



Letter to the Editor

In Memoriam: Dr. Shoji Naruse (1945–2025)

Regretfully, **Dr. Shoji Naruse's** passing was announced in 2025. Dr. Naruse, a Japanese neurosurgeon and radiologist, made significant pioneering contributions to the early development of *in vivo* biomedical applications of NMR and MRI. Notably, he reported changes in proton (^1H) relaxation times in experimental cerebral edema, cerebral infarction, and brain tumors, and was the first to measure changes in energy metabolism in cerebral ischemic lesions using ^{31}P NMR. He also served on the editorial board of the MRI journal for many years and made significant contributions in its early stages.

Dr. Naruse led the establishment of an MRI research group centered at the Kyoto Prefectural University of Medicine in Japan, fostering strong collaborations with U.S. investigators, including Professor Michael Weiner at UCSF. He also made major contributions to the growth of both the **International Society for Magnetic Resonance in Medicine (ISMRM)** and its predecessor, the Society of Magnetic Resonance, serving as an ISMRM Fellow (2004) and a member of the Local Organizing Committee for ISMRM 2004 in Kyoto.

In 1979, Dr. Naruse and his colleagues successfully detected proton NMR signals in rat brain tissue, and subsequently organized a Kyoto-based research group focused on *in vivo* MRI. They conducted *in vitro* ^1H NMR relaxation time and spectral analyses of experimental cerebral infarctions, brain tumors, and post-surgery tissue specimens. Dr. Naruse was also the first to apply *in vivo* ^{31}P -MRS to experimental cerebral ischemia (*J Physiol*, 33, 1983; *Brain Res*, 296, 1984) and to report the detection of *N*-acetylaspartate (NAA) in the human brain (*Magn Reson Imag*, 4, 1986). He also revealed the potential of Mn as an MRI contrast agent by demonstrating manganese-induced relaxation time shortening in brain edema models (*Seminars in Neurology*, 6, 1986; *Neurotraumatology*, 4, 1981).

His pioneering work further extended metabolic analyses of brain tumors using ^{31}P -MRS for therapeutic evaluation (*Cancer Res*, 45, 1985; *Radiology*, 160, 1986). Remarkably, in 1986, he proposed the combined use of RF hyperthermia and MRS monitoring within an NMR system, which is equivalent to today's **theranostics** concept (*Proc Natl Acad Sci USA* 83, 1986).

Beyond basic research, Dr. Naruse expanded clinical applications of MRI. His passion contributed to the creation of the field of *in vivo* neuroscience. Using Shimadzu's superconducting MRI systems (0.5 T in 1984, and 2.0 T from 1986), his team successfully detected ^{31}P NMR spectra in human brains (*3rd SMRM*, 1984). He continued to investigate clinical applications of ^1H -MRS in brain tumors (*SMRM/ISMRM*, 1988–1996; *J Magn Reson*, 81, 1989), contributing to diffusion MRI (*JSMRM*, 1989; *Brain and Nerve*, 43, 1991; *J Magn Reson Imaging*, 3, 1993; *Radiology*, 203, 1997) and early-stage fMRI investigations (*Neurological Medicine*, 39(5), 1993).

In addition to his scientific achievements, Dr. Naruse devoted himself to mentoring numerous talented researchers and physicians who have gone on to play leading roles in the field of MRI worldwide. The co-authors of this tribute represent only a small fraction of those inspired by his vision, humanity, and “blaze of passion”. While deeply mourning his passing, his friends and “children,” who spiritually **resonated** with him, continue to contribute to the advancement of “Magnetic Resonance in Medicine” in Japan and around the world.

Today, Japan operates more than **7240 MRI scanners** (2021), representing the highest per-capita number in the world, allowing patient access not only in major urban medical centers, but also in regional hospitals. This accessibility to MRI is believed to be one of the factors contributing to Japan's world-leading life expectancy (84.46 years, *World Health Statistics 2025*, WHO). For Dr. Naruse's early recognition of the clinical potential of MRI and his leadership in translating biophysical principles into diagnostic and therapeutic practice, he is widely regarded as “**a Trailblazer of MRI**” in Japanese medicine.

With deepest gratitude,

Ichio Aoki, Chuzo Tanaka, Toshihiro Higuchi, Toshihiko Ebisu, Masahiro Umeda, Masaki Fukunaga, Yuki Mori, Yoshiharu Horikawa, Seiichi Furuya, Takaaki Tokumitsu, Tetsuro Takegami, Kei Yamada

In Memoriam: Dr. Shoji Naruse

On behalf of my family including our son Matt, our daughter Sara and my wife Barbara, we all wish to express our deepest condolences and sadness at the death of our dear friend, Shoji Naruse.

