does ventral hippocampus influence auditory processing? An optogenetic fMRI study
		Eddie C. Wong[1,2], Russell W. Chan[1,2], Alex T. L. Leong[1,2], Celia M. Dong[1,2], Karim El Hallaoui[1,2], Anthea To[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China
		Hippocampus has traditionally been associated to memory, navigation and emotional behaviors. However, little is known about its influence on processing auditory sensory information. In this study, we combine optogenetic stimulation and auditory fMRI to investigate the influence of the ventral hippocampus on auditory processing across the auditory pathway, including inferior colliculus, medial geniculate body and primary auditory cortex. Our results reveal for the first time the influence of the ventral hippocampus on auditory processing of behaviorally relevant sound at auditory midbrain, thalamus and cortex.

1010	8:36	DREADD-fMRI combination detects effects of activation of the striatal D1 receptor-expressing neurons on the basal ganglia-thalamocortical network in mice

		Yuki Nakamura[1], Assunta Pelosi[1], Boucif Djemai[2], Denis Herve[1], Jean-Antoine Girault[1], and Tomokazu Tsurugizawa[2]
		[1]Institut du Fer à Moulin, Inserm UPMC UMR-S839, Paris, France, [2]NeuroSpin, Commissariat à l'Energie Atomique-Saclay Center, Gif-sur-Yvette, France
		The dorsal striatum is a key region in motor behavior and motor disorders such as Parkinson's and Huntington's diseases. We expressed designer receptors exclusively activated by designer drugs (DREADD) in D1 dopamine receptor-expressing neurons in the dorsal striatum in mice and investigated the behavioral and BOLD signal changes during the neuronal activation by clozapine-N-oxide (CNO) treatment. The increased BOLD signals with no susceptibility artifact in the dorsal striatum and the correlated BOLD signal changes in several regions including the substantia nigra and the globus pallidus were observed after CNO injection.

1011	8:48	A novel method for mesoscale connectome mapping: focal infrared neural stimulation in high-field functional MRI
		Augix Guohua Xu[1], Meizhen Qian[1], Zheming Li[1], Pei Li[1], Jianbao Wang[1], Yang Gao[1], Yi Sun[2], Peng Li[1], Xuemei Song[1], Xiaotong Zhang[1], and Anna Wang Roe[1]
		[1]Interdisciplinary Institute of Neuroscience and Technology, Qiushi Academy for Advanced Studies, Zhejiang University, Hangzhou, China, [2]MR Collaboration NE Asia, Siemens Healthcare, Shanghai, China
		Establishing connection patterns between cortical columns is essential for understanding human brain networks. However, currently, there is no method to systematically map at this sub-millimeter scale. Here, we combined pulsed infrared neural stimulation (INS) with high field fMRI. Applying this method in cat and monkey brains, we found that single site INS stimulation produces reproducible, intensity-dependent activation. Our experiments revealed (1) connections between cortex and subcortical locations, (2) long-range cortico-cortical connections, and (3) local cortical connections. We suggest that INS-fMRI is a new *in vivo* functional tract tracing technique that can map networks with high spatial resolution.

1012	9:00	Vagus Nerve Stimulation Evokes Widespread BOLD Responses in the Rat Brain
		Jiayue Cao[1], Kun-Han Lu[2], Terry L. Powley[1,3], and Zhongming Liu[1,2]
		[1]Biomedical Engineering, Purdue University, West Lafayette, IN, United States, [2]Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States, [3]Psychological Science, Purdue University, West Lafayette, IN, United States

		Vagus nerve stimulation (VNS) is an emerging treatment for brain disorders, such as depression and epilepsy. However, its efficacy varies, and its mechanism is unclear. Prior studies have used functional MRI (fMRI) to map brain activations with VNS in human brains but yielded inconsistent findings. The source of the inconsistency might be attributed to the complex temporal characteristics of VNS-evoked responses that cannot be fully explained by simplified response models. Using a rat model, we aimed to characterize the VNS evoked responses at the level of brain networks without assuming any priori response model. Our results suggest that the repetitive and block-wise stimulation to the vagus nerve induces activations at widespread brain regions. The responses are complex and variable across regions, much beyond what can be described with conventionally assumed HRF.

1013	9:12	Focused Ultrasound Induced Opening of the Blood-Brain Barrier Disrupts Inter-Hemispheric Resting State Functional Connectivity in the Rat Brain
		Nick Todd[1], Yongzhi Zhang[1], Michael Arcaro[2], Lino Becerra[3], David Borsook[3], Margaret Livingstone[2], and Nathan McDannold[1]
		[1]Brigham and Women's Hospital, Boston, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Boston Children's Hospital, Boston, MA, United States
		Focused ultrasound can be used as a non-invasive method to disrupt the blood-brain barrier in a targeted, localized, and safe manner. This technology allows for targeted delivery of drugs into the brain for treatment and research applications. While FUS-induced BBB opening has been shown to be safe, there is evidence that it modulates neuronal activity and/or vascular hemodynamics. This study uses resting state fMRI data from rats to investigate these effects. We find that FUS BBB opening targeted to the primary somatosensory cortex reduces local functional connectivity in the ipsilateral sensorimotor cortical areas and in the contralateral primary somatosensory cortex.

1014	9:24	Development of Multimodal Neuroimaging Technology at Ultrahigh Field for Studying Brain Function from Cell to Network
		Wei Zhu[1], Meng Cui[2], Bowen Wei[2], Yiyong Han[2], Xiao-Hong Zhu[1], Kamil Ugurbil[1], and Wei Chen[1]
		[1]Center of Magnetic Resonance Research, Department of Radiology, University of Minnesota Medical School, Minneapolis, MN, United States, [2]School of Electrical and Computer Engineering, Department of Biological Sciences, Purdue University, West Lafayette, IN, United States

		Functional MRI based on blood oxygenation level dependent (BOLD) contrast has become an indispensable method for mapping effective and functional connectivity. However, subject to intrinsic resolution limit, fMRI cannot be used to directly explore cellular and neurovascular mechanisms underlying BOLD contrast at microscopic scale. To overcome this obstacle, a novel integrated two-photon fluorescence microscopy (TPM)-MRI system at ultrahigh field of 16.4 tesla is proposed and developed. This multimodal neuroimaging tool will enable noninvasive and simultaneous measurement of neurophysiological change and fMRI signal with unprecedented resolution and sensitivity, thus, bridging microscopic neural and vascular dynamics with macroscopic brain networks.

1015	9:36	Dopamine Release and Neural Activation Differs between Control and MDD during Reward Anticipation: a Simultaneous [^{11}C]Raclopride PET-fMRI Study
		Xue Zhang[1,2], Fuyixue Wang[3,4], J. Paul Hamilton[5], Jingyuan E. Chen[1], Ian H. Gotlib[6], Mehdi Khalighi[7], and Gary H. Glover[1]
		[1]Radiological Sciences Laboratory, Department of Radiology, Stanford University, Palo Alto, CA, United States, [2]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [3]Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States, [4]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [5]Center for Social and Affective Neuroscience, Linköping University, Linköping, Sweden, [6]Department of Psychology, Stanford University, Palo Alto, CA, United States, [7]Applied Science Lab, GE Healthcare, Menlo Park, CA, United States
		The interaction between the midbrain dopaminergic system and the striatum is implicated in reward processing; it is still unknown, however, how this interaction is altered in Major Depressive Disorder (MDD). In the current study, we compared coupling of dopamine release/binding and neural activity in adults diagnosed with MDD and healthy controls (CTLs) during a monetary incentive delay (MID) task using simultaneous $$$[^{11}C]$$$Raclopride PET and fMRI. We obtained significant correlations in CTLs but not in MDD patients, indicating that the decoupling of dopaminergic system and striatum, especially nucleus accumbens, may play a vital role in the pathophysiology of MDD.

1016	9:48	Validating the detection of slow BOLD changes with multi-echo fMRI denoised data using simultaneous EEG
		Jennifer Evans[1], Silvina Horovitz[2], Peter Bandettini[3], Carlos Zarate[4], and Prantik Kundu[5]
		[1]ETPB/NIMH, NIH, Bethesda, MD, United States, [2]NINDS, NIH, Bethesda, MD, United States, [3]NIMH, NIH, Bethesda, MD, United States, [4]NIH, NIH, Bethesda, MD, United States, [5]Mount Sinai, New York, NY, United States

		In this study we use simultaneous electroencephalography (EEG) and multi-echo functional magnetic resonance imaging (ME-fMRI) to demonstrate the ability of ME-ICA denoising to resolve slow changes without need for baseline models. We use a visual flickering checkerboard with varying contrast to elicit a response measurable by fMRI and also EEG. We find that the ME-denoised data improves the fMRI timeseries correlation with the ideal task without removing the task signature that is shown to exist in the EEG data.

Oral

Approaches to Quantitative Mapping

N03	Thursday 8:00 - 10:00	*Moderators:* Valentina Taviani & Jakob Assländer

1017	8:00	Fast 3D MR fingerprinting with spiral projection acquisition for whole brain quantification imaging
		Xiaozhi Cao[1], Congyu Liao[1], Qing Li[1], Huihui Ye[1,2], Hongjian He[1], and Jianhui Zhong[1]
		[1]Center for Brain Imaging Science,Department of Biomedical Engineering, Zhejiang University, Hangzhou, China, [2]State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China
		A spiral projection acquisition scheme was used for 3D MR fingerprinting to achieve isotropic resolution of 1.2x1.2x1.2 mm^3 with FOV of 240x240x240 mm^3 for whole brain T_1 and T_2 mapping within 4.3 minutes.

1018	8:12	Magnetic Field Fingerprinting (MFF)
		Gregor Körzdörfer[1,2], Yun Jiang[3], Peter Speier[1], Josef Pfeuffer[1], Dan Ma[3], Bartosz Guzek[1,4], Bernhard Hensel[2], Vikas Gulani[3,5], Mark Griswold[3,5], and Mathias Nittka[1]
		[1]Siemens Healthcare GmbH, Erlangen, Germany, [2]Max Schaldach-Stiftungsprofessur für Biomedizinische Technik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany, [3]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [4]Georg-August-Universität Göttingen, Göttingen, Germany, [5]Radiology, Case Western Reserve University, Cleveland, OH, United States
		Parameter maps obtained from Magnetic Resonance Fingerprinting (MRF) are sensitive to magnetic field inhomogeneities. Most MRF publications are based on FISP to minimize the dependency on B0. In FISP however, the magnetization is spoiled at the end of every TR resulting in lower T2 differentiation capability and SNR compared to TrueFISP. We propose an MRF variant that applies TrueFISP, FISP and FLASH in a continuous acquisition, and additionally incorporates B1 and B0 in the dictionary, which are resolved by a pattern match. This implementation enables increased spiral resolution and spiral deblurring with the derived high-resolution B0 maps.

1019	8:24	Improving uniqueness of Magnetic Resonance Fingerprinting (MRF) signal evolutions using spatio-temporal variation of non-linear ΔB0 shim coil.
		Bhairav Bipin Mehta[1], Michael Twieg[1], Mingrui Yang[1], Dan Ma[1], Yun Jiang[1], Simone Coppo[1], Haoqin Zhu[2], Shinya Handa[2], Labros Petropoulos[2], Hiroyuki Fujita[2], and Mark Alan Griswold[1]
		[1]Radiology, Case western reserve university, Cleveland, OH, United States, [2]Quality Electrodynamics, Mayfield Village, OH, United States
		Magnetic Resonance Fingerprinting (MRF) framework uses variation in acquisition parameters to generate unique signal evolutions, which can be treated as “fingerprints”. The iPRES coil concept provides independent and dynamic variations of multiple magnetic fields, which can be used to improve the uniqueness of signal evolutions through spatio-temporal variations of multiple fields. In this study, we present a proof-of-concept implementation illustrating spatio-temporal variations of local non-linear ΔB_0 fields improve the uniqueness of signal evolutions for MRF. Our phantom results show reduction in variation of estimated tissue properties for data with 500frames, thereby illustrating the capability of acceleration using these field variations.

1020	8:36	Optimized 3D Stack-of-Spirals MR Fingerprinting with Hybrid Sliding-Window and GRAPPA Reconstruction
		Congyu Liao[1,2], Berkin Bilgic[2], Mary Kate Manhard[2], Xiaozhi Cao[1], Jianhui Zhong[1], Lawrence L Wald[2], and Kawin Setsompop[2]
		[1]Department of Biomedical Engineering, Zhejiang University, Hangzhou, China, [2]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, United States
		We demonstrate 3D stack-of-spiral MRF acquisition with hybrid sliding-window and GRAPPA (SW+GRAPPA) reconstruction using a constant density spiral (CDS) rather than standard variable density spiral (VDS). The CDS was found to mitigates high-frequency artifacts after in-plane sliding-window (SW) combination and improve the subsequent GRAPPA and dictionary matching reconstruction. The proposed 3D constant density stack-of-spiral MRF allows whole-brain (240×240×192 mm^3) parametric mapping at 1 mm isotropic resolution with high quality in 8 minutes.

1021	8:48	Diffusion-weighted in vivo imaging with ≤100 μm resolution: Principles and applications to ADC mapping of pregnant mice
		Qingjia Bao[1], Gilad Liberman[1], Eddy Solomon[1], Miki Lustig[2], and Lucio Fydman[1]
		[1]Departments of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Electrical Engineering and Computer Science, UC Berkeley, Berkeley, CA, United States

		Although a major advantage of SPatiotemporal ENcoding (SPEN) vs EPI is a higher immunity to artifacts, it suffers –as all single-shot experiments– from resolution and SNR limitations. These can be dealt by multi-scan interleaving, which unlike EPI counterparts leads to independent low-resolution images free from aliasing artifacts. We present an acquisition and processing protocol that reconstructs from these data a composite image free from hardware or motional imperfections, possessing unprecedented resolution. The power of this self-referenced method is demonstrated with *in vivo* ADC maps of brains, kidneys and fetal organs in pregnant mice, possessing resolutions in the 78-230 μm range.

1022	9:00	Segmentation of Brain Tissues using a Bayesian Estimation of Multicomponent Relaxation Values in Magnetic Resonance Fingerprinting
		Debra McGivney[1], Yun Jiang[1], Dan Ma[1], Chaitra Badve[2], Vikas Gulani[1], and Mark Griswold[1]
		[1]Radiology, Case Western Reserve University, Cleveland, OH, United States, [2]Radiology, University Hospitals, Cleveland, OH, United States
		A Bayesian methodology has been previously applied to MRF reconstructions to analyze subvoxel T_1 and T_2 distributions. The multidimensional results from this algorithm are difficult to visualize. We propose to apply this Bayesian approach in the brain to create T_1 and T_2 Gaussian distributions to represent various tissue types. Using these distributions as prior information, the Bayesian methodology is applied over the brain with a smaller dictionary. Results from this Bayesian approach with a smaller dictionary are weighted by the Gaussian probabilities and summed to create tissue probability maps in normal volunteers and a brain tumor patient.

1023	9:12	Simultaneous quantification of T1, T2 and Apparent Diffusion Coefficient using Magnetic Resonance Fingerprinting based on Echo Planar Imaging
		Benedikt Rieger[1], Mehmet Akçakaya[2,3], Lothar R. Schad[1], and Sebastian Weingärtner[2,4]
		[1]Computer Assisted Clinical Medicine, Heidelberg University, Mannheim, Germany, [2]Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States, [3]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [4]Heidelberg University, Mannheim, Germany
		In this study we propose to integrate diffusion imaging into magnetic resonance fingerprinting, a method that has shown promise for time-efficient simultaneous quantification of multiple tissue parameters. The proposed sequence for quantitative T_1, T_2 and the apparent diffusion coefficient (ADC) is based on using Cartesian EPI readout. The contrast is generated using spin-echo EPI and gradient spoiling with diffusion gradients of varying moment and varying TR and TE. Joint T_1, T_2 and ADC parameter-maps acquired in phantoms are in good agreement with reference measurements and demonstrate high quality in-vivo maps, within a scan time of 28 seconds per slice.

1024	9:24	Accelerated Distortion-Free Diffusion Imaging at 7T – by Fusing PSF and VAT

		Yi-Hang Tung[1], Myung-Ho In[2], Sinyeob Ahn[3], Alessandro Sciarra[1], and Oliver Speck[1,4,5,6]
		[1]Department of Biomedical Magnetic Resonance, Otto-von-Guericke-University Magdeburg, Magdeburg, Germany, [2]Department of Radiology, Mayo Clinic, Rochester, MN, United States, [3]Siemens Healthcare, San Francisco, CA, United States, [4]Site Magdeburg, German Centre for Neurodegenerative Diseases (DZNE), Magdeburg, Germany, [5]Leibniz Institute for Neurobiology, Magdeburg, Germany, [6]Center for Behavioral Brain Sciences, Magdeburg, Germany
		In this study, combining view angle tilting (VAT) with the novel PSF diffusion EPI sequence demonstrates the feasibility to further accelerate distortion-free diffusion weighted imaging at high field.

1025	9:36	Musculoskeletal MR Fingerprinting with dictionary-based fat and water separation
		Matteo Cencini[1,2], Laura Biagi[2,3], Joshua D Kaggie[4], Rolf F Schulte[5], Michela Tosetti[2,3], and Guido Buonincontri[2]
		[1]Department of Physics, University of Pisa, Pisa, Italy, [2]IMAGO7 Foundation, Pisa, Italy, [3]Laboratory of Medical Physics and Magnetic Resonance, IRCCS Fondazione Stella Maris, Pisa, Italy, [4]Department of Radiology, University of Cambridge, Cambridge, United Kingdom, [5]GE Healthcare, Munich, Germany
		The purpose of this work is to obtain quantitative MRI maps of fat and water with a fast acquisition using MR Fingerprinting (MRF). The major advantage of MRF is its intrinsic multicomponent quantification capability, which overcomes the limitations of traditional separation techniques. Previous methods using MRF have repeated the same acquisitions for multiple echo times in order to obtain fat fraction maps. Here, variable echo times within a single MRF acquisition are used, in order to estimate T1 and PD of water and fat. We demonstrate quantitative maps in 16s per slice and improved delineation of anatomy in human knees.

1026	9:48	Quantitative Ultrashort Echo Time (UTE) Magnetic Resonance Imaging of Knee Osteoarthritis (OA)
		Yajun Ma[1], Lidi Wan[1], Xin Cheng[1], Yinghua Zhao[1], Eric Y Chang[1,2], and Jiang Du[1]
		[1]University of California, San Diego, San Diego, CA, United States, [2]VA San Diego Healthcare System, San Diego, CA, United States
		In this study we aimed to develop a comprehensive quantitative UTE imaging package including UTE-Cones actual flip angle imaging (UTE-Cones-AFI) for accurate B1 mapping, UTE-Cones variable flip angle (UTE-Cones-VFA) for T_1 mapping, 3D UTE-Cones-MT for MT modeling, UTE-Cones-AdiabT1rho for T1r mapping, and multi-echo UTE-Cones for T2* mapping. The techniques were evaluated on cadaveric human knee joints.

Oral

Diffusion MRI: Applications

N04	Thursday 8:00 - 10:00	*Moderators:* Koji Kamagata & Timothy Shepherd

1027	8:00	Development of a diffusion-weighted SSFP acquisition and processing pipeline to quantify the diffusion properties of the post-mortem ALS brain at 7T
		Benjamin Tendler[1], Saad Jbabdi[1], Sean Foxley[2], Menuka Pallebage-Gamarallage[3], Moises Hernandez Fernandez[1], Ricarda Menke[1], Thomas Nichols[4], Martin Turner[3], Olaf Ansorge[3], and Karla Miller[1]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]Department of Radiology, University of Chicago, Chicago, IL, United States, [3]Clinical Neurology, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [4]Oxford Big Data Institute, Li Ka Shing Centre for Health Information and Discovery, Nuffield Department of Population Health, University of Oxford, Oxford, United Kingdom
		An acquisition and processing pipeline is outlined to quantify the diffusion properties of post-mortem brain samples from diffusion-weighted steady-state free precession (dwSSFP), as part of an ongoing project examining the impact of amyotrophic lateral sclerosis (ALS) on the human brain. Preliminary results are presented comparing the post-mortem diffusion properties of control brains and patients diagnosed with ALS over the corpus callosum. Clear trends are observed within the results, with a maximum deviation between control and ALS brains observed within callosal regions connecting the motor cortices in the two hemispheres.

1028	8:12	Optimization of advanced high-resolution diffusion-weighted imaging (DWI) techniques in lower neck imaging
		Tong Su[1], Yu Chen[1], Tianyi Qian[2], Wei Liu[3], Huadan Xue[1], Zhengyu Jin[1], Zhuhua Zhang[1], and Hailong Zhou[1]
		[1]PUMCH, Beijing, China, [2]Siemens, Beijing, China, [3]Siemens, Shenzhen, China
		Readout-segmented echo-planar imaging (rs-EPI) could significantly reduce magnetic susceptibility artifacts in head and neck regions. In this study, the images were qualitatively evaluated among three types of rs-EPI: with and without readout partial Fourier (RPF), and with simultaneous multi-slice (SMS) technique. The SNRs and CNRs were compared with the additional use of special surface coils (SC). There was no significant differences in the image quality, SNRs, or CNRs among three rs-EPI acquisition methods of all the 31 volunteers and 9 hypopharyngeal carcinoma patients. Markedly, the special surface coils offered better image quality for the evaluation of lower neck lesions.

1029	8:24	Gaze Evoked Changes in Diffusion Characteristics of Human Optic Nerve
		Kenneth T Wengler[1], Tao Wang[2], Patricia Stefancin[2], Patrick A Sibony[3], Tim Q Duong[2], and Xiang He[2]

		[1]Biomedical Engineering, Stony Brook University, Stony Brook, NY, United States, [2]Radiology, Stony Brook University Hospital, Stony Brook, NY, United States, [3]Ophthalmology, Stony Brook University Hospital, Stony Brook, NY, United States
		Disorders of the optic nerve (ON) are both life and sight threatening. Although disorders such as papilledema and ischemic optic neuropathy cause deformation of the peripapillary basement membrane layer, earlier pathological changes to the ON may occur further away from the eye. In this study a novel zoom-RESOLVE DTI method was developed for in vivo human ON imaging. Significant changes were observed in diffusion characteristics when comparing adduction, primary position and abduction. Gaze evoked changes in diffusion characteristics have the potential to assess diseases that affect the optic nerve before manifestation of ocular anatomical changes observed in OCT.

1030	8:36	The connectivity fingerprint of the fusiform gyrus predicts the Autism Observation Scale for Infants (AOSI) in Tuberous Sclerosis Complex
		Benoit Scherrer[1], Kush Kapur[2], Anna Prohl[1], Jurriaan M Peters[2], Xavier Tomas-Fernandez[1], Darcy Krueger[3], Mustafa Sahin[2], and Simon K Warfield[1]
		[1]Radiology, Boston Children's Hospital, Harvard Medical School, Boston, MA, United States, [2]Neurology, Boston Children's Hospital, Harvard Medical School, Boston, MA, United States, [3]Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States
		Autism spectrum disorder is characterized by severe deficits in face processing. We achieved MR diffusion imaging of 27 infants (~2yo) with Tuberous Sclerosis Complex, a population at risk of autism, and assessed whether the structural connectivity fingerprint of their fusiform gyrus, a central region in face perception, can predict the Autism Observation Scale for Infants total score. We found that the diffusion tensor imaging connectivity fingerprint had poor prediction capabilities. In contrast, a diffusion compartment imaging, fixel-based fingerprint captured the structure of the abnormal connectivity in infants at risk of ASD and allowed in-sample prediction with a correlation of 0.97.

1031	8:48	U-fiber, Long-range, and Inter-limbic Tractography Comparison in Epilepsy Patients at 7 Tesla
		John W Rutland[1], Rebecca E Feldman[1], Lara V Marcuse[2], Madeline C Fields[2], Bradley N Delman[3], Rafael O'Halloran[1], and Priti Balchandani[1]
		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Department of Neurology, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, NY, United States

		This study measures alterations in wholebrain connectivity and connectivity of the suspected seizure onset zone (SOZ) in MRI-negative epilepsy patients. Short-range (U-fibers), long-range, and inter-limbic white matter tracts were measured independently in a group of 19 epilepsy subjects and 10 healthy controls using diffusion imaging. Relative wholebrain hypo-connectivity of both U-fibers and inter-limbic fibers was found in epilepsy subjects. Additionally, hyper-connectivity of all 3 fiber types was found in SOZ regions compared with non-SOZ regions. These findings suggest abnormal connectivity in MRI-negative patients may prove useful in SOZ localization and treatment planning.

1032	9:00	Diffusion-based tractography atlas of the human acoustic radiation
		Chiara Maffei[1], Silvio Sarubbo[2], and Jorge Jovicich[1]
		[1]CIMeC Center for Mind/Brain Sciences, Trento, Italy, [2]Structural and Functional Connectivity Lab, Div. of Neurosurgery, "S.Chiara Hospital", Trento, Italy
		This study presents the first tractography-based atlas of the acoustic radiation from a population of 34 young healthy subjects. The atlas was constructed using high quality MRI data from the Human Connectome Project. The acoustic radiation reconstruction was optimized with a systematic evaluation of MRI acquisition and analysis parameters using as reference reconstructions validated from an ex-vivo dissection study from our group (Maffei et al., 2017). The optimized reconstruction parameters and the atlas may be used in future studies interested in identifying and characterizing the acoustic radiation.

1033	9:12	OGSE- versus PGSE-derived ADC measurements in patients with liver metastases show reduced hindrance to diffusion at short length scales
		Mihaela Rata[1], David Collins[1], Maria Bali[1], Thorsten Feiweier[2], Julie Hughes[1], Erica Scurr[1], Matthew Orton[1], James d`Arcy[1], Martin O Leach[1], and Dow-Mu Koh[1]
		[1]CR-UK Cancer Imaging Centre, The Institute of Cancer Research and Royal Marsden Hospital, London, United Kingdom, [2]Siemens Healthcare, Erlangen, Germany
		The oscillating gradient spin echo (OGSE) diffusion method probes the diffusion spectrum at defined length scales. This comparative study investigates the effect of short diffusion times on apparent diffusion coefficient (ADC) measurements using OGSE and PGSE diffusion sequences in six patients with liver metastases. Similar cohort mean ADC values were reported for all PGSE measurements, while the OGSE-derived ADC was significantly higher (paired t-test p-value=0.029). This increase in OGSE-measured ADC in liver tumours suggests that water molecules suffer less hindrance at shorter diffusion times (as already observed in brain studies) and provides additional information regarding the tissue microstructure.

1034	9:24	Prostate microstructure specificity with diffusion relaxometry

		Gregory Lemberskiy[1,2], Els Fieremans[1], Jelle Veraart[1], Andrew B. Rosenkrantz[1], and Dmitry S Novikov[1]
		[1]Radiology, NYU School of Medicine, New York, NY, United States, [2]Sackler Institute of Graduate Biomedical Sciences, NYU School of Medicine, New York, NY, United States
		We identify the contributions of prostate cellular and glandular compartments to the overall diffusion time-dependent diffusion tensor, by varying echo time and relying on their different T2 values. We test the functional form of compartment tensor eigenvalues with respect to the diffusion time against a variety of tissue models, and find the glandular tissue being best described by the short-time surface-to-volume limit, whereas the random permeable barrier model is most applicable in cellular tissue, and for tumors of various grade. Our framework allows quantification of glandular sizes, cellular fiber diameters, membrane permeability, compartment T2-values, and volume fractions.

1035	9:36	High resolution diffusion MRI maps of mice with normal and dysfunctional placentas reveal clear fetal differences
		Qingjia Bao[1], Eddy Solomon[1], Ron Hadas[2], Stefan Markovic[1], Michal Neeman[2], and Lucio Fydman[1]
		[1]Department of Chemical and Biological Physics, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Biological Regulation, Weizmann Institute of Science, Rehovot, Israel
		DWI could evaluate pregnancy-related dysfunctions, yet EPI's sensitivity to motions and air/water/fat heterogeneities prevent these studies in preclinical settings. We developed DWI methodologies based on SPatiotemporal ENcoding (SPEN) for overcoming these obstacles, delivering ADC images at ≈150μm resolutions. We demonstrate the power of these new methods to resolve placental layers (maternal, fetal, trophoblastic) and umbilical cords, as well as brain features in developing mice fetuses. Daily monitoring of pregnancies for naïve and for eNOS-/- mice also showed differences in the development of placental and fetal (e.g. brain) structures. SPEN DWI thus opens the potential for the early detection of pregnancy disorders.

1036	9:48	A Pilot Study of Correlations Between Mean Diffusivity and Drug Release Over Time For an Implantable Drug Delivery System
		Nicole Vike[1], Xin Li[2], Kelsey Hopkins[2], Joseph Rispoli[2,3], and Luis Solorio[2]
		[1]Basic Medical Sciences, Purdue University, West Lafayette, IN, United States, [2]Biomedical Engineering, Purdue University, West Lafayette, IN, United States, [3]Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States

		In situ forming implants (ISFI) allow for precise placement of a drug eluting depot into the body, using a simple injection. However, the properties of the injection sites can alter the drug release profile in situ. Diffusion weighted imaging (DWI) provides a method for non-invasively and nondestructively tracking changes in the implant diffusivity *in situ*. Using DWI, we have characterized the diffusivity profile of ISFIs made using a poly(lactic-co-glycolic) acid polymer, loaded with the mock drug fluorescein. The ability to characterize the diffusivity profile of implants *in situ*, will provide the necessary tools for improving the rational design of implants.

Oral

MSK: Harder, Better, Faster, Stronger

S02	Thursday 8:00 - 10:00	*Moderators:* James MacKay & Erin Englund

1037	8:00	Fully Automated Deep Learning Pipeline for Meniscus Segmentation and Lesion Detection
		Berk Norman[1], Valentina Pedoia[1], Thomas Link[1], and Sharmila Majumdar[1]
		[1]Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States
		Damage to the meniscus is a physically limiting injury that can lead to further medical complications. Automatically classifying this type of meniscal damage poses the advantage for quicker and more accurate diagnosis at the time of an MRI scan. Using a fully automated deep learning pipeline we identify the region around the 4 meniscal horns and then classify if a lesion exists and if so, its severity based on WORMS grading. Lesion detection achieved 89.81% specificity and 81.98% sensitivity. This algorithm has the ability to quickly identify meniscal lesions from MRI and filter higher risk lesion subjects.

1038	8:12	The influence of different MR contrasts in multi-channel convolutional neural networks on pseudo-CT generation for orthopedic purposes
		Mateusz C Florkow[1], Frank Zijlstra[1], Koen Willemsen[1], René M Castelein[1], Harrie Weinans[1], Bart CH van der Wal[1], Max A Viergever[1], Marijn van Stralen[1], and Peter R Seevinck[1]
		[1]UMC Utrecht, Utrecht, Netherlands

		Conventional MR images and pseudo-CT's (pCT's) generated using state-of-the-art machine learning techniques poorly characterize bone anatomies, preventing applicability for orthopedic applications. We hypothesize that smart use of several specific MR contrasts will expose the information needed for diagnostic quality bone visualization. We designed a patch-based convolutional neural network taking groups of different MR contrasts - which were obtained from a single multi-gradient sequence- as inputs . It generated competitive pCT scans, capturing local anatomical variances present in the dataset. We show that Dixon reconstructed inputs appear to generate better soft-tissue visualization, while complex-valued data show promising results in bone reconstruction.

1039	8:24	Super-Resolution Musculoskeletal MRI using Deep Learning Akshay S Chaudhari[1,2], Zhognan Fang[3], Feliks Kogan[1], Jeff P Wood[1], Kathryn J Stevens[1,4], Jin Hyung Lee[2,3,5,6,7], Garry E Gold[1,2,4], and Brian A Hargreaves[1,2,6] *[1]Radiology, Stanford University, Palo Alto, CA, United States, [2]Bioengineering, Stanford University, Palo Alto, CA, United States, [3]LVIS Corporation, Palo Alto, CA, United States, [4]Orthopaedic Surgery, Stanford University, Palo Alto, CA, United States, [5]Neurology & Neurological Sciences, Stanford University, Palo Alto, CA, United States, [6]Electrical Engineering, Stanford University, Palo Alto, CA, United States, [7]Neurosurgery, Stanford University, Palo Alto, CA, United States* Near-isotropic high-resolution magnetic resonance imaging (MRI) of the knee is beneficial for reducing partial volume effects and allowing multi-planar image analysis. However, previous methods exploring isotropic resolutions, typically compromised in-plane resolution for thin slices, due to intrinsic signal-to-noise ratio (SNR) limitations. Even computer-vision-based super-resolution methods have been rarely been used in medical imaging due to limited resolution improvements. In this study, we utilize deep-learning-based 3D super-resolution for rapidly generating high-resolution thin-slice knee MRI from slices originally 2-8 times thicker. Through quantitative image quality metrics and a reader study, we demonstrate superior performance to both conventionally utilized and state-of-the-art super-resolution methods.

1040	8:36	Fully-Automated One-Button-Push 10-min 3D CAIPIRINHA SPACE TSE MRI of the Knee: A Multi-Center Multi-Reader Multi-Field-Strength Validation Study Filippo Del Grande[1], Marco Delcogliano[1], Riccardo Guglielmi[1], Esther Raithel[2], Derek Papp[3], Steven E Stern[4], Christian Candrian[1], and Jan Fritz[3] *[1]Ospedale Regionale di Lugano, Lugano, Switzerland, [2]Siemens Healthcare GmbH, Erlangen, Germany, [3]The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [4]Bond Business School, Gold Coast, Australia*

		2D TSE MRI is widely used for the evaluation of internal knee derangement but is time-consuming. Recently introduced 3D TSE acceleration strategies, such as CAIPIRINHA allow for fast sampling, and together with AutoAlign technology enable now fully automated one-button-push 3D MRI protocols in 10 minutes total scan time. In a prospective study of 150 subjects, we analyzed the frequencies of structural abnormalities, inter-reader reliability, inter-method concordance, diagnostic definitiveness, and interchangeability of 10-min 3D CAIPIRINHA SPACE TSE protocols and 20-min 2D TSE standard-of-reference protocols. Our results indicated that that 10-min 3D TSE protocols are at least equivalent to 20-min 2D TSE protocols for the diagnosis of internal derangement of the knee.

1041	8:48	Reducing scan time for full MRI examination of the ankle by 45% while maintaining diagnostic value using combined compressed sensing and parallel imaging. Onno Baur[1], Chiel Den Harder[1], Robert Hemke[1], Mario Maas[1], Farood Faridmojtahedi[2], Elwin De Weerdt[3], Maarten Versluis[3], Mascha Van Der Kwaak[1], and Aart Nederveen[2] *[1]Radiology & Nuclear medicine, Academic Medical Center, Amsterdam, Netherlands, [2]Radiologie, Academic Medical Center, Amsterdam, Netherlands, [3]Healthcare, Philips, Best, Netherlands* Dixon imaging is a well-known imaging technique that provides robust water-fat separation but requires relatively long acquisition times. We scanned twelve healthy volunteers with a standard ankle examination containing multiple Dixon sequences and an accelerated examination using CS-SENSE, a combination of Parallel Imaging and Compressed Sensing. A five-point Likert scale was used to compare reference images to CS-SENSE images. Although using CS-SENSE caused a slight SNR reduction, the diagnostic value was not impaired. Applying CS-SENSE on an ankle examination protocol resulted in a feasible reduction of the total acquisition time by 45% from 13’38” to 7’49”, without losing diagnostic value.

1042	9:00	Intravoxel Incoherent Motion (IVIM) Imaging in Human Achilles Tendon Kenneth T Wengler[1], Dharmesh Tank[2], Mingqian Huang[2], Elaine Gould[2], Mark Schweitzer[2], and Xiang He[2] *[1]Biomedical Engineering, Stony Brook University, Stony Brook, NY, United States, [2]Radiology, Stony Brook University Hospital, Stony Brook, NY, United States* Clinically, Achilles tendon (AT) rupture accounts for 40-60% of all operative tendon repairs. AT microcirculation plays a crucial role in the progression of tendinopathy and tendon repair. In this study a novel ste-RESOLVE IVIM protocol was developed to image AT microcirculation. Healthy participants were imaged pre- and post-exercise, and exercised induced increases in blood volume and blood flow were observed. AT tendinopathy patients exhibited greater baseline blood volume and blood flow when compared to healthy participants. For the first time, a robust MRI-based technique was developed to investigate the role of Achilles tendon microcirculation in tendinopathy.

1043	9:12	Visualisation and quantification of collagen fibers in a partially torn ligament using magic angle imaging

		Karyn Elizabeth Chappell[1], Catherine Van Der Straeten[1], Donald McRobbie[2], Wladyslaw Gedroyc[1], Mihailo Ristic[3], Djordje Brujic[3], and Richard Meeson[4]
		[1]Medicine, Surgery and Cancer, Imperial College London, London, United Kingdom, [2]University of Adelaide, Adelaide, Australia, [3]Mechanical Engineering, Imperial College London, London, United Kingdom, [4]Department of Clinical Sciences and Services, Royal Veterinary College, Hertfordshire, United Kingdom
		Human partial anterior cruciate ligament tears can be extremely difficult to diagnose with conventional MRI. Variations of signal intensity within the ligament are suggestive of injury but it is not possible to confirm damage or assess the collagen alignment within the ligaments. We have shown that magic angle imaging has the ability to visualise and quantify collagen fibers in a partially torn canine cruciate ligament. Furthermore it can delineate between damaged and healthy fiber bundles within the same ligament. This method has the potential to become a non-invasive alternative to arthroscopy for assessing and monitoring ligament damage and repair outcomes.

