Poster: CV PowerBeat: Part 1

Power Pitch Theater A - Exhibition Hall	Monday 9:15 - 10:15

1	Plasma 1	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
		4D-flow-MRI enables the non-invasive assessment of cardiovascular pressure drops; however, estimation accuracy depends on vascular topology and acquisition noise. Here, we present a method that minimizes the impact of these by using virtual fields to isolate and probe hemodynamic pressure drops. We show that, *in-silico*, the method accurately assesses pressure drops over multiple segments of a patient-specific co-arcted aorta (average error below 22%), independent of anatomical bifurcations. Additionally, the method compares successfully against catheter measurements, using 4D-flow-MRI *in-vivo* (average error at peak systole below 15%). With this, the method represents a refined tool for hemodynamic analysis of cardiovascular flow.

2	Plasma 2	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
		In-vitro cardiovascular simulation permits quantification of hemodynamics that cannot be assessed in-vivo. However, simulation accuracy depends on anatomical and physiological realism of in-vitro models and flow. To determine the effect of model compliance and pulsatile flow, a rigid model of an aorta was compared with a geometrically identical compliant model. Models were perfused with pulsatile flow using a positive displacement pump. Flow dynamic parameters for simulations, obtained using 4D flow MRI, showed that model compliance plays a significant role in hemodynamics during pulsatile flow. Future development of realistic in-vitro simulation, paired with in-vivo validation, will aid in surgical planning.

3	Plasma 3	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
		Familial hypercholesterolemia (FH) is an autosomal dominant disorder of lipoprotein metabolism, that are associated with premature atherosclerosis, early-onset of cardiovascular disease (CVD) with an elevated mortality. It would be prudent to develop and investigate imaging-based hemodynamics biomarkers that assist in cardiovascular risk assessment of FH patients. In this work, we obtain several hemodynamics parameters in HP patients using a single methodology, which is based on the analysis of 4D flow data using a finite element method. We found distinctive biomarkers as WSS (magnitude, axial, circumferential) and Kinetic Energy those present more significant differences along the entire aorta.

4	Plasma 4	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
		Caval flow contribution to each lung is of interest in Fontan circulation due to the increased risk of developing pulmonary arteriovenous malformations when flow is unevenly distributed. Existing methods to assess this risk are invasive and require ionizing radiation, posing additional risks to pediatric patients during longitudinal monitoring. In this study, we demonstrate a non-invasive, non-ionizing assessment of the origin of pulmonary blood flow, as well as quantitative pulmonary perfusion using arterial spin labeled MR, and compare with the previously proposed 4D-flow measurement of caval flow distribution.

5	Plasma 5	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
		Postoperative hemodynamic changes in the aorta in patients with aortic valve stenosis (AS) remain unclear. Four-dimensional (4D) flow MRI was perfumed in 11 AS patients before and after aortic valve replacement (AVR). We evaluated volume flow rate and the main flow direction, setting 15 planes of the aorta and 3 planes of the arch branches. Volume flow rate significantly increased in the ascending aorta and the arch branches. The main flow direction came to match with the axial direction of the aorta. These results suggest that AVR results in more efficient blood transport to the upper body including the brain.

6	Plasma 6	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
		Altered aortic anatomy after prosthesis implantation has been shown to increase secondary flow patterns with potential long-term effects. Therefore, patients after valve-sparing aortic root and ascending aorta replacement with a physiologically pre-shaped prosthesis were examined with 4D-Flow-MRI and compared to patients with straight grafts and age-matched volunteers. A reduced angulation at the distal anastomosis as well as a slightly reduced intensity of secondary flow patterns was confirmed. However, there was no reduction of secondary flow patterns in comparison to straight prostheses potentially attributed to a residual angulation at the proximal anastomosis and a dilatation at the distal anastomosis.

7	Plasma 7	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
		For implementing 4D flow in clinical routine, standardization is important. We evaluated equivalence of 4D flow parameters in different sequences and at three different field strengths. Ten healthy volunteers were scanned at 1.5T, 3.0T and 7.0T. At 1.5T, three different sequences were applied. Ascending aorta, aortic arch and descending aorta of each scan were evaluated for diagnostic quality. After exclusion of non-diagnostic segments, equivalence testing for flow, wall shear stress and peak velocity was performed. Acceptable equivalence was determined by intra-rater analysis. Comparison of different field strengths as well as different sequences did not reach equivalence. 4D flow sequences are not interchangeable.

8	Plasma 8	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
		Distortions in the velocity fields acquired by 4D Flow MRI affect particle tracking based visualization and quantification methods. Particle residence time was calculated in a subject with aortic aneurysm and was used to assess how particle tracking methods are impacted by noise and offset errors. To do so, a computationally derived ideal velocity field was created and distorted by adding noise and background phase-offsets. We found that particle tracking methods are severely impacted by offset errors, though more robust to random noise. Understanding the limits of these methods is crucial for their appropriate use.

9	Plasma 9	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

		The rapid rise in the popularity and use of the electronic cigarettes among adolescents are unsettling trends in spite of the limited science that exists on the health effects of e-cigarettes. The purpose of this project was to introduce a noninvasive method for the study of the systemic acute effects of e-cigarette aerosol inhalation on the cardiovascular system by means of quantitative MRI that targets various vascular territories. Preliminary data show reduced femoral vein SvO_2 and impaired flow-mediated dilation in the femoral artery, along with elevated aortic arch pulse-wave velocity after an e-cigarette challenge equivalent to one conventional cigarette.

10	Plasma 10	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
		4D-Flow MRI is a powerful technique for simultaneously imaging vascular anatomy and hemodynamics. However, its clinical utility is limited by long (10-20 minute) scan times. This work aims to shorten scan times by using fast RF pulses and convex optimized gradient waveforms. The waveforms are optimized with arbitrary shapes, and are designed to go as fast possible without causing peripheral nerve stimulation by including an additional PNS constraint. The optimized sequence is implemented and tested in flow phantoms and a volunteer. The data acquired with the optimized waveforms is up to 33% faster, with no significant difference in measured data compared to a reference sequence.

11	Plasma 11	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
		Dual VENC Velocity quantification has been previously carried out with the two different VENCs acquired in separate repetition cycles (TRs). We propose a magnetic resonance imaging sequence that acquires the phase matrix for two different VENC values in one TR, and use the developed sequence for slow motions and fast flows.

12	Plasma 12	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
		4D flow MRI enables visualization and quantification of complex blood flow, and provides relevant biomarkers, such as wall shear stress. A 4D flow MRI acquisition, however, takes between 15-40 min, which complicates its use in clinical practice. In this work, we developed a technique to reduce scan time by prospectively undersampling k-space in a pseudo-spiral Cartesian fashion. Combined with a Compressed Sensing reconstruction using a total variation sparsifying transform in time, this technique makes 4D flow MRI in the carotid arteries 20-30 times faster, while preserving accuracy in flow and wall shear stress measurements.

13	Plasma 13	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
		4D flow MRI supports the development of novel energetic biomarkers in hypertrophic cardiomyopathy (HCM) – a disease marked by dynamic left ventricular outflow tract obstruction with mitral regurgitation (MR). We compared kinetic energy and velocity metrics between obstructive and non-obstructive HCM subtypes to determine where in the left heart high kinetic energy and flows were generated. Left atrium showed significantly higher systolic kinetic energy and velocities throughout ventricular systole due to MR. Including these energetic parameters may be useful to detect significant MR that is underestimated by echo, identify patients at higher risk of atrial fibrillation, and inform treatment options.

14	Plasma 14	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

		We describe a new approach for flow imaging and quantification consisting of a prototype cine arterial spin labeling (ASL) pulse sequence using a highly-accelerated radial fast interrupted steady-state (FISS) readout. The technique was successfully applied in several vascular regions (coronary arteries, pulmonary arteries, renal arteries, circle of Willis). These preliminary results suggest that cine FISS ASL has the potential to provide an efficient and visually-appealing alternative to phase contrast for the depiction and quantification of blood flow.

15	Plasma 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
		Mitral insufficiency (MI) is difficult to quantify, due to cardiac motion and complex regurgitation patterns. This study evaluated the use of 4D flow MRI with semi-automated retrospective valve tracking for assessment of severe MI. Valve tracking of both the mitral and aortic valve allowed for direct measurement of retrograde flow and indirect measurement based on total left-ventricular inflow and aortic outflow. Conventional 2D MRI-based indirect quantification was used as a reference. Eccentric regurgitation patterns complicated direct quantification, necessitating manual plane angulation for accurate measurement. Indirect quantification corresponded well with 2D MRI and might be a more reproducible alternative.

Electronic Power Pitch Poster

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

Power Pitch Theater B - Exhibition Hall	Monday 9:15 - 10:15

16	Plasma 16	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

		The iPRES-W AIR coil is a highly novel RF coil design that can simultaneously perform image acquisition, wireless communication, and wirelessly controlled localized B_0 shimming. In addition, the iPRES-W AIR coil benefits from all advantages of the recently unveiled AIR coil technology, which offers a flexible and ultra-lightweight coil for increased patient comfort and freedom in overlap positioning between coil elements without degrading the performance. This technology has enormous potential to improve image quality, spatial fidelity, diagnostic accuracy, and patient comfort in a wide range of MRI applications.

17	Plasma 17	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
		Today, MRI coils can be made flexible and stretchable. Signals can be sent out of bore by optical or wireless links. Nonetheless, wearable digital coil arrays have not yet found their way into MRI although enhanced patient comfort and workflow can be expected. In this work we explore the feasability of stretchable coil arrays with on-coil digitization and optical transmission, and present a first implementation for wrist imaging.

18	Plasma 18	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
		Resonant inductive coupling is commonly seen as an undesired fundamental phenomenon emergent in densely packed resonant structures, such as nuclear magnetic resonance phased array detectors. The need to mitigate coupling imposes rigid constraints on the detector design, impeding performance and limiting the scope of magnetic resonance experiments. Here we introduce a high impedance detector design, which can cloak itself from electrodynamic interactions with neighboring elements. We verify experimentally that the high impedance detectors do not suffer from signal-to-noise degradation mechanisms observed with traditional low impedance elements. Using this new-found robustness, we demonstrate an adaptive wearable detector array for magnetic resonance imaging of the hand. The unique properties of the detector glove reveal new pathways to study the biomechanics of soft tissues, and exemplify the enabling potential of high-impedance detectors for a wide range of demanding applications that are not well suited to traditional coil designs.

19	Plasma 19	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
		MR neurography of the Brachial Plexus (BP) is technically challenging, due in part to complex topographical anatomy that is sub-optimally accommodated with existing rigid receiver coil arrays. In this work we propose a wearable garment with integrated flexible loop receiver coils that conforms to the contour of the neck and shoulder, as well as variations in subject size. The loops can flex in multiple dimensions without seriously affecting noise correlation.
20	Plasma 20	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
		We developed process for fabricating patient-specific MRI receive coils via scalable and adaptable additive manufacturing approaches. Process relies on spray-depositing solution-processed electronic materials onto 3D printed custom substrates. We conducted careful materials selection, process optimization and fabricated fully functional coils. The coils spray deposited onto spherical substrate demonstrated higher SNR than control coil, when evaluated using phantom of the spherical shape, due to superior conformability to the phantom. Our approach is poised to enhance high quality clinical imaging by ensuring optimum fit of the MRI receive coils to the body parts with complex geometries, enabling reproducible placing on the patient and eliminating motion artifacts.
21	Plasma 21	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

		Pediatric MRI is often performed suboptimally by the use of heavy, large, and relatively inflexible coil arrays that are designed and built for adult MR imaging. For the child, these arrays can be intimidating and uncomfortable, restricting breathing. For parents, they contribute to the stress of the exam. For pediatric caregivers for smaller children, the coils complicate placing medical support equipment. Here, we assess the use of screen printed flexible coil arrays for pediatric applications, focusing on clinical image quality and caregiver acceptance. We conclude that a flexible screen-printed MRI receive coil is likely to yield diagnostic image quality and be preferred to a traditional coil by patients, parents, and caregivers.

22	Plasma 22	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
		We propose and characterise a novel metamaterial-inspired approach which reduces substantially the required outer diameter of a dielectric resonator thus making possible to design compact structures for 3 T. When used in an inductively-coupled wireless mode, the sensitivity of the “meta-resonator” was measured to be slightly higher than that of a standard dielectric resonator operating in its degenerate circularly-polarized HEM_{11} modes. This study demonstrates the first application of a metamaterial-based approach to MR volume coil design.

23	Plasma 23	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
		The presence of medical implants often results in MR scans with low SAR being prescribed, which reduces the diagnostic quality of the images. This work shows that one can achieve an increase in local transmit efficiency and a corresponding decrease in SAR at 1.5 Tesla using new ferroelectric materials (based on $BaTiO_3$ with ZrO_2 and CeO_2-additives) with relative permittivities higher than 4500. Simulations and phantom/in vivo experiments show an increased local transmit efficiency of ~50% from the body transmit coil, with a corresponding increase in SNR for a given value of SAR.

24	Plasma 24	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
		We evaluate the performance both in simulation and experiment of two 10.5T head transceiver arrays. The first is a 16-channel monopole/dipole hybrid array (called the Mono-Dipole array for brevity). The second is a 16-channel monopole/HDC disk dipole array. (A combination of two 8-channel arrays: a monopole array and a high dielectric constant (HDC) disk dipole array). These novel coil designs were compared against a standard 16-channel stripline array to elucidate their relative benefits and drawbacks.

25	Plasma 25	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
		For wireless MRI to become a reality, methods must be developed to synchronize receivers that have no physical connection to the scanner. Here, we demonstrate that dual pilot tones are needed to correct for both timing skew and frequency offsets. Bench tests were performed with a master and free running slave receiver, in which the images were re-synchronized by frequency estimation methods on pilot tones.

26	Plasma 26	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
		We demonstrate experimentally a new design of self-resonant tunable volumetric wireless coil based on a periodic array of coupled split-loop resonators. The wireless coil operates via inductive coupling with a birdcage coil enhancing the sensitivity of the latter at 1.5T and can be used for extremities imaging. Phantom and *in-vivo* wrist imaging with the proposed coil demonstrate 8.6 times higher transmit power efficiency in comparison with the birdcage coil and up to 2 times higher SNR versus standard receive-only coil.

27	Plasma 27	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
		Wireless MRI coils require a local frequency reference that is very tightly synchronized with the main MRI system clock. In order to keep phase encoding errors to less than 1 degree of phase at 3T, the local reference clock cannot drift by more than +/-22ps. Unlike RF cables or optical fibers, a wireless communication channel is not constant in phase over time. Patient motion and multi-path fading cause the wireless signal to be modulated in amplitude and phase. When disciplining a local clock with the MRI system clock by wireless means, channel impairments have to be monitored and corrected.

28	Plasma 28	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
		This work explored the antenna design choices for wireless MRI, specifically for clock synchronization and scanner state detection. Antennas at 1.6GHz for the clock signal, and 3.5GHz for Q-spoil signal were tested for transmit and receive performance. Reflectors were constructed and improvements in antenna path loss were observed. A better understanding of these antennas is necessary to help satisfy link budget requirements.

29	Plasma 29	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
		A low-cost portable brain MRI scanner could extend the reach of brain MRI to remote locations and point-of-care situations and extend the use of MRI into monitoring applications. We previously presented 3D imaging in a portable magnet without gradient coils using the natural field variation of a rotating permanent magnet for in-plane encoding and RF phase gradients for encoding the third direction. In this work, we show that an efficient gradient coil can phase-encode the third direction in a single shot CPMG train with minimal current (~2A) allowing low-cost amplifiers and negligible power needs, acoustic noise or heating.

30	Plasma 30	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
		Widely accessible, fast, and portable MR relaxometry can provide highly valuable diagnostic information in many diseases including fluid overload, dehydration, and muscle degeneration. High cost, large size, and extended acquisition time limit the use of traditional MRI for relaxometry. We introduce a novel portable MR sensor with a large, remote, uniform magnetic field created by a Unilateral Linear Halbach array capable of performing spatially selective, multi-component relaxometry. Strong agreement between simulation and experimental results indicates highly reliable magnet design methods. Spatial selectivity is achieved through variation of either RF pulse length or B1 frequency. Quantitative multi-component T2 relaxometry is demonstrated.

Electronic Power Pitch Poster

Poster: Molecular & Metabolic Imaging

Power Pitch Theater A - Exhibition Hall	Monday 14:45 - 15:45

102	Plasma 1	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
		We introduce a new deconvolution approach for multicolor imaging of different 19F compounds with complex spectra. The method exploits the sparse nature of most 19F images by iterative sparse deconvolution, removes the chemical shift artifacts associated with multiple peaks in the 19F spectra, and efficiently separates multiple 19F compounds in the images. We performed numerical simulations and phantom experiments, which showed that the signal from two fluorinated compounds, i.e. PFOB and PFCE, can be separately detected without chemical shift artifacts. Moreover, we demonstrated chemical shift artifact-free multicolor detection of PFOB- and PFCE emulsion in a mouse.

103	Plasma 2	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
		The purpose of the present study was to evaluate key molecular and cellular features of Graves' orbitopathy by simultaneous monitoring of alterations in morphology, inflammatory patterns, and tissue remodeling. Beyond anatomical ^{1}H MRI, we employed T2 mapping for visualization of edema, chemical exchange saturation transfer for detection of hyaluronan, and ^{19}F MRI for tracking of in situ labeled immune cells after intravenous injection of perfluorcarbons. In particular, ^{19}F MRI allowed a sensitive demarcation of inflammatory foci in the orbit, even when other markers indicated only weak or no signs of tissue alterations.
104	Plasma 3	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
		A promising approach to treatment of chronic lung diseases is the intratracheal delivery of pluripotent stem cell derived alveolar-like macrophages (PSC-ALMs) into the injured lung to facilitate repair of damaged tissue. This treatment is hindered by the inability to assess where in the lung these cells end up. Here, hyperpolarized Xe-129 MRI paired with iron-labeled cells was used to demonstrate a proof-of-concept visualization of cells introduced in the lungs of rats. Signal hypointensities were observed at least one hour after instillation of approximately two million labeled cells in one rat, compared to instillation of control solutions in separate rats.
105	Plasma 4	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

		Silicon nano- and microparticles are well-suited for targeted molecular imaging, due to their biocompatibility, easily modifiable surface, and long-lasting ^{29}Si MR signal (which can be enhanced by several orders of magnitude via dynamic nuclear polarization). We demonstrate targeted molecular imaging of human MUC1-expressing colon tumors in orthotopic mouse models using hyperpolarized ^{29}Si MRI. The particles were able to selectively bind to MUC1-expressing tumors compared to controls, and the results were confirmed via histology of the excised tissue. The goal is to develop these targeted particles as a platform technology that will allow non-invasive screening of colorectal cancer using ^{29}Si MRI.

106	Plasma 5	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
		We studied brain redox capacity using ascorbate-derived hyperpolarized (HP) ^{13}C MR and ^{11}C PET probes. We first demonstrated the molecular transport and biodistribution features of the ascorbic acid (VitC)-dehydroascorbate (DHA) pair by leveraging both HP MR and PET modalities. We then showed that HP ^{13}C DHA could detect redox modulation of the brain in a pharmacologic glutathione-depletion rat model. In conclusion, HP ^{13}C DHA MR has the potential for non-invasive evaluation of brain redox capacity.

107	Plasma 6	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
		Cellular redox state is intricately linked with cardiac ischemia. Historically, tissue levels of lactate to pyruvate and β-hydroxybutyrate to acetoacetate have been used as indices of cytosolic and mitochondrial redox, respectively. The present study was designed to evaluate the potential of using co-hyperpolarized (HP) [1-^{13}C] pyruvate and [1,3-^{13}C] acetoacetate as reporters of cytosolic and mitochondrial redox, respectively. ^{13}C NMR spectra of perfused rat hearts displayed increased production of both HP-lactate and HP-β-hydroxybutyrate in low flow ischemia, rotenone, and aminooxyacetate (AOA) treated hearts. The result suggests that HP-lactate and HP-β-hydroxybutyrate are sensitive metabolic markers of tissue redox in heart tissue.

108	Plasma 7	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
		Detoxification of ammonia by the urea cycle and maintenance of glucose homeostasis by gluconeogenesis are two critical functions of the liver. The bile duct ligation (BDL) model of cirrhosis was used to test the ability of hyperpolarized [6-^{13}C]arginine and [1-^{13}C]pyruvate to detect changes in liver function. The conversion of hyperpolarized L-[6-^{13}C]arginine to ^{13}C-urea was observed in a sham-operated rat but not in BDL rats. Striking differences in pyruvate metabolism between the two groups were also noted, indicating that these probes can sense changes in hepatic mitochondrial and cytoplasmic metabolism associated with biliary cirrhosis.

109	Plasma 8	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
		In this study, we demonstrate hollow manganese silicate nanoparticle (HMS) as a liver specific magnetic resonance imaging (MRI) contrast agent. HMS releases Mn^{2+} ions in the acidic physiological condition, which can be utilized for characterizing different tumor types.

110	Plasma 9	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

		Image-guided cancer therapy have the ability to integrate noninvasive imaging and minimally invasive interventions such as photothermal therapy (PTT) together to improve the precision of treatment. In the present study, we investigated magnetic resonance temperature imaging (MRTI) as a tool for non-invasive monitoring of tumor temperature distribution and changes during laser irradiation. To this end, we injected PEGylated graphene oxide (GO-PEG) to 4T1 tumor models and irradiated the tumors to induce PTT. Our studies demonstrate that MRTI, which is a feasible tool for the determination of temperature distribution, can be used to guide nanoparticle-mediated tumor photothermal therapy.

111	Plasma 10	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
		A correct preoperatively predicting grade histologic subtype and tumor proliferation of meningioma is important in clinic treatment. APT imaging are designed to assess brain tumor on the level of cell and molecule. In this study we hoping to explore if this technique was useful in evaluating the meningioma comprehensively.

112	Plasma 11	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
		Brown adipose tissue (BAT) has a great relevance in metabolic diseases and has been shown to be reduced in obesity and insulin resistance patients. Currently, Dixon MRI is used to calculate fat-water fraction (FWF) and differentiate BAT from the less hydrated and more lipid-rich white fat. However, it may introduce fat-water swapping artifacts. Here, we showed that Z-Spectrum MRI can effectively measure FWF and BAT mass *in vivo* free from artifacts, due to the direct saturation of both water and fat protons.

113	Plasma 12	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
		Carbon nanodots (Cdots), are a relatively new type of eco-friendly nanoparticles that are being utilized extensively as drug carriers with inherent fluorescence imaging. In the present study, we explored their intrinsic chemical exchange saturation transfer (CEST) MRI contrast. We showed that Cdots can be directly detected by CEST MRI due to the abundant exchangeable hydrogen protons on their surfaces, which allows Cdots inherently bimodal contrast agents. Application to cell labeling was demonstrated in vitro. To the best of our knowledge, this is the first demonstration of diamagnetic nanoparticulate CEST MRI contrast agents.

