Magnetic Resonance in Medicine

HIGHLIGHTS

Aloha!

MR stories from Hawai'i

ISMRM and ISMRT Presidential Interviews

Margaret Hall-Craggs and Brandy Reed

Speaker Profiles

YIA Finalists, NIBIB Lecturer, and Mansfield Lecturer

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January – December 2024

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Happy 10th Birthday, *MRM Highlights!*

This year marks the 10th anniversary since MRM Highlights was first distributed at the 2016 Singapore meeting of ISMRM. Ten issues later, it's wonderful seeing how this Society is growing in all directions: science, inclusivity, public engagement…and more!

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This is also the fourth time the Annual Meeting is being held in Honolulu, so what better time to bring you on a journey to discover ISMRM memories and MR research in Hawai'i! Through the following pages you'll read the memories of past Presidents and AMPC Chairs regarding previous Hawaiian meetings (2002, 2009, 2017), as well as the stories of Hawai'i-based researchers through the years.

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Furthermore, you'll find not one, but two Presidential interviews, from ISMRM President Margaret Hall-Craggs and ISMRT President Brandy Reed, and you will also get to know better two of this year's named lecturers, Reza Razavi and Shintaro Ichikawa. Exciting updates are provided on initiatives to democratize MRI by fostering EDI culture and access to MRI education, through the ISMRT Future Leaders Program. The profile from the 2000 YIA Moore winner, Talissa Altes, is also ahead, but don't forget the current finalists, they're showcased in this issue, too!

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And if you have learned to know and love Highlights, you'll be happy to see the return of Q&As with some of the authors of 2024 MRM Editor's picks!

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Together with Mathieu Boudreau, Editor of the Highlights Digital Content, and Peter Jezzard, MRM Editor-In-Chief, we want to thank our volunteer collaborators, the ISMRM Central Office, and the team at Wiley who have all helped this magazine to see the light of day. We hope you enjoy reading it as much as we enjoyed making it!

Maria Eugenia Caligiuri
MRM Highlights Magazine Editor

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CONTENTS

Recollections of the 2002 President: Chris Boesch

INTERVIEW BY **THOMAS LINDNER**

Prof. Chris Boesch has been an ISMRM member since the very early days of SMRM (predecessor society to ISMRM) and was ISMRM President at the 2002 Hawai'i meeting. He became an Emeritus member in 2018 and still participates in the ISMRM efforts of shaping the field. In this interview he talks about his past experiences from the very first Annual Meeting on the island of Hawai'i while also giving insights on how our field has changed since then.

Chris Boesch

MRMH: Hello Chris, can you briefly introduce yourself?

Chris Boesch: As you have noticed, I have been President between two MDs. That was the case since I'm not a typical MD/PhD, i.e. an MD with a scientific thesis, but I'm both an MD and a PhD, so in principle I could have chosen either career. But in my own thinking, I'm more a physicist than MD. I started with my master's in physics at the ETH Zurich followed by a PhD thesis in Kurt Wüthrichs lab, also at the ETH Zurich. Using high-resolution NMR I was looking at a molecule, the polypeptide glucagon. During my PhD research I realized that I didn't understand too much about the function of this polypeptide. I was doing 3D conformation studies with high-resolution NMR, but the medical applications I didn't see. So, the idea came up to also complete a full medical degree - at least to the MD thesis. During my PhD I was allowed by my supervisor Kurt Wüthrich to attend medical school at the University Zurich in parallel with the first year of the program. When I finished my PhD thesis, I changed fully to medical school for the next five years and finished with a state license. Then I did my MD thesis at the University Children's Hospital in Zurich, actually on the realization and installation of a 2.35T 40cm magnet for neonates - for them this was a whole-body magnet. The next magnetic field strength below that was a 1.9T magnet at University College Hospital in London but most clinical whole-body scanners had 0.5T magnets in those days. Thus, we were far above the typical field strength at that time. We were doing a lot of development work as we needed to monitor the vital functions of the neonates in the small magnet. Back to my double education: the advantage is that I can bridge the two fields of physics and medicine. The disadvantage is that a generalist is never as good as a specialist! Particularly in the last 10 years of my career I really had the benefit of this double education, though, when I was a Research Council member of the Swiss National Science Foundation where I had to cover all the imaging modalities (MRI, CT, ultrasound, PET etc.) – in addition to a few structural biology applications due to my thesis experience. In the most recent years, I again have needed both my two complementary trainings since I'm now member of a Research Ethical Committee where I'm also bridging the two fields. I need to learn a lot from scratch in all medical fields beyond MRI. The applications to the REC reach from rheumatology to oncology to radiology and so on. While I had a training in both fields, I was working as a researcher all my career long and wasn't involved in routine clinical work. My contact with patients was always within research projects.

MRMH: Okay, thank you. So just to clarify, you have been a radiologist by training then as well?

Chris: No, after passing my medical state license I didn't continue with a specialization, since I remained in research. So, despite the fact that I was working in and was part of the wider management of a large University Radiology Department for several years, I'm not a radiologist.

MRMH: In 2002 you were President of the ISMRM. It was in the early days, so could you let us know how it came to be that you became the President of the Society?

Chris: It started a bit earlier, in 1991, when I was appointed to a professorship at the University of Bern, Switzerland. From then on, I was active with ESMRMB (the European society), first as Treasurer, then as SPC (Scientific Program Committee) chair for Prague, and then as ESMRMB President in 1998. During the same year, 1998, I also became SPC chair for ISMRM in Sydney. Because my SPC chair role in Sydney was in parallel with my ESMRMB presidency, I was once asked by a good colleague if I would burn the candle at both ends. Despite the heavy workload, it was so much fun, particularly the organization of the scientific program in

Sydney. Following several years as a member of the Board of Trustees of ISMRM, I was elected and became ISMRM President in Hawai'i. You see, with Sydney and Hawai'i, I was always so lucky to have wonderful places when I had an official function.

MRMH: So, you were ISMRM President in 2002, as we mentioned. It was the first Annual Meeting held in Hawai'i and is now a staple in the calendar for many members who are looking forward to going there. Was it your idea to hold the conference for the first time in Hawai'i where everybody had to travel far? Or how did this develop back in the days?

Chris: Actually, the decision for the venue of an Annual Meeting is usually taken four to five years in advance. Roberta Kravitz, who was at that time Meeting Coordinator in the Central Office led by the Executive Director, Jane Tiemann, was traveling to several places and then the potential places were presented to the Board of Trustees. But that was four or five years before the Annual Meeting itself. Based on the different suggestions, the Board of Trustees decided to go to Hawai'i. A major intention behind it was to attract particularly people from the Pacific Rim, for example Japan, China, Singapore, Hong Kong, Australia, etc. Hawai'i is quite convenient also for the West Coast of the US, however not so much for us Europeans, but for the Pacific Rim researchers it's relatively close. Two years later, ISMRM wanted to strengthen this commitment with the Annual Meeting that was held in Kyoto, Japan.

MRMH: So with the island, there is obviously many more logistics involved to go there and have the meeting. Back then there were no zoom meetings and a lot of technology that we use now had not been developed yet. Can you tell us a bit about the logistics that were involved during that time?

Chris: The logistics of an Annual Meeting, I have to say, are not so much the President's job. The President, together with the Executive Board, is more involved in long-term planning. The people who really do the work for the Annual Meeting are the Central Office staff, the Meeting Coordinator and, in particular, the SPC (now AMPC) Chair and the Education Chair. In Hawai'i 2002, the office, the SPC Chair, Jeffrey Evelhoch, and the Education Chair, Douglas Noll, did an outstanding job, and they deserve the applause for a successful meeting, much more than I do as President. A very memorable event with enormous consequences happened during one of our weekly telephone conferences involving the ISMRM Executive Director, Jane Tiemann, the ISMRM Vice-President, Richard Ehman and me as President. As usual, the telephone conference was taking place on Tuesday evening my local time in Switzerland and Tuesday morning in Berkeley. I joined this telephone conference, and Jane and Richard had already been connected by the operator. They spoke with shock about an incident that had just occurred in the USA - it was September 11th 2001. I was working in my office and wasn't looking at any news channels, therefore I was completely unaware and surprised to learn about the terror act that had happened. At least I didn't realize for the next couple of months how strong the impact could have been for ISMRM, because it was only two months before deadline for the submission of the paper abstracts and many people were not willing or maybe not allowed to travel anymore. That could have influenced that meeting tremendously. As far as I know all congresses and meetings scheduled at the meeting venue in Honolulu were cancelled, and we were the first one that entered again. I also have heard that our loyalty gave us a very good position for the negotiations for the following meetings in Hawai'i. Our membership is so committed to the Annual Meetings that it seems we show up whatever happens. I think I remember that, for example, a Japanese surgery meeting was cancelled just the week before we came in. Thanks to our members, our meeting wasn't cancelled and the lecture halls were full. I don't know how much Jane and perhaps also Jeff were thinking about the possibility of cancellation, but we didn't discuss that a lot. Interestingly, a similar thing happened one year later in Toronto when I was Past President and Richard Ehman was President. Because in May 2003, SARS, the first coronavirus infection, was very strong in Canada. It seems that the origin was in Southern China,

and since Canada, and in particular Toronto, had strong ties with China, SARS was particularly strong in Canada and especially in Toronto. So, we were in a similar situation as before the Hawai'i meeting, but now we discussed in the Executive Committee about either cancellation, moving to Miami, or postponing. In the end we decided to postpone the 2003 meeting in Toronto from May to July. In contrast, as far as I can remember, that was not discussed before the Hawai'i meeting. Maybe I was a little bit naïve or just lucky that everything turned out so perfectly for the meeting. Because we didn't cancel but just postponed the Toronto meeting, it was again a very good basis for the next couple of contracts with the congress center. While the decision to postpone was being made by the Executive committee, the tremendous work to postpone the whole program with all speakers and abstracts was done by the Central Office and by the SPC Chair, David Lomas, and Education Chair, Michal Neeman. In hindsight, I think the fact that we didn't change anything in Honolulu the year before and still didn't fail was just luck and thanks to a great membership.

MRMH: In 2001 I read about the catastrophic electronic abstract submission when the system was changed. Did that affect you?

Chris: The office and Jeffrey Evelhoch were

doing such an extraordinary job that for me as a President it didn't affect me so much, as it has already been solved by them. I know this transition from paper to electronic abstracts was a very big step, but they did it so carefully and were so committed that we in the Executive Committee didn't see all the work they did to fix it – at least as far as I can remember. My congratulations really go to the office and to the SPC chairs for that.

MRMH: We have been talking about the past, remembering the 2002 meeting. Did you also attend the 2009 and 2017 Hawai'i meetings, and how much changed between them? What do you think about the changes that happened over these years?

Chris: I was looking back, and I have seen that after my first meeting in London 1985 with SMRM, I attended all meetings between 1987 and 2019, and then again in London 2022. In other words, I have attended 35 meetings in person plus the virtual meetings in 2020 and 2021, plus Singapore 2024 which I attended also online. That means, yes, I also attended Hawai'i 2009 and 2017. Being President or being a regular member is like night and day. As a President you have an agenda of two pages, every single line representing a meeting. You don't see a lot of the meeting as a President. As an ex-officio member of pretty much all committees you're always in meetings. You are informed about everything but going to a lecture is almost impossible. The great change in 2009 and 2017 compared to 2002 was that I was happy to attend lectures, so it was completely different. In addition to my own role, many transitions happened during these years, like the electronic abstract submission, wireless access in the lectures halls and so on, these were big changes. Concerning the wireless in the lecture halls, I can remember that we always had glitches. When Roberta was Executive Director, she always mentioned to the congress center that we will have a lot of people who use wireless, and they never believed her how much data transfer would have to be handled. As a consequence, we were always happy with the wireless connection on Saturday and Sunday, however, starting on Monday morning when all attendees arrived, you usually had terrible problems to get any wireless access. And I think even today the Central Office must fight with the congress centers as they don't believe a community can require so much data transfer as we do.

MRMH: But I guess this was different in 2002, right? There was no wireless yet at the conference center. It was much easier then.

Chris: When wireless access was discussed later, I was astonished that all the different types of wireless standards were working so well. I was expecting that it wouldn't work because I assumed they had different standards for the different electronic hardware companies. But it was, in principle, surprisingly smooth, although, as I said, the problem was that the congress centers always underestimated our data traffic.

MRMH: If we can go back again to the meeting in 2002, can you tell us your personal experiences when you went to Hawai'i for the meeting for the first time then and how did it feel when you at the venue?

Chris: I was preparing personally the time after the Annual Meeting quite carefully, since I knew for example the history of Pearl Harbor and, thus, I knew that I wanted to go there and to see this place which was historically so important. I addition, I was reading about Hawaiian culture, where did the Hawaiian people come from, the whole landscape like the volcano, a sunrise on Maui, and so on. For example, I had read, and have seen it later with my own eyes, that a street can just be closed because a volcano eruption caused a lava stream to flow across the street. In particular, the Big Island was sensational in that respect but also with the astronomical installations and buildings. Beyond these well-known attractions of Hawai'i, I was preparing the time after the meeting because I'm a sailor. When I was looking for a sailing opportunity, first in Hawai'i, I realized that Hawai'i is very famous for surfing. Unfortunately, surfing and sailing require different kinds of sea waves. If you can surf in the enormous waves, you are not very happy with a sailing boat. Therefore, I included the whole pacific region when I was searching for sailing opportunities and came across the term "Polynesian Triangle". The "Polynesian Triangle" is the triangle spanned by New Zealand in the South, Hawai'i in the North, and the Easter Islands in the East, with French Polynesia in the middle. Reading a lot about this common culture, I learned that people from Tahiti sailed with their tiny two-hull boats from Tahiti to Hawai'i. This is quite a distance, and they didn't have any GPS, no charts, they didn't have anything we rely on today. But they were able to find another island several thousands of miles away around the year 1000. These seafarers from Tahiti were able to cross the ocean looking at birds, looking at currents, the color of the sea, and so on. I was fascinated by this culture, therefore, my wife and I decided, that after a wonderful time on Oahu, Maui, and the Big Island we would fly to Tahiti and Raiatea, where we chartered a sailing boat. Among other islands, we sailed to Bora Bora. In addition to having the fun of sailing, it was also the experience of this common culture which was fascinating.

MRMH: So, you took the entire experience with you then, from Polynesia. Could

you tell us about the most memorable thing that happened in 2002, during the meeting that you have in your mind, that is engraved in your mind?

Chris: I was thinking about it. The opening plenary session was fascinating, when the lecture given by Paul Lauterbur – before he received the Nobel Prize. He was a fascinating figure and gave a very good lecture. Then we had some social events on the roof of the congress center – that was very special. I think the sessions on "Sounds and Visions" started the year before in Glasgow, but we also had one in Hawai'i which I was able to attend, and it was again enormous fun. Perhaps you don't know the "Sounds and Visions" concept? - for example you program your scanner to play music. Others were playing the guitar, and the text was related to MR. Some of these movies were astonishing, for example when the gradients of an MR-scanner were playing Mozart. On the other hand, I have the impression that during an Annual Meeting as a President, you don't have many outstanding events, it's more a continuum of going from meeting to meeting to meeting and to see everything works fine. It's great, it's fun, but it's different from the experience as an SPC Chair or from those of a regular member. For example, if a newbie has his or her first lecture at such a large and important Annual Meeting, it is a unique experience. As a President, you are nervous that everything goes well, but it's more routine and, as I said, more a continuum than any single highlight.

MRMH: This brings me to the next question that I wanted to ask you, because I think it's always important to have the experience from the senior members and past presidents. Are there any tips or hints that you would like to tell the newbies, the first-time attendees or young scientists who are attending their first ISMRM? What tips can you give them for their meeting now or in the future?

Chris: My personal experience was that I more and more went to plenary lectures and educational lectures and less and less to specific scientific sessions. I have had the chance to look beyond my own specialty when I went to a plenary lecture. I think even if the title of the plenary sounds as if it is not so close to your own field, go there and don't miss the plenary lectures. In addition, the morning educational sessions are excellent, and I didn't miss any of them. I always got up before 7 o'clock to visit them because I think that education outside of your own field is so important during an Annual Meeting. You need to look at the newest developments in your field, but I think the big chance at the Annual Meeting is to get out of your own specialty. Speaking of your own specialty, I think it is important that you network and speak with people who do something similar. In particular, the study groups are important, because in the study groups even newbies can give a lecture, or ultimately even become one of the responsible persons such as secretary. That is one way of getting into a career in ISMRM. Besides that, I can just emphasize again that it is important to look beyond your own specialty.

MRMH: My final question for you is will you attend the meeting in 2025 and reminisce the last 23 years and see how things have developed?

Chris: Yes, I will attend the 2025 Annual Meeting, but online. One reason is that I learn more online than when I am in a lecture hall. I can remember that I usually had five or six pages of citations when I came home from a meeting. Citations means that when someone gives a lecture, you are sitting there, and he or she mentions that paper XYZ shows this and that. I write down the citation and, in the end, I have many pages with citations which would help me to understand the lecture in detail. However, when I come home, I typically have no time and forget the list with citations. During an online session, I stop the lecture. I go to PubMed. Then I can look at least at the abstract, and if it is really important I download the whole paper and look at it more carefully. I can't do that during an oral lecture if I attend the lecture physically. I think that online helps me more to understand a lecture. Another point is actually that I'm concentrating a little bit more on the ESMRMB meetings now. In my function in the Research Ethical Committee I see how MR research is heavily affected by the new European Medical Device Regulation. I see how members of the regulatory bodies speak a completely different language than the MR people, with the consequence that they don't understand each other. We need to bring the two worlds together and I'm leading an ESMRMB working group where we want to find out how we can help MR researchers fulfill the requirements of the Medical Device Regulations and help to overcome the bureaucratic problems. In addition, we will also teach MR people to design a proper study which is necessary to go through the applications to an ethical committee. MR research is fun and creative, but fun can also be a contradiction when it comes to designing a perhaps boring but well-structured clinical trial. On the other hand, members of the regulatory bodies need to understand MR better, which is difficult because they must deal with thousands of different devices, starting with surgical tools to cardiac devices etc., not just MR scanners. In addition, MR people, and in particular young MR people, need to learn that MR is fun but not just a PlayStation. I have the impressions that the MR world has so many great ideas which die after a first quick paper because the inventor of the idea immediately jumps to the next idea and again to the next idea. I understand that's more fun than to prove that the new sequence which has been developed can be really used to help people or to diagnose something. I understand my current job to bridge this gap between regulatory bodies and the MR community, and for that job I need to know the most recent developments in MR, and that I can get from the ISMRM meetings mainly online. I know that one misses online the crucial social component from an Annual Meeting, including networking, but currently I can enjoy this component at the ESMRMB Annual Meetings. Nonetheless, I think for Cape Town I will attend physically again!