1044	9:24	Longitudinal Changes in Quantitative MRI and Ultrasound Metrics of Patellar Tendon are Associated with Tendon Degeneration and Leg Dominance within of Collegiate Basketball Players over One Season of Play
		Erin C. Argentieri[1], Matthew F. Koff[1], Bin Lin[2], Parina H. Shah[1], Hollis G. Potter[1], and O. Kenechi Nwawka[1]
		[1]Radiology and Imaging, Hospital for Special Surgery, New York, NY, United States, [2]Biostatistics, Hospital for Special Surgery, New York, NY, United States
		This study assessed correlations between quantitative T2* and Shear wave elastography (SWE) ultrasound metrics of the patellar tendon and qualitative morphologic grades patellar tendinosis (PT) within collegiate basketball players over one season of play. Within the current study, significant and strong correlations existed between T2* and SWE metrics, though morphologic PT grades were correlated with T2* metrics only. These findings support the notion that T2* relaxometry could benefit the clinical management of PT, as it is sensitive to changes in pathologic severity over time, and could therefore serve as a metric to guide treatment plans and evaluate intervention efficacy.

1045	9:36	Isotropic resolution DTI of lower back nerves using a phase-corrected diffusion-prepared 3D TSE
		Barbara Cervantes[1], Anh Van[2], Dominik Weidlich[1], Hendrik Kooijman[3], Andreas Hock[3], Ernst Rummeny[1], Alexandra Gersing[1], Jan Kirschke[4], and Dimitrios Karampinos[1]
		[1]Interventional and Diagnostic Radiology, Technical University of Munich, Munich, Germany, [2]Institute of Medical Engineering, Technical University of Munich, Garching, Germany, [3]Philips Healthcare, Hamburg, Germany, [4]Interventional and Diagnostic Neuroradiology, Technical University of Munich, Munich, Germany

		Diffusion-prepared 3D TSE (dprep-3D TSE) has been applied for isotropic-resolution distortion-free proximal- and peripheral-nerve DWI. Dprep-3D TSE has been combined with magnitude stabilizers to reduce magnitude modulation induced by motion and eddy currents and has used velocity compensation to reduce motion-induced phase modulation in diffusion-weighted signals. However, due to the multi-shot nature of dprep-3D TSE, remaining motion-induced phase leads to image and DTI-parameter artifacts and requires phase navigation. The purpose of this work is to develop a phase-navigation and phase-correction scheme for dprep-3D TSE and to apply the developed method in vivo for isotropic-resolution DTI of lumbosacral and sciatic nerves.

1046	9:48	Simultaneous Multislice Accelerated Diffusion-Tensor Imaging of Thigh Muscles in Myositis
		Fengdan Wang[1], Chanyuan Wu[2], Caiyuan Sun[1,3], Dong Liu[1], Yi Sun[4], Qian Wang[2], and Zhengyu Jin[1]
		[1]Radiology, Peking Union Medical College Hospital, Beijing, China, [2]Rheumatology, Peking Union Medical College Hospital, Beijing, China, [3]Radiology, Shenzhen Sun Yat-Sen Cardiovascular Hospital, Shenzhen, China, [4]MR Collaboration NE Asia, Siemens Healthcare, Shanghai, China
		We investigated the clinical feasibility of using simultaneous multislice accelerated echo planar imaging diffusion-tensor imaging (SMS-EPI-DTI) to image thigh muscles of both 10 healthy control subjects and 20 dermatomyositis (DM)/ polymyositis (PM) patients. This technique yielded a reduced scan time to only about five minutes. The results showed that the tractographic imaging and DTI-derived parameters of edematous muscles differed among affected and unaffected muscles of the DM/PM patients and normal muscles of the control subjects. In conclusion, SMS-EPI-DTI is clinically feasible for imaging thigh muscles and quantitatively evaluating edematous muscles of DM and PM patients.

Oral

CMR Innovations

S03	Thursday 8:00 - 10:00	*Moderators:* Markus Henningsson & Dana Peters

1047	8:00	Automatic AHA model segmentation of cardiac T1 maps with deep learning
		Nicola Martini[1], Daniele Della Latta[1], Gianmarco Santini[1,2], Gabriele Valvano[1], Andrea Barison[3], Francesco Avogliero[1], Daniele De Marchi[3], Luigi Landini[1,2], and Dante Chiappino[1]
		[1]Fondazione Toscana "G. Monasterio", Massa, Italy, [2]University of Pisa, Pisa, Italy, [3]Fondazione Toscana "G. Monasterio", Pisa, Italy

		We proposed a fully automated approach for the segmental analysis of T1 mapping using a fully convolutional neural network architecture. T1 maps acquired using the MOLLI sequence from 394 subjects were considered. Excellent segmentation results are demonstrated by high Jaccard (0.969±0.023) and a Dice (0.984±0.012) indexes. No significant difference in the obtained segmental T1 values compared to manual measurements was found, with a mismatch percentage ranging from 0.95% to 3.14% across segments.

1048	8:12	Single Breath-held, ECG-Free Cardiac CINE MRI using Parallel Imaging and Deep Learning Combined Image Reconstruction
		Fei Han[1], Ziwu Zhou[1], Vahid Ghodrati Kouzehkonan[1], Yu Gao[1], Yingli Yang[2], and Peng Hu[1]
		[1]Radiology, University of California, Los Angeles, Los Angeles, CA, United States, [2]Radiation Oncology, University of California, Los Angeles, Los Angeles, CA, United States
		Cardiac CINE MRI is widely used for evaluating ventricular wall motion and cardiac function. Conventional cardiac CINE consists of ECG-triggered k-space segmented 2D acquisitions, each performed within a breath-hold. In this study, we propose an ECG-free, cardiac CINE protocol that covers the entire LV within a single breath-hold. Our solution is based on a highly accelerated real-time imaging that is enabled by our recently proposed parallel imaging and deep learning combined (PI-DL) image reconstruction. In this study, we evaluated the proposed solution in healthy volunteers and compare its performance with cardiac CINE images acquired using conventional protocol.

1049	8:24	Deep Convolutional Neural Network Enhanced 3D High Resolution Turbo Spin Echo Intracranial Vessel Wall Imaging
		Zechen Zhou[1], Shuo Chen[2], Jiayi Wu[3], Xihai Zhao[2], Peter Börnert[4], and Chun Yuan[2,5]
		[1]Philips Research North America, Cambridge, MA, United States, [2]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [3]The Institute of Artificial Intelligence and Robotics, Xi'an Jiaotong University, Xi'an, China, [4]Philips Research Hamburg, Hamburg, Germany, [5]Vascular Imaging Lab, Department of Radiology, University of Washington, Seattle, WA, United States
		Turbo spin echo (TSE) imaging with variable flip angle (VFA) is commonly used for three-dimensional (3D) high resolution intracranial vessel wall imaging. However, different tissues may experience various blurring effects particularly for longer TSE factor. In this study, a deep convolutional neural network is trained to provide a solution for this special deblurring problem. Combined with a signal-to-noise ratio (SNR)-priority VFA design scheme, the developed technique can provide a better tradeoff across scan efficiency, point spread function and SNR for 3D TSE acquisitions. Preliminary results have demonstrated its improvement for sharper delineation of intracranial vessel wall and plaque boundaries at isotropic 0.5mm resolution.

1050	8:36	Super Resolution MRI Using 3D Generative Adversarial Network: Towards Single Breath-Hold Coronary MR Angiography
		Yibin Xie[1], Ruiyuan Lin[2], Yuhua Chen[1,3], Yubo Zhang[2], Feng Shi[1], Yanan Fei[2], Zixin Deng[1,3], Derenik Haghverdian[2], Madhvi Kannan[2], Hyuk-Jae Chang[4], C.-C. Jay Kuo[2], and Debiao Li[1,3]
		[1]Biomedical Imaging Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [2]Ming Hsieh Department of Electrical Engineering, University of Southern California, Los Angeles, CA, United States, [3]Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA, United States, [4]Division of Cardiology, Severance Hospital, Yonsei University College of Medicine, Seoul, Republic of Korea
		Coronary MRA is an attractive imaging tool to offer noninvasive, radiation-free evaluation of coronary artery disease. However, long scan time and sensitivity to motion limit its current clinical applications. In this paper, we propose a super resolution reconstruction framework based on 3D generative adversarial network (GAN) to allow substantial acceleration (10x plus) and potentially whole-heart coronary MRA within a breath-hold. Preliminary results demonstrated significantly improved vessel sharpness and image quality metrics in highly under-sampled coronary MRA dataset.

1051	8:48	Automatic Segmentation of Carotid Vessel Wall in Multi-Contrast Blackblood Images using Deep Learning
		Jifan Li[1], Shuo Chen[1], Xihai Zhao[1], Chun Yuan[1,2], and Rui Li[1]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]Vascular Imaging Laboratory, Department of Radiology, University of Washington, Seattle, WA, United States
		In this work, we proposed an automatic approach for segmentation of carotid vessel wall in multi-contrast blackblood images, using a fine-tuning U-net neural network. The U-net network consists of an encoder path that captures context and reduces data dimension and a symmetric decoder path that enables precise localization and high resolution. The fine-tuning was utilized to accommodate multi-contrast images input. The pixel-level sensitivity, specificity and IoU of our model achieved 0.869, 0.987 and 0.751 on the test data set, respectively.

1052	9:00	Fetal whole-heart 3D cine reconstruction using motion-corrected multi-slice dynamic imaging
		Joshua FP van Amerom[1], David FA Lloyd[1], Maria Kuklisova Murgasova[1], Anthony N Price[1], Shaihan J Malik[1], Milou Van Poppel[1], Kuberan Pushparajah[1,2], Mary A Rutherford[3], Reza Razavi[1,2], and Joseph V Hajnal[1]
		[1]School of Biomedical Engineering & Imaging Sciences, King's College London, London, United Kingdom, [2]Department of Congenital Heart Disease, Evelina London Children's Hospital, London, United Kingdom, [3]Centre for the Developing Brain, King's College London, London, United Kingdom

		Cine fetal cardiac imaging with whole heart coverage presents numerous challenges due to maternal and fetal motion as well as high heart rate and lack of reliable independent synchronisation signal. To overcome these challenges, highly accelerated multi-slice 2D dynamic images were retrospectively reordered in time and aligned in space to produce a 3D cine using scattered interpolation methods with outlier rejection. The proposed methods were tested on ten human fetal subjects and validated using a numerical phantom.
1053	9:12	Dark-blood T2 mapping for improved assessment of the left ventricular subendocardium, right ventricle and left atrium Chenxi Hu[1] and Dana Peters[1] *[1]Yale University, New Haven, CT, United States* The accuracy of cardiac T2 mapping in small structures, such as the subendocardium, right ventricle, and left atrium, is impaired by the partial-voluming effect between myocardium and blood. In this work, we propose a dark-blood T2 mapping method that nulls the blood prior to the T2 quantification, so that partial-voluming is reduced and T2 estimation accuracy in these small structures is improved. Both conventional and the proposed dark-blood T2 mapping methods were performed in healthy subjects. The results demonstrated the potential of dark-blood T2 mapping to improve the clinical assessment of the subendocardium, right ventricle, and left atrium.
1054	9:24	Myocardial Infarct Border Zone Metabolism Measured by Hyperpolarized 13C-Pyruvate MRI James J Pilla[1], Gabor Mizsei[1], Jerry Zsido II[1], Norman Butler[1], Yoshiaki Saito[1], Gabrielle Pilla[1], Akito Imai[1], Keitaro Okamoto,[1], Christopher L Gade[2], Mehrdad Pourfathi[1], Kai Ruppert[1], Stephen L Kadlecek[1], Sarmad Siddiqui[1], Rahim R Rizi[1], Joseph H Gorman III[1], Robert C Gorman[1], and Terence Gade[1] *[1]University of Pennsylvania, Philadelphia, PA, United States, [2]Weill Medical Coll of Cornell NY, New York, NY, United States* Adverse remodeling after a myocardial infarct has been linked to the elevated wall stress in the myocardium adjacent to the infarct (i.e. border zone). Perturbed metabolism in this region could drive the transition from compensated to adverse remodeling. To evaluate regional metabolism this study compared the uptake and intracellular conversion of [1-^{13}C]pyruvate using hyperpolarized ^{13}C. An infarct model of ventricular remodeling was used to investigate region metabolism. Pharmacologic stress produced an increase in remote metabolite flux compared to border zone region which may provide a metabolic mechanism for the established association of mechanical stress and adverse cardiac remodeling following infarct.
1055	9:36	Transient intrinsic torsional shear wave propagation demonstrates a difference in Left Ventricular Myocardial stiffness between volunteers and patients with HFpEF

		Jessica Webb[1,2], Jurgen Runge[1], Omar Darwish[1], Alessandro Polcaro[1,3], Torben Schneider[4], Gerald Carr-White[1,2], Jordi Martorell[3], David Nordsletten[1], Reza Razavi[1,2], and Ralph Sinkus[1]
		[1]King's College London, London, United Kingdom, [2]Guys and St Thomas' NHS Trust, London, United Kingdom, [3]Universitat Ramon Llull, Barcelona, Spain, [4]Philips Healthcare, Guildford, United Kingdom
		Heart Failure with preserved Ejection Fraction is common, associated with high morbidity and mortality, and is challenging to diagnose. We have developed a novel patient friendly non-invasive technique to quantify myocardial stiffness using transient MR Elastography. Aortic valve closure results in the propagation of a transient shear wave through the myocardium. Torsional wave propagation can be visualised using a 1D pencil beam navigator positioned longitudinally along the myocardial septum, using four breath holds each 15 seconds. Providing a temporal resolution of 0.3ms, we observe increased myocardial stiffness in HFpEF patients compared to healthy volunteers (torsional speed 5.5 ± 1.1 m/s in volunteers and 10.0 ± 0.7 m/s in Patients; stiffness 36 ± 12.0 kPa and 108 ± 15.2 kPa, respectively) .

1056	9:48	Simultaneous Multi-Slice (SMS) Cardiac CINE using embedded Hadamard-encoded reference data at 7 Tesla
		stanislas Rapacchi[1], Thomas Troalen[2], Maxime Guye[3], Monique Bernard[3], Alexis Jacquier[3], and Frank Kober[3]
		[1]CRMBM, Aix Marseille University CNRS, Marseille, France, [2]Siemens Healthineers, Saint Denis, France, [3]Aix-Marseille Univ, CNRS, CRMBM, Marseille, France
		To perform high-resolution cardiac function MRI, thin-slice Cine MRI at 7T is accelerated using Simultaneous Multi-Slice (SMS) technique. Additionally, Hadamard encoding strategy along the temporal dimension is superimposed on the CAIPIRINHA phase shift. The Hadamard-decoded data serve as embedded reference for SMS image reconstruction. Additional in-plane L1-SPIRiT reconstruction allows for limited noise amplification. Results show excellent slice separation, satisfactory SNR and CNR for assessment of cardiac function. However, SAR restrictions impose a lower flip angle for SMS acquisitions that result in poorer blood-to-myocardium contrast.

Oral

MRS/MRSI Acquisition

S05	Thursday 8:00 - 10:00	*Moderators:* Borjan Gagoski & Zhong Chen

1057	8:00	Reduction of Acquisition time by Partition of the sIgnal Decay in Spectroscopic Imaging (RAPID-SI) technique: Preliminary In-vivo results and comparison with CSI.
		Sourav Bhaduri[1], Patricia Clement[1], Eric Achten[1], and Hacene Serrai[1,2]

		[1]Department of Radiology and nuclear medicine, University of Ghent, Gent, Belgium, [2]Robarts Research Institute, University of Western Ontario, London, ON, Canada
		We describe the development of the RAPID-SI technique and its implementation on a 3 T Siemens scanner. In-vivo studies demonstrate the performance of this technique in terms of acquisition time, signal-to-noise ratio, and data analysis. The results are compared to the CSI technique. Compared to CSI, RAPID reduces the acquisition time by a factor of R and provides accurate quantification results. The SNR of RAPID at the acquisition level is lower by √R and increased by data pre-processing. Quantification results of RAPID-SI are comparable to the CSI ones. The study shows that RAPID-SI provides accurate metabolite quantification results while significantly reducing acquisition time in obtaining MRSI data similar to CSI in terms of resolution and sensitivity.

1058	8:12	Further Accelerating SPICE for Ultrafast MRSI Using Learned Spectral Features
		Fan Lam[1], Yudu Li[1,2], Rong Guo[1,2], Bryan Clifford[1,2], Xi Peng[1], and Zhi-Pei Liang[1,2]
		[1]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States
		This work presents a new method to incorporate machine learning into SPICE (SPectroscopic Imaging by exploiting spatiospectral CorrElation) to further enhance its data acquisition speeds. The proposed method exploits the significant amount of prior knowledge about the spectral variations of biological tissues, e.g., molecular composition and resonance structures, by devising a novel strategy to learn the molecule-specific spectral features from training data, and incorporating the learned features into a subspace representation of the desired spatiospectral distribution for a general MRSI study. Impressive results have been produced by the proposed method from ^{1}H-MRSI of the brain without any suppression pulses.

1059	8:24	Combining multi-band slice selection with COKE (COherent K-t-space EPSI) for accelerated spectral imaging
		Rita Schmidt[1,2], Amir Seginer[3], and Assaf Tal[3]
		[1]Radiology, Leiden University Medical Center (LUMC), Leiden, Netherlands, [2]Neurobiology, Weizmann Institute of Science, Rehovot, Israel, [3]Chemical physics, Weizmann Institute of Science, Rehovot, Israel
		One of the powerful techniques for faster spectroscopic imaging acquisition is so called proton echo planar spectroscopic imaging (EPSI). An alternative method, which we here term COKE (COherent K-t space EPSI), relies on interleaving “blipped” PE gradients in between readouts to produce coherent phase between the k-t space lines. COKE enables to double the SW in comparison to EPSI or to halve the acquisition duration. We designed a sequence that integrates a multi-band CAIPIRINHA with COKE acquisition for faster spectroscopic imaging. This was demonstrated in both phantoms and in-vivo.

1060	8:36	MEGA-SPICE: A subspace-based approach to high-resolution spectral edited MRSI
		Chao Ma[1], Paul Kyu Han[1], Shuang Hu[1,2], and Georges El Fakhri[1]
		[1]Gordon Center for Medical Imaging, Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [2]Nuclear Medicine, West China Hospital, Sichuan University, Sichuan, China
		Spectral edited MRS/MRSI is a powerful tool to detect metabolites with J-coupled spins (e.g., GABA and 2-HG) that are otherwise overlapped with other high concentration metabolites (e.g., Cho and Cr). Compared to conventional MRSI, it is even more challenging to achieve high-resolution spectral edited MRSI because of lower metabolite concentration and less time-efficient spatial-spectral encoding. A subspace-based approach, called SPICE (SPectroscopic Imaging by exploiting spatiospectral CorrElation), has been proposed for high-resolution MRSI, producing 3D MRSI images at 3 mm isotropic resolution within 10 mins. We present here a method, termed MEGA-SPICE, for accelerated high-resolution spectral edited MRSI, which is enabled by spectral editing using MEGA pulses and subspace-based data acquisition and processing strategies.

1061	8:48	Elliptical Localization with Pulsed Second-Order Fields (ECLIPSE) for Robust Lipid Suppression in Proton MRSI
		Robin A. de Graaf[1], Peter B Brown[1], Henk M De Feyter[1], Scott McIntyre[1], and Terence W Nixon[1]
		[1]MRRC, Yale University, New Haven, CT, United States
		Proton MRSI has great clinical potential for metabolic mapping of healthy and pathological human brain. However, technical challenges related to poor spectral quality caused by magnetic field inhomogeneity, limited RF transmit power and incomplete lipid suppression have dampened the utility of MRSI. Here a novel method for lipid suppression is presented based on localization of an elliptical region-of-interest using pulsed second-order magnetic fields. A high-amplitude gradient setup was designed and constructed, containing coils to generate Z2, X2Y2 and XY magnetic fields. Simulations, phantom MRI and MRSI on human brain in vivo demonstrate robust localization and suppression of extracranial lipids.

1062	9:00	Dynamically Switched B0 Field Control for Separate Optimization of Tailored Volume Lipid Suppression and B0 Homogeneity for Brain Chemical Shift Imaging at 3T using Multi-Coil Shim Array
		Nicolas Arango[1], Jason P. Stockman[2,3], Bernhard Strasser[2], Borjan Gagoski[3,4], Ovidiu Andronesi[2], Lawrence L. Wald[2,3], Jacob White[1], and Elfar Adalsteinsson[1,5]
		[1]Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [2]A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospita, Charlestown, MA, United States, [3]Department of Radiology, Harvard Medical School, Boston, MA, United States, [4]Fetal Neonatal Neuroimaging and Developmental Science Center, Boston Children's Hospital, Boston, MA, United States, [5]Institute for Medical Engineering and Science, Massachusetts Institute of Technology, Cambridge, MA, United States

		A rapidly reconfigurable 32-channel local-multi-coil-shim-array is used to both enhance lipid suppression and narrow metabolite linewidth in chemical-shift imaging of the brain. Using in-situ optimization, the array is first configured to widen the spectral gap between spatially separate lipid and metabolite regions, to improve lipid-surpressing inversion, and then reconfigured for field homogeneity, to narrow metabolite linewidth during readout. For 2cm thick brain slab, using the dynamically-reconfigured array reduced lipid contamination by 24.5%, reduced linewidth by 34%, and increased well-imaged brain area by 38% over static 2nd order shimming

1063	9:12	Dynamic Spatially Selective Dephasing for Outer Volume Suppression
		Jing-Huei Lee[1], Jullie W Pan[2], and Hoby P. Hetherington[2]
		[1]Biomedical Engineering, University of Cincinnati, Cincinnati, OH, United States, [2]Radiology, University of Pittsburgh, Pittsburgh, PA, United States
		A novel dynamic spatially selective dephasing (DSSD) for outer volume suppression (OVS) is introduced. This technique uses high-order shim pulses to accomplish OVS by creating a low and high field gradient within and outside of region of interest. The effectiveness of DSSD is investigated with phantom and human using an 8-channel parallel transmit 7 Tesla Siemens system. Similar suppression performance was obtained in phantom and human brain using DSSD with a circular and an elliptical shape, respectively. The results show that OVS can be achieved by using a high degree shim insert to generate a steep B_0 gradient at periphery of target region.

1064	9:24	Reproducibility and clinical feasibility of diffusion-weighted MRS using sLASER and STEAM in the human brain in vivo at 3T
		Guglielmo Genovese[1,2], Lydia Yahia Cherif[1,2], Malgorzata Marjanska[3], Edward J Auerbach[3], Romain Valabrègue[1,2], Itamar Ronen[4], Stéphane Lehéricy[1,2], and Francesca Branzoli[1,2]
		[1]Brain and Spine Institute (ICM), Center for Neuroimaging Research (CENIR), Paris, France, [2]Sorbonne Universités, UPMC Univ Paris 06 UMR S 1127, Inserm U 1127, CNRS UMR 7225, Paris, France, [3]Center for Magnetic Resonance Research and Department of Radiology, University of Minnesota, Minneapolis, MN, United States, [4]C. J. Gorter Center for High Field MRI, Department of Radiology, Leiden University Medical Center, Leiden, Netherlands
		Diffusion-weighted MR spectroscopy (DW-MRS) allows disentanglement of different pathological mechanisms of brain tissue by exploiting the specific compartmentation of metabolites in different cell types. In this study, we estimated the reproducibility of metabolite diffusion measures obtained using DW-sLASER and DW-STEAM sequences at 3T. The inter- and intra-subject variability of the apparent diffusion coefficients (ADC) of the three major metabolites, as well as the effect of the acquisition time on the variance of these measures were calculated for both sequences in two brain regions. Power calculations were performed to facilitate the choice of the optimal protocol for specific clinical needs.

1065	9:36	Direct signal detection of exchangeable protons of metabolites with high SNR using ultrashort-TE, short-TR 1-H MRSI without water presaturation
		Wolfgang Dreher[1] and Felizitas Charlotte Wermter[1,2]
		[1]FB02 (Chemistry), University of Bremen, Bremen, Germany, [2]Inegrative Ecophysiology, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany
		Chemical exchange saturation transfer (CEST) is a powerful technique for inverse metabolic imaging and non-invasive pH measurements, and is most efficient in the intermediate exchange regime between protons of metabolites and water. We examined the use of ultrashort-TE, short-TR MRSI for the direct signal detection of exchangeable protons of metabolites. If water is not saturated, fresh z-magnetization is transferred to the protons of metabolites, allowing a high SNR despite short TR. This approach was evaluated by simulations and measurements on creatine phantoms using solutions with different pH, demonstrating direct signal detection for exchange rates up to ~1000 s^{-1}.

1066	9:48	Water suppression in the human brain with hypergeometric RF pulses for single- and multi- voxel MR spectroscopy
		Kimberly Chan[1,2,3], Ronald Ouwerkerk[4], and Peter Barker[2,3]
		[1]Biomedical Engineering, Johns Hopkins School of Medicine, Baltimore, MD, United States, [2]Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins School of Medicine, Baltimore, MD, United States, [3]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States, [4]Biomedical and Metabolic Imaging Branch, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, United States
		In this study, a novel water suppression sequence with hypergeometric RF pulses (HGWS) is investigated and compared to the commonly used VAPOR sequence in simulations, single and multi- voxel acquisitions. In simulations, HGWS and VAPOR are insensitive to B1 and water T1 variations, but with no B1 variation, HGWS has a lower average residual water fraction than that of VAPOR. In vivo, HGWS provides better water suppression than VAPOR in both single-voxel and multi-voxel acquisitions with a shorter sequence duration.

Oral

Magnetic Resonance Elastography: Applications & Methods

S06	Thursday 8:00 - 10:00	*Moderators:* Thomas Royston & Jeong Hee Yoon

1067	8:00	Altered brain tissue stiffness in pediatric cerebral palsy measured with magnetic resonance elastography

		Charlotte A Chaze[1], Daniel R Smith[1], Grace McIlvain[1], Gabrielle Villermaux[2], Nicole Maguire[1], Freeman Miller[3], Jeremy R Crenshaw[4], and Curtis L Johnson[1,2]
		[1]Biomedical Engineering, University of Delaware, Newark, DE, United States, [2]Psychological and Brain Studies, University of Delaware, Newark, DE, United States, [3]Orthopedics, Nemours Alfred I. duPont Hospital for Children, Wilmington, DE, United States, [4]Department of Kinesiology and Applied Physiology, University of Delaware, Newark, DE, United States
		Magnetic resonance elastography (MRE) measures the viscoelastic mechanical properties of tissues, which vary extensively between normal and disease states. In this study, we hypothesized that the mechanical integrity of brain tissue is reduced in children with cerebral palsy (CP). Through MRE, we found the stiffness of the cerebrum in children with CP ages 5-12 is significantly lower than in typically developing (TD) children. This finding indicates that there is a difference in brain tissue health in children with CP that is quantifiable through stiffness measured with MRE.

1068	8:12	Imaging Visual Cortex Activity with Intrinsic Activation MRE
		Reihaneh Forouhandehpour[1] and Elijah EW Van Houten[2]
		[1]Department of Diagnostic Radiology, University of Sherbrooke, Sherbrooke, QC, Canada, [2]Department of Mechanical Engineering, University of Sherbrooke, Sherbrooke, QC, Canada
		Initial RD-MRE results from intrinsic activation during repeated ON-OFF visual stimulation cycles are presented. Processed probability values from independent t-tests show areas of isolated activity in the region of the visual cortex for certain mechanical parameters, including the real shear modulus and the imaginary bulk modulus. Overlays of these probability value images with co-registered BOLD images show complimentary regions of activation.

1069	8:24	Assessing tumor mechanical properties and blood perfusion with MRI and correlation with tumor pressure at different compression levels in mice
		Gwenaël Pagé[1], Marion Tardieu[1], Laurent Besret[2], Bernard Van-Beers[1,3], and Philippe Garteiser[1]
		[1]Laboratory of Imaging Biomarkers, UMR1149, INSERM-University Paris Diderot, Paris, France, [2]Sanofi Aventis, Vitry-Sur-Seine, France, [3]Department of Radiology, Beaujon University Hospital Paris Nord, Clichy, France

		The purpose of this study was to evaluate the changes of total tumor pressure and mechanical properties as a function of increasing stress. MR elastography and perfusion measurements (FAIR method) were performed in mice with tumors xenografted subcutaneously. Tumor pressure was measured with a catheter-transducer system. Measurements were performed at different stress levels by externally compressing the tumor with an inflatable balloon. The results show that increasing the externally applied compression results in increased mechanical properties and tumor pressure and decreased perfusion. These results suggest that elevated tumor pressure can be explained by solid stress rather than fluid pressure.

1070	8:36	Multi-Excitation MRE in Aging Human Brain
		Aaron T Anderson[1,2], Curtis L Johnson[3], Tracey M Wszalek[2], Bradley P Sutton[2,4], Elijah EW Van Houten[5], and John G Georgiadis[6]
		[1]Mechanical Science & Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [2]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [3]Biomedical Engineering, University of Delaware, Newark, DE, United States, [4]Bioengineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [5]Département de génie mécanique, Université de Sherbrooke, Sherbrooke, QC, Canada, [6]Biomedical Engineering, Illinois Institute of Technology, Chicago, IL, United States
		The adult aging process affects human brains in different ways and becomes more prone to neurodegenerative diseases. MRE has shown it's sensitivity to both changes within healthy brains and identifying biomarkers in diseased brains. This study builds on previous MRE aging research and adds higher-resolution, full-coverage MRE imaging and the ability to identify tissue anisotropy, or lack thereof, with the multi-excitation experiment. We were able to identify important anisotropic differences in the loss modulus for some white matter (WM) regions within the young group and a loss of group-level anisotropy in the select WM regions in the older group.

1071	8:48	Hemispheric specialisation of hippocampal viscoelasticity for memory performance in healthy older adults
		Lucy V Hiscox[1,2], Curtis L Johnson[3], Matthew DJ McGarry[4], Hillary Schwarb[5], Edwin JR van Beek[2], Neil Roberts[2], and John M Starr[1]
		[1]Alzheimer Scotland Dementia Research Centre, University of Edinburgh, Edinburgh, United Kingdom, [2]Edinburgh Imaging Facility, QMRI, University of Edinburgh, Edinburgh, United Kingdom, [3]Department of Biomedical Engineering, University of Delaware, Newark, DE, United States, [4]Thayer School of Engineering, Dartmouth College, Hanover, NH, United States, [5]Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, United States

		MR Elastography of the hippocampus has been associated with memory performance in young adults and thus may have potential as a novel imaging biomarker for Alzheimer's disease (AD). In healthy older-adults, hippocampal damping ratio ξ was significantly associated with performance on a verbal memory task. Due to greater hippocampal atrophy present in older populations, the contributions of voxels containing CSF were analysed. Stronger correlations with memory were found once CSF voxels were excluded, and when the left hippocampus was analysed separately. MRE of the hippocampus may be a sensitive marker for detecting early pathological changes in patients with AD.

1072	9:00	In Vivo Characterization of 3D Skull and Brain Motion using MR Elastography with Multi-Excitation Head Driver
		Ziying Yin[1], Yi Sui[1], Joshua D Trzasko[1], Phillip J Rossman[1], Armando Manduca[1], Richard L Ehman[1], and John Huston III[1]
		[1]Radiology, Mayo clinic, Rochester, MN, United States
		Characterization of skull-brain interactions during applied motion is essential to understanding the mechanics of traumatic brain injury. In this study, MR elastography was performed on volunteers to study *in vivo* skull-brain motion responding to different vibrational directions using a multi-excitation driver. With novel dual-saturation imaging and dual-sensitivity motion encoding schemes, we directly measured relative skull-brain displacement on a voxel basis. Our results show that the skull-brain interface tends to significantly attenuate and delay rotational motion compared to translational motion. In slip interface imaging, the skull-brain slip interface is not completely evident, and the slip pattern is spatially heterogeneous.

1073	9:12	Ultra-Fast 4D MR Elastography using Down-Stream Echoes
		Christian Guenthner[1], Sweta Sethi[2], Ayse Sila Dokumaci[3], Ralph Sinkus[3], and Sebastian Kozerke[1]
		[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland, [2]Division of Research Oncology, Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom, [3]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom
		We propose the readout of the lowest order SSFP echo also referred to as down-stream echo of a phase-locked, spoiled SSFP sequence and utilize the unbalanced gradient moment as a highly efficient motion encoding gradient for ultra-fast MRE and demonstrate its feasibility for rapid breast MRE.

1074	9:24	In Vivo MR Elastography in Abdominal Aortic Aneurysm Porcine Model: A Comparison to Burst Testing and Mechanical Testing
		Huiming Dong[1,2], Matthew Joseph[3], Alan Litsky[2], Xiaokui Mo[4], Prateek Kalra[1], Richard White[1], and Arunark Kolipaka[1]

		[1]Department of Radiology, The Ohio State University Wexner Medical Center, Columbus, OH, United States, [2]Department of Biomedical Engineering, The Ohio State University, Columbus, OH, United States, [3]Dorothy M. Davis Heart and Lung Research Institute Interventional Cardiology Catheterization Core Lab, The Ohio State University Wexner Medical Center, Columbus, OH, United States, [4]Center for Biostatistics, The Ohio State University, Columbus, OH, United States
		Abdominal aortic aneurysm (AAA) can result in death due to rupture. Aortic stiffness is an important biomechanical property that can potentially provide accurate rupture risk evaluation. MR elastography (MRE) is a non-invasive technique to estimate aortic stiffness and has not been validated. Therefore, the aim of this study is to use in vivo aortic MRE to estimate aortic stiffness in AAA-induced animal models, and compare it with mechanical testing as well as burst testing. Results demonstrated that aortic stiffness was significantly higher in AAA when compared to normal aorta, while bursting pressure and peak stress was significantly lower in AAA.

1075	9:36	Respiratory-triggered (RT) spin-echo echo-planar imaging (SE-EPI) based MR Elastography (MRE)
		Hui Wang[1], Jean Tkach[2], Tom Cull[3], Andrew Trout[2], Charles Dumoulin[2], and Jonathan R. Dillman[2]
		[1]Philips, Cincinnati, OH, United States, [2]Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [3]Philips, Wickliffe, OH, United States
		In this work, we describe the development of respiratory-triggered (RT) SE-EPI MR elastography (MRE) and its validation with respect to breath-hold (BH) SE-EPI MRE in adult volunteer subjects.

1076	9:48	Usage of Octahedral Shear Strain Weights in the Inversion of Multifrequency MR Elastography
		Cemre Ariyurek[1,2], Bilal Tasdelen[1,2], Eric Barnhill[3], Arif Sanli Ergun[4], Yusuf Ziya Ider[1], and Ergin Atalar[1,2]
		[1]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey, [2]National Magnetic Resonance Research Center (UMRAM), Ankara, Turkey, [3]Radiological Sciences, Charité - Universitätsmedizin Berlin, Berlin, Germany, [4]Department of Electrical and Electronics Engineering, TOBB-University of Economics and Technology, Ankara, Turkey
		Multifrequency MR elastography (MMRE) is useful for compensating the influence of amplitude nulls on the elastogram by combining computations at different frequencies by amplitude-weighted averaging or directly without using weights. Previously, it was shown that strain-SNR measures the quality of the data for reconstructing accurate elastography maps. Therefore, using octahedral shear strain (OSS) weights may lead to more accurate elastograms. In this study, k-MDEV and multifrequency Helmholtz inversion have been used. Including OSS-weights in the inversions yielded more reliable elastograms for simulation and experiment phantom. Furthermore, elastograms in higher resolution were obtained for the brain model and human brain data.

Oral

Thoracic MRI: Lung & Mediastinum

W05/06	Thursday 8:00 - 10:00	*Moderators:* Simon Veldhoen & Yoshiharu Ohno

1077	8:00	Motion-resolved UTE based Pulmonary Quantitative Susceptibility Mapping
		Xucheng Zhu[1,2], Hongjiang Wei[3], Kevin M. Johnson[4,5], Scott K. Nagle[4,5], Wenwen Jiang[6], Joseph Cheng[7], Shreyas S. Vasanawala[7], Michael Lustig[3], Chunlei Liu[3], and Peder E.Z. Larson[1,2]
		[1]Bioengineering, UCSF&UC Berkeley, San Francisco, CA, United States, [2]Department of Radiology and Biomedical Imaging, UCSF, San Francisco, CA, United States, [3]Department of Electrical Engineering and Computer Sciences, UC Berkeley, Berkeley, CA, United States, [4]Department of Medical Physics, University of Wisconsin, Madison, Madison, WI, United States, [5]Department of Radiology, University of Wisconsin, Madison, Madison, WI, United States, [6]Heartvista Inc., Los Altos, CA, United States, [7]Department of Radiology, Stanford University, Stanford, CA, United States
		Pulmonary MRI is challenging due to many factors, such as short T2* relaxation time and respiratory motion corruption. However, the large susceptibility differences in the lungs from blood oxygenation and O_2 content might provide more information related to pulmonary function. In this work, we combined ultra-short TE(UTE) acquisition, quantitative susceptibility mapping(QSM), and motion-resolved reconstruction techniques together to look at the susceptibility contrast in the lung and changes in different motion states. According to the results, this technique provides extra contrast information compared to traditional intensity images, and shows susceptibility changing of lung in different respiration states.