114	Plasma 13	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
		The pH-value as physiological marker for clinical diagnosis can be measured with special hardware over ^{31}P-MRSI. APT-CEST MRI offers an alternative method for such quantification but is challenging because of magnetization transfer from other tissue compartments. To evaluate the role of pH for APT-CEST, we investigated 12 patients with first diagnosis of glioblastoma and 11 healthy controls, based on asymmetric analysis of magnetization transfer (MTR_{asym}) and calculated pH maps over ^{31}P-MRSI. Our results show a high correlation between both parameters and support the hypothesis that an enhancement of MTR_{asym} at 3.5ppm is associated with increased pH.

115	Plasma 14	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

		Checkpoint inhibitors, adoptive T-cell transfer and tumor vaccination are different cancer immunotherapies which have demonstrated clinical efficacy in certain patients[1-3]. All of these therapies require sufficient infiltration of cytotoxic T-cells into the tumor and direct contact with cancer cells. However, the reasons why certain tumors present with high T-cell infiltration while others do not are poorly understood. We therefore set out to assess if imaging vascular adhesion molecule 1 (VCAM-1) expression in the tumor vasculature could explain some of the observed differences in T-cell infiltration.

116	Plasma 15	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
		The interpretation of radiogenomic findings and its biological or clinical meaning is currently discussed and still unknown. Therefrom, a translational approach is aimed for integration of laboratory investigations and radiogenomic findings resulting in meaningful integration of radiogenomic discoveries. The presented study aimed to explore the molecular background of a MR-Spectroscopy imaging. In a stepwise approach findings were validated on tissue samples and finally taken into glioma cell models.

Electronic Power Pitch Poster

Poster: MRI in Cancer Therapy & Diagnostics

Power Pitch Theater B - Exhibition Hall	Monday 14:45 - 15:45

117	Plasma 16	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
		A MRI-only treatment planning pipeline, deepMTP, was constructed using a deep learning approach to generate continuously-valued pseudo CT images from MR images. A deep convolutional neural network was designed to identify tissue features in volumetric head MR images training with co-registered kVCT images. A set of 40 retrospective 3D T1-weighted head images was utilized to train the model, and evaluated in 10 clinical cases with brain metastases. Statistical analysis was used to compare dosimetric parameters of plans made with pseudo CT images generated from deepMTP to those made with kVCT based clinical treatment plan, where no significant difference was found.

118	Plasma 17	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
		To assist treatment delivery to moving tissues on hybrid MRI-guided radiotherapy systems, high quality midposition (of the respiratory cycle) and 4D-T2w images are desirable. Current approaches to rapidly obtaining 4D-T2w MRI are often limited by thick slices, incomplete motion information and binning artefacts. Midposition and 4D-T2w images were calculated using motion-modelling and a super-resolution reconstruction, and verified by comparison with the initially acquired images. Calculated 4D-T2w images exhibited high spatiotemporal resolution (1.0x1.0x1.0 mm^3, 8 respiratory phases), displayed reduced binning artefacts and no missing data. An acquisition time of 5.0-7.5 minutes was found sufficient to obtain representative midposition T2w images.

119	Plasma 18	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
		During ocular movement, the shape and location of the intra-orbital structures change. Outlining these changes will improve the accuracy of radiotherapy treatment planning for ocular tumors and the treatment of impaired ocular movement. The resolution of ocular MRI is, however, limited by acquisition time due to eye-motion. Therefore, an acquisition strategy in which outer k-space data is shared between gaze directions was developed and evaluated in 7 healthy and 2 myopic subjects. With this technique, the location of the orbital structures was determined for nine gaze directions in approximately one minute.

120	Plasma 19	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

		Optic pathway glioma (OPG) is a childhood tumour of the visual pathway. Clinical management of OPG remains challenging, as the extent of tumour infiltration of the visual pathway is not perceptible on conventional MRI. We used diffusion-MRI to delineate the visual pathway in OPG patients. Advanced ophthalmological assessment was also performed using visual evoked potentials (VEP) and optical coherence tomography. We demonstrate that fractional anisotropy (FA) in the optic pathway correlates with retinal nerve-fibre layer thickness and VEP response, and tumour invasion anterior to the optic chiasm can be detected via inter-ocular differences in optic nerve FA.

121	Plasma 20	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
		This study proposes a radiomics patch-based analysis, based on conventional MRI, for classification of the non-enhancing lesion area into vasogenic edema and infiltrative tumor in patients with high-grade-gliomas. 179 MRI scans obtained from 102 patients were included: 67 patients with high-grade-gliomas and 35 patients with brain-metastases. A total of 225 histogram and gray-level-co-occurrence-matrix based features were extracted from the non-enhancing lesion. Classification was performed using various machine-learning classifiers. The best results were obtained using Linear support-vector-machine, with accuracy=87%, sensitivity=86%, and specificity=89%. Preliminary results in patients treated with bevacizumab demonstrate the clinical potential of this method to improve therapy response assessment.

122	Plasma 21	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
		The malignant form of human glioblastoma multiforme (GBM) is linked to intratumoral necrosis. Since novel immunotherapies are being sought to treat these patients, non-invasively characterizing intratumoral necrosis in gliomas is clinically important. Here, we describe a multi-modal MRI study of acidity, cellularity, and vascularity in two glioma models that feature comparable necrosis and proliferation, but differ in vascular markers. The intratumoral necrotic core (INC) and intratumoral surrounding tissue (IST) had distinct slow and fast Gd-enhanced profiles, respectively. Despite immunohistochemical/histopathological differences, these GBM models show similar profiles of INC-IST gradients for acidity and cellularity, but not for vascularity.

123	Plasma 22	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
		Oxygen-enhanced MRI (OE-MRI) has shown promise as a technique for quantifying and spatially mapping tumour hypoxia. Here, we report a world first-in-man study showing that OE-MRI signals in perfused tumour can non-invasively track changes in hypoxia induced by radiotherapy. We show that OE-MRI detects (1) reduction in hypoxia in Calu6 xenografts and that this change is due to hypoxia modification; and (2) reduction in hypoxia is also seen in 14 patients with non-small cell lung cancer. These data support first-in-man use of OE-MRI biomarkers in clinical trials of (chemo)-radiotherapy as single agent or in combination with hypoxia-modifying agents.

124	Plasma 23	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
		Radiofrequency ablation (RFA) is commonly used to treat tumors such as hepatocellular carcinomas. However, there is evidence that liver RFA can stimulate growth in tumors at other sites, a process attributed to the HFG/c-Met pathway. Hyperpolarized ^{13}C-pyruvate MRI showed increased intratumoral lactate production in subcutaneously-implanted R3230 tumors following RFA of normal liver in a rat model. This effect is suppressed when liver RFA is combined with a c-Met inhibitor. ^{13}C MRI could potentially be used to identify tumors at risk for this off-target effect.

125	Plasma 24	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
		Preoperative MRI is routinely used for diagnosis, staging, and operative planning of colorectal liver metastases (CRCLM), but still relatively unexplored for preoperative prognosis. Tumour fibrosis in post-hepatectomy CRCLM specimens is associated with long-term survival and late gadolinium enhancement is associated with tumour fibrosis in other disease processes (eg. cholangiocarcinoma). We performed a retrospective cohort study (n=121) in patients who received a clinical gadolinium-enhanced MRI prior to hepatectomy for CRCLM. We determined that strong enhancement on delayed phase MRI was associated with tumour fibrosis post-hepatectomy and overall survival.

126	Plasma 25	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
		Hyperpolarized ^{13}C metabolic imaging is a powerful technique with proven safety and efficacy for human studies. The goal of this project was to investigate pyruvate metabolism in patients with prostate and breast cancer metastases with both echo-planar spectroscopic imaging (EPSI) and the echo-planar imaging (EPI) acquisitions in the same exam. The results revealed similarly valuable information of up-regulated LDH-catalyzed conversion of pyruvate to lactate with some advantages and differences between the two acquisition methods.

127	Plasma 26	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

		Kidney tumour metabolism may have chemical signatures that distinguish indolent from aggressive small renal masses (SRM). Indolent or benign SRM could be managed conservatively. Here we have used two dimensional (2D) COrrelation SpectroscopY (COSY) on nephrectomy samples to assign and measure metabolite and lipid resonances. High level bioinformatics analysis was then applied. We report metabolic chemical signatures that can be used to distinguish histologically-diagnosed kidney tumour subtypes.

128	Plasma 27	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
		Magnetic Particle Imaging (MPI) is a novel, high-contrast, and quantitative imaging modality that directly detects superparamagnetic iron oxide nanoparticle (SPIO) tracers. These SPIOs have been previously used as a MRI contrast agent. However, with MRI SPIOs are limited by poor specificity and difficulty associated with quantifying the negative signal. MPI enables the direct detection of these SPIOs with both high sensitivity and positive contrast. MPI is well poised to support MRI in developing a clinically translatable cancer detection platform with SPIO. Here we demonstrate in vivo cancer detection and dynamic perfusion imaging with MPI.

129	Plasma 28	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
		Whereas experience is growing rapidly with the use of ferumoxytol as an alternative to gadolinium based contrast agents (GBCA) for cardiovascular imaging, little has been reported about its potential for imaging of solid organs. The pharmacokinetics and relaxometry of ferumoxytol are very different to all of the available GBCA, and data are lacking about its behavior in extracranial solid organ lesions. We report early results of FE-MR imaging in a variety of solid organ mass lesions with focus on enhancement characteristics and clinical impact.

130	Plasma 29	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
		Whole-body diffusion with background suppression (DWIBS) has increased sensitivity and specificity for metastatic cancer detection. However, DWIBS using echo-planar readout suffers from geometric distortions due to large B0 inhomogeneities associated with large FOV, used in whole-body MRI. Additionally, DWIBS suffers from low spatial resolution and long scan times due to low signal to noise ratio. In this work, we developed an alternative WB-MRI technique at 3T using fast, high-resolution and high-SNR T2-weighted imaging with simultaneous fat and fluid suppression, called DETECT. Patient studies show that, DETECT is time-efficient, robust, and generates distortion-free images with good lesion conspicuity, compared to DWIBS.

131	Plasma 30	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
		Whole-body MRI (WB-MRI) offers an alternative non-ionising radiation technique to current gold-standard imaging, 18F-FDG PET-CT, for assessment of paediatric and adolescent Hodgkin's lymphoma (HL). In this work we prospectively evaluated WB-MRI, including diffusion-weighted-imaging (DWI), for initial staging and early interim response monitoring in 50 paediatric HL patients. WB-MRI with DWI has reasonable intrinsic diagnostic accuracy for nodal and extra-nodal staging of paediatric HL but it fails to achieve full concordance with standard imaging for all disease sites in minority of patients. WB-MRI has reasonable accuracy for interim response classification but tends to underestimate disease response, particularly in extra-nodal disease sites.

Poster: Pulse Sequence Highlights

Power Pitch Theater A - Exhibition Hall	Monday 17:15 - 18:15

207	Plasma 1	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
		Asymmetric gradient waveforms enable efficient diffusion encoding but suffer from signal bias and image artifacts due to Maxwell terms (concomitant fields). We propose a novel method for generating "Maxwell-compensated" waveforms, and we demonstrate that such waveforms retain superior efficiency and exhibit negligible effects due to concomitant fields.

208	Plasma 2	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
		A method for echo planar imaging dynamic B_0 field correction based on phase unwrapping is presented. For gradient-echo functional studies, the phase of the natively acquired images is used to estimate the accumulated B_0-induced dephasing. For spin-echo diffusion, a matched echo planar imaging field echo navigator is acquired after the spin-echo readout so that motion-induced phase components can be subtracted before unwrapping. Application to both functional and diffusion in-vivo 3T fetal brain imaging is illustrated.

209	Plasma 3	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

		Cardiac MRI requires fast and robust acquisition and reconstruction strategies to generate clinically reliable results. Using a combination of non-aligned radial Simultaneous Multi-slice (SMS) acquisitions and Regularized Nonlinear Inverse reconstruction, time-consistent movies of multiple slices can be generated. Here, we develop a self-gating technique for real-time radial SMS measurements which allows for the reconstruction of high-quality self-gated cine loops in addition to real-time movies from the same measurement.

210	Plasma 4	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
		xSPEN is a single-shot MRI approach whose timing and pre-acquisition hyperbolic phase, endow it with exceptional resilience to offsets. We recently introduced multi-scan, phase-encoded (PE) 3D xSPEN MRI which preserves this while increasing resolution along the PE (y) and slab-selection (z) dimensions. It is here shown that parallel receivers endow this 3D approach with unprecedented PE downsampling performances. This reflects xSPEN's unusual kernel, whose hyperbolic phase couples the directly-sampled k_z information with the y coil sensors. This mitigates the artifacts associated with a highly undersampled k_y axis, as demonstrated by highly accelerated in vitro and human scans.

211	Plasma 5	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
		In this work, a self-calibrating wave-encoded 3D FSE technique was proposed with self-refocusing gradient waveforms and autocalibrated estimation of wave-encoding point-spread-function and coil sensitivity maps. Compared to conventional Cartesian approach at the same acceleration factor, the proposed method achieves reduced artifacts and better anatomical delineation for highly undersampled abdominal imaging. It enables 10-fold acceleration for 3D FSE scans of the abdomen, allowing 3D FSE sequences to be less sensitive to subject motion.

212	Plasma 6	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
		The main challenge in high-resolution EPI is the significant B_0-distortion and T_2*-blurring artifacts. PSF-encoded EPI has been proposed to achieve distortion- and blurring- free imaging at a cost of extremely long acquisition time, not practical for most applications. In this work, we introduce the "*tilted-CAIPI*" method, which can provide >20x acceleration for PSF-EPI by utilizing the concept of B_0-inhomogeneity encoding and optimized sampling. With the proposed method, PSF-encoded EPI at a 1mm resolution range can be obtained using just 4-8 EPI-shots. PSF-EPI with *tilted-CAIPI* was demonstrated for efficient acquisition of distortion- and blurring- free T_2-weighted, T_2*-weighted, and diffusion-weighted images.

213	Plasma 7	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
		Because MRF provides a flexible framework without any requirement for constant repetition times or gradient amplitudes, we propose to use arbitrary gradient waveforms and randomized TR times to reduce the acoustic noise, while still providing quantitative 3D T1 and T2 values.

214	Plasma 8	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
		This study reports focused, high-resolution, distortion-free diffusion imaging using a combination of DIADEM (Distortion-free Imaging: A Double Encoding Method) and reduced field-of-view (rFOV) imaging. DIADEM is a hybrid, multi-shot approach inspired by the point-spread-function mapping technique for distortion-free imaging. The multiple-shots effectively signal average and compensate for the reduced image SNR resulting from the rFOV. The rFOV reduces the number of phase-encoding steps, which shortens the scan time, making it more clinically feasible. The results demonstrate focused distortion-free diffusion images with a high in-plane resolution (0.86 mm^2), which could provide improved anatomic depiction of local brain tissue structures.

215	Plasma 9	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
		This study proposes a rapid and accurate MR fingerprinting (MRF) framework based on a diffusion-prepared, turbo spin-echo (DP-TSE) sequence. Compared to both conventional parametric mapping and recent FISP-based MRF methods, the proposed framework provides accurate T_2 maps and three main apparent diffusion coefficients (ADCs) for 15 slices within 7 minutes. This new MRF strategy can achieve accurate, inherently co-registered, high resolution T2 and ADC maps simultaneously.

216	Plasma 10	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
		Achieving robust sub-millimeter resolution EPI at 7 Tesla is a challenge since conventional single shot images suffer from long echo times and severe image distortions, while multishot EPI suffers from motion- and respiration-induced shot-to-shot phase errors. Recently, Taviani et al described an ‘in-plane multiband’ or ‘shuttered EPI’ method for 3T breast diffusion imaging, in which data are acquired in each shot after exciting a set of shutters across the imaged slice and combined using a phase- and motion-insensitive reconstruction. Here we present an implementation of this approach for high-resolution 7T brain imaging, which required a new RF pulse construction.

217	Plasma 11	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

		A new technique, termed *Echo Planar Time-resolved Imaging* (EPTI), was developed to address EPI's geometric distortion and blurring, and to provide new temporal signal evolution information across the EPI readout window. Using only a few shots, a time-series of multi-contrast images can be created free of distortion and blurring (up to 100 T_2- and T_2*-weighted images with time interval of an EPI echo spacing). This should make EPTI useful for numerous applications where undistorted images across multiple-contrasts are desired. We demonstrated EPTI in brain to simultaneously map T_2, T_2*, and tissue phase, as well as to provide SWI.

218	Plasma 12	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
		We present a simple MR pulse programming framework for rapid prototyping of complex, custom MR pulse sequences. We define a file format that contains all low-level details of an MR imaging experiment, along with a driver (or interpreter) that loads the file(s) and executes the experiment on a General Electric scanner. We demonstrate that a wide range of sequences can be implemented with this setup, subject to limitations such as non-overlapping waveforms. Our framework is conceptually similar to Pulseq, a recently-introduced file format specification for which drivers for other vendor platforms exist (at present, Siemens and Bruker).

219	Plasma 13	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
		We demonstrate the joint design of minimum duration RF and slice selective gradient shapes with included gradient impulse response function (GIRF) to correct for non-ideal slice selective gradients in the pulse design. The proposed time-optimal control method designs slice selective gradient shapes with matched RF shapes for the distorted slice selective gradient. Phantom experiments on a 3T scanner validate the optimized results and demonstrate the successful correction of gradient imperfections with the proposed approach.

220	Plasma 14	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
		An inversion recovery bSSFP measurement allows to generate a spectrum of the apparent relaxation time T_1* and hence to identify multiple components in a voxel. However, it is not possible to extract unambiguous T_1 and T_2 information for each individual component. Here, we demonstrate that this limitation can be overcome by an additional bSSFP measurement without inversion pulse. Additive and subtractive combinations of the measured signal courses provide enough information for assigning unambiguous T_1, T_2 and proton density values to each component. In that way, 2D T_1-T_2 correlation spectra can be generated voxel-wise in a very time-efficient manner.

221	Plasma 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
		We propose to use the motion encoding gradients (MEGs) of a conventional 3D GRE-MRE sequence as efficient 1D projection navigators with only minor changes to the sequence timing. We show that MEG-NAVs can be used to detect breathing motion, flexing of the thigh muscle, as well as changes in magnitude and phase of the MRE transducer. The additional MEG-NAV data can be used to check breath-hold compliance in conventional GRE-MRE liver exams as well as to ensure optimal transducer operation.

Electronic Power Pitch Poster

Poster: Psychoradiology: A Potpourri

Power Pitch Theater B - Exhibition Hall	Monday 17:15 - 18:15

222	Plasma 16	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

		We employ a genetic-imaging approach to examine the underlying genetic basis of magnetic susceptibility reductions at a major locus of pathophysiology in Gilles de la Tourette syndrome (GTS). Voxel-wise statistical differences of motor-striatal susceptibility exhibited significant associations with the expression profile of iron-related gene-sets extracted from the Allen Human Brain Atlas, thus suggesting that the expression of iron-related genes coincides with patterns of susceptibility reductions in GTS. This work supports previous studies relating magnetic susceptibility to brain iron and provides an example of an analytic strategy in which valuable insights can be gleaned by exploring associations between gene-expression and image-derived phenotypes.

223	Plasma 17	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
		In this study, we tested whether CBF changes after acute administration of antipsychotics in healthy volunteers are associated with receptor distribution profiles of one of their main targets, namely the dopamine D2 receptor. Receptor distribution profiles were extracted from an in-house [18F]Fallypride template and from the Human Allen Brain Atlas. Results show that changes in CBF measures are directly proportional to dopamine D2 receptor levels as indexed by PET maps and mRNA expression levels. Overall the present study shows evidence that CBF is ultimately a functional marker which can be adopted in drug challenges to inform the drug development process.

224	Plasma 18	Impaired modulation of hippocampal glutamate during memory consolidation in schizophrenia: Evidence from ^{1}H 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

		Schizophrenia is one of the most debilitating, life-long mental illnesses where treatment has a limited impact in restoring real-life functions such as deficits in learning and memory. The hippocampus is particularly rich in glutamatergic neurons and altered neuroplasticity related to glutamate has been proposed as a critical mechanism mediating learning and memory in schizophrenia. Understanding glutamate-related dysfunction in schizophrenia may therefore, elucidate mechanisms underlying the illness as well as help tailor intervention strategies. Here we provide the first ever evidence of a dysfunctional modulation of hippocampal glutamate during memory encoding in schizophrenia using ¹H fMRS.

225	Plasma 19	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
		Schizophrenia implies different alterations in prefrontal cortex and in particular, a disrupted connectivity in this brain area and a redox dysregulation. In a previous analysis, glutathione levels (main antioxidant and redox regulator) correlated with functional connectivity within the cingulate cortex. In this study, we investigate the effect of N-acetyl-cysteine (NAC) (precursor of glutathione) supplementation on functional connectivity in early psychosis patients. The results show an increased functional connectivity strength and betweenness centrality in these regions, suggesting that cingulate cortex functional connectivity could be a biomarker for NAC treatment efficacy

226	Plasma 20	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
		Catechol-O-methyltransferase (COMT) polymorphisms have been implicated as an important contributor to psychosis and cognitive differences. Such cognitive alterations may have a neurodevelopmental basis, however, the effect of COMT polymorphisms on early brain development are unclear. Here, we perform the first longitudinal study of differential cortical maturation in infants and young children ages 1 to 6 based on COMT genotype. We demonstrate altered rates of cortical development in the cingulate, frontal and temporal lobes in children with the rs46480 (Val/Met) genotype, suggesting the COMT genotype has an important impact on brain maturation.

227	Plasma 21	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
		The results of a 7T MRS study of a large cohort of patients with a first episode of psychosis (FEP) and healthy control subjects (HC) are reported. In patients with FEP, significant reductions in the neurotransmitters glutamate and GABA were found in selected gray matter regions, and the neuromodulator NAAG was reduced in white matter. Other metabolic abnormalities were reduced NAA (suggesting neuroaxonal damage) and glutathione. Metabolite differences were also found to depend on diagnosis. This study suggests that 7T MRS is a useful modality for understanding the molecular pathophysiology of psychosis.
228	Plasma 22	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
		We applied machine learning to DTI-based structural connectome data in order to predict improvement of symptoms in 30 depressed adolescents with cognitive-behavioral therapy (CBT). The J48 pruned tree classifier was applied with a 10-fold cross-validation, resulting in an 83% accuracy. The resulting tree highlights the role of the thalamus, a region known to be directly involved in anticipatory anhedonia and generation of goal-directed behavior, the lack of which can make subsequent CBT ineffective. The gained knowledge can significantly improve treatment planning in cases of adolescent depression and help optimize and develop new preventive and therapeutic interventions for this devastating disorder.
229	Plasma 23	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

		The diagnosis of ADHD relies on psychiatrists' knowledge and subjective experience. Many studies aimed to develop an objective method to assist diagnosis, but the performance of classification between ADHD and controls was not acceptable for clinical use. Here, we proposed a neural network model based on white matter information to classify ADHD and typically developing controls. Diffusion spectrum imaging and tract-based automatic analysis were used to measure properties of white matter. The neural network classification model was developed with high accuracy in the training and test data. It might be helpful to provide an objective way for diagnosis of ADHD.