MRMH: I think these were very important and very interesting last words for this interview. I would like to thank you for your time having the interview with me. And, although we might not see one another in person in Hawai'i, we hopefully will in Cape Town. ■

Recollections of the 2009 President: Vivian Lee

INTERVIEW BY **ATENA AKBARI**

Dr Vivian S. Lee is an MR radiologist, healthcare and tech executive, and former ISMRM President (2008–2009). A Rhodes Scholar, she holds an MD from Harvard, a PhD in medical engineering from Oxford, and an M.B.A. from NYU. She has led University of Utah Health as CEO and Dean, founded Verily Health Platforms (Alphabet), and authored The Long Fix, focusing on healthcare reform. In the following, you'll read an interview with her for *MRM Highlights – ISMRM in Hawai'i,* where she reflects on her experiences and insights from past ISMRM gatherings.

MRMH: Can you tell us a bit about your background and your journey with ISMRM?

Vivian Lee: I discovered MRI during my radiology residency at Duke in the 1990s and fully committed to it during my NYU fellowship (1997–1998). A key moment was attending the Monterey (Stanford-Duke) MRI course, which was transformative, especially Dwight Nishimura's explanation of k-space! I was elected to the ISMRM Board of Trustees in 2002, joined ISMRM's Scientific Program Committee (2003–2005) and chaired the 2005 Miami meeting. I really enjoyed the culture of the ISMRM from the beginning.

MRMH: What stands out to you as the most memorable experience from the 2009 ISMRM Annual Meeting in Honolulu?

> *I still believe that we could strengthen the alignment between areas of research focus and clinical impact. AI and generative models now offer opportunities to enhance patient understanding of imaging findings, increasing the impact and accessibility of radiology."*
>
> –Vivian Lee

Vivian: Working with Margaret Hall-Craggs, who is President of ISMRM this year and who led the Annual Meeting Program Committee (AMPC) for the 2009 meeting, was a highlight. She and the AMPC set attendance records that year. 2008-2009 was also a pivotal year financially. After the 2008 downturn, we strengthened ISMRM's reserves, and that record-setting attendance at the Annual Meeting helped to increase revenue. Beyond the remarkable science, the closing party was great fun!

MRMH: What motivated the 2009 ISMRM CME course, and what impact did it have?

Vivian: The goal was to attract more clinicians to ISMRM by making sure we had offerings that were attractive to different specialties throughout the week. It worked! The content at the ISMRM is unrivaled, and we wanted more MR clinicians to realize that it was the place to get a refresher on MR physics, to catch up on the latest scientific advances, and even get some Continuing Medical Education (CME) credits.

MRMH: In what ways has ISMRM evolved since 2009, and how do you see its role in advancing magnetic resonance in medicine today?

Vivian: MRI technology has become more user-friendly, reducing variability in clinical imaging. I still believe that we could strengthen the alignment between areas of research focus and clinical impact. AI and generative models now offer opportunities to enhance patient understanding of imaging findings, increasing the impact and accessibility of radiology. I hope we can continue to build valuable training sets for AI models and think holistically about how to integrate imaging with other clinical data to improve diagnoses and patient care.

MRMH: What emerging trends or technologies in MRI excite you the most?

Vivian: I'm really looking forward to attending the meeting in Honolulu this year. I'm curious to see the latest developments in ultra-low-field MRI since last year's meeting. When I served on the Defense Health Board (advisory to the US Department of Defense), it was clear that many were interested in the applications in the field to assess trauma. Science is fascinating at its extremes, and this is an area where I see exciting potential. I'm also eager to learn more about how foundation models are impacting MRI.

MRMH: What inspired you to take on the role of ISMRM President, and how did your previous experiences prepare you for this position?

Vivian: I was honored to be nominated to run for Vice-President-Elect, which eventually led to the ISMRM presidency. If I recall correctly, this happened right after I served as Program Chair in 2005. The path involves several stages—Vice-President-Elect, Vice-President, President, and then Past-President—so it's a long journey. When I was elected Vice-President-Elect in 2006, it was still relatively early in my career, and I was so surprised.

Before serving as ISMRM President in 2008, I had been actively involved in the Society, including chairing what was then called the Scientific Program Committee (SPC, now called the AMPC), and before those overseeing educational initiatives. These roles, plus serving on a number of committees and the Board of Trustees, gave me a solid understanding of how the Society and its meetings operate.

Vivian Lee

By 2008, in my day job, I was Vice Dean for Science and Chief Scientific Officer at NYU, overseeing research across the entire medical school, and so I was already very much thinking about interdisciplinary collaboration. Serving as President of ISMRM was made much more manageable thanks to the amazing individuals on the Board and the Society's office, led by Roberta Kravitz back then, who provided excellent support.

MRMH: Looking back, what do you consider your most significant accomplishments during your ISMRM presidency?

Vivian: There were a few key initiatives. One was developing the clinical track and focusing on attracting more clinicians to the meeting. Another was strengthening the Society's financial resilience. Most of the other accomplishments that year should be credited to Margaret Hall-Craggs who was also

Hawaiian dancers at ISMRM2009 in one of Vivian's (top-right) slides.

on the Board and was AMPC Chair—she supported the launch of the virtual conference and, together with the AMPC, ensured we had an outstanding Annual Meeting.

MRMH: As one of the few female ISMRM presidents at the time, what advice would you give to women aspiring to leadership roles in MRI?

Vivian: When I became President, I was the first woman since the predecessor societies to hold the role, but that doesn't mean there weren't many women throughout the history actively shaping the Society's programs, serving on the Board, and leading key initiatives. Women have made a huge impact on the ISMRM, without a doubt!

One lesson that significantly shaped my leadership journey is the power of engagement. Early in my career, I made a deliberate choice to contribute actively in professional settings. I challenged myself to speak up at least once per meeting (in my job) and once a session at conferences like ISMRM. It forced me to concentrate on the content of the meeting, gave me a chance to make contributions, and strengthened my confidence. It probably also created opportunities for leadership. So, for women aspiring to leadership roles in MRI, I encourage them to engage actively. You will learn more, and people will recognize your contributions. That's one way to get invited to moderate sessions, join committees, and take on leadership positions. This advice isn't just for women. The more we all engage, the better our organization.

MRMH: How did your experience as ISMRM President shape your career path and leadership approach in the years that followed?

Vivian: It wasn't just the presidency itself, but ISMRM as a whole that had a profound impact on my career. One aspect I haven't discussed much is my own research. For over 20 years, I led a wonderful group of people in my NIH-funded lab at NYU and then at the University of Utah and, for our team, ISMRM was the highlight of the year.

My earliest research involved using small doses of gadolinium contrast in body MRI to determine timing for angiographic imaging. I discovered that monitoring gadolinium transit through the kidney provided valuable insights into kidney function, leading to quantitative measures of renal function. This work expanded into broader kidney research. Cardiovascular MR was another area heavily influenced by collaborations I formed through ISMRM.

Perhaps the most impactful collaboration was in non-contrast MRA. I was inspired by Mitsue Miyazaki's work at Toshiba on gated turbo-spin-echo techniques, which allowed for black-blood and white-blood imaging in different cardiac phases. By subtracting these images, we could visualize vessels without contrast. It was through meetings like the ISMRM that this method gained traction, creating collaborations between researchers from Japan, the U.S., and beyond.

While serving as ISMRM President was an honor, I would say the greater impact on my career came from being a member of the ISMRM—the network, the collaborations, and the opportunity to engage with outstanding researchers worldwide.

MRMH: What lessons from your presidency would you pass on to future ISMRM leaders?

Vivian: ISMRM has been fortunate to have had leaders who bring their own vision and strengths to the role, continually shaping the Society for the better. If I were to highlight key lessons, I would emphasize:

Financial Stability Matters

Ensuring the Society's financial health may not be the most exciting task, but it is critical for sustaining ISMRM's operations and long-term success.

Diversity and Retention

It's important to attract and support a broad range of researchers in MRI. Future leaders should consider strategies to not only bring people into the field but also ensure they stay and thrive.

Personalized Leadership

Each president has brought their unique perspective to ISMRM, shaping its direction in meaningful ways. The same is true with AMPC chairs. That's why our meeting has become such a rich experience for all. Leaders of the Society should embrace their own strengths and passions and continue to be bold.

At its core, ISMRM is about fostering collaboration and innovation. The more we can support and retain diverse talent—and have fun together—the more our field will grow and have impact. ■

Recollections of the 2017 President: Garry Gold

INTERVIEW BY **ALINA CAPATINA**

Professor **Garry Gold** is a Professor of Radiology and Biomedical Imaging, actively involved in patient-oriented research, at Stanford University. As the 2017 President of ISMRM and a passionate member of the Society with numerous achievements over the years, including an ISMRM Gold Medal award in 2023, Prof. Gold has agreed to share some of his memories from past Hawaiian ISMRM meetings.

MRMH: I would like to start by asking you to share with us what ISMRM means to you on a personal level, and also from a career perspective, especially since you are a Past President of this Society.

Garry Gold: The ISMRM has really been my scientific home for my entire career. It has provided me a place to meet with brilliant scientists and clinician scientists from all over the world, and discuss my research and their research, and learn, and get new ideas for future projects. I love this society. What I especially like about it is that, as I'm a medical doctor, I have some technical knowledge and technical skills, but I'm not nearly as bright as the brilliant scientists who do the groundbreaking work in MR physics every day all over the world. And the ISMRM really gives me a place to talk to those people about clinical problems that I feel are important and learn from them about new ways in which we can use imaging technology to make diagnoses and help our patients.

Throughout my whole career, the ISMRM has been incredibly supportive of students and young people's participation in science. And I really value that, especially at this point in my career where I'm a more senior member. Having a society where my students go, present their work, talk to other students, talk to professors and luminaries from all over the world, is just incredibly valuable. And it's so gratifying to see my students grow and succeed in the Society and in the field, in the way that I did many years ago. It is hard to describe. But I really do love the Society. Now, at this point in my career, every year going back is like going to see my friends from all over the world. I'm just so incredibly grateful to be part of such a welcoming, kind, generous, and thoughtful, brilliant group of people.

MRMH: In 2017, the ISMRM Annual Meeting was organized in Honolulu. Could you tell us a bit about that? Some memorable anecdotes and maybe some groundbreaking research presented at that meeting.

Garry: We've been fortunate to hold the ISMRM meeting in Hawai'i now three times, in 2002, 2009 and 2017. I was extremely fortunate to be President of the Society in 2017, when we held the meeting in Honolulu, and it was just an amazing venue, an amazing meeting. The setting was spectacular. The timing of the meeting was very important, because this was not long after the first Trump administration and the Women's March in DC. And there was a lot of interest on the part of the younger members of the Society to rally and support science. So, we had a 'Stand Up for Science' event on the roof of the convention center. I think it was on the Saturday of the meeting, and people were just extremely passionate about their support for doing good science and the importance of scientific research and rigor to society and to everyone's well-being. It was just wonderful to see and hear so many people so passionate about the work they were doing.

2017 is also the year when we had the Women's Forum. I think it might have been the first year of the Women's Forum which later became the Diversity Forum for the Society. It's so critical that we support young scientists of all backgrounds, and we know that women and underrepresented minorities are not represented in the field in the way that they should be, and we have to be especially careful to support women as they grow in their careers and become the next generation of great MR scientists and clinician scientists. I thought the Forum was just wonderful. Liz Morris, who was the head of the committee, did a spectacular job, and I feel so lucky to be at a point in the history of the Society, in the field, where I could make a little contribution to moving the needle in the right direction there. Despite the noise coming out of Washington DC, the scientific data shows that we do better as a field, better as scientists, when we listen to a diverse group of opinions from a diverse group of people. So I believe that this is the right course for the Society and the field as a whole.

Garry Gold

The other event that I remember from the 2017 meeting was the 5K run. It was on the beach. I used to run, but I'm not much of a

Stanford University

runner these days. My postdoc at the time, Felix Kogan, who was a Young Investigator Award finalist, finished 4th in the 5K run. I finished last. But the good news was that the staff were remarkably happy to see that I'd finished, because they were worried I was just going to keel over on the course. So it took a long time, but it was definitely worthwhile. And I might finish last this year again in 2025. We'll have to see.

MRMH: Amazing, fingers crossed for that! So you mentioned the 2002 and 2009 meetings as well. Would you be able to tell us a bit about those? How has the ISMRM developed over the years? And how do the current meetings compare to those that happened back then.

Garry: We were really fortunate to have the first meeting in 2002, and that was soon after the establishment of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at the National Institutes of Health. We had a terrific setting and venue. I think we fit a little easier into the Conference center in Honolulu at that time than we do now. But I remember that meeting because those were some of my earliest educational talks that I ever gave at the ISMRM. It was a wonderful opportunity to sort of learn from the best clinician scientists and teach as well. I truly believe you never learn a subject quite as well as when you actually have to teach it. I think we get terrific educational talks with the Society every year, and I was in the 7am morning categorical course for musculoskeletal that year, and I remember getting up early every day to go to the meeting, it's always worthwhile. That was also the year that I tried surfing for the first time. Technically, you could say that I never really surfed, but I think, like anything, it depends on the time scale. You look at things, and there was probably a millisecond or two in the process of falling where I was standing on the board. It was just a wonderful thing to be able to do right there on the beach right next to the conference center and the hotel for the conference, and I really encourage students and even faculty members to go out and try it.

At one point, during setup for the 2017 Hawai'i meeting, I was in Honolulu with my Program Chair, Scott Reeder, and his family, and I asked my son Evan who the best surfer in our group was, and he said, "Oh, Jack's dad", meaning Scott Reeder, not his dad.

I also remember that was the meeting where Brian Hargreaves said we're never going to have to wear a tie ever again at the ISMRM, because people were going in Hawaiian shirts to the sessions. It was just wonderful!

MRMH: Could you tell us a bit about how Hawai'i ended up becoming a key location for these meetings?

Garry: The ISMRM has always been organized around the principle that we want to be the global MRI society. And for a lot of complicated financial and logistical reasons, the board has decided, and I think wisely, that we want to hold a meeting in Europe every four years. We want to hold the meeting in the Asian Pacific region every four years, and then, in between those two meetings, we hold two meetings in North America. It's been in Canada and Toronto and Vancouver, but also in the US. We have a big contingent of European members, and we love to go to Europe every chance we get, the same for the Asia Pacific region. We've had great meetings all over that area: Kyoto, Singapore, Australia. And I think Honolulu is just a wonderful venue, because it's a little easier to get to than Australia or Singapore. It's a beautiful setting. The convention center has been extremely generous with the Society, I would say, in terms of letting the Society hold meetings there at an extremely low cost, and even though it's hard on the folks who come from Europe, it's a lot of time zones, it is a beautiful location. I would encourage people from Europe to come and stay for a week or two after the meeting and explore the Hawaiian Islands, because the other islands in Hawai'i are spectacular along with Oahu, outside of the city of Honolulu. My friend Dwight Nishimura, who's from Oahu, has always said that he believes Oahu is the most beautiful of the islands outside of the city. So I think it's a great place to explore.

MRMH: What would you advise young researchers to look for when participating in the 2025 ISMRM meeting in order to make the most out of it? What is the meeting all about?

Garry: I think the word that comes to mind for me when I think of the ISMRM is "connection", the opportunity to meet and talk with researchers all around the world and discuss at a deep level scientific issues around the use of MR in the clinic, in the research environment, and about new developments in the field. Learning from the luminaries in the field, in the plenary lectures, and the named lectures, going and meeting your colleagues from all over the world and talking with them about their work and having them come see your work - it's just a tremendous opportunity to get to know people and to learn from everybody you encounter at the meeting. I just love going around the posters and seeing what's going on. And in my area, I love going to scientific sessions that are even far afield from what I do. I always go to rapid imaging. I find that's a really super innovative part of the meeting. There's often innovative stuff these days around machine learning and AI, and

I'm trying my best to understand all of that. It's just the kind of meeting where I can be sitting in the Young Investigator session, and the person speaking is doing something in the brain, and I'll be thinking, I bet we could use that in the knee. Not for this problem, but for that problem and so I love going to just random sessions and speaking with people even outside of my own discipline, just to understand the directions the field is going.

I see all of my friends from all over the world at the meeting, and we get together for social occasions in the evenings and go out to dinner and have parties at the hotels, and it's like a big reunion from the days when I was working in the lab as a graduate student or a postdoc.

It truly is like I go to see all my friends at the meeting.

MRMH: Speaking about the early years, could you tell us a bit about your experience as a young researcher participating in the conference? Do you have any fun anecdotes or memorable encounters from that time?

Garry: I remember I had a Young Investigator Award talk in Nice in 1995, and I practiced that talk so much, and one of the things that my co-authors recommended to me was, when somebody asks you questions, you always thank the questioner. So, I got asked an initial question, and I said: "That's an excellent question". Then for the second question, I said: "That's an excellent question". Then for the third question, I said for a third time: "That's an excellent question". And the person asking the question just lost it, just laughed and laughed because it was totally clear that I had psyched myself to thank the questioner, I just did it the same way every time. It was one of my first talks at the ISMRM that I gave in that session, and I was very fortunate that year.

But I also remember that, in those days, slides were actually physical slides that you had to print, and you had to take to the photo shop and have them developed, so I couldn't edit my slides at all. And after my talk, one of my friends pointed out to me that I had misspelled the word musculoskeletal on one of my slides. So it happens. But I loved the opportunity to present my work in a session that was heavily attended, and it was very stressful, but very worthwhile, and I think after that, I was hooked on coming to the ISMRM every year.

A memory from ISMRM 2017

MRMH: So would you say that would be your most memorable ISMRM meeting, or do you have another one that's even closer to your heart?

Garry: That's a tough question! That probably was my most memorable meeting. I would say a close second was Sydney, Australia, in 1998. I was two weeks away from taking the radiology board exam. So I had this backpack full of books and CDs to study for the board exam while I was at the meeting. And of course I lugged the whole thing down to Australia and didn't look at anything, didn't study at all. I was so captivated by the science at the conference. Then afterwards, I was very fortunate to go on a trip with my friend Greg Scott. We went on a dive boat out in Australia, on the Gold Coast, and saw the Great Barrier Reef, and that was amazing. I feel like I've gotten to see the world by going to the ISMRM and then spending a week after the meeting doing something else in the region the meeting was in.

There are so many great meetings, though! In 2023 I won the gold medal in Toronto, from the Society, and that was extremely memorable, because my family was able to attend and see me win the gold medal, and I had a list of like 150 people to thank. My acceptance speech just went way over. But I went as fast as I could. The great thing about the Society is that they say it takes a village, and I think that's really true in science. It takes a village to create scientific magic the way we've been so fortunate to work on in MRI for the past 30 years.