1078	8:12	Repeatability of ventilation and perfusion impairment assessed with matrix pencil decomposition MRI and lung function in children with cystic fibrosis
		Grzegorz Bauman[1,2], Sylvia Nyilas[3], Orso Pusterla[1,2], Enno Stranzinger[4], Kathryn Ramsey[3], Florian Singer[3], Sophie Yammine[3], Carmen Casaulta[3], Philipp Latzin[3], and Oliver Bieri[1,2]
		[1]Division of Radiological Physics, Department of Radiology, University of Basel Hospital, Basel, Switzerland, [2]Department of Biomedical Engineering, University of Basel, Basel, Switzerland, [3]Pediatric Respiratory Medicine, Department of Pediatrics, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland, [4]Departement of Diagnostic, Interventional and Paediatric Radiology, Inselspital, University Hospital Bern, Bern, Switzerland
		This study examines the repeatability of functional lung MRI using matrix pencil decomposition and lung function tests with multiple breath washout technique in children with cystic fibrosis and age-matched healthy controls. We found a good degree of the agreement between outcomes measured on two consecutive days in both groups. Furthermore, a strong correlation between functional MRI and global ventilation inhomogeneity index from multiple breath washout was observed. The results of this study highlight the potential of matrix pencil decomposition MRI for the assessment of disease progression in cystic fibrosis

1079	8:24	Imaging-Based Spirometry in Chronic Obstructive Pulmonary Disease (COPD) Patients using Phase Resolved Functional Lung Imaging (PREFUL)
		Andreas Voskrebenzev[1,2], Filip Klimeš[1,2], Marcel Gutberlet[1,2], Till Kaireit[1,2], Christian Schönfeld[1,2], Julius Renne[1,2], Heike Biller[2,3], Jens Hohlfeld[2,3], Frank Wacker[1,2], and Jens Vogel-Claussen[1,2]
		[1]Institute of Diagnostic and Interventional Radiology, Hannover Medical School, Hanover, Germany, [2]Biomedical Research in Endstage and Obstructive Lung Disease Hannover (BREATH), German Center for Lung Research (DZL), Hanover, Germany, [3]Clinical Airway Research, Fraunhofer Institute of Toxicology and Experimental Medicine, Hanover, Germany
		Recently, an alternative proton lung MRI Fourier Decomposition (FD) method for phase resolved functional lung imaging (PREFUL) was proposed. Using a sine model, respiratory and cardiac cycles with increased temporal resolution are obtained, enabling the assessment of dynamic parameters. Similar to flow-volume loops in spirometry, the regional ventilation can be quantified in terms of fractional ventilation (FV) loops. In this study the FV loops of six healthy volunteers and 16 chronic obstructive pulmonary disease patients are evaluated. As a metric the cross-correlation to a healthy reference is used. The results suggest potential benefits for early detection or treatment monitoring.

1080	8:36	Pulmonary MRI Measurements of Ventilation Heterogeneity in Obstructive Lung Disease: Relationship to Oscillometry, Quality of Life and Disease Control
		Heather M Young[1,2], Fumin Guo[1,3], Rachel L Eddy[1,2], Geoffrey N Maksym[4], and Grace Parraga[1,2]
		[1]Robarts Research Institute, London, ON, Canada, [2]Medical Biophysics, Western University, London, ON, Canada, [3]Graduate Program in Biomedical Engineering, Western University, London, ON, Canada, [4]School of Biomedical Engineering, Dalhousie University, London, ON, Canada
		We measured ventilation heterogeneity in 100 patients (50 asthma, 50 COPD) with hyperpolarized ^{3}He MRI, oscillometry and quality-of-life questionnaires. We showed that MRI-measured ventilation heterogeneity is significantly related to FOT-measured small airways resistance and worsened quality-of-life for asthma and COPD patients. We also showed that MRI-measured ventilation heterogeneity is significantly increased in asthmatic patients with poor disease control. This study directly demonstrates the relationships between ^{3}He MRI ventilation heterogeneity with small airway dysfunction and patient quality-of-life.

1081	8:48	Altered Right-Heart 3D Blood Flow and Kinetic Energy in Chronic Obstructive Pulmonary Disease. The MESA COPD Study
		Haben Berhane[1], Ozair Rahman[2], Pallavi Balte[3], Kenichiro Suwa[2], Stephen Dashnaw[3], David A. Bluemke[4], Martin R. Prince[5,6], Bharath Venkatesh[7], Joao Lima[7], James Carr[2], Antoinette S. Gomes[8], Karol Watson[8], Cynthia Rigsby[1], R. Graham Barr[3], and Michael Markl[2]

		[1]Department of Medical Imaging, Lurie Children's Hospital, Chicago, IL, United States, [2]Department of Radiology, Northwestern University, Chicago, IL, United States, [3]Department of Medicine and Epidemiology, Columbia University, New York, NY, United States, [4]Department of Radiology, University of Wisconsin School of Medicine and Public Health, Madison, WI, United States, [5]Department of Radiology, Weill Cornell Medical College, New York, NY, United States, [6]Department of Radiology, Columbia College of Physicians and Surgeons, New York, NY, United States, [7]Division of Cardiology, John Hopkins University, Baltimore, MD, United States, [8]Department of Medicine, UCLA, Los Angeles, CA, United States
		Chronic Obstructive Pulmonary Disease (COPD) affects over 65 million people worldwide and is the third leading cause of death in the US. The aim of this feasibility study was to employ 4D-flow MRI for the comprehensive assessment of the effects of COPD on right-sided hemodynamics. Measures of blood kinetic energy (KE) were used to quantify hemodynamic changes in COPD patients compared to controls. Findings showed a significant increase in KE in the right atrium across increasing categories of COPD severity. Right-sided 4D flow MRI maybe a promising tool for the detection of hemodynamic disruptions in COPD and other vasoconstrictive diseases.

1082	9:00	A Technique for Quantitatively Measuring Gas Uptake in the Lung and its Distribution to the Kidneys Using Hyperpolarized Xenon-129 MR Imaging
		Hooman Hamedani[1], Stephen Kadlecek[1], Kai Ruppert[1], Yi Xin[1], Mehrdad Pourfathi[1], Sarmad Siddiqui[1], Faraz Amzajerdian[1], Luis Loza[1], Harrilla Profka[1], Ryan Baron[1], Tahmina Achekzai[1], Shampa Chatterjee[2], Maurizio Cereda[3], and Rahim R. Rizi[1]
		[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Physiology, University of Pennsylvania, Philadelphia, PA, United States, [3]Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, PA, United States
		Hyperpolarized ^{129}Xe was used before to image lung function and structure. It was also shown to be a very good marker of oxygen diffusion and uptake from the lung, and a surrogate for alveolar wall thickness. Here, we demonstrated a technique for quantitatively measuring gas uptake in the lung and its distribution to the kidney and calculate the arrival time of the gas to the kidneys. Appropriate acquisition parameters will enable the same technique to be used to measure the gas' arrival at the heart, specific vasculature, or other organs/tissue as appropriate to specific disease states.

1083	9:12	Hyperpolarised gas MRI shows a decrease in lung ventilation defects at increased inspiratory lung volumes in Cystic Fibrosis
		Laurie Smith[1,2], Paul J.C. Hughes[1], Helen Marshall[1], Guilhem Collier[1], Noreen West[2], Alex Horsley[3], and Jim Wild[1]
		[1]POLARIS, Academic Radiology, University of Sheffield, Sheffield, United Kingdom, [2]Sheffield Children's Hospital NHS Foundation Trust, Sheffield, United Kingdom, [3]University of Manchester, Manchester, United Kingdom

		The effect of lung inflation level on ventilation defects, using hyperpolarised (HP) gas ventilation MRI, has not been assessed. The most commonly adopted method of inhaling a volume of 1L from functional residual capacity (FRC) will result in a lung volume closer to total lung capacity (TLC) for smaller people, compared with taller people. We assessed HP-MRI in 21 people with cystic fibrosis at both end inspiratory tidal volume (EIVt) and at TLC. Ventilation defects decreased in all subjects at TLC when compared to EIVt and therefore the inspiratory volume should be carefully considered when interpreting ventilation-imaging results.

1084	9:24	Quantification of gas concentration and fractional ventilation using high temporal resolution MRI of pulmonary fluorinated (19F) gas washin dynamics in free breathing
		Marcel Gutberlet[1,2], Arnd Obert[1,2], Andreas Voskrebenzev[1,2], Filip Klimes[1,2], Frank Wacker[1,2], and Jens Vogel-Claussen[1,2]
		[1]Institute of Diagnostic and Interventional Radiology, Hannover Medical School, Hannover, Germany, [2]Biomedical Research in Endstage and Obstructive Lung Disease Hannover (BREATH), Member of the German Center for Lung Research, Hannover, Germany
		^{19}F gas washin/ washout MRI allows quantification of regional lung ventilation in free breathing even in obstructed lungs. By increasing the temporal and spatial resolution of dynamic ^{19}F gas MRI at adequate image quality lung ventilation imaging was improved. In addition to measuring regional gas washin/ washout times, gas density variations during breathing were determined, giving further information of gas dynamics and therefore lung function. Additionally, the concentration of the fluorinated gas tracer and therefore its distribution in the lung was quantified. The new approaches were tested in a healthy volunteer and a COPD patient.

1085	9:36	Comparing ^{19}F C_3F_8 Lung Ventilation Imaging with Hyperpolarized ^{129}Xe: Similarities and Limitations
		Adam Maunder[1], Paul J.C. Hughes[1], Ho-Fung Chan[1], Graham Norquay[1], Guilhem Collier[1], Oliver Rodgers[1], Fraser Robb[1,2], Madhwesha Rao[1], and Jim Wild[1]
		[1]POLARIS, Academic Radiology, University of Sheffield, Sheffield, United Kingdom, [2]GE Healthcare Inc., Aurora, OH, United States
		Fluorinated gases are a cheaper alternative to hyperpolarized gas for lung ventilation imaging. However, lower resolution images are necessitated by the inherently smaller MR signal from ^{19}F. Within this study we determine the feasibility of using C_3F_8 for lung ventilation imaging by comparing quantitative metrics of lung function obtained from ventilation images of ^{19}F with those obtained from ventilation images of hyperpolarized ^{129}Xe. A reproducibly lowered coefficient of variation distribution was observed due to lower resolution of ^{19}F imaging. However, ventilation images acquired with ^{19}F were of comparable SNR to those using ^{129}Xe.

1086	9:48	Dynamic 3D Isotropic Resolution Imaging of Human Lungs Using Oxygen-enhanced Radial UTE MRI

		Wei Zha[1], Robert V Cadman[1], Andrew D Hahn[1], Kevin M Johnson[1,2], and Sean B Fain[1,2,3]
		[1]Medical Physics, University of Wisconsin-Madison, Madison, WI, United States, [2]Radiology, University of Wisconsin-Madison, Madison, WI, United States, [3]Biomedical Engineering, University of Wisconsin-Madison, Madison, WI, United States
		Oxygen-enhanced 3D radial UTE MRI (UTE OE-MRI) has the potential for dynamic imaging of oxygen wash-in and wash-out in the lungs with isotropic resolution and full chest coverage. Four normal subjects underwent DESPOT1 and ~13-min dynamic OE-MRI using 3D radial UTE MRI. Temporal variations in median percent signal enhancement (MPSE) strongly correlated (p<0.0001) in the lungs and aorta. Wash-in (0.61±0.13 min) and wash-out (0.30±0.18 min) time constants for partial pressure of oxygen (ΔPO_2) time curves are comparable to values in the literature. This study shows feasibility for dynamic imaging with whole lung coverage and isotropic spatial resolution for clinical research.

Study Groups

Pediatric MR Business Meeting

W07	Thursday 9:00 - 10:00	*(no CME credit)*

Plenary Session

High-End MRI: Added Value vs. Added Science

Organizers: Elena Kaye, Anke Henning, Jenny Bencardino, Alex MacKay

Plenary Hall (Paris Room)	Thursday 11:15 - 12:15	*Moderators:* Anke Henning & Elena Kaye

11:15	High-End MRI: Added Value
	Siegfried Trattnig[1]
	[1]Medical University of Vienna, Austria

11:35	High-End MRI: Added Science
	Peter Jezzard[1]
	[1]FMRIB Centre, University of Oxford, United Kingdom

11:55	A Case Study: Interventional MRI: Prostate cancer diagnosis
	Clare Tempany-Afdhal[1]
	[1]Brigham & Women's Hosp. Prof. of Rad., United States

12:15	Adjournment

Oral

Special Session: Highlights of the Joint Annual Meeting ISMRM-ESMRMB

Plenary Hall (Paris Room)	Thursday 11:15 - 11:45	*Moderators:* Julien Cohen-Adad & Jessica Dubois

1087	11:15	Creatine kinase energy supply correlates with mechanical work and efficiency in healthy and failing human heart: a combined noninvasive MRI/MRS study
		Refaat E Gabr[1,2], AbdEl-Monem M El-Sharkawy[1,3], Michael Schär[1], Gary Gerstenblith[4], Robert G Weiss[4], and Paul A Bottomley[1]
		[1]Division of MR Research, Department of Radiology, The Johns Hopkins University, Baltimore, MD, United States, [2]Department of Diagnostic and Interventional Imaging, University of Texas Health Science Center at Houston, Houston, TX, United States, [3]Systems and Biomedical Engineering, Faculty of Engineering, Cairo University, Cairo, Egypt, [4]Department of Cardiology, The Johns Hopkins University, Baltimore, MD, United States
		It is hypothesized that chemical energy supply is insufficient to fuel normal mechanical pump function in heart failure (HF). To test whether reduced function correlates with reduced energy supply, we used magnetic resonance spectroscopy and imaging to measure adenosine triphosphate (ATP) synthesis via the creatine kinase reaction–the heart's primary reserve–and cardiac mechanical stroke work in 14 healthy subjects and 27 patients with mild-to-moderate HF. We found significantly reduced cardiac creatine kinase flux that correlated with peak and average stroke work rates and with mechanical efficiency. These first noninvasive findings are consistent with the energy deprivation hypothesis of HF.

1088	11:21	Metabolomic Evaluations of Human Prostate Tissue from mp-MRI/US Fusion Biopsy
		Lindsey A. Vandergrift[1], Taylor L. Fuss[1], Yannick Berker[1], Shulin Wu[1], Chris Dietz[1,2], Felix Ehret[1,2], Sarah S. Dinges[1,3], Edouard Nicaise[4], Piet Habbel[3], Johannes Nowak[2], Chin-Lee Wu[1], Adam Feldman[4], and Leo L. Cheng[1]

		[1]Pathology, Massachusetts General Hospital, Charlestown, MA, United States, [2]Radiology, University of Wurzburg, Wurzburg, Germany, [3]Oncology, Charite Medical University, Berlin, Germany, [4]Urology, Massachusetts General Hospital, Boston, MA, United States
		Heterogeneity and clinical insignificance of prostate cancer (PCa) lesions challenges diagnosis and management. Introduction of the multi-parameter (mp)-MRI/ultrasound fusion-guided biopsy increased detection of clinically significant cancer. Prostate MRI lesions receive a PI-RADS score based on likelihood of being cancer-positive. Fusing MRI images with live ultrasound guides biopsy from the targeted area. Previously, PI-RADS score has been correlated with clinical significance of cancer and morphological variations in PCa lesions. We studied PI-RADS score according to tissue MRS-based metabolomics. Metabolic differences between Target and Non-target cores, regardless if Targets were cancer-positive, support the assumption that targeted areas fundamentally differ from non-targeted areas.

1089	11:27	In vivo MRI detection of early β-amyloid pathologies targeted by curcumin-conjugated magnetic nanoparticles
		Celia M. Dong[1,2], Anthea To[1,2], Eddie C. Wong[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China
		Early state β-amyloid oligomers (AβOs) and late stage Aβ plaques are the pathological hallmarks of Alzheimer's disease (AD) brains, and they can be targeted by curcumin. We have recently designed and synthesized a new curcumin-conjugated magnetic nanoparticles (Cur-MNPs) to target these Aβ pathologies. In this study, we aimed to assess this novel Cur-MNPs based MRI contrast agent for its in vivo ability to detect and visualize the Aβ pathologies during both very early and late stage of AD progression in AD mouse models.

1090	11:33	Tensor-valued diffusion MRI in under 3 minutes: An initial survey of microscopic anisotropy and tissue heterogeneity in four brain tumor types
		Markus Nilsson[1], Filip Szczepankiewicz[1,2], Carl-Fredrik Westin[3], Alexandra Golby[3], Danielle van Westen[1], and Pia C Sundgren[1]
		[1]Clinical Sciences Lund, Radiology, Lund University, Lund, Sweden, [2]Random Walk Imaging, Lund, Sweden, [3]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States
		Microscopic diffusion anisotropy and tissue heterogeneity are two independent features of tumor microstructure that can be probed by diffusion MRI but only by using so-called b-tensor encoding. These independent features reflect cell shapes and cell density variance in tumors. Here, we demonstrate high-quality maps of these features, derived from data acquired in only 3 minutes, in patients with various brain tumor histologies. Several remarkable features were observed which suggest that the maps may contribute valuable diagnostic information, in particular since the features vary both within and between tumors.

1091	11:39	Variational Adversarial Networks for Accelerated MR Image Reconstruction
		Kerstin Hammernik[1,2], Erich Kobler[1], Thomas Pock[1,3], Michael P Recht[2], Daniel K Sodickson[2], and Florian Knoll[2] *[1]Institute of Computer Graphics and Vision, Graz University of Technology, Graz, Austria, [2]Center for Biomedical Imaging, New York University School of Medicine, New York, NY, United States, [3]Safety & Security Department, AIT Austrian Institute of Technology GmbH, Vienna, Austria*
		Inspired by variational networks and adversarial training, we introduce variational adversarial networks for accelerated MR image reconstruction to overcome typical limitations of using simple image quality measures as loss functions for training. While simple loss functions, such as mean-squared-error and structural similarity index, result in low resolution and blurry images, we show that the proposed variational adversarial network leads to sharper images and preserves fine details for clinical low and high SNR patient data.

Event

Silver Corporate Symposium: Canon Medical Systems Corporation

Plenary Hall (Paris Room)	Thursday 12:00 - 13:00	*(no CME credit)*

Traditional Poster: Cardiovascular

Exhibition Hall 2896-2923	Thursday 13:15 - 15:15	*(no CME credit)*

Traditional Poster: Molecular Imaging

Exhibition Hall 3020-3032	Thursday 13:15 - 15:15	*(no CME credit)*

Electronic Poster: fMRI

Exhibition Hall	Thursday 13:15 - 14:15	*(no CME credit)*

Electronic Poster: Contrast Mechanisms

Exhibition Hall	Thursday 13:15 - 15:15	*(no CME credit)*

Study Groups

Musculoskeletal MR Business Meeting

W07	Thursday 13:15 - 14:15	*(no CME credit)*

Member-Initiated Symposium

From Ultrahigh- to Extreme-Field MR: Where Physics, Engineering, Physiology & Medicine Meet

Organizers: Thoralf Niendorf, Nicola De Zanche, Cornelis van den Berg

N04	Thursday 13:15 - 15:15	*Moderators:* Thoralf Niendorf & Nicola De Zanche	*(no CME credit)*

	13:15	Insights from 7.0 T MRI in a Clinical Environment: The User's View
		Karin Markenroth Bloch[1]
		[1]Lund University Bioimaging Center, Lund University, Lund, Sweden

	13:32	Clinical Applications of 7.0 T MRI & the Inescapable Attraction of Even Higher Fields: The Clinician's View
		Anja Gwendolyn van der Kolk[1]
		[1]University Medical Center Utrecht, Netherlands

	13:49	Parallel Transmission at 10.5 T: The MR Physics Perspective
		Xiaoping Wu

	14:06	How to Build a 11.7 T Class Human Brain MR System: The Engineering Insights
		Denis Le Bihan[1]
		[1]CEA Neurospin, France

	14:23	Magnet Design for 14.0 T & 20.0 T Class Human MR Scanners: The Engineering Angle
		Mark Bird

	14:40	RF Coil Concepts & RF Power Deposition Considerations for Human MR at 23.5 T
		Eva Oberacker[1]
		[1]Berlin Ultrahigh Field Facility (B.U.F.F.), Max Delbrueck Center for Molecular Medicine, Berlin, Germany

	14:57	Implant Safety on the Ultrahigh Field Frontier: Is It a Rodeo Ride?
		Andrew Webb

Member-Initiated Symposium

Moving from Preclinical to Clinical Applications of Hyperpolarised MRI: Successes & Challenges

Organizers: Arnaud Comment, Bastiaan Driehuys, Christoffer Laustsen

W03/04	Thursday 13:15 - 15:15	*(no CME credit)*

	13:15	Multisite Clinical Trials with Hyperpolarized X-Nuclei: 129Xe Leads the Way
		Sarah Svenningsen[1]
		[1]McMaster University, Hamilton, ON, Canada

	13:37	Moving to Clinical Applications of Hyperpolarized Gas MRI: Successes & Challenges
		Jim Wild[1]
		[1]University of Sheffield

	13:59	On the Challenges to Translate Preclinical HP 13C Models to Clinical Applications
		Kayvan Keshari[1]
		[1]MSKCC, NY, United States

	14:21	The Challenges of Directly Developing Hyperpolarized 13C MRI in a Clinical Environment
		Shonit Punawi

	14:43	Panel Discussion

Weekday Course

Quantitative Imaging: How to Get Started

Organizers: Dong-Hyun Kim, Joshua Trzasko

N02	Thursday 13:15 - 15:15	*Moderators:* Dong-Hyun Kim & Joshua Trzasko

	13:15	What Is Quantitative Imaging?
		Kyung Sung[1]
		[1]Radiological Sciences, University of California, Los Angeles, Los Angeles, CA, United States

	13:55	Walk-Through
		Kathryn Keenan[1]
		[1]NIST, United States
		This talk will present how to use and pick a phantom for specific applications, how the phantom can identify possible pitfalls or sources of error, and how to perform reproducibility and reliability studies.

	14:35	Quantitative relaxation time measurements in MSK: Clinical use and quality control
		Siegfried Trattnig[1]
		[1]Medical University of Vienna, Austria

	Quantitative MRI provides information that is intrinsically more tissue-specific and less dependent on subjective visual assessment. The quantitative data can also be postprocessed such as segmentation based on biophysical properties and anatomy, distribution histograms, and synthetic MR images. In clinical applications T1 and T2 mapping offer early diagnosis of disease and a predictive marker for outcome. T1 mapping has become part of a routine cardiac MR imaging protocol. However many factors can cause systematic errors that can compromise the accuracy of the T1 and T2 maps and a high variability of relaxation times in different tissues has been reported.

	15:15	Adjournment & Meet the Teachers

Weekday Course

Lung Imaging

Organizers: Kathryn Fowler, Catherine Hines, Kartik Jhaveri, Lorenzo Mannelli, Valeria Panebianco, Scott Reeder, Reiko Woodhams

S01	Thursday 13:15 - 15:15	*Moderators:* Chi Wan Koo

	Hyperpolarized Gas: Clinical Applications or No?
	Edwin J.R. van Beek[1]
	[1]Edinburgh Imaging, University of Edinburgh, Edinburgh, United Kingdom
13:15	Hyperpolarized gas MR imaging has shown promising results since its first evaluations began in the mid 1990s. However, after implementation of hyperpolarized 3-He MRI was showing of interest, conflicts with other fields requiring this gas made long-term application and translation impossible. This has driven developments of 129-Xe MRI as an alternative, and following hardware, polarization and sequence changes, this method is now surging in applications and is being used for a variety of pathophysiological processes (that even go beyond the lung). This presentation will highlight some of the latest developments and will offer a glimpse at the future of hyperpolarized 129-Xe MRI.

13:45	MRI for Stratifying Pulmonary Vascular Disease
	Christopher J François[1]
	[1]Radiology, University of Wisconsin-Madison, Madison, WI, United States

		This presentation will review the role of pulmonary MRA and cardiac MRI in the diagnosis and management of patients with pulmonary vascular disease. The primary focus will be on the identification of the signs of pulmonary hypertension on MRA and the findings of right ventricle dysfunction in patients with pulmonary vascular disease.

	14:15	MRI for Pulmonary Parenchymal Disease (COPD, IPF)
		Jens Vogel-Claussen[1]
		[1]Medizinische Hochschule Hannover, Germany
		Chronic obstructive pulmonary disease (COPD) and interstitial pulmonary fibrosis (IPF) are heterogeneous diseases with different features and phenotypes. Accordingly, one goal is the development of ways to identify regional lung structure and function in these patients to improve patient care and outcomes. Although forced vital capacity is validated for the assessment of COPD and IPF progression and prediction of mortality, the need for tests that are more sensitive to pathophysiological change in the lungs is well recognized for earlier diagnosis, longitudinal assessment and for better markers of therapy and prognosis.

	14:45	Oxygen-Enhanced MRI: Ready for Clinical Use?
		Yoshiharu Ohno[1,2]
		[1]Division of Functional and Diagnostic Imaging Research, Department of Radiology, Kobe Univ. Grad. Sch. of Med., Kobe, Japan, [2]Advanced Biomedical Imaging Research Center, Kobe University Graduate School of Medicine, Kobe, Japan
		In this lecture, I present 1) theory of oxygen-enhancement; 2) clinical study results; and 3) future direction and new technique for oxygen-enhanced MR imaging.

	15:15	Adjournment & Meet the Teachers

Power Pitch

Pitch: Tissue Microstructure

Power Pitch Theater A - Exhibition Hall	Thursday 13:15 - 14:15	*Moderators:* Sune Jespersen & Clémence Ligneul	*(no CME credit)*

1092	13:15	Probing microstructure with different tomographic methods: Comparing dMRI and X-ray scattering-derived parameters in mouse and human brains
		Marios Georgiadis[1,2], Dmitry S. Novikov[1], Manuel Guizar-Sicairos[3], Marianne Liebi[3,4], Vivianne Lutz-Bueno[3], Benjamin Ades-Aron[1], Timothy M. Shepherd[1], Aileen Schroeter[2], Markus Rudin[2], and Els Fieremans[1]
		[1]NYU Langone Medical Center, New York, NY, United States, [2]ETH Zurich, Zurich, Switzerland, [3]Paul Scherrer Institute, Villigen, Switzerland, [4]Chalmers University of Technology, Gothenburg, Sweden

1093	13:15	Diffusion-time dependence of diffusional kurtosis in the mouse brain using pulsed and oscillating gradients
		Manisha Aggarwal[1], Kyle Martin[2], Matthew Smith[2], and Peter Calabresi[2]
		[1]Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, United States

1094	13:15	Biophysical modeling of the gray matter: does the “stick” model hold?
		Jelle Veraart[1], Els Fieremans[1], Umesh Rudrapatna[2], Derek K Jones[2], and Dmitry S Novikov[1]
		[1]Center for Biomedical Imaging, NYU School of Medicine, New York, NY, United States, [2]CUBRIC, Cardiff University, Cardiff, United Kingdom

1095	13:15	Mean lung alveolar dimension mapping with hyperpolarized 3He and 129Xe diffusion-weighted MRI
		Ho-Fung Chan[1], Guilhem J. Collier[1], and Jim M. Wild[1]
		[1]Academic Unit of Radiology, University of Sheffield, Sheffield, United Kingdom

1096	13:15	A compartment based model for non-invasive cell body imaging by diffusion MRI
		Marco Palombo[1], Noam Shemesh[2], Andrada Ianus[1,2], Daniel C. Alexander[1], and Hui Zhang[1]
		[1]Computer Science Department and Centre for Medical Imaging Computing, University College London, London, United Kingdom, [2]Champalimaud Neuroscience Programme, Champalimaud Centre for the Unknown, Lisbon, Portugal

1097	13:15	GPU-based Monte-Carlo simulation of diffusion in astrocytes reconstructed from confocal microscopy
		Khieu Van NGUYEN[1], Edwin Hernandez Garzon[1], and Julien Valette[1]
		[1]Molecular Imaging Research Center (MIRCen), Commissariat à l'Energie Atomique, Fontenay-aux-Roses, France, Fontenay aux Roses, France

1098	13:15	What is the feasibility of estimating axonal conduction velocity from in vivo microstructural MRI?
		Mark Drakesmith[1] and Derek K Jones[1]
		[1]CUBRIC, Cardiff University, Cardiff, United Kingdom

1099	13:15	Measurement of Intra-Axonal Water Diffusivity in Normal Human White Matter
		Bibek Dhital[1], Marco Reisert[1], Elias Kellner[1], and Valerij G. Kiselev[1]
		[1]Clinic for Radiology, Medical Physics, Faculty of Medicine, Medical Center - University of Freiburg, Germany, Freiburg, Germany

1100	13:15	Accurate Estimation of Microscopic Diffusion Anisotropy Using Multi-shell Double Diffusion Encoding
		Andrada Ianus[1,2], Sune N. Jespersen[3,4], Ivana Drobnjak[2], and Noam Shemesh[1]
		[1]Champalimaud Neuroscience Programme, Champalimaud Centre for the Unknown, Lisbon, Portugal, [2]Centre for Medical Image Computing, Department of Computer Science, University College London, London, United Kingdom, [3]Center of Functionally Integrative Neuroscience (CFIN), Aarhus University, Aarhus, Denmark, [4]Department of Physics and Astronomy, Aarhus University, Aarhus, Denmark

1101	13:15	From physical chemistry to human brain biology: unconstrained inversion of 5-dimensional diffusion-T2 correlation data
		Chantal M.W. Tax[1], João P. de Almeida Martins[2,3], Filip Szczepankiewicz[3,4], Carl-Fredrik Westin[5], Maxime Chamberland[1], Daniel Topgaard[2], and Derek K Jones[1]

		[1]CUBRIC, School of Psychology, Cardiff University, Cardiff, United Kingdom, [2]Physical Chemistry, Department of Chemistry, Lund University, Lund, Sweden, [3]Random Walk Imaging AB, Lund, Sweden, [4]Clinical sciences, Lund, Lund University, Lund, Sweden, [5]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States

1102	13:15	Echo Time Dependence of Double Diffusion Encoding Measurements of Microscopic Diffusion Anisotropy
		Grant Yang[1,2] and Jennifer McNab[2]
		[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States

1103	13:15	Validity extension of stimulated echoes to imaginary signals arising for double diffusion encoding of closed pores
		Kerstin Demberg[1], Frederik Bernd Laun[2], Peter Bachert[1], and Tristan Anselm Kuder[1]
		[1]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Institute of Radiology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany

1104	13:15	Measurement of diffusion exchange in yeast with Diffusion Exchange Spectroscopy (DEXSY)
		James Olav Breen-Norris[1], Bernard Siow[1,2], Ben Hipwell[1], Thomas A. Roberts[1], Mark F. Lythgoe[1], Andrada Ianus[3], Daniel C. Alexander[3], and Simon Walker-Samuel[1]
		[1]Centre for Advanced Biomedical Imaging, Division of Medicine, UCL, London, United Kingdom, [2]The Francis Crick Institute, London, United Kingdom, [3]Centre for Medical Imaging Computing, Department of Computer Science, UCL, London, United Kingdom

1105	13:15	Differences between treated glioblastoma and metastatic brain neoplasms revealed by non-Gaussian diffusion MRI and 18F-FET-PET
		Farida Grinberg[1,2], Francesco D'Amore[1], Ganna Blazhenets[1], Ezequiel Farrher[1], Karl-Josef Langen[1,3,4], and N. Jon Shah[1,2,4]

		[1]Institute of Neuroscience and Medicine 4, Research Centre Juelich, Juelich, Germany, [2]Department of Neurology, Faculty of Medicine, RWTH Aachen University, Aachen, Germany, [3]Center of Integrated Oncology (CIO), Universities of Cologne and Bonn, Cologne, Germany, [4]JARA - BRAIN - Translational Medicine, RWTH Aachen University, Aachen, Germany

1106	13:15	Simulation of diffusion in axons with harmonic and stochastic trajectories
		Jan Brabec[1], Samo Lasic[2], and Markus Nilsson[1]
		[1]Clinical Sciences Lund, Radiology, Lund University, Lund, Sweden, [2]Random Walk Imaging, Lund, Sweden

Power Pitch

Pitch: Preclinical fMRI: Neuroscience & Emerging Techniques

Power Pitch Theater B - Exhibition Hall	Thursday 13:15 - 14:15	*Moderators:* Alexandra PETIET & Yen-Yu Ian Shih	*(no CME credit)*

1107	13:15	Functional MRI mapping the optogenetic activation of the lateral hypothalamus driven by an MRI-guided robotic arm (MgRA)
		Yi Chen[1,2], Pais Roldán Patricia[1,2], Xuming Chen[1], Michael Frosz[3], and Xin Yu[1,4]
		[1]Research Group of Translational Neuroimaging and Neural Control, High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]Graduate Training Centre of Neuroscience, University of Tuebingen, Tuebingen, Germany, [3]The Max Planck Institute for the Science of Light, Erlangen, Germany, [4]The Werner Reichardt Centre for Integrative Neuroscience, University of Tuebingen, Tuebingen, Germany

1108	13:15	Multi-centre resting-state fMRI comparison reveals common functional networks in the mouse brain.
		Joanes Grandjean[1], Carola Canella[2,3], Cynthia Anckaerts[4], Gülebru Ayranci[5], Ludovico Coletta[2,3], Daniel Gallino[5], Natalia Gass[6], Neele Hübner[7], Silke Kreitz[8], Anna E Mechling[7], Sandra Strobelt[8], Tong Wu[9,10], Isabel Wank[8], Mallar Chakravarty[5,11], Wei-Tang Chang[1], Dominik von Elverfeldt[7], Laura-Adela Harsan[12], Andreas Hess[8], Georgios Keliris[4], Markus Rudin[13,14], Alexander Sartorius[6], Tianzi Jiang[9,15,16], Annemie Van der Linden[4], Marleen Verhoye[4], Wolfgang Weber-Fahr[6], Nicole Wenderoth[17], Valerio Zerbi[17], and Alessandro Gozzi[2]

		[1]Singapore Bioimaging Consoritum, Agency for Science, Technology and Research, Singapre, Singapore, [2]Istituto Italiano di Tecnologia, Center for Neuroscience and Cognitive Systems @ UNITN, Rovereto, Italy, [3]Center for Mind/Brain Sciences, University of Trento, Rovereto, Italy, [4]Department of Biomedical Sciences, University of Antwerp, Antwerp, Belgium, [5]Douglas Mental Health University Institute, McGill University, Montreal, QC, Canada, [6]Central Institute of Mental Health, University of Heidelberg, Mannheim, Germany, [7]Department of Radiology, University of Freiburg, Freiburg, Germany, [8]Institute of Experimental and Clinical Pharmacology and Toxicology, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen, Germany, [9]Queensland Brain Institute, The University of Queensland, Brisbane, Australia, [10]Max Planck University College London Centre for Computational Psychiatry and Ageing Research, University College London, London, United Kingdom, [11]Departments of Psychiatry and Biological and Biomedical Engineering, McGill University, Montreal, QC, Canada, [12]Department of Biophysics and Nuclear Medicine, University Hospital Strasbourg, Strasbourg, France, [13]Institute for Biomedical Engineering, University and ETH Zürich, Zürich, Switzerland, [14]Institute of Pharmacology and Toxicology, University of Zürich, Zürich, Switzerland, [15]Institute of Automation, Chinese Academy of Sciences, Beijing, China, [16]School of Life Science and Technology, University of Electronic Science and Technology of China, Chengdu, China, [17]Department of Health Sciences and Technology, ETH Zürich, Zürich, Switzerland

1109	13:15	Brain-wide functional organization of the hippocampus along the dorsoventral axis: an optogenetic fMRI study
		Russell W. Chan[1,2,3], Eddie C. Wong[1,2], Alex T. L. Leong[1,2], Xunda Wang[1,2], Celia M. Dong[1,2], Karim E. Hallaoui[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China, [3]Neurology and Neurological Sciences, Stanford University, Stanford, CA, United States

1110	13:15	Simultaneous fMRI and Fast-Scan Cyclic Voltammetry: Methodological Considerations and In Vivo Oxygen Measurements
		Lindsay Walton[1], Matthew Verber[2], R. Mark Wightman[2], and Yen-Yu Ian Shih[1]
		[1]Biomedical Research Imaging Center and Department of Neurology, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Chemistry, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States

1111	13:15	Neural activity pattern(s) underlying brain interhemispheric propagation: An optogenetic fMRI study
		Alex T. L. Leong[1,2], Xunda Wang[1,2], Russell W. Chan[1,2], Karim El Hallaoui[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China