230	Plasma 24	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
		This study quantifies connectomic changes that occur within hippocampal subfields in patients with major depressive disorder (MDD). Using ultra-high field MRI (7 Tesla), we performed subfield-specific tractography in 6 MDD patients and 9 healthy controls. The degree of the hippocampal fissure was bilaterally increased in MDD patients compared to controls. Edgewise analyses revealed that CA3-vPFC, CA3-dlPFC, and CA1-vPFC edges were significantly increased in MDD patients compared to controls within the right hemisphere. These in vivo findings indicate that MDD patients display increased connectivity within certain hippocampal subfields, and between subfields the prefrontal cortex (PFC).

231	Plasma 25	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
		The present study investigated graph properties of single-subject grey matter networks in PTSD using a new method proposed by Tijms and colleagues to statistically describe gray matter networks in individual subjects using T1-weighted MRI scans. Compared with trauma exposed controls, global topology of single-subject grey matter networks of PTSD was characterized by decreased clustering coefficient and local efficiency. The reduced segregation in grey matter network and its negative relation with increased segregation in the functional network may be important for understanding the nature of the brain network disorganization associated with PTSD and facilitate clinical diagnosis in patients with suspected PTSD

232	Plasma 26	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
		How sertraline alleviates depressive syndrome by modulating the intrinsic connectivity networks (ICNs) remains elusive. Herein, we take a network-based investigation on SN to rationalize the functional and behavior effect of the sertraline treatment using resting-state functional connectivity (rsFC). Our study demonstrated that the sertraline treatment exhibited beneficial modulations on the DN_{MTL}–SN–thalamus pathway for alleviating depressive syndromes in MDD patients.

234	Plasma 28	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
		We aim to investigate whether dynamic perfusion image time series instead of static perfusion image can offer extra insight to bipolar disorder (BD). Average perfusion and perfusion fluctuation maps were compared between patients with BD and controls using customized Statistical non-Parametric Mapping (SnPM). Perfusion decrease in the posterior lateral regions of the default mode network and increase of perfusion fluctuations in the parahippocampus and amygdala regions were observed. The abnormal perfusion fluctuations may be supported by perturbed functional connectivity at the same regions. These results indicate that dynamic perfusion image series may serve as potential novel neuroimaging biomarkers for BD.

235	Plasma 29	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

		Brain iron is critical for neural processes implicated in addiction. Recently, disrupted iron regulation was detected in individuals with cocaine use disorder (CUD) using quantitative susceptibility mapping. Our goal was to replicate these findings using an alternative iron imaging method called magnetic field correlation imaging. Consistent with the only study of brain iron in CUD, we detected elevated brain iron levels in globus pallidus regions and loss of age-related iron accumulation in CUD. Our replication of aberrant brain iron findings in CUD using a different MRI modality lends support for further investigation of iron homeostasis in CUD.

236	Plasma 30	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
		This project pursues a previous study presented at ISMRM[1] which established an age- and brain region dependent neurochemical metabolic profile in a *Crtc1*$^{-/-}$ based mouse model of mood disorders. Here, we show that a decline in cerebral lactate levels is a consistent and reliable endophenotype[2] of *Crtc1* deletion, and an indicator of neuroenergetic dysfunction in the dorsal hippocampus. The decline in brain lactate levels appears to arise from a measured reduction of glucose entering the brain.

Electronic Power Pitch Poster

Poster: Neuro Acquisition: Seeing the CNS Better

Power Pitch Theater A - Exhibition Hall	Tuesday 9:15 - 10:15

312	Plasma 1	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

		Particularly for improved imaging of the thoracic spinal cord, a radial sampling variant of the averaged magnetization inversion recovery acquisitions approach was developed (radial AMIRA). The radial AMIRA approach is less prone to fold over artifacts and it is demonstrated that simple pulse triggering removes potential streak artifacts that may occur near big vessels or near the heart. Just as for the conventional Cartesian AMIRA approach, a series of images with remarkable different tissue contrasts is acquired and some of these images can be combined to enhance and fine-tune the desired tissue contrast.

313	Plasma 2	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
		Accurate localization of the thalamic subregions is of paramount importance for Deep Brain Stimulation (DBS) planning. Current MRI protocols use T2 and Gadolinium-enhanced T1 images, to visualize both the basal ganglia and the vessels, in order to define the electrode trajectory and target. This study shows the usefulness of Fluid and White Matter Suppression, i.e. FLAWS imaging, in eleven drug-resistant epileptic patients for preoperative Deep Brain Stimulation planning and anterior thalamic nucleus targeting.

314	Plasma 3	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
		ZTE image encoding was combined with burst imaging by reversing segments of 3D radial spokes both in time and amplitude. This recalls gradient echoes for the individual spokes. Multiple burst echoes can be acquired by repeating the trajectories. This “burzte” pulse sequence encodes T2* in a silent manner.

315	Plasma 4	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
		The goal of this study is to develop 3D high resolution MRF scans and partial volume analysis methods to assist detection and characterization of epileptogenic foci in patients with drug refractory epilepsy undergoing presurgical evaluation. In addition to providing quantitative T1/T2 values for tissue characterization, we hypothesize that quantitative maps also provide better sensitivity in detecting subtle epileptic lesions. To this end, high resolution T1 and T2 maps, as well as gray matter, white matter fractions maps and tissue cluster maps, were used to detect and characterize epileptic lesions that were difficult to identify from the weighted images and from conventional voxel-based post-processing analysis based on T1-weighted images.

316	Plasma 5	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
		T2-weighted imaging of the brain using single shot sequences such as HASTE suffer from reduced spatial resolution, blurring artifacts and decreased conspicuity of small lesions. We present an analytic framework to design the refocusing flip angles for the HASTE sequence tailored for brain imaging. The flip angles are optimized to minimize SAR and blurring, and maximize SNR. The utility of this sequence is demonstrated by incorporating it in a brain tumor protocol and comparing its performance to conventional T2w Turbo Spin Echo in 21 patients.

317	Plasma 6	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

		Research sites in the “UK7T Network”, a consortium of 7 tesla capable sites in the UK, have conducted a pilot multi-site, multi-vendor neuroimaging study. The Network aims to create a harmonized set of imaging protocols relevant for clinical research. This study evaluates the differences seen in a set of structural and functional sequences run on three different scanner models, manufactured by two different vendors, at four different sites. In this abstract we identify key differences found between systems and a provide a synopsis of the main findings. The results will inform a future ten subject “travelling heads” study.

318	Plasma 7	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
		A new readout method for 3D scans, wave-CAIPI, with low g-factor characteristics that enable high degrees of acceleration, can reduce the scan time for a 1.0 mm MPRAGE to under 90 seconds. We have validated the morphometrics from this rapid wave-MPRAGE with those from conventional MPRAGE scans. The wave-MPRAGE sequence produces a lower-SNR image of the brain, but surfaces created from the wave images match those from the conventional scans well. In morphometric data, a bias is seen toward the conventional MPRAGE scans in average cortical thickness and estimated total intra-cranial volume, however values for total brain volume are similar.

319	Plasma 8	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
		A technique named Strategically Acquired Gradient Echo (STAGE) was recently published, which can acquire 10 images with sufficient resolution, good SNR, and co-registration in one 5-min scan on 3T. With an additional 4-min scan, MRAV and MRA can also be produced. However, to acquire a full set of 12 images on 1.5T takes over 20 minutes, which is still longer than clinical expectation. Novel acquisition and reconstruction schemes are developed in this work to further reduce acquisition time. Feasibility experiments demonstrate it is achievable to acquire 12 high quality clinically meaningful images with 0.67×1.33×2.7 mm^3 in 8 minutes on 1.5T.

320	Plasma 9	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
		We introduce and demonstrate a novel “k-t-segmented” gradient echo 3D-EPI variant for motion-robust, rapid quantitative susceptibility and R_2* mapping at 3T. The combination of a versatile 2D-CAIPIRINHA EPI sampling (“k-segmentation”) and two complementing multi-echo options (“t-segmentation”) provides maximum time- and SNR-efficiency by acquiring exactly as many k-space lines per echo time as fit to the required R_2* sampling without compromising spatial resolution. Offline averaging of multiple, rapid measurements (here: 6 averages, 6 echo times from 6.5-31.5ms, 52s/average) following optional, retrospective correction for motion and B_0 drift, yields excellent quantitative whole-brain maps at 0.8mm isotropic resolution acquired in approximately 5 minutes.

321	Plasma 10	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
		In this work, the efficacy of long-T_2 tissue water suppression by adiabatic inversion-recovery preparation is examined by IR-UTE imaging of an ovine spinal cord specimen in native hydration and deuterium oxide (D_2O)-exchanged states. Myelin density in three white matter regions of interest (ROIs) was found to be 18.1% to 23.5% in the non-exchanged cord, and 19.9% to 22.5% in the D_2O-exchanged cord, with the highest density in the dorsal columns. The agreement of myelin density measurements between non-exchanged and D_2O-exchanged cords supports the efficacy of tissue water suppression in white matter by adiabatic inversion-recovery with an appropriately-chosen TI.

322	Plasma 11	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
		Quantitative magnetization transfer (qMT) and multi-exponential T_2-based myelin water imaging (MWI) are commonly-used MRI methods to quantify myelin content. Ex vivo MRI remains an essential step for validating these quantitative in vivo MRI biomarkers. However, ex vivo tissue is often preserved using formalin, which cross-links proteins and directly impacts these methods. We performed qMT and MWI on human spinal cord tissue before and after formalin fixation to quantify the effect of fixation on these biomarkers. QMT bound pool fraction (F) increased by 37.5% and MWI myelin water fraction (MWF) increased by 35.5-38.6%, but myelin-related image contrast was preserved.

323	Plasma 12	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
		Diffusion tensor imaging of the hippocampus in temporal lobe epilepsy (TLE) has previously relied on very low spatial resolution acquisitions, limiting localization of hippocampal substructure and leading to partial volume effects in diffusion parameter quantification. This study uses a high resolution (1x1x1 mm^3) single-shot diffusion protocol to yield excellent quality mean diffusion weighted images (DWIs) that allow for visualization of hippocampal substructure (e.g. presence/absence of the stratum lacunosum moleculare). Improved delineation of structure allows for segmentation of the hippocampus in native space (without co-registration to anatomical images), revealing elevated MD and loss of internal architecture in TLE subgroups.

324	Plasma 13	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

		Cardiac-induced brain tissue volumetric strain (an important metric reflecting microvascular blood volume pulsation) exhibits large inter-subject variability. We measured the intra-subject repeatability of brain tissue volumetric strain over the cardiac cycle in healthy subjects at 7T using a high resolution retrospectively-gated DENSE and found that the strain curve shape and peak value were very consistent between measurements. Furthermore, we validated the peak brain tissue volume change against measured spinal CSF stroke volume at C2-C3, and observed a strong correlation. The consistent findings strengthens the potential of volumetric strain as biomarker for microvascular function in the ageing brain.

325	Plasma 14	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
		Absolute quantification of R1 and R2 relaxation and proton density PD has been gaining considerable attention in the recent years. As yet, simultaneous quantification of R1, R2 and PD has been restricted to 2D methods, with high resolution in-plane but using relatively thick slices. A previously published method on cardiac quantification, QALAS, has been applied to the brain, providing a full quantification of R1, R2 and PD at 1.2 mm isotropic resolution in 3D using only 6 minutes scan time.

326	Plasma 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
		We present results using a Zero Time of Echo sequence ("Silent") with an Adiabatic Fat Suppression Pulse (ASPIR). As well as providing fat suppression that is relatively robust to field inhomogeneities at 7T, ASPIR-Silent also generates images with an additional off-resonant contrast. We show this contrast derives primarily from Magnetisation Transfer effects, and give an in vivo example.

Electronic Power Pitch Poster

Poster: Musculoskeletal Madness

327	Plasma 16	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
		Skeletal muscle function impairment can be associated to changes in both muscle volume and structural arrangement of fascicles/fibers within the muscle thereby leading to the reduction of muscle force production. Diffusion properties and 3D structural organization of muscle fibers were quantified from high-resolution diffusion tensor images recorded at ultra-high-field MRI (UHF-7T). These parameters were assessed regarding their intramuscular variability and sensitivity to sex difference. This application of UHF-7T might be of high interest for the assessment of muscular injuries in both athletes and patients with muscular disorders.

328	Plasma 17	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
		We used time-dependent diffusion, with diffusion times up to 500ms to assess the muscle tissue microstructure in two different mouse models of Duchenne muscular dystrophy (DMD). We found significant differences in diffusivities between DMD models and the genetic background matched wild types in diffusion times up to 100ms. We modeled diffusion time-dependence with the random permeable barrier model (RPBM), which yielded surface-to-volume ratios indicative of fiber size and compared these values to gold-standard histology of the same muscles. The RPBM predicted relative differences in fiber dimensions between *mdx* and wild type within each genetic background.

329	Plasma 18	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
		Diffusion Tensor Imaging (DTI) enables the microstructural examination of muscle tissue as well as its pathological and stress-dependent changes. Little is known about the associations between muscular DTI parameters and corresponding muscle strength measurements. The present study investigated the correlations of DTI parameters of paraspinal muscles with isometric strength measurements in healthy subjects. The results indicate that DTI may potentially track slight changes of back muscle tissue microstructure that relate to muscle strength and may be useful in the early diagnosis of back muscle diseases and back pain.

330	Plasma 19	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
		Neuromuscular diseases can lead to characteristic changes in the anatomy of motor units (MU). In this study we developed an MR approach to image motor unit activity. In-scanner electrical stimulation of MU was synchronized to a pulsed-gradient spin-echo imaging sequence sensitive to microscopic contraction of muscle fibers. Experimental data was compared to a simple theoretical model and scan parameters evaluated. The spatial pattern of muscle fibers forming different MU was imaged for the first time in healthy controls.

331	Plasma 20	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

		Multi-spectral MRI reduces susceptibility when imaging near total joint arthroplasty (TJA). MAVRIC SL acquires 24 bins of off-resonance data to generate images, but most implants require fewer bins. This study uses a calibration scan, to determine an adequate number of bins, coupled with long echo trains and variable flip angles to permit an isotropic MAVRIC SL acquisition in clinically feasible scan times. The isotropic MAVRIC SL acquisition showed an improved detection of the implant-bone interface surrounding TJA, while retaining image contrast and overall SNR. An isotropic acquisition may improve the diagnostic capability of MAVRIC SL images.

332	Plasma 21	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
		Computed tomography (CT) imaging is the imaging modality of choice for 3D visualization of bone. However, there is growing concern about repeated exposure to ionizing radiation, in particular during infancy, for instance, in patients with craniosynostosis pre- and post-surgery. Here, we developed a dual-RF, dual-echo, 3D UTE sequence using view-sharing to minimize scan time. Images are reconstructed by combining long- and short-RF, first and second echoes, yielding soft-tissue suppressed skull images at 1.1 mm isotropic resolution in 6 minutes scan time in a human skull ex vivo and test subjects in vivo. 3D renderings display the relevant craniofacial skeleton similar to CT.

333	Plasma 22	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
		Studies of bone marrow adipose tissue (bMAT) composition in osteoporosis has revealed increased [a1] in fat content and decreased unsaturated fatty acid in the proximal femur in osteoporosis (OP) patients compared to controls. Advancements in MR image-based methods for fat assessment have allowed quantification of fat content though chemical-shift encoded MRI (CSE-MRI). CSE-MRI methods have not been compared to MRS for bMAT composition assessment. The aim of this study was to quantify, within subregions of the proximal femur, bone marrow PDFF as well as saturated and unsaturated fat using both CSE-MRI and MRS.

334	Plasma 23	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
		Tendon damage has been traditionally evaluated invasively with biopsy. This pilot study evaluated the effects of an induced mechanical strain of the patellar tendon on UTE-MRI metrics and corresponding histology. The induced strain had a greater effect on the quantitative MRI metrics over time, by percentage change, than by the level of induced strain. A corresponding histologic analysis had similar findings. The results indicate the capability of utilizing MRI to evaluate differences in the quantitative T2* metrics of the patellar tendon. Time dependent changes in quantitative UTE-MRI metrics may be detected using a model of induced subclinical tendon damage.

335	Plasma 24	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
		Recently, there has been a growing interest in assessing lesions in the deep layers of knee cartilage as a pathogenesis of osteoarthritis. Ultrashort echo-time (UTE) T_2* mapping in the deep layers has demonstrated great potential to detect early degenerative changes. Fat suppression is normally accompanied to reduce off-resonance artifacts from adjacent fatty tissues; however, it can also suppress significant amount of short T_2 tissues and affect quantification. In this work, we quantified cartilage T_2* by decomposing fat and water components using no fat-suppressed 3D multi-echo UTE images and demonstrated shorter T_2* compared to that from fat-suppressed 3D UTE images.

336	Plasma 25	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

		Chemical exchange has likely a significant impact on the dispersion of $T_{1\rho}$ in cartilaginous tissue. In order to quantify this effect, we are developing atomistic simulation strategies for direct modelling of proton transfer reactions between biomacromolecules – first and foremost chondroitin sulfate – and water. Here we present benchmarking results from a number of semi-empirical quantum mechanics methods for several key system properties. Results suggest feasibility of the chosen approach.

337	Plasma 26	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
		In this study we utilize a deep learning approach to automatically segment the femoral and acetabular cartilages in the hip. From these segmentations we also calculate T1ρ and T2 relaxation times then compare to manual segmentations and their T1ρ and T2 values. We show the T1ρ and T2 relaxation times, calculated using manual and automatic segmentations, are very correlated, R values above .94, and comparable.

338	Plasma 27	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
		Even though the measurement of T2 relaxation time is one of the most widespread available assets of quantitative MRI in clinical routine, it is left with untapped potential as the required scan time is too long. GRAPPATINI is a model-based iterative algorithm reconstructing T2 maps and T2-weighted images from highly-undersampled k-space data. The aim of this study was to compare the quantitative results of an established standard method with this novel technique in the intervertebral disc with the additional benefit of GRAPPATINI to simulate T2w contrasts at arbitrarily chosen echo times.

339	Plasma 28	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
		It is often difficult to differentiate myxoid-rich soft-tissue tumors on conventional imaging. In this study, we performed a direct voxel-wise comparison of amide proton transfer (APT) signals and standardized uptake values (SUVs) obtained on FDG-PET/MR imaging. Among myxoid-rich tumors including myxoid liposarcomas, myxofibrosarcomas, myxoid chondrosarcomas, and schwannomas, the mean APT/SUV was significantly higher in liposarcomas than in the other myxoid-rich tumors while a single parameter such as APT, SUV or apparent diffusion coefficient (ADC) did not show any significant differences between the two groups. The APT/SUV could be a reliable bio-imaging marker for differentiating soft-tissue tumors.

340	Plasma 29	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
		We compared remission status at completion of chemotherapy with changes in MRI biomarkers obtained by advanced MRI techniques, including total tumor volume calculated from whole-body diffusion-weighted imaging and fat fraction by mDIXON soon after induction of chemotherapy for patients with multiple myeloma. The early change in fat fraction of lumbar bone marrow and serum monoclonal protein after 2 cycles of chemotherapy contributed significantly to the prediction of CR/VGPR status. Results of this study may indicate that prediction of remission status can be achieved by assessing bone marrow on lumbar spinal MRI with mDIXON.

341	Plasma 30	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

		Osteoarthritis (OA) is commonly a bilateral disease. While long scan time and costs have precluded separate scanning of both knees in clinical MRI, there is evidence that bilateral examinations are beneficial for evaluation of OA changes, especially for longitudinal studies. In this study, we demonstrate that a bilateral coil-array setup can image both knees simultaneously in similar scan times as conventional unilateral knee scans with comparable image quality and quantitative accuracy. This has the potential to improve the value of MRI knee evaluations.

Electronic Power Pitch Poster

Poster: Machine Learning Unleashed

Power Pitch Theater A - Exhibition Hall	Tuesday 14:45 - 15:45

428	Plasma 1	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
		3D cones trajectories have the flexibility to be more scan-time efficient than 3D Cartesian trajectories, especially with long readouts. However, long readouts are subject to blurring from off-resonance, limiting the efficiency. We propose a convolutional residual network to correct for off-resonance artifacts to allow for reduced scan time. Fifteen exams were acquired with both conservative readout durations and readouts 2.4x as long. Long-readout images were corrected with the proposed method. The corrected long-readout images had non-inferior ($p<0.01$) reader scores in all features examined compared to conservative readout images.

429	Plasma 2	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

		The Gibbs-ringing artifact is caused by the insufficient sampling of the high frequency data. Existing methods generally exploit smooth constraints to reduce intensity oscillations near high-contrast boundaries but at the cost of blurring details. This work presents a convolutional neural network (CNN) method that maps ringing images to their ringing-free counterparts for Gibbs-ringing artifact removal in MRI. The experimental results demonstrate that the proposed method can effectively remove Gibbs-ringing without introducing noticeable blurring.

430	Plasma 3	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
		Varying acquisition and reconstruction conditions as well as long examination times make MRI susceptible to various kinds of artifacts. If suitable correction techniques are not available/applicable, if human experts who judge the achieved quality are not present or for epidemiological cohort studies in which a manual quality analysis of the large database is impracticable, an automated detection and identification of these artifacts is of interest. Convolutional neural networks with residual and inception layers localize and identify occurring artifacts. Artifacts (motion and field inhomogeneity) can be precisely identified with an accuracy of 92% in a whole-body setting with varying contrasts.

431	Plasma 4	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
		In this study, we aimed to develop a convolutional neural network (CNN) to assess the quality of multi-contrast carotid plaque MR images automatically. The network was trained on large amount of plaque images combined with image quality scores labeled by experienced radiologists. Transfer learning was utilized to take the advantage of state-of-the-art CNN pre-trained on ImageNet dataset. The accuracy of image quality estimation achieved 86.0% with preprocessing and fine-tuning of the network.

432	Plasma 5	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

In this abstract, a deep residual neural network based approach that improves the automatic detection and labeling of cerebral microbleeds by significantly reducing the number of false positives compared to previously published algorithms is proposed. This combined method removed 89% of false positives in the test patients with brain tumors who had radiation-induce CMBs while losing only 3% of the true microbleeds and has the potential to fully automate CMB detection.

433 Plasma 6

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

Convolutional neural networks (CNNs) often require very large datasets for robust training and evaluation. As an alternative approach, we introduce deep learning diffusion fingerprinting (DLDF), which treats every voxel as an independent data point, rather than using whole images or patches. We use DLDF to classify diffusion-weighted imaging voxels in a mouse model of glioblastoma, both prior to and in response to Temozolomide chemotherapy. We show that, even with limited training, DLDF can automatically segment brain tumours from normal brain, can distinguish between young and older tumours and that DLDF can detect if a tumour has been treated with chemotherapy.