MRMH: How do you see the MRI/ISMRM community evolving over the years? And what aspects of the current MRI research do you think are most likely to be the focus of future MRI research?

Garry: I think it's so important that we democratize MRI and make it available all over the world. If you look at a global map of where MR is used and prevalent, it is in North America and Europe. And we need to make MRI affordable and easy enough to use so that it can be used in low resource environments, in South America and in Africa. We need to make the technology available to everybody in the world. And it's not only about creating markets for people to sell machines. It's really about health equity. It's about the fact that in Africa, if you're a child with hydrocephalus, it's very hard to get a diagnosis, because there isn't MRI technology readily available. We need to make it bulletproof, make it low cost and make it work really well in those environments. I think that it's not only the right thing to do, it is imperative as a part of what we call health equity amongst the physicians in the field, that everybody should have the technology available.

Last Fall, I fell critically ill with sepsis, and they were able to use MRI to diagnose where the areas of infection were, and I was able to have life-saving surgery as a result. I'm incredibly fortunate to live two miles away from one of the best hospitals in the world, and I got terrific care there. But if I had been in Africa or South America or India, things could have turned out, and probably would have turned out, quite differently.

So I would love to see us focus more on bringing MRI to the rest of the world. ■

Recollections of the 2017 AMPC Chair: Scott Reeder

INTERVIEW BY **ATENA AKBARI**

Dr Scott Reeder is a leading expert in MR physics, and cardiovascular and abdominal MRI research, with a career spanning over three decades. He began his work in MRI in 1991, focusing on cardiac imaging and MR physics. A long-time member of the ISMRM, he has been deeply involved in the society since attending his first meeting in 1993. Dr Reeder served as the AMPC Chair for the 2017 ISMRM Annual Meeting in Honolulu, playing a key role in shaping its scientific and educational programs, and later as ISMRM President in 2023. His leadership has contributed significantly to the evolution of ISMRM conferences, fostering engagement and innovation within the MRI community.

MRMH: Could you tell us about yourself and how you got involved with MRI and ISMRM in general?

Scott Reeder: I've been involved in MRI research since 1991, starting in graduate school with a focus on cardiac MRI and MR physics. Attending my first ISMRM meeting in 1993, I quickly became engaged, and found my academic home. Except for a brief period during medical school, I haven't missed a meeting since.

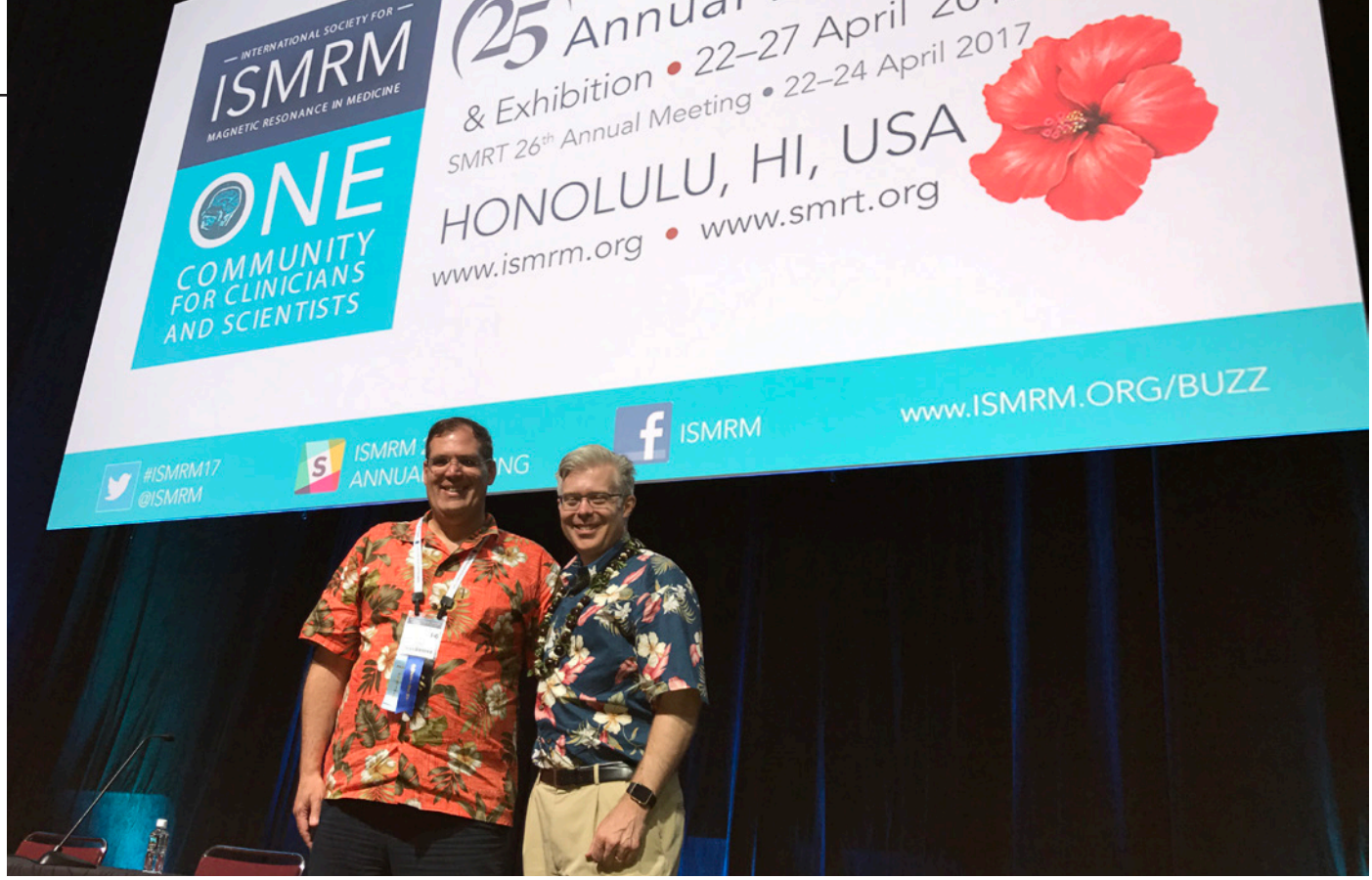
MRMH: What are your most vivid memories from organizing that conference?

Scott: Working with a passionate and engaged AMPC team was the biggest highlight. The construction meeting on Jekyll Island was memorable and wearing our aloha shirts both there and at the annual meeting added a fun touch.

MRMH: What was the biggest challenge in putting together the scientific and educational program that year?

Scott: Similar to other years, organizing vast amounts of amazing scientific and educational content was a challenge. We made major structural changes to the meeting in 2017, including shifting plenaries to late morning, moving the opening ceremony to Sunday evening, and eliminating the Friday session, which required major changes to the overall schedule.

Scott Reeder, in person and on paper, in Honolulu at ISMRM 2017



Scott and Garry Gold, respectively AMPC Chair and ISMRM President in 2017

MRMH: Were there any unexpected moments or surprises during the event?

Scott: One standout event was the "Rally for Science" on the rooftop of the Hawai'i Convention Center. It was an inspiring moment, bringing together ISMRM members of all ages to voice support for scientific values amid political challenges at the time.

MRMH: What was your proudest achievement as AMPC Chair for that meeting?

Scott: I'm most proud of the energy and engagement throughout the meeting. Restructuring the schedule ensured that every day felt equally important. Many thanks to Karla Miller's vision, we introduced the Resonarium and Secret Sessions for the first time in 2017. These innovations have remained successful ever since.

MRMH: The 2017 meeting introduced several changes, like doubling power pitches and adding more sunrise courses. How did those changes impact the conference experience?

Scott: We saw a record number of abstract submissions, in part due to these changes, which provided more opportunities for presenters to share their work. In my view, this has increased engagement with a lasting impact on future meetings.

> *I've been involved in MRI research since 1991, starting in graduate school with a focus on cardiac MRI and MR physics.*
>
> –Scott Reeder

MRMH: How did your experience as AMPC Chair influence your subsequent involvement with ISMRM and the broader MR community?

Scott: It deepened my connections within the community, especially beyond my own research area. I gained a deep understanding of how the ISMRM operates, which I was pleased to leverage during my subsequent time on the Board of Trustees and later serving as President.

MRMH: What initiatives or changes introduced during the 2017 meeting had a lasting impact on future ISMRM conferences?

Scott: Key changes included restructuring plenary sessions, the opening and awards ceremonies, and eliminating Friday. We also significantly expanded live streaming, which was previously limited.

MRMH: What advice would you give to someone taking on the AMPC Chair role today?

Scott: Consider the commitment carefully—it's a big second job… but entirely worth it. Talk to past chairs, past and current presidents, and most importantly to as many members as you can to understand their perspectives. Most importantly, bring your own vision and energy to the role.

MRMH: If you could capture the essence of the 2017 meeting in one word, what would it be?

Scott: Energizing! ■

MR Research in Hawai'i: Linda Chang and Thomas Ernst

INTERVIEW BY **THOMAS LINDNER**

In this interview Prof. **Linda Chang** and Prof. **Thomas Ernst** introduce us to the research lab they built from scratch beginning in 2004 at the University of Hawai'i and share their reminiscences of the early days of their research.

Linda Chang

MRMH: Can you briefly introduce yourself?

Thomas Ernst: I'm an MRI physicist who received a PhD at the University of Freiburg. My early technical work was on localized 1H MRS in the brain, especially absolute quantitation. More recently, I focused on prospective motion correction for brain MRI, both using external (camera) and navigator-based tracking approaches.

Linda Chang: I am a clinician-scientist with a training in Neurology. I have used various neuroimaging techniques, primarily advanced MRI techniques, but also SPECT, PET and focused ultrasound for my clinical and preclinical research.

MRMH: Could you give us a short sketch of your career and how it led you to work and lead an imaging department in Hawai'i for around 13 years?

Thomas: Freiburg – HMRI / Caltech – UCLA – BNL – Hawai

Linda: MD at Georgetown University, Neurology Residency at UCLA, then we were both recruited to Brookhaven National Laboratory (BNL, 2000-2004) before moving to the University of Hawai'i (2004-2017). They were recruiting a Neurologist with research experience in neuro-HIV to start a neuroscience program at UH, and I was a perfect fit for them. However, they didn't have any neuroimaging research in Hawai'i. Thomas and I wrote a grant to the Office of National Drug Control Policy (ONDCP), a White House office, and obtained funding ($3 million) to purchase a Siemens 3 Tesla MR scanner to start a neuroimaging research program in Hawai'i, with a focus on research in methamphetamine use disorders across the age spectrum. This was before the S10 program for large instrumentation was available at the NIH.

MRMH: You built up a neuroimaging department. Can you tell us a little about it? From what did you start and how did it develop?

Thomas: We were recruited to Hawai'i by the late dean Ed Cadman of the Medical School in 2003. Dean Cadman wanted to build up biomedical research in the State and saw the potential in our (neuro) imaging

Thomas Ernst

work. We decided that the best location for a research scanner would be in the largest hospital in the State of Hawai'i, the Queen's Medical Center (QMC) in downtown Honolulu. We wrote a successful proposal for a research-dedicated 3T Siemens Trio scanner. Both the Medical School Dean and the former CEO of QMC invested a substantial amount of startup funds for our program and for installing and housing the scanner. The QMC provided an additional $2 million to renovate a large (>5.000 sq ft) space for us to house the scanner and to build up research offices and space for us to initiate our program.

Once we were settled at the medical school, we obtained many more NIH grants to support our research program, and initiated many collaborations both within the medical school and across the UH Manoa campus with other departments.

MRMH: What is the difference between continental America and an island like Hawai'i to conduct research?

Thomas: This is a very interesting question. At a relatively smaller medical school like that at the U Hawai'i, there are fewer opportunities for collaboration compared to some of the "power houses" (research-intensive medical schools) on the mainland. It can also be challenging to find graduate students who are interested in MRI research. However, we collaborated with numerous outstanding colleagues from the mainland, who were generally very motivated to visit collaborators like us in Honolulu. Likewise, we were able to attract some outstanding post-docs, including many from Europe, to our program.

Linda: Furthermore, since the population in Hawai'i tends to have fewer relocations (compared to those living on the mainland), we and others were able to conduct many longitudinal studies to follow these individuals over longer periods of time.

At one point, we had about 1/5 of all research funding within the medical school. This can have a certain advantage (since people may value your input), but can also be a challenge (since some people think there's extra money – but it's really tied to projects and hence spending is restricted).

MRMH: Tell us your most important research goals that you achieved during your time in Hawai'i. What was the main focus of your research?

Thomas: On the technical side I worked on prospective motion correction for brain MRI using camera-based tracking. We actually created a small startup company, with initial support from UH, that was rather successful for a few years.

Linda: I was able to study the effects of methamphetamine use disorders on the brain, not only in adults, but also in adolescents, as well as infants and children with prenatal exposure to the methamphetamine and/or nicotine (since their mothers were using the drug during their pregnancy). This work led to many additional collaborations with colleagues at Johns Hopkins University, who worked closely with us to develop brain atlases for neonatal and pediatric structural and diffusion MRI studies. Our work with young children led to an NIH-funded multicenter study (9 sites) that we co-led with UCSD colleagues to study brain development in 1,500 typically developing children ages 3-20 years. This work also led to the longitudinal ABCD study, which enrolled 11,878 9-10 year-old children and are following them over 10 years.

> *We decided that the best location for a research scanner would be in the largest hospital in the State of Hawai'i, the Queen's Medical Center (QMC) in downtown Honolulu*

In addition, I continued to apply various MR techniques to study the effects of HIV on the brain, and to use these techniques to monitor both age-related brain changes as well as treatment effects. I initiated a clinical trial and used task-fMRI, as well as resting-state-fMRI to monitor the effects of computerized cognitive training in persons with HIV.

MRMH: The ISMRM meetings in Hawai'i happened in 2009 and 2017. How did you experience the ISMRM being right in your neighborhood after being there for more than a decade? Did the meetings give your department a push?

Thomas: It certainly is an interesting experience. The nice thing is that our home is about 20 minutes from the convention center, and so each morning we simply pulled into the convention center garage. At both meetings, we also hosted a party at our home for some of our friends and long-term collaborators. The disadvantage is that our lab staff knew we were in town and hence we constantly commuted between the convention center and work. We were able to allow most of our trainees to attend these meetings.

MRMH: Do you miss living and working on the island?

Thomas: Yes. In my mind, Hawai'i provides the highest quality of living amongst all places that I have lived. These included not only the nice weather but also a safe and convenient living environment. The only disadvantage is that it is far from other places (~2500 miles from any other major cities): about 5-6 hour flight times to the mainland USA and 7-8 hours to Asia (Japan).

MRMH: What was your ultimate reason to go to Baltimore and how did you manage the handover to Andrew Stegner? What was the process like?

Thomas and Linda: The main reason that we relocated to Baltimore, University of Maryland, was because Linda's mother was ill and we wanted to move back to the East Coast to help her, and it was also closer to Germany for Thomas to visit his elderly parents who were also battling with illnesses. We were initially being recruited to the NIH, but ultimately we were recruited to the University of Maryland, where we were able to relocate our research program and helped build a vibrant research environment for the Department of Radiology. However, before we left Hawai'i, in 2015, we had obtained a large NIH grant, the ABCD study, which required that we upgrade our 3 Tesla Trio scanner to a Prisma scanner. We were able to obtain institutional support from UH to upgrade this research-dedicated scanner. Therefore, since the scanner was upgraded, Andy Stenger was able to continue his advanced MR research at UH. ■

Interview with Andrew Stenger

INTERVIEW BY **ALINA CAPATINA**

Andrew Stenger is a professor from the John A. Burns School of Medicine at the University of Hawai'i and associate member of the University of Hawai'i Cancer Center. His current work focuses on enhancing functional MRI for biomedical research purposes with the goal of improving MRI-based diagnostics. As a member of the Hawai'i MRI community for over 20 years, Prof. Andrew Stenger discusses his research journey and the people who helped him become the scientist he is today. He also provides an insight into the research going on in Honolulu and the fantastic scientific community at this remote site.

Andrew Stenger

MRMH: As someone who has worked with MRI research for over 20 years, could you briefly tell us about the most memorable research projects in your career and how you ended up in Hawai'i?

Andrew Stenger: I was lucky enough to be part of the whole parallel imaging revolution. It's very standard now to have a phased array coil for all the scanners, but we didn't have that before. We just had, like a bird cage, a single channel receiver. I remember somebody gave me a phased array coil and told me to look at it for brain imaging. And I didn't like it because it was just kind of bright on the outside. It wasn't uniform, and nobody liked it. But then it took some smart people like Klaas Pruessmann, Mark Griswold and Daniel Sodickson to realize that you could use those different channels to really speed up MRI acquisitions. And so seeing that revolution was nice. I played a little bit of a small part in that. I worked on parallel transmission, and so I was one of the first people to use parallel transmitters. Through that, I met some really great people. I met Kawin Setsompop through that, Larry Wald and all these really amazing researchers. And I'd say that was probably a very fun time where we could see the field changing a lot and where something went from research to standard clinical care.

MRMH: Did you have any mentors who played a significant role in your career?

Andrew: I had a bunch, but I would have to say Doug Noll, who is very well known and works at the University of Michigan, and Fernando Boada, who was at Stanford. Doug was my postdoc mentor, and I was actually a physics PhD, I was looking for a job close to where my wife was finishing up her medical school, and I just met Doug. I didn't know anything about MRI. He was just a really nice person. I just said to myself, "hey, this guy seems like somebody that I think is going to be a nice person to work with", and he's just been great. I know one of the questions later is advice for younger researchers, and that would be my biggest piece of advice: surround yourself with positive, good people, because everybody's smart, but some people have a really good character, and it makes a big difference. And I was really lucky.

Doug was even connected with me coming to Hawai'i, because he knew the people that were starting the group here. He also knew that I'm actually from Hawai'i, so he thought that I would be a good fit for them. He introduced me to them, and I'm still here today. I have my family here; I have personal and professional reasons to be here. So that's what I mean by having a nice mentor, they know you personally and they know what's better for you and for your life. That's really important.

MRMH: Are there any unique aspects of living and working in Hawai'i that you'd like to share with us?

Andrew: Well, obviously, it's nice, right?! It's 70-something degrees Fahrenheit right now and sunny. And it's like that every day, obviously.

But I think that the thing that's nice about it is that it's culturally diverse, and it has always been like that. All these issues and all this division that's going on in the world, we just never had those problems here.