1112	13:15	Dynamic Autoregulation in Pharmacological Mouse fMRI Revisited: Abrupt Changes in Systemic Blood Pressure Elicit Significant BOLD Effects in the Murine Brain
		Henning Matthias Reimann[1], Mihail Todiras[2], Erdmann Seeliger[3], Michael Bader[2,4,5], Andreas Pohlmann[1], and Thoralf Niendorf[1,6]
		[1]Berlin Ultrahigh Field Facility (B.U.F.F.), Max Delbrueck Center for Molecular Medicine (MDC) in the Helmholtz Association, Berlin, Germany, [2]Max Delbrueck Center for Molecular Medicine (MDC) in the Helmholtz Association, Berlin, Germany, [3]Institute of Vegetative Physiology, Charité – University Medicine, Berlin, Germany, [4]DZHK (German Centre for Cardiovascular Research), Berlin, Germany, [5]Department of Endocrinology, Charité – University Medicine, Berlin, Germany, [6]Experimental and Clinical Research Center, a joint cooperation between the Charité Medical Faculty and the Max Delbrück Center for Molecular Medicine in the Helmholtz Association, Berlin, Germany
1113	13:15	Focused ultrasound-mediated disruption of the blood-brain barrier for targeted delivery of neurotransmitters to the rat brain
		Nick Todd[1], Yongzhi Zhang[1], Lino Becerra[2], David Borsook[2], Margaret Livingstone[3], and Nathan McDannold[1]
		[1]Brigham and Women's Hospital, Boston, MA, United States, [2]Boston Children's Hospital, Boston, MA, United States, [3]Harvard Medical School, Boston, MA, United States
1114	13:15	Simultaneous fMRI and multispectral fiber-photometry for concurrent triple-modality measurement of genetically encoded calcium activity, CBV and BOLD
		Wei-Ting Zhang[1], Tzu-Hao Chao[1], Sung-Ho Lee[1], Brittany Michelle Katz[1], Esteban Oyarzabal[1], Guohong Cui[2], and Yen-Yu Ian Shih[1]
		[1]Biomedical Research Imaging Center and Department of Neurology, The University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Neurobiology Laboratory, National Institute of Environmental Health Sciences, NIH, RTP, NC, United States
1115	13:15	CBV fMRI study of the olfactory and visual processing in same mice
		Fuqiang Zhao[1], Xiangjun Meng[1], Lynn Hyde[2], Sherry Lu[3], Matthew E Kennedy[4], Andrea K Houghton[1], Jeffrey L Evelhoch[1], and Catherine D. G. Hines[1]
		[1]Merck & Co., Inc., West Point, PA, United States, [2]Merck & Co., Inc., Rahway, NJ, United States, [3]Merck & Co., Inc., South San Francisco, CA, United States, [4]Merck & Co., Inc., Boston, MA, United States

1116	13:15	Distinct structure-function relationships at different hierarchical levels of structural connectivity in the rat brain.
		Milou Straathof[1], Michel R T Sinke[1], Theresia J M Roelofs[1,2], Erwin L A Blezer[1], Oliver Schmitt[3], Willem M Otte[1,4], and Rick M Dijkhuizen[1]
		[1]Biomedical MR Imaging and Spectroscopy group, Center for Image Sciences, University Medical Center Utrecht and Utrecht University, Utrecht, Netherlands, [2]Department of Translational Neuroscience, Brain Center Rudolf Magnus, University Medical Center Utrecht, Utrecht, Netherlands, [3]Department of Anatomy, University of Rostock, Rostock, Germany, [4]Department of Pediatric Neurology, Brain Center Rudolf Magnus, University Medical Center Utrecht, Utrecht, Netherlands
1117	13:15	Functional connectivity under six anesthesia protocols and the awake condition in rat brain
		Jaakko Paasonen[1], Petteri Stenroos[1], Raimo A Salo[1], Vesa Kiviniemi[2], and Olli Gröhn[1]
		[1]A.I.V. Institute for Molecular Sciences, University of Eastern Finland, Kuopio, Finland, [2]Department of Radiology, Oulu University Hospital, Oulu, Finland
1118	13:15	Quasiperiodic Patterns in BOLD fMRI Reflect Neuromodulatory Input
		Anzar Abbas[1], Maysam Nezafati[2], Isak Thomas[2], and Shella Keilholz[1,2]
		[1]Neuroscience, Emory University, Atlanta, GA, United States, [2]Biomedical Engineering, Emory University and Georgia Institute of Technology, Atlanta, GA, United States
1119	13:15	Validation of spinal cord fMRI with LFP and spike activity in non-human primates
		Tung-Lin Wu[1,2], Pai-Feng Yang[1,3], Feng Wang[1,3], Zhaoyue Shi[1,2], Arabinda Mishra[1,3], Ruiqi Wu[1], Li Min Chen[1,3], and John C Gore[1,2,3]
		[1]Vanderbilt University Institute of Imaging Science, Nashville, TN, United States, [2]Biomedical Engineering, Vanderbilt University, Nashville, TN, United States, [3]Radiology and Radiological Sciences, Vanderbilt University Medical Center, Nashville, TN, United States
1120	13:15	Diffusion fMRI reveals thalamo-cortical circuitry using forepaw stimulation in rats
		Daniel Nunes[1], Andrada Ianus[1,2], Cristina Chavarrias[1], and Noam Shemesh[1]

		[1]Champalimaud Research, Champalimaud Centre for the Unknown, Lisbon, Portugal, [2]Department of Computer Science, Centre for Medical Image Computing, London, United Kingdom

1121	13:15	Orthonasal versus retronasal glomerular activity in rat olfactory bulb by fMRI
		Basavaraju G Sanganahalli[1,2,3], Garth J Thompson[1,2], Peter Herman[1,2,3], Gordon M Shepherd[4], Justus V Verhagen[5], and Fahmeed Hyder[1,2,3,6]
		[1]Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States, [2]Magnetic Resonance Research Center (MRRC), Yale University, New Haven, CT, United States, [3]Quantitative Neuroscience with Magnetic Resonance (QNMR) Core Center, Yale University, New Haven, CT, United States, [4]Neuroscience, Yale University, New Haven, CT, United States, [5]The John B. Pierce Laboratory, Yale University, New Haven, CT, United States, [6]Biomedical Engineering, Yale University, New Haven, CT, United States

Combined Educational & Scientific Session

Brain Connectivity & Dynamics

Organizers: Richard Buxton, Hanzhang Lu, Benedikt Poser

N01	Thursday 13:15 - 15:15	*Moderators:* Hanzhang Lu & Richard Buxton

	13:15	Dynamic Functional Connectivity Methods
		Thomas Liu[1]
		[1]University of California, San Diego, United States
		This educational talk will review methods for the assessment of dynamic functional brain connectivity.

	13:45	Mechanisms & Clinical Applications of Dynamic Functional Connectivity
		Victor M. Vergara[1] and Vince D. Calhoun[2]
		[1]MIALab, [2]The Mind Research Network, Albuquerque, NM, United States

		Dynamic functional network connectivity is a promising technique for clinical applications. It has been successfully applied in the analysis of neurological illnesses and as a source of classification features to separate patients from controls. Advantages and pitfalls of dynamic analysis is discussed and compared to it's to static connectivity alternative. The two flavors of functional connectivity offer complementary information depending on the specific application. This is exemplified discussing the results obtained from schizophrenia, Huntington's disease, traumatic brain injury and substance addiction.

1122	14:15	Voxel-wise mapping of spontaneous brain network dynamics in the mouse brain
		Daniel Gutierrez-Barragan[1,2], Stefano Panzeri[1], and Alessandro Gozzi[3]
		[1]Neural Computation Laboratory, Istituto Italiano di Tecnologia, CNCS@UNITN, Rovereto, Italy, [2]CIMEC, University of Trento, Rovereto, Italy, [3]Functional Neuroimaging Laboratory, Istituto Italiano di Tecnologia, CNCS@UNITN, Rovereto, Italy
		Resting-state fMRI has been widely used to map brain network dynamics via sliding-window correlations between regional functional signals. Using frame-wise clustering of spontaneous BOLD fMRI, here we map the dynamics of brain-wide network activity in the mouse brain with voxel-resolution, at the subject and group level, without the need to use pre-imposed regional parcellation or correlation windows. This approach revealed a reproducible set of recurrent brain states encompassing previously defined functional connectivity networks, which happen at specific phases of global fMRI signal oscillations. Our results provide a novel interpretative framework for the emergence and organization of brain-wide network dynamics.

1123	14:27	Whole brain Quasi-Periodic patterns interact with visual stimulation processing in mice
		Michaël Belloy[1], Behnaz Yousefi[2], Jacob Billings[2], Rukun Hinz[1], Annemie van Der Linden[1], Shella Keilholz[2], Georgios A. Keliris[1], and Marleen Verhoye[1]
		[1]University of Antwerp, Antwerpen, Belgium, [2]Emory university, Atlanta, GA, United States
		We show the detection of whole-brain mouse Quasi-periodic patterns (QPPs), highlighting their interaction with the global signal and coincidence with anti-correlation between speculative mouse Default Mode (DMN) and Task-Positive (TPN)-like networks. We further investigated how QPPs interact with sensory information processing. By tracking QPP behavior during an fMRI visual stimulation block design, we illustrate how QPPs can become modulated by visual stimulation, triggering or diminishing their occurrence. We then linearly regressed QPPs from the fMRI images to show how QPPs underlie a substantial fraction of visual response magnitude and variance. These results suggest the relevance of QPPs in sensory processing.

1124	14:39	Quantitative deconvolution of neuronal-related BOLD events with Multi-Echo Sparse Free Paradigm Mapping
		Javier Gonzalez-Castillo[1], Cesar Caballero-Gaudes[2], and Pater A Bandettini[1,3]

		[1]Section on Functional Imaging Methods, National Institute of Mental Health, Bethesda, MD, United States, [2]Basque Center on Cognition, Brain and Language, San Sebastian, Spain, [3]FMRI Core, National Institute of Mental Health, Bethesda, MD, United States
		This work proposes a novel formulation of the Sparse Free Paradigm Mapping (SPFM) algorithm for Multi-Echo (ME) fMRI that produces estimates of ΔR_2^* with interpretable units (s^{-1}) without prior timing information of task events. Here we show how ΔR_2^* time-series estimated with ME-SPFM have physiologically plausible values, in agreement with previously published estimates of ΔR_2^* for neuronal events. We also show, how having easily interpretable units permits detection of artefactual events that can be easily removed from subsequent analysis and interpretation. Our results suggest that ME-SPFM may provide a pseudo-quantitative method to study the time-varying nature of brain activity in experimentally unconstrained paradigms (naturalistic, resting-state) or clinical applications (detection of inter-ictal epileptic events).

1125	14:51	Efficacy of different dynamic functional connectivity methods to capture cognitively relevant information
		Hua Xie[1,2], Javier Gonzalez-Castillo[2], Daniel A. Handwerker[2], Peter Molfese[2], Peter A. Bandettini[2,3], and Sunanda Mitra[1]
		[1]Department of Electrical & Computer Engineering, Texas Tech University, Lubbock, TX, United States, [2]Section on Functional Imaging Methods, Laboratory of Brain and Cognition, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, United States, [3]FMRI Core, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, United States
		With a multitask dataset (rest, memory, video, and math) serving as ground truth, we evaluated the efficacy of four different methods of estimating dynamic functional connectivity (dFC)—namely sliding window correlation (SWC), sliding window correlation with L1-regularization (SWC_L1), dynamic conditional correlation (DCC), and multiplication of temporal derivatives (MTD)—to capture cognitively relevant information. We used dFC estimates of each method as inputs for k-means, and evaluated how well they segregate scan periods for different tasks. We found that moving average DCC produces best results, especially for short window length (WL ≤ 9sec), suggesting DCC may more reliably reveal dFC linked to mental states.

1126	15:03	EEG microstate and spectral signatures of epileptic patterns found in fMRI dynamic functional connectivity
		Rodolfo Abreu[1], Alberto Leal[2], and Patrícia Figueiredo[1]
		[1]ISR-Lisboa/LARSyS and Department of Bioengineering, Instituto Superior Técnico, Lisboa, Portugal, [2]Department of Neurophysiology, Centro Hospitalar Psiquiátrico de Lisboa, Lisboa, Portugal

		We aimed to investigate EEG signatures specifically associated with epileptic patterns of dynamic functional connectivity (dFC) found in BOLD-fMRI data. We estimated dFC using a sliding-window correlation analysis and applied dictionary learning (DL) to identify the most prominent patterns while forcing a certain degree of sparsity in time. Upon the labelling of each time window based on the pattern exhibiting the highest contribution, we investigated pattern-specific microstates (MS) and spectral proprieties in simultaneously recorded EEG data. In contrast with the spectral proprieties, EEG MS revealed robust signatures of epileptic dFC patterns in all patients.

	15:15	Adjournment & Meet the Teachers

Oral

RF Pulses & Sequences

N03	Thursday 13:15 - 15:15	*Moderators:* Huijun Chen & Joseph Hajnal

1127	13:15	On the Point of Gradient Moment Expansion for Multi-Spoke RF Pulses
		Simon Schmidt[1], Sebastian Flassbeck[1], Mark E. Ladd[1], and Sebastian Schmitter[1,2]
		[1]Medical Physics in Radiology, German Cancer Research Center (DKFZ), Heidelberg, Germany, [2]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig and Berlin, Germany
		In this work we investigated the influence of the point of gradient moment expansion (t_{exp}) for multi-spoke RF pulses. The results demonstrate that $t_{exp}=t_{ISO}$ is ideal if no flow in the RO direction is present, but severe displacement artifacts occur if this is the case. t_{exp}=TE induces shifts that are directed along the vessel orientation and are independent of the encoding orientation. The presented techniques are the basis for correct velocity quantification with controlled displacement for multi-spoke RF pulses allowing in-plane B_1^+ homogenization using parallel transmission at UHF.

1128	13:27	Design of universal parallel-transmit refocusing kT-point pulses and application to 3D T2-weighted imaging at 7T
		Vincent Gras[1], Franck Mauconduit[2], Alexandre Vignaud[1], Alexis Amadon[1], Denis Le Bihan[1], Tony Stöcker[3], and Nicolas Boulant[1]
		[1]DRF/Joliot/Neurospin, CEA, Gif sur Yvette, France, [2]Siemens Healthcare, Saint Denis, France, [3]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany

		The k_T-point technique exploits the dynamic RF shimming capability of parallel transmission to uniformly excite the spins. That technique allows homogenizing the flip angle in RF-spoiled sequences but also the rotation angle in sequences involving non-selective refocusing pulses. As far as the flip angle is concerned, it has been shown that so-called universal k_T-point pulses can be designed to work robustly on any subject without having to tailor the pulse to the subject. In this study we propose to extend the universality concept to refocusing pulses, and to give an experimental demonstration with 3D fast spin echo brain imaging.

1129	13:39	Improving FLAIR SAR efficiency by predicting B1-maps at 7T from a standard localizer scan using deep convolutional neural networks
		Steffen Bollmann[1], Samuel Kelly[1], Viktor Vegh[1], Anders Rodell[2], Yas Tesiram[1], Markus Barth[1], and Kieran O'Brien[2]
		[1]Centre for Advanced Imaging, The University of Queensland, Brisbane, Australia, [2]Siemens Healthcare Pty Ltd., Brisbane, Australia
		Ultra-high-field (7T) instrumentation offers the possibility of acquiring FLAIR images at an improved resolution when challenges such as efficient B1 calibration and SAR reductions can be realized. Instead of acquiring a separate B1-map, we propose to predict B1-maps based on the implicit B1 inhomogeneity field present in an AutoAlign localizer using deep convolutional neural networks. We show that a 34% reduction in SAR can be achieved by adjusting the power of FLAIR's adiabatic inversion pulse on a slice-by-slice basis using the B1 information without degradation of image quality.

1130	13:51	In-vitro demonstration of explicit temperature control using pTx and temperature virtual observation points at 7T
		Nicolas Boulant[1], Vincent Gras[1], and Pierre-François Van de Moortele[2]
		[1]NeuroSpin, CEA, Saclay, France, [2]CMRR, University of Minnesota, Minneapolis, MN, United States
		Recent numerical studies have shown that temperature could be controlled explicitly at the pulse design stage in parallel transmission, furthermore reporting that further scan performance could be gained if the more relevant safety metric that is temperature, instead of the specific absorption rate, was controlled. Bioheat models yet are still undergoing experimental validations. So as a first step, this work reports an experimental demonstration of flip-angle homogenization with temperature control on a water phantom with parallel transmission at 7T.

1131	14:03	Slab-Selective Spectral and Spectral-Spatial Prewinding RF Pulses
		Sydney Nicole Williams[1], Jon-Fredrik Nielsen[1], Jeffrey A Fessler[2], and Douglas C Noll[1]

		[1]Biomedical Engineering, University of Michigan, Ann Arbor, MI, United States, [2]Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States
		We introduce a new type of small-tip angle prewinding RF pulse that compensates for spin dephasing attributed to off-resonance and is also slab-selective, which can help limit the volume of coverage. We design purely spectral slab-selective pulses that prewind a limited global off-resonance bandwidth, and spectral-spatial slab-selective pulses that adapt the prewinding bandwidth spatially. We demonstrate these pulse designs in simulation and in experiments using a gel phantom with a distorted field and a volunteer's brain. Both pulses create sharp slab profiles, while the spectral-spatial pulse outperforms in terms of target magnetization phase.

1132	14:15	Magnetization Transfer effects in Actual Flip angle Imaging
		Shaihan J Malik[1], Rui Pedro A.G. Teixeira[1], and Joseph V Hajnal[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom
		The AFI sequence is a robust flip angle mapping method and is used within quantitative MRI protocols. AFI is a modified spoiled gradient echo (SPGR) sequence, employing interleaved TR times of different lengths. It is well known that SPGR signal behaviour is sensitive to Magnetization Transfer effects, so in this work we used a two-pool model to derive signal equations for AFI that include MT. We found that MT will lead to an underestimation of flip angle by up to 6% in white matter and that longer TR and lower RF energy lead to larger bias.

1133	14:27	The travelling pulses: multicenter evaluation of universal pulses at 7T
		Xiaoping Wu[1], Vincent Gras[2], Alexandre Vignaud[2], Franck Mauconduit[3], Markus Boland[4], Tony Stoecker[4], Kamil Ugurbil[1], and Nicolas Boulant[2]
		[1]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [2]NeuroSpin, CEA, Saclay, France, [3]Siemens Healthcare, Saint-Denis, France, [4]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany
		It has been shown recently that parallel transmission universal pulses (UPs), optimized offline on a training field-maps database, can be used to robustly mitigate B_1^+ inhomogeneity on other subjects, thus holding great potential for spreading their utility by sparing the user the time-consuming individualized calibration. For these UPs to be used widely, however their performance needs to be immune to inter-site differences. In this study, we examined the robustness of the UPs against inter-site variability. Our results so far obtained at two sites show that the UPs are quite robust in producing uniform contrast across the brain despite these differences.

1134	14:39	In vivo Simultaneous Measurement of δf, T1, T2, and T2* by Magnetic Resonance Fingerprinting with Quadratic RF Phase

Charlie Yi Wang[1], Simone Coppo[2], Bhairav Bipin Mehta[2], Nicole Seiberlich[1,2], Xin Yu[1,2], and Mark Alan Griswold[1,2]

[1]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [2]Radiology, Case Western Reserve University, Cleveland, OH, United States

We propose a novel Magnetic Resonance Fingerprinting pulse sequence with quadratic RF excitation phase (qRF-MRF) for the purpose of simultaneous measurement of T_2* in addition to previously established spin parameters δf, T_1, and T_2. The original bSSFP based MRF pulse sequence[1] was modified to incorporate excitation segments with quadratic RF phase to sensitize signal evolutions to T_2*. Measurements using qRF-MRF were performed in both phantom and *in vivo*. Maps from qRF-MRF were validated against bSSFP based MRF and Multi-GRE.

1135 | 14:51

Cortical T1 mapping with 3D MR Fingerprinting at 7T using a single transmit channel

Koji Fujimoto[1], Martijn A. Cloos[2], Yuta Urushibata[3], and Tomohisa Okada[1]

[1]Human Brain Research Center, Kyoto University Graduate School of Medicine, Kyoto, Japan, [2]Department of Radiology, New York University School of Medicine, Center for Advanced Imaging Innovation and Research (CAI2R) and Bernard and Irene Schwartz Center for Biomedical Imaging, New York, NY, United States, [3]Siemens Healthcare K.K., Tokyo, Japan

A prototype 3D MRF sequence was evaluated for cortical T1 mapping at 7T in the context of the Human Connectome Project (HCP). Phantom results showed that the 3D MRF T1 map of a liquid was in good agreement with gold standard IR-SE measurements. The synthetic MPRAGE and synthetic T2-SPACE created from the 3D MRF data performed well in HCP pipeline. The cortical thickness estimation was fairly stable across different imaging resolutions. The R1 of the cortex showed higher value than expected, which may indicate that more advanced signal models may be necessary to accurately describe the spin dynamics in-vivo.

1136 | 15:03

Pulseq-GPI: A single, comprehensive framework for MR method development

Sneha Potdar[1], Pavan Poojar[1,2], Ashok kumar Reddy[2], Keerthi Sravan[1,3], Stefan Kroboth[4], Jon-Fredrik Nielsen[5], Maxim Zaitsev[4], Ramesh Venkatesan[2], and Sairam Geethanath[1,6]

[1]Medical Imaging Research Center, MIRC, Dayananda Sagar Institutions, Bengaluru, India, [2]Wipro GE Healthcare Pvt Ltd, Bengaluru, India, [3]New York University Tandon School of Engineering, New York, NY, United States, [4]Dept of Radiology, Medical Physics, Medical Center University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, Freiburg, Germany, [5]Functional MRI Laboratory, University of Michigan, Michigan, MI, United States, [6]Dept. of Radiology, Columbia University Medical Center, New York, NY., Columbia, SC, United States

		This work develops and integrates an open source implementation of the Pulseq framework with Graphical Programming Interface (GPI). The purpose is to provide a single, open-source platform for comprehensive MR algorithm design, development, deployment and analysis. The Pulseq framework was implemented in Python and integrated with GPI. In this work, a Spin Echo sequence was implemented, deployed through an interpreter to a scanner, and reconstructed and visualized in Pulseq-GPI. The code execution times of three variants of Pulseq implementations (MATLAB, Python and Pulseq-GPI) were compared. Also, the functionalities available in Pulseq-GPI framework and other open source tools were tabulated.

Oral

Neurofluids & Glymphatic System

S02	Thursday 13:15 - 15:15	*Moderators:* Nivedita Agarwal & Shigeki Aoki

1137	13:15	Imaging Brain Clearance in the Mouse Brain: Aquaporin-4 Modulates Glymphatic Inflow
		Ian F Harrison[1], Ozama Ismail[1], Yolanda Ohene[1], Payam Nahavandi[1], Jack A Wells[1], and Mark F Lythgoe[1]
		[1]Centre for Advanced Biomedical Imaging, University College London, London, United Kingdom
		The ‘glymphatic’ system, which has recently been identified using MRI, is a brain-wide pathway for removal of waste solutes. This system is implicated in Alzheimer’s disease (AD), due to discovery that both amyloid-β and tau, accumulations that define AD, are cleared from the brain via this pathway. Using contrast-enhanced MRI, we demonstrate that glymphatic function is dependent upon aquaporin-4, a water channel located on astrocytic endfeet surrounding blood vessels in the brain. Herein, using a novel pharmacological approach, we show that aquaporin-4 represents a suitable drug target for manipulation of glymphatic function in the brain, and in treatment of AD.

1138	13:27	PC-MRI measurements of net CSF flow through the cerebral aqueduct strongly depend on respiration
		Jolanda M Spijkerman[1], Lennart J Geurts[1], Jeroen CW Siero[1,2], Jeroen Hendrikse[1], Peter R Luijten[1], and Jaco JM Zwanenburg[1]
		[1]Department of Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [2]Spinoza Center for Neuroimaging, Amsterdam, Netherlands

		In this work the influence of respiration on net CSF flow measurements was investigated. In 12 volunteers net CSF flow was measured in the cerebral aqueduct using PC-MRI at 7T, with respiratory gating on expiration and on inspiration, and without respiratory gating. Repeated measurements were performed. Net flow over the cardiac cycle was determined. Net CSF flow (mean±sd) was -0.64±0.32 mL/min (caudal) during expiration, +0.12±0.49 mL/min (cranial) during inspiration, and -0.31±0.18 mL/min without respiratory gating. Two outliers, with reversed (cranial) net CSF flow, were observed when no respiratory gating was performed. Repeatability was best for gating on inspiration.

1139	13:39	Cine MRI assessment of carotid artery pulse wave velocity and reflected wave amplitude in children with sickle cell disease Jackie Leung[1], Datta Goolaub[1], Christopher Macgowan[1], Lindsay Cahill[1], John Sled[1,2], and Andrea Kassner[1,2] *[1]SickKids Hospital, Toronto, ON, Canada, [2]University of Toronto, Toronto, ON, Canada* The mechanical and morphological properties of the cerebral vasculature can be studied by measuring blood flow dynamics of the feeding arteries. In this study, we used high resolution phase contrast MRI to measure the blood flow and vessel area of the common carotid arteries of children with and without sickle cell disease (SCD). Preliminary results show that pulse wave velocity and wave reflection is significantly higher in patients with SCD, suggesting increased vessel stiffness and downstream abnormalities in the vasculature. This method is clinically feasible and may provide useful insight into the vascular properties of children with cerebrovascular disease.

1140	13:51	Optic Nerve Sheath Volume Changes Acutely in Response to Intracranial Pressure Change after Lumbar Puncture and CSF Drainage John Oshinski[1], Muhammad Islam[1], Chansu Kim[1], and Amit Saindane[1] *[1]Radiology and Imaging Sciences, Emory University, Atlanta, GA, United States* This study used 3D, T2W imaging of the brain to evaluate the optic nerve sheath (ONS) in 10 patients with idiopathic intracranial hypertension (IIH). Patients were imaged pre- and *immediately* post-lumbar puncture/CSF drainage. Images were reformatted to be perpendicular to the optic nerve and the volume of the ONS pre- and post-lumbar puncture was calculated. The study found that ONS volume decreased *significantly* within an 82 minute window in response to a reduction in CSF pressure, and this change can be quantitatively evaluated using MRI.

1141	14:03	Association between Gray Matter alterations and CSF biomarkers in amnestic MCI patients

		Domenico Zacà[1], Giuliano Giari[2], Moira Marizzoni[3], Clarissa Ferrari[4], Samantha Galluzzi[3], Diego Albani[5], Claudio Babiloni[6,7], Mira Didic[8], Josè Luis Molinuevo[9], Flavio Mariano Nobili[10], Lucilla Parnetti[11], Pierre Payoux[12], Paolo Maria Rossini[13], Peter Schönknecht[14], Andrea Soricelli[15], Magda Tsolaki[16], Pieter Jelle Visser[17,18], Jens Wiltfang[19], Regis Bordet[20], Libera Cavaliere[3], Jill Richardson[21], Olivier Blin[22], Giovanni B. Frisoni[23,24], and Jorge Jovicich[1]
		[1]Center for Mind/Brain Sciences-University of Trento, Trento, Italy, [2]Department of Psychology and Cognitive Science-University of Trento, Trento, Italy, [3]IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy, [4]Service of Statistics, IRCCS Fatebenefratelli, Brescia, Italy, [5]IRCCS, Istituto di Ricerche Farmacologiche Mario Negri, Milano, Italy, [6]Department of Physiology and Pharmacology, University of Rome, Rome, Italy, [7]Sapienza University of Rome, Rome, Italy, [8]Aix-Marseille Universitè, Marseille, France, [9]Alzheimer's Disease Unit and Other Cognitive Disorders Unit, Hospital Clinic de Barcelona, Barcelona, Spain, [10]University of Genoa, Genoa, Italy, [11]Lab of Clinical Neurochemistry, University of Perugia, Perugia, Italy, [12]INSERM, Imagerie Cerebrale et Handicaps Neurologiques, Toulouse, France, [13]Catholic University, Policlinico Gemelli, Rome, Italy, [14]University of Leipzig, Leipzig, Germany, [15]Fondazione SDN per la Ricerca e l'Alta Formazione in Diagnostica Nucleare, Naples, Italy, [16]Aristotle University of Thessaloniki, Thessaloniki, Greece, [17]Alzheimer Center, Amsterdam Neuroscience, VU University Medical Center, Amsterdam, Netherlands, [18]VU University Medical Center, Amsterdam, Netherlands, [19]University Medical Center, Goettingen, Georg-August-University, Goettingen, Germany, [20]Service de Pharmacologie-Hôpital Huriez-CHRU, Lille, France, [21]GSK, Neurosciences Therapeutic Area, Brentford, United Kingdom, [22]Mediterranean Institute of Cognitive Neurosciences, Marseille, France, [23]Memory Clinic and LANVIE - Laboratory of Neuroimaging of Aging, University Hospitals and University of Geneva, Geneva, Switzerland, [24]Laboratory of Alzheimer's Neuroimaging and Epidemiology - LANE, IRCCS Institute - The Saint John of God Clinical Research Centre, Brescia, Italy
		In this study the association between CSF and structural imaging based early biomarker of Alzheimer Diasease (AD) was investigated in amnestic Mild Cognitive Impairment (aMCI) patients. Voxel based morphometry and partial least square correlation were used to analyze differences in local and whole brain GM profiles (covariance) between two groups of aMCI patients divided in two groups based on CSF amyloid (Aβ42) levels. Both voxel-wise and structural covariance GM differentiated Aβ positive (prodromal AD) from Aβ negative patients. These results indicate that GM measures may provide a sensitive metric for tracking AD progression.

1142	14:15	2D phase contrast MRI to quantify CSF dynamics change after surgery of Chiari "malformations"
		olivier baledent [1], pauline padovani[2], anthony fichten[2], patrick toussaint[2], catherine gondry-jouet[3], serge metanbou[3], johann peltier[2], and cyrille capel[2]
		[1]imaging processing, university hospital, Amiens, France, [2]neurosurgery, university hospital, Amiens, France, [3]radiology, university hospital, Amiens, France
		Diagnosis of Chiari malformation (CM) is mainly based on morphological. The objective of this study was to quantify the evolution of CSF and blood flows dynamics before and after surgery treatment of CM. 21 patients who underwent surgery for CM, and presented good clinical outcome at 12 months were retrospectively included. We have shown that in CM, CSF flow is mainly reduced at the foramen magnum whereas it is normal at the cervical level. CM reduces jugular outflow. Complementary to the morphological investigation 2D PCMRI should be take in account to improve the evaluation of the severity of the Chiari Malformation.

1143	14:27	Quantitative Modeling of Glymphatic Pathways of the Brain Using MRI
		Esmaeil Davoodi-bojd[1], Guangliang Ding[1], Li Zhang[1], Qingjiang Li[1], Lian Li[1], Michael Chopp[1,2,3], and Quan Jiang[1,2,3]
		[1]Neurology, henry ford health system, detroit, MI, United States, [2]Neurology, Wayne State University, detroit, MI, United States, [3]Physics, Oakland University, Rochester, MI, United States
		The dynamic exchange of CSF with ISF is identified as the glymphatic system. The impairment of the glymphatic clearance is involved in the development of neurodegenerative conditions. Despite many recent studies that investigated the glymphatic system, few studies have tried to use a mathematical model to describe this system, quantitatively. In this study, we aim to model the glymphatic system from the kinetics of GD-DTPA tracer in order to 1) map the glymphatic system pathways, 2) derive kinetic parameters of the glymphatic system, and 3) provide quantitative maps of the structure and function of this system.

1144	14:39	Phase-contrast MRI for estimating global cerebral blood flow of mice at 11.7T: optimization and age-dependence
		Zhiliang Wei[1,2], Lin Chen[1,2,3], Zixuan Lin[4], Jiadi Xu[1,2], Peter van Zijl[1,2], and Hanzhang Lu[1,2,4]
		[1]Department of Radiology and Radiological Science, Johns Hopkins University, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Research Institute, Baltimore, MD, United States, [3]Department of Electronic Science, Xiamen University, Xiamen, Fujian, China, [4]Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD, United States
		Cerebral blood flow (CBF) is a crucial physiological parameter reflective of brain functioning and metabolism. In this study, our goal was to systematically optimize a phase-contrast (PC) quantitative flow technique for CBF assessment in mice. We also demonstrated the sensitivity of this technique to longitudinal CBF changes in aging. This optimized PC protocol may serve as a helpful non-invasive tool for CBF measurement in preclinical studies of brain physiology and pathophysiology with mouse disease models.

1145	14:51	Impact of the glymphatic system on the kinetic and distribution of gadodiamide in the rat brain: Observation by dynamic MRI and effect of circadian rhythm on tissue gadolinium concentrations.
		Toshiaki Taoka[1], Gregor Jost[2], Shinji Naganawa[1], and Hubertus Pietsch[2]
		[1]Nagoya University, Nagoya, Japan, [2]MR&CT Contrast Media Research, Bayer AG, Berlin, Germany

		We tried to elucidate the role of the glymphatic system on the distribution and kinetics of a linear gadolinium based contrast agent in the rat brain. Dynamic MRI signal changes of the brain and the cerebrospinal fluid (CSF) indicated that intravenously administrated gadodiamide enter from blood into the CSF, indicating the involvement of the glymphatic system. The long term presence of gadolinium in the brain after repeated administration of gadodiamide quantified by ICP-MS indicates the involvement of the glymphatic system on the clearance of gadolinium from brain tissue in terms of the influence of circadian rhythm and anesthesia during administration.

1146	15:03	Increased pulsatility in cerebral perforating arteries in patients with lacunar infarction or deep intracerebral hemorrhage, an explorative 7T MRI study
		Lennart Johannes Geurts[1], Geert Jan Biessels[2], Peter Luijten[1], Karin Klijn[3], and Jaco Zwanenburg[1]
		[1]Radiology, UMCU, Utrecht, Netherlands, [2]Brain Center Rudolf Magnus, UMCU, Utrecht, Netherlands, [3]Department of Neurology, Radboud University Medical Center, Nijmegen, Netherlands
		Cerebral small vessel disease is a major cause of dementia and stroke with unknown pathophysiology. Increased blood flow pulsation is hypothesized to be an underlying pathology of small vessel disease, but has not been investigated in cerebral small vessels. Using 2D phase contrast MRI at 7T, we measured the pulsatility index in cerebral perforating arteries of patients with lacunar infarction or deep intracerebral haemorrhage and a group of healthy controls. We showed that both patient groups have a higher pulsatility index in small vessels than controls. This warrants further research into the possible role of pulsatility in small vessel disease.

Oral

MRS Applications

S03	Thursday 13:15 - 15:15	*Moderators:* Ovidiu Andronesi & Hermien Kan

1147	13:15	Correlating Proteoglycan Concentration in Intervertebral Discs Using 1H MR Spectroscopy with Lumber Lordotic Angle
		Lisa Maria Harris[1,2], Joely Smith[1], Ella Hodder[3], Michael Mills[1], Janice Bush[2], Vincent Pelling[1], Mara Cercignani[2], and Nicholas Dowell[2]
		[1]Radiological Science, Brighton and Sussex University Hospitals NHS Trust, Brighton, United Kingdom, [2]Clinical Imaging Sciences Centre, Brighton Sussex Medical School, Brighton, United Kingdom, [3]Computing, Engineering and Mathematics, University of Brighton, Brighton, United Kingdom

		Both proteoglycan (PG) concentration and lumbar lordotic (LL) angle are linked with the health of spinal discs. Previously, it has been shown that PG concentration can reliably be measured using 1H MR Spectroscopy at 1.5T and that PG concentration is higher in female discs compared with male discs. This study has now been extended to show a correlation between PG and LL angle in a group of female participants.

1148	13:27	31P NMRS-determined intramuscular Mg2+ and its relation to quantitative NMR imaging and spectroscopy outcome measures in Duchenne muscular dystrophy
		Harmen Reyngoudt[1,2] and Pierre G Carlier[1,2]
		[1]NMR Laboratory, Institute of Myology, Paris, France, [2]NMR Laboratory, CEA, DRF, IBFJ, MIRCen, Paris, France
		Free [Mg^{2+}] determination with ^{31}P NMRS is highly dependent on a precise knowledge of intracellular pH. The pH of Duchenne muscular dystrophy patients as determined by the ^{31}P NMRS chemical shift of inorganic phosphate is abnormally alkaline. We have recently shown that intracellular pH in skeletal muscle could be determined using ^{1}H NMRS of carnosine and that intracellular pH was alkaline in a proportion but not in all the DMD patients with a ^{31}P NMRS-based alkaline pH. We decided to take advantage of this ^{1}H NMRS-based intracellular determination to determine whether free intramuscular [Mg^{2+}] is, in fact, abnormally low in DMD patients and investigate its relation with water T_2 and fat fraction.

1149	13:39	Carnitine supplementation improves skeletal muscle acetylcarnitine formation and metabolic flexibility
		Yvonne MH Bruls[1], Marlies de Ligt[2], Esther Phielix[2], Bas Havekes[3], Joachim E Wildberger[1], Matthijs K Hesselink[2], Patrick Schrauwen[2], Lucas Lindeboom[1,2], and Vera B Schrauwen-Hinderling[1,2]
		[1]Department of Radiology & Nuclear Medicine, Maastricht University Medical Center +, Maastricht, Netherlands, [2]Department of Human Biology & Human Movement Sciences, Maastricht University Medical Center +, Maastricht, Netherlands, [3]Department of Internal Medicine, Division of Endocrinology, Maastricht University Medical Center +, Maastricht, Netherlands
		The formation of acetylcarnitine may serve as a mitochondrial rescue mechanism to prevent the development of metabolic inflexibility and type 2 diabetes. We here used a novel magnetic resonance spectroscopy protocol, using long echo times, to determine acetylcarnitine concentrations in skeletal muscle in vivo. Carnitine supplementation enhanced the increase in acetylcarnitine concentration in resting muscle over the day as well as the capacity to form acetylcarnitine with exercise. Furthermore, carnitine supplementation completely restored metabolic flexibility suggesting that carnitine supplementation may be an interesting aid in improving disturbed metabolism in subjects prone to develop type 2 diabetes mellitus.