434 Plasma 7

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

		Estimating axonal permeability reliably is extremely important, however not yet achieved because mathematical models that express its relationship to the MR signal accurately are intractable. Recently introduced machine learning based computational model showed to outperforms previous approximate mathematical models. Here we apply and validate this novel method experimentally on a highly controlled *in-vivo* mouse model of axonal demyelination, and demonstrate for the first time in practice the power of machine learning as a mechanism to construct complex biophysical models for quantitative MRI.

435	Plasma 8	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
		Multi-shell, multi-tissue, constrained spherical deconvolution is an appealing method for the reconstruction of fiber orientation distribution function (fODF), which is of great importance for solving complex fiber configurations to achieve reliable tractography. However, many diffusion measurements and multiple reconstruction steps are required. In this study, the deep neural network were employed to form a multi-output regression problem for establishing a fast and direct estimation of fODF. The proposed method offers a new streamlined reconstruction procedure which exhibits great potential for accelerating the reconstruction of fODF with whole-brain coverage, with satisfactory accuracy in two minutes.

436	Plasma 9	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
		Single-vessel fMRI has enabled the detection of slow fluctuations (<0.1Hz) of the hemodynamic fMRI signal from individual vessels in both rat and human brains. The Echo State Network (ESN) has been used to encode the slowly changing temporal dynamics of individual vessels by training the network to predict the oscillatory signals from individual vessels 10 seconds ahead in time. Distinct network reservoirs are optimized for human and animal vascular signals, showing high correlation for the ESN-predictive signal with the original fresh data. This work establishes ESN-based signal prediction for the slow-oscillatory brain fMRI signal in real-time.

437	Plasma 10	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
		DCM-RNN is a Generalized Recurrent Neural Network accommodating the Dynamic Causal Modelling (DCM), which links the biophysical interpretability of DCM and the power of neural networks. It significantly extends the flexibility of DCM, provides unique parameter estimation methods, and offers neural network compatibility. In this abstract, we show how to incorporate neuron firing model into DCM-RNN with ease. An effective connectivity estimation experiment with simulated fMRI data shows that the influence of the firing model is substantial. Ignoring it, as the classical DCM does, can lead to degraded results.

438	Plasma 11	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
		Although the macroscopic equations of motion for nuclear magnetic resonance have been described and modeled for decades by the Bloch equations, limited human intuition of their nonlinear dynamics is an obstacle to fully exploiting the vast parameter space of MR pulse sequences. Here we recast the general problem of pulse sequence development as a game of perfect information, and propose an approach to optimize game play with a Bayesian derivative of reinforcement learning within a MRI physics simulation environment. We demonstrate an AI agent learning a canonical pulse sequence (gradient echo) and generating non-intuitive pulse sequences approximating Fourier spatial encoding.

439	Plasma 12	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

		Carotid artery atherosclerosis is one of the main causes of stroke and there is a pressing need for a non-invasive method to quantify, monitor and assess carotid artery stenosis, composition and distensiblity. Here we focus on developing a fully automated convolutional neural network (CNN) with time-context for segmenting the common carotid artery lumen from dynamic magnetic resonance images. The challenge in developing a fully automated carotid segmentation algorithm is that there are other vessels with size and spatial location comparable to the carotid artery. Our preliminary results indicate that a CNN with time-context is capable of distinguishing and segmenting the carotid artery from other vessels.

440	Plasma 13	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
		Artificial neural networks (ANNs) were trained using simulated displacement fields to perform stiffness estimation from MRE data. These neural network-based inversions (NNIs) are evaluated in simulation and in vivo. In a test set of simulated data, NNI is shown to provide a more accurate estimate of stiffness compared to a standard direct inversion (DI) approach. In vivo, NNI-based stiffness strongly correlated with DI-based stiffness across a range of fibrosis stages in the liver and ages in the brain, indicating that NNI can detect relevant biology. Finally, test-retest error in the brain is reduced using NNI compared to DI.

441	Plasma 14	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
		In this work, we propose a novel joint manifold learning and sparsity aware framework for highly accelerated cardiac cine imaging. The proposed method efficiently captures the intrinsic low dimensional nonlinear manifold geometry and inherent periodicity of cardiac data, and outperforms the current state-of-the-art accelerated MRI methods.

442	Plasma 15	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
		The primary focus of this work is to introduce a novel deep learning framework, which synergistically combines the benefits of model-based image recovery with the power of deep learning. This work enables the easy exploitation of prior information available from calibration scans, in addition to significantly reducing the number of network parameters, amount of training data required, and computational complexity. More importantly, the insensitivity of the learned model to the acquisition parameters also facilitates its easy reuse with a range of acquisition settings.

Electronic Power Pitch Poster

Poster: Hot Topics in MRS

Power Pitch Theater B - Exhibition Hall	Tuesday 14:45 - 15:45

443	Plasma 16	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
		We present a method to discriminate dissolved 129Xe spectra by tissue type and location based on local variations in T2*. Mixed contributions of parenchyma and vasculature can be separated almost completely. The method is particularly useful to high field imaging in species lacking distinct dissolved phase spectral components.

444	Plasma 17	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

		Based on its sensitivity to cell viability and tissue microstructure, sodium MRI has the potential to provide quantitative biomarkers of tumor grade and response to therapy. For biomarkers such as total sodium concentration (TSC) to have clinical utility, they require technical and biological validation. This work focuses on the technical validation of TSC, specifically assessing the repeatability and reproducibility of measurements in healthy volunteers. The results presented here show consistent TSC measurements across repeated scans at different sites, and good repeatability and reproducibility (coefficients of variation, CoVs < 10%).

445	Plasma 18	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
		Changes in saturated and unsaturated fatty acids with hepatic triglycerides following the formation of abnormal metabolites, which play an important pathogenic role, can be measured by magnetic resonance (MR) spectroscopy. High-field-strength MR imaging scanners, which have an improved signal-to-noise ratio and high resolution for multiple lipid resonance components, are used to detect each component of lipid resonance. The aims of this study were to quantify hepatic lipid content and triglyceride composition in a preclinical nonalcoholic steatohepatitis model during the progression of steatohepatitis by assessing potential biomarkers, including spin-spin relaxation time, and applying in vivo proton MR spectroscopy with serum biochemistry.

446	Plasma 19	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

		Liver transplantation is the only cure for end-stage liver disease. Unfortunately, 20% of patients die waiting for a donor. New techniques for preserving transplant livers, such as normothermic machine perfusion (NMP), provide an opportunity to utilise 'marginal' (currently discarded) donated livers if their viability can be assessed accurately. We present initial results from a CE-marked NMP system that we adapted for use in an MRI scanner. We demonstrate the power of NMP-MRI to assess structure and metabolism in a freshly donated pig liver, dynamically over a 10-hour period. Our protocol includes ^{1}H imaging, ^{31}P spectroscopy, and hyperpolarised ^{13}C spectroscopy.

447	Plasma 20	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
		Deuteration of metabolites is increasingly popular in hyperpolarization experiments as it prolongs the T_1 of the ^{13}C resonances. However, the effect of deuteration on metabolism needs to be investigate to validate the hyperpolarization experiments. Kinetic isotope effects of deuteration of pyruvate were analyzed in isolated rat hearts. No kinetic isotope effect were observed in the pyruvate pool (lactate/alanine) or the TCA cycle (glutamate C5), but a ^{2}H-^{1}H displacement was observed in alanine transaminase and an increase of the contribution of unlabeled sources.

448	Plasma 21	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
		Oxidative stress is believed to play a role in the pathogenesis of chronic hepatic encephalopathy (CHE), however no in-vivo studies to assess the course of cerebral oxidative stress in CHE were performed. We investigated the oxidative stress in the hippocampus of a rat model of chronic HE using in-vivo and longitudinal 1H-MRS combined with ex-vivo ESR spectroscopy. Early changes in brain antioxidants (Asc, 4weeks post-BDL), concomitant with Gln and NH4+ changes were detected for the first time in-vivo. These results were confirmed by ESR spectroscopy suggesting that central oxidative stress is an early event in CHE.

449	Plasma 22	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
		Early detection of brain cancer will help saving lives. The currently available diagnostic techniques are not robust and expensive. Therefore, it is necessary to develop cost effective, minimally invasive, and highly sensitive analytical tools to identify brain tumors at an early stage. In this study we are investigating metabolism based biomarkers in platelets derived from low grade glioma II, glioblastoma, and healthy patients identified by nuclear magnetic resonance (NMR) spectroscopy. The platelet metabolites - glucose, citrate, and succinate are determined to be promising candidates for identifying and differentiating different stages of brain tumors with implication of employing simple blood based NMR metabolomics for early detection of brain cancer.

450	Plasma 23	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
		Ketogenic diet has been proposed for the adjuvant therapy in the treatment of brain tumors. The rationale behind using ketogenic diet in the cancer treatment is the inability of tumor mitochondria to oxidize KBs. Recent studies on ketone body metabolism using 9L and RG2 cell lines and glioma models suggest that brain tumor mitochondria are capable of oxidizing ketone bodies. The current study was undertaken to determine relative utilization of betahydroxy-butyrate (BHB) and glucose in patient-derived glioblastoma cells. Our findings clearly indicate that human brain tumor cells are fully capable of oxidizing ketone bodies even under normoglycemic conditions.

451	Plasma 24	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
		The application of high-resolution MRSI at 7T to the measurement of brain tumours was recently shown with preliminary data. In order to better resolve the glioma structure and metabolism for clinical use, a further increase in resolution over the currently achievable would be necessary. This can be achieved by the application of modern image up-sampling techniques. Therefore, we demonstrate the successful application and benefits of one such technique, patch-based superresolution, to 7T MRSI maps in glioma patients. Our results show the resolution of metabolic hotspots with unprecedented detail.

452	Plasma 25	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
		Although several *in vitro* and *ex vivo* evidence support the existence of lactate exchange between astrocytes and neurons, a direct demonstration *in vivo* is still lacking. The aim of this study was to determine if the neuronal lactate transporter MCT2 is required for proper substrate use by neurons during brain activation. We therefore quantified the brain lactate content by 1H-NMR spectroscopy shRNA-control injected rats (called UNIV rats), MCT4 knockdown rats (called MCT4 rats) and MCT2 knockdown rats (called MCT2 rats), at rest or during whisker stimulation. Moreover, we examined the BOLD fMRI response of the somatosensory cortex associated with whisker stimulation.

453	Plasma 26	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
		The high energy requirements of the brain are sustained by a unique metabolic relationship between astrocytes and neurons. Here, we show how cocaine administration shifts neurometabolism at a fundamental level. Using a novel approach combining dynamic nuclear polarization-enabled metabolic flux measurements with steady state magnetic resonance measures of metabolite pools, we reveal acute cocaine administration disrupts the balance of oxidative and non-oxidative metabolic pathways. These results demonstrate significant metabolic shifts in response to cocaine administration, providing insight into the observed short-term effects of cocaine use.

454	Plasma 27	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
		N-acetyl-aspartate (NAA) is commonly referred to as an ‘axonal marker’ but recent electron microscopy evidence demonstrates higher levels of NAA in myelin than in neurons. Given the multi-exponential T_2 nature of water in white matter (WM), we sought to determine if there are similarly two pools of NAA in WM. We performed multi-echo magnetic resonance spectroscopy in the WM of 5 healthy volunteers at 3T with TE from 10-800ms and observed a short T_2 component between 13-40ms arising from 16-20% of the total signal. These preliminary results encourage further research into the bi-exponential nature of NAA in WM.

455	Plasma 28	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

		Brain NAA is known to be elevated in Canavan's disease but is usually decreased in association with loss of neuronal integrity. Elevated NAA is herein reported in murine models of sickle cell disease (SCD) and is associated with anemia, hypoxic and oxidative stress and may reflect increased glutathione turnover and / or increase demand for mitochondrial energy. These findings provide insight into why elevated NAA has been observed in children but not adults with SCD, and suggests a mechanism for increased susceptibility to stroke, and alternative roles for NAA in the brain.

456	Plasma 29	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
		Obstructive sleep apnea (OSA) is a chronic, multisystem sleep disorder that has been linked with dementia, stroke and increased risks of cardiovascular disease. Continuous positive airway pressure (CPAP) is the most common treatment method for OSA patients, but its effect on different organ systems and to reverse the rate of cognitive decline is still unclear. In this study, we evaluated neurochemical changes of untreated and CPAP treated OSA patients versus healthy controls in twelve brain regions using a semi-laser based accelerated five-dimensional (5D) echo-planar J-resolved spectroscopic imaging (EP-JRESI) sequence. We also explored the relationship between brain metabolite ratios and apnea hypopnea index (AHI), a measure indicative of the severity of sleep apnea. We observed significant differences of several metabolites in many brain regions. We also found that, among other metabolites, AHI correlated positively with lactate in right parietal insular cortex. This may be the result of hypoxemia and tissue hypoxia during sleep caused by OSA. To validate our findings, further longitudinal studies using a large cohort of OSA subjects before and after CPAP are required.

457	Plasma 30	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

		Although diagnosed based on sociocommunicative deficits, autism spectrum disorder (ASD) is characterized by superior performance on selective attention tasks, particularly visual search. In neurotypical individuals, region-specific concentrations of GABA are associated with differences in attention and perception. While it has been hypothesized that ASD may be associated with an excitatory-inhibitory imbalance, it remains unclear how this may contribute to autistic search advantage. To test this, 10 children with ASD participated in a magnetic resonance spectroscopy (MRS) study using MEGA-semi-LASER to detect GABA concentrations in target regions, including the frontal eye fields, temporal parietal junction, and visual cortex.

Electronic Power Pitch Poster

Poster: Conductivity, Relaxation, Water-Fat & Beyond

Power Pitch Theater A - Exhibition Hall	Tuesday 17:15 - 18:15

533	Plasma 1	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
		In numerical simulations and initial *in vivo* results of multi-parametric mapping in the calcaneus, the feasibility of measuring trabecular bone microstructure is explored. The combination of R_2^* for measuring intra-voxel dephasing and quantitative magnetic susceptibilty to detect trabecular bone density is investigated and indicates feasibility to differentiate trabecular bone networks with isotropic and anisotropic microstructure.

534	Plasma 2	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

		MRI of tissues with short transverse relaxation times below 1 millisecond such as bone or myelin raises both scientific and clinical interest. However, achieving high spatial resolution for short-T2 signals is challenging as large gradient strengths are required. Furthermore, large G implies high signal bandwidth, thus increasing the demands for short-T2 imaging techniques. Therefore, currently, short-T2 imaging faces significant restrictions with respect to spatial resolution and accessible T2s. In this work, all these challenges are tackled to expand the limits of short-T2 MRI using large G up to 200 mT/m and high BW up to 2 MHz.

535	Plasma 3	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
		In this work, we demonstrated that a modified gradient-echo sampling of FID and echo (mGESFIDE) sequence was able to produce multiple contrast images (R_2, R_2', R_2*, local field map, QSM, positive and negative susceptibility maps) in 5 minutes of scan time. We developed a new algorithm for improved R_2 and R_2' maps by considering RF slice profiles in the excitation and refocusing RF pulses. Additionally, we developed a new method that generated a high-quality local field map by utilizing all echoes of mGESFIDE.

536	Plasma 4	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
		Our purpose was to develop a robust method for joint quantification of water and fat fractions as well as fatty acid maps from bipolar multi-echo MR data. Its accuracy and reproducibility across field strengths and sequences was demonstrated using an oil phantom. Repeated in-vivo breath-hold acquisitions in n = 11 patients yielded median absolute differences of 4.8%, 1.0% and 8.2% for the saturated, mono-unsaturated and poly-unsaturated fat components in the liver, spleen and subcutaneous, perirenal and mesenteric fat depots.

537	Plasma 5	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
		Variable Flip Angle (VFA)-based T1 maps are known to be prone to errors deriving from B1 errors (inaccurate knowledge of flip angles) and poor signal spoiling. In general, in vivo $T1_{VFA}$ values tend to overestimate T1 values obtained using a gold standard inversion recovery method :$T1_{IR}$. Calibrating $T1_{VFA}$ with $T1_{IR}$ has been proposed but it requires knowledge of the exact relationship between these. This work models the contribution of B1 errors and poor spoiling to $T1_{VFA}$ errors and via simulations, the conditions for $T1_{VFA}/T1_{IR}$= constant (i.e. simple scaling) are derived. Experiments on phantoms and in vivo are used for validation.

538	Plasma 6	“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
		This work aims at developing an innovative diagnostic strategy, based on the "in vivo" measurements of longitudinal relaxation times at low and ultra-low magnetic fields with Fast Field Cycling FFC-NMR to obtain quantitative information on tumour metastatic potential, due to different water content and mobility, that is invisible to standard MRI. Preliminary results show that the endogenous contrast between normal and diseased tissue, due to differences in T1, is much greater at low field and the shape of the relaxation dispersion profiles may be used as a reporter of the molecular dynamical processes, biomarkers of the disease grade.

539	Plasma 7	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

		Tracing neuronal connections of the peripheral and central nervous system has relied on invasive techniques that make it difficult to reconstruct information. We demonstrate the feasibility of utilizing manganese enhanced magnetic resonance imaging (MEMRI) and vagus nerve stimulation (VNS) to trace the vagus nerve to central nervous system (CNS) connections. This experimental approach shows the non-invasive visualization and quantified increased enhancement of manganese transport from the nodose ganglion to the left nucleus tractus solitaries (NTS).

540	Plasma 8	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
		In this work we demonstrate high-resolution bipolar water-fat imaging sequence produces same fat quantification as compared to conventional unipolar water-fat imaging sequence under the same scan time. Images of resolved boundaries in bipolar Proton Density Fat Fraction (PDFF) maps are presented. Fat quantifications of the same regions of interest drawn on bipolar and unipolar PDFF were compared and statistical analysis was performed to evaluate the similarity of the two methods.

541	Plasma 9	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
		Purpose: To propose an robust fat water separation method using binary decision tree algorithm. Methods: In this paper, a novel fat-water separation algorithm using binary decision tree is proposed. Pixels are firstly clustered into sub-regions. Different from existing region growing algorithms, the proposed method solves the phasor ambiguity problem region by region. The method was tested on data sets from ISMRM 2012 Challenge. Results:Fat-water separation were successfully achieved by the proposed method in the datasets. Conclusion: A novel method using binary decision tree algorithm is proposed for robust and accurate water-fat separation.

542	Plasma 10	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
		MRCDI is a novel technique for non-invasive measurement of weak currents in the human head, which is important in several neuroscience applications. Here, we present reliable in-vivo MRCDI measurements in the human brain based on SSFP-FID, yielding an unprecedented accuracy. We demonstrate the destructive influences of stray magnetic fields caused by the current passing through feeding cables, and propose a correction method. Also, we show inter-individual differences in MRCDI measurements for two different current profiles, and compare the measurements with simulations based on individualized head models. The simulations of the current-induced magnetic fields show good agreement with in-vivo brain measurements.

543	Plasma 11	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
		Phase-based EPT assumes the spatial homogeneity of both B1+ and B1- magnitude. However, when it comes to multi-receivers is used for improved SNR, the assumption becomes invalid especially for B1-. To overcome this problem, a subject-specific multi-Rx combination method was suggested [2]. However, this method can give a solution that is biased by the transmit field (B1+) when it is inhomogeneous. In this study, an alternative multi-Rx combination method is proposed. B1- is estimated from multi-receiver images by solving an inverse problem. Afterwards, optimal coil-coefficients for combination are calculated using the estimated B1- field. The method is applied to in-vivo breast conductivity imaging.

544	Plasma 12	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
		The feasibility of permittivity imaging relies on high precision of the underlying $$$\it{B_1^+}$$$ amplitude maps. We tested AFI, Bloch-Siegert and DREAM $$$\it{B_1^+}$$$ mapping techniques on a pelvic-sized phantom at 3T, comparing their SNR in $$$\it{B_1^+}$$$ maps and (resulting) permittivity precision. Our results indicated that the DREAM-based permittivity map was the most sensitive to sequence-related systematic errors. The commonly-used AFI technique, instead, was the least precise method. We also found that Bloch-Siegert is generally best suited for permittivity mapping compared to the other two methods, due to its higher $$$\it{B_1^+}$$$ precision and accuracy.

545	Plasma 13	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
		Magnetic Resonance Electrical Impedance Tomography (MREIT) has been used to measure low frequency (ca. 10 Hz) electrical conductivity properties. Here, finite element simulations are used to show that it should be possible to measure electrical properties at frequencies in the range 10- ~5000 Hz using current waveform modulation. We also show imaging results that demonstrate differential signals can be measured in phantoms containing dialysis membranes with different thicknesses and permittivity characteristics.

546	Plasma 14	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
		It has recently been shown that the WHO grade of a glioma is correlated with its electric conductivity, which can be determined via post-processing the acquired MR transceive phase. However, the transceive phase and thus the derived conductivity might be corrupted by motion induced phase, particularly from cardiac pulsation transferred to the cerebrospinal fluid (CSF). In this study, the impact of CSF pulsation on the reconstructed conductivity was investigated by synchronizing the transceive phase acquisition to the cardiac cycle. It turned out that the pulsation significantly affects reconstructed conductivity of the CSF, but not of gray and white matter.

547	Plasma 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
		Radiation therapy (RT) has been widely used as a powerful treatment to remove cancerous tissues because of its ability to control cell growth. Ionizing radiation works by damaging the DNA of cancerous tissue leading to cellular death. Medical imaging has limitations on credibility for evaluation of tissue response and prediction of therapeutic effect due to lacks of contrast information on gradual and minute tissue changes after RT. Conductivity mapping after RT may provide direct and high sensitive information on tissue response because its contrast mechanism originated from the concentration and mobility of ions in the extra- and intracellular environment.

Electronic Power Pitch Poster

Poster: Advances in Contrast: MT, CEST & Perfusion

Power Pitch Theater B - Exhibition Hall	Tuesday 17:15 - 18:15

548	Plasma 16	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
		Collateral perfusion has a major effect on clinical outcome in carotid steno-occlusive disease. Arterial spin labeling (ASL) may provide a biomarker of collateral perfusion by measuring arterial transit time (ATT) in addition to cerebral blood flow (CBF). However, the concomitant measurement of ATT and CBF is not feasible for clinical applications. As an alternative, ATT can be estimated from single post-labeling delay ASL image using the spatial coefficient of variance (CoV). In this study, we investigate whether the spatial CoV lateralization through collateral perfusion can predict the side of carotid occlusion as a proof-of-principle. In addition to spatial CoV, we also investigated whether temporal variance (tVAR) of the ASL signal could be used as a predictor of occlusion versus stenosis.

549	Plasma 17	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
		Since the labeling efficiency in pCASL is dependent on velocity and off-resonance effects, one could imagine that small natural occurring fluctuations at the labeling plane would lead to similar fluctuations in the ASL-signal. Such fluctuations at the brain level would be similar for voxels belonging to the same flow territory and might enable detection of flow territories, e.g. by an ICA-type of resting-state ASL analysis that is normally used for identification of neuronal networks. By deliberately manipulating the labeling efficiency, we can report that with small fluctuations in labeling efficiency flow territories can be determined, which diminish in robustness for smaller fluctuations.