I would say people are very nice here, and people are very friendly. It's an island so you know everybody. So, when you drive on the road, you drive politely. A million people live in Honolulu and everybody knows every-

body. I think that's something about Hawai'i that people don't realize; it's actually the type of environment where people prioritize their family and friends.

MRMH: What are the challenges and rewards of conducting MRI research in Hawai'i?

Andrew: I would say a primary challenge is the isolation, the distance. You're far from the rest of the world. We don't have a big medical centre and resources are tight. The big challenge is just how to get the resources. However, because it's small, it makes things a little bit flatter in terms of the hierarchy. You can go to somebody's office and explain the problem and kind of cut red tape and get things done. But the biggest challenge is just the distance. Zoom has really improved that. But when you come here, you know it's going to be a long flight and you're going to see a lot of blue, a lot of ocean.

MRMH: Could you tell us a bit more about the facilities that you have there, what other research projects are going on, how many groups you have, how the community is at the University of Hawai'i, things like that?

Andrew: We have a Siemens 3T Prisma scanner and we kind of share it with the hospital. It is used clinically, but we also have days that are free for research, when we can use it primarily for experiments.

The good thing about the University of Hawai'i, like I said, is that things are smaller, so it's easy to work with everybody, and personal relationships at work go far here. Currently, we have about eight groups. I can kind of divide them up based on their research topic.

In Hawai'i, we have a very diverse population with unique nutrition and unique lifestyles. Therefore, one of the areas we are interested in here is looking at things like obesity, for example. MRI is really good for looking at body composition, water and fat and all that. Therefore, we do a lot of body imaging in children. We also have maybe four groups looking at the liver and how liver fat can lead to cancer.

Then we also have a lot of functional MRI used in psychology with about three to four people looking at this. They are interested in anything from linguistics to brain development. They do fetal and neonatal MRI looking at functional MRI in the brain. A lot of research here looks at children who are bilingual because a lot of the kids here speak many languages. And we are interested to know how a bilingual brain changes throughout development. There's a lot of that kind of research. I think the unique thing that we have here is a unique population, and we can look at certain things like that. That's the strength. It's small but diverse.

The University of Hawai'i

MRMH: Could you tell us a bit about your current work and your future research goals?

Andrew: I've always kind of been a functional MRI, brain imaging and pulse sequencing person. I am collaborating with the groups I mentioned previously. I'm doing liver fat

The John A. Burns School of Medicine (JABSOM)

imaging and trying to do radial imaging and Dixon-type imaging. I am also really interested in trying to look at motion and functional MRI for fetal imaging and for studies in children. I am also interested in studying electrical properties and connectivity imaging, because it turns out that there's a link with fat imaging, and you can use it to look at different properties of tissue.

But there's also a new development that we will probably see a lot at this meeting, I'm sure. It is using connectivity for functional MRI, so that people can actually do fMRI using connectivity mapping. And that may be a big breakthrough in the fMRI field, by bringing a new biomarker that allows us to look at things. So that's kind of where I'm going.

MRMH: Do you think there are other areas that might be particularly interesting in the future of MRI research?

Andrew: Yeah, even though I don't really work on this, I think affordable MRI is super important. We need to move from a device that's a million dollars to tens of thousands, and it can be purchased by developing countries. And I think that push that people are making to make "the doctor's office MRI" should be the future, where you get to hand-held MRI, like an ultrasound.

I think using AI for MRI-based diagnosis is something for the future. You know how you go to ChatGPT and ask it questions, and it will give you a diagnosis that's pretty accurate? Imagine you can get an MRI and AI just reads your image for you and gives you the radiology report straight away. I think that's going to happen.

MRMH: How do you see the role of MRI evolving in healthcare in the coming years? Do you think there is a large gap between research and clinical use at the moment? Or, on the contrary, are we managing to bridge that gap a bit better?

Andrew: I think the gap is pretty big. And it's mainly just because it's hard to convince industry to invest in something that's not going to give them a monetary return. Also, there are regulations and safety and all these things that they have to do. So it still leaves a big gap. People have thrown around the idea of opening up the scanner platforms, so instead of making everything proprietary, actually opening it up like your iPhone, so people can have an app store, and you can analyse MRI with it. But I don't know how practical that is. And I would argue that the gap is still pretty big.

MRMH: What is your opinion on the younger generation of scientists based on the community in Hawai'i, and also based on your interaction with younger scientists worldwide?

Andrew: They're amazing! It's really great to see, actually. I think that's the funniest thing about getting older. You can see the younger people that actually took something that you worked on and did a better job with it. Each generation has the advantage of having the older generation's knowledge. And so it's definitely moving in the right direction. That's the best part of going to conferences, just seeing the young people.

MRMH: You already gave me some advice for the young people. Would you have any more advice for the young PhD students and investigators in the community, and especially for anyone who would like to come to Hawai'i?

Andrew: I think in general, I would just say, be true to yourself and prioritize your happiness, because at the end of the day, you have to make career decisions, but make sure that you're doing it because it's what you want. Don't feel like you have to do it for somebody else. I mean, when you walk around ISMRM, it's intimidating because everybody is so smart. But you don't have to compare yourself to everybody. You just have to find what you want to do and figure out how you can make a contribution and just do it.

And again, surround yourself with good people that are positive, that bring you a lot of joy, because no matter what job you have, when you go to work, it's the people that you're working with every day that matter. And if you become friends with them and do things outside of work, it really makes a big difference. And you feel much better and might be willing to put up with, maybe, less than ideal career options if the people around you are great people. That's what I would say.

As for coming to Hawai'i, well, one of the issues that most people have when they come here, students and postdocs, is that they don't want to leave, because it's so nice. Our current postdoc, she's leaving, and she has to move, so she's excited to go off to a new life, but she's also like, "oh, I can't go freediving anymore".

My advice is, if you can, come on over. But you know, it's tough to leave. And so that's why I'm stuck here. ■

Interview with Mehmet Akçakaya

INTERVIEW BY **ATENA AKBARI**

Dr Mehmet Akçakaya is an Associate Professor at the University of Minnesota, specializing in signal processing, machine learning, and computational imaging for MRI. He leads the IMAGINE Lab, focusing on fast, high-precision medical imaging techniques. Having spent time in Hawai'i as a Visiting Professor at the John A. Burns School of Medicine (JABSOM), he brings a unique perspective on conducting MRI research in diverse environments. In the following, you'll read an interview with him for MRM Highlights – MRI in Hawai'i, where he reflects on his time at JABSOM.

MRMH: Can you tell us about your academic background?

Mehmet Akçakaya: I studied electrical engineering for my bachelor's degree, applied math for my master's degree, and my PhD focused on the theoretical bounds of compressed sensing. My transition to MRI happened by chance—I was at Harvard when a researcher from Harvard Medical School approached me about applying compressed sensing to MRI acquisitions. I found the work fascinating and continued as a postdoc under Reza Nezafat. Later, I moved to the University of Minnesota's Department of Electrical and Computer Engineering, where I could teach and collaborate with CMRR researchers.

MRMH: What brought you to the John A. Burns School of Medicine (JABSOM) as a visiting professor?

Mehmet: When my first sabbatical came up, we wanted to go somewhere warmer after a harsh winter. My wife needed to work remotely in the U.S., so Hawai'i seemed like a good option. I connected with Andrew Stenger, and he was very receptive, which led to my Visiting Professor position at JABSOM for seven to eight months.

MRMH: How was your experience at JABSOM, both academically and personally?

Mehmet and his PhD students visiting JABSOM

Mehmet, friends and family watch the Waikiki fireworks

Mehmet: JABSOM is a small but close-knit group, and they were very welcoming. They specialize in non-Cartesian acquisitions, while my expertise is in reconstruction and AI, so our collaboration was complementary

Personally, the lifestyle was very different. I enjoyed walking to work—something difficult in Minnesota's cold winters—and spending more time outdoors. Even my phone noticed I was taking more steps than usual!

MRMH: What projects did you work on?

Mehmet: The main project was non-Cartesian multi-echo fMRI, specifically spiral acquisitions, which we aimed to improve using deep-learning reconstruction techniques. There were unique challenges, as our lab had limited experience with non-Cartesian reconstructions. From this collaboration we published a couple of conference papers and are working on journal publications. The goal is to enhance resolution and eventually incorporate more quantitative approaches.

MRMH: Did any notable collaborations emerge from your time there?

Mehmet: Yes, we're continuing our work on multi-echo spiral fMRI, with plans to integrate quantitative imaging and high-resolution acquisitions for better brain connectivity analysis.

MRMH: What is your current research focus?

Mehmet: We focus on computational MRI, particularly improving reconstruction and denoising using AI. My work primarily involves the heart and brain—achieving high resolution while minimizing motion artifacts in cardiac imaging and pushing fMRI and diffusion MRI into a high-resolution regime for better connectivity mapping.

MRMH: How does the research environment at JABSOM compare to CMRR?

Mehmet: CMRR is a large center with extensive resources and many faculty, making it easy to find experts in different areas. JABSOM is much smaller, but that fosters close collaboration—everyone knows each other and interacts daily.

MRMH: What did you enjoy most about living in Hawai'i?

Mehmet: The weather and lifestyle were a big change. People are more relaxed, and social plans are more spontaneous compared to Minnesota, where everything is scheduled weeks in advance. Many of us lived near work, so it was easy to meet up.

We also explored hidden beaches, hiked regularly (even with young kids), and visited other islands. The Big Island's Volcanoes National Park was particularly memorable. Each island has its unique appeal, but we spent most of our time on Oahu.

MRMH: Any advice for researchers considering a Visiting Professor position in Hawai'i?

Mehmet: If you can make it work, go for it! It's a great place both academically and personally. JABSOM's collaborative environment is excellent, and I had a fantastic experience—one that continues through ongoing collaborations. ■

PRESIDENTIAL INTERVIEW

ISMRM President Margaret Hall-Craggs

INTERVIEW BY **MELISSA LOWE**

Margaret Hall-Craggs, Professor of Medical Imaging at UCL and Consultant Radiologist at UCLH, is the current President of ISMRM. She has been an active member of the international MR community, recently completing 6 years as ISMRM Secretary and acting as Chair of the ISMRM Annual Meeting Program Committee from 2007-2010. Margaret has over 240 publications and her current research interest is centred on the imaging and quantitative assessment of bone health in inflammatory arthritis, myeloma and obesity. In this interview we discussed her path into the field of MRI, current advancements in the field and what to expect from ISMRM 2025 in Honolulu.

Margaret Hall-Craggs

MRMH: What first drew you to the field of MRI?

Margaret Hall-Craggs: It feels so long ago now, I can hardly remember! When I started as a radiology trainee, there were X-rays, real time ultrasound and the early days of single-slice CT. I thought - this is nice, but it's not good enough. I started reading about MRI and I was fortunate enough that my training hospital did some MR, but it was outsourced to external centres. It was clear that MR offered something that X-ray-based radiology could not, but nobody had a scanner! Great Ormond Street Hospital was having the first ever paediatric MR scanner in the whole world installed, so I applied to Action Research for funding. They gave me 3.5 years of funding with no strings attached, and I joined Great Ormond Street Hospital after finishing my radiology exams.

I set up the new scanner with Paul Finn, a previous president of ISMRM and now professor at UCLA. We had to start completely from scratch. How do you scan a child? What coils do we use? At this time, we only had a standard head coil, so we used to position these little babies inside the head coil. We had to work out how to get them to sleep, so we worked with an anaesthetist to sedate them, and we published some work on suitable sedation for children in an MRI scanner. It was right at the very beginning of clinical MR!

An extraordinary thing was that Great Ormond Street Hospital had lots of children with neurological disorders who had never been scanned; there was no information on the paediatric brain apart from CT. So, we scanned children with epilepsy, developmental delay, tumours, and it was a complete minefield of conditions that no one had ever scanned before. No one even knew how to look at myelination, so we wrote a protocol and published a paper on that. We wanted to look at body imaging, as everyone was staging cancer with CT and ultrasound. We started doing MRI in three cancers: hepatoblastoma, Wilms tumours and neuroblastomas. I based my thesis on this and then my money ran out and I had to get a job! So, I left and became a consultant at The Middlesex Hospital, later merging to form UCLH. It was the most phenomenal time because we were looking at things that nobody had ever looked at before. Every day was like opening a Christmas present. It was extraordinary, absolutely extraordinary.

So, with all that material, how could you not be excited about MR? It was fantastic. It was so exciting and everyone else was excited around us. The neurologists used to come zooming down to the MR scanner and we'd go through the scans with them, and say, what does this mean? We had no idea!

MRMH: Did you always know you wanted to work in research?

Margaret: Yes, I was always a why, why, why person. I drove people mad! As a medical student I was fortunate enough that I could do Physiology Part 2, requiring me to read papers and original material. I used to sit in the Physiology Lab at Cambridge and read all the papers from The Journal of Physiology, so evidence-based thinking was very natural to me. If you have a question and then you think, I want to answer that with evidence - then you become a researcher!

Serious radiology research wasn't really happening back then. If you pick up a radiology journal from the 1980s, there may have been an odd case reports or a small series - and then it grew very rapidly. With MR happening and then spiral CT, there were more toys to play with, more to investigate. It became much more exciting and continues to be much more exciting to this day.

MRMH: How did you initially get involved with ISMRM? Do you remember your first ISMRM Annual Meeting?

Margaret and grand-daughter

Margaret: When I was appointed at The Middlesex Hospital, we had two scanners, one of which was funded by the MRC to work on the neurological complications of HIV. We had a research team, led by the neurologist Professor Mike Harrison. There was a big cohort of patients with HIV because it was before the antiretroviral drugs were developed. We were looking into the effects of the disease and how it can be quantified in the brain. So, we had quite a lot of material which we were writing up. And, of course, where do you take it? To a radiology meeting! So, we took it to ISMRM. I think that was the first meeting I attended, and it may have been in Nice.

Back then the meeting was really small. All your mates were there, and it was very easy to attend most of the meeting and talk to everyone. There was so little around in those days, and so you went to the conference to learn; what everyone was doing, what was possible, what the physicists were thinking? It was very interesting.

I started going to ISMRM every year. I was Secretary of the British Chapter for several years and then somebody on the British Chapter put me forward for the ISMRM Board of Trustees. I was put on the ballot and I got elected to the Board and then once you're on the Board you begin to understand the organisation. Then I was chosen as AMPC chair by the president at the time, Vivian Lee. Following that, I got invited to be Secretary of the Society and then proceeded to be put on the ballot again as President. So, it wasn't planned; it was entirely serendipitous, and it just happened from following my interests. I was quite an active member of the Board of Trustees because I was interested in it. When you're the AMPC chair, you get to know everybody, and you are heavily involved in organising the meeting. So, I became interested in how the Society functioned and delivered a meeting.

MRMH: You served as Program Chair for ISMRM 2009 in Honolulu. What key lessons from that experience will you bring to ISMRM 2025?

Magaret: When you're Program Chair, it's a four-year commitment. You're Vice Chair Elect, then Vice Chair, then Chair, and then Past Chair. It's very much a team delivery! The Vice Chair does education. The Chair does the science side and is more involved in the shape of the meeting, what it looks like, and any new initiatives. I was Vice Chair in Toronto, Chair in Honolulu and Past Chair in Stockholm.

Being President is a very different experience, and it's much more about the Society. There's lots of background work that goes into organising a Society, making sure that we stay financially solvent and run in a seamless way. It is different, but because I had been Secretary to the Society for six years, I knew how the Society ran, and I knew what my priorities would be when I became President.

MRMH: ISMRM 2024 focused on 'connecting the world of MR,' with discussions around improving access to MRI, ultra-low-field imaging, and more. What themes can we expect for ISMRM 2025?

Margaret: The theme of this year is 'ISMRM towards a healthier footprint', with a focus on sustainability. When Derek Jones was President, he set up the Sustainability Committee under the chairmanship of Kate Hanneman, and I've been working closely with Kate about sustainability issues for the society. Her team has developed a sustainability template, which we're now using when making decisions about the location of future meetings. For example, the overall carbon footprint, including air travel, sustainable practices of the centres, no plastic water bottles etc. In previous years we have had a fourth named lecture called the Ernst Lecture, but this year we are having an Ernst plenary instead. This will be on 'sustainability Wednesday' and will cover the sustainability of MR equipment and machinery. We hope to have a sustainability session as well.

We will also continue with the theme of accessibility. An area that we've been looking into is South America. In the past we have had very few members from South America, even though they have lot of MR scanners. We have two new chapters; the Brazilian Chapter and the Latin American Chapter. The Brazilian Chapter has a meeting in Sao Paulo just before our Annual Meeting and they've given us a room to host ISMRM sessions, so 3 of our senior members will be running this.

MRMH: In a recent ISMRM blog post, you mentioned the launch of Higher Logic. Can you tell us more about what it is and how it will benefit the ISMRM community?

Margaret: Higher Logic is a platform which you can use within an organisation to organise and communicate with your membership. It's not going to be ready for Hawai'i 2025, but it will be launched over the next 12 months. From a member's point of view, it offers a single sign on. All of ISMRM will be on one platform; you've got study groups, chapters, membership directory, subscriptions and payments. Chapters and study groups will be able to communicate more easily through Higher Logic. If you are a new attendee of ISMRM and you go to the newbies meeting and you want to stay in touch, you can create your own newbies group within Higher Logic! It's for organisation and networking. Look out for the demo at the meeting in May – there will be a QR code to give everyone access to a taster of what it can do!

MRMH: What advice would you give to young researchers attending ISMRM for the first time?

Margaret: As I mentioned, there's a newbie party! Thomas Lindner and Sola Adeleke are running a "Navigate the meeting for Newbies" session again this year, and it's a fantastic initiative. I think this signposting of how to negotiate and navigate the meeting is important. I would also say to socialise with people and take their e-mails and phone numbers. I made lots of relationships with people that I then went on to do research with, which was great. Then, at future meetings, you can get back in contact – it's Hawai'i, so you could arrange to go to the beach together!

I remember meeting Mark Henkelman, about my third year of going to ISMRM. I was still doing my research thesis, and I'd read all his papers about how to reduce artefacts. I can remember seeing him and thinking - he's a complete MR God! He started chatting to me and he was just really, really nice. I told him about our research with imaging children, and he was interested in how we were coping with their rapid breathing. It was such a lovely experience.

MRMH: How do you see advancements in AI impacting the field of diagnostic radiology, particularly in MRI?