1150	13:51	Why does a transient NAD+ infusion lead to a sustained increase in brain ATP levels? - A dynamic 31P MRS-MT imaging investigation at ultrahigh field
		Xiao-Hong Zhu[1], Ming Lu[1], Yi Zhang[1], and wei Chen[1]
		[1]Center of Magnetic Resonance Research, Department of Radiology, University of Minnesota Medical School, Minneapolis, MN, United States
		It has been observed recently that transient intraperitoneal infusion of oxidized nicotinamide adenine dinucleotide (NAD^+) can increase intracellular ATP levels in healthy rat brain over time. Intrigued by this fascinating phenomenon, we investigated the dynamic changes of major phosphorous metabolites and the kinetics and metabolic rates of the ATP synthesis reactions in rat brain before and after introducing exogenous NAD^+ using combined *in vivo* ^{31}P MR spectroscopy (MRS) imaging with magnetization transfer (MT) technique at 16.4 Tesla magnet. The results of this comprehensive study provide important information for elucidating the cerebral energetic mechanism and regulation underlying this phenomenon.

1151	14:03	Early MRS biomarkers accurately predict neurodevelopment after neonatal encephalopathy in a multicentre setting
		Peter J Lally[1,2], Paolo Montaldo[1,2], Vânia Oliveira[1,2], Ravi Swamy[1,2], Gaurav Atreja[1,2], Josephine Mendoza[1,2], Alan Bainbridge[3], David Price[3], Aung Soe[4], Seetha Shankaran[5], and Sudhin Thayyil[1,2]
		[1]Centre for Perinatal Neuroscience, Imperial College London, London, United Kingdom, [2]Imperial College Healthcare NHS Trust, London, United Kingdom, [3]Medical Physics and Bioengineering, University College London Hospitals NHS Trust, London, United Kingdom, [4]Medway NHS Foundation Trust, Kent, United Kingdom, [5]Department of Neonatology, Children's Hospital of Michigan, Detroit, MI, United States
		In neuroprotection trials for neonatal encephalopathy, the typical clinical outcome measures can only be measured reliably after a period of years. In a multicentre study covering eight sites and recruiting 224 infants, we demonstrate that MRS measures made within two weeks of birth provide quantitative and objective tools for predicting neurodevelopmental abnormalities usually only observed years after the initial injury. In particular, the thalamic concentration of tNAA (N-acetyl aspartate + N-acetyl aspartyl glutamate) has an area under the receiver operating characteristic curve of 0.99 (95%CI 0.98–1.00, n=82). Such tools could greatly speed up the next generation of clinical trials.

1152	14:15	Probing the Excitatory-Inhibitory Balance in Humans during Probabilistic Learning
		Vered Bezalel[1,2], Rony Paz[1], and Assaf Tal[2]
		[1]Department of Neurobiology, Weizmann Institute of Science, Rehovot, Israel, [2]Department of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel

		The dorsal anterior cingulate cortex (dACC) is crucial for reinforcement learning and decision-making. However, the excitatory and inhibitory mechanisms underlying these functions, governed by glutamate and GABA, are not properly understood. We used ^{1}H-MRS to probe glutamate and GABA in the dACC during a task comprised of three conditions: discrimination, uncertainty and a null condition. A preference to higher gain option during the discrimination condition was reflected by elevated GABA levels during the uncertainty condition compared to the discrimination condition. Elevated GABA levels during the null condition predicted better behavioral-acquisition. These results indicate dACC involvement during learning of high load cognitive situation.

1153	14:27	Investigation of Anterior Cingulate Cortex γ-Aminobutyric Acid and Glutamate-Glutamine Levels in Patients with Obsessive-Compulsive Disorder by Proton Magnetic Resonance Spectroscopy
		Yan Li[1], Naying He[1], Hongmin Xv[1], Zhijia Jin[1], ChenCheng Zhang[2], Weibo Chen[3], Yansong Zhao[4], Richard A. E. Edden[5], and Fuhua Yan[1]
		[1]Department of Radiology, Ruijin Hospital Shanghai Jiaotong University School of Medicine, Shanghai, China, [2]Department of Functional Neurosurgery, Ruijin Hospital Shanghai Jiaotong University School of Medicine, Shanghai, China, [3]Philips Healthcare, Shanghai, China, [4]Philips Healthcare, Cleveland, OH, United States, [5]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States
		The aim of this study is to evaluate the feasibility of ^{1}H-MR edited spectroscopy for the detection of cerebral abnormalities in Obsessive-Compulsive Disorder (OCD) patients. Twenty-three OCD patients and Twenty-four normal controls (NC) underwent MRS. The γ-Aminobutyric Acid (GABA) and Glutamate-Glutamine (Glx) level of anterior cingulate cortex (ACC) was quantified based on the GANNET 2.0 software. Differences of GABA and Glx levels between two groups were analyzed using independent two sample t-test analysis. Relative to NC group, OCD patients had higher GABA concentration in the ACC (p<0.05), but had no significant difference in ACC Glx levels. To our knowledge, this study presents the first GABA concentration measurements within ACC in OCD patients. Our results suggested that GABA and Glx levels in the ACC might be promising diagnostic and monitoring biomarker for OCD.

1154	14:39	Increased spatial resolution of MR Spectroscopic Imaging improves the detectability of metabolic changes in Multiple Sclerosis lesions
		Eva Heckova[1], Gilbert Hangel[1], Bernhard Strasser[2], Michal Považan[3,4], Assunta Dal-Bianco[5], Paulus Rommer[5], Elisabeth Springer[1], Stephan Gruber[1], Siegfried Trattnig[1,6], and Wolfgang Bogner[1,6]
		[1]High Field MR Centre, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [2]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [3]Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [4]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MA, United States, [5]Department of Neurology, Medical University of Vienna, Vienna, Austria, [6]Christian Doppler Laboratory for Clinical Molecular Molecular MR Imaging, Vienna, Austria

		MR Spectroscopic Imaging provides the ability to assess the abundance and spatial distribution of several neurometabolites, which are characteristic for pathophysiological processes related to the formation and development of Multiple Sclerosis lesions. In presented work we aimed to compare the detectability of metabolic changes in MS lesions for three different in-plane resolutions of MRSI, i.e. 2.2×2.2 mm^2, 3.4×3.4 mm^2 and 6.8×6.8 mm^2. Our results suggest that the vast majority of metabolic changes in MS cannot be reliably assessed using MRSI with typical matrix sizes of 24x24 to 32x32. With ultra-high spatial resolution (2.2x2.2 mm^2 in-plane) even very small MS lesions can be well resolved.

1155	14:51	A Feasibility Study of Radiation Therapy Dose Escalation Guided by Spectroscopic Magnetic Resonance Imaging in Patients with Glioblastoma
		Saumya S. Gurbani[1,2], Eric Mellon[3], Brent D. Weinberg[2], Eduard Schreibmann[1], Andrew A. Maudlsey[4], Sulaiman Sheriff[4], Peter B. Barker[5], Lawrence Kleinberg[6], Lee A. D. Cooper[7], Hui-Kuo Shu[1], and Hyunsuk Shim[1,2]
		[1]Department of Radiation Oncology, Winship Cancer Institute of Emory University, Atlanta, GA, United States, [2]Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, GA, United States, [3]Department of Radiation Oncology, University of Miami Miller School of Medicine, Miami, FL, United States, [4]Department of Radiology, University of Miami Miller School of Medicine, Miami, FL, United States, [5]Department of Radiology and Radiological Science, The Johns Hopkins University, Baltimore, MD, United States, [6]Department of Radiation Oncology, The Johns Hopkins University, Baltimore, MD, United States, [7]Department of Biomedical Informatics, Emory University School of Medicine, Atlanta, GA, United States
		Glioblastoma (GBM) is a grade IV primary brain tumor with poor outcomes despite surgical resection, chemotherapy, and radiation. Often, disease will recur in regions in the penumbra of the treatment volume, hypothesized to occur because anatomic MRI does not fully capture neoplastic infiltration. Spectroscopic magnetic resonance imaging (sMRI) enables in vivo whole-brain analysis of metabolic activity, and has been shown to sensitively and specifically identify regions of non-enhancing, infiltrating tumor. We present an ongoing prospective clinical study to target metabolically active tumor identified by sMRI for a radiation boost, with the aim of improving outcome in patients with GBM.

1156	15:03	Predictive Value of Magnetic Resonance Spectroscopic Imaging during Anti-angiogenic Treatment in Recurrent Glioblastoma
		Daniel Kim[1,2], Jorg Dietrich[3], Elizabeth Gerstner[2,3], Julian He[1], Otto Rapalino[1], Yangming Ou[4], Yi-Fen Yen[1,2], Mark Vangel[1], Ovidiu Andronesi[1,2], Isabel Arrillaga[3], Deborah Forst[3], Jayashree Kalpathy-Cramer [1,2], Bruce Rosen[1,2], Tracy Batchelor[3], Ramon Gilberto Gonzalez[1], and Eva-Maria Ratai[1,2]
		[1]Radiology, Massachusetts General Hospital, Boston, MA, United States, [2]Radiology, Athinoula A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [3]Neurology, Massachusetts General Hospital, Boston, MA, United States, [4]Radiology, Boston Children's Hospital, Boston, MA, United States

		Our study examines the use of MR Spectroscopic Imaging to predict treatment response to anti-angiogenic therapy for recurrent glioblastoma patients. Our data demonstrated that early changes at 1-3 days, 4 weeks, and 6 weeks in Cho/NAA, Lac/nCr, and Lac/NAA can be predictive of 9-months survival outcomes in patients with recurrent glioblastoma treated with bevacizumab. Theses preliminary findings suggest that early changes in certain metabolic ratios can be useful markers for predicting therapeutic response to bevacizumab treatment.

Oral

Predictive & Prognostic Cancer Imaging

S04	Thursday 13:15 - 15:15	*Moderators:* Wei Huang & Kei Yamada

1157	13:15	Investigating Oxygen Sensitive MRI to Provide Prognostic Biomarkers for Tumor Radiation Response
		Tatsuya Arai[1], Donghan M Yang[1], James W Campbell III[1], Tsuicheng Chiu[2], Strahinja Stojadinovic[2], and Ralph P. Mason[1]
		[1]Radiology, University of Texas Southwestern Medical Center, Dallas, TX, United States, [2]Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, TX, United States
		Prognostic imaging biomarkers to assess tumor hypoxia remain a Holy Grail. We present evidence that T_1-weighted signal response to an oxygen breathing challenge before a single high dose of radiation is related to long term tumor control. Specifically, Dunning prostate R3327-AT1 tumors showing a small signal response showed poor control for relatively lower doses (30-50 Gy). Meanwhile, higher doses overcame the radio resistance, which we associate with hypoxia. A large BOLD response (ΔR_2^*) was associated with poor outcome irrespective of radiation dose. These results provide further evidence for the potential utility of oxygen sensitive MRI in guiding radiation therapy.

1158	13:27	Multi-modality molecular imaging with hyperpolarized [1-13C]pyruvate MRSI and 18FDG-PET of early tumor response to a novel TRAIL agonist (MEDI3039)
		Richard L Hesketh[1], Jiazheng Wang[1], Alan J Wright[1], Maria Fala[1], Susana Ros[1], Jodi Miller[1], David Y Lewis[1,2], and Kevin M Brindle[1,3]
		[1]CRUK Cambridge Institute, University of Cambridge, Cambridge, United Kingdom, [2]CRUK Beatson Institute, Glasgow, United Kingdom, [3]Department of Biochemistry, University of Cambridge, Cambridge, United Kingdom

		This study compared the capability of 3D magnetic resonance spectroscopic imaging (MRSI) of hyperpolarized [1-^{13}C]pyruvate metabolism and ^{18}FDG-PET to detect early responses to a TRAIL agonist (Medimmune MEDI3039) in Colo205 colorectal cancer and MDA-MB-231 triple-negative breast cancer xenograft models expressing luciferase and mStrawberry fluorescent protein. 24 hours after treatment, bioluminescence and hyperpolarized lactate/pyruvate ratio decreased significantly in all treated animals, preceding decreases in tumor volume. Conversely, ^{18}FDG-PET did not detect treatment response. This suggests that for some tumors hyperpolarized [1-^{13}C]pyruvate may be an improvement on ^{18}FDG-PET and RECIST for the early detection of treatment response.

1159	13:39	Tracking the evolution of individual prostate cancer metastases in patients under the selective pressure of Radium-223 treatment using whole-body radiomics.
		Matthew D Blackledge[1,2], Dow Mu Koh[1,2], David J Collins[1,2], Matthew R Orton[1,2], Erica Scurr[2], Julie Hughes[2], Chris Parker[1,3], Martin O Leach[1,2], and Nina Tunariu[1,2]
		[1]Division of Radiotherapy and Imaging, The Institute of Cancer Research, London, United Kingdom, [2]MRI Unit, The Royal Marsden NHS Foundation Trust, London, United Kingdom, [3]Urology Department, The Royal Marsden NHS Foundation Trust, London, United Kingdom
		Whole-Body Diffusion-Weighted-MRI is emerging as an imaging response biomarker in metastatic bone disease. Tumour heterogeneity resulting in differential response to therapy is a well-recognized phenomenon. We propose that calculating radiomic features from the apparent diffusion coefficients within individual lesions can identify differential response patterns in whole-body bone disease. Robust statistical assessment of radiomic features based on repeatability assessment aids identification of significant changes.

1160	13:51	Predicting the spatio-temporal evolution of tumor vasculature and cellularity following whole brain radiation therapy
		David A Hormuth II[1], Angela Jarrett[1], and Thomas E Yankeelov[1,2,3,4]
		[1]Institute for Computational Engineering and Sciences, The University of Texas at Austin, Austin, TX, United States, [2]Department of Diagnostic Medicine, The University of Texas at Austin, Austin, TX, United States, [3]Department of Biomedical Engineering, The University of Texas at Austin, Austin, TX, United States, [4]Livestrong Cancer Institutes, The University of Texas at Austin, Austin, TX, United States
		A fundamental challenge in the care of patients with brain tumors is the limitation of standard radiographic measurements to accurately evaluate, let alone predict, patient response. To address this challenge, we have developed a biophysical model of tumor growth, angiogenesis, and response to radiation therapy that is calibrated on a subject-specific basis using diffusion-weighted and dynamic contrast enhanced MRI data. We evaluated the predictive accuracy of the model in rats with C6 gliomas receiving whole brain radiation. The model accurately predicted future tumor volume (error ranged from 12.1 to 18.5%).

1161	14:03	Susceptibility contrast-MRI predicts response to the vascular endothelial growth factor receptor inhibitor cediranib in the Th-*MYCN* model of neuroblastoma
		Konstantinos Zormpas-Petridis[1], Matthew D. Blackledge[1], Louis Chesler[2], Yinyin Yuan[3], Simon P. Robinson[1], and Yann Jamin[1]
		[1]Division of Radiotherapy and Imaging, Institute of Cancer Research, London, United Kingdom, [2]Division of Clinical Studies, Institute of Cancer Research, London, United Kingdom, [3]Division of Molecular Pathology, Institute of Cancer Research, London, United Kingdom
		In this study we demonstrate that fractional blood volume, measured by susceptibility contrast-MRI, predicts response to the vascular endothelial growth factor receptor inhibitor cediranib in the Th-*MYCN* genetically-engineered mouse model of neuroblastoma.

1162	14:15	The Effect of Altered Glucose Utilization on Dynamic GlucoCEST in a Preclinical Model of Glioblastoma
		Xiang Xu[1,2], Jing Liu[1,3,4], Jiadi Xu[1,2], Linda Knutsson[1,5], Huanling Liu[1,6], Yuguo Li[1,2], Bachchu Lal[7], John Laterra[7], Peter C.M. van Zijl[1,2], and Kannie Chan[1,8]
		[1]Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University, Baltimore, MD, United States, [2]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Research Institute, Baltimore, MD, United States, [3]Radiology College, Guizhou Medical University, Guiyang, China, [4]Department of Radiology, Guangdong Academy of Medical Sciences/Guangdong General Hospital, Guangzhou, China, [5]Department of Medical Radiation Physics, Lund University, Lund, Sweden, [6]Department of Ultrasound, Guangzhou Panyu Central Hospital, Guangdong, China, [7]Division of Cancer Imaging Research, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [8]Department of Mechanical and Biomedical Engineering, City University of Hong Kong, Hong Kong, Hong Kong
		To investigate the origin of glucoCEST contrast, we altered glucose utilization using an mTOR inhibitor (rapamycin) and studied dynamic glucoCEST signals in a human glioblastoma mouse model. By inhibiting glucose transport, cellular uptake and metabolism are suppressed and the perfusion of vessels and leakage into extravascular extracellular space highlighted. A great increase in glucoCEST contrast was seen in tumors in mice with the inhibitor compared to without. This provides evidence of a large extracellular glucose contribution to glucoCEST, and suggests that we can use glucoCEST to monitor the efficacy of rapamicin with respect to its inhibitory effect.

1163	14:27	Radiomics of DCE-MRI to selectively down-stage the risk of breast cancers with a high-risk 70-gene signature
		Hui Shan Chan[1], Tycho Bismeijer[2], Bas van der Velden[1], Jelle Wesseling[2], Esther Lips[2], Claudette Loo[2], Lodewyk Wessels[2], and Kenneth Gilhuijs[1]
		[1]Image Sciences Institute, UMC Utrecht, Utrecht, Netherlands, [2]Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital, Amsterdam, Netherlands

		The 70-gene signature (70GS) is a prognostic marker for patient survival that is used to guide treatment decisions. For a dataset of early-stage breast cancer patients, the 70GS were established retrospectively. We investigated the potential of DCE-MRI to stratify patient survival within the high-risk 70GS group. Eigentumor analysis and 3D lesion texture features from washin and post-contrast images were compared in survival analysis and hazard ratios were computed. Results show that the investigated features are able to significantly stratify survival, and suggest that radiomics of DCE-MRI may have complementary value to the 70-gene signature to reduce overtreatment.

1164	14:39	Predicting breast cancer patient survival using textural features in CE MR images
		Beathe Sitter[1], Guro Fanneløb Giskeødegård[1], Ioanna Chronaiou[1], Jose Teruel[2], Roja Hedayati[3,4], Steinar Lundgren[3,4], Else Marie Huuse Røneid[5], Martin Pickles[6], Peter Gibbs[7], and Tone Frost Bathen[1]
		[1]Department of Circulation and Medical Imaging, NTNU, Trondheim, Norway, [2]Department of Radiation Oncology, NYU Langone Health, New York, NY, United States, [3]Cancer clininc, St. Olavs University Hospital, Trondheim, Norway, [4]Department of Clinical and Molecular Medicine, NTNU, Trondheim, Norway, [5]Department of Radiology, St. Olavs University Hospital, Trondheim, Norway, [6]Radiology department, Hull & East Yorkshire Hospitals NHS Trust, Hull, United Kingdom, [7]Department of Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States
		Treatment for women with locally advanced breast cancer (LABC) is determined with inadequate knowledge of the long-term outcome. We evaluated the prognostic value of textural features derived from pre-treatment CE-MRI in 55 LABC patients scheduled for neoadjuvant chemotherapy. Using overall survival at 7-years follow-up as endpoint, textural features derived from post-contrast pre-treatment images were significantly different. Using all textural features as input for multivariate analysis, we achieved a classification accuracy of 72% ($p<0.001$), which increased to 78% when including traditional prognostic factors ($p<0.001$). Textural features provide prognostic information, which can complement the stratification of patients to treatment.

1165	14:51	Proton MRS-Detected Creatine Metabolic Profiles in Human Breast Cancer Cells Correlate with the Prognostic Indicator Ubiquitous Mitochondrial Creatine Kinase (CKMT1)
		Vinay Ayyappan[1], Menglin Cheng[1], Ruoqing Cai[1], Caitlin Tressler[1], Kanchan Sonkar[1], Michael T. McMahon[2], and Kristine Glunde[1]
		[1]Radiology, The Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, United States

		Ubiquitous mitochondrial creatine kinase (*CKMT1*) is an important mitochondrial membrane component responsible for the reversible conversion of creatine (Cr) to phosphocreatine (PCr). This study shows that in five breast cell lines of varying aggressiveness, ^{1}H MRS-detected PCr levels correlated with *CKMT1* mRNA expression. *CKMT1* expression was significantly downregulated in triple-negative breast cancer cells compared to estrogen receptor (ER)/ progesterone receptor (PR)-positive cells, and nonmalignant cells. *CKMT1* is a prognostic indicator in several cancers; thus, PCr holds promise as potential marker for improved cancer diagnosis, patient stratification, and theranostic treatment monitoring.

1166	15:03	Radiomics subtyping improves 5-year disease free survival prediction beyond key clinical and radiological characteristics in patients with locally advanced rectal cancer (LARC)
		Ke Nie[1], Peng Hu[2], Fei Peng[3], Tingyu Mao[4], Xiao Wang[1], Ning Yue[1], and Jihong Sun[2]
		[1]Department of Radiation Oncology, Rutgers-The State University of New Jersey, New Brunswick, NJ, United States, [2]Department of Radiological Sciences, Sir Run Run Shaw Hospital, Zhejiang University School of Medicine, Hangzhou, China, [3]Institute of Translational Medicine，Zhejiang University, Hangzhou, China, [4]Department of Electrical Engineering, Columbia University, New York, NY, United States
		In this study, we have identified an 11-feature set from a large panel of radiomics signature (5248 features from pre-operative T1w, T2w, DCE and DWI images) that allows prediction of 5-year disease free survival of locally advanced rectal cancer patients underwent surgical resection. The selected radiomics signature demonstrates improved performance compared with that of established clinical and radiological risk models. The results were tested and validated on a consecutive 165-patient cohort with an average of 54±20 months follow-ups.

Oral

Motion Correction: Clear Your Head

S05	Thursday 13:15 - 15:15	*Moderators:* Maxim Zaitsev & Daniel Gallichan

1167	13:15	Markerless real-time motion correction for T1- and T2-weighted neuroanatomical MRI
		Robert Frost[1], Paul Wighton[1], Isik Karahanoglu[1], Richard L. Robertson[2], P. Ellen Grant[2,3], Bruce Fischl[1,4], M. Dylan Tisdall[5], and Andre J. W. van der Kouwe[1]
		[1]Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [2]Department of Radiology, Boston Children's Hospital, Harvard Medical School, Boston, MA, United States, [3]Fetal-Neonatal Neuroimaging and Developmental Science Center, Boston Children's Hospital, Boston, MA, United States, [4]Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, United States, [5]Radiology, University of Pennsylvania, Philadelphia, PA, United States

		This study investigates real-time head motion correction using markerless tracking of the subject's face to mitigate the major problems caused by patient movement in clinical and research MRI. The effects of motion include repeat scanning, impaired clinical diagnosis, need for sedation or anesthesia, and biased research results. Markerless tracking and correction is appealing because it could offer minimal disruption to the MRI workflow, sequence independence, and high-frequency motion estimation. Real-time correction substantially improved T2-SPACE and MPRAGE image quality in scans with intentional motion, compared to uncorrected scans. Cortical surface reconstructions, brain structure volumes, and cortical thickness estimated from the motion-corrected MPRAGE scan showed good correspondence with the gold standard scans without intentional movement. Markerless real-time correction is a promising approach to reduce the effects of motion in neuro MRI.

1168	13:27	Simultaneous detection of cardiac, respiratory, and rigid body head motion using the scattering of a parallel transmit RF coil at 7T
		Daniel Papp[1], Sven Jaeschke[2], Sebastian W. Rieger[1,3], Stuart Clare[1], and Aaron T. Hess[4]
		[1]Wellcome Centre for Integrative Neuroimaging, FMRIB, Nuffield Department of Clinical Neurosciences, University of Oxford, OXFORD, United Kingdom, [2]University of Oxford Centre for Magnetic Resonance Research, University of Oxford, OXFORD, United Kingdom, [3]Oxford Centre for Human Brain Activity, Wellcome Centre for Integrative Neuroimaging, Department of Psychiatry, University of Oxford, Oxford, United Kingdom, [4]British Heart Foundation Centre of Research Excellence, Department of Cardiovascular Medicine, Oxford, OXFORD, United Kingdom
		Cardiac pulsation, respiration and rigid-body head motion induce changes in relative tissue conductivity. These changes can be detected via the scattering of a parallel transmit RF coil array at 7T, by monitoring the forward and reflected power of each channel, with a 5ms pulse. The time series of the scattering data can be used to detect cardiac and respiratory motion, as well as predict head position using training data. We show that detected heart and respiration rates match those recorded with independent monitoring, and head position may be predicted with reasonable precision, at little extra time cost.

1169	13:39	Noise navigator based motion detection and compensation
		Robin J.M. Navest[1], Tom Bruijnen[1], Jan J.W. Lagendijk[1], Anna Andreychenko[1], and Cornelis A.T. van den Berg[1]
		[1]Radiotherapy, UMC Utrecht, Utrecht, Netherlands
		The feasibility of irregular and unpredictable motion detection and retrospective head motion artifact removal was demonstrated based on the noise navigator. The key advantages of the noise navigator are its inherent synchronization with MR acquisition, compatibility with most read-out strategies and no additional acquisition or hardware is required. Only the raw k-space data needs to be available for this method.

1170	13:51	Prospective Motion Correction in Multiband fMRI Using Multislice-to-Volume Image Registration
		Daniel Christopher Hoinkiss[1], Peter Erhard[1,2], Matthias Günther[1,2], Nora-Josefin Breutigam[1], Federico von Samson-Himmelstjerna[1], and David Andrew Porter[3]
		[1]Fraunhofer MEVIS, Bremen, Germany, [2]University of Bremen, Bremen, Germany, [3]Imaging Centre of Excellence, College of Medical, Veterinary & Life Sciences, University of Glasgow, Glasgow, Scotland
		This study introduces an image-based technique for prospective motion correction in multiband fMRI utilizing multislice-to-volume image registration. Motion detection is based on a single multiband excitation and readout, which allows a high temporal resolution and does not depend on the repetition time or the total number of slices. Results show high accuracy in correcting involuntary as well as intentional head movements in typical fMRI experiments. Residual motion parameters were observed to be within the ranges ±0.2mm/±0.2° without and ±0.5mm/±0.5° with intentional head movements. Comparison with volume-to-volume based prospective motion correction demonstrated an improved performance for high-frequency components of motion.

1171	14:03	Robust rigid-body motion estimation from extremely short subsets of 3D Cartesian scans
		Gregory R Lee[1,2]
		[1]Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [2]Radiology, University of Cincinnati, School of Medicine, Cincinnati, OH, OH, United States
		In this work, the ability to accurately co-register 3D volumes reconstructed from subsets of a variable-density 3D Cartesian acquisition is shown. Accurate rigid-body motion correction was possible for undersampling factors as high as a factor of 125 in a brain imaging application employing a 32-channel head coil. This enables efficient retrospective motion correction without loss of scan efficiency and without the need for any specialized MR hardware. This approach may help reduce the incidence of failed scans due to motion, potentially leading to a reduction for the need for sedation in pediatric patients.

1172	14:15	Data-Driven Correction of B0-off-resonance fluctuations in gradient-echo MRI
		Jakob Meineke[1] and Tim Nielsen[1]
		[1]Philips Research Europe, Hamburg, Germany
		B0-off-resonance fluctuations can lead to artifacts in gradient-echo MRI with long echo-times. This work presents a purely data-driven method to estimate and correct for any B0-off-resonance fluctuation occurring during scanning, without additional data acquisition, navigator or image-processing. The estimated B0-off-resonance fluctuations are shown to be highly correlated with the signal from a respiratory bellows, the spatial variation of the fluctuations can be determined by exploiting the spatially varying coil sensitivities and histograms of R2* measurements show reduced variance.

1173	14:27	Rigid motion corrected low rank magnetic resonance fingerprinting
		Gastao Cruz[1], Olivier Jaubert[1], Shaihan Malik[1], Torben Schneider[2], René M Botnar[1], and Claudia Prieto[1]
		[1]School of Biomedical Engineering and Imaging Sciences, King's College London, London, United Kingdom, [2]Philips Healthcare, Guildford, United Kingdom
		Magnetic Resonance Fingerprinting (MRF) is a novel transient state relaxometry method that simultaneously estimates multiple quantitative tissue parameters. Motion occurring during the MRF acquisition can propagate errors into the parametric maps. Here we propose a novel motion corrected low rank method (MC-MRF) to simultaneously correct for rigid body motion and accelerate the scan. We investigated MC-MRF to correct for 2D in-plane motion on standardized phantom and in-vivo acquisitions. Additionally, we investigated the effect of through-plane motion in 2D MRF. Successful motion correction is achieved with MC-MRF for in-plane motion. Residual artefacts remain from through-plane motion after 2D retrospective motion correction.
1174	14:39	Motion Correction in MRI using Deep Convolutional Neural Network
		Kamlesh Pawar[1,2], Zhaolin Chen[1,3], N Jon Shah[1,4], and Gary F Egan[1,2]
		[1]Monash Biomedical Imaging, Monash University, Melbourne, Australia, [2]School of Psychological Sciences, Monash University, Melbourne, Australia, [3]Department of Electrical and Computer System Engineering, Monash University, Melbourne, Australia, [4]Institute of Medicine, Research Centre Juelich, Juelich, Germany
		Patient motion during MR data acquisition appears in the reconstructed image as blurring and incoherent artefacts. In this work, we present a novel deep learning encoder-decoder convolutional neural network (CNN) that recasts the problem of motion correction into an artefact reduction problem. A CNN was designed and trained on simulated motion corrupted images that learned to remove the motion artefact. The motion compensated image reconstruction was transformed into quantized pixel classification, where each pixel in the motion corrupted MR image was classified to its uncorrupted quantized value using a trained deep learning encoder-decoder CNN.
1175	14:51	Correction of motion artifacts using a multi-resolution fully convolutional neural network
		Karsten Sommer[1], Tom Brosch[1], Rafael Wiemker[1], Tim Harder[1], Axel Saalbach[1], Christopher S. Hall[2], and Jalal B. Andre[3]
		[1]Philips GmbH Innovative Technologies, Hamburg, Germany, [2]Philips Radiology Solutions, Seattle, WA, United States, [3]Department of Radiology, University of Washington, Seattle, WA, United States

		Motion artifacts are a frequent source of image degradation in clinical practice. Here we demonstrate the feasibility of correcting motion artifacts in magnitude-only MR images using a multi-resolution fully convolutional neural network. Training and testing datasets were generated using artificially created artifacts introduced onto *in vivo* clinical brain scans. Both the corrupted input and filtered output images were rated by an experienced neuroradiologist.

1176	15:03	Non-rigid Brain MRI Registration Using Two-stage Deep Perceptive Networks
		Xiaohuan Cao[1,2], Jianhua Yang[1], Li Wang[2], Qian Wang[3], and Dinggang Shen[2]
		[1]School of Automation, Northwestern Polytechnical University, Xi'an, China, [2]Department of Radiology and BRIC, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [3]School of Biomedical Engineering, Med-X Research Institute, Shanghai Jiao Tong University, Shanghai, China
		Non-rigid image registration is a fundamental procedure for the quantitative analysis of brain images. The goal of non-rigid registration is to obtain the smooth deformation field that can build anatomical correspondences among two or more images. Conventional non-rigid registration methods require iterative optimization with careful parameter tuning, which is less flexible when dealing with the diverse data. Therefore, we propose a two-stage deep network to directly estimate the deformation field between an arbitrary pair of images. This method can tackle various registration tasks, and is consistently accurate and robust without parameter tuning. Thus, it is applicable to clinical applications.

Oral

Body Imaging: Genitourinary Imaging (Non-Prostate)

S06	Thursday 13:15 - 15:15	*Moderators:* Victoria Chernyak & Yasser Abbas

1177	13:15	Cervical cancer staging and surveillance using Restriction Spectrum Imaging (RSI)-MRI in comparison to PET-CT: Pilot Clinical Application
		Ghiam Yamin[1], Kaveh Zakeri[2], Natalie M. Schenker-Ahmed[1], Nathan S. White[1], Hauke Bartsch[1], Joshua Kuperman[1], Loren K. Mell[2], Michael Hahn[1], David S. Karow[1], Anders M. Dale[3], and Rebecca A. Rakow-Penner[1]
		[1]Radiology, University of California, San Diego, San Diego, CA, United States, [2]Radiation Medicine and Applied Sciences, University of California, San Diego, La Jolla, CA, United States, [3]Radiology & Neurosciences, University of California, San Diego, La Jolla, CA, United States

		This proof of concept study suggests restriction spectrum imaging (RSI)-magnetic resonance imaging (MRI) provides similar cervical cancer staging and surveillance information compared to standard of care MP-MRI and PET-CT. Advantages over the standard of care modalities may include improved cost-effectiveness, brevity, radiation-free, and contrast media-free. Pilot cases suggest that RSI-MRI cellularity index can detect residual and recurrent tumor in post-treatment cervical cancer patients with similar sensitivity to PET-CT. RSI-MRI has the advantage of minimal false positive results related to radiation-related post-treatment changes that often confound interpretation of PET-CT.

1178	13:27	MR R2* values in diagnosing the stage Ia and Ib endometrial carcinoma
		Meng-yao Wang[1], Mei-yu Sun[1], Xu Han[1], Rui Fan[1], and Lizhi Xie[2]
		[1]Radiology, the First Affiliated Hospital of Dalian Medical University, Dalian, China, [2]GE Healthcare, Beijing, China
		Endometrial carcinoma(EC) patients staged stage Ia or Ib have different operation methods and prognosis. To evaluate the value of enhanced T2*-weighted angiography(ESWAN) in the differential diagnosis between stage Ia and Ib of endometrial carcinoma. In this work, we found it is feasible that ESWAN sequence derived R2* value can be applied in the differential diagnosis between stage Ia and Ib of endometrial carcinoma, which can provide detailed information for clinical treatment.

1179	13:39	Ex vivo MRI evaluation of vulvar cancer in fresh wide local excision specimens for cancer localization and prediction of the surgical tumour free margins.
		Jan Heidkamp[1], Petra Zusterzeel[2], Andor Veltien[1], Arie Maat[3], Ilse van Engen-van Grunsven[3], Maroeska Rovers[4], and Jurgen Fütterer[1]
		[1]Radiology and Nuclear Medicine, Radboud university medical center, Nijmegen, Netherlands, [2]Obstetrics and Gynaecology, Radboud university medical center, Nijmegen, Netherlands, [3]Pathology, Radboud university medical center, Nijmegen, Netherlands, [4]Operating Rooms, Radboud university medical center, Nijmegen, Netherlands
		Currently, perioperative information on the surgical margin status of wide local excision specimens containing vulvar cancer is only based on the surgeon's estimation. In this study we performed both a non-blinded and a blinded annotation of vulvar cancer location and surgical tumour free margins in the ex vivo MRI obtained from fresh wide local excision specimens. Annotated whole-mount section histopathology slides obtained from totally included specimens were adhered as gold standard. There was high correlation and agreement between ex vivo MRI, and high NPV and PPV were obtained for vulvar cancer localization and identification of margins <8 mm.

1180	13:51	Texture analysis of multiparametric MRI in cervical cancer before and after chemoradiotherapy

		Jose Angelo Udal Perucho[1], Elaine Yuen Phin Lee[1], Richard Du[1], Varut Vardhanabhuti[1], and Queenie Chan[2]
		[1]Diagnostic Radiology, The University of Hong Kong, Hong Kong, Hong Kong, [2]Philips Healthcare, Hong Kong, Hong Kong
		Texture analysis of multiparametric MRI (mpMRI) consisting of diffusion-weighted MRI (DWI) and T2-weighted (T2W) texture features could be a promising quantitative approach in assessing tumor heterogeneity. We retrospectively studied forty patients who had paired mpMRI examinations before and at week-4 of chemoradiotherapy (CRT). Based on the changes in stable mpMRI features, we observed that initially more anatomically and functionally homogenous tumors had better response to treatment and that tumors became more functionally heterogenous after treatment.

1181	14:03	Multivariate Analysis including Biological Biomarkers, Diffusion-Weighted Imaging, T1 and T2 Mapping for Renal Fibrosis Prediction
		Iris Friedli[1], Lena Berchtold[2], Lindsey A Crowe[3], Chantal Martinez[2], Solange Moll[2], Karine Hadaya[2], Thomas De Perrot[2], Pierre-Yves Martin[2], Jean-Paul Vallée[2], and Sophie De Seigneux[2]
		[1]Radiology, University of Geneva, Geneva, Switzerland, [2]University Hospital of Geneva, Geneva, Switzerland, [3]University of Geneva, Geneva, Switzerland
		Recently, the cortico-medullary difference in Apparent Diffusion Coefficient (ΔADC) from (RESOLVE) diffusion-weighted imaging (DWI with readout segmentation of long variable echo train) allowed the classification of kidney allograft patients according to whether they had more or less than 40% interstitial fibrosis. In this study, ΔADC was externally validated, with a very good AUC, as an index to identify patients with more than 40% fibrosis in a larger and mixed population of 130 patients. In addition, a mixed scoring including the combination of routinely obtained serologic markers including eGFR, and MRI-derived (ΔADC and ΔT1) was proposed to improve renal fibrosis prediction.