550	Plasma 18	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
		In this study we investigated whether velocity-selective arterial spin labeling (VS-ASL) and acceleration-selective spin labeling (Acc-ASL) can be used to measure pulsatility in the microvascular system of the brain, since the amount of generated label will depend on the velocity or acceleration of the spins at the moment the VS-ASL (Acc-ASL) module is applied. Results showed no significant variation in the amount of label when applying these modules at different cardiac phases. However, the generated label did show a pattern which coincides with the flow territories, suggesting a underlying physiological cause.

551	Plasma 19	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
		We proposed a new convolutional neural network (CNN) framework to quantify cerebral blood flow (CBF) in Hadamard-encoded pseudo-continuous arterial spin labeling (HE-pCASL). Improving sensitivity and robustness in ASL signals allows CNNs to quantify CBF accurately with a smaller number of data acquisitions. The proposed methods outperformed the conventional averaging method in both normal and pathologic regions. Therefore, CNNs can be a good alternative to quantify CBF in ASL imaging.

552	Plasma 20	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
		Early detection of high-grade malignancy using novel contrast mechanisms and detection methods significantly increases the treatment options and the patients' survival rate. For this purpose, the local magnetic-field-gradient variations due to irregular water contents and deoxyhemoglobin concentration in early glioblastoma multiforme (GBM) is sensitively detected by active-feedback electronic devices and nonlinear spin dynamics. The active-feedback phases and strength were tuned to manipulate the underlying spin dynamics and thus optimize the feedback-induced avalanching spin amplification effect. *In vivo* results from GBM mouse models show that up to 12 times of improved tumor-to-normal-tissue contrasts can be achieved to highlight early GBM.

553	Plasma 21	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
		In 2006, Parker et al published a population-average AIF that has subsequently been used by numerous investigators for both simulation and data analysis. Despite its utility, the published AIF suffers from a number of limitations. In this study we tried to address many of these limitations and made measurements in a population of patients with advanced breast cancer, resulting in a total of 74 individual AIFs. We fitted each AIF with a physiological model and assessed inter- and intra-patient variability.

554	Plasma 22	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

		We propose a novel alternative approach to estimate pharmacokinetic (PK) parameters of dynamic contrast enhanced (DCE)-MRI. Our approach leverages machine learning field and mainly targets to automatically learn temporal patterns of the voxel-wise concentration-time curves (CTCs) from a large amount of training samples in order to make accurate parameter estimations. We consider the estimation of parameters as a regression problem and specifically use Random Forest (RF) regression. We demonstrate its potential and utility to improve the conventional model-fitting based quantitative analysis of DCE-MRI especially in various noise conditions, and validate our method on clinical brain stroke datasets.

555	Plasma 23	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
		We investigate the influence of 2D $$$(k_y,k_z,t)$$$ sampling strategies on the minimum achievable variance without bias for pharmaco-kinetic parameter estimation in 3D whole-brain DCE-MRI (equivalent to the best possible precision without bias). Cramér-Rao analysis is combined with a pathologically- and anatomically-realistic digital reference object to objectively compare measurement procedures independent of any estimator. This study did not identify any significant difference between lattice and random undersampling, or between their uniform and variable density variants.

556	Plasma 24	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
		In this study role of hemodynamic parameters (breast-blood-volume and breast blood-flow), obtained using T_1-perfusion MRI data of breast, in the differentiation of benign from malignant breast lesions and classification of malignant lesions into different grades is evaluated. Hemodynamic parameters were also compared with the tracer kinetic parameters and semi-quantitative T_1-perfusion analysis in term of grading. The high sensitivity and specificity of breast-blood-volume in differentiating between benign and malignant as well as in the grading of breast lesions (grade-I, grade-II and grade-III) were observed.

557	Plasma 25	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
		Type 1 diabetes mellitus results in autoiummune destruction of β-cells in the pancreas, which are responsible for insulin production. Paramagnetic Mn^{2+} ions are taken up by β-cells as a calcium analogue and could be used as an MR contrast agent to monitor β-cell function and therefore treatment or disease progression in these patients. Three manganese-based contrast agents ($MnCl_2$, mangafodipir and Mn gluconate) were used to measure pancreas enhancement after saline and glucose challenge in healthy rats. All agents showed greater enhancement after glucose challenge, with no marked difference between the two agents that have been used clinically.

558	Plasma 26	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
		Using volumetric snapshot-GRE CEST MRI at 9.4T with high frequency sampling, we were able to separate novel CEST peaks at +2.7 ppm, +1.2 ppm and -1.7 ppm reliably in the CEST-spectrum and showed creation of maps of these CEST MRI contrasts in the healthy human brain to be feasible in vivo.

559	Plasma 27	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
		Most current amide proton transfer (APT) imaging protocols, a variant of CEST-MRI, are essentially not quantitative and acquire qualitative APT-weighted images, limiting pH or concentration specificity. Herein, we propose a novel dictionary-free MRF concept to allow APT quantification by subgrouping proton exchange models (CEST-SPEM). The results of numerical phantom studies demonstrate that CEST-SPEM can enable absolute quantification of the APT exchange rate and concentration on 3T clinical scanners. The same model used for in vivo allows fast quantification of exchange rates and apparent concentrations for the combined solute components at the CEST frequency studied.

560	Plasma 28	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
		Creatine(Cr)-weighted chemical-exchange-saturation-transfer(CEST) MRI is being developed to detect alteration in Cr concentration during modulation as well as Cr-associated disorders. Cr-weighted CEST contrast show dependence on saturation parameters and overlap from other effects in brain. The conventional asymmetry approach results in a mixed contrast, which is less specific to Cr. By using appropriate saturation parameters, contamination from some of the metabolites/molecules can be reduced; however, it is difficult to suppress the contamination completely as shown by simulation studies. Proposed protocol and improved z-spectral fitting approach can be used for computing Cr-weighted CEST contrast with reduced contamination in human brain at 7T.

561	Plasma 29	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
		Chemical exchange saturation transfer from taurine to water (TauCEST) is primarily detectable in the low temperature range. Since, TauCEST asymmetry is bijective in the physiological pH-range (6.8-7.5), TauCEST is a potential candidate for *in vivo* studies on brain of polar fish. The specificity of TauCEST MRI on the brain of polar cod at 1.5°C shows a taurine contribution of 65%. TauCEST in brain of polar cod significantly increased under elevated CO_2 concentrations by about 1.34%-3.17% in comparison to control, reflecting pH_i changes since localized ^{1}H NMR spectra show no significant changes in metabolite concentration for the different treatments.

562	Plasma 30	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
		In the present study, we used both numerical simulations and experiments performed in a preclinical setup to characterize the mechanisms of the ihMT boost effect (signal enhancement achieved using concentrated bursts of high-power RF for saturation). We demonstrated that the ihMT boost effect depends on T_{1D} and is more intense in short-T_{1D} components. This feature allowed, using various strategies for dual frequency-offset RF saturation, different ihMT contrasts to be produced and revealed strong ihMT signal outside the brain.

Electronic Power Pitch Poster

Poster: Interventional & RF: Safety & Solutions

Power Pitch Theater A - Exhibition Hall	Wednesday 9:15 - 10:15

638	Plasma 1	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
		Patients with deep brain stimulation devices have a safety concern for localized heating that can arise during MRI. Clinically, the lead trajectory for the surgical stimulation procedure varies among patient population. We have shown in previous numerical simulations that the lead trajectory would affect the performance of heating suppression in patient-specific pTx optimization. The present work experimentally validated that RF-induced heating can be suppressed for a high-risk patient-specific lead trajectory, using optimal pTx input parameters.

639	Plasma 2	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

		This study investigated the use of electrical-lengthening as an alternative method of simulating meandered dipole arrays. Dipoles were compared with (a) differing inductor positions, (b) rotating dipole along main axis and (c) for multiple dipole transmission. Results showed a simple single wire dipole model with electrical-lengthening produced comparable SAR solutions, were less effected by rotations and cut simulation times by up to 10 times.

640	Plasma 3	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
		The accurate simulation of SAR is important to guarantee patient safety in MRI measurements especially for local variations. Although most clinical RF systems are hybrid systems (separate Transmit (Tx) and Receive (Rx) coils), the effect of the Rx coils on Tx power consumption, B_1^+-homogeneity and SAR have been seldom investigated. Rx coils present highly conductive surfaces which affect the RF field distribution. In this work, we evaluate the performance of several detuning concepts and their realization in the EM simulations concerning Tx power consumption, B_1^+-homogeneity and SAR for a hybrid setup at 3T.

641	Plasma 4	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
		Peripheral nerve stimulation (PNS) has become the main limitation for MRI with high-performance gradients. Recently, we proposed a simulation framework to predict PNS thresholds for arbitrary coil geometries to directly address PNS considerations during the coil prototyping phase. In order to ensure robust modeling of PNS (and thus convergence of the coil optimization phase), we analyze the sensitivity of our framework to key simulation parameters such as the temporal and spatial resolution of the induced electric fields, dielectric tissue parameters of our body models, and the location of the neurodynamic model compartments along the nerve fibers.

642	Plasma 5	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
		To investigate deep brain stimulators, pacemakers or other elongated structures the transfer function was proposed to characterize these devices. A electro-optic E-field sensor is used to acquire 2D field data of copper wires excited at one tip for 64 and 123MHz. The data is compared to simulations and transfer functions are calculated from these simulations. These are compared to experimentally acquired transfer functions.

643	Plasma 6	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
		Actual SAR values measured by calorimetry varied for a factor of 2.3 among three different scanners (two 1.5T and one 3T) even at identical console SAR settings. Console B1+RMS values also deviate for a factor of 1.2 between the two 1.5T. Image quality assessment performed by three radiologists suggested that the image quality change due to the console SAR setting was not critical at a 1.5-T scanner, but was so at a 3-T scanner. Therefore attention should be paid to the variation of the actual SAR even if the console SAR is at a condition specified for an implantable medical device.

644	Plasma 7	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

		In this study, we proposed a prototype implant that can be controlled wirelessly to change the connection impedance between the lead and the case. To show the effect of the connection impedance between the lead and the case, the tip temperature increase was calculated for 3 different lead lengths by placing a capacitance between the lead and the case. Two different case to lead connection impedance values were switched in this work as proof of a concept and tip temperature heating was changed during the scanning. It is demonstrated that by changing the impedance, the lead tip heating properties can be changed allowing safe scanning. it can be useful for avoiding excessive heating if resonance condition occurs due to environmental factors inside human body and position inside the scanner.

645	Plasma 8	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
		We summarize the experimental implementation of test-field diversity (TFD) method for radiated immunity testing of medical implants. The TFD method is used to provide a diverse and well-characterized incident conditions to the implant during radiated immunity test. As an illustrative example, the TFD is used for in vitro validation of a Tier 3 model that describes RF-induced heating of a commercial medical implant at 64 MHz. Results shown a dynamic range of 10 dB for the tip deposited power can be obtained experimentally. The experimental instrumentation and the practical considerations of the method are discussed.

646	Plasma 9	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
		We propose a passive needle tracking method for MR-guided interventions. We combined undersampled 2D radial multi-echo acquisitions, the white marker phenomenon, and simulations and template matching of artifacts around the needle tip to achieve real-time (10 Hz) tracking of the needle tip, while simultaneously being able to reconstruct anatomical images using a sliding window reconstruction. The method is demonstrated to smoothly track the insertion of a needle in porcine tissue while also showing deformations in the anatomical image caused by the needle insertion. These results bridge a gap between active and passive tracking of needles.

647	Plasma 10	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
		Orthopedic implant manufacturers produce a large portfolio of on-bone devices. Current implant RF safety standards, e.g., ASTM F2182-11a and TS/ISO 10974, do not take advantage of very well-defined data on relevant RF exposures of these devices, i.e., E-fields tangential to the bone-surface. In our approach presented here, we explore the use of the bone-surface-averaged tangential E-field as a close approximation of the incident field impacting an on-bone orthopedic device. The relevant surface-averaged tangential E-fields are less than half of the corresponding peak volume-averaged E-fields, which allows for realistic but not overly conservative assessment of RF implant safety in MRI.

648	Plasma 11	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
		Thermo-acoustic ultrasound (TAUS) has been shown to be able to detect the peaks in local SAR indicative of RF-induced lead tip heating in an MRI setting. Here, we detail a reproducible TAUS acquisition system consisting entirely of commercially accessible electronics that can interface with an MRI scanner. This system achieves comparable performance to our previously demonstrated acquisition system with lower cost electronics, while also providing additional functionality that could aid in the development of a robust TAUS pre-scan to assess the risk of RF-induced lead tip heating in MRI.

649	Plasma 12	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

		Catheter visualization and guidance under MRI guidance can be challenging, and conventional MR tracking coils decrease the flexibility and increase the profile of catheters. We used aerosol jet deposition to print a capacitor and an inductor with a double helix geometry on a polymer catheter. bSSFP sequences with flip angles 5°, 15°, and 90°, and a B_1+ map were acquired at 3T, and CNR and amplification were measured. The marker demonstrated good CNR and B_1+ signal amplification, suggesting that fabrication of complete 3D printed LC circuits for use as markers on catheters is feasible and can exhibit good tracking characteristics.

650	Plasma 13	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
		Metal-reinforced catheters have improved steerability and pushability. Currently, long (>wavelength/8) metallic-braided or metallic-tube-reinforced active MRI-compatible devices do not exist, due to risks of heating of surrounding tissue. Metallic-backbone devices may be possible if heating-sources are attenuated. Concentric-tube RF traps were miniaturized (“MBaluns)” by using leaky (loosely-wound) solenoids in-place of the external tube, providing transverse magnetic fields to attenuate (a) surface electric-fields on metals and (b) common-mode propagation on internal-cables. We validated (1) a 1.1mm outer-diameter (OD) active metallic-tube-based guidewire and (2) a 2.6mm OD metallic-braid-based electrophysiology catheter via; Electromagnetic modeling, Network-Analyzer electrical tests, phantom imaging and navigation into swine hearts.

651	Plasma 14	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
		In this work, we present a novel low profile and active biopsy needle for MRI guided prostate interventions. We show that using conductive ink printed non-planar RF antenna components does not compromise overall device profile while maintaining required mechanical properties for clinical grade devices. We confirmed that the biopsy needle design is conspicious under MRI while maintaining RF induced heating below the allowed limits. This work demonstrates the feasibility of developing ultra low profile active interventional devices and potentially enables physicians to perform MRI guided prostate interventions.

652	Plasma 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
		An MRI-compatible robotic arm was developed to provide a precise fiber positioning for optogenetic fMRI of the rat brain. Corpus callosum connects two hemispheres through a thin sheet of spreading fiber bundle with only a few hundred micron thickness in the brain. This work shows that MgRA can guide fiber optic to precisely target the callosal fiber bundles. The optogenetically driven callosal axonal fiber-mediated neural activity leads to strong antidromic activation in the hemisphere with callosal neurons expressing ChR2 by fMRI.

Electronic Power Pitch Poster

Poster: Motion & Image Analysis Highlights

Power Pitch Theater B - Exhibition Hall	Wednesday 9:15 - 10:15

653	Plasma 16	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
		Although human cerebrovascular system is the basis of most non-invasive measures of neural activity, its structure is poorly understood owing to the difficulty in identifying, segmenting and separating venous and arterial vessels. To resolve this, we used Susceptibility Weighting Imaging (SWI) and Magnetic Resonance Angiography Time-of-Flight (MRA-TOF) to develop a probabilistic template of vascular architecture in the MNI space using an iterative back projection approach. This template is then paired with an anatomical atlas illustrates how some grey-matter areas are more vascularized than others. This could be the first steps toward a region-based vascular regression tool for the analysis hemodynamic-based measures of brain activity, such as fMRI.

654	Plasma 17	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
		We propose a comprehensive framework for spatiotemporal multi-organ fetal MR atlasing and segmentation. Volumetric fetal brain and trunk image data for 78 healthy fetuses acquired at different gestational age were reconstructed separately from motion corrupted MRI scans to 0.75mm isotropic resolution using slice-to-volume reconstruction. For each week, an affine template was generated from 15 subjects by averaging them in the atlas space. This template was further improved by non-linear registration of all the subjects using B-spline free-form deformations. For consistency, the template at each week was rigidly transformed. The annotated organs of the atlas include brain, lung, heart, and spine.

655	Plasma 18	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
		DWI acquired with b-values greater than 1000 s/mm^2 and higher-order diffusion analyses based on such DWI series have the potential to improve tumor differentiation, while the extended sampling of b-values makes the acquisition time inconveniently long. We propose an acceleration scheme that sparsely samples k-space and reconstructs images using a new low-rank tensor model which exploits both global and local low-rank structure. Under an acceleration factor of 8, parameter mapping results on one simulated and 7 patient datasets show improved accuracy over another low-rank tensor model that exploits global correlation only, and comparable accuracy to clinically used four-fold GRAPPA reconstruction.

656	Plasma 19	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

		Rhesus macaque is a widely used animal model helping understand neural development in the human brain. Available adult macaque brain atlases are not suitable for infant studies, due to their dramatic brain difference. Building age-matched atlases is thus highly desirable yet still lacking. In this study, using MRI scans for 32 healthy rhesus monkeys, we constructed the first spatiotemporal cortical surface atlas for macaques aged from 2 weeks to 24 months, which were further equipped with developmental-trajectory-based parcellation maps. These surface atlases and parcellation maps will greatly facilitate the early brain development studies of macaques.

657	Plasma 20	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
		Spatial resolution is of paramount importance for intracranial vessel wall (IVW) MR imaging because the vessel wall is submillimeter thin. However, high spatial resolution typically comes at the expense of long scan time, small spatial coverage and low signal-to-noise ratio (SNR). If we can reconstruct a high-resolution (HR) image from a low-resolution (LR) input, we can potentially achieve larger spatial coverage, higher SNR and better spatial resolution in a shorter scan. In this work, we propose a new Single Image Super-Resolution(SISR) technique which recovers an HR image from an LR image using 3D Densely Connected Super-Resolution Networks (DCSRN). We compared our network with state-of-art deep learning network in restoring 4x down-graded images and ours are faster and better.

658	Plasma 21	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
		This study demonstrated a method for 3D simultaneous relaxometry and segmentation of human brain tissues through a deep neural network. Ranges of T1 and T2 values for gray matter, white matter and cerebrospinal fluid (CSF) were used as the prior knowledge. The proposed method can directly generate brain T1 and T2 maps in conjunction with segmentation of gray matter, white matter and CSF, and in particular was robust for relaxometry/segmentation in the challenging region of deep brain nuclei.

659	Plasma 22	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
		Large multi-site studies that pool magnetic resonance imaging (MRI) data across research sites present exceptional opportunities to advance neuroscience and enhance reproducibility of neuroimaging research. However, inconsistent MRI data collection platforms and scanning sequences both introduce systematic variability that can confound the true effect of interest and make the interpretation of results obtained from combined data difficult. Unfortunately, methods to address this problem are scant. In this study, we propose a novel denoising approach for multi-site, multi-modal MRI data that implements a data-driven linked independent component analysis to efficiently identify scanner/site-related effects for removal.

660	Plasma 23	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
		In Chemical Exchange Saturation Transfer (CEST) MRI, images are acquired by applying saturation RF pulses at multiple frequencies of small increments to generate the CEST-spectrum. This makes CEST sensitive to motion and field inhomogeneity. Several factors can also vary the shim prepared by the scanner. To date, no study has been conducted to evaluate and correct shim fluctuation during CEST acquisition. In this study, we implement CEST with Double volumetric Navigators (DvNavs) to evaluate and update in real-time motion, zero and first-order shim parameters. The results show the ability of the DvNavs to correct shim and motion during CEST acquisition.

661	Plasma 24	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
		Movement during MR imaging may cause significant motion artifacts that can impair the experiment. This is especially true in CEST imaging, which relies on comparison between images recorded at different time points during the experiment. We implemented a real-time motion correction method and a retrospective receiver sensitivity(B_1^-) correction based on volumetric EPI navigators interleaved with the CEST measurements. We tested these methods on phantoms and healthy volunteers. Together with adequate B_0 and B_1^+ corrections, motion and sensitivity corrections may completely restore CEST data fidelity in the presence of involuntary head motion, thereby facilitating CEST imaging of restless patients.

662	Plasma 25	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
		Structural MRI studies have pointed out the potential role of the brainstem in the pathophysiology of ASD. However, the findings in volume alterations in subjects with ASD are controversial. In this study, structural MRI was used to measure brainstem volume in a group of 152 young children with and without ASD, with five different methods (FSL-FIRST, ANTs, FS 5.3, FS 6.0, FS 6.0 with substructures). One out of five (FSL-FIRST) showed poor agreement with the other segmentation methods, which, by contrasts, consistently showed Pearson correlations greater than 0.93 and average Dice indexes greater than 0.76 in comparison among each other.

663	Plasma 26	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

		Advanced 7T MR imaging improves the visualization of perivascular spaces (PVSs) in human brains. However, accurate PVS segmentation for quantitative morphological studies is still challenging, since PVSs are very thin tubular structures with low contrast in noisy MR images. We proposed a new multi-channel fully convolutional network (mFCN) to automatically segment 3D PVSs. Our mFCN method adopts multi-channel inputs to complementarily provide enhanced tubular structural information and detailed image information. Multi-scale image features are automatically learned to delineate PVSs, without requirement of any pre-defined regions of interest (ROIs). The proposed method outperforms existing automatic/semi-automatic methods with a large margin.

664	Plasma 27	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
		Motion is still one of the major extrinsic factors degrading image quality. Automated detection of these artifacts is of interest, (i) if suitable prospective or retrospective correction techniques are not available/applicable, (ii) if human experts who judge the achieved quality are not present, or (iii) if a manual quality analysis of large databases from epidemiological cohort studies is impracticable. A convolutional neural network assesses and localizes the motion artifacts. This work extends the previously published method by proposing a general architecture for a whole-body scenario with varying contrast weightings. High accuracies of >90% were achieved in a volunteer study.

665	Plasma 28	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

		The use of a-priori anatomical information can effectively improve statistical analysis of neuroimaging data. In this work, we introduce a new method called Tract-Based Cluster Analysis (TBCA) that exploits the rich anatomical information present in a whole-brain tractogram to inform the cluster-level inference analysis of voxel-based images. The method is based on the novel concept of hyper-voxel which incorporates local and global anatomical information derived from tractography data. When applied to real clinical data TBCA demonstrates clear benefits compared to previous cluster-level inference approaches.

666	Plasma 29	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
		MRI phase images are increasingly used, for example for Susceptibility Mapping, and distortion correction in functional and diffusion MRI. However, measured phase images contain wraps, because the phase is defined only between 0 and 2π. PRELUDE is the current gold-standard method for robust, 3D, spatial phase unwrapping, but its computation time can become very long (e.g. 10 hours), especially at high field and outside the brain. Here, we developed a new method, SEGUE, that produced similar results to PRELUDE in multi-echo brain and head-and-neck images, successfully unwrapped some regions where PRELUDE failed and was between 1.6 and 83 times faster.