Shoji was a trained neurosurgeon. He told me that early in his career he developed a medical problem which prevented him from practicing neurosurgery in the clinical environment. Therefore, he decided to do research and he learned about the biological uses of NMR around 1980.

Shoji Naruse was one of the very first physicians in the world to recognize the potential of nuclear magnetic resonance to study the brain. His very early studies showing that ^{31}P NMR spectroscopy could detect changes in the brain after stroke was a pioneering and very highly impactful work. In my opinion, much of what today we call “neuroscience” comes out of Shoji's innovative and pioneering studies.

Our family was privileged to meet with Shoji and his family during

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our first trip to Japan in about 1986, and he arranged for a very memorable visit of our family to view the special garden in the Kiyomizu Dera Temple in Kyoto. We have never forgotten this special experience and we still remember this as one of the special events for our family.

I was honored that Shoji chose to spend his Sabbatical year working with me in my laboratory at the University of California in San Francisco. We remember very special times when Shoji brought his entire family, including his two young children to our home in Mill Valley. We always laugh when we remember how well-behaved Japanese children were, in contrast to the often-noisy behavior of American children.

After Shoji returned to Japan, he arranged for a number of young physicians to come to San Francisco to work with our team including Andrew Maudsley. My wife and I often met with Shoji and visited his home during some visits to Kyoto.

Shoji had a particular interest in MR Spectroscopy, in contrast to most clinicians who focused on the MRI aspects. He joined the faculty at Meiji University of Oriental Medicine and continued MR Spectroscopy studies of the human brain for research and also clinical diagnosis.

In recent years, Shoji's work and my work went in different directions, and we didn't see each other so often. However, during my last visit to Kyoto in the Fall of 2023, I was able to visit Shoji in the hospital. At that time he was in the advanced stages of Parkinson's disease.

I always considered Shoji a very close friend. He and I had a number of private conversations where we discussed the differences between Japanese and American culture, and all the things that we had in common, especially a love for our families, our dedication to science and medicine, and a desire to help make the world a better place.

I hope that these words provide some comfort to Shoji's family. All in our family mourn the loss.

With the greatest respects,

Michael Weiner

CRediT authorship contribution statement

Ichio Aoki: Conceptualization, Writing – original draft. **Chuzo Tanaka:** Conceptualization. **Toshihiro Higuchi:** Conceptualization. **Toshihiko Ebisu:** Conceptualization. **Masahiro Umeda:** Conceptualization. **Masaki Fukunaga:** Conceptualization. **Yuki Mori:** Conceptualization, Writing – review & editing. **Yoshiharu Horikawa:** Conceptualization. **Seiichi Furuya:** Conceptualization. **Takaaki Tokumitsu:** Conceptualization. **Tetsuro Takegami:** Conceptualization. **Kei Yamada:** Conceptualization, Writing – original draft. **Michael Weiner:** Conceptualization, Writing – original draft.

Ichio Aoki^{a,*}, Chuzo Tanaka^b, Toshihiro Higuchi^{b,c}, Toshihiko Ebisu^{b,d}, Masahiro Umeda^b, Masaki Fukunaga^e, Yuki Mori^f, Yoshiharu Horikawa^g, Seiichi Furuya^g, Takaaki Tokumitsu^g, Tetsuro Takegami^{g,h}, Kei Yamada^g, Michael Weinerⁱ

^a National Institutes for Quantum Science and Technology, Chiba 263-8555, Japan

^b Meiji University of Integrative Medicine, Kyoto 629-0392, Japan

^c Rakuwakai Healthcare System, Kyoto 629-0392, Japan

^d Kansai Electric Power Medical Research Institute, Osaka 553-0003, Japan

^e National Institute for Physiological Sciences, Aichi 444-8585, Japan

^f University of Copenhagen, Copenhagen 2200, Denmark

^g Kyoto Prefectural University of Medicine, Kyoto 606-0823, Japan

^h Kyoto Daiichi Red Cross Hospital, Emergency and Critical Care Medical Center, Kyoto 605-0981, Japan

ⁱ University of California, San Francisco, United States

* Corresponding author.

E-mail address: iaoki.jp@gmail.com (I. Aoki).