1182	14:15	MR Elastography, Diffusion Imaging and BOLD-Imaging for the Detection of Early Changes of Renal Stiffness in Patients with Lupus Nephritis
		Stephan Rodrigo Marticorena Garcia[1], Markus Grossmann[1], Anne Bruns[2], Heiko Tzschätzsch[1], Bernd Hamm[1], Jürgen Braun[3], Ingolf Sack[1], and Jing Guo[1]
		[1]Radiology, Charité - Universitätsmedizin Berlin, Berlin, Germany, [2]Rheumatology, Charité - Universitätsmedizin Berlin, Berlin, Germany, [3]Medical Informatics, Charité - Universitätsmedizin Berlin, Berlin, Germany

		Renal stiffness was investigated using MR elastography (MRE) and tomoelastography data processing in healthy controls and patients with lupus nephritis (LN). Our results showed that patients had lower renal stiffness than controls, while subregions such as medulla and inner cortex allowed to differentiate early chronic kidney disease (CKD=1) from progressed disease stages based on MRE values. The observed reduction in renal stiffness is associated with decreased ADC-values and increased T2*-values due to LN with CKD≥2. The decreased stiffness due to CKD=1 was reflected by T2*-values but not by ADC-values. MRE provided the highest diagnostic accuracy for detection of LN.

1183	14:27	Diffusion-weighted magnetic resonance imaging in bladder cancer: comparison of readout-segmented EPI and single-shot EPI Techniques
		Haihu Chen[1], Luguang Chen[1], Fang Liu[1], Qingsong Yang[1], Jianping Lu[1], and Li Wang[1]
		[1]Radiology, Changhai Hospital of Shanghai, Shanghai, China
		Diffusion weighted imaging showed the potential to assess bladder cancer. This study aimed to investigate whether readout-segmented EPI can offer better image quality in imaging bladder patients in comparison with single-shot EPI, and to compare quantitative image parameters, derived from RS-EPI with those of SS-EPI. Thirty-five patients were examined using both diffusion techniques. There were significant differences in susceptibility artifacts, lesion detectability, image blurring, CNR and SIR values, except for motion artifacts, SNR and ADC values of the bladder lesions. This study found that the RS-EPI technique provides significant image quality improvement compared with SS-EPI in bladder at 3 Tesla.

1184	14:39	4D flow MRI in renal transplant: preliminary results.
		Octavia Bane[1,2], Sara Lewis[1,2], Stefanie Hectors[1,2], Sonja Gordic[2,3], Paul Kennedy[1,2], Mathilde Wagner[2,4], Michael Markl[5,6], Rafael Khaim[7], Veronica Delaney[7], Fadi El Salem[8], Madhav Menon[7], and Bachir Taouli[1,2]
		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [2]Radiology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [3]University Hospital Zurich, Zurich, Switzerland, [4]Groupe Hospitalier Pitie-Salpetriere, Paris, France, [5]Feinberg School of Medicine, Radiology, Northwestern University, Chicago, IL, United States, [6]McCormick School of Engineering, Biomedical Engineering, Northwestern University, Chicago, IL, United States, [7]Recanati-Miller Transplantation Institute, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States, [8]Pathology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, United States
		In this preliminary study, we sought to determine the test-retest repeatability of flow quantification in renal allograft vessels using a 4D flow phase-contrast (PC) MRI sequence, and to correlate flow parameters with renal function. We observed significantly decreased renal arterial flow in allografts with chronic dysfunction, as well as positive correlation between flow and velocities in renal transplant vessels and renal function. We conclude that 4D flow imaging is sensitive to the vascular changes that accompany renal transplant dysfunction, to be confirmed in a larger study.

1185	14:51	Free-breathing R2* Mapping in the Entire Placenta During Early Gestation Using 3D Stack-of-Radial MRI at 3 T: Investigation of Spatial and Temporal Variation
		Tess Armstrong[1,2], Dapeng Liu[1], Thomas Martin[1,2], Cass Wong[1], Irish Del Rosario[3], Sherin U. Devaskar[4], Carla Janzen[5], Teresa Chanlaw[4], Rinat Masamed[1], Kyunghyun Sung[1,2], and Holden H. Wu[1,2]
		[1]Radiological Sciences, University of California Los Angeles, Los Angeles, CA, United States, [2]Physics and Biology in Medicine, University of California Los Angeles, Los Angeles, CA, United States, [3]Epidemiology, University of California Los Angeles, Los Angeles, CA, United States, [4]Pediatrics, David Geffen School of Medicine at UCLA, University of California Los Angeles, Los Angeles, CA, United States, [5]Obstetrics and Gynecology, David Geffen School of Medicine at UCLA, University of California Los Angeles, Los Angeles, CA, United States
		Current methods for detecting ischemic placental disease are either invasive or have low sensitivity. MRI can be used to non-invasively characterize tissue hypoxia with R_2* mapping. However, conventional Cartesian MRI methods are sensitive to motion artifacts due to maternal and fetal motion. In this study, a non-Cartesian free-breathing 3D stack-of-radial MRI technique (FB radial) for R_2* mapping in the placenta during early gestation was investigated at 3T. In 20 subjects, placental R_2* range, accuracy, repeatability, spatial variation, and temporal variation were analyzed. Results demonstrate that FB radial is an accurate and repeatable technique for R_2* mapping in the entire placenta.

1186	15:03	Placental Metabolic Rate of Oxygen
		Ana E Rodríguez-Soto[1], Michael C Langham[1], Eileen E Hwuang[2], Walter R Witschey[1], Nadav E Schwartz[3], and Felix W Wehrli[1]
		[1]Department of Radiology, University of Pennsylvania, Philadelphia, PA, United States, [2]Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, United States, [3]Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, University of Pennsylvania, Philadelphia, PA, United States
		Placental dysfunction is widely accepted as a major cause of common adverse pregnancy outcomes. However, current clinically available tools are limited in their ability to assess placental function. Here, we have incorporated quantitative MRI methods to estimate placental metabolic rate of O_2 ($PMRO_2$), which may contribute to the understanding of placental dysfunction. Presented results demonstrate the feasibility of estimating $PMRO_2$ *in vivo*. Further, these data suggest, in a limited number of participants, that $PRMO_2$ may in fact contribute to the understanding of pregnancy complications.

Oral

Thermometry & MR-HIFU

W05/06	Thursday 13:15 - 15:15	*Moderators:* Pooja Gaur & Michael Bock

1187	13:15	Feasibility of Blood-Brain Barrier Opening in Patients with Alzheimer's Disease by MR-Guided Focused Ultrasound
		Yuexi Huang[1], Nir Lipsman[2,3], Ying Meng[2,3], Allison J. Bethune[3], Benjamin Lam[3,4], Mario Masellis[3,4], Nathan Herrmann[3,5], Chinthaka Heyn[1,6], Isabelle Aubert[1,3], Alexandre Boutet[6], Gwenn S. Smith[7], Sandra E. Black[3,4], and Kullervo Hynynen[1,8]
		[1]Sunnybrook Research Institute, Toronto, ON, Canada, [2]Division of Neurosurgery, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [3]Hurvitz Brain Sciences Research Program, Sunnybrook Research Institute, Toronto, ON, Canada, [4]Division of Neurology, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [5]Division of Geriatric Psychiatry, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [6]Department of Medical Imaging, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, [7]Department of Psychiatry and Behavioral Sciences and Radiology and Radiological Sciences, Johns Hopkins University, Baltimore, MD, United States, [8]Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada
		In a phase I clinical trial, the feasibility and safety of focal blood-brain barrier (BBB) opening in patients with Alzheimer's disease using the ExAblate focused ultrasound system was evaluated. Six patients were treated in the white matter of the prefrontal cortex. It was demonstrated that BBB opening can be achieved without any red-blood-cell extravasation.

1188	13:27	Noninvasive neuromodulation induced by focused ultrasound combined with fMRI in the non-human primate brain
		Tingting He#[1], Chih-Hung Tsai#[2], Ssu-Ju Li[3], Xianfeng Feng[1], Kaiyue Wang[1], Chao-Ting Wang[1,2], Xiao Yu[1], Wei Xiong[1], You-Yin Chen[3], Hao-Li Liu*[1,2], and Hsin-Yi Lai*[1]
		[1]Interdisciplinary Institute of Neuroscience and Technology, Qiushi Academy for Advanced Studies, Zhejiang University, Hangzhou City, China, [2]School of Medicine, Department of Electrical Engineering, Chang Gung University, Taoyuan County, Taiwan, [3]Department of Biomedical Engineering, National Yang-Ming University, Taipei City, Taiwan
		Currently, the field of neuromodulation using focused ultrasound is growing due to its potential clinical applications. Using the lab-designed MRI-compatible FUS transducer and 7T research MRI system with the customer-made transmit/receive surface coil, the current study demonstrated that focused ultrasound (FUS) can induce BOLD responses in visual cortex in non-human primate. The effect of FUS could sostenuto influence the neuron activity in the visual cortex to enhance BOLD responses evoked by visual stimulus. FUS combined with fMRI has potential to explore the mechanism of neuromodulation in NHP induced by focused ultrasound.

1189	13:39	In vivo MR-ARFI for transcranial focused ultrasound in large animals
		Pooja Gaur[1], Ningrui Li[2], Rachelle Bitton[1], and Kim Butts Pauly[1]

		[1]Radiology, Stanford University, Stanford, CA, United States, [2]Electrical Engineering, Stanford University, Stanford, CA, United States
		Focused ultrasound through the skull is desirable for noninvasive brain therapies such as neuromodulation. However, the skull distorts the ultrasound beam and absorbs varying amounts of energy depending on bone thickness and composition. In light of these challenges, we investigate magnetic resonance acoustic radiation force imaging (MR-ARFI) focal spot imaging of subcortical brain tissue in a large animal, and simulations and measurements of acoustic pressure transmitted through the skull. Results show in vivo MR-ARFI focal spot imaging through the skull for the first time, and provide practical information on focal spot targeting through skulls of varying shape, thickness, and composition.

1190	13:51	Focus Correction in MR Thermometry for Precise Targeting in Focused Ultrasound Thalamotomy for Essential Tremor: Statistical Study from 121 Sonications in 7 Patients
		Chang-Sheng Mei[1], Shenyan Zong[2], Bruno Madore[3], and Nathan McDannold[3]
		[1]Physics, Soochow University, Taipei, Taiwan, [2]Biomedical Engineering, Shanghai Jiao Tong University, Shanghai, China, [3]Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States
		Focused ultrasound thalamotomy was approved by FDA for the treatment of essential tremor under MRI guidance. However, spatial errors in the location of focal spots are often observed and could jeopardize the patient safety if not taken into account. We previously explained the causes of this error and proposed a correction method. Using the method, data associated with 121 sonications from 7 patients were statistically analyzed in the present study. Results show the focus was shifted by 0.05 mm/°C. The size of shift for treating sonication agrees with the value reported in literature.

1191	14:03	Interleaved scanning for MR-guided High Intensity Focused Ultrasound mediated drug delivery
		Edwin Heijman[1], Esther Kneepkens[2], Jochen Keupp[3], Steffen Weiss[3], and Holger Grüll[4]
		[1]Oncology Solutions, Philips Research, Cologne, Germany, [2]Biomedical NMR, Eindhoven University of Technology, Eindhoven, Netherlands, [3]Philips Research, Hamburg, Germany, [4]Department of Radiology, Experimental Imaging and Image-guided Therapy, University Hospital of Cologne, Cologne, Netherlands
		MR-guided High Intensity Focused Ultrasound (MR-HIFU) is a method that allows non-invasive heating of lesions to well-controlled ablative or hyperthermic temperatures. Control of acoustic power and focus position is achieved using a feedback based on MR thermometry. Local hyperthermia can be used as a trigger for image guided drug delivery using temperature sensitive liposomes co-encapsulating doxorubicin and MR contrast agent. The challenge is to acquire both temperature and R_1-maps during hyperthermia dynamically. We investigated a novel MR method interleaving both acquisitions, with their own temporal resolution, without compromising temperature feedback showing a gradually increase of contrast agent inside rat tumors.

1192	14:15	An experimental model for mild hyperthermia with predictive temperature control in osteolytic bone metastases, using MR-guided focused ultrasound.
		Sana Boudabbous[1], Pauline Guillemin[1], Orane Lorton[1], Laura Gui-Levy[1], Stephane Desgranges[1], Xavier Montet[1], Christoph D Becker[1], Raymond Miralbell[2], Thomas Zilli[2], and Rares Salomir[1]
		[1]Radiology, Geneva University Hospitals, Image guided Interventions Laboratory, Geneva, Switzerland, [2]Radiation Oncology, Geneva University Hospitals, Geneva, Switzerland
		Combination of hyperthermia with ionizing radiation is strongly compelling, based on principles of classic radiobiology, molecular biology, and tumor physiology. MR-guided focused ultrasound (MRgFUS) is a “touch-less” approach already employed for ablative pain palliation of symptomatic bone metastases (SBM). MRgFUS mild hyperthermia adjuvant to radiation therapy has not been reported for SMB pain palliation. We optimized here the geometry of MRgFUS sonication and the automatic temperature control during steady-state long lasting hyperthermia using a realistic ex-vivo anatomic model mimicking osteolytic bone tumors. The results demonstrated uniform spatio-temporal heating, together with predictable and safe thermal condition of the cortical bone.

1193	14:27	Correction of focused ultrasound beam defocusing in heterogeneous soft tissues
		Allison Payne[1], Henrik Odeen[1], Christopher Dillon[1], Hailey McLean[1], Douglas A Christensen[2,3], and Dennis L Parker[1]
		[1]Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, United States, [2]Bioengineering, University of Utah, Salt Lake City, UT, United States, [3]Electrical and Computer Engineering, University of Utah, Salt Lake City, UT, United States
		Soft tissue MRgFUS treatments can be adversely affected by aberration of the focused ultrasound beam due to speed of sound differences between heterogeneous tissues. A quasi-real time beam aberration correction technique that uses an MRI derived model is presented and experimentally validated in a heterogeneous breast-mimicking phantom model. Comparison of MRgFUS sonications performed with and without phase aberration correction demonstrates that this model-based correction algorithm results in improved MRgFUS treatment efficiency and accuracy. This is shown to affect both thermal and mechanical MRgFUS applications.

1194	14:39	Intra-vascular, MRI-Guided, perivascular ultrasound ablation with thermometric monitoring of therapy delivery
		Xiaoyang Liu[1,2], Nicholas Ellens[2,3], Emery Williams[4], Clif Burdette[4], Parag Karmarkar[2], and Paul Bottomley[1,2]
		[1]Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, United States, [2]Russell H. Morgan Dept. of Radiology, Johns Hopkins University, Baltimore, MD, United States, [3]Acertara Acoustic Laboratories, Longmont, CO, United States, [4]Acoustic MedSystems, Inc, Champaign, IL, United States

		Vessel invasion from a tumor is a major challenge for both surgical resection and extracorporeal HIFU ablation. Conceivably, an intravascular ultrasound ablation catheter combined with an intravascular high-resolution MRI coil could precisely target and monitor of peri-vascular therapy delivery that preserves the vessel wall via MRI thermometry. We present results from an intra-vascular 3T ultrasound ablation/MRI antenna probe that document MRI thermometry-based thermal dosage and lesion formation in porcine liver and chicken specimens with vessel wall preservation. A simple motion-correction method that employs the antenna's intrinsic sensitivity profile as a navigator for thermometry is tested *in vivo*.

1195	14:51	Long-Term Volumetric Thermometry for Measurement of Diffuse Tissue Heating during MRgFUS Treatments
		Eugene Ozhinsky[1], Matthew D. Bucknor[1], and Viola Rieke[1]
		[1]Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States
		Currently, PRF MR thermometry is commonly used for temperature monitoring and thermal dose estimation during MRgFUS treatments. The temperature is calculated based on the phase change between the current image and the baseline image, which is acquired before each sonication starts. This does not account for residual heat from previous sonications. In this work, we have developed a volumetric long-term thermometry technique to measure the change in temperature of the entire region of treatment for the duration of the procedure

1196	15:03	Evaluation of 2D simultaneous multi-slice EPI at 1.5T for MR-thermometry in presence of motion.
		Valéry Ozenne[1,2,3], Pierre Bour[1,2,3,4], Baudouin Denis De Senneville[5], Marylene Delcey[1,2,3,6], Wadie Ben Hassen[7], Alexis Vaussy[7], Rainer Schneider[8], and Bruno Quesson[1,2,3]
		[1]IHU Liryc, Electrophysiology and Heart Modeling Institute, Fondation Bordeaux Université, Bordeaux, France, [2]Univ. Bordeaux, Centre de recherche Cardio-Thoracique de Bordeaux, U1045, Bordeaux, France, [3]INSERM, Centre de recherche Cardio-Thoracique de Bordeaux, U1045, Bordeaux, France, [4]Image Guided Therapy SA, Bordeaux, France, [5]Institute of Mathematics of Bordeaux, UMR 674 5251, Bordeaux, France, [6]Siemens Healthineers, Saint Denis, France, [7]Siemens Healthcare, Saint Denis, France, [8]Siemens Healthcare, Erlangen, Germany
		Temperature mapping in presence of respiratory motion can accommodate intra-scan motion using fast 2D-EPI sequence but inter-scan motion remains a challenge during free-breathing acquisition. To address this limitation, we evaluated, in vitro on a mobile gel, a 2D simultaneous multi-slice EPI sequence with a slice acceleration factor up to 3 during radiofrequency ablation. Inter-scan motion and temperature elevation measured with accelerated sequences are compared to reference values using a non-accelerated sequence. Additionally, evidence or absence of potential false-positive heating are considered.

Electronic Poster: Acquisition, Reconstruction & Analysis

Exhibition Hall	Thursday 14:15 - 15:15	*(no CME credit)*

Study Groups

Current Issues in Brain Function Business Meeting

W07	Thursday 15:30 - 16:30	*(no CME credit)*

Member-Initiated Symposium

Big Data, Annotations & Machine Learning for Neuro MR: A No-Brainer

Organizers: Matthew Budde, Alex Rovira, Hugo Vrenken

N04	Thursday 15:30 - 17:30	*(no CME credit)*

	15:30	Introduction
		Hugo Vrenken

	15:35	Data Sharing Initiatives in Neuroimaging & Beyond: Experiences & Lessons Learned
		Tim Dyrby[1]
		[1]Danish Research Centre for MR

	15:58	Successes of Big Data & Data Sharing in Understanding Neurological Diseases
		Paola Valsasina[1]
		[1]Neuroimaging Research Unit, San Raffaele Scientific Institute, Milan, Italy

	16:21	Analysis Pipeline Sharing: Making Life Easier?
		Nikola Stikov

	16:44	Public Engagement 2.0: On the Possibilities of "Citizen Science"
		Roberto Toro[1]
		[1]Institut Pasteur

	17:07	What Can Learning Machines Teach Us About the CNS?
		Sébastien Ourselin[1]
		[1]University College London

Member-Initiated Symposium

Pre-Clinical Multi-Modality Imaging: Nuts & Bolts

Organizers: Kristine Glunde, Natalie Serkova

W03/04	Thursday 15:30 - 17:30	*Moderators:* Kristine Glunde & Natalie Serkova	*(no CME credit)*

	15:30	Introduction to Animal Imaging in Translational Research

	15:35	Animal Handling for an Imaging Study: Do We Really Do It Correctly?
		Jeff Dunn[1]
		[1]University of Calgary, Canada

	15:55	State-of-the-Art MRI/MRS in Animal Research: Novel MR Contrast; Multinucear (Including Hyperpolarized) MRS; Treatment Response
		Paula Foster[1]
		[1]Robarts Research Institute, Canada

	16:15	Molecular Imaging Beyond MRI: Novel PET Radiotracers & Applications, Optical Imaging

		TBD

	16:35	Vascular Imaging in Animal Research: MRI, MicroCT, Ultrasound
		Arvind Pathak[1]
		[1]Radiology, Johns Hopkins University, Baltimore, MD, United States

	16:55	Multi-Parametric Image Analysis: Quantitative Image Analysis & Multi-Parametric Multi-Modal Imaging Biomarkers
		Harish Poptani

	17:15	Panel Discussion

Weekday Course

The MRI Artifacts Game Show

Organizers: Adrienne Campbell-Washburn, Edward DiBella, Eric Stinson, Dominik Von Elverfeldt

S02	Thursday 15:30 - 17:30	*Moderators:* Adrienne Campbell-Washburn & Eric Stinson

	15:30	Artifact Game Show
		Eric Stinson[1], Adrienne Campbell-Washburn[2], Dominik von Elverfeldt[3], and Edward DiBella[4]
		[1]Mayo Clinic, Rochester, MN, United States, [2]National Institutes of Health, Bethesda, MD, United States, [3]Uniklinik-Freiburg, Freiburg, Germany, [4]University of Utah, Salt Lake City, UT, United States
		Come participate in the ISMRM Artifact Game Show! Learn about common MR artifacts and how to avoid them in a light-hearted game show setting. Contestants will participate in a variety of games to learn about artifacts, and then experts will provide more information. If you're in the room, you have the chance to play! Come for the artifacts, stay for the fun and prizes!

	17:30	Adjournment & Meet the Teachers

Weekday Course

MR Physics & Techniques for Clinicians

Organizers: Marcus Alley, Bernd Jung

S01	Thursday 15:30 - 17:30	*Moderators:* Joseph Cheng & Bernd Jung

	15:30	Artifacts to Artefacts
		Bernd Jung[1]
		[1]University Hospital Bern, Switzerland
		Imaging artifacts are routinely encountered in MR clinical practice. Therefore the presentation focuses on 1) the understanding why MR artifacts arise, 2) the identification of key artifacts and to understand their origins, 3) the elimination or mitigation of artifacts (if desired or possible), and 4) artifacts that can be utilized for diagnostic purposes.

	16:10	Contrast Agents, Focusing on the Gadolinium Chelates and Safety
		Val M. Runge[1]
		[1]INSELSPITAL, Universitätsspital Bern, Switzerland
		The gadolinium chelates (the GBCAs) are critical to disease diagnosis by MR, indeed to clinical medicine worldwide, and have proven to be overall a very safe class of contrast media. This review focuses on the current knowledge regarding accumulation of gadolinium in the brain (dentate nucleus and other structures) and body, with clinical recommendations based on that and other safety data, including discussion of the recent European Medicines Agency (EMA) ruling.

	16:50	High Field Imaging
		Sebastian Schmitter[1]
		[1]Physikalisch-Technische Bundesanstalt, Braunschweig and Berlin, Germany

		The MRI main field strength has been constantly increased over the past decades and today, scanners with 3T, 7T and even beyond are in use. However, ultrahigh-field (>7T) systems are still mostly used in research centers although a transition into hospitals is expected. The reasons for using (ultra-)high fields are multifold and will be outlined in this presentation Along with these benefits go a larger range of challenges, which are among the reasons for the rather slow transition of UHF into clinical applications. Solutions to most of these challenges will be presented and applications will be highlighted.

	17:30	Adjournment & Meet the Teachers

Combined Educational & Scientific Session

Faster Imaging, Faster Evaluation

Organizers: Christopher Hess, Alex MacKay

N01	Thursday 15:30 - 17:30	*Moderators:* Christopher Hess & Alex MacKay

	15:30	Fast Imaging Techniques for Brain Imaging
		Stefan Skare[1]
		[1]Karolinska University Hospital, Sweden
		"Fast Imaging Techniques for Brain Imaging" is a wide topic. This presentation will focus on the most recent advances in fast brain imaging towards comprehensive clinical brain exams by acquiring multiple MR contrasts simultaneously in minimal scan time.

	16:00	Medical Applications of Fast MR Imaging of Brain
		Kambiz Nael[1]
		[1]Radiology, Mount Sinai Hospital, New York, NY, United States

		The target audience of this talk are neuroscientists and clinicians including neurologists and neuroradiologists interested in the development and application of rapid brain MRI imaging. The objectives are: 1. To be familiar with the latest available methodology for fast brain MR imaging 2. Learn how to obtain routine brain MRI examinations in 5 minutes 3. Learn how to perform and interpret a 6-minute comprehensive stroke MR imaging 4. Accelerate brain vascular imaging using highly under sampled methodology: - Compressed sensing for brain vessel wall imaging and MRA - k-t accelerated imaging for clinical brain 4D flow imaging

1197	16:30	Highly Accelerated Multi-Contrast 3D Isotropic MRI in 5 Minutes: A Feasibility Study for Multiple Sclerosis
		Xiaoxiao Ma[1], Xin Lou[1], Hyunkyung Maeng[2], Sugil Kim[2,3], Suhyung Park[2], Guobin Li[4], Chaohong Wang[4], and Jaeseok Park[2]
		[1]Chinese PLA General Hospital, Beijing, China, [2]Department of Biomedical Engineering, Sungkyunkwan University, Suwon, Republic of Korea, [3]Department of Brain and Cognitive Engineering, Korea University, Seoul, Republic of Korea, [4]United Imaging Healthcare(UIH), Shanghai, China
		Multiple sclerosis(MS) is a chronic disease that damages the nerves in the brain and results in multiple areas of scar tissues within the central nervous system. Multi-contrast structural MRI, which includes T1, T2, and FLAIR, has been routinely used in detecting MS lesions. Nevertheless, it is still challenging to accurately detect small MS lesions diffused over the entire brain due to the limitation of spatial resolution and long imaging time. The purpose of this work is to investigate the feasibility of achieving highly accelerated, multi-contrast 3D isotropic (~ 1.0 mm3) MRI (T1, T2, and FLAIR), which exploits sharable information across images, for detection of MS lesions over the whole brain roughly in 5 minutes.

1198	16:45	Through-time and hybrid radial GRAPPA to improve the visualisation of velic motion in real-time speech MRI
		Matthieu Ruthven[1], Andreia C Freitas[2], Redha Boubertakh[1], and Marc E Miquel[1,2]
		[1]Clinical Physics, Barts Health NHS Trust, London, United Kingdom, [2]William Harvey Research Institute, Queen Mary University of London, London, United Kingdom

		Aim: to investigate if radial GRAPPA could be used to: (a) improve velic motion visualisation when compared with standard protocols and reconstructions; (b) enable multislice imaging by sufficiently accelerating real-time MRI data acquisition. *Methods:* datasets of healthy adult volunteers were acquired at 3T and reconstructed using through-time and hybrid GRAPPA methods. *Results:* velic motion visualisation was superior in GRAPPA images than in images acquired using standard protocols and reconstructions. Multislice imaging (two slices) at 8fps per slice was achieved. *Conclusions:* radial GRAPPA shows promise as a method for use in clinical imaging of speech.

1199	17:00	A multi-center study on fast full-brain quantitative multi-parameter mapping of R1, MT, and R2*: scan-rescan repeatability and inter-site reproducibility
		Maryam Seif[1,2], Tobias Leutritz[2], Rebecca S Samson[3], Armin Curt[1], Claudia Angela Gandini Wheeler-kingshott[3,4,5], Patrick Freund[1,2,6], and Nikolaus Weiskopf[2]
		[1]Spinal Cord Injury Center Balgrist, University of Zurich, Zurich, Switzerland, [2]Max Planck Institute for Human Cognitive and Brain Science, Leipzig, Germany, [3]Queen Square MS Centre, UCL Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom, [4]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy, [5]Brain MRI 3T Centre, C. Mondino National Neurological Institute, Pavia, Italy, [6]Department of Brain Repair and Rehabilitation, UCL Institute of Neurology, London, United Kingdom
		We present a multi-center, multi-vendor study evaluating repeatability and reproducibility of quantitative MRI data acquired using high resolution (1 mm³) multi-parameter mapping which provides quantitative R1, MT and R2* maps of the whole brain within less than 18 min. The protocol was implemented at four clinical sites with different Siemens and Philips 3T MRI scanners. Scan-rescan measurements of the same five healthy volunteers at all sites showed good intra-site reproducibility in all parameter maps. However, the inter-site comparisons showed higher reproducibility within a single vendor than across vendors.

1200	17:15	Multi-contrast EPI - Towards clinical application
		Tim Sprenger[1], Mathias Engström[1], Ola Norbeck[2,3], Henric Rydén[2,3], Enrico Avventi[2,3], Johan Berglund[3], and Stefan Skare[2,3]
		[1]MR Applied Science Laboratory Europe, GE Healthcare, Stockholm, Sweden, [2]Karolinska University Hospital, Dept of Neuroradiology, Stockholm, Sweden, [3]Karolinska Institute, Dept of Clinical Neuroscience, Stockholm, Sweden

		We present an enhanced version of our multi-contrast EPI sequence which generates T1-FLAIR, T2-FLAIR, T2*w, T2w, iso-DWI, ADC images of 36 slices in 90 s. We introduce various optimization including tetrahedral diffusion encoding, different partial Fourier factors for the EPI trains and multi-echo acquisition for T2-FLAIR, T2*w, T2w, and DWI. The improved sequence is compared to our previous implementation and superior image quality is shown especially for the diffusion contrast. Finally, multi-contrast EPI patient data is shown and compared to conventional imaging sequences.

	17:30	Adjournment & Meet the Teachers

Oral

Diffusion MRI: Acquisition & Artifact Correction

N02	Thursday 15:30 - 17:30	*Moderators:* Hua Guo & Trong-Kha Truong

1201	15:30	3D Diffusion Imaging with SPiral Encoded Navigators from Stimulated Echoes (3D DISPENSE)
		Qinwei Zhang[1], Bram F. Coolen[2], Aart J. Nederveen[1], and Gustav J. Strijkers[2]
		[1]Department of Radiology, Academical Medical Center, Amsterdam, Netherlands, [2]Department of Biomedical Engineering and Physics, Academic Medical Center, Amsterdam, Netherlands
		In this work, we present a new method for motion-insensitive 3D multi-shot diffusion imaging, by using 3D **D**iffusion **I**maging with **SP**iral **E**ncoded **N**avigators from **S**timulated **E**choes (3D DISPENSE). The 3D spiral navigator is acquired with a single readout and generated between diffusion preparation and image acquisition from the twin-pathway of the stimulated echo TSE imaging signal pathway. Therefore, the proposed 3D navigator technique does not compromise diffusion weighting or TSE readout efficiency. We demonstrated the feasibility of this method in phantoms, as well as by *in vivo* 3D high resolution artifact-free diffusion tensor imaging with nearly full brain coverage.

1202	15:42	A 3D k-Space Fourier Encoding and Reconstruction Framework for Simultaneous Multi-Slab Acquisition
		Erpeng Dai[1], Yu-hsuan Wu[1], and Hua Guo[1]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China

		3D multi-slab acquisition is an important technique for high-resolution isotropic diffusion imaging. To further accelerate the acquisition, simultaneous multi-slice (SMS) excitation can be combined with multi-slab. Although either multi-slab or SMS acquisition can be described using a 3D k-space, it's hard to describe simultaneous multi-slab (SMSlab) using a 3D k-space. In this study, it's shown that by using RF modulation and gradient encoding together, SMSlab acquisition can also be described by a 3D k-space. It's further demonstrated that parallel imaging techniques, such as 2D SENSE and 2D GRAPPA, can be used to recover the under-sampled k-space from SMSlab.

1203	15:54	Distortion-Free, High-Resolution Diffusion Imaging in a Clinically-Feasible Scan Time on a Compact 3T MRI with High-Performance Gradients
		Myung-Ho In[1], Ek Tsoon Tan[2], Joshua D Trzasko[1], Yunhong Shu[1], Shengzhen Tao[1], Erin M Gray[1], John Huston[1], and Matt A Bernstein[1]
		[1]Department of Radiology, Mayo Clinic, Rochester, MN, United States, [2]GE Global Research, Niskayuna, NY, United States
		DIADEM (Distortion-free Imaging: A Double Encoding Method) is a hybrid, multi-shot approach using a spin-warp and echo-planar phase-encoding strategy. It is inspired by the point-spread-function mapping method to enable distortion-free high-resolution diffusion imaging, which has a great potential for clinical practice. However, its prolonged scan time poses an obstacle for its adoption. We demonstrate that DIADEM achieves high-resolution (1.4 mm^3 isotropic or 0.86 mm^2 in-plane), distortion-free, and whole-brain, diffusion tensor images under 9 minutes scan time with: i) sequence optimization and ii) the high-performance gradients (80 mT/m, 700 T/m/s) on a compact 3T MRI.

1204	16:06	Fast Distortion-Free Diffusion Imaging using "tilted-CAIPI" PSF-EPI
		Zijing Dong[1], Fuyixue Wang[2,3], Timothy G. Reese[2], Mary Kate Manhard[2], Berkin Bilgic[2], Lawrence L. Wald[2,3], Hua Guo[1], and Kawin Setsompop[2,3]
		[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, [2]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [3]Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States
		Single-shot EPI is widely used for diffusion imaging, but suffers from susceptibility-induced distortion and T_2* blurring, which limit its resolution and ability to detect detailed structures. PSF-encoded EPI with an added 2D-navigator has recently been developed to allow distortion- and blurring- free diffusion imaging. However, the extremely long acquisition of PSF-EPI makes it impractical for high angular resolution diffusion imaging. In this work, PSF-EPI is accelerated by >20x using a novel "*tilted-CAIPI*" approach, along with self-navigation strategy. This has enabled distortion- and blurring-free diffusion imaging at 1.2mm isotropic to be acquired with 48 diffusion directions in 21-minutes for whole-brain.

1205	16:18	Diffusion-prepared multi-shot bSSFP imaging with gradient stabilizer
		Yu Gao[1,2], Fei Han[1], Ziwu Zhou[1], Xingfeng Shao[3], Xiaodong Zhong[4], Danny JJ Wang[3], Yingli Yang[2,5], and Peng Hu[1,2]
		[1]Department of Radiological Sciences, University of California, Los Angeles, Los Angeles, CA, United States, [2]Physics and Biology in Medicine IDP, University of California, Los Angeles, Los Angeles, CA, United States, [3]Keck School of Medicine, University of Southern California, Los Angeles, CA, United States, [4]Siemens Healthcare, Los Angeles, CA, United States, [5]Department of Radiation Oncology, University of California, Los Angeles, Los Angeles, CA, United States
		A gradient stabilizer strategy was proposed to solve the k-space magnitude inconsistency problem in multi-shot diffusion-prepared bSSFP imaging. Simulation studies showed that the proposed approach is insensitive to phase errors during the diffusion encoding stage, and has built-in fat-saturation property. Phantom and in-vivo studies verified that adding gradient stabilizers could remove signal loss and artifacts, and provide repeatable artifact-free images. Combined with existing phase correction techniques, the proposed approach provided distortion-free high-quality 2D diffusion-weighted and diffusion tensor images, and has the potential of extending to 3D.

1206	16:30	Can we correct for interactions between subject motion and gradient-nonlinearity in diffusion MRI?
		Suryanarayana Umesh Rudrapatna[1], Greg D Parker[1], Jamie Roberts[2], and Derek K Jones[1]
		[1]CUBRIC, Cardiff University, Cardiff, United Kingdom, [2]Royal United Hospitals Bath, NHS Foundation Trust, Bath, United Kingdom
		Scanners with ultra-strong gradients promise unprecedented opportunities for diffusion imaging. However, their effective use requires correction of gradient-nonlinearity effects during data analysis. Although such techniques exist, they neglect the effects of motion which induces *spatio-temporal* variations in b-values and b-vectors. Here, we propose a technique that accounts for interaction of subject motion with such non-linearity and study its effectiveness by performing diffusion experiments with volunteers positioned in regions with incrementally increasing gradient-nonlinearities. Our experiments reveal the importance of accounting for motion-induced spatio-temporal variations in B-matrices and our proposed technique corrects most gradient-nonlinearity effects.

1207	16:42	Motion-robust sub-millimeter isotropic diffusion imaging through Motion Corrected Generalized Slice Dithered Enhanced Resolution (MC-gSlider) acquisition
		Fuyixue Wang[1,2], Berkin Bilgic[1], Zijing Dong[3], Mary Katherine Manhard[1], Ned Ohringer[1], Bo Zhao[1], Melissa Haskell[1,4], Stephen F. Cauley[1], Qiuyun Fan[1], Thomas Witzel[1], Elfar Adalsteinsson[2,5], Lawrence L. Wald[1,2], and Kawin Setsompop[1,2]

		[1]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [2]Harvard-MIT Health Sciences and Technology, MIT, Cambridge, MA, United States, [3]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [4]Graduate Program in Biophysics, Harvard University, Cambridge, MA, United States, [5]Department of Electrical Engineering and Computer Science, MIT, Cambridge, MA, United States
		gSlider is an SNR-efficient acquisition technique for high-resolution diffusion imaging (dMRI). However, subject motion is inevitable during long scans in high-resolution dMRI, leading to potential for artifacts and blurring. In this study, Motion Corrected gSlider (MC-gSlider) is proposed to obtain high-quality dMRI in the presence of large in-plane and through-plane motion, without use of a navigator. A motion-aware reconstruction with spatially-adaptive regularization is developed to achieve good reconstruction, even under difficult through-plane motions. MC-gSlider was demonstrated in-vivo to provide motion-robust, sub-millimeter isotropic dMRI with a motion correction rate of 2s, allowing for good reconstruction in the presence of large motions.

1208	16:54	Higher order spherical harmonics reconstruction of fetal diffusion MRI with intensity correction
		Maria Deprez[1], Anthony Price[1], Daan Christiaens[1], Donald Tournier[1], Mary Rutherford[2], Serena Counsell[2], and Jo Hajnal[1]
		[1]Biomedical Engineering, King's College London, London, United Kingdom, [2]Perinatal Imaging and Health, King's College London, London, United Kingdom
		We present a comprehensive method for reconstruction of fetal dMRI signal using a higher order spherical harmonics representation. We show that intensity correction improves the consistency of the volumetric reconstruction. By applying constrained spherical deconvolution and whole brain tractography to reconstructed fetal dMRI we are able to identify anatomically plausible fiber crossings.