667	Plasma 30	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

		Longitudinal analyses in Multiple Sclerosis are often performed to assess disease progression and evaluate treatment response. The number of new and enlarged lesions as well as total lesion volume variations over time are imaging biomarkers used in MS follow-up assessment. Here, we evaluate the performance of an in-house prototype algorithm for lesion detection and volume estimation in a longitudinal scenario. Our algorithm can be run with or without partial volume modelling. Both detection and volume estimation improved using the partial volume model with respect to manual delineations, especially in small lesions and at lesion borders.

Electronic Power Pitch Poster

Poster: Applications of Diffusion MRI

Power Pitch Theater A - Exhibition Hall	Wednesday 14:45 - 15:45

743	Plasma 1	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
		Current limitations of diffusion-weighted tractography algorithms face the complexity of white matter fiber crossings, especially for the cortico-lateral projections of the cortico-spinal tract (CST) in the human brain. In this work, to improve cortico-spinal tracking in crossing areas we combined accurate anatomical region positioning along the CST in each individual with a new bundle-specific tractography algorithm. We thus built a probabilistic atlas of the whole-fanning CST in 410 healthy participants.

744	Plasma 2	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

		The dentato-rubro-thalamic-tract (DRTT) has recently been suggested as a target for tremor control in deep brain stimulation and stereotactic radiosurgery, however, its efficacy has been challenged because different approaches to diffusion MRI (dMRI) tractography exhibited significantly different sensitivity in detecting the DRTT. We implemented a framework to quantitatively evaluate the performance of dMRI tractography by comparing the dMRI tracts to the histological DRTT identified from Nissl-stained sections in the same squirrel monkey brain. The Jaccard index between our dMRI tractography strategy and the histological DRTT is above 0.7. In the future, other tractography strategies can be tested using this framework.

745	Plasma 3	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
		We have developed an approach to elucidate the macrostructural changes of individual white matter tracts in neonatal brains, using deformation-based morphometry. Many studies have investigated how microstructure changes during development, however it is not clear how to disentangle changes in tissue microstructure from macrostructural volume changes. The latter is particularly challenging in the absence of longitudinal data from the same subject, which is the norm given the difficulty in scanning neonates. We propose an approach that is aimed towards this problem. Results are presented from analysis carried out on publicly available diffusion MRI data from the developing Human Connectome Project.

746	Plasma 4	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
		Accurate identification of infarcted regions of the brain is critical in management of stroke patients. An efficient and accurate method based on a deep convolutional neural network for segmentation of infarcts in the diffusion-weighted images is proposed.

747	Plasma 5	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
		Selective degeneration of crossing fibres has been reported in diffusion MRI studies of Alzheimer's disease alongside increased fractional anisotropy (FA). Similar albeit more subtle selective degeneration has been suggested in healthy aging, but increased FA with age has not been reported on cross-sectional studies of aging. In this work, we use DTI tractography to measure selective degeneration of crossing fibres in healthy aging among 212 subjects. Increased FA with age is found in this cohort only after applying free water elimination (FWE), suggesting that increasing extracellular water in aging may introduce variability that obscure finer structural phenomena in cross-sectional designs.

748	Plasma 6	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
		This study aims to provide to the research community quantitative measurements about the axon diameter overestimation due to the straight-cylinder assumption usually made in state-of-the-art models for diameter mapping with DW-MRI. Our methodology uses a Monte Carlo diffusion simulator to compute the diffusion weighted magnetic resonance signals of undulating axons. We use in our experiments plausible tissue values, we also explore a broad parameter set that depicts undulation. The results of this study provide useful information to understand the differences between the estimators from histology vs. the estimated diameters when using the model assumption of simple shaped axons.

749	Plasma 7	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

		A better understanding of the complex water diffusion dynamics in the extra-axonal environment may aid in the mathematical modeling of the diffusion MRI signal and have application to pathologies that specifically impact glial cells and the surrounding extracellular space. Here we employ a novel method of combining diffusion MRI data for weak and strong diffusion weightings to show that extra-axonal water diffusion anisotropy strongly correlates with intra-axonal diffusion anisotropy and takes on large values in voxels with highly aligned axons. This connection suggests that the geometrical alignment of axonal fibers is important for both intra-axonal and extra-axonal water diffusion.

750	Plasma 8	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
		Multishot imaging has been shown to provide high resolution diffusion-weighted images (DWIs) with reduced distortion, however, significant aliasing artifacts and signal cancellation still occur due to the mismatch of the motion-induced phase between different shots. The reconstruction becomes non-convex and intractable to solve when this phase is included into the forward model. The goal of this work is to solve this problem by circumventing the challenging phase estimation step. The brain and breast examples demonstrate that this can be efficiently achieved using a locally low-rank reconstruction approach.

751	Plasma 9	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
		White matter abnormalities are commonly identified on cerebral malaria patients. We proposed a method to overcome technical limitations of low-field MRI, and quantitatively calculate the ADC and b0 maps, enabling discrimination of the true restricted diffusion from T2 shine-through. A unique pattern of reversible restricted diffusion was identified in some patients.

752	Plasma 10	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
		DTI templates of the adult human brain are commonly used in neuroimaging, and their characteristics influence the accuracy of the application. The purpose of this work was to compare eight available standardized DTI templates to each other, as well as to study-specific templates, in terms of template characteristics and performance in spatial normalization and detection of small inter-group FA differences. The IIT v.3.0 template was shown to combine a number of desirable characteristics, and allows higher inter-subject spatial normalization accuracy and detection of smaller inter-group FA differences, compared to other templates, including study-specific templates, for both younger and older adults.

753	Plasma 11	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
		Axonal damage is thought to be the substrate of disability in multiple sclerosis. We have recently introduced a method based on the spherical mean framework that provides per-voxel axon diameter and volume fraction that is independent of fiber crossings/dispersion. We apply this approach to estimate whole brain axon diameter and density in a group of patients with MS to healthy controls. Widespread alterations in axon diameter and density were found throughout the NAWM and lesions of MS patients that may reflect diffuse axonal loss and swelling in the setting of chronic demyelination.

754	Plasma 12	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

		Diffusion MRI and tractography hold great potential for surgery planning, but fiber tract reconstruction requires an expert rater. In this work, we set up an automated reconstruction pipeline based on anatomical criteria that does not require manual intervention and we validated it on epilepsy patients with specific focus on language-related bundles. We first compared the results with the ones obtained from human raters and then further validated them using task fMRI. The fiber tracts reconstructed from the pipeline were in line with the agreement between different human raters and showed good overlap with function.

755	Plasma 13	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
		Hyperpolarized gas pulmonary MRI provides physiologically relevant biomarkers of obstructive lung disease including emphysema, bronchopulmonary dysplasia, congenital lobar emphysema and alpha-1 antitrypsin deficiency. Recently, a stretched-exponential-model combined with under-sampling in the imaging and diffusion directions was proposed for the evaluation of hyperpolarized gas multiple b-value diffusion-weighted MRI. The major advantage of this method is the possibility to significantly speed up the data acquisition using acceleration factors between 7 and 10. We hypothesize that this method can be extended to provide whole lung hyperpolarized gas MRI-based emphysema biomarkers including static-ventilation, T_2* ADC and morphometry maps with high spatial image resolution.

756	Plasma 14	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
		VERDICT (Vascular, Extracellular, and Restricted Diffusion for Cytometry in Tumours) MRI combines a diffusion-weighted MRI acquisition with a three-compartment mathematical model that describes signal from i) intracellular water (fIC), ii) water in extracellular-extravascular space (fEES) and iii) water in the microvasculature (fvasc). In contrast to VERDICT, clinical ADC is derived from a mono-exponential model. Upon comparison between VERDICT parameters and clinical ADC, we showed that fIC was better able to discriminate between Gleason ≥3+4 histology pattern and Gleason ≤3+3/benign histology. We also showed that image quality of VERDICT-MRI maps and clinical ADC was comparable.

757	Plasma 15	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
		Compartmental models are increasingly being used to quantify diffusion MRI signals from tumours. We have developed a complex, multiscale mathematical modelling platform for simulating tumour pathophysiology, using high-resolution optical imaging data from complete tumour samples. Diffusion MRI signals from these tumours were simulated, including vascular flow and intra- and extracellular diffusion. These data were fitted to the VERDICT compartmental model, and the resulting parameters compared against ground truth simulation values. Cell radius and intra/extracellular fractional volume parameters and respective ground truth values were strongly correlated. A more complex relationship was found in vascular volume fractions.

Electronic Power Pitch Poster

Poster: CV PowerBeat: Part 2

Power Pitch Theater B - Exhibition Hall	Wednesday 14:45 - 15:45

758	Plasma 16	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
		We present the use of Double DANTE as an improved method for DANTE prepared 3D TSE imaging of intracranial arteries. DANTE preparation inherently leads to banding artifacts, which become increasingly visible at high-resolution imaging. We show that Double DANTE strongly reduces banding separation without changes in the DANTE pulse train duration, and more importantly, without compromising flow suppression of blood or CSF. Double DANTE therefore enables high-quality intracranial vessel wall MRI at 0.6mm isotropic resolution.

759	Plasma 17	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
		Late gadolinium enhancement (LGE) MRI often suffers from poor scar-to-blood contrast when used for detection of (sub)endocardial scar due to the bright signal of adjacent blood. We sought to validate a novel dark-blood LGE technique in a large cohort of 250 patients at both 1.5T and 3T. Combining left ventricular blood nulling with phase-sensitive inversion-recovery significantly improved both image quality and diagnostic confidence compared to conventional bright-blood LGE. As no additional magnetization preparation is used, clinical application on current MRI systems is readily available without the need for extensive simulations, software modifications and/or additional training.

760	Plasma 18	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
		We investigated the feasibility of free-breathing fetal cine cardiac MRI using Doppler Ultrasound retrospective binning combined with continuous tiny golden angle radial sampling and compressed sensing via the tyGRASP reconstruction method. Motion due to maternal respiration and fetal movement was estimated by registration applied to reconstructed images of low temporal resolution. K-space radial profiles containing motion were either corrected or rejected from the reconstruction process. The reconstruction results demonstrated good image and diagnostic quality showing that the absence of fetal ECG can be bypassed in a computationally efficient way by Doppler Ultrasound even in the presence of motion.

761	Plasma 19	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
		BAV patients and patients with MFS are predisposed to develop geometrical changes in the aorta. The geometrical assessment of the aorta using MRI in these patients generates an operator dependency and variability given by the 2D planer reformatting of the data. In this work, we propose finite element Laplace formulation, which allows us to obtain 3D maps of geometrical parameters in the aorta, avoiding the 2D reformatting process of the MRI data. We apply our method on volunteers, BAV and MFS patients. Our method allows applying it to any type of volumetric segmentation from MR or CT.

762	Plasma 20	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
		Myocardial T_1 and T_2 relaxation times obtained with MRF were compared to values from traditional mapping sequences (MOLLI and T_2-prep bSSFP) and evaluated for repeatability and reproducibility in 50 normal volunteers, as per SCMR consensus guidelines. MRF compared favorably with traditional sequences without significant proportional or systemic differences with fair to excellent repeatability and reproducibility, while providing better image quality.

763	Plasma 21	Pericardial Enhancement in Recurrent and Constrictive Pericarditis: Correlation with Pathology in 52 Patients
		James Glockner[1]
		[1]Radiology, Mayo Clinic, Rochester, MN, United States

		Pericardial late gadolinium enhancement was correlated with pathologic specimens in 52 patients who had pericardiectomy performed for constrictive or chronic pericarditis. Pericardial LGE is an indicator of pericardial inflammation; however, it does not reliably distinguish inflammation from fibrosis: LGE was seen in 9/10 patients with pericardial fibrosis and minimal or no pericardial inflammation. Pericardial edema or early pericardial enhancement may be more useful biomarkers for pericardial inflammation.

764	Plasma 22	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
		A quantitative myocardial first-pass perfusion approach is proposed using multi-echo Dixon acquisition. The fat images (unaffected by contrast bolus) are used to estimate respiratory motion and the transformations are applied to the corresponding diagnostic water images. The three echo images are also used to perform T2* correction of the arterial input function. Evaluation was performed in 8 patients during free-breathing rest perfusion. Motion correction reduced quantiation variability, while T2* correction of the arterial input function reduced the myocardial blood flow by 0.7ml/g/min across all patients.

765	Plasma 23	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
		4D flow magnetic resonance imaging (MRI) can provide a way to analyze both the anatomical and hemodynamic properties related to complex vessel networks. Using basic principles related to flow conservation the entire vessel networks data can be used to help improve local flow calculations. A Bayesian approach is utilized with a Markov Chain Monte Carlo where flow conservation is enforced to obtain, for a complete vascular network, estimates of mean flow and flow uncertainty. The estimated data results in a lower flow uncertainty overall and can allow for localization of potential erroneous branches in the initial data.

766	Plasma 24	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
		Defining carotid plaque characteristics predictive of stroke using non-invasive MR imaging is clinically relevant, but has been mostly limited to qualitative visualization of signal intensity in multi-contrast MR images. Here we present two robust and fast T2 and T1 mapping techniques based on radial data acquisition and demonstrate them in terms of carotid plaque characterization.

767	Plasma 25	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
		Displacement encoding with stimulated echoes (DENSE) measures myocardial displacements using the signal phase. Phase wrapping generally occurs during systolic phases, thus spatiotemporal phase unwrapping algorithms are required to compute motion trajectories and strain. Current DENSE analysis methods are aided by user-defined myocardial contours. A fully automatic DENSE analysis method is proposed where phase predictions using multiple pathways and region growing are used to simultaneously unwrap and segment the myocardium. Compared to a prior automatic method, this method selects fewer extramyocardial pixels, reducing the computation time, and has a greater phase unwrapping success rate.

768	Plasma 26	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

		Myocardial edema is commonly imaged using T2 based imaging technique, such as T2w-TSE, T2p-bSSFP and T2 mapping. Noting its elevated T1 and T2 value, a single-shot technique using T2 prepared STIR called T2STIR-bSSFP has been proposed for edema imaging. This study compared the contrast of T2p-bSSFP, T2 mapping and the newly proposed T2STIR-bSSFP methods via simulation, phantom experiment and patient study. The results showed that T2STIR-bSSFP has the highest contrast in myocardial edema image among the three methods at a shot scan time. It may provide a fast edema imaging technique for the whole heart covering.

769	Plasma 27	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
		The aim of this study was to validate whether preoperative QSM-based OEF (OEF_{QSM}) map at 7T could predict the development of postoperative hyperperfusion (HP) after carotid endarterectomy (CEA) in patients with internal carotid artery stenosis. In quantitative assessment, OEF_{QSM} was significantly higher in the presence group than that in the absence group of HP. Receiver operating characteristic analysis showed the OEF_{QSM} was a good indicator for predicting the development of HP after CEA when the suitable cut-off value. Finally, the present study demonstrated that preoperative OEF_{QSM} map at 7T can identify patients at risk for HP after CEA.

770	Plasma 28	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

		Deep vein thrombosis (DVT) affects 1 in 1000 people and when the ilio-femoral segment is involved, over half will develop post-thrombotic syndrome (PTS). PTS can be debilitating for the patients and carries a huge health cost burden. Thrombolysis reduces the incidence of PTS, but is only successful in 60% of patients. There is no reliable method of identifying thrombi susceptible to lysis. We have developed a non-contrast-enhanced magnetic resonance multi-sequence thrombus imaging (MSTI) protocol that provides information on the structural composition of the thrombus and may be a reliable method of predicting thrombus lysability.

771	Plasma 29	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
		A method is proposed for myocardial strain estimation, based on 3D isotropic cine MRI. A free-breathing, motion-corrected super-resolution acquisition is used to obtain the 3D isotropic cine dataset. Then the left ventricular (LV) myocardium is manually segmented using a sparse segmentation technique. Finally a registration-based technique is used to obtain displacement fields that best match diastolic and systolic 3D isotropic masks of the LV, and subsequent Lagrangian strain estimates. The method was evaluated in 20 Duchenne muscular dystrophy patients. Segment-wise analysis showed that the proposed radial strain estimates correlated well with the presence of fibrosis.

772	Plasma 30	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
		Conventionally, free-breathing whole-heart 3D coronary MR angiography (CMRA) uses navigator-gated acquisitions to reduce respiratory motion, by acquiring data only at a specific respiratory phase, which leads to prolonged scan times. Respiratory-resolved reconstruction approaches have been proposed to achieve 100% scan efficiency using mainly non-Cartesian acquisitions and exploiting sparsity in the respiratory dimension. Here, a robust framework for Cartesian imaging is proposed, which provides high-quality respiratory-resolved images by incorporating motion information from image navigators (iNAV) to increase the sparsity in the respiratory dimension. Furthermore, iNAV motion information is used to compensate for 2D translational motion within each respiratory phase.

Poster: Techniques & Applications of Microcirculation Imaging

Power Pitch Theater A - Exhibition Hall	Wednesday 17:15 - 18:15

853	Plasma 1	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
		Arterial spin labeling (ASL) provides easy-access non-invasive quantification of regional cerebral blood (CBF) but its accuracy is not established. The aim of the study was to compare simultaneous measurements of absolute CBF obtained by ASL MRI and 15O-H2O PET CBF measurements in healthy subjects using a hybrid PET/MR system. Simultaneous 15O-H2O PET and ASL MRI were performed in resting state, hypoperfusion and hyperperfusion. Overall highly significant positive and linear correlation of ASL MRI and H2O PET in gCBF was observed across all perfusion states, confirming the ability of ASL MRI to quantify gCBF in good agreement with PET.

854	Plasma 2	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
		Even when focal, brain lesions have local and remote effects that impact functionally and structurally connected circuits. We developed a free open-source software (BCBtoolkit) that gathers different methods to estimate these effects on structural (using healthy controls tractography) and functional networks, using T1-images and fMRI data, and relate them to behavioral impairment. We applied these methods to 37 patients with a chronic focal brain lesion and 54 healthy controls in the context of category fluency. Our methods revealed a large set of directly and indirectly disconnected brain regions that had significantly impacted the performance.

855	Plasma 3	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
		We validated cerebrovascular reactivity (CVR) in Moyamoya disease measured by arterial spin labeling (ASL) simultaneously with ^{15}O-positron emission tomography (PET) using hybrid PET/MRI scanner. We compared the three types of ASL including standard-delay, multi-delay with extended post-label delay, and velocity selective ASL (VS-ASL). To quantify absolute PET cerebral blood flow (CBF) without arterial blood samples, we scaled the static PET maps using simultaneously collected phase-contrast (PC) MRI. Multi-delay ASL showed the strongest correlation with PC-PET on both baseline and post-ACZ CBF (R^2 = 0.48 and 0.66 respectively). Multi-delay ASL and VS-ASL showed similar good correlations with PC-PET on CVR.

856	Plasma 4	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
		In this work, we applied a novel ASL method (Turbo-QUASAR) to evaluate the effects of life-long anaemia on cerebral physiology by comparing patients with Sickle Cell Disease to healthy controls. Turbo-QUASAR enables simultaneous assessment of cerebral blood flow (CBF), cerebral blood volume (aCBV) and arterial transit time (ATT) as well as tissue T1 and M0. We found normal ATT in the presence of elevated CBF in patients. In addition we found increased aCBV in patients. Acetazolamide administration shortened ATT with no change in aCBV suggesting maximal dilation and reserves being accessed by faster ATT. aCBV was inversely related to haemoglobin.

857	Plasma 5	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*
		Blood transfusions are often administered for secondary stroke prevention in adults with sickle cell anemia (SCA). We utilized noninvasive MRI methods to evaluate how oxygen extraction fraction (OEF) and cerebral blood flow (CBF) adjust after transfusion in adults with SCA. OEF reduced on average, while CBF did not change significantly. The OEF reduction paralleled increases in hematocrit but was unrelated to the reduction in hemoglobin-S. This implies that most patients receiving transfusions operate near autoregulatory reserve capacity even after transfusion, and improving oxygen delivery by increasing hematocrit can be visualized noninvasively with OEF-MRI.

858	Plasma 6	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*
		High-resolution vessel wall imaging(HR-VWI) is an novel technique used to assess intracranial artery stenosis, and it has been useful in clinical practice. In addition, time-to-maximum (Tmax) maps, derived from PWI, are increasingly being used in studies of ischemic stroke, such as EPITHET and DEFUSE-2 . Our study aimed to investigate how the degree of stenosis of the MCA or ICA affects brain tissue perfusion. The results showed that the degree of MCA or ICA stenosis was positively correlated with the Tmax delay volume, and different degrees of ICA or MCA stenosis presented with different perfusion delay volumes.

859	Plasma 7	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*
		Our goal was to evaluate a multi-delay, pseudocontinuous arterial spin labeling (ASL) approach to detect focal delayed cerebral ischemia in patients with vasospasm. We show that inferences on vascular origins based on ASL and standardized perfusion territories correlated well with expert reader reads that rely on an invasive catheter-based digital subtraction angiography (DSA) examination. Importantly, ASL identified possible ischemic zones due to distal vasospasm, which are nearly undetectable on conventional DSA. Thus, use of ASL may prevent unnecessary DSA examinations and improve patient prognosis.

860	Plasma 8	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
		Perfusion imaging plays an important role in management decisions for a variety of cerebrovascular diseases. Most clinical perfusion MRI of stroke requires the use of contrast agent. However, contrast-agent perfusion cannot be used or fails to be used in 10-20% of patients. Therefore, an alternative technique to Gd-perfusion will benefit a substantial number of patients in clinical practice. Recently, a MR-Fingerprinting (MRF) ASL was developed for simultaneous estimations of CBF and bolus timing. In this study, we demonstrated the clinical utility of MRF-ASL in two types of cerebrovascular diseases, ischemic stroke and Moyamoya disease.

861	Plasma 9	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
		The detection of intracranial AV-shunts may be difficult with non-invasive imaging. Due to the nature of spin-labeled protons, ASL-based MRA is likely to be highly specific for AV-shunting. We sought to determine the sensitivity and specificity of ASL-based MRA in a group of 32 patients, among those 14 with AV-shunts. Furthermore, the diagnostic performance for vascular pathology not associated with AV-shunting was assessed. We found ASL-based MRA to be more specific with an equivalent sensitivity compared to a clinical MRA-exam for intracranial AV-shunts. All vascular pathology not associated with AV-shunting were detected with ASL-based and clinical MRA.

862	Plasma 10	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
		The aim of our study was to investigate the plaque characteristics and the lenticulostriate artery (LSA) status in artery-to-artery (A-to-A) embolism and branch atheromatous disease (BAD) using whole-brain high-resolution MRI. The results showed that patients with A-to-A embolism presented more frequently hyperintense plaques (HIP), plaque surface irregularity, and severe stenosis than patients with BAD. A significant reduction in the number and lengths of LSA branches in patients with BAD compared to A-to-A embolism was also found. Multivariate analysis further demonstrated that HIP was independently associated with A-to-A embolism, whereas the reduction in LSA branches was independently associated with BAD.