Margaret: We're already using it every day! I don't think you can just assume that because everyone is saying it's the best, it is the best. You need to test it locally and make sure it really fulfils your needs. We've done some work on AI and inflammatory spinal disease, and I still believe that going forward humans will have to provide input alongside the AI. Maybe it'll get so good that they don't need any of us, but I continue to see it as AI assisting humans. The application that I think is really exciting is in screening. For example, it's so dull reporting normal CT brains in people who've had minor head injuries – this is an area that'll become a function of AI, and it'll flag when something abnormal is identified. This will relieve us of some of the more tedious, routine tasks. Radiologists will still be necessary to discuss difficult cases, using all your clinical experience and the whole clinical picture of a patient. I think this holistic approach will be more difficult for AI, and I don't know how innovative and good at lateral thinking AI will be. Then again, it keeps getting better and better – so I don't know where we'll end up!

MRMH: Your research has focused on imaging and the quantitative assessment of bone health in conditions like inflammatory arthritis, myeloma, and obesity. What emerging developments do you see on the horizon in this field?

Margaret: My current research focus is on inflammatory MSK disease because we've got a big rheumatology department at UCLH. Our rheumatologists are just wonderful people, always trying to do better for their patients. They're very open to research and they're active researchers themselves, so it's a very good environment to do this sort of work in. I had a PhD student called Tim Bray (a complete star) and we did lots of work on inflammatory spinal disease and bone marrow imaging, and he's now leading on that. I'm leading more on the use of MR to assess joint disease activity, particularly in juvenile inflammatory arthritis and adult inflammatory disease. We've been introducing different protocols for rapid assessment of inflammatory disease, whole-body assessment of inflammatory disease and we've received overwhelmingly positive responses from the clinicians. We feel we're making breakthroughs all the time because we have completely changed clinical practice in our own hospital. Now we need to share these developments with the world!

MRMH: What should people look forward to the most at ISMRM this year?

Margaret: I hope people enjoy the sustainability plenary! There are lots of other initiatives that Kei and Katy, the current and incoming AMPC chairs, have been working on. A panel of translators has been put in place to support presenters where English is not their first language, especially with understanding questions from the audience. We're running a MiniHub, which is all about accessibility and sustainability. It's based in Lille, France, making it easier for people in Europe to attend, especially those who may have caring responsibilities or physical disabilities limiting their travel. Material from the main meeting will be streamed, and some faculty members will be there to help lead discussions. This has never been done before, so it is an experiment! We need enough people registered by the 12th of March to make this financially viable. If it's a success, then Mark Griswold (upcoming President) might plan a MiniHub for the South Africa Annual Meeting next year.

Margaret and niece at the 2022 London ISMRM Annual Meeting

MRMH: Thanks very much Margaret - you've certainly had an exciting career!

Margaret: I think I've been really lucky. I got into the right thing at the right time, and it has just been phenomenal. I have never been bored by MRI. Never. Sometimes I find it really hard, and I don't understand it, but I've always found it interesting. ■

ISMRT President Brandy J Reed

INTERVIEW BY **CRISTIAN MONTALBA**

Brandy J Reed, MBA, RT(R)(MR), serves as 2024-2025 ISMRT President. She is Clinical Research Imaging Manager at MD Anderson Cancer Center in Baytown, Texas, USA. In this interview she tells us about her journey within ISMRT, her thoughts on the clinical translation of research innovations and her experience as ISMRT President.

Brandy J Reed

MRMH: Can you share your journey in MRI and in the ISMRT?

Brandy Reed: I actually learned MRI on-the-job while serving in the United States Navy (many years ago). I attended some MRI physics courses at a local university in Maryland while stationed at the National Naval Medical Center in Bethesda, Maryland. The professor was a physicist who wrote our textbook! It was an intense course, to say the very least. My interest in MRI started years before that when I was in radiology school rotating through the modality. I knew that's where I wanted to be.

I was extremely lucky to have some impressive mentors as I grew as a Radiographer and MRI Technologist. One of those mentors is a past president of the ISMRT. We lost touch when I left Bethesda but was thrilled to see Maureen Hood at my first ISMRT conference in Toronto many years later. This was the beginning of my ISMRT journey.

After the Navy and a few years as a civilian in the Pacific Northwest, I moved back home to Texas and started a career at The University of Texas MD Anderson Cancer Center in Houston. I found my home in the Department of Imaging Physics… it must have been that physics curriculum…

My immediate supervisor as well as many colleagues were members of the ISMRT/ISMRM. I was the lead technologist supporting an inflammatory breast cancer trial. Our physicians & physicists were producing some exceptional work, and it was exciting. Krista Runge (Supervisor and active ISMRT member, or SMRT as it was then known) encouraged me to write an abstract on the technical aspects to achieve our necessary image quality and processing of the spectroscopy data. I remember looking at her like a deer in the headlights... 1: what's an abstract? And 2: what is SMRT? I'm proud to say that my abstract received 2nd place research-focused proffered paper that year (2008). Since then, I have served on multiple ISMRT committees, the ISMRT Governing Board, various ISMRM study groups as the ISMRT Representative and now serving our global community as the 2024-2025 ISMRT President. It is truly an honor to have been elected by my peers to be in this position.

MRMH: What inspired you to take on the leadership role as president of this society?

Brandy: It was the leaders in our organization past and present. This society is a family. I have made lifelong friends along the way. With that, you want to see the society grow. I wanted to be a part of this and make a difference where I could support MR Radiographers and Technologist around the world.

The last time we were in Hawai' i for the annual meeting, I introduced myself to Shawna Farquharson. She has such an infectious energy and charisma about her and her love of the society grows from within. She introduced me to several Governing Board members, and I was convinced I needed to be a part of this team. As you know, serving on the Governing Board is very rewarding and fulfilling. It can be a lot of work, but so very worth it.

After a year of being off the board, I continued to be in supporting roles on committees and study groups. When I was approached to be nominated for the president-elect position, I wasn't sure I would be able to fill the shoes of the presidents before me. The likes of Shawna and Nancy Beluk, as well as the many past presidents, well… I just didn't want to let them down, nor let the society down. My institution was very supportive, and after talking to some close friends in the society, I agreed.

MRMH: What are the main goals and vision of the society under your presidency?

Brandy: I want to expand our membership numbers and support education. The Governing Board and Executive Leadership are doing some amazing things this year, including taking a close look at our financials. It's important for us as a society to be good stewards of our finances if we want our society to be sustainable.

We are creating new divisions and

chapters in many places. In addition to that, we need to foster and support our current chapters and divisions to continue to be active and support the radiographers and technologists in the local communities. We know not everyone will be able to attend the annual meetings; therefore, it is important for us to support and foster local activities as well. Our Virtual Meetings Committee has been very busy this year and their work has connected the ISMRT communities around the world.

One thing I wanted to see this year was the ability to join the society at any time during the year and the possibility of a monthly payment. We did do some research this year, but it will take longer than my term to see this take place. Maybe one day.

MRMH: How can ISMRM and ISMRT work together to advance innovation in MRI technology while ensuring its effective clinical translation and implementation?

Brandy: Wow, that's a great question. The ISMRM and ISMRT have complementary roles that can significantly accelerate innovation in MRI technology while ensuring its effective clinical translation and implementation. The first thing that comes to mind are the Study Groups. By multi-disciplinary collaboration and sharing of knowledge, together we can tackle the technical and practical challenges of new MRI innovations. This includes translating theoretical development to real-world applications. A few years ago, I had the pleasure of being a guest speaker at the Cancer Workshop in California. The title of my presentation was Pathways for Clinical Translation: Clinical Best Practices. Midway through the conference, I revamped my lecture. I realized that most of the researchers presenting did not acknowledge the technologist, only fellow physicists or physicians.

Some of the best practices are the sharing of knowledge with everyone and to make research inclusive of the whole team. MDs & PhDs should trust their technologist, and ask their opinion (since they want to be involved and be supportive in their role to ensure success of the whole team, whether it is research or clinical). This is why I always encourage the ISMRT to participate and step up to be a representative on the Study Groups. It's a great way to learn and help to bridge gaps between the societies. We do have a few radiographers (some are PhDs) who hold dual memberships. I think this is a great example of how the MRI Technologist career path as expanded through the years.

Brandy and fellow ISMRT members in Toronto at the 2023 Annual Meeting

I love that many of the ISMRM workshops include ISMRT participation and some are co-organized. This expands access to everyone and encourages communication and promotes global collaboration.

MRMH: How can ISMRT help bridge the gap in MRI education and resources in low- and middle-income countries?

Brandy: We have a unique opportunity to help bridge the gap in LMICs, where access to advanced MRI technology and trained radiographers can be limited. Many of the Governing Board members are active in the Future Leaders program and are doing just. They are organizing virtual training sessions that cover fundamental and advanced MRI techniques, safety protocols, and maintenance practices, allowing professionals to receive high-quality education without needing to travel.

The team has selected from our database of educational materials to fit the individual needs of each of the LMICs they are working with. By fostering global networks, ISMRT is connecting MRI radiographers from LMICs with their counterparts in higher-income countries for mentorship, knowledge sharing, and best practices. Virtual collaboration platforms are enabling the exchange of ideas, solutions, and innovations that work in resource-limited setting.

MRMH: How does the ISMRT support the continuous education and upskilling of MRI radiographers?

Brandy: We support via conferences and virtual meetings. The Annual Meeting, as well as many virtual meetings, allows MRI radiographers to learn about the latest technologies, imaging techniques, and best practices. I absolutely value the study groups for advancing knowledge. There is always an invaluable question and answer session at the end, and no one ever says there is a stupid question.

Being an ISMRT member opens the door to many educational opportunities from our online learning database to being able to rewatch recorded meetings to attending local and international meetings.

Let's not forget about the networking and mentorship opportunities. Through our global network, ISMRT creates opportunities for MRI radiographers and technologist to connect with their peers across the world. Networking with other professionals helps us share experiences, solutions, and innovative ideas, which can lead to personal and professional growth. I, personally, have emailed or "WhatsApp'd" colleagues in other countries to ask a question or to get their opinion on scanning protocols.

> *When I was approached to be nominated for the president-elect position, I wasn't sure I would be able to fill the shoes of the presidents before me… I just didn't want to let them down, nor let the society down.*
>
> –Brandy J Reed

MRMH: What has been the most rewarding aspect of your tenure as president?

Brandy: Being a part of a team that is the best of the best from around the world. The ISMRT Executive Leadership team never ceases to impress me. Adam, Wendy, Glenn, Sarah, & Deb are amazing to work with and I truly value the experience and knowledge each of them brings to the table. We are able to speak freely, disagree when warranted, and still work together to make decisions that are best for the society.

I love to meet the newer members of the society and want to help spark the love I have for the society in them as a mentor sparked in me. I only hope I am a good role model.

MRMH: What advice would you give to MRI radiographers looking to take on leadership roles in the profession?

Brandy: I would say don't be afraid to take the first step and become active in the ISMRT. It doesn't matter if it's a local divisional meeting or national chapter, all the way to the international stage. Join and participate in an ISMRT committee and a study group. If you do not have a division near you, why not get a group of technologists together for study and socializing? You may just have the means to start a division together.

Being active in the ISMRT is a valuable step in progressing personally in your profession, too. I believe the leadership skills I have learned by being a member of the ISMRT has helped my career grow as well. I am now the manager of two departments and two programs. I oversee 87 technologists over 22 clinical MRI units and, on the research side, a 14-member multi-modality technologist team that performs research scans on MRI, CT, PETCT, SpectCT, and PETMR scanners.

MRMH: Do you have any recommendations for tourism in Hawai'i?

Brandy: Oahu is one of the most beautiful and diverse islands in Hawai'i. This will be my 3rd meeting in Hawai'i and I'm excited to return. Of course, the number one priority is the fabulous Annual Meeting that is sure to be one of the best we have ever held. I do recommend staying a few extra days to take in the sights and experience the culture.

Waikiki Beach is famous for its golden sand and clear waters.

A visit to the Pearl Harbor National Memorial is essential for history buffs. You can tour the USS Arizona Memorial, which honors the lives lost during the attack on Pearl Harbor in 1941.

Diamond Head is a dormant volcanic crater offering breathtaking panoramic views of Oahu from the summit. It's a relatively short hike but with some steep parts.

Rent a jeep and take a drive to the North Shore. Known for its world-class surfing, North Shore is home to some of the most famous beaches, including Waimea Bay, Sunset Beach, and Pipeline. Although, the waves are "larger" in the winter, it's still a breathtaking view. Don't miss the food trucks on the North Shore! Giovanni's has the best Hot & Spicy Shrimp.

And my personal favorite is the Polynesian Cultural Center. It offers a deep dive into Hawaiian and Polynesian cultures with interactive exhibits, traditional performances, and authentic food (yes, a luau). This is a great place for families and those interested in learning about Hawaii's history. ■

2025 MANSFIELD LECTURER

Reza Razavi

INTERVIEW BY **MARIA CELESTE BONACCI,** TRANSCRIPT BY **EMMA BIONDETTI**

Professor **Reza Razavi** is Professor of Paediatric cardiovascular Science at King's College London and an Honorary Consultant Paediatric Cardiologist at Guy's & St Thomas's Hospital. He was the Head of Division of Imaging Sciences and Biomedical Engineering (Jan 2007 – March 2017) and Vice President (Research) (March 2017- Jan 2023) at King's College London and the Director of Research at King's Health Partners (June 2015 - Sept 2020). He was also the Director of the King's Wellcome Trust EPSRC Centre For Medical Engineering (until May 2021) and The London AI Centre for Value Based Healthcare (until March 2024).

MRMH: Do you want to tell us about your academic background and your current profession?

Reza Razavi: I am a clinical academic with a background in medicine and a specialization in pediatric cardiology. My journey into academia began during my clinical training when I started researching MRI. At the time, we had one of the first Philips MR scanners in the UK located at Guy's Hospital. MRI was already becoming a routine imaging tool for the brain and other areas, but using it to scan children with heart conditions was a novel approach. We began developing new techniques to image congenital heart defects that are present from birth, which is very distinct from heart diseases seen in adults. This work was particularly challenging because performing MRI on infants and young children required sedation to keep them still. Moreover, MRI technology 25 years ago was far less advanced than it is today, with scanners that were much longer and less accessible. My research career from the start was shaped by close collaboration with physicists, biomedical engineers, and computer scientists. This interdisciplinary teamwork was the key to success bringing together clinical expertise and scientific innovation to advance cardiovascular imaging. In 2000-2001, we had the opportunity to acquire a specialized system that allowed us to perform interventional procedures inside an MR scanner, combining MRI and X-ray technology in a single room. At the time, catheter-based procedures were performed exclusively using X-rays, with the radiation posing a higher risk to children than adults. This provided a compelling reason to explore MRI as a safer alternative for cardiac catheterisation. Developing this technology required extensive research and development. It wasn't just about optimizing imaging sequences but also working closely with Philips to ensure the safe and effective application of MRI in clinical settings. Ultimately, we became the first team to successfully perform cardiac MRI catheterisation in both children and adults, paving the way for new possibilities for the use of MRI.

> *MRI technology 25 years ago was far less advanced than it is today, with scanners that were much longer and less accessible. My research career from the start was shaped by close collaboration with physicists, biomedical engineers, and computer scientists.*
>
> – Reza Razavi

Reza Razavi

MRMH: This is great! Your work perfectly exemplifies how research can translate into real-world clinical advancements.

Reza: We moved from initially sedation to anesthetic which made procedures much easier. Not only have we developed new imaging techniques to examine children's hearts, but we have also made a crucial contribution to the treatment of congenital heart disease in infants and children. By providing 3D imaging, and physiological information

such as accurate measures of pulmonary vascular resistance, we have enabled surgeons to better understand the condition and effectively plan their procedures.

MRMH: It was a remarkable achievement, especially for a field that is constantly evolving.

Reza: Exactly! Previously, patients required invasive catheter procedures to image the heart for diagnosis and treatment planning. The introduction of MRI revolutionized this process, making imaging non-invasive. This was a major step in bringing research into clinical practice. We then established this service across hospitals in London and wider a field in the UK.

Our MR guided cardiac catheterisation program also progressed from congenital heart disease to performing ablation procedures for treating cardiac arrhythmias.

More recently we have also pioneered advanced fetal heart imaging for antnatal diagnosis of congenital heart disease.

MRMH: I'm truly impressed by these responses, as they highlight the vital role of collaboration between different professions in achieving significant advancements. What is your main source of motivation to obtain all these successes?

Reza: The first source of motivation is research that has clinical impact. In my daily work, I see first-hand how our efforts significantly improve patient care, making a real difference for both children and their parents. Alongside this, we have extended our research in cardiac MRI to adults, getting clinical impact across different age groups.

MRMH: In relation to all these achievements, what has been the most important experience of your career?

Reza: For me, the most important experience has been seeing the success of the researchers I've had the privilege to support along the way. Watching them excel and succeed is, honestly, more fulfilling than my own research though I'm proud of the work I've been involved in. It's even more satisfying to see others thrive, knowing we've created an environment that nurtures their growth and success.

I have been able to do this with leadership roles, particularly within my department, Imaging Sciences and Biomedical Engineering at King's College London by focusing on recruiting top talent and fostering an environment that enables people to excel. An environment that combines clinical practice, research, and industry collaboration. Partnering closely with industry leaders initially Philips and then Siemens has been crucial in establishing the best environment for groundbreaking work. By bringing together top talent and fostering strong partnerships, we have been able to drive meaningful advancements in the field.

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– Reza Razavi

MRMH: I can only imagine the difficulties to maintain the balance between these different and important personalities.

Reza: Exactly! We also have a diverse group of researchers from different disciplines, including many great PhD students, and industry scientists who play a crucial role in translating our research findings into real-world clinical applications.

MRMH: Sharing results with medical professionals is incredibly challenging, so having strong support is absolutely crucial.

Reza: Translating research into clinical practice is challenging, but taking it beyond the experimental setting of one hospital to ensure it works across every hospital is an even more difficult journey. However, it's a crucial one, and it requires persistence and hard work.

MRMH: This is a noble answer. Meeting a supervisor with this idea is lucky for a younger researcher. And what was the most difficult experience?

Reza: I think there have been many difficult moments, especially when working with different people securing funding, collaborating effectively with industry, and managing various researchers. One of the most challenging moments was when we had to relocate to a new campus along with all the clinical teams and services. We had to secure funding for a new scanner and build a new team from scratch. Initially, it seemed like an insurmountable task, but in the end, we overcame the challenges. I learned that persistence is key, and you can't take 'no' as a final answer. Now, we have a robust infrastructure with researchers and clinicians working closely together, and it's been incredibly rewarding.

MRMH: Wow! This was a hard story but with a positive outcome in the end. Moreover, How did you overcome the "bad" times during your career?

Reza: The biggest factor in overcoming challenges has been the support we provide one another as a team. When you're part of a close-knit team that feels like a family, you can rely on your colleagues during tough times. That support has been

crucial in getting through difficult moments, and for me, it has always been one of the most important aspects of our work.