1209	17:06	Estimating susceptibility-induced field changes directly from diffusion MRI images and overcoming associated computational bottlenecks through GPU parallelisation
		Frederik Lange[1], Mark Graham[2], Ivana Drobnjak[2], Hui Zhang[2], Jon Campbell[1], and Jesper Andersson[1]
		[1]FMRIB, Wellcome Centre for Integrative Neuroimaging, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, [2]Centre for Medical Image Computing & Department of Computer Science, University College London, London, United Kingdom

		We present a novel method (incorporated into FSL $$$\texttt{eddy}$$$) of estimating and correcting distortions due to dynamic changes in the susceptibility field when measuring diffusion using EPI. This method is able to track how the field changes with movement using only the diffusion data itself. We demonstrate an improvement in distortion correction, compared to using a static susceptibility field, for both simulated and actual data. Additionally, we demonstrate how computationally intensive portions of the estimation algorithm can be speeded up through GPU parallelisation. Reducing the runtime increases the likelihood of this method being widely adopted and broadens its impact potential.

1210	17:18	In-Plane Superresolution with Phaseless Subpixel Encoding
		Franciszek Hennel[1], Rui Tian[1], Maria Engel[1], and Klaas P Pruessmann[1]
		[1]Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland
		A method to obtain a high-resolution 2D image from a series of subpixel-encoded low-resolution 2D scans is presented. The phaseless character of this encoding allows unknown signal phase fluctuations to be easily discarded and makes the method a promising alternative to k-space segmenting in motion-sensitive experiments such as diffusion MRI. Based on an analogy with the structured illumination method used in superresolution optics, important improvements have been introduced that reduce artefacts caused by k-space truncation and magnetic field inhomogeneity. The utility of the method is demonstrated by a 3-fold resolution enhancement of diffusion-weighted EPI of human head.

Oral

Brain Connectivity

N03	Thursday 15:30 - 17:30	*Moderators:* Fernando Calamante & Baete Steven

1211	15:30	Optogenetic fMRI dissection of brain-wide vestibular pathways
		Alex T. L. Leong[1,2], Xunda Wang[1,2], Russell W. Chan[1,2], Xiong Cao[1,2], and Ed X. Wu[1,2]
		[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China
		The vestibular system is essential to our sense of balance and spatial orientation. fMRI mapping of the vestibular system has been challenging due to the physical constraints limiting a subject’s ability to perform motion, balance and orientation related tasks within an MRI scanner. At present, our knowledge of the brain-wide cortical and subcortical regions that participate in processing the vestibular sense is scarce. Here, we combine fMRI and optogenetic stimulation of vestibular excitatory neurons and, for the first time, successfully map the multiple brain-wide vestibular pathways.

1212	15:42	A novel approach for fMRI of rodents actively performing optogenetic self-stimulation
		Hanbing H Lu[1], Christopher G Cover[1], Andrew Kesner[2], Elliot A Stein[1], Satoshi Satoshi Ikemoto [2], and Yihong Yang[1]
		[1]Neuroimaging Research Branch, National Institute on Drug Abuse, NIH, Baltimore, MD, United States, [2]Behavioral Neuroscience Research Branch, National Institute on Drug Abuse, NIH, Baltimore, MD, United States
		Linking the dynamics of neural circuits to behavior is arguably a central theme in neuroscience. fMRI in rodent animals offers the opportunity to combine systems-level brain readout with modern in-vivo cell biology tools, such as DREADDS and optogenetics, to dissect circuit dynamics. Despite efforts to image awake rodents to avoid confounds from anesthesia, there has been no report on fMRI of rodent animals being actively engaged in a goal-directed behavior. We report a method that permits fMRI of brain dynamics while a mouse is actively self-administering optogenetic stimulation, opening the door to real-time imaging of animal behavior using MRI.

1213	15:54	MouseStream: A Software Suite for Mapping and Analyzing Mouse Cortical Functional Architecture In Vivo Using Magnetic Resonance Microscopy
		Jia Guo[1], Xinyang Feng[1], Hannah Sigmon[2], Frank Provenzano[2], and Scott A. Small[3]
		[1]Department of Biomedical Engineering, Columbia University, New York, NY, United States, [2]Departments of Neurology, Columbia University College of Physicians and Surgeons, New York, NY, United States, [3]Departments of Neurology, Radiology or Psychiatry, Columbia University College of Physicians and Surgeons, New York, NY, United States
		The functional architecture of the cortex has never been mapped *in vivo* with the fidelity necessary to distinguish “functional unit”. Mapping the functional architecture of the cortex, reflecting the observed regional and layer differences in synaptic density and its correlate energy metabolism, has been very challenging. Here we set out to address this issue by *in vivo* high-resolution cerebral blood volume (CBV) mapping of the mouse cortex. Tailored software, MouseStream, was developed to reconstruct the cortical CBV data through the normalized curved cortical coordinate (NCCC). NCCC allows projection of functional architectures mapped using CBV onto the cortical surface across the whole cortex and from different cortical depths.

1214	16:06	Longitudinal alterations of resting-state functional connectivity in Alzheimer’s disease in a tauopathy mouse model
		Laetitia Degiorgis[1], Meltem Karatas[1,2,3,4], Marion Sourty[1], Thomas Bienert[3], Marco Reisert[3], Chantal Mathis[5], Anne-Laurence Boutillier[5], Frédéric Blanc[1,6], Jean-Paul Armspach[1], and Laura-Adela Harsan[1,3,7]

		[1]ICube, University of Strasbourg, CNRS, Strasbourg, France, [2]Faculty of Biology, University of Freiburg, Strasbourg, France, [3]Dept. of Radiology, Medical Physics, University Medical Center Freiburg, Freiburg im Breisgau, Germany, [4]INCI University of Strasbourg, Strasbourg, France, [5]LNCA, University of Strasbourg, Strasbourg, France, [6]Centres Mémoire de Ressources et de Recherche, CHU de Strasbourg, Services Neurologiques et Gériatriques, Strasbourg, France, [7]Département de Biophysique et Médecine Nucléaire, Hôpitaux Universitaires de Strasbourg, Strasbourg, France
		Alzheimer's disease is the most widespread cause of dementia and constitutes one of the biggest challenges for society. Among dominant mechanisms of the disease is the abnormal accumulation of the protein tau leading to tauopathy. In this study we explored in vivo the longitudinal evolution of the brain functional connectome, in the Thy-Tau22 mouse, a model of tauopathy. We used resting-state functional MRI in correlation with behavioral analysis to show the remodeling functional circuitry over-time including default mode network and memory networks in transgenic mice.

1215	16:18	Brain perfusion patterns and their relationships with fMRI resting state networks and arterial vascular territories
		Maria Marcella Lagana[1], Laura Pelizzari[1,2], Alice Pirastru[1], Niels Bergsland[1,3], Mario Clerici[1,4], Pietro Cecconi[5], and Francesca Baglio[1]
		[1]Fondazione Don Carlo Gnocchi ONLUS, Milan, Italy, [2]Department of Electronics, Information and Bioengineering, Politecnico di Milano, Milan, Italy, [3]Buffalo Neuroimaging Analysis Center, Department of Neurology, School of Medicine and Biomedical Sciences, University at Buffalo, State University of New York, Buffalo, NY, United States, [4]Università degli Studi di Milano, Milan, Italy, [5]Radiology, Fondazione Don Carlo Gnocchi ONLUS, Milan, Italy
		In this study, we aimed to assess the consistency of the perfusion patterns that can be extracted using independent component analysis (ICA) on cerebral blood flow (CBF) maps derived from arterial spin labeling (ASL) data. Furthermore, we aimed to evaluate the similarity between the CBF-derived components and the well-known spatial patterns of functional MRI resting state networks (RSN) and cerebral vascular territories (VT). Our results showed that good spatial constancy of perfusion patterns can be extracted from CBF maps. Almost all the derived components overlapped with RSN or specific VT.

1216	16:30	An approach to capture time-varying spatial connectivity in resting fMRI networks
		Armin Iraji[1], Maziar Yaesoubi[1], Anees Abrol[1], Zening Fu[1], Yuhui Du[1], Srinivas Rachakonda[1], and Vince D. Calhoun[1,2]
		[1]The Mind Research Network, Albuquerque, NM, United States, [2]Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM, United States

		The analysis of time-varying connectivity has become an important part of neuroscience discussions. The majority of such studies have focused primarily on the temporal variations of functional connectivity among fixed regions of interest (ROIs) or brain networks. However, the brain reorganizes itself on both spatial and temporal scales. Approaches that capture spatial and temporal coupling variations are needed. Here, we describe a novel approach capable of identifying the base states of brain networks and capturing their spatial variations over time. It also provides a unique opportunity to characterize the temporal variations of the brain at both network and global scales.

1217	16:42	Physical Exercise Increased Involvement of Motor Networks as compensatory mechanism under challenging cognitive task
		Lanxin Ji[1,2,3], Godfrey D Pearlson[1,2], Keith A Hawkins[1,2], David C Steffens[4], and Lihong Wang[4]
		[1]Departments of Psychiatry & Neuroscience, Yale University, New Haven, CT, United States, [2]Olin Neuropsychiatry Research Center, Hartford Hospital/Institute of Living, Hartford, CT, United States, [3]Center for Biomedical Imaging Research, Department of Biomedical Engineering, Tsinghua University, Beijing, China, [4]Department of Psychiatry, University of Connecticut School of Medicine, Farmington, CT, United States
		Neuroimaging studies show reorganization of neural resources in older adults may compensate for cognitive decline. To effectively evaluate neural compensation, we proposed a data-driven independent component analysis method, and tested the measure through a longitudinal study. Twenty-six healthy older adults participated in a 6-week physical exercise program. Gait speed, cognitive function, and fMRI during a challenging memory task were measured before and after the program. Results showed a positive correlation between the compensatory ability measure and gait speed at baseline. Physical exercise improved gait speed, cognition, and compensatory ability through increased involvement of motor-related networks in conducting the cognitive task.

1218	16:54	Are prediabetes and type 2 diabetes associated with white matter connectivity alterations? The Maastricht Study
		Laura W.M. Vergoossen[1], Walter H. Backes[1], Miranda T. Schram[2], Jacobus F.A. Jansen[1], and on behalf of The Maastricht Study[2]
		[1]Radiology and Nuclear Medicine, Maastricht University Medical Center, Maastricht, Netherlands, [2]Medicine, Maastricht University Medical Center, Maastricht, Netherlands
		Type 2 diabetes (T2DM) is associated with cognitive decline, while prediabetes may already show comparable cognitive decrements. We investigated whether white matter network integrity is associated with prediabetes and/or T2DM in a large population-based cohort study. For calculation of white matter volumes and graph measures, 3T structural and diffusion MRI (dMRI) were performed. Prediabetes had lower clustering coefficient and local efficiency compared to NGM. Communicability was significantly higher in T2DM, but not in prediabetes, which suggests that alternative white matter connections are used to compensate for structural disturbances and white matter decline, which may not be present yet in prediabetes.

1219	17:06	Exploring diffusion derived connectivity patterns between cognitively impaired and nonimpaired active professional fighters
		Virendra R Mishra[1], Karthik Sreenivasan[1], Zhengshi Yang[1], Xiaowei Zhuang[1], Sarah Banks[1], Dietmar Cordes[1], and Charles Bernick[1]
		[1]Imaging, Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States
		In this study, we utilized the diffusion MRI (dMRI) data of cognitively impaired and nonimpaired active professional fighters from the Professional Fighters Brain Health Study and investigated the structural connectivity patterns between the two groups. Our study showed a disrupted connectivity pattern between cognitively impaired and nonimpaired active professional fighters, mainly due to short-range fibres. Further, a complex heterogeneous pattern was speculated due to fighting. These findings may help the clinicians better understand the effect of repeated head trauma on structural connectivity pattern and its association with later mental defects due to fighting.

1220	17:18	Longitudinal structural and functional brain network alterations in a mouse model of neuropathic pain
		Claudia Falfan-Melgoza[1,2], Ainhoa Bilbao[3,4], Robert Becker[1,2], Sarah Leixner[3,4], Markus Sack[1,2], Gabriele Ende[2], Alexander Sartorius[1,5], Rainer Spanagel[4], and Wolfgang Weber-Fahr[1,2]
		[1]RG Translational Imaging, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, [2]Neuroimaging, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, [3]RG Behavioral Genetics, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, [4]Psychopharmacology, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, [5]Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany
		We combined multimodal (rsfMRI,M MRS, VBM) neuroimaging to longitudinally monitor changes in brain metabolism, structure and connectivity using the spared nerve injury (SNI) mouse model of chronic neuropathic pain. Voxel-based morphometry demonstrated volume decrease in all brain sites assessed. Global and local network changes after SNI disappeared over time, except the nucleus accumbens, prefrontal cortex and hippocampus. Connectivity changes were accompanied by enhanced glutamate levels in the hippocampus. We suggest that hippocampal hyperexcitability may alter synaptic plasticity within the nucleus accumbens, circadian motor activity and emotionality during pain chronification.

Oral

Cervical & Intracranial Flow

S03	Thursday 15:30 - 17:30	*Moderators:* Huijun Chen & David Saloner

1221	15:30	Advantages of Dual-Venc 4D flow MRI in the evaluation of cerebral aneurysms
		Susanne Schnell[1], Maria Aristova[1], Matthew B Potts[2], Babak S Jahromi[2], Liliana Ma[1], Alireza Vali[1], Amer A Syed[1], Michael C Hurley[3], Michael Markl[1,4], and Sameer A Ansari[5]
		[1]Radiology, Northwestern University, Chicago, IL, United States, [2]Neurological Surgery, Northwestern University, Chicago, IL, United States, [3]Radiology and Neurological Surgery, Northwestern University, Chicago, IL, United States, [4]Biomedical Engineering, Northwestern University, Evanston, IL, United States, [5]Radiology, Neurological Surgery and Neurology, Northwestern University, Chicago, IL, United States
		We applied and investigated the benefits of using kt-GRAPPA accelerated dual-*venc* 4D flow MRI in five patients who presented with cerebral aneurysm between 4 and 12mm (smallest and largest dimension). Velocity values were systematically compared with the high-*venc*-only part of the same acquisition using correlation and histogram analysis. Blood flow was visualized with streamlines and quality was visually assessed. Results show that dual-*venc* 4D flow MRI provides refined information on slow flow and recirculating flow in cerebral aneurysms. Future studies will assess the feasibility of advanced hemodynamic measures obtained from dual-*venc* 4D flow MRI as predictive imaging biomarkers.

1222	15:42	Evaluation of non-contrast enhanced 4-dimensional MRA with stack-of-stars golden angle radial trajectory in conjunction with KWIC reconstruction for the depiction of arteriovenous malformations
		Lirong Yan[1], Songlin Yu[2], Samantha Ma[1], Jonathan Russin[3], Arun Amar[3], Yelong Shen[1,4], Qi Huang[1,5], Nader Pouratian[6], Hee Kwon Song[7], and Danny JJ Wang[1]
		[1]Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States, [2]Beijing Tiantan Hospital, Beijing, China, [3]Department of Neurological Surgery, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States, [4]School of Medicine, Shandong University, Jinan, China, [5]Department of Biomedical Engineering, University of Southern California, Los Angeles, CA, United States, [6]Neurosurgery, University of California Los Angeles, Los Angeles, CA, United States, [7]University of Pennsylvania, Philadelphia, PA, United States
		This study evaluated a recently developed non-contrast enhanced 4-dimensional MRA (NCE 4D MRA) with stack-of-stars golden-angle radial trajectory and KWIC reconstruction for the detection of cerebral arteriovenous malformation (AVM) by comparison with DSA, TOF and standard Cartesian 4D MRA. The characterizations of AVM lesions using this radial 4D MRA are consistent with those of DSA. 4D MRA combined with TOF improves diagnostic confidence. Compared to Cartesian acquisition, radial acquisition shows improved delineation of dynamic flow with less motion artifacts and short scan time. Our findings indicate radial 4D MRA may be a promising alternative for the characterization of AVM features.

1223	15:54	4D Flow assessment of arterial pulsation in the patients with internal carotid artery stenotic disease
		Takahiro Ando[1], Tetsuro Sekine[1], Yasuo Murai[2], Ryo Takagi[3], Yasuo Amano[3], Erika Orita[1], Kotomi Iwata[1], Makoto Obara[4], Yoshio Matsumura[1], and Shin-Ichiro Kumita[1]

		[1]Radiology, Nippon Medical School, Tokyo, Japan, [2]Neurosurgery, Nippon Medical School, Tokyo, Japan, [3]Radiology, Nihon University School of Medicine, Tokyo, Japan, [4]Philips Electronics Japan, Tokyo, Japan
		We performed 4D Flow MRI assessment of arterial pulsation in internal carotid artery stenotic disease (ICS) patients comparing to SPECT with acetazolamide challenge. Twelve patients with unilateral ICS were recruited. The blood flow volumes and the ratio of ΔF (*r*ΔF) was calculated. In the affected-side MCA territory, the ratio of rest cerebral blood flow control ($RCBF_{MCA}$) and cerebral vascular reserve (CVR_{MCA}) were calculated from SPECT dataset. *r*ΔF was significantly lower in the low CVR group than high group (P=0.008). The 6-min-standard 4D Flow MRI assessment of arterial pulsation in ICS patients can identify misery perfusion.

1224	16:06	In-vivo correlations between hemodynamics and wall inflammation in patients with intracranial aneurysms: comparing 4D Flow MRI and vessel wall enhancement.
		Myriam EDJLALI[1], Dahan Kim[2], Leonardo Rivera-Rivera[2], Pauline Roca[1], Catherine Oppenheim[1], Olivier Naggara[1], Patrick Turski[3], Oliver Wieben[2], and Kevin M Johnson[2]
		[1]Neuro-Radiology, Centre Hospitalier Sainte-Anne, Paris, France, [2]department of medical physics, University of Wisconsin, Madison, WI, United States, [3]department of Radiology, University of Wisconsin, Madison, WI, United States
		Recent studies point out hemodynamics and wall inflammation as individual risk factors for aneurysm evolution. We investigated on 28 aneurysms in-vivo correlations between hemodynamics and wall inflammation by comparing 4D Flow parameters and quantitative aneurysm wall enhancement. Viscous energy loss and kinetic energy were correlated to maximum values of enhancement with high correlation coefficients ($p<0.0001$; correlation coefficient 0.79 and $p<0.0001$; correlation coefficient 0.85, respectively). By showing that flow instability and spatial flow complexity are highly correlated with aneurysm wall enhancement, this study highlights the existence of a link between inflammation process depicted through vessel wall enhancement and hemodynamic patterns.

1225	16:18	New 4D-MRA approach named 4D-APACK by integrating 4D-PACK and AccASL for visualization of long transit time artery: Investigating hemodynamics accuracy and AVM clinical case
		Yuta Akamine[1], Makoto Obara[1], Osamu Togao[2], Shuhei Shibukawa[3], Masami Yoneyama[1], Tomoyuki Okuaki[1], and Marc Van Cauteren[4]
		[1]Philips Japan, Shinagawa, Tokyo, Japan, [2]Department of Clinical Radiology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan, [3]Department of Radiology, Tokai University Hospital, Kanagawa, Japan, [4]Philips Healthcare, Shinagawa, Tokyo, Japan

		A new 4D-MRA approach named 4D-AccASL-PACK (4D-APACK) was implemented and images were acquired in six healthy volunteers and one AVM patient. 4D-APACK consists of 4D-PACK and acceleration-selective arterial spin labeling (AccASL) for obtaining efficiently both dynamic information and ATT independent visualization of very slow flow. 4D-APACK replaces last timepoint data of 4D-PACK with AccASL. To investigate hemodynamics accuracy for 4D-APACK, ATT correlation between 4D-pCASL and 4D-APACK and contamination of sinuses were measured. The vessel visualization of MCA M1 to M4 were compared with 4D-pCASL. We demonstrate that 4D-APACK brings reliable hemodynamic information comparable to 4D-pCASL, while retaining MCA visualization performance.

1226	16:30	Sing-vessel cerebral blood flow (velocity) fMRI with phase-contrast imaging
		Xuming Chen[1,2,3], Rolf Pohmann[1], Klaus Scheffler[1], and Xin Yu[1]
		[1]High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany, [2]University of Tuebingen, Tuebingen, Germany, [3]Neurology, Renmin Hospital of Wuhan Universit, Wuhan University, Wuhan, China
		Single-vessel fMRI has been developed to map the BOLD signal from individual venules and the CBV signal from individual arterioles penetrating the cortex of anesthetized rats. Here, we applied phase-contrast (PC) imaging to measure the velocity of blood flow from individual penetrating arterioles and venules, which could be characterized as dark and bright dots in an arteriole-venule map with a multi gradient-echo sequence. The neuronal activity-coupled cerebral blood flow (CBF) changes can be directly measured with the PC-based velocity mapping from individual vessels. Thus, we have established single-vessel CBF fMRI mapping with phase-contrast imaging.

1227	16:42	Sub-millimetric 4D Flow MR in small intracerebral aneurysms at 7 Tesla with experimental verification in upscaled 3D printed replica.
		Pierre-Francois Van de Moortele[1], Mostafa Toloui[1], Omid Amili[2], Sean Moen[3], Sebastian Schmitter[1,4], Susanne Schnell[5], Michael Markl[5,6], Kamil Ugurbil[1], Filippo Coletti[2,7], and Bharathi Jagadeesan[3,8,9]
		[1]Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States, [2]Department of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, MN, United States, [3]Department of Neurosurgery, University of Minnesota, Minneapolis, MN, United States, [4]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig and Berlin, Germany, [5]Department of Radiology, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States, [6]Department Biomedical Engineering, McCormick School of Engineering, Northwestern University, Evanston, IL, United States, [7]St. Anthony Falls Laboratory, University of Minnesota, Minneapolis, MN, United States, [8]Department of Radiology, University of Minnesota, Minneapolis, MN, United States, [9]Department of Neurology, University of Minnesota, Minneapolis, MN, United States

		Asymptomatic intracerebral aneurysms of small size (<7mm) pose a difficult therapeutic challenge: left alone they may stay stable with no consequence or they may grow and/or rupture with devastating subarachnoid hemorrages. Pre-emptive treatment (surgical or endovascular) however carries non-negligible mortality and morbidity and there is no biomarker predicting these relative risk. Flow dynamics inside small aneurysms however could have a critical impact on their evolution. Here we investigate the use of 4D Flow MR to acquire submillimitric flow information in small aneurysms in vivo as well as in 3D printed up-scaled replica of actual aneurysms measured in patients.

1228	16:54	Characterization of Ultra-short Echo and Standard echo Phase-Contrast MRI for Neurovascular disease application
		Dahan Kim[1,2], Katrina Ruedinger[3], David Rutkowski[3], Alejandro Roldán-Alzate[4,5], Patrick Turski[2,5], and Kevin M Johnson[2,5]
		[1]Department of Physics, University of Wisconsin - Madison, Madison, WI, United States, [2]Department of Medical Physics, University of Wisconsin - Madison, Madison, WI, United States, [3]Department of Biomedical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [4]Department of Mechanical Engineering, University of Wisconsin - Madison, Madison, WI, United States, [5]Department of Radiology, University of Wisconsin - Madison, Madison, WI, United States
		We examined velocity measurements of standard (STD-PC) and ultra-short echo (UTE-PC) phase-contrast MRI in three different study cases, to characterize the effect of shortening echo time on artifacts from flow and metal. We found that UTE-PC measures higher velocity magnitudes not only in disturbed flow but also in normal vasculature, that UTE-PC results in smaller divergence of velocity field but no difference in erroneous flux through arterial wall within metal aneurysm stent, and that UTE-PC higher velocity magnitudes, less signal loss, and coherent flow directions in both untreated and un-treated aneurysm phantom.

1229	17:06	Intracranial flow measurements at 7T gated with Doppler Ultrasound
		Karin Markenroth Bloch[1], Fabian Kording[2,3], and Johannes Töger[4]
		[1]Lund University Bioimaging Center, Lund University, Lund, Sweden, [2]Dept. of Diagnostic and Interventional Radiology and Nuclear Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [3]nnorth medical Gmbh, Hamburg, Germany, [4]Dept. of Diagnostic Radiology, Lund University, Lund, Sweden
		Intracranial flow measurements at high field (7T) has the potential to give new information on hemodynamic properties. However, the strong field disturbs ECG gating, possibly compromising image quality. This work investigates possible benefits of using Doppler ultrasound (DUS) cardiac triggering compared to ECG–triggering in throughplane (2D) flow measurements at 7T. 2D flow was acquired using both ECG and DUS triggering in random order in healthy volunteers (n=8). The DUS was found to have a higher trigger sensitivity and fewer false negative and positive triggers. Flow and velocity results did not differ between ECG and DUS triggering.

1230	17:18	Scan parameter optimization of dual-venc 4D Flow MRI for the assessment of neurovascular flow networks in brain arteriovenous malformation
		Maria Aristova[1], Alireza Vali[2], Alex Barker[2], Ali Shaibani[3], Sameer Ansari[4], Matthew Potts[5], Babak Jahromi[5], Michael Hurley[4], Susanne Schnell[2], and Michael Markl[2]
		[1]Biomedical Engineering, Northwestern University, Chicago, IL, United States, [2]Radiology, Northwestern University, Chicago, IL, United States, [3]Radiology, Neurosurgery, Northwestern University, Chicago, IL, United States, [4]Neurointerventional radiology, Northwestern University, Chicago, IL, United States, [5]Neurosurgery, Northwestern University, Chicago, IL, United States
		To optimize dual-*venc* 4D Flow MRI parameters for flow assessment in brain arteriovenous malformations, we conducted an in-vitro optimization analysis and compared it to in-vivo data from a patient with complex AVM. Using k-t acceleration factors of 2-5 and about 2-10 voxels across the imaged vessels, we quantified the agreement with the ground truth flow and geometry. We applied a flow distribution network graph concept to characterize flow conservation as an additional quality metric. Data indicated that approximately 5 voxels across imaged vessels are needed, consistent with results from previous publications.

Oral

Brain Tumours: Post-Treatment

S04	Thursday 15:30 - 17:30	*Moderators:* Michaël Belloy & Sabrina Ronen

1231	15:30	A High Resolution Gradient-Echo/Spin-Echo EPI Sequence for Vessel Architecture Imaging
		Ke Zhang[1,2], Seong Dae Yun[3], Simon M.F. Triphan[4], Volker J. Sturm[1,2], Lukas R. Buschle[1,2], Artur Hahn[2], Sabine Heiland[2], Martin Bendszus[2], Heinz-Peter Schlemmer[1], N. Jon Shah[3,5], Christian H. Ziener[1,2], and Felix T. Kurz[1,2]
		[1]Department of Radiology, German Cancer Research Center, Heidelberg, Germany, [2]Department of Neuroradiology, Heidelberg University Hospital, Heidelberg, Germany, [3]Institute of Neuroscience and Medicine – 4, Medical Imaging Physics, Forschungszentrum Jülich, Jülich, Germany, [4]Department of Diagnostic & Interventional Radiology, German Cancer Research Center, Heidelberg, Germany, [5]Department of Neurology, Faculty of Medicine, JARA, RWTH Aachen University, Aachen, Germany
		To obtain vessel architectural imaging (VAI), a dual gradient-echo/spin-echo EPI sequence is needed to simultaneously track the dynamic signal changes in both gradient echo and spin echo contrasts. However, brain coverage and in-plane matrix size in previous brain studies were limited. In this study, the multiband excitation and blipped-CAIPI techniques were applied to improve the slice coverage. To enhance the in-plane resolution, two rephasing gradients were inserted after the GE readout, to return the data acquisition to the k-space center before the SE readout and enable parallel imaging techniques.

1232	15:42	Combined 18-FET-PET and diffusion kurtosis imaging study in treated glioblastoma patients: differentiation between metabolically active tumours and treatment-induced tissue abnormalities
		Farida Grinberg[1,2], Francesco D'Amore[1], Jörg Mauler[1], Norbert Galldiks[3,4,5], Ezequiel Farrher[1], Ganna Blazhenets[1], Gabriele Stoffels[1], N. Jon Shah[1,2,6], and Karl-Josef Langen[1,5,6]
		[1]Institute of Neuroscience and Medicine 4, Research Centre Juelich, Juelich, Germany, [2]Department of Neurology, Faculty of Medicine, RWTH Aachen University, Aachen, Germany, [3]Institute of Neuroscience and Medicine 3, Forschungszentrum Juelich, Jülich, Germany, [4]Department of Neurology, University Hospital Cologne, Cologne, Germany, [5]Center of Integrated Oncology (CIO), Universities of Cologne and Bonn, Cologne, Germany, [6]JARA - BRAIN - Translational Medicine, RWTH Aachen University, Aachen, Germany
		MRI and diffusion MRI techniques provide important diagnostic information regarding anatomic structure and microstructural features in brain tumours with high spatial resolution. 18F-FET-PET enables identification of the metabolically active regions in spatially heterogeneous lesions, information lacking in any MRI techniques. In this work we report a novel approach combining metabolic information gained from PET and microstructural information obtained from diffusion kurtosis histogram analysis. This approach was shown to provide sensitive biomarkers allowing for differentiation between progressing tumours and treatment-induced tissue abnormalities in glioblastoma patients. *The first two authors contributed equally to the work.

1233	15:54	Moving Towards A DSC-MRI Consensus: A new single dose option for standardized rCBV.
		Kathleen M Schmainda[1], Melissa A Prah[1], Robert T Wujek[1], and Jennifer M Connelly[2,3]
		[1]Radiology, Medical College of Wisconsin, Milwaukee, WI, United States, [2]Neurology, Medical College of Wisconsin, Milwaukee, WI, United States, [3]Neurosurgery, Medical College of Wisconsin, Milwaukee, WI, United States
		DSC-MRI is the most common approach used for brain tumor perfusion imaging. Consensus is being reached regarding a recommended method for data acquisition, one that requires a contrast agent preload and the application of leakage correction. However, recent simulations suggest that if a low flip angle is used for DSC-MRI data collection then a contrast agent preload might not be necessary. In this study DSC-MRI data collected in 19 patients with brain tumors supports this hypothesis and further suggests that the application of leakage correction as well as a standardization algorithm further improves the results.

1234	16:06	Multi-Parametric and Multi-Regional Histogram Analysis of MRI: Revealing Imaging Phenotypes of Glioblastoma Correlated with Patient Survival
		Chao Li[1,2], Shuo Wang[3], Angela Serra[4], Turid Torheim[5], Florian Markowetz[5], and Stephen J Price[1]

		[1]Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom, [2]Department of Neurosurgery, Shanghai General Hospital, Shagnhai, China, [3]Department of Radiology, University of Cambridge, Cambridge, United Kingdom, [4]NeuRoNeLab, DISA-MIS, University of Salerno, Salerno, Italy, [5]Cancer Research UK Cambridge Institute, University of Cambridge, Cambridge, United Kingdom
		Glioblastoma is characterized by its remarkable heterogeneity and dismal prognosis. Histogram features of MRI modality show potential in measuring the intratumoral heterogeneity. We integrate multi-parametric and multi-regional MRI histogram features to divide patients into groups and assess the relevance to treatment outcome. The results demonstrated that integrating multi-parametric and multi-regional MRI histogram features may help to stratify patients. The feature selected in this process also displayed prognostic values in the multivariate survival analysis. The histogram features selected from the proposed approach may be used as potential imaging markers in personalized treatment strategy and response determination.

1235	16:18	Supratentorial reorganization after treatment for childhood infratentorial tumors from a graph theoretical perspective
		Charlotte Sleurs[1,2], Dafnis Batalle[3], Jurgen Lemiere[1], Daan Christiaens[3], Jacques-Donald Tournier[3], Stefan Sunaert[2], Anne Uyttebroeck[1], Sandra Jacobs[1], Serena Counsell[3], and Sabine Deprez[2]
		[1]Pediatric Hemato-Oncology, UZ Leuven, Leuven, Belgium, [2]Radiology, UZ Leuven, Leuven, Belgium, [3]Perinatal Imaging & Health, King's College London, London, United Kingdom
		In this study, structural brain topology was investigated in young adults who were treated for infratentorial tumors during childhood, using graph theory metrics based on whole-brain tractography. Comparisons with healthy controls yielded significant differences in global efficiency measures, independently from network density threshold. This cost-corrected measure was significantly related with IQ scores. By contrast, local efficiency and average nodal strength appeared different for core networks only. This finding suggests that connectivity of highly connected supratentorial hubs are predominantly affected following treatment for infratentorial tumours.

1236	16:30	Effect of Vascular Input Function Selection on Quantitative Dynamic Contrast-Enhanced MRI for Differentiating Pseudo-progression from True Progression in Glioblastomas
		Kevin Yuqi Wang[1], Melissa Chen[2], and Ho-Ling Liu[3]
		[1]Radiology, Baylor College of Medicine, Houston, TX, United States, [2]Diagnostic Radiology, MD Anderson, Houston, TX, United States, [3]Imaging Physics, MD Anderson, Houston, TX, United States

		Vascular input function (VIF) is a major source of error in the pharmacokinetic modeling of dynamic contrast-enhanced (DCE) magnetic resonance imaging (MRI) data. We investigated the influence of VIF variability on forward volumetric transfer constant, K^{trans}, one of the kinetic parameters of DCE MRI. The diagnostic power of DCE MRI to discriminate between pseudo-progression and true progression of glioblastoma following chemoradiation therapy was determined by deriving K^{trans} from five different VIF sources (population-based, middle cerebral artery, superior sagittal sinus—the latter two calculated by applying either an assumed or a measured T1) and using receiver operating curve analysis.

1237	16:42	Clinical predictors of serial changes in radiotherapy-induced microbleed burden and their relationship to white matter damage in 133 patients with glioma
		Melanie A Morrison[1], Angela Jakary[1], Devika Nair[1], Christopher P Hess[2], Jennifer L Clarke [3], Nicholas Butowski[4], Susan M Chang[4], Annette M Molinaro[4], and Janine M Lupo[1]
		[1]Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, United States, [2]Radiology, University of California San Francisco, San Francisco, CA, United States, [3]Neurology, University of California San Francisco, San Francisco, CA, United States, [4]Neurological Surgery, University of California San Francisco, San Francisco, CA, United States
		In the treatment of adult brain tumors, radiation therapy is associated with long-term effects including vascular injury in the form of cerebral microbleeds (CMBs), and white-matter changes. Ultra high-field MRI was used to detect CMBs, and predictors of CMB development were identified. Changes in individual and total CMB burden were characterized from serial imaging data with white-matter changes. Time since RT, multiple surgeries, tumor type and location were all predictors of development. The total number and volume of CMBs increased over time, while individual CMB size decreased and the surrounding white-matter showed signs of degradation.

1238	16:54	MRI Predictors of Response to Pembrolizumab, Bevacizumab and Hypofractionated Stereotactic Irradiation in Patients with Recurrent High Grade Gliomas
		Samuel Hawkins[1], Olya Stringfield[2], Nicolas Rognin[1], John Arrington[3], Michael Yu[4], Heiko Enderling[5], Solmaz Sahebjam[6], and Natarajan Raghunand[1]
		[1]Cancer Imaging & Metabolism, Moffitt Cancer Center, Tampa, FL, United States, [2]Cancer Imaging & Metabolism, Image Response Assessment Team Core, Moffitt Cancer Center, Tampa, FL, United States, [3]Radiology, Moffitt Cancer Center, Tampa, FL, United States, [4]Radiation Oncology, Moffitt Cancer Center, Tampa, FL, United States, [5]Integrated Mathematical Oncology, Moffitt Cancer Center, Tampa, FL, United States, [6]Neuro-Oncology, Moffitt Cancer Center, Tampa, FL, United States

		Standard MRI scans of patients with recurrent high grade gliomas treated with pembrolizumab were analyzed to build a model to predict time-to-progression. Images from five standard MRI sequences were co-registered across multiple scan dates per patient and automatically segmented into normal and pathologic tissue types based on calibrated pixel intensities. 308 radiomic features describing size, shape, and texture were extracted per image type. The four most predictive features were used in a linear regression model that could predict time-to-progression to within an average of three months of actual progression in test patients.

1239	17:06	Evaluating patients with Glioma using Multi-modal Hyperpolarized C-13 and H-1 Metabolic Imaging
		Yan Li[1], Adam Autry[1], Jeremy W Gordon[1], Ilwoo Park[2], Duan Xu[1], Susan M Chang[1], Daniel Vigneron[1], and Sarah J Nelson[1]
		[1]University of California San Francisco, San Francisco, CA, United States, [2]Chonam National University Medical School and Hospital, Chonam, Republic of Korea
		Gliomas are heterogeneous and infiltrative brain tumors. Noninvasive evaluation of the extent and activity of tumor is important for making decisions about how to manage patients with glioma. In this study, we are examining the relationship between dynamic hyperpolarized C-13 data and H-1 MRSI parameters. Eleven patients with glioma were studied with both hyperpolarized [1-^{13}C]pyruvate imaging and 3D H-1 lactate-edited MRSI. The H-1 data were affinely registered to the C-13 data, which allows voxel-by-voxel comparison. While these initial results indicate that there may be a trend towards an inverse relationship between C-13 lactate/pyruvate and steady state normalized lactate within the choline-to-NAA (CNI) lesion, further analysis is needed in a larger population of patients.