863	Plasma 11	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
		Traditional pulsed ASL (PASL) suffers from arterial transit delay (ATD) effects, often resulting in inaccurate perfusion measurements in cerebral ischemia. Velocity selective ASL (VSASL), on the other hand, accurately measures perfusion independent of ATD. In this study, we compare VSASL and PASL perfusion in 27 patients with suspected cerebral cortical ischemia. Normal perfusion on VSASL and PASL had nearly perfect negative predictive value for ischemia, abnormal PASL perfusion had a high false positive rate for ischemia (25-35%), and abnormal VSASL perfusion had a ~0% false positive rate for ischemia.

864	Plasma 12	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
		Intravoxel Incoherent Motion (IVIM) MR perfusion is of particular interest in stroke because it derives intrinsic microvascular perfusion information, and might therefore include information regarding collateral blood flow without being influenced by time delay in blood arrival, which is a limitation of other perfusion techniques. In this preliminary work in 23 patients with hyperacute stroke, we found the IVIM microvascular perfusion paramteters were significantly reduced in the infarct core but not in the penumbra, compared to the contralateral side, suggesting that at time of imaging, microvascular perfusion is maintained through collateral blood flow in the penumbra.

865	Plasma 13	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
		In the present study, we demonstrated the utility of superselective 4D-MR angiography with pCASL combined with CENTRA-keyhole (SS-4D-PACK) for the visualization of brain AVMs. This method enables a time-resolved and vessel-selective angiography within 5 minutes without a use of contrast agents. It was showed that almost perfect vessel selectivity was achieved with SS-4D-PACK. Although CNRs were slightly reduced in SS-4D-PACK due to a labeling loss during superselective label focusing, this was acceptable since visualization was well preserved. SS-4D-PACK can be a non-invasive clinical tool for assessing brain AVMs.

866	Plasma 14	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
		Intracranial atherosclerotic stenosis (IAS) remains at risk of recurrent ischemic events despite intensive medical management. Cerebrovascular reactivity (CVR) assessed by hypercapnic challenge using BOLD functional MRI (CVR BOLD fMRI) estimates cerebrovascular reserve and may allow to identify patients at higher risk of recurrent ischemic events. 19 patients referred for unilateral symptomatic IAS were studied to estimate the relationships between baseline characteristics, recurrence of ischemic events, and CVR. During follow-up, recurrent ischemic events were more frequent in patients with impaired CVR. CVR mapping may help to better select among IAS patients those at higher risk to discuss additional treatment.

867	Plasma 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
		The early stage of hemodynamic failure in ischemic cerebrovascular diseases is characterized by diminished cerebrovascular reserve. Tissues at this stage are at high risk for stroke. Assessment of cerebrovascular reserve by cerebrovascular reactivity (CVR) measurement usually requires the administration of vasoactive challenges (e.g., acetazolamide or CO2), which is often difficult or impractical in stroke patients. In this study, we demonstrate that CVR can be mapped in stroke patients without a physiological challenge but using the natural fluctuations of the resting-state BOLD signal. Results indicate that this technique can assess CVR in lesion, peri-lesional, and healthy tissue in a reproducible manner.

Electronic Power Pitch Poster

Poster: fMRI: Signal Characteristics & Analysis

Power Pitch Theater B - Exhibition Hall	Wednesday 17:15 - 18:15

868	Plasma 16	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
		Previously we have reported that fluctuations in fMRI signals at approximately 0.1Hz are highly correlated with blood pressure fluctuations at the same frequency. A multi-echo resting-state fMRI experiment was performed at 7T to separate the effect of changes in transverse relaxation (R_2*) and longitudinal magnetisation (S_0) in these fluctuations. We demonstrate that the magnitudes of correlations with blood pressure are significantly greater for R_2* signals, compared with corresponding S_0 signals. These data suggest that there is a significant proportion of BOLD dependent signal variance in fMRI that is of non-neuronal origin.

869	Plasma 17	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
		We applied a novel time-regression analysis to hypercapnic BOLD imaging data in a cohort of moyamoya patients with progressive steno-occlusion of the intracranial arteries before and after surgical revascularization with the overall goal of elucidating gray and white matter differences in cerebrovascular reactivity (CVR)-weighted responses and vascular compliance time measures. We observed differences between gray and white matter reactivity time delays, as well as depth-dependent differences in reactivity and time delays within the white matter. Additionally, we observed that the improvement in both white and gray matter hemodynamics following surgical revascularization was closely related to pre-surgical CVR-weighted metrics.

870	Plasma 18	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
		fMRI is noisy and suffers from signal origin ambiguities. We propose a straightforward method that can classify the origin of neurally- and non-neurally-driven signal fluctuations by means of simultaneously acquired BOLD and CBV fMRI-data. For neurally-driven fMRI-signal fluctuations, BOLD and CBV are synchronized. For non-neurally-driven fluctuations, however, abnormal temporal correlations are seen. Upon identification of the non-neural components, they can be filtered out. This helps to remove artifacts and improve the specificity and interpretability of fMRI activation maps. Moreover, we show that it can remove venous signal components in ultra-high-resolution fMRI and improve the spatial specificity across cortical laminae.

871	Plasma 19	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

		Information processing in the brain occurs through a hierarchy of temporal receptive windows (TRWs). Anesthetic drugs induce a reversible suppression of consciousness and thus offer a unique opportunity to investigate the state-dependence of TRWs. Here we demonstrate that sedation with propofol is accompanied by the prolongation of the brain's intrinsic functional timescales, i.e. enlarged TRWs. This is accomplished by an increase of local and regional signal synchronization, which in turn disrupts information exchange among distant brain regions. Finally, we show that the brain's information processing timescales exhibit distinct dynamic signatures in sedation, deep anesthesia, and disorders of consciousness.

872	Plasma 20	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
		Athletes involved in collision sports can sustain up to ~1400 head impacts, within a single season. In this study, we explore the physiological nature of sub-concussive impacts using a calibrated MRI method, which combines hypercapnic and hyperoxic breathing manipulations. Collegiate football players were scanned at pre-season baseline and following three weeks of practices and one game. Relative to baseline, we observed global increased resting oxygen extraction fraction (OEF_0) and cerebral metabolic rate of oxygen consumption ($CMRO_{2|0}$) in the grey-matter, with significant differences found within the frontal lobe (P<0.05). These results emphasize the need to regulate exposure to head impacts in sports.

873	Plasma 21	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
		Existing studies have reported various results regarding $CMRO_2$ behaviors during hypoxia. In this study, a simultaneous acquisition of CBV, CBF and BOLD signals was implemented to evaluate task-induced $\delta CMRO_2$ under both normoxia and hypoxia conditions. Of 40 subjects who completed two runs of block-designed, black-and-white checkerboard visual tasks (normoxia and hypoxia) and a CO_2 challenge, we found $\delta CMRO_2$ increase significantly during hypoxia. We reckon that the simultaneous acquisition technique makes it possible for all necessary data to be acquired in one run of task, thus minimizing motion and physiological artifacts caused by separate data acquisitions through task repetitions.

874	Plasma 22	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
		In order to combat overfitting in computational encoding models, one method is to reduce the number of fit parameters. In population receptive field (pRF) mapping, a haemodynamic response function (HRF) is parameterized from the fMRI timeseries, and this may inflate model fits (r^2). Here, we show that measured HRF estimates from a brief set of separate HRF measurement scans can be included in the pRF fitting procedure, reducing the degrees of freedom. We show that model fits between our "HRF-informed" pRF and the traditional fitted HRFs are comparable, suggesting that this method is more representative of the ground truth.

875	Plasma 23	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
		The functional architecture of temporal frequency preference of human visual system is not well characterized. We collected fMRI data with visual stimuli varying flicker frequency from 1 to 40 Hz. Using model fit and K-means clustering on frequency tuning curve we were able to show evidence for a temporal frequency specific architecture of visual system.

876	Plasma 24	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

		A probabilistic atlas of the digit representations of the left and right hand in primary somatosensory cortex is formed. The atlas is generated in volume and surface standardized space from somatotopic maps of 21 right-handed subjects obtained using a travelling wave paradigm with vibrotactile stimuli. Metrics quantify the likelihood of a given position being assigned to a digit (full probability map) and the most probable digit for a position (maximum probability map), with the atlas validated using a leave-one-out cross validation procedure. This probabilistic atlas quantifies variability in healthy subjects and can be used as a reference in patient studies.

877	Plasma 25	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
		This study is aimed to apply a newly developed machine learning approach to predict individual motor performance from resting state functional MRI. Our data demonstrate that resting state fMRI even using conventional EPI protocols can predict individual motor performance. Our results suggest that the novel machine learning model could more accurately predict motor function at the individual level, compared to the independent component analysis method.

878	Plasma 26	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
		Principal component analysis is commonly used in data fusion for dimension reduction prior to performing fusion analysis. However, PCA does not address that a large proportion of voxels may be irrelevant to extract joint information in data fusion. We implemented sparse PCA to suppress irrelevant voxels while simultaneously reducing the data dimension. Results show that introducing sparsity to data fusion provides better group discrimination.

879	Plasma 27	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
		Aimed at studying the nature of voxel-wise interactions in the brain, this study finds the evidence of dense functional connectivity in the brain using resting state fMRI data from over 700 subjects. To study the nature of these interactions, we used a bipartite graph embedding algorithm on the connectivity network obtained with multiple pre-processing strategies with respect to global signal regression. We also analyzed interactions between and whithin grey and white matter. The results point to a dense non-bipartite network covering 74.63% of the brain leading to new insights towards understanding the human functional connectome.

880	Plasma 28	Matrix Tri-Factorization for BOLD-fMRI
		Michael Hütel[1], Andrew Melbourne[1], and Sebastien Ourselin[1]
		[1]UCL, London, United Kingdom
		We present Matrix Tri-Factorization as a means to obtain an individual's BOLD-fMRI decomposition into unique neuronal activation patterns, spatial network maps and their corresponding hemodynamic response functions. We validate our proposed method on the motor cortex localization task of the Human Connectome Project 1200 Subject Release and show that neural activation patterns from our proposed Unsupervised Machine Learning technique resemble the given motor task profiles.

881	Plasma 29	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
		In the fMRI literature, most authors reported solely the significance of their findings which hampered the critical interpretation of the found results and power analyses for subsequent studies. To reveal the effect size and overlap between individual subject activation maps, we reanalyzed data from multiple fMRI studies. For each of the 44 contrasts tested, our study revealed fairly strong effect sizes and reasonable overlap between the individual results. However, the overlap between the individual results and the results of the corresponding group analysis was rather poor. This observation supports the call that reporting significance solely, is not enough.

882	Plasma 30	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
		Cerebral venous oxygenation (Y_v) is an important physiological parameter and has potential clinical application in many diseases. T_2-relaxation-under-spin-tagging (TRUST) is a commonly used MRI method to measure Y_v. Harmonization of TRUST across MRI vendors is important for dissemination and multi-center studies of brain oxygenation as a disease biomarker. In this work, we harmonized TRUST pulse sequence components and imaging parameters across two major MRI vendors, Philips and Siemens. We showed that Y_v measured on the two vendors were highly compatible and strongly correlated, had excellent reproducibility, and can reliably detect oxygenation changes associated with physiological challenges on both scanners.

Electronic Power Pitch Poster

Poster: Neurodegeneration

Power Pitch Theater A - Exhibition Hall	Thursday 9:00 - 10:00

973	Plasma 1	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
		In order to investigate the likely progression of neurodegeneration in amyotrophic lateral sclerosis (ALS) patients, we applied a novel mathematical model to multi-site diffusion MRI data. Our results indicate directional evolution of disease in the corticospinal tracts (CSTs) of ALS patients, in a distal to proximal manner.

974	Plasma 2	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
		Staging system for ALS is important for clinical practice. Howerer, the validation of the mechanism that underneath the proposed stages in ALS remains unclear. We used surface-based cortical morphology and more precise anatomical evaluation for 72 patients at different stages and 88 controls, confirmed the consecutive involvement of cortical thinning in PrG along disease progression. Moreover, the extensive but similar PrG involvement in patients at stage 2 and stage 3, highlighted a critical therapeutic window from stage 1 to stage 2, and also underlined the incorporation of cortical evaluation as additional features to King's clinical stages for promising clinical management.

975	Plasma 3	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
		Amyotrophic Lateral Sclerosis (ALS) is a fatal disease, but no fully validated and clinically specific biomarkers have been identified yet. We studied the brain entropy (BEN) of ALS patients using resting state functional magnetic resonance imaging (rs-fMRI) on fifty-six ALS patients without cognitive impairments and forty-six age- and sex-matched healthy controls. We found increased low frequency entropy in SMA/SMF and increased whole frequency entropy in precuneur/PCC regions in ALS patients. The results may improved our understanding of ALS and provide new biomarkers for diagnosis of ALS.

976	Plasma 4	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

		Huntington's disease (HD) is a neurodegenerative disease caused by a single genetic mutation. Neurovascular abnormalities have been implicated in the pathophysiology of HD. Here, dynamic responses in BOLD, cerebral-blood-flow (CBF) and -volume (CBV) during visual stimulation were measured using 3D-TRiple-acquisition-after-Inversion-Preparation (3D-TRIP) MRI in premanifest HD patients and healthy controls, from which cerebral-metabolic-rate-of-oxygen ($CMRO_2$) response was estimated. Decreased $\Delta CMRO_2$ and increased ΔCBV were observed in HD patients compared to controls, which correlated with genetic measures. The results suggested potential value of $\Delta CMRO_2$ as a biomarker for HD, and may shed light on the pathophysiology in HD in terms of mitochondrial deficiency.

977	Plasma 5	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
		Survivors of acute lymphoblastic leukemia (ALL) can develop neurocognitive deficits and leukoencephalopathy. On-therapy and follow-up MRI examinations of the brain for 173 ALL survivors were reviewed for leukoencephalopathy. At follow-up, the survivors also underwent neurocognitive testing and brain diffusion tensor imaging (DTI). DTI parameters were associated with leukoencephalopathy in multiple regions of the brain. Although there were no associations between neurocognitive performance and leukoencephalopathy, increased mean diffusivity (MD) in certain fiber tracts was associated with neurocognitive impairment. DTI, in particular MD, may better detect loss of white matter integrity associated with neurocognitive deficits in ALL survivors than leukoencephalopathy.

978	Plasma 6	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

		In this study a CO_2-challenge was applied to test the effect of amyloid deposition in HCHWA-D, a hereditary form of cerebral amyloid angiopathy (CAA), on the cerebrovascular reactivity (CVR). With dual echo arterial spin labeling, providing cerebral blood flow (CBF) and BOLD images, the CVR was measured in grey and white matter and the CO_2-challenge was evaluated as a whole brain biomarker. The effect of the CO_2-challenge was best measured with CBF in the grey matter. Future research should prove whether it is sensitive enough to detect treatment induced changes in (pre-)symptomatic CAA patients.

979	Plasma 7	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
		Around 200,000 veterans of the 1991 Gulf War (GW) suffer from GW illness (GWI), which is characterized by multiple deficits in cognitive, emotion, sensory and interoception domains. In this study we examined resting state fMRI data from 23 GWI patients and 30 age-matched controls with group independent components analysis (ICA). Deficits in neurocognitive assessment scores of different brain function domains in GWI veterans strongly correlated with impaired functional connectivity within and between specific brain function networks engaged during performance of the corresponding neuropsychological tests, thereby elucidating brain mechanisms underlying cognitive deficits in GWI.

980	Plasma 8	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
		The recently discovered glymphatic system has become an exciting area of research because of it plays an important role in neurological diseases. However, the interaction between the vascular and the glymphatic systems in terms of waste clearance from the brain is not clear. In addition to the glymphatic system, our preliminary MRI results suggest that the venous system involves in waste removal and waste clearance increases after diabetes. Current study provide the first investigation of the interaction between the vascular and the glymphatic systems in brain waste clearance after diabetes.

981	Plasma 9	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
		A major neurochemical regulator of the thalamocortical network is GABA. We used J-edited MRS with compartment correction to evaluate the pharmacological effect of Dopamine agonist (DAA) therapy on thalamic GABA in patients with Parkinson's disease (PD). Our findings suggest that DAA alters GABA release in PD patients, and that medication-induced changes may be associated to the presence of impulsive behaviors. These results provide evidence that J-edited MRS can be used to measure subcortical neurotransmitter concentration non-invasively, allowing the investigation of the pharmacological effects in GABAergic activity in humans.
982	Plasma 10	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
		The herbicide paraquat (PQ) is believed to have a neurotoxic role in the development of Parkinson's disease (PD) as there is increased risk of exposure in rural areas. The HFEH63D polymorphism has been shown to cause brain abnormalities and disrupt iron homeostasis, key components of PD etiology. This work hypothesized that HFEH67D carrier status would augment PQ induced PD histological and imaging metrics. The R2 and histology data from PQ treated mice provide evidence that PQ had a marked effect in the WT but not HFEH67D mice, suggesting that the H67D polymorphism imparts a neuroprotective role in PD.
983	Plasma 11	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

		Mild cognitive impairment in Parkinson’s disease (PD-MCI) is one of the most significant risk factors for Parkinson’s disease dementia. In this study, we defined proton magnetic resonance spectroscopic imaging (1H-MRSI) based biomarkers of PD-MCI. After chemical shift misregistration correction and registration to MNI152 brain atlas of multi-voxel 1H-MRSI data, 101 regions defined in MNI structural and Harvard-Oxford cortical and subcortical structural atlases were analyzed for metabolic differences between PD-MCI, cognitively normal PD (PD-CN) and healthy controls. Temporal occipital fusiform cortex, and posterior divisions of parahippocampal gyrus and right temporal fusiform cortex were indicated as the main regions for metabolic differences.

984	Plasma 12	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
		To use graph theory approaches and high resolution T1-weighted structural magnetic resonance imaging to explore the brain grey matter morphological network in patients with Parkinson's disease (PD). The individual morphological brain networks were constructed by estimating interregional similarity in the distribution of regional grey matter volume of 90 brain regions. The higher clustering coefficient and local efficiency in the PD patients relative to healthy controls were found, indicating that brain morphological networks are closer to regularization, which was different from previous functional connectome studies, suggesting relatively fixed structural network organization can produce diverse functional network patterns.

985	Plasma 13	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

		6-hydroxydopamine (6-OHDA) striatal lesion is a well-established rat model of early-stage Parkinson's disease. The aim of the study was to compare connectivity patterns between 20 6-OHDA lesion rats and 10 sham controls under urethane anesthesia, modelling natural sleep, by using functional magnetic resonance imaging (fMRI). We found that functional connectivity patterns were disturbed in lesion animals. The decrease in functional connectivity, however, occurred only in rapid eye movement (REM)-like state. Furthermore, thalamocortical functional connectivity was correlating with striatal dopamine depletion ratio, making these changes possible early diagnostic markers for Parkinson's disease.

986	Plasma 14	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
		We investigated cerebellar deficits in dual-motor-tasking in Parkinson's disease (PD) patients. Eighteen PD patients (scanned ON and OFF dopaminergic medication) and 18 matched controls performed simultaneous finger movements in a coupled or individuated fashion, and with different visual cues at 3T. We showed that cerebello-striatal network interactions play a role in symptomatic dual tasks in PD, and is influenced by dopaminergic medication. Our data suggest that cerebellar-striatal loop is involved in planning fine dexterous tasks without interacting with the cortical motor areas.

987	Plasma 15	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

		We used quantitative multimodal MRI to investigate the region-specific damage in progressive supranuclear palsy (PSP) in order to generate a precise in-vivo model of neurodegeneration at various levels of the central nervous system. Additionally, we aimed to test the markers for differentiating the PSP from Parkinson disease (PD) patients and from healthy subjects. PSP patients showed extensive volume decrease and microstructural diffusion changes in the brainstem and the basal ganglia in agreement with previous pathological studies. These results suggest the possibility of direct non-invasive assessment of brain damage in PSP even in small brainstem nuclei.

Electronic Power Pitch Poster

Poster: Body: Power Potpourri

Power Pitch Theater B - Exhibition Hall	Thursday 9:00 - 10:00

988	Plasma 16	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
		The success of lung volume reduction with endobronchial valves in patients with Chronic Obstructive Pulmonary Disease (COPD) depends on the absence of collateral ventilation into the target lung segment. Collateral ventilation can be assessed using time-resolved ^{3}He MRI, but providing this clinical application with ^{129}Xe MRI would be desirable. Two patients with severe COPD were scanned with time-resolved ^{3}He and ^{129}Xe MRI. In both patients, collateral ventilation visualised using ^{3}He MRI was not observed with ^{129}Xe MRI. Although the small sample size is a limitation, this suggests that ^{129}Xe MRI may not be suitable for the assessment of collateral ventilation.

989	Plasma 17	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

		Neonatal airway malacia (dynamic larynx, trachea, and/or bronchi collapse) is a common airway complication often associated with preterm birth and congenital abnormalities but has not been extensively studied. This condition is currently diagnosed through visual bronchoscopy, which can be unreliable and poses increased risks to patients. We address these issues with an innovative technique using retrospectively respiratory-gated ultrashort echo time MRI and geometric analysis of moving airway anatomy for regional, quantitative evaluation of dynamic airway collapse in quiet-breathing, non-sedated neonates. This method has the potential to yield more accurate and objective assessment of neonatal airway collapse than current techniques allow.

990	Plasma 18	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
		Intrauterine growth restriction (IUGR) is associated with impaired placental metabolism and transport. Hyperpolarized carbon-13 ($HP^{13}C$) MRI was used to detect metabolic differences between control and IUGR placentae in pregnant guinea pigs, and to determine the impact of maternal hyperoxygenation on placental metabolism. Area under the curve (AUC) was calculated for lactate, alanine, and bicarbonate and expressed as a ratio relative to pyruvate AUC. The ratio of alanine to pyruvate AUC decreased significantly in IUGR versus control placentae. Maternal hyperoxygenation resulted in significant increases in ratios of alanine and bicarbonate to pyruvate AUCs for both control and IUGR placentae.

991	Plasma 19	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

		Deuterium Metabolic Imaging (DMI) is a novel approach providing high 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 liver glycogen synthesis in rats and human subjects. In rats at 11.7T, DMI revealed differences in liver glycogen synthesis between glucose administrations through an intravenous and intraperitoneal route. At 4T, we showed that DMI is feasible in humans and could detect labeling of liver glycogen after oral intake of [6,6'-$^{2}H_2$]-glucose.

992	Plasma 20	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
		Multishot imaging has been shown to provide high resolution diffusion-weighted images (DWIs) with reduced distortion, however, significant aliasing artifacts and signal cancellation still occur due to the mismatch of the motion-induced phase between different shots. Several proposed SENSE-based methods without using navigators work well for brain DWI. However, these methods may fail when phase variations are more complex, in body DWI. In this work, we circumvent the challenging phase estimation step and efficiently solve this problem by using a locally low-rank reconstruction approach. The proposed reconstruction enables high resolution imaging with reduced geometric distortion compared with other approaches.