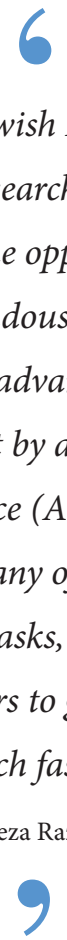
MRMH: And who helped you most in your career?

Reza: I have to say that the partnership with my engineering and physics colleagues has been key to my success. From the very beginning, when I started as a junior researcher, with Dave Hawks and Derek Hill computer scientists working in medical imaging who helped me get started. Later, close collaboration with Tobias Schaeffter, Renee Botnar, and Jo Hajnal, and most recently Sebastian Roujol and Andy King. All of these brilliant engineers physicists and computer scientists have played a crucial role in helping me succeed over the years.

MRMH: What would you suggest to us younger researchers for our career?

Reza: I work closely with younger researchers in my department, many of whom are physicists and computer scientists who have completed their PhDs or postdocs with me and have gone on to become academics themselves. One of the things I find most rewarding is helping them grow. There are a few things I always share with them, and I try to lead by example. I believe there are three key ingredients for success: first, your research ideas and how you develop them; second, the importance of publishing well and building strong connections; and third, the research environment you're part of. To achieve all of this, you need to be brave and generous. While research can be highly competitive, and there's always the desire to outshine other teams or individuals, I believe collaboration is far more important. Being generous with your time, your collaborations, and your approach to working with others is key. If you approach your work with generosity, the world reflects that spirit in your research, and true success follows.

MRMH: These are truly valuable suggestions for younger researchers, as the biggest challenge often lies in recognizing the importance of collaboration. We tend to focus on the competition between us, forgetting that each individual contribution plays a crucial role in achieving a great outcome. It's easy to get caught up in the race, but it's the collective effort that truly drives success. Which do you think are the most important skills that a young researcher should have?



I often wish I were a young researcher today, because the opportunities are tremendous, especially with the advancements brought by artificial intelligence (AI). AI can handle many of the more routine tasks, allowing researchers to get results much faster.

– Reza Razavi

Reza: As we've discussed before, generosity is key, but of course, hard work and curiosity are essential too. However, one of the most important skills is learning how to deal with failure and how to learn from things that don't work. In research, almost always the first attempt doesn't succeed, and that's perfectly normal. The key is not becoming discouraged and never giving up.

MRMH: What would you like to wish to young researchers?

Reza: I often wish I were a young researcher today, because the opportunities are tremendous, especially with the advancements brought by artificial intelligence (AI). AI can handle many of the more routine tasks, allowing researchers to get results much faster. These tools can be applied across all areas, freeing you up to focus on the creative problem-solving and innovative ideas that drive research forward. It's a fantastic time to be a researcher, and the world has become more multidisciplinary, offering real opportunities to move ahead. One more piece of advice I'd offer is to remain open to steering your career in different directions. You can translate your technology and research into clinical practice by licensing it to a large company, or you could even create your own startup to move those ideas forward. The skills needed for entrepreneurship differ from those needed for research, but the key is being open to learning and embracing change whether that's in your research or your career path.

MRMH: What do you wish for your working future?

Reza: As I mentioned earlier, I'm transitioning into a new phase of entrepreneurship, where I aim to turn a promising research idea into a product and service that truly benefits patients and is integrated into hospitals. Of course, for this to be successful, it has to work effectively, but you also need to navigate regulatory challenges and make critical commercial decisions. The goal is to take the research technology developed to improve patient outcomes and also reduce healthcare costs a crucial consideration today. With health systems facing limited capacity and financial constraints, we need to leverage technology, research, and innovation not only to enhance patient outcomes but also to improve the economics of healthcare.

MRMH: Thank you for this inspiring interview Prof. Razavi!

Reza: Thank you so much for the time and the opportunity. ■

2025 NIBIB NEW HORIZONS LECTURER

Shintaro Ichikawa

INTERVIEW BY **JIANPAN HUANG**

Dr Shintaro Ichikawa is an Associate Professor in the Department of Radiology, Hamamatsu University School of Medicine, Hamamatsu, Japan. For this year's Annual Meeting, he has been invited to present his groundbreaking work in the prestigious National Institute of Biomedical Imaging and Bioengineering (NIBIB) New Horizons Lecture.

MRMH: What is your academic background and your current profession?

Shintaro Ichikawa: I completed my medical education and training at the University of Yamanashi in Japan, where I earned my medical degree in 2005. I then underwent residency and fellowship training at the same university, specializing in diagnostic imaging, particularly abdominal imaging. In 2014, I was appointed as an Assistant Professor at the University of Yamanashi. From 2018 to 2020, I was a visiting scholar at the University of California, San Diego (UCSD). Currently, I am an Associate Professor at Hamamatsu University School of Medicine.

MRMH: Wow! You have been researching and working in medical imaging for a long time. What is your main source of motivation?

Shintaro: A good question. My main motivation comes from my passion for advancing medical imaging and improving patient care. As a radiologist, I'm driven by the desire to enhance diagnostic accuracy and contribute to the development of new imaging techniques. I believe that the direct impact of my work on patient outcomes and collaborating with dedicated colleagues in the field continually inspire me. Additionally, mentoring young professionals and contributing to academic research provides me with a strong sense of fulfillment.

MRMH: I like this answer and I believe that advancing medical imaging and improving patient care are shared goals of our community, and we really need more young researchers and clinicians to contribute to this field. What has been the most important experience of your career?

Shintaro Ichikawa

Shintaro: The most important experience of my career was my time as a visiting scholar at UC San Diego. I had the privilege of spending two years with the Liver Imaging Group, led by Professor Claude Sirlin, a founder of the LI-RADS. This experience allowed me to work closely with top experts in the field and gain valuable insights into cutting-edge imaging research.

MRMH: I see. What about the most difficult experience?

Shintaro: One of the most difficult experiences in my career was the final six months of my time in UC San Diego. Due to the COVID-19 pandemic, the campus went into lockdown, and I was unable to go to the lab for about six months. As a result, I could not complete the research project I had been working on. Fortunately, after returning to Japan, I was able to complete the project by utilizing cases from the University of Yamanashi and successfully published the research.

MRMH: Indeed, I believe that the time during the pandemic has been difficult for many people around the world. How did you overcome the "bad" times during Covid-19 at UC San Diego?

Shintaro: It was a very tough time. To overcome such difficulties, I relied on my adaptability and patience. When I was unable to access the lab, I shifted my efforts to data analysis and writing papers, making the most of remote work. In addition, I relied on the support of my family. My children, who were in elementary school at that time, had to adapt to remote learning, which was a completely new experience for them and for us. My wife helped me go through the uncertainties of the pandemic. We faced these challenges together as a family.

MRMH: Wow, the whole family went to San Diego with you. That must mean a lot to you!

Shintaro: Yeah. And my kids speak English better than I do because they learned it in a native English environment and, as children, they pick up languages quickly.

MRMH: Haha, that's interesting! Who helped you most in your career?

Shintaro: Of course, many people have helped me, but one of the individuals who had the most significant impact on my career is my mentor. He taught me everything from the foundations of research and planning to data analysis, conference presentations, and academic writing. His guidance was invaluable in shaping my approach to research and clinical practice. Thanks to his mentorship,

I was able to develop the skills necessary to conduct meaningful research and contribute to the field. I am deeply grateful for his support and the knowledge he shared with me.

MRMH: Your mentor for your PhD study?

Shintaro: Yes, my PhD mentor, Utaroh Motosugi. He was a radiologist at the University of Yamanashi in Japan. He later moved to a public hospital to work as a diagnostic radiologist. However, we still keep in touch from time to time.

MRMH: What would you suggest to us younger researchers for our career?

Shintaro: My advice to younger researchers is to continue challenges without hesitation. Even if something seems difficult at first, give it a try. You will learn and grow from the experience. Always be open to new opportunities and avoid turning down offers, as each experience can lead to unexpected growth and valuable connections. Additionally, when facing difficulties, don't try to handle everything alone. Seek advice from colleagues, mentors, peers, and family. Collaboration and support from others are essential for overcoming obstacles and advancing in your career.

MRMH: Good suggestions! Which do you think are the most important skills that a young researcher should have?

Shintaro: I believe the most important skills for young researchers are the ability to engage others and strong communication skills. Research is not something that can be done alone; it requires collaboration, discussion, and teamwork. The ability to involve others, share ideas effectively, and build strong professional relationships significantly enhances both the quality of research and career development. Additionally, it is crucial to publish research findings in a timely manner. If a study loses its relevance, the chances of acceptance decrease. Therefore, being proactive in writing and submitting papers is essential for success in academia.

MRMH: Have you ever experienced missing the right timing to publish your work?

Shintaro: Yes, actually in Japan radiologists often don't have enough time to write papers due to the demands of a fast-paced clinical practice. When I was younger, there were times when I couldn't complete my writing on time. As a result, I missed the opportunity to publish some of my findings. That's why I would like to offer this suggestion to young researchers as well.

Shintaro Ichikawa and his research group.

MRMH: I totally agree. This is something that researchers really need to pay attention to. What would you like to wish to young researchers?

Shintaro: I wish for young researchers to truly enjoy their research. Of course, you may have a hard time, but please enjoy your research. Your research, driven by passion and curiosity, is the driving force behind meaningful discoveries. I also encourage you to actively participate in conferences onsite and expand your professional network. Connecting with other researchers opens up new opportunities and collaborations, greatly enhancing your careers. Most importantly, I wish young researchers to always maintain integrity. It may seem obvious, but ethical research practices are the foundation of trust and credibility in academia.

MRMH: Thank you! These are such good wishes and suggestions for young researchers!

What do you wish for your working future?

Shintaro: In the future, I hope to continue contributing to the advancement of medical imaging research while fostering collaborations with colleagues worldwide. I also wish to mentor young researchers, just as my mentor did for me, helping them develop their skills and pursue their own academic goals. Additionally, I aim to stay engaged in clinical practice, ensuring that my research remains closely connected to real-world medical needs. By balancing research, education, and clinical work, I hope to make meaningful contributions to both academia and patient care.

MRMH: Is there anything else you want to add?

Shintaro: I have been given the opportunity to present the NIBIB lecture at the ISMRM 2025. This would not have been possible without the support and recommendations from my colleagues, as well as the right timing and great luck. I am truly grateful to those who have helped me along the way. I will always cherish this sense of gratitude.

MRMH: Thank you for the inspiring chat! I look forward to your lecture at ISMRM 2025.

Shintaro: Thank you for providing this opportunity! See you in Hawai'i! ■

ISMRM's 2000 W.S. Moore Young Investigator Award winner

INTERVIEW BY **KATYA BLANTER**

Dr Talissa Altes is Professor and Chair of Radiology at the University of Missouri. She is a practicing pediatric radiologist with a research interest in lung imaging. For over 25 years, Dr Altes has been an active researcher in the field of hyperpolarized gas MRI. She pioneered the application of this technique to a variety of lung diseases including asthma, cystic fibrosis and bronchopulmonary dysplasia (also known as chronic lung disease of prematurity). Together with University of Virginia MRI physicist collaborators, her lab pioneered a number of hyperpolarized gas imaging techniques including diffusion-weighted imaging and direct dissolved phase imaging. Dr Altes has received funding from the National Institutes of Health, foundations and industry. She has over 120 publications and has given over 150 invited talks.

Talissa Altes

We interviewed Dr Altes on the 25th anniversary of her winning the W.S. Moore Young Investigator Award for her work titled Hyperpolarized 3He MR lung ventilation imaging in asthmatics: preliminary findings.*

MRMH: How did you get into MRI and lung imaging?

Talissa Altes: I was a radiology resident at the University of Virginia (UVA) when Bruce Hillman, MD was Chair of Radiology. He started a radiology research resident track at UVA and I was the third resident accepted into the program. During my second year of radiology residency, I spent a year doing research, working toward a Master's degree in Biomedical Engineering (BME), and, of course, taking radiology resident call. We had a number of outstanding researchers in the department and I fortunate to work with Dave Kallmes, MD as my primary mentor. My research project was done in a research building, and I got to know some of the radiology researchers including James (Jim) Brookeman, PhD and John Mugler III, PhD. They had acquired an early helium polarizer from Polarean. UVA was one of the first sites where they were exploring what could be done on human subjects. Just due to proximity, I ended up helping one of their graduate students create an animal model for a hyperpolarized helium MRI research project. I quickly became enamored with hyperpolarized gas lung MRI. It was so interesting to see things in the lungs that we knew were there but didn't have a way to see before. It was just like the rest of imaging where, for example, you can see appendicitis without opening the abdomen. When I recruited my first asthmatic subject and actually saw their regional ventilation defects, I was hooked. It was so interesting to me because there were so many questions that we could now answer with this new method. Eduard deLange, MD, one of our Body Imaging Faculty, was already involved with hyperpolarized gas MR research and became a generous mentor/colleague.

I feel PhD imaging scientists benefit from collaboration with clinicians to drive clinically relevant research. And the reverse is equally true. Clinician scientists benefit from collaborations with PhD researchers to drive their research to the cutting edge of technology. For me, it was a rewarding partnership where each side brought things to the table. Getting involved in hyperpolarized gas MRI research was complete serendipity and certainly my good fortune. Of course, I couldn't have been successful without such a wonderful group of mentors/collaborators and the existing research infrastructure.

MRMH: Were you sure you could succeed when starting the project?

Talissa: I guess I never thought about it in that way. It was more of a curiosity, not success or failure. It didn't matter what we found, since we were just seeking to understand lung diseases better. I was not as invested in the technique as the ability to better understand lung disease.

MRMH: What was it like to win the YIA in 2000?

Talissa: I was a clinical radiology resident so I

didn't know much about ISMRM or the YIA. My BME thesis advisor, Jim Brookeman, suggested that I submit an abstract. When it was accepted for the YIA, my mentors were excited to have our research showcased in this way. Back then, I didn't really understand what it really meant in the MR community to win this award. When I won, I felt like somebody like me, an MD, can do good research, particularly when in partnership with PhDs. These types of opportunities and successes were integral to my deciding to pursue an academic career.

Working in a research team is tremendously fun. By having researchers of different backgrounds on the team, you gain new insights into how solve whatever problem you are trying to figure out. In isolation you can be good, but in partnership you can be great. I feel collaboration with MDs early in project will facilitate translation. They may see things in what you're doing that you don't see, like ways to make a bigger clinical impact. Talking freely about ideas was one of the great things that Jim Brookeman fostered. To this day, I feel it is important to be open and share your ideas/work. He saw science as a team sport and I believe in that too. He, and all of my UVA mentors/collaborators, had a profound impact on me—for which I am immensely grateful.

MRMH: Did winning the W.S. Moore award influence your career?

Talissa: Absolutely. It really helped me see myself as an academic and someone who will continue doing research. Part of my value on a research team is the ability to translate a new technique and make it successful/useful in clinical practice. As a PhD, if you work with an MD who is going to translate your research from the beginning, it will be much easier to get to clinical practice. I can't tell you how many times I've had researchers come to me wanting to translate something into the clinic that they've spent years working on but is something clinicians would never use for one reason or another. A lot of wasted effort can be avoided by partnering early.

MRMH: Do you have any advice for early career researchers who are, today, where you were in 2000?

Talissa: I won the award 25 years ago and I've had a very enjoyable career. Now as I reflect back on my career, the most important thing is the people. In a research career you may be lucky, like John Mugler who developed MPRAGE and SPACE, to come up with things that have a massive clinical impact. I imagine that feels rewarding. But for most of us, the biggest impact we have is on the people you train and work with. It may seem like the most important things are the projects, but in reality, it's the people. As a trainee, you may think of yourself as the recipient of the training, but you are an integral part of the team. You can make the person next to you in the lab (trainee or faculty) more successful, happy, and likely to stay in our field.

> *Getting involved in hyperpolarized gas MRI research was complete serendipity and certainly my good fortune. Of course, I couldn't have been successful without such a wonderful group of mentors/collaborators and the existing research infrastructure.*
>
> –Dr Talissa Altes

Also, I feel it is hard to be a good mentor or teacher. We all were in school for a long time and we had good and bad teachers and mentors. You think when you get out that you're not going to be like the bad ones but then you find yourself doing something that the bad ones did. Then you say to yourself "wow, I swore I'd never be that person." It took me a long time to learn that each trainee needs a different mentorship style.

Another thing is that I was very naive when I started. When I was a resident and working with the wonderful team of faculty and trainees, I didn't realize that they were going to be my collaborators for many years to come. It was the same with the physicians who trained me. I became faculty at UVA and they became my colleagues. I didn't recognize that I was entering a community. I thought I was a transient, but I wasn't.

MRMH: ISMRM is a pretty great community as well, since we see the same people develop their ideas or come up with new ones year after year.

Talissa: ISMRM is by far my favorite professional society in all of radiology. It's an amazing society. It's one of the few places where I'll walk up to a poster and ask, 'can you explain this to me?' and they'll ask me whether I am an MD or a PhD. When I say I'm an MD, they'll say something like, "well, I think I can dumb it down for you." I smile from ear to ear every time that happens. I love how openly everyone shares new ideas. I always leave the meeting so energized.

In sum, I feel tremendously lucky to have had such wonderful mentors and colleagues at UVA. Without them, I never would have developed the skills and had the opportunities to do so many of the things that have been so rewarding in my career. ISMRM gave me the opportunity to be part of an amazing community of clinicians and researchers. Participating in the 2000 the YIA award competition was one of the experiences that led me to pursue an academic career. Many thanks to everyone who contributes to the success of the ISMRM. ■

**Talissa A. Altes, Patrick L. Powers, Jack Knight-Scott, Gary Rakes, Thomas AE Platts-Mills, Eduard E. de Lange, Bennett A. Alford, John P. Mugler III, and James R. Brookeman. "Hyperpolarized 3He MR lung ventilation imaging in asthmatics: preliminary findings." Journal of Magnetic Resonance Imaging: An Official Journal of the International Society for Magnetic Resonance in Medicine 13, no. 3 (2001): 378-384.*

2025 ISMRM Young Investigator Award Finalists

EDITED BY **ALAURA BORTOLOTTI**

This year, the Society has nominated eight finalists for its Young Investigator Awards (YIAs), and the winners will be announced at the Annual Meeting. The I.I. Rabi Award is given for a paper published on original basic science research, whereas the W.S. Moore Award is given for a paper published on original clinical research. The Prince-Meaney Award is given for a paper published on translational science research. As usual, we have an outstanding group of finalists, and we have the pleasure of showcasing them here, in the MRM Highlights magazine.