1240	17:18	Longitudinal Evaluation of Glioblastoma (GBM) Response to Chemo-radiation with Quantitative Magnetization Transfer (qMT)
		Hatef Mehrabian[1,2], Sten Myrehaug[3], Hany Soliman[3], Arjun Sahgal[3], and Greg J Stanisz[1]
		[1]Physical Sciences, Sunnybrook Research Institute, Toronto, ON, Canada, [2]Radiology & Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [3]Radiation Oncology, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
		Assessing response of glioblastoma (GBM) to standard 6-week chemo-radiation at early stages of the treatment allows for changing or adjusting therapy in patients with progressive tumors. Quantitative magnetization transfer (qMT) which probes the properties of the macromolecular content of the tumor and their interactions with free water protons is more sensitive to treatment-induced effects and is capable of differentiating progressors from non-progressors as early as two weeks into the treatment. Moreover, certain qMT parameters (i.e. amount of MT and direct effect of free water pool) were capable of characterizing GBM aggressiveness even before the start of the treatment.

Oral

Little Bones

S05	Thursday 15:30 - 17:30	*Moderators:* Mikko Nissi

1241	15:30	Simultaneous PET-MRI for Investigating Associations Between Bone and Cartilage Biomarkers of Knee Osteoarthritis
		Hatef Mehrabian[1], Valentina Pedoia[1], Jasmine Rossi-Devries[1], Emma Bahroos[1], Dragana Savic[2], and Sharmila Majumdar[1]
		[1]Radiology & Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [2]Physiology, Anatomy, Genetics, University of Oxford, Oxford, United Kingdom
		Knee osteoarthritis (OA) is caused by cartilage degeneration which has been shown to be accompanied by the changes in adjacent subchondral bone. Simultaneous PET-MRI enables investigating the biomarkers of cartilage degeneration in OA with MRI (i.e. $T_{1\rho}$, T_2 and Gadolinium uptake) as well as biomarkers of bone remodeling in OA with PET (uptake of NaF tracer in bone) at the same time. PET-MRI also allows for probing the associations between different bone and cartilage markers. Voxel-wise assessment of these associations provides insight into the local correlations between different OA markers and yields comprehensive assessment of knee OA progression.

1242	15:42	Automated Textural Classification of Osteoarthritis Magnetic Resonance Images
		Joshua D Kaggie[1,2], Rob Tovey[3], James MacKay[1,2], Fiona J Gilbert[1,2], Ferdia Gallagher[1,2], Andrew McCaskie[2,4], and Martin J Graves[1,2]
		[1]Radiology, University of Cambridge, Cambridge, United Kingdom, [2]Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom, [3]Mathematics, University of Cambridge, Cambridge, United Kingdom, [4]Division of Trauma and Orthopaedic Surgery, University of Cambridge, Cambridge, United Kingdom
		Osteoarthritis (OA) is the most common cause of disability in the United Kingdom and United States. Identifying the rate of OA progression remains an important clinical and research challenge for early disease monitoring. Texture analysis of tibial subchondral bone using magnetic resonance imaging (MRI) has demonstrated the ability to discriminate between different stages of OA. This work combines texture analysis with machine learning methods (Lasso, Decision Tree, and Neural Network) to predict radiographic disease progression over 3 years, trained using data from the Osteoarthritis Initiative. We achieved high sensitivity (86%), specificity (64%) and accuracy (74%) for predictions of OA progression.

1243	15:54	Anatomical variation of age-related changes in vertebral bone marrow composition using chemical shift encoding-based water-fat MRI

		Thomas Baum[1], Alexander Rohrmeier[1], Jan Syväri[2], Maximilian N Diefenbach[2], Daniela Franz[2], Michael Dieckmeyer[2], Andreas Scharr[1], Hans Hauner[3], Stefan Ruschke[2], Jan S Kirschke[1], and Dimitrios C Karampinos[2]
		[1]Department of Neuroradiology, Technical University of Munich, Munich, Germany, [2]Department of Radiology, Technical University of Munich, Munich, Germany, [3]Department of Nutritional Medicine, Technical University of Munich, Munich, Germany
		The assessment of vertebral bone marrow water-fat composition is attracting growing interest for applications in osteoporosis and bone metabolism. Chemical shift encoding-based water-fat MRI allows spatially resolved assessment of proton density fat fraction (PDFF) at the spine. This study demonstrated that males started with greater PDFF values in the Twenties compared to females. However, females showed an accelerated bone marrow fatty conversion until the Seventies on. This finding can be explained by the (patho-)physiological process of menopause. Interestingly, the relative age-related PDFF changes from the Twenties to the Seventies were dependent on the anatomical location and were most pronounced at lower lumbar vertebral levels in both genders.

1244	16:06	Unravelling bone marrow adipose tissue composition in proximal femur sub-regions through 3T Chemical Shift Encoded-MRI: differences between osteoporosis and glucocorticoid-induced osteoporosis
		Dimitri MARTEL[1], Benjamin LEPORQ[2], Amit SAXENA[3], H.Michael BELMONT[3], Gabrielle TURYAN[4], Stephen HONIG[5], Ravinder R. REGATTE[1], and Gregory CHANG[1]
		[1]Department of Radiology, NYU Langone Health, New York, NY, United States, [2]Université de Lyon; CREATIS CNRS UMR 5220, Inserm U1206, INSA-Lyon, UCBL Lyon 1, Villeurbanne, France, [3]Department of Rheumatology, NYU Langone Health, New York, NY, United States, [4]Radiology, NYU Langone Health, New York, NY, United States, [5]Osteoporosis Center, Hospital for Joint Diseases, NYU Langone Health, New York, NY, United States
		Osteoporosis (OP) is due to weak bone and can ultimately lead to fracture. Recent findings shows link between bone marrow adipose tissue (bMAT) composition and amount and OP. OP can be induced by drugs such as glucocorticoids resulting in glucocorticoid-induced osteoporosis (GIO) and can affect energy metabolism pathways, induce changes in bone including increased total marrow adiposity and changes in bMAT composition. The composition of bMAT in GIO has not been previously investigated. Our aim was to assess the bMAT composition of a GIO population and compare it to OP patients using 3T Chemical Shift Encoded- MRI (CSE-MRI).

1245	16:18	Quantitative Susceptibility Mapping of Human Spine: Correlation with Quantitative Computed Tomography and Reproducibility
		Yihao Guo[1], Yingjie Mei[2], Xintao Zhang[3], Yanjun Chen[3], Xiaodong Zhang[3], and Yanqiu Feng[1]

		[1]Guangdong Provincial Key Laboratory of Medical Image Processing,School of Biomedical Engineering, Southern Medical University, Guangzhou, China, [2]Philips Healthcare, Guangzhou, China, [3]Department of Medical Imaging, The Third Affiliated Hospital, Southern Medical University, Guangzhou, China
		This work aim to investigate the correlation between quantitative susceptibility mapping (QSM) and quantitative computed tomography (QCT) values, and the reproducibility of QSM value in human spine. Sixty-one subjects underwent QCT measurement for once and QSM measurement for twice in spine. The results showed that QSM value has strong correlation with QCT value, and has good reproducibility between two scans. These indicated that QSM has the potential to be an effective and stable measurement of BMD in clinical application.

1246	16:30	Preliminary Application Researches of Quantitative Susceptibility Mapping in Evaluating the Osteoporosis
		Xintao Zhang[1], Yihao Guo[2], Yanjun Chen[1], Yingjie Mei[3], Yanqiu Feng[2], and Xiaodong Zhang[1]
		[1]Department of Medical Radiology, The Third Affiliated Hospital of Southern Medical University, Guangzhou, China, [2]School of Biomedical Engineering, Guangdong Provincial Key Laboratory of Medical Image Processing, Southern Medical University, Guangzhou, China, [3]Philips Healthcare, Guangzhou, China
		The purpose of this work was to explore the clinical application of quantitative susceptibility mapping（QSM） using an ultrashort echo time (UTE) gradient echo (GRE) sequence in evaluating the bone mineral density（BMD）of lumbar vertebra by analyzing the correlation between QSM and quantitative computed tomography (QCT). Our results showed that there was strong correlation between QSM and QCT. QSM has the potential to be a biomarker providing new insights into osteoporosis.

1247	16:42	In Vivo Bone 31P Relaxation Measurement and Its Implications on Mineral Quantification
		Xia Zhao[1], Hee Kwon Song[1], and Felix W. Wehrli[1]
		[1]University of Pennsylvania, Philadelphia, PA, United States
		In MRI-based bone mineral assessment, pixel intensity of the bone is compared against that of the sample to estimate the 31P density after correcting for their relaxation properties. Knowledge of bone 31P relaxation times is therefore crucial. Using saturation-recovery spectroscopy and ZTE-PETRA, T1, T2* and density of bone 31P in healthy subjects (26 to 76 y/o) were measured yielding 36.8±1.4s, 196.9±10.1μs and 6.10±0.62 mol/L. Measured T1 and T2* errors are expected to be within 6% and 15%, resulting in an error of quantified [31P] of ≤ 6.3%. The small inter-subject variations may therefore obviate the need for individual T1 measurements.

1248	16:54	Zero TE Hip MRI: Osseous Measurements Assessing Femoroacetabular Impingement

		Ryan E Breighner[1], Eric Bogner[1], Brian T Kelly[2], Matthew F Koff[1], and Hollis G Potter[1]
		[1]Radiology and Imaging, Hospital for Special Surgery, New York, NY, United States, [2]Sports Medicine, Hospital for Special Surgery, New York, NY, United States
		Due to short tissue relaxation times and signal scarcity, routine MRI does not provide direct visualization of bone. This study investigates the use of proton density zero echo time (ZTE) MRI of bone in the hip, with emphasis on femoroacetabular impingement (FAI). Hip CT and ZTE images were acquired for 24 hips (14 patients). Ten measures of osseous morphology were compared between modalities. 'Moderate' to 'excellent' agreement was seen in all but one of the measurements. Zero Echo Time MRI may mitigate the need for CT in some cases.

1249	17:06	Three-Dimensional Ultrashort Echo Time Cones Actual Flip Angle Imaging with Variable Repetition Time (3D UTE-Cones AFI-VTR) for Accurate T1 mapping of Short T2 Tissues
		Yajun Ma[1], Xing Lu[1], Michael Carl[2], Yanchun Zhu[1], Nikolaus M Szeverenyi[1], Graeme M Bydder[1], Eric Y Chang[1,3], and Jiang Du[1]
		[1]University of California, San Diego, San Diego, CA, United States, [2]GE Healthcare, San Diego, CA, United States, [3]VA San Diego Healthcare System, San Diego, CA, United States
		To overcome the challenges (i.e. fast signal decay and low excitation efficiency) which would other render T1 measurements inaccurate for short T2 tissues, we propose a new approach by combining 3D UTE-Cones the actual flip angle imaging (AFI) with UTE-Cones variable repetition time (VTR) (3D UTE-Cones-AFI-VTR) method, where the identical RF pulses and flip angles are used for signal excitation in both sequences.

1250	17:18	CORTICAL BONE VESSEL IDENTIFICATION ON CONTRAST-ENHANCED MR IMAGES
		Po-hung Wu[1], Jing Liu[1], Julio Carballido-Gamio[2], Misung Han[1], Roland Krug[1], and Galateia Kazakia[1]
		[1]Radiology and Biomedical Imaging, University of California - San Francisco, San francisco, CA, United States, [2]School of Medicine, Radiology, University of Colorado Denver - Anschutz Medical Campus, Aurora, CO, United States
		Pathological cortical bone porosity negatively impacts bone strength, but the mechanisms of pathological pore growth are not understood. We hypothesize that the contents of cortical bone pores (marrow or vessels) may be useful indicators of pore expansion mechanisms. In this study, we developed a technique using high resolution CT and DCE-MRI to visualize and identify pore contents. Dynamic features such as temporal intensity difference and transition slope within pore voxels were evaluated and clustered by a K-means clustering algorithm. The average intensity of segmented vessel-filled pores increased over time, demonstrating the ability of our technique to positively identify vessel-filled pores.

Oral

Methods & Applications for PET/MR

S06	Thursday 15:30 - 17:30	*Moderators:* Uwe Himmelreich & Tone Bathen

1251	15:30	ZTE MRI for attenuation correction in PET/MR: performance in a large cohort of cognitive disorder patients
		Maya Khalifé[1], Brian Sgard[2,3], Arthur Bouchut[1], Brice Fernandez[4], Marine Soret[2], Gaspar Delso[5], Marie-Odile Habert[2,3], and Aurélie Kas[2,3]
		[1]Centre de NeuroImagerie de Recherche (CENIR), Institut du Cerveau et de la Moelle Epinière (ICM), Paris, France, [2]Department of Nuclear Medicine, Groupe Hospitalier Pitié-Salpêtrière C. Foix, Paris, France, [3]Laboratoire d'Imagerie Biomédicale, Sorbonne Universités, UPMC Univ Paris 06, Inserm U 1146, CNRS UMR 7371, Paris, France, [4]Applications and Workflow, GE Healthcare, Orsay, France, [5]Applications and Workflow, GE Healthcare, Cambridge, United Kingdom
		Several attenuation correction (AC) methods based on Zero Echo Time (ZTE) MRI are available in brain PET/MR. However, most of them were evaluated in healthy subjects or in patients without apparent brain disease. In this work, we investigated ZTE-AC in a 50-patient cohort imaged for cognitive disorders and we compared its performance with default atlas-AC and reference CT-based AC. The impact of the two AC methods (ZTE-AC and atlas-AC) was evaluated and compared to reference CT-AC, using a Volume of Interest (VOI) analysis and voxelwise group comparison between patients with normal cortical metabolism vs. metabolic pattern suggestive of Alzheimer's disease.

1252	15:42	UTE with Multi-Echo Radial Acquisition for PET/MRI Attenuation Correction
		Zhengyang Ming[1], Paul Kyu Han[2], Debra E. Horng[2], Shuang Hu[2,3], Kui Ying[1,4], Chao Ma[2], and Georges El Fakhri[2]
		[1]Engineering Physics, Tsinghua University, Beijing, China, [2]Gordon Center for Medical Imaging, Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States, [3]Nuclear Medicine, West China Hospital, Sichuan University, Sichuan, China, [4]Key Laboratory of Particle and Radiation Imaging, Ministry of Education, Medical Physics and Engineering Institute, Tsinghua University, Beijing, China
		Reliable estimation of PET attenuation coefficient (AC) is a fundamental problem in PET/MR imaging. Accurate measurement of bone density variation is vital to generate reliable subject-specific AC maps using MR. Also, minimizing the data acquisition time of MR sequences for AC is essential to allow more MR scans in a single PET/MR scanning session. In this work, we propose a new acquisition scheme combining UTE and multi-echo radial acquisition to reliably estimate the composition of water, fat and bone in a minute scan. Results show that water, fat and bone signals can be estimated in using the proposed method, which can be potentially used to estimate subject-specific AC maps.

1253	15:54	Deep Learning based pseudo-CT computation and its application for PET/MR attenuation correction and MR-guided radiation therapy planning
		Sandeep Kaushik[1], Cristina Cozzini[2], Mikael Bylund [3], Jaewon Yang[4], Dattesh Shanbhag[1], Joakim Jonsson[3], Josef Lundman[3], Thomas Hope[4], Tufve Nyholm[3], Andrew Leynes[4], Peder Larson[4], and Florian Wiesinger[2]
		[1]GE Global Research, Bangalore, India, [2]GE Healthcare, Munich, Germany, [3]Umeå University, Umeå, Sweden, [4]UCSF, San Fransisco, CA, United States
		In this work, we demonstrate a generic deep learning (DL) model that computes pCT images (i.e. continuous density bone) using a single channel ZTE MRI data and is robust to protocol and coil variations (as dictated by application needs). The method was evaluated for PET/MR attenuation correction protocol (low resolution for speed) and MRgRTP dose planning protocol (higher resolution for spatial accuracy). The advantages include a single model for multiple protocols, pCT which are very much like real CT in appearance, as well as excellent quantitative accuracy of estimated bone values in the computed pCT.

1254	16:06	MR-Based Respiratory and Cardiac Motion Corrected PET/MR
		Philip Robson[1], MariaGiovanna Trivieri[2], Nicolas Karakatsanis[1], Ronan Abgral[3], Marc Dweck[4], Jason Kovacic[2], and Zahi Fayad[1]
		[1]Translational and Molecular Imaging Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [2]Cardiovascular Institute, Icahn School of Medicine at Mount Sinai, New York, NY, United States, [3]Department of Nuclear Medicine, European University of Brittany, Brest, France, [4]British Heart Foundation Centre for Cardiovascular Science, University of Edinburgh, Edinburgh, United Kingdom
		A major advantage of hybrid PET/MR systems is the radiation-free high spatial and temporal resolution of MR imaging that can be used to estimate cardio-respiratory motion present during PET data acquisition. This information can be incorporated into reconstruction algorithms to correct for motion in the PET data to reduce blurring and increase target-to-background ratios (TBR) of PET hotspots. This may be of particular importance in cardiac imaging where the heart is in constant motion. In this work, we demonstrate a method for cardio-respiratory motion correction and evaluate the effect on TBR in the myocardium in a cohort of patients.

1255	16:18	Simultaneous characterization of tumor cellularity and aerobic glycolysis with PET, MR and MRSI
		Christian Hundshammer[1,2], Miriam Braeuer[1], Christoph Müller[3,4], Adam E. Hansen[5], Mathias Schillmaier[6], Stephan Düwel[1,2,7], Benedikt Feuerecker[1], Steffen J. Glaser[2], Axel Haase[7], Jorge Cabello[1], Franz Schilling[1], Jan B. Hövener[3], Andreas Kjaer[5], Stephan Nekolla[1], and Schwaiger Markus[1]

		[1]Department of Nuclear Medicine, Technical University Munich, Klinikum rechts der Isar, Munich, Germany, [2]Department of Chemistry, Technical University Munich, Garching, Germany, [3]Department of Radiology, Medical Physics, Medical Center - University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, [4]German Consortium for Translational Cancer Research (DKTK), Partnersite Freiburg, German Center for Cancer Research (DKFZ), Heidelberg, Germany, [5]Department of Clinical Physiology, Nuclear Medicine & PET and Cluster for Molecular Imaging, Rigshospitalet and University of Copenhagen, Copenhagen, Denmark, [6]Department of Radiology, Technical University Munich, Klinikum rechts der Isar, Munich, Germany, [7]Munich School of Bioengineering, Technical University Munich, Garching, Germany
		The new paradigm in oncology to tailor patient-specific therapies triggered the invention of powerful imaging techniques to non-invasively quantify tumor biology in depth. PET/MR is an emerging new hybrid imaging modality that allows the simultaneous acquisition of high resolution anatomical, functional and metabolic information. We established a multimodal imaging workflow on a whole-body PET/MR system to quantify tumor cellularity, glucose uptake and aerobic glycolysis. We applied this workflow on a pre-clinical breast cancer model in a longitudinal study to analyze the effect of necrosis and tumor growth on metabolic parameters and measure the correlation of glucose uptake and LDH activity.

1256	16:30	Simultaneous PET and MRSI of Prostate Cancer
		Kirsten Margrete Selnæs[1,2], Morteza Esmaeili[1], Nassim Tayari[3], Tom Scheenen[3], Mattijs Elschot[1], Arend Heerschap[3], and Tone Frost Bathen[1]
		[1]Department of Circulation and Medical Imaing, NTNU - Norwegian University of Science and Technology, Trondheim, Norway, [2]St. Olavs Hospital, Trondheim University Hospital, Trondheim, Norway, [3]Department of Radiology and Nuclear Medicine, Radboud University Medical Center, Nijmegen, Netherlands
		Both positron emission tomography (PET) and magnetic resonance spectroscopic imaging (MRSI) can give important information about cancer metabolism. With an integrated PET/MR scanner, MRSI and PET images can be acquired simultaneously. The aim of this study was to examine possible correlations between ^{18}F-Fluciclovine PET and MRSI measurements and evaluate their diagnostic performance in prostate cancer. The results showed a significant moderate correlation between both SUV_{mean} and SUV_{max} and the CCS/C ratio. A combination of the imaging outcomes derived from the integrated PET-MRSI modalities improved the localization accuracy of prostate cancer lesions.

1257	16:42	Comparison of Staging Capability among PET/MRI, MRI, PET/CT and Conventional Staging Method in Patients with Malignant Pleural Mesothelioma
		Yoshiharu Ohno[1,2], Masao Yui[3], Yuji Kishida[4], Shinichiro Seki[1,2], Kota Aoyagi[3], Katsusuke Kyotani[5], Yoshimori Kassai[3], and Takeshi Yoshikawa[1,2]

		[1]Division of Functional and Diagnostic Imaging Research, Department of Radiology, Kobe University Graduate School of Medicine, Kobe, Japan, [2]Advanced Biomedical Imaging Research Center, Kobe University Graduate School of Medicine, Kobe, Japan, [3]Toshiba Medical Systems Corporation, Otawara, Japan, [4]Division of Radiology, Department of Radiology, Kobe University Graduate School of Medicine, Kobe, Japan, [5]Center for Radiology and Radiation Oncology, Kobe University Hospital, Kobe, Japan
		No direct comparisons for TNM staging capability among whole-body PET/CT, whole-body PET/ MRI, whole-body MRI and conventional radiological examination in malignant pleural mesothelioma (MPM). We hypothesize that whole-body FDG-PET/MRI and MRI have better potential for TNM stage assessment than whole-body FDG-PET/CT and conventional staging method in MPM patients. The purpose of this study was to directly and prospectively compare the TNM staging capability among whole-body FDG-PET/MRI, MRI with DWI, FDG-PET/CT and conventional staging method in MPM patients

1258	16:54	Correlation between APT-CEST and 18F-Choline PET in glioma at 3T
		marilena rega[1], Francisco Torrealdea[2], Joe Hearle[3], Moritz Zaiss[4], Ana Carvalho[1], Asim Asaf[1], Shonit Punwani[2], Xavier Golay[5], John Dickson[1], Anath Shankar[6], and Harpreet Hyare[5]
		[1]Institute of Nuclear Medicine, UCLH, London, United Kingdom, [2]Centre for Medical Imaging, UCL, london, United Kingdom, [3]Medical school, UCL, london, United Kingdom, [4]High Field Magnetic Resonance, Max Plank Institute, Tubinghen, Germany, [5]Brain repair and Rehabilitation, UCL, London, United Kingdom, [6]Teenage Cancer Unit, UCLH, london, United Kingdom
		Chemical exchange saturation transfer MRI is emerging as a powerful diagnostic tool and has been shown to correlate with glioma tumour grade and molecular genetics. In this study, we aim to investigate whether APT signal is a non-invasive biomarker of Teenage and Young Adult glioma cell proliferation through correlation with 18F-Cho PET SUV as the gold standard. The strong positive correlation found in APT and 18F-Cho PET SUV indirectly demonstrates that APT SI may be a marker of glioma cell proliferation and further demonstrates the potential of APT in the assessment of glioma burden.

1259	17:06	Separating BOLD into local and non-local components using a novel simultaneous fMRI-fPET dual analysis
		Phillip G D Ward[1,2,3], Francesco Sforazzini[1], Sharna D Jamadar[1,2,3], Jakub Baran[1], Shenpeng Li[1,4], Zhaolin Chen[1,4], and Gary F Egan[1,2,3]
		[1]Monash Biomedical Imaging, Monash University, Melbourne, Australia, [2]Monash Institute of Cognitive and Clinical Neurosciences, Monash University, Melbourne, Australia, [3]Centre of Excellence for Integrative Brain Function, Australian Research Council, Melbourne, Australia, [4]Department of Electrical and Computer Systems Engineering, Monash University, Melbourne, Australia

		The objective was to separate the MRI BOLD response into local and non-local components using a simultaneously acquired functional FDG-PET (fPET) dataset. We used a visual task, with both high-frequency and low-frequency temporal components, to simultaneously evoke glucose and BOLD responses. Joint analysis of the fMRI and fPET identified two components, including a positively-correlated map of the visual cortex, and a negatively-correlated map of sub-regions of the visual cortex in fMRI and the draining vasculature in fPET. These findings provide preliminary evidence that we can deconstruct the fMRI BOLD signal into local (neuronal) and non-local (haemodynamic) components using simultaneous fMRI-fPET.

1260	17:18	Using Simultaneous PET/MRI and Cell Tracking to Evaluate Immunotherapies in Breast and Ovarian Cancer Models
		Brianna Kelly[1,2], Victoria Gonzalez[1,2], Marie-Laurence Tremblay[1], Andrea Nuschke[1], Christa Davis[1], Alecia MacKay[3], Andrea West[3], Barbara Vanderhyden[4], Genevieve Weir[3], Marianne Stanford[2,3], and Kim Brewer[1,2]
		[1]Biomedical Translational Imaging Centre (BIOTIC), Halifax, NS, Canada, [2]Dalhousie University, Halifax, NS, Canada, [3]Immunovaccine Inc., Halifax, NS, Canada, [4]Ottawa Hospital Research Institute, Ottawa, ON, Canada
		Epithelial ovarian cancer and triple negative breast cancer (TNBC) are aggressive cancers with poor survival outcomes. Simultaneous FDG-PET/MRI and quantitative cell tracking were used to monitor orthotopic ovarian cancer and TNBC models for longitudinal tumor growth and metabolism in response to therapy while tracking immune cell subsets labeled with superparamagnetic iron oxide (SPIO). PET/MRI enabled monitoring of tumor growth and internal physiological changes and allowed quantitative assessment of tumor volumes over time. MRI cell tracking results indicated changes in the recruitment rates of three unique immune cell types over time in the group level with significant individual-level variability.

Oral

High-Risk, High-Reward Translations

W05/06	Thursday 15:30 - 17:30	*Moderators:* Catherine Hines & Denis Le Bihan

1261	15:30	Assessment of Renal Fibrosis in a Rat Model of Unilateral Ureteral Obstruction with Diffusion Kurtosis Imaging: Comparison with α-SMA Expression and 18F-FDG PET
		Anqin Li[1], Zhen Li[1], Jiali Li[1], Yao Hu[1], and Daoyu Hu[1]
		[1]Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

		To evaluate the value of diffusional kurtosis imaging (DKI) in renal fibrosis using a rat model of unilateral ureteral obstruction (UUO). Differences of DKI parameters among the time points and between the sides were compared. The correlation of DKI parameters with positron emission tomography (PET) renal function and expression of the fibrosis maker α-SMA were determined. There were significant differences on mean diffusivity (MD) and fractional anisotropy (FA) among days and between two sides. FA was moderate correlated with SUV and α-SMA. Therefore, quantitative DKI could be considered a useful and noninvasive method to help assess renal fibrosis.

1262	15:42	Applying T2 Relaxation Under Spin Tagging (TRUST) to assess renal oxygenation in the kidney
		Alexander J Daniel[1], Eleanor F Cox[1], Charlotte E Buchanan[1], Chris R Bradley [1], and Susan T Francis[1]
		[1]Sir Peter Mansfield Imaging Centre, The University of Nottingham, Nottingham, United Kingdom
		T_2 Relaxation Under Spin Tagging (TRUST) provides a method to measure oxygenation in venous vessels within the brain. Here, a TRUST scheme is adapted for use within the body, specifically to assess oxygenation in the renal vein, using a respiratory-triggered Flow-sensitive Alternating Inversion Recovery (FAIR) labelling technique. This FAIR-TRUST variant has been tested in the brain, its reproducibility assessed in the kidney, and used to measure a change in blood oxygenation during an oxygen challenge. Changes in renal vein oxygenation could be measured more robustly than changes in BOLD T_2^*, the current MRI standard tissue oxygenation assessment within the kidney.

1263	15:54	Principles for measuring whole kidney nephron endowment in mice with in vivo MRI
		Edwin J. Baldelomar[1], Jennifer R. Charlton[2], and Kevin M. Bennett[3]
		[1]Physics, University of Hawaii at Manoa, HONOLULU, HI, United States, [2]Pediatrics, University of Virginia, Charlottesville, VA, United States, [3]Biology, University of Hawaii at Manoa, Honolulu, HI, United States
		Nephron endowment is a strong predictor for renal health and nephron loss is a hallmark of early development of chronic kidney disease, but there are no techniques to measure nephron endowment in vivo. Here, we performed CFE-MRI in rats and mice to determine the limits of in vivo measurements of nephron endowment in vivo. We correlated in vivo measurements with measurements from ex vivo, high-resolution images of same kidneys. This work lays the foundation for consistent and accurate whole kidney glomerular number and size measurements in the mouse and rat kidney, in vivo.

1264	16:06	Multiphase Hepatocyte-Specific Contrast Enhanced MRI of Liver in a Non-Human Primate Model of Ebola
		Ji Hyun Lee[1], David Thomasson[1], Jeffrey Solomon[2], Joseph Laux[1], Katie R. Hagen[1], Robin Gross[1], Peter B. Jahrling[1,3], Irwin M. Feuerstein[1], and Reed F. Johnson[3]

		[1]Integrated Research Facility, National Institute of Allergy and Infectious Diseases, National Institute of Health, Frederick, MD, United States, [2]Clinical Research Directorate/Clinical Monitoring Research Program, NCI Campus at Frederick, Leidos Biomedical Research, Inc., Frederick, MD, United States, [3]Emerging Viral Pathogens Section, National Institute of Allergy and Infectious Diseases, National Institute of Health, Frederick, MD, United States
		The purpose of this experiment was to assess the impact of Ebola virus infection on liver function during the acute phase of Ebola virus disease (EVD) in the rhesus macaque model in vivo imaging in a Biosafety level-4 facility. Multiphase liver-specific contrast, Eovist, enhanced MRI technique could detect the EVD liver failure. We observed a decreasing trend of Eovist uptake in the liver and biliary execution, and an increasing trend of liver volume with disease progression. Our findings highlight the spatiotemporal differences in Eovist uptake in a non-human primate model of Ebola.

1265	16:18	Comparison of long TE 1H-MRS to gas chromatography-mass spectrometry for analysis of adipose tissue fat composition
		Jesper Lundbom[1], Kálmán Bodis[1], Daniel Markgraf[1], Julia Szendrödi[1], and Michael Roden[1]
		[1]German Diabetes Center Düsseldorf, Düsseldorf, Germany
		Long TE ^{1}H-MRS of fat results in an improved baseline and more narrow peaks but may be impacted by J-coupling effects. Here we compare long TE ^{1}H-MRS of adipose tissue fat composition to gas chromatography-mass spectrometry (GC-MS) of adipose tissue biopsies. There was a close correlation between the two methods for both unsaturation =CH/CH2 ($R = 0.719$, $P < 0.00001$) and saturated chain length CH2/CH3 ($R = 0.782$, $P < 0.00001$). MRS overestimated unsaturation and underestimated saturated chain length. Long TE ^{1}H-MRS allows assessment of adipose tissue fat composition, however correction factors are needed for comparison to other methodologies.

1266	16:30	The presence of brown adipose tissue is associated with thyroid function in subjects with low and normal BMI
		Daniela Franz[1], Dominik Weidlich[1], Jan Syväri[1], Maximilian N. Diefenbach[1], Christina Holzapfel[2], Theresa Drabsch[2], Thomas Baum[3], Holger Eggers[4], Ernst J. Rummeny[1], Hans Hauner[2], and Dimitrios C. Karampinos[1]
		[1]Department of Diagnostic and Interventional Radiology, Technical University of Munich, Munich, Germany, [2]Else Kröner Fresenius Center for Nutritional Medicine, Technical University of Munich, Munich, Germany, [3]Department of Diagnostic and Interventional Neuroradiology, Technical University of Munich, Munich, Germany, [4]Philips Research Laboratory, Hamburg, Germany

		Brown adipose tissue (BAT) is important for energy and glucose metabolism in humans. Thyroid hormones regulate BAT development and function. Proton density fat fraction (PDFF) mapping based on a multi-echo gradient echo acquisition enables spatially-resolved fat quantification and can be indicative of the presence of BAT in adults. This study investigates the relationship between supraclavicular PDFF as surrogate marker for BAT, and serum levels of free thyroxine and free triiodothyronine with body mass index (BMI) as grouping variable.

1267	16:42	Magnetic Resonance Imaging Based Assessment of High Fat Diet Induced Mitochondrial Dysfunction Mediated Impaired Lipid Oxidation in Brown Adipose Tissue: Novel Mechanistic Insights
		Jadegoud Yaligar[1], Rengaraj Anantharaj[1], Giang Le Thi Thu [1], Ritu Chawla[2], Sanjay Kumar Verma[1], Venkatesh Gopalan[1], Houchun H Hu[3], Karthik Mallilankaraman[2], and S. Sendhil Velan[1]
		[1]Laboratory of Molecular Imaging, Singapore Bioimaging Consortium, Singapore, Singapore, [2]Department of Physiology, National University of Singapore, Singapore, Singapore, [3]Department of Radiology, Nationwide Children's Hospital, Columbus, OH, United States
		Understanding the functional aspects of BAT under obese and overweight conditions is important to improve metabolic dysfunction. Mechanisms that regulate the quality of BAT are influenced by dietary lipids and plays a vital role in fat oxidation. Our imaging and molecular biology data suggests that lipid oxidative capacity of the mitochondria in iBAT is compromised with increased accumulation of lipids. High fat dietary feeding did not affect the mitochondrial content. However, the mitochondrial function was profoundly impaired. The novel finding in this study is the reduction in the activity of complex II in HFD fed rats leading to mitochondrial dysfunction.

1268	16:54	Tongue deformation during mandibular advancement, as determined using tagged-MRI, may help to predict mandibular advancement treatment outcome in Obstructive sleep apnoea.
		Lauriane Jugé[1,2], Fiona Knapman[1], Peter Burke[1,2], Elizabeth Brown[1,3], Jane Butler[1,2], Danny Eckert[1,2], Jo Ngiam[4], Kate Sutherland[4,5], Peter Cistulli[4,5], and Lynne Bilston[1,6]
		[1]Neuroscience Research Australia, Sydney, Australia, [2]School of Medical Sciences, University of New South Wales, Sydney, Australia, [3]Prince of Wales Hospital, Sydney, Australia, [4]Department of Respiratory and Sleep Medicine, Royal North Shore Hospital, Sydney, Australia, [5]Charles Perkins Centre, University of Sydney, Sydney, Australia, [6]Prince of Wales Clinical School, University of New South Wales, Sydney, Australia
		Tongue deformation during mandibular advancement, as characterised by tagged-MRI, may be helpful to predict mandibular advancement splint (MAS) therapy for obstructive sleep apnea (OSA). 68 OSA patients untreated underwent a MRI scan prior to trialling a MAS and treatment outcome was determined. Preliminary results identified 3 possible tongue deformations (en bloc, oropharyngeal and minimal/backward) with variable impact on the upper airway size. Over all participants, tongue deformation was not associated with treatment outcome, but among obese participants, "en bloc" tongue deformation was associated with positive treatment outcomes. This may also improve the understanding of the mechanisms underpinning MAS therapy effectiveness.

1269	17:06	Non-invasive T1 mapping of the vitreous humour can detect central retinal vein occlusion and may discriminate between other forms of retinal ischaemia
		Nicholas G Dowell[1], Andrew R H Simpson[2], Samira N Bouyagoub[1], and Edward H Hughes[2]
		[1]Neuroscience, Brighton and Sussex Medical School, Brighton, United Kingdom, [2]Sussex Eye Hospital, Brighton and Sussex University Hospital, Brighton, United Kingdom
		In this work we demonstrate that careful T_1 mapping of the vitreous humour can identify disease in the retina. We studied a cohort of patients with central vein retinal occlusion (a type of retinal ischaemia) and show that significant decreases in T_1 of the vitreous humour are observed compared to healthy control eyes. We speculate that the decreases may be the result of increased pO_2 that could arise when the oxygen demand of the retina is reduced as a consequence of damage. We show preliminary data from patients with proliferative diabetic retinopathy and ocular ischaemic syndrome that suggest that it may be possible to discriminate different forms of retinal ischaemia completely non-invasively with MRI.

1270	17:18	Vagus Nerve Stimulation Promotes Gastric Emptying in Rat Measured by Magnetic Resonance Imaging
		Kun-Han Lu[1], Jiayue Cao[2], Steven Oleson[2], Matthew Ward[2,3], Terry Powley[4], and Zhongming Liu[1,2]
		[1]Electrical and Computer Engineering, Purdue University, West lafayette, IN, United States, [2]Biomedical Engineering, Purdue University, West lafayette, IN, United States, [3]Indiana University School of Medicine, Indianapolis, IN, United States, [4]Psychological Sciences, Purdue University, West lafayette, IN, United States
		We developed in vivo contrast-enhanced MRI and an image processing pipeline to image and assess the therapeutic effect of cervical vagus nerve stimulation (VNS) on gastric emptying and motility in rat. We found that: (1) VNS significantly promoted the rate of gastric emptying. (2) VNS significantly increased the degree to which the pyloric ring opened, and this outcome was correlated to the rate of gastric emptying. (3) The VNS parameters used in this study did not alter antral motility significantly. The proposed method allows non-invasive and repeated preclinical imaging of gastric physiology and diseases given electroceutical treatments.

Study Groups

MR Spectroscopy Business Meeting

W07	Thursday 16:30 - 17:30	*(no CME credit)*

Plenary Session

Lauterbur Lecture: MRI in Yon Times of Yore

Plenary Hall (Paris Room)	Thursday 17:45 - 18:45

17:45	Young Investigator Awards Presentation
17:50	Closing Remarks
18:45	Adjournment
18:45	MRI in Yon Times of Yore

Event

Closing Party

Les Pavillons de Bercy	Thursday 19:00 - 21:00	*(no CME credit)*