993	Plasma 21	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

		Two different convolutional neural network architectures were applied to differentiate subtype breast cancer based on 5 DCE-MRI time frame images: (1) a conventional serial convolutional neural network; (2) a convolutional long short term memory (CLSTM) Network. In addition, a logistic classifier was trained using morphology and texture features, selected using a random forest algorithm. For CNN, a bounding box based on the automated tumor segmentation was used to create a cropped image of the tumor as network input. A total of 94 cancers were analyzed, including 14 triple negative, 29 HER2-positive, and 51 Hormonal-positive, HER2-negative. Upon 10-fold validation, the differentiation accuracy is 0.81-0.86 using serial CNN, and 0.88-0.95 using the CLSTM.

994	Plasma 22	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
		This prospective study included 37 patients with 39 breast lesions. DWI images were acquired at 2 b values (200, 1500s/mm²) on a 3T-MRI scanner with a dedicated 16-channel breast coil. From the images a non-Gaussian diffusion based absolute quantitative biomarker, so-called Signature Index (S-index), was calculated by comparing tissue signals to a library of tissue reference signals to provide a classification of tumor types. The median S-index for malignant lesions was significantly higher ($p < 0.0001$) than for benign lesions, and the overall S-index diagnostic performance was significantly higher than BI-RADS (AUC=0.96 and 0.83, respectively), without contrast agents.

995	Plasma 23	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
		When applying MR elastography (MRE) in pancreas, the waves propagated in individuals with high Body Mass Index (BMI) tend to travel longer distances with more challenges. In this study, we performed MRE in 18 obese subjects before and after an administration of a 75 g oral glucose load (OGL), and we found that 40Hz had better wave image quality than 60Hz and was more sensitive to detect the stiffness decrease after OGL.

996	Plasma 24	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
		L-carnitine acts as a buffer of acetyl-CoA units in the mitochondria, as well as facilitating transport of fatty acids. In addition, L-carnitine levels are decreased in the diabetic heart. The purpose of this study was to investigate the effect of L-carnitine supplementation on cardiac function and metabolism in the diabetic rat heart. We show that daily injections of L-carnitine can alter cardiac metabolism in the *in-vivo* diabetic rat heart, and can improve functional recovery as well as fatty acid oxidation rates post ischemia. Such studies allow a better understanding of the interactions between metabolism and function in the diabetic heart and may provide new insight into novel therapeutics.

997	Plasma 25	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
		Elastography techniques for staging liver fibrosis assess the right liver and require additional hardware. MRI cine-tagging evaluates the strain of liver tissue and shows promise for staging liver fibrosis without additional hardware. It can be performed routinely during MRI examinations. Strain showed high correlation with fibrosis stages (ρ = -0.60, P < 0.001). AUC was 0.78 to distinguish fibrosis stages F0 vs. ≥ F1, 0.78 for ≤ F1 vs. ≥ F2, 0.87 for ≤ F2 vs. ≥ F3, and 0.87 for ≤ F3 vs. F4. Larger studies in cohorts with specific liver disease are required to validate this technique.

998	Plasma 26	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

		Abdominal T2-weighted imaging is conventionally lengthy, but single shot approaches significantly improve current acquisition times. For single shot fast spin echo (SSFSE), axial imaging speed and sharpness are constrained by limited parallel imaging acceleration. Here, SSFSE technique with wave encoding and variable-density sampling (wSSFSE) was developed to enable higher accelerations and improve overall image quality. The purpose of this study is to assess image quality, delineation of anatomical structures, lesion conspicuity, and speed improvements with wSSFSE.

999	Plasma 27	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
		We present an automated approach to liver lesion segmentation in abdominal MRI scans. We use a 3D fully convolutional neural network to segment liver lesions; segmentations are then used to estimate longest linear diameter (LLD) and volume. We show that the median LLD error is 2.01 mm and that these estimates are within limits of clinically usability as part of a semi or fully-automated workflow. Automating lesion segmentation may pave the way for tracking lesion volume and tumor burden as well as treatment response.

1000	Plasma 28	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
		Non-Cartesian acquisitions combined with parallel imaging and compressed sensing have been proposed for high spatial and temporal resolution free breathing motion robust 4D contrast enhanced applications. While these approaches provide substantial reduction of contrast blurring and motion robustness, the sampling in itself may still provide limitations to capture the temporal image content. Our approach focuses on the optimization of the 4D sampling strategy with a unique 4D variable density, elliptical-centric radial stack of stars sharing approach. This approach reduces not only the minimum scan time of the 4D scan but also provide possibilties to optimally adjust and capture temporal information like motion and contrast enhancement.

1001	Plasma 29	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
		Higher-resolution prostate DWI has the potential to improve prostate cancer diagnosis, but suffers from additional SNR reduction due to increased TE at longer EPI readouts for current diffusion encoding schemes. In this work, we evaluated the newly proposed Eddy Current Nulled Convex Optimized Diffusion Encoding to achieve eddy-current-free diffusion encoding with minimized TE for prostate diffusion MRI using standard and higher-resolution protocols. The ENCODE higher-resolution protocol achieves higher scores for image sharpness and contrast compared to standard-resolution prostate DWI.

1002	Plasma 30	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
		Prostate cancer can be detected using a multi-component T2 mapping technique termed luminal water imaging (LWI). The purpose of our study is: i) to accelerate the LWI acquisition by using inner volume selection (IVS) in GRASE and ii) to assess the accuracy of estimated T2 values and fractions. Simulations, phantom and in-vivo prostate experiments were performed. Results show that the estimated parameters should be interpreted with caution in noisy scenarios and at low fractions of the long T2 component. Results demonstrate that GRASE with IVS is effective for accelerating prostate LWI by at least a factor of three.

Electronic Power Pitch Poster

Poster: Tissue Microstructure

Power Pitch Theater A - Exhibition Hall	Thursday 14:15 - 15:15

1092	Plasma 1	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
		Despite MRI's coarse resolution, diffusion MRI (dMRI) enables probing cellular microstructure. Advanced dMRI acquisition and biophysical modeling can provide microstructural metrics related to disease processes, and spherical harmonics (SH)-based orientation distribution function (ODF). Yet, these still need structural validation, and a gold standard for quantifying microstructure, particularly fiber dispersion, is missing. X-ray scattering directly probes tissue microstructure, exploiting the ~17nm myelin repeat distance, and can also represent ODF in a SH basis. Here, we show good correspondence between SH coefficients from dMRI and X-ray scattering on a mouse brain, with analysis on human samples and histological validation to follow.

1093	Plasma 2	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
		Non-vanishing excess kurtosis and diffusion-time dependence are two key hallmarks of non-Gaussian or restricted water diffusion in complex brain tissue microenvironments. However, the relation between diffusional kurtosis and diffusion time in the brain remains elusive. In this work, we investigated the time-dependence of diffusional kurtosis in the mouse brain using pulsed- and oscillating-gradient (PGSE and OGSE) diffusion kurtosis imaging (DKI). The results of this work reveal unique tissue contrasts based on the time-dependence of diffusional kurtosis in both gray and white matter, with sensitivity to probe region-selective microstructural changes due to cuprizone-induced demyelination.

1094	Plasma 3	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

		The use of term “neurites” implies that many biophysical models of diffusion in the white matter can be applied in the gray matter as well. However, the validity of representing dendrites as a collection of zero-radius impermeably sticks, a widely adopted representation of myelinated axons, has not been evaluated yet. By evaluating the diffusion-weighted signal decay as a function of the $$$b$$$-value up to $$$b=25000\,\mathrm{ms/\mu\,m^2}$$$ in the living human brain, we show that a more accurate representation of the diffusion in neuronal processes in the gray matter must account for a fast proton exchange between the intra- and extra-cellular compartments.

1095	Plasma 4	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
		Lung morphometry parameters can be derived from multiple b-value hyperpolarized gas diffusion-weighted (DW)-MRI using the cylinder (CM) and stretched exponential (SEM) models. Mean alveolar diameter (L_{Alv}) and diffusive length scale (Lm_D) are calculated from the CM and SEM, respectively. This work compares the parameters L_{Alv} and Lm_D derived from a range of subjects with both ^{3}He and ^{129}Xe DW-MRI. Excellent linear agreement is observed between the L_{Alv} and Lm_D parameters for both gases. This indicates these parameters are equivalently representative indices of mean alveolar diameter dimension within the range of experimental conditions considered.

1096	Plasma 5	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
		This study aims to open a new window onto brain tissue microstructure by proposing a new technique to estimate cell body (namely soma) size/density non-invasively. Using Monte-Carlo simulation and data from rat brain, we show that soma’s size and density have a specific signature on the direction-averaged DW-MRI signal at high b values. Simulation shows that, at reasonably short diffusion times, soma and neurites can be approximated as two non-exchanging compartments, modelled as “sphere” and “sticks” respectively. Fitting this simple compartment model to rat data produces maps with contrast consistent with published histological data.

1097	Plasma 6	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
		Here we implement a GPU-based Monte-Carlo simulation of diffusion to efficiently simulate diffusion-weighting in realistic, complex cellular structures such as astrocytes as directly derived from confocal microscopy. This opens new possibilities to better understand intracellular diffusion, validate diffusion models, and create dictionaries of intracellular diffusion signatures.

1098	Plasma 7	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
		Microstructural MRI provides non-invasive measures of the microstructure of white-matter axons, including diameter and g-ratio. These can theoretically be used to infer axonal conduction velocity (CV). However, several other morphological and physiological parameters also contribute to CV, which are not accessible through MRI. Using sensitivity analysis on a comprehensive model of axon electrophysiology, we test the feasibility of modelling CV and associated uncertainty using only MRI-accessible parameters. Results show 88.5% of the variance in CV is accounted for by axon diameter and g-ratio and uncertainty due to non-imageable parameters can be easily modelled by a simple linear function. When these measurements can be made reliably it is feasible to obtain estimates of axonal CVs from micro-structural parameters obtained from MRI.

1099	Plasma 8	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
		How to measure the intra-axonal diffusion coefficient in the normal human brain? This contribution reports on such a measurement performed with minimum model assumptions. The result is about $$$2\,\rm\mu m^2/ms$$$, which constructively limits the scope of acceptable biophysical models for interpretation of diffusion MRI in terms of tissue microstructure. A side finding is the width of axonal orientation distribution in the most coherent fiber bundles, which is estimated as $$$19^\circ$$$ for the standard deviation. The core of the method is the suppression of signal from water that can move in the plane transverse to the principal fiber direction.

1100	Plasma 9	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
		Advanced diffusion MRI acquisitions, such as double diffusion encoding (DDE), have been used to provide estimates of microscopic anisotropy, and the majority of DDE studies to date have acquired data at a single b-value. This study shows in simulations and ex-vivo experiments that the D(O)DE derived microscopic anisotropy metric strongly depends on the choice of b-value and proposes a multi shell estimation scheme which provides accurate measurements.

1101	Plasma 10	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
		Studying the diffusion MRI signal as a function of more experimental parameters allows to establish correlations between different chemical and physical properties and to disentangle different compartments. Such measurements are common in the field of physical chemistry to characterise heterogeneous media, but are rendered impractical on human scanners due to hardware limitations. Here, we leverage ultra-strong gradients to acquire a 5-dimensional in-vivo human brain correlation dataset, which allows the characterisation of microstructural features through unconstrained inversion.

1102	Plasma 11	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

		In this study, double diffusion encoding (DDE) MRI measurements of microscopic fractional anisotropy (μFA) are compared at two different echo times (TE). At longer TE, higher mean μFA values were measured in single fiber regions but not in crossing fiber regions. Consistent with prior work on the TE dependence of fractional anisotropy (FA) the largest differences were found in regions known to be highly myelinated such as the genu of the corpus callosum.
1103	Plasma 12	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
		We extend diffusion-weighted acquisitions using the stimulated echo acquisition mode (STEAM) to imaginary signals. In classical diffusion encoding, only real signals arise; however, for special applications of double diffusion encoding (DDE), complex signals arise, as shown here for diffusion pore imaging, a method that allows determining the shape of arbitrary closed pores filled with an NMR-detectable medium. It is shown that the phase information of complex signals is preserved under application of stimulated echoes: We show the analytically derived signal for DDE with STEAM and use Monte Carlo simulations for validation. Consequently STEAM can be employed for diffusion pore imaging.
1104	Plasma 13	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
		We demonstrate the feasibility of measuring diffusion exchange using Diffusion Exchange Spectroscopy (DEXSY), in yeast. We show data acquired from yeast suspensions with a 9.4 T Varian scanner using two different sets of DEXSY scan parameters in order to probe different diffusion lengths.
1105	Plasma 14	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
		Metastatic brain tumours constitute the majority of all brain tumours in adult population. Differentiation of metastases from primary brain tumours such as malignant gliomas may be a diagnostic problem and is important because of different treatment strategies. Recently, and advanced diffusion MRI method, diffusion kurtosis imaging, has been shown to provide information on tumour grade of cerebral gliomas. The purpose of this work was to study the potential of two non-Gaussian diffusion methods, including diffusion kurtosis imaging and gamma-distribution-function imaging, in differentiation of the brain metastases and high-grade tumours.

1106	Plasma 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
		We investigated effects on the diffusion MRI signal from harmonic and stochastic variations in the trajectories of thin axon-like structures. Trajectories with different types of variations exhibited characteristically different diffusion spectra (time-dependence) that, for low frequencies, bare similarities with those from restricted diffusion environments. Non-straight trajectories can thus bias axon diameter estimation. Results also indicated that observable effects of structural disorder may not be specific for extracellular diffusion but may also be found for intra-axonal spaces.

Electronic Power Pitch Poster

Poster: Preclinical fMRI: Neuroscience & Emerging Techniques

Power Pitch Theater B - Exhibition Hall	Thursday 14:15 - 15:15

1107	Plasma 16	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
		A multiple degree-of-freedom robotic controlling system was developed to guide the fiber optic targeting lateral hypothalamus in the rat brain inside the high field (14.1T) MRI scanner. Optogenetic activation of the LH leads to highly reliable functional fMRI activation patterns in the LH and its projecting regions including LPO, MPA, MPOL and StA across animals. The MgRA provides a MR-compatible brain intervention strategy to target deep brain nuclei for optogenetic activation or calcium recordings with high precision and flexibility.

1108	Plasma 17	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 Ayrancı[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
		Functional imaging studies in rodent have gained considerable momentum over the past years, holding the promise to provide a crucial translational tool to comprehend the functional signatures of the healthy and diseased brain. Mouse resting-state (rs-)fMRI has been adopted by numerous laboratories world-wide, yet, variations in equipment, animal handling and data analysis protocols render the comparison of results between studies difficult. We have carried out a multi-centre comparison comprising 12 mice rs-fMRI datasets analysed through a common pipeline and identified the major resting-state networks expressed across datasets. We provide a detailed investigation into the reproducibility and robustness of the protocols.

1109	Plasma 18	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
		Hippocampus plays a prominent role in central nervous system functions. It receives convergent projections and sends reciprocal divergent projections, forming an interactive cortico-hippocampal-cortical network. However, the precise brain-wide functional organization of different hippocampal activities along dorsoventral axis remains unknown. Using optogenetic fMRI, we revealed that functional organization of low frequency hippocampal activities along dorsoventral axis exhibits a gradual change from regions mainly involved in cognition and sensory processing to regions also involved in motor control and anxiety-related behavior. Additionally, hippocampal activities generally transit from long-range propagation to downstream cortical/subcortical regions to local intra-hippocampal propagation with increasing frequencies.

1110	Plasma 19	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
		fMRI is based on the dogma that neuronal activity couples to local hemodynamic changes; however, exceptions to this rule exist with little explanation why. Additional neurophysiological context, such as concurrent release of vasoactive neurotransmitters, is required to discern how other underlying factors contribute to evoked hemodynamic responses. Fast-scan cyclic voltammetry (FSCV) is a minimally-invasive technique capable of detecting neurotransmitters and tissue oxygen with high temporal and spatial resolution. Here, we design a multimodal platform to perform simultaneous fMRI and FSCV, prove its feasibility in vitro, and expand its use to characterize evoked oxygen detection in vivo.

1111	Plasma 20	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
		The sensory system is topographically organized by highly interconnected excitatory thalamo-cortical and interhemispheric cortical-cortical projections. However, little is known at present regarding the existence of spatiotemporal neural activity pattern(s) that may dictate the propagation of activity between cortices at both hemispheres. Here, we employed a novel paired-pulse optogenetic fMRI stimulation paradigm to reveal a temporally-specific neural activity pattern initiated from the somatosensory thalamus that could drive activity propagation from the ipsilateral to contralateral cortex. We found that propagation from the ipsilateral to contralateral somatosensory cortex was facilitated when paired optogenetic stimulation pulses were spaced at 100ms, but not 50ms.

1112	Plasma 21	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
		Pharmacological fMRI (phfMRI) is widely utilized to study the effect of specific drugs on brain circuitries and neurotransmitter systems. Some drugs induce elevations in *mean arterial blood pressure* (MABP) which can increase *cerebral blood flow* (CBF) and translate into *blood oxygenation level-dependent* (BOLD) effects. Dynamic autoregulation buffers abrupt changes in MABP to keep CBF relatively constant in a particular range, which was previously defined in rats as 60-120 mmHg and sanguinely applied to mice. By pharmacologically challenging and monitoring the MABP during fMRI we show that these limits of dynamic autoregulation do not apply to mice. Therefore murine phfMRI studies should be interpreted with caution.

1113	Plasma 22	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

		Here we present a novel approach to non-invasive neuromodulation that affects neuronal activity by delivering neurotransmitter chemicals to targeted areas of the brain. This is achieved by using focused ultrasound to open the blood-brain barrier in a targeted brain region such that a systemically injected neuroactive chemical will enter into the brain parenchyma only at the intended site. We demonstrate the proof of concept in a rodent model by delivering GABA to the somatosensory cortex to suppress activation from hindpaw stimulation, and by delivering glutamate to the thalamus to enhance activation downstream in the cortex from hindpaw stimulation.

1114	Plasma 23	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
		We demonstrate the experimental setup and the use of multispectral fiber-photometry during fMRI in vivo for concurrent measurements of GCaMP6f, CBV, and BOLD. The fluorescent intensity of GCaMP6f and Rhodamine B, a red fluorescent dye which represents CBV, increased during spontaneous motion in the freely moving animal. GCaMP6f, CBV, and BOLD increased when forepaw electric stimulation was given in the simultaneous fMRI and fiber-photometry. We conclude that simultaneous multispectral fiber-photometry and functional MRI is a powerful tool which has an advantage in both temporal and spatial dimensions. Rhodamine B could be a surrogate CBV indicator in the regions of interest.

1115	Plasma 24	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
		fMRI offers an excellent opportunity to study neural activations in the central nervous system. In this study, cerebral blood volume (CBV) fMRI with USPIO was used to measure simultaneous odorant and visual stimulation-induced neural activations in mice. Olfactory responses were observed in the olfactory bulb, anterior olfactory nucleus (AON), and piriform cortex (PC), while visual responses were observed in the lateral geniculate nuclei, visual cortex, and cingulate cortex. The neural phenomenon of “post-inhibition excitation rebound” was observed in the responses in AON and PC, and the fMRI phenomenon of “post-stimulus undershoot” was observed in the visual responses.

1116	Plasma 25	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
		The relationship between functional and structural connectivity strength in the brain remains uncertain. We compared high-field resting-state fMRI, diffusion-based tractography and neuronal tracer data to robustly characterize the rat connectome. Our study revealed that strong structural connectivity is not required for strong functional connectivity. We found distinct structure-function relationships at different hierarchical levels in the rat brain: functional connectivity strength correlated moderately with diffusion-based structural connectivity strength, but did not significantly correlate with neuronal tracer-based structural connectivity strength. Hereby we demonstrate the importance of examining or appraising connectivity at different hierarchical levels for reliable assessment of neural network organization.

1117	Plasma 26	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
		Most preclinical resting-state functional magnetic resonance imaging studies are performed in anesthetized animals, but the confounding effects of anesthesia on the measured functional connectivity (FC) are poorly understood. Therefore, we measured FC under six anesthesia protocols and compared the findings with data obtained from awake rats. Connectivity patterns obtained under propofol and urethane anesthesia were most similar to that observed in awake rats. FC patterns in the α-chloralose and isoflurane-medetomidine combination groups had moderate to good correspondence with that in the awake group. The FC patterns in the isoflurane and medetomidine groups differed most from that in the awake rats.

1118	Plasma 27	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

		The mechanisms behind spontaneous activations in the BOLD signal are not understood. Quasiperiodic patterns are reliably recurring spatiotemporal events that involve spontaneous fluctuations of brain regions. We hypothesize that quasiperiodic patterns are regulated by neuromodulatory inputs from a subcortical driver. Pharmaceutical modulation of the locus coeruleus resulted in reduction of the strength and frequency of quasiperiodic patterns in the BOLD signal. This indicates a direct relationship between the locus coeruleus and quasiperiodic patterns. These findings suggest that spontaneous activity in the brain may be arising from controlled neuromodulatory input, allowing for a clearer understanding of the mechanisms that drive it.

1119	Plasma 28	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
		Stimulus-driven and resting-state fMRI BOLD signals have previously been reported in the spinal cord to delineate its functional architecture. However, validation of these resting-state findings has yet to be performed. In this study, we compared spinal fMRI results with electrophysiology (LFP and spike activity) in non-human primates and found that 1) signals elicited by stimulation occur predominantly in the ipsilateral dorsal horn and only in the appropriate segments 2) resting-state dorsal-dorsal functional connectivity is significantly greater than that in dorsal-to-intermediate-gray-matter, and 3) resting-state functional connectivity is spatially constrained to two spinal segments.

1120	Plasma 29	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]
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		Diffusion fMRI (dfMRI) has been suggested as an alternative means for mapping activity more directly than its BOLD fMRI counterpart. However, it remains unclear whether dfMRI can deliver information not revealed by BOLD. Here, isotropic diffusion encoding dfMRI was used for mapping activity elicited by electrical forepaw stimulation. Data-driven analysis revealed that active voxels are localized within functionally distinct cortical units in dfMRI, while BOLD maps only evidenced widespread signals in the primary somatosensory cortex. Furthermore, dfMRI extracted the expected thalamocortical brain circuitry whereas BOLD fMRI did not, suggesting a potential role for dfMRI in direct detection of activity.

1121	Plasma 30	Orthonasal versus retronasal glomerular activity in rat olfactory bulb by fMRI
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		Animals perceive their olfactory environment not only from odors originating in the external world (orthonasal route), but also from odors released in the oral cavity while eating food (retronasal route). We delivered odorants via the orthonasal and retronasal routes and measured whole olfactory bulb (OB) glomerular activity responses by fMRI. Our fMRI BOLD activation maps from the whole OB revealed gross spatial activation patterns that are largely independent of stimulus route, except for lower efficacy of retronasal stimuli as compared to orthonasal stimuli. This different encoding likely alters the odor perception for food vs. smelling.