Vadim Malis

From an early age, I saw physics as the key to understanding how the world operates on a fundamental level. This curiosity led me to Moscow State University, where I studied physics and developed advanced mathematical skills. However, as I explored more complex theories, I became increasingly curious about their connection to real-world challenges. This growing interest led me to explore how scientific principles extend beyond theory, gradually drawing me toward translational research and its role in bridging fundamental discoveries with medical applications.

Vadmin Malis

To further pursue this goal, I moved to the United States to complete a PhD in physics at UC San Diego, USA. Under the mentorship of Dr Shantanu Sinha, I had the opportunity to explore MRI, gaining experience in phase-contrast MRI, ultra-short echo time (UTE) imaging, and diffusion tensor imaging. My work focused on investigating age-related changes in muscle structure and function, highlighting MRI's versatility and role in uncovering complex physiological mechanisms.

Currently, I am a Project Scientist in Dr Mitsue Miyazaki's research group at UC San Diego, where we focus on developing advanced, contrast-free MRI techniques to solve unmet clinical needs. For instance, neurofluid imaging for neurodegenerative diseases involving brain waste clearance, lung UTE imaging, whole-heart coronary artery imaging, and non-contrast peripheral artery techniques. Due to safe contrast-free techniques, patients can be screened and followed up after various treatments.

Over the past twelve years, my involvement with the ISMRM has been essential to my professional development, providing opportunities to collaborate, present my research, and stay at the forefront of MRI innovation. This year, I am honored to have one of my projects nominated for a Young Investigator Award—recognition that strengthens my commitment to advancing MRI technology for improved clinical care.

NOMINATED PAPER

Multiparametric exchange protons using Z-Spectrum Analysis Proton (ZAP) & Chemical Exchange Saturation Transfer (CEST) on phantoms & human abdomen

Chemical exchange saturation transfer (CEST) MRI has demonstrated potential for advanced tissue characterization, yet its clinical adoption remains limited due to complex acquisition protocols and the need for intricate post-processing. In this study, we introduce Z-Spectrum Analysis Protons (ZAP) combined with CEST imaging to provide a more comprehensive assessment of proton exchange dynamics. While CEST targets specific chemical groups such as hydroxyl, amide, and amine protons, ZAP extends beyond conventional CEST by sweeping a wide frequency range (±100 ppm), capturing a comprehensive profile of both CEST and the much broader pool of exchangeable protons. The feasibility of this approach was evaluated on a clinical 3T MRI scanner through both phantom and in-vivo studies.

An important outcome of the study is the development of quantitative metrics, including free and restricted proton

fractions and their apparent relaxation times, which enhance tissue characterization. Phantom validation demonstrated that ZAP-derived metrics reliably capture variations in proton exchange rates and pH conditions, confirming their reproducibility and potential for quantitative biochemical assessment. In human studies, we observed significant differences in ZAP-derived metrics across various abdominal organs, including the liver, pancreas, and gallbladder, reflecting variations in tissue composition and biochemical environment.

These findings underscore the potential of ZAP metrics as reliable imaging biomarkers, delivering a more comprehensive and quantitative evaluation of the biochemistry of tissues and fluids. By complementing CEST acquisitions with the ZAP technique, sensitivity to microenvironmental changes—including variations in pH, proton exchange rates, and molecular composition—is significantly enhanced. Capturing a broader spectrum of exchangeable protons improves tissue differentiation, facilitating earlier detection of pathological changes. The robust and reproducible nature of ZAP-derived metrics supports the potential for future clinical translation, holding promise for improved disease monitoring and treatment response while enhancing diagnostic precision and advancing personalized patient care.

Zijing Dong

I am an MRI researcher at the Athinoula A. Martinos Center, Massachusetts General Hospital, Harvard Medical School, USA. My research focuses on developing MRI acquisition and reconstruction technologies to enhance spatiotemporal resolution, data quality, and information content for structural and functional imaging. The goal is to develop novel and practical imaging tools for both neuroscientific and clinical applications. I joined the Martinos Center as a Research Fellow in 2021 and recently transitioned to a faculty position after receiving an NIH K99/R00 Pathway to Independence Award. Previously, I earned my PhD in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology.

My research has been dedicated to developing new MRI acquisition and reconstruction techniques with enhanced sensitivity, specificity, and spatiotemporal resolutions to advance the investigation of structure, function, and physiology of the human brain and body. My research interests span various imaging modalities, including functional MRI, diffusion MRI, quantitative MRI, glymphatic flow imaging, with a common goal of creating advanced tools to advance both neuroscientific research and clinical applications. Specifically, to study brain's structural organization and investigate fine-scale circuitries, I have been developing high-resolution diffusion MRI techniques, from multi-shot EPI to tilted-CAIPI and EPTI. We have now achieved mesoscale diffusion MRI at 500μm-isotropic resolution in vivo enabled by the Romer-EPTI technique that I am presenting this year for the YIA. My ongoing research also focuses on developing non-invasive imaging tools to map CSF flow in the human brain to provide new insights into the brain's waste clearance system and glymphatic physiology. By creating highly sensitive CSF flow imaging techniques, we have successfully mapped quantitative CSF flow across the entire human brain, including previously inaccessible but critical regions such as the subarachnoid spaces. These advancements open new opportunities for identifying biomarkers and developing treatment strategies for neurodegenerative diseases.

NOMINATED PAPER

Romer-EPTI: rotating-view motion-robust super-resolution EPTI for SNR-efficient distortion-free in-vivo mesoscale dMRI & microstructure imaging

In this paper, we introduced a novel acquisition technique, Romer-EPTI, to address major challenges that persist in diffusion MRI acquisition, including low SNR, distortion and blurring artifacts, and motion vulnerability. Even state-of-the-art

Zijing Dond

methods have fallen short of overcoming these challenges, limiting our ability to achieve high-quality in-vivo dMRI at high spatial resolutions and high b-values. To address this, the proposed Romer-EPTI achieves not only significantly higher SNR efficiency, but also high image quality, free from distortion and slab boundary striping artifacts with minimal spatial blurring. In addition, it is also developed to achieve high robustness to various sources of motion, including 3D bulk motion, physiological motion, and motion-related dynamic distortions. Finally, Romer-EPTI addresses unique challenges for 7T dMRI as it achieves minimal TE and has no extra SAR or B0/B1 susceptibility.

Using Romer-EPTI, we demonstrated, for the first time, whole-brain in-vivo dMRI at mesoscale resolutions at both 3T (500 μm-isotropic) and 7T (485 μm-isotropic). In addition, we showed Romer-EPTI's significant SNR gain and robustness

for high b-value and time-dependent diffusion imaging—another vital application in dMRI that can be SNR-starved. All our demonstrations were performed on widely accessible clinical 3T or 7T scanners, aiming to make a broad impact on various applications. Recently, we have developed Romer-EPTI on the Connectome 2.0 scanner and achieved 387 µm-isotropic resolution, bridging the gap of resolution between in-vivo and ex-vivo dMRI. By providing significantly improved SNR efficiency, image quality, and motion robustness, we believe this technique will greatly facilitate the application of high-resolution dMRI and microstructure imaging for both neuroscientific research and clinical applications. As part of our ongoing efforts, we are also extending Romer-EPTI from brain to body to address even greater challenges in body diffusion MRI, with the goal of achieving high-quality, high-resolution body diffusion imaging.

Zexuan Liu

My journey in MRI began during an undergraduate medical imaging systems course at Case Western Reserve University, taught by Dr Xin Yu. Captivated by the versatility of MR physics and its immense potential for clinical applications, I pursued advanced studies in proton MR spectroscopy during my master's degree in the joint Biomedical Engineering Program at Georgia Institute of Technology and Emory University. Under the mentorship of Dr Candace Fleischer, I explored innovative methods of MR spectroscopy (MRS) and their clinical potential. I studied brain metabolite changes in young athletes, quantified using proton MRS, aiming to better understand the neurochemical alterations associated with repeated head impacts and concussions in high school American football players. Working on this project, which is the topic of our nominated paper, reinforced my commitment to advancing non-invasive imaging solutions for complex clinical problems. Currently, as a PhD student at the University of Michigan under the guidance of Dr Jesse Hamilton, I focus on cardiac and pulmonary tissue property mapping using MR fingerprinting, with a particular emphasis on leveraging 0.55T MRI and deep learning reconstruction methods to address challenges of imaging the lungs.

Throughout my academic journey, I have been fortunate to collaborate with diverse groups of MR physicists, clinicians, and engineers, which has deepened my appreciation for the multidisciplinary nature of MRI research. These collaborations have exposed me to cutting-edge innovations in the field and have inspired me to approach complex clinical problems with creativity and technical rigor. I am motivated by the immense potential of MRI to bridge the gap between technological advancements and their real-world clinical applications.

Being named a finalist for the ISMRM Young Investigator Award is an incredible honor. I would like to extend my heartfelt gratitude to the ISMRM committee for this opportunity and to my mentors, collaborators, and colleagues who have supported me throughout this journey. I am excited to continue contributing to the field of MRI, with a focus on both technical advancements and their clinical applications to address pressing healthcare challenges.

NOMINATED PAPER

Associations between brain metabolites measured with MR spectroscopy & head impacts in high school American football athletes

Diagnosis and prognosis of sports-related traumatic brain injury is a known challenge, particularly in young athletes. Reliance on clinical symptom presentation alone may fail to identify neurological impairments caused by repeated head impacts. While the detrimental effects of repeated concussions on brain health are well documented, there is growing concern that repeated yet asymptomatic head impacts, even in the absence of concussion, may also pose long term consequences particularly to the developing brain. Prior studies have shown alterations in brain structure and connectivity after brain injury, but neurochemical changes also occur. Proton MRS allows simultaneous quantification of multiple brain metabolites that may be associated with injury processes in the brain. Despite the long-standing availability of MRS, neurochemical alterations associated with sports-related brain injuries and repeated head impacts in adolescent athletes have not been well characterized.

Zexuan Liu

This work investigates the relationship between brain metabolite changes, measured using MRS, and repeated head impacts in a cohort of 215 high school athletes over a single season of American football. Additionally, we examined the effects of sustaining a concussion and the use of a novel protective jugular vein compression (JVC) collar on this relationship. This work represents the largest longitudinal cohort of high school American football athletes to date and identified the neurochemical alterations induced by a season of repeated head impacts. We identified choline in

the primary motor cortex as a key metric of injury, as well as a significant association between myo-inositol in the anterior cingulate cortex and impacts of high magnitude in participants who wore the JVC collar. These findings may be generalizable to adolescent athletes exposed to repeated head impacts and after concussion, and support the continued use of MRS as a neuroimaging metric of neurological alterations in sports-related injuries.

Yuran Zhu

I am a PhD student in biomedical engineering at Case Western Reserve University (CWRU) in Cleveland, focusing on advancing quantitative and dynamic contrast-enhanced (DCE) MRI methods for preclinical imaging of the mouse brain to address critical challenges in neuroscience.

It took me some time to find my passion for developing new imaging methods for biomedical research. From an early age, imaging was a tool of discovery—whether observing chloroplasts in leaves or studying bacterial commensal behaviors for high school science projects. My perspective transformed during a Smile Asia medical mission in the Tibetan region, where I served as a medical scribe for children with cleft lip and/or palate. Witnessing how medical imaging and genetic screening guided both diagnosis and treatment planning revealed the profound impact of interdisciplinary approaches in medicine.

During my undergraduate years at CWRU, I participated in a summer research program at Fudan University in Shanghai, where I immersed myself in advanced optical imaging, working with transgenic cells and zebrafish. Watching fluorescent proteins illuminate structures in transparent zebrafish embryos ignited my fascination with tracer imaging, a powerful tool for visualizing dynamic biological processes in living organisms.

This passion led me to Dr Xin Yu's lab at CWRU, where I began developing DCE-MRI methods for pathophysiological studies in rodent models. After completing my BSc in Biomedical Engineering in 2020, I knew I had found my scientific home and continued into the PhD program under Dr Yu's mentorship. My research now focuses on developing quantitative DCE-MRI approaches using magnetic resonance fingerprinting (MRF) to map cerebrospinal fluid (CSF) transport. This work is crucial, as CSF facilitates the removal of metabolic waste and neurotoxic proteins through the recently discovered glymphatic system. We have developed a pioneering 3D MRF pipeline for ultra-high field preclinical scanners that simultaneously maps T1 and T2, revolutionizing how we quantify contrast agent transport in CSF. The innovative potential of this work has been recognized through an American Heart Association predoctoral fellowship for using 3D MRF to investigate altered CSF flow in post-stroke edema and potential treatment.

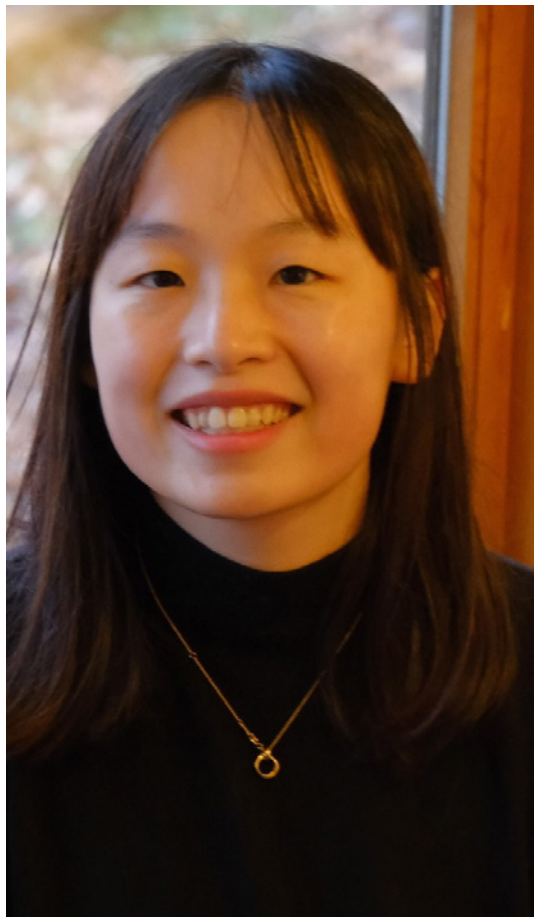
As I approach the completion of my PhD training, my goal is to build on this momentum and reshape preclinical quantitative MRI, ultimately bridging the gap between laboratory discoveries and clinical applications.

NOMINATED PAPER

3D MR fingerprinting for dynamic contrast-enhanced imaging of whole mouse brain

Preclinical investigations using mouse models provide invaluable insights into the pathophysiology of neurological disorders. Quantification of T1 and T2 relaxation times by MRI enables sensitive detection of pathological changes and dynamic tracking of contrast agent transport across the whole brain. However, a significant challenge in imaging mouse brain is balancing high spatial resolution with reasonable temporal resolution to maintain sufficient signal-to-noise ratio. Conventional methods require prolonged scan times to map T1 and T2 in a single slice, making whole-brain quantitative imaging and dynamic contrast agent tracking infeasible. This limitation has become particularly pressing with the growing understanding of neurofluid transport in brain waste clearance. While optical imaging studies have revealed the complexity of solute transport in localized regions, they also underscored the urgent need for a dynamic, whole-brain imaging method. Although dynamic contrast-enhanced MRI (DCE-MRI) is a promising approach, traditional T1-weighted DCE-MRI fails to provide quantitative measurements of tracer transport.

Our work bridges this critical gap by introducing 3D magnetic resonance fingerprinting (MRF) to ultra-high field preclinical systems. This breakthrough enables whole-brain, simultaneous T1 and T2 mapping in just 4.3 minutes—an unprecedented achievement in small animal imaging. The MRF sequence was designed with variable acquisition segment lengths and magnetization preparations, optimized specifically for pre- and post-contrast imaging of the mouse brain at 9.4T. Using model-based reconstruction, we achieved high-resolu-



Yuran Zhu

tion whole-brain coverage while maintaining the temporal resolution essential for tracking solute transport dynamics. We rigorously validated the method's accuracy and repeatability through phantom studies and in-vivo non-contrast brain scans. Furthermore, we demonstrated its practical utility by quantitatively tracking an intracisternally infused gadolinium-based contrast agent throughout the whole brain.

The impact of this innovation extends beyond technical advancement. By enabling whole-brain, quantitative contrast agent tracking, our method eliminates the need for signal normalization between animals and across scan sessions. This capability opens new avenues for investigating brain waste clearance pathways and evaluating therapeutic agent distribution in preclinical studies. More importantly, it bridges the gap between laboratory discoveries and clinical applications, potentially transforming how we approach imaging studies in patients with neurodegenerative diseases.

Zepeng Wang

My journey in MRI began during my undergraduate years at Tsinghua University in China. I took a course on medical imaging, which introduced me to various imaging modalities: optical, ultrasound, X-ray/CT, and MRI. I was immediately amazed by the power of MR in generating detailed images with so much flexibility in the choice of contrasts, and noninvasively! That drove my curiosity to explore MRI theory further by pursuing graduate school.

My research mainly focuses on developing advanced multi-dimensional quantitative MRI/MRSI technology by integrating MR physics, signal processing and AI-powered computational methods, and their applications to clinical applications as well as neuroscience investigations. I would like to dedicate my career to providing robust MRI/MRSI solutions to facilitate the study of brain function, metabolism, and tissue microstructure under various pathophysiological conditions. I am honored to be selected as a YIA finalist, which I consider an important validation of my years of hard work. I am excited to keep pushing the boundaries of MR technologies and contributing to next-generation radiology paradigms, which will enhance the diagnosis/prognosis of neurological diseases and help accelerate the arrival of equal, personalized healthcare.

I felt extremely fortunate to have incredible mentors who guided me throughout my research journey. Dr Jiang Du introduced me to the world of MRI and helped my early research on UTE MRI as a summer intern at UCSD. My PhD advisor, Dr Fan Lam, who brought me to UIUC, shaped me into a solid, independent researcher, worked side-by-side with me through many challenges, and inspired my dedication to high-quality research and future careers in the MRI field. I am also grateful to Dr Brad Sutton for his insight and support in my YIA work. My special thanks go to Dr Zhi-Pei Liang, whose vision and advice helped shape my career direction. I also appreciate the ISMRM community for organizing amazing events and providing such a creative and collaborative platform, allowing me to present my work and get recognized by and connected with fellow researchers worldwide.

NOMINATED PAPER

High-resolution, volumetric diffusion-weighted MR spectroscopic imaging of the brain

Diffusion MRI (dMRI) is a prominent neuroimaging technology widely used for examining tissue microstructure and understanding and characterizing neurological diseases. Meanwhile, it has been increasingly recognized that measuring water diffusion alone offers limited specificity to changes in individual compartments or cell types in neural tissues due to the ubiquitous presence of water, limiting its power for resolving the complex tissue microenvironment alterations present in many diseases. Diffusion-weighted MRSI (DW-MRSI) combines diffusion encoding and the multiplexed molecular imaging capability of MRSI to provide molecule-specific diffusion measures. Given the cell-type-specific and intracellular nature of many metabolites,

Zepeng Wang

DW-MRSI promises to significantly enrich tissue microstructural information obtainable in vivo.
However, the development and application of in-vivo DW-MRSI have been slowly progressing due to several long-standing technical challenges: (1) increased dimensionality due to the need to encode and decode spatial, spectral and diffusion dimensions; (2) further reduced SNR, which is already limited for MRSI, due to diffusion weighting; (3) strong susceptibility to instabilities such as phase variations due to undesired motions, eddy current and other system imperfection; and (4) complex parameter estimation due to the need of simultaneous quantifying metabolites and their diffusion parameters from noisy measurements. State-of-the-art methods are mostly constrained to single-voxel or 2D acquisitions with cm-level resolutions and small brain coverage.
In this work, we developed a new tech-

nology to address these challenges and enable fast, high-resolution, volumetric DW-MRSI of the brain within clinically relevant times. Our method integrated several innovative acquisition and processing strategies, and built on and significantly extended the subspace-based MRSI concept. High-resolution, 3D metabolite and metabolite-specific ADC maps can be generated simultaneously at an approximately 4.4×4.4×5.6 mm3 resolution for the first time, revealing region-specific, metabolite diffusion in the brain (details in the manuscript). We believe this new imaging capability holds significant promise for new ways of in-vivo microstructural imaging with potential application to various clinical and neuroscience studies.

Nan Wang

I am currently a postdoctoral scholar at the Radiology Department of Stanford University. My journey in MRI began in 2015 during my PhD at UCLA under the supervision of Dr Debiao Li. I have been deeply fascinated by MRI's ability to capture the structure and function of the human body. My PhD research focused on developing fast, motion-resolved, and quantitative techniques to improve body imaging. A key contribution was the development of Multitasking DCE, which enables high-spatiotemporal-resolution characterization of lesion microvascular properties while enhancing patient comfort with free-breathing acquisition. This technique has been successfully applied to studying pancreatic cancer, chronic pancreatitis, and breast cancer. Through this experience, I not only gained expertise in imaging technology but also developed a deep appreciation for both the potential and practical challenges of MRI. This solidified my career goal: to develop fast, quantitative, reproducible, and comprehensive MRI tools that enhance healthcare.

To further this goal, I joined Dr. Kawin Setsompop's lab at Stanford University as a postdoctoral scholar in 2021 to expand my expertise into neuroimaging. My work focused on developing rapid and high-quality submillimeter quantitative MRI techniques for mapping fine brain structure and function. A major contribution has been the development of spherical Echo Planar Time-Resolved Imaging (sEPTI), which enables ultrafast, submillimeter quantification of T2* and susceptibility. This technique has strong potential to reveal iron evolution in brain development, aging, and neurodegenerative diseases. Achieving such ultrafast, high-resolution quantitative imaging requires multiple innovations, including incoherent and efficient sampling, data-matching field inhomogeneity estimation for high-fidelity reconstruction, gradient imperfection characterization and correction, and a generalizable deep learning network for SNR enhancement. Ongoing work includes the development of a data-driven high-temporal-resolution motion and real-time field inhomogeneity correction technique to enable robust quantitative neuroimaging.

With recent revolutionary advances in MRI, I envision a future where MRI becomes a "push-button" modality—easy to set up, fast to acquire, and capable of providing rich, quantitative information. I hope to continue my career in this direction, contributing to cutting-edge MRI technologies that advance both clinical practice and scientific discovery.

NOMINATED PAPER

Spherical Echo-Planar Time-resolved Imaging (sEPTI) for rapid 3D quantitative T2 & susceptibility imaging*

T2* mapping and quantitative susceptibility mapping (QSM) provides essential insights into brain iron content, playing a critical role in studying brain development, aging, and neurodegenerative diseases. However, conventional methods suffer from long acquisition times and limited spatial resolution. Recent advancements, such as Echo Planar Time-Resolved Imaging (EPTI), have enabled T2* and QSM quantification at approximately 1 mm3 resolution within a few minutes, but further improvements are necessary to achieve faster acquisition, higher resolution, and enhanced image quality.

Nan Wang

To overcome these limitations and unlock the potential of submillimeter-resolution T2* and QSM at 3T for scientific and clinical applications, we developed spherical EPTI (sEPTI), a novel technique with a comprehensive reconstruction pipeline for ultrafast and robust quantitative neuroimaging. This technique introduces four key innovations. First, a sEPTI sampling was designed, which traverses a tight spherical k-space coverage with varying echo spacing to reduce the scan time. Second, an iterative rank-shrinking field inhomogeneity estimation approach was developed to provide high-quality filed maps, which allows high undersampling without degrading image quality. Third, the reconstruction model was adjusted to account for eddy-current-induced high-order phase errors to mitigate the related artifacts. Last, a physics-informed unrolled network was integrated into the pipeline to boost

the SNR for single-average acquisition at submillimeter resolution.

Combining these advances, sEPTI achieves whole-brain, high-SNR, distortion- and blurring-free quantification of T2* and QSM at 1 mm isotropic resolution in 45 seconds, and 0.75 mm isotropic resolution in 90 seconds on a clinical 3T system. The technique is being validated in infants under 1 year old, pediatric epilepsy patients, and adults with Multiple Sclerosis. Across these diverse populations with different ranges of T2* and QSM, sEPTI has consistently provided high-quality multi-echo images and quantitative maps and reduced susceptibility to motion due to the short scan time, demonstrating its promise for future clinical applications.

Moving forward, our next step is to develop a high-temporal-resolution motion and field inhomogeneity correction technique and incorporate it into the sEPTI framework to further improve the robustness to all kinds of challenging populations. This will open the door to studying iron distribution across the lifespan and advance our understanding of brain development, aging, and pathological processes.

Seyma Alcicek

After graduating from medical school in Turkey, I began a residency in nuclear medicine. I have always been passionate about research and particularly interested in understanding the basic science behind imaging tools used in clinical practice. To build a strong foundation in fundamental science, I applied for a PhD fellowship within the European Union Horizon 2020 Innovative Training Network (ITN) and became a Marie Skłodowska-Curie Early-Stage Researcher at the Institute of Physics, Jagiellonian University, Krakow, Poland, under the supervision of Prof. Szymon Pustelny. My PhD focused on zero- and ultralow-field nuclear magnetic resonance (ZULF NMR), a regime where the Earth's magnetic field is attenuated to isolate molecule-specific spin-spin interactions, enabling precise chemical and biochemical analysis. As part of the ZULF ITN, I learned from renowned NMR experts and developed a deep understanding of the field.

To combine my medical and NMR backgrounds, I became a Mildred-Scheel Career Center Research Fellow at Goethe University, University Hospital, Frankfurt, Germany and joined Asst. Prof. Dr Katharina Wenger-Alakmeh's group (Translational Imaging Section at Co-BIC) with Dr Ulrich Pilatus as my mentor. We investigated how fasting affects brain tumor metabolism using multinuclear in-vivo MR spectroscopic imaging and ex-vivo high-resolution magic-angle spinning NMR. This interdisciplinary project allowed me to bridge basic science with clinical applications. More recently, I completed a short-term fellowship at Johns Hopkins University in Asst. Prof. Dr Georg Oeltzschner's team to expand my knowledge in analyzing in-vivo MR tumor spectra using different signal modeling strategies.

My primary research interest is incorporating in-vivo multinuclear MR spectroscopic imaging into routine clinical practice. This technique enables direct metabolic fingerprinting of brain tumor manifestations in patients, with the goal of identifying biomarkers for therapy stratification and treatment monitoring. I believe integrating MR spectroscopy with other molecular imaging methods has the potential to enhance personalized treatment strategies.

Seyma Alcicek

NOMINATED PAPER

2D 1H sLASER long-TE & 3D 31P chemical shift imaging at 3 T for monitoring fasting-induced changes in brain tumor tissue

Diet-induced nutrient deprivation has been investigated as a complementary therapeutic approach for glioma treatment, aiming to limit glucose availability under the assumption that fasting induces the "anti-Warburg effect". However, the actual metabolic response to glucose restriction remains unclear. Glioblastoma exhibits multiple molecular subtypes with varying metabolic plasticity, alongside significant intratumoral heterogeneity, including hypoxic regions that enforce metabolic switches. Understanding diet-induced changes in tumor tissue at the individual patient level is crucial for integrating dietary interventions into current treatment options.

$^{1}H/^{31}P$ MR spectroscopic imaging (MRSI) is a powerful tool for non-invasive in-vivo biochemical monitoring of tumor tissue. While ^{1}H MRSI quantifies and maps ketone bodies (KBs) and general metabolite profiles in tumors, ^{31}P MRSI offers complementary insights into cellular energy metabolism, hypoxic physicochemical status, and membrane turnover. In this study, we developed a $^{1}H/^{31}P$ MRSI protocol for non-invasive metabolic monitoring of fasting-induced cerebral changes at an individual patient/tumor level. Given the importance of technical reliability and reproducibility, we carefully evaluated the data to demonstrate the

protocol's consistency between sessions (before and after fasting). Furthermore, we integrated multi-parametric fully-automated brain tumor segmentation with MRSI, with the goal of assessing metabolism in tumor sub-regions under diet-induced nutrient deprivation.

Our optimized MRSI protocol revealed substantially increased concentrations of KBs, particularly β-hydroxybutyrate, within tumor tissue. We identified a significant correlation between KBs and both necrotic and contrast-enhanced tissue volumes. This may result from neovascularization, blood-brain barrier compromise, and lack of KB consumption in necrosis. In-vivo findings were validated by ex-vivo ^{1}H magic-angle spinning NMR (14T) on necrotic tissue samples obtained post-intervention. We believe that thorough data evaluation adhering to MR consensus guidelines, combined with ex-vivo NMR validation, has established a solid foundation for using our multinuclear MRSI data as an additional layer in multi-omics data integration alongside layers derived from post-surgical tissue analysis.

Yueqi Qiu

I completed my undergraduate studies in biomedical engineering at Shanghai Jiao Tong University. My interest in magnetic resonance imaging began after encountering Prof. Zhiyong Zhang (who later became my PhD advisor) in his first taught class at Shanghai Jiao Tong. Although I had a hard time understanding the drawings with a lot of trapezoids (these were sequence diagrams), I was drawn to the underlying physical principles and the development of innovative applications of MRI physics, particularly sequence design. This led me to the topic of low-field MRI, an area offering great potential benefits for accessible, clinical MRI, while also presenting unique challenges and possibilities for innovation.

Building our first low-field MRI system took more work with a screwdriver than a keyboard. I spent countless hours in a dim basement assembling components and debugging assorted circuits until the system produced its first clean image, free of single-frequency interference artifacts. Working on low-field systems is extremely rewarding since it allows us to revisit many of the challenges faced in the early development of MRI systems. Because of the prevalence of hardware imperfections in portable systems, we must be a bit creative and utilize unique advantages provided on low-field systems. Differences such as reduced SAR enable novel sequence designs that are impractical at higher field strengths.

This year, I am honored to be named a finalist for the ISMRM Young Investigator Awards, considering my work on applying the Spatial Temporal Encoding (SPEN) sequence in portable MRI systems. The potential of SPEN, previously constrained by SAR limitations in high-field MRI systems, has now found new opportunities. I hope to develop more context-specific innovations at low fields, such as tailored sequences for surgical navigation applications or acquisitions for constant gradient systems.

NOMINATED PAPER

Spatiotemporal encoding MRI in a portable low field system

Low-field magnetic resonance imaging offers a cost-effective and portable alternative to clinical high-field systems. While high-field superconducting magnets provide highly uniform B0 polarizing fields (1-2 ppm after passive shimming), portable magnets exhibit significantly greater spatial inhomogeneity, ranging from hundreds to thousands of ppm. This inherent inhomogeneity presents substantial challenges for EPI acquisitions due to their limited phase-encoding bandwidth.

Spatiotemporal encoding (SPEN) has emerged as a promising alternative to EPI, demonstrating superior resilience to magnetic field inhomogeneities while maintaining comparable acquisition times. This advantage is particularly pronounced in scenarios where specific absorption rate limitations are less restrictive, and parallel imaging techniques, which are constrained on low-field systems, cannot be applied to acceleration and multi-shot techniques. In this study, we showcase the capability of SPEN MRI to significantly reduce image distortions compared to EPI on a 110 mT portable low-field system. Furthermore, we evaluate the robustness of SPEN MRI through 3D imaging and diffusion-weighted brain MRI acquisitions.

Beyond its current applications, the potential for further advancements based on SPEN technology in portable MRI systems is highly promising. For instance, these advancements include the integration of SPEN with multi-band RF techniques, its application in low-field navigation for interventional procedures, and the development of advanced SPEN-based techniques such as xSPEN—which may leverage higher peak B1 values to better compensate for field inhomogeneities. These developments hold the potential to expand the utility and performance of portable MRI systems, opening new avenues for clinical applications. ■

Yueqi Qiu

Deputy Editors Susie Huang, Ergin Atalar and Kannie Chan

INTERVIEW BY **MARIA EUGENIA CALIGIURI,** TRANSCRIPT BY **MARIA CELESTE BONACCI**

Susie Huang

Ergin Atalar

Kannie Chan

MRMH: What is your academic background and current field of research?

Susie Huang: I am a neuroradiologist with both an MD and a PhD. My journey in NMR and MRI research began as an undergraduate student working in a physical chemistry lab. I studied chemistry at Harvard and later pursued a PhD in chemistry at UCLA. During this transition, I realized that while I loved research in fundamental physics and chemistry, I wanted my work to have a tangible impact on human health. This realization led me to medical school. After completing my PhD, I enrolled in the Harvard-MIT Health Sciences and Technology MD program, which encourages students to integrate research into their medical training. As part of this program, I worked as a research assistant during my preclinical years and joined the Martinos Center, where I had the privilege of working with Bruce Rosen and Larry Wald, both incredible mentors to me and many others in engineering, physics, and neuroscience. After medical school, I continued on to do radiology residency and neuroradiology fellowship at Mass General Hospital. I'm now a board-certified neuroradiologist but I actually spend most of my time in research.

Ergin Atalar: I graduated from Bilkent University in Turkiye and am now a faculty member at the Electrical Engineering Department at this University. I went to Johns Hopkins University for postdoctoral research. I spent 14 years there, eventually becoming a Professor of Radiology. In 2005, I returned to Turkiye with the dream of creating an environment where radiologists and engineers could collaborate. However, I rejoined the Electrical Engineering Department and faced significant challenges in establishing such a space. Despite the obstacles, I founded a multidisciplinary research center where experts from various fields work together. I helped with the formation of a neuroscience department, but today, there is one. My passion for electrical engineering and electronics continues to drive my work as I strive to foster interdisciplinary collaboration.

Kannie Chan: I began my academic journey with a PhD in chemistry at The University of Hong Kong. Following that, I pursued postdoctoral training at Johns Hopkins University, and became an Assistant Professor at the Department of Radiology and Radiological Science in 2014. Now, I am a Professor in BME at City University of Hong Kong and the Director of the Hong Kong Centre for Cerebro-cardiovascular Health Engineering. My seven years at Hopkins were incredibly rewarding. I had the privilege to work with Peter van Zijl, Jeff Bulte, Michael McMahon, Guanshu Liu, Jiadi Xu and Xiang Xu, a great multi-disciplinary team. In 2016, I moved back to Hong Kong, my home town. My passion with molecules dated back to high

school. Through imaging, I can explore how molecules interact and distribute within the body, especially the molecular composition of the brain. I am interested in identifying molecules that contribute to CEST contrasts and understanding their contrast mechanisms. For instance, imaging glucose can help to detect neuropathologies, such as those in Alzheimer's disease.

MRMH: What are the topics and techniques that you focus on?

Susie: I spend one day a week in the clinic and the rest of the time working with my research lab. My lab is divided into two parts: the bulk of my research team works on hardware and acquisition technology development for high-gradient diffusion MRI and biophysical modeling of tissue microstructure, while the other part works on how these techniques can improve the detection, diagnosis and prognostication of various neurological disorders. I also work on the clinical translation of fast MRI techniques in partnership with MR physicists and engineers, radiologists, and MRI technologists.

Ergin: I have a strong passion for circuit design, and one of my earliest research interests was interventional MRI. I developed devices for interventional MR, including systems for cardiovascular MRI, as well as prostate interventions and biopsy procedures. Currently, my focus is primarily on RF amplifier development, as well as advancements in gradient coils and gradient amplifiers.

Kannie: I focused on CEST MRI. My team studies the biomedical applications of CEST in drug delivery, particularly to the brain, for improving theranostic approaches in cancer. I also investigate the use of CEST-MRI to study changes in molecular, protein and lipid content in neurodegenerative diseases, such as multiple sclerosis and Alzheimer's disease.

Huang lab dinner Singapore

"What I love most about this role is the opportunity to read a wide range of papers in my field. It allows me to stay updated on the latest developments and discoveries, which is incredibly gratifying.

–Susie Huang

MRMH: Do you remember the first time you reviewed for MRM?

Susie: That's a great question. The first paper I remember reviewing was likely early in my faculty tenure, around 2017. I distinctly recall it because it focused on diffusion kurtosis imaging. After that, I began reviewing regularly for MRM, and I truly admire the way the journal is managed.

Ergin: I'm not sure when I reviewed my first paper, but it may have been before 1998, though I haven't found any records from earlier than that. At the time, Felix Wehrli was the Editor-in-Chief, and I remember receiving papers for review by physical mail!

Kannie: Yes, I started to review for MRM in 2013. When I received my first invitation, I was quite excited. It was a unique experience

to evaluate a manuscript not as an author, but from a reviewer's perspective. I realized that I could contribute my expertise while also indirectly exchange ideas with colleagues in the field. That sense of connection and collaboration made the experience even more rewarding!

Ergin with his family

MRMH: Can you tell us about your path to become Deputy Editor?

Susie: Over the past five years, I have collaborated extensively with researchers submitting papers to MRM, often contributing as a collaborator rather than as a senior author. I still remember submitting my first paper to MRM for the Young Investigator Award while finishing graduate school; it was selected as a finalist for the I.I. Rabi Award, marking the beginning of my longstanding relationship with the journal. Eventually, this connection led me to the role of Deputy Editor. Before that, Mara Cercignani, my predecessor, handled many of the papers we submitted. However, in December, when she informed Peter Jezzard (current Editor-in-Chief) that she would be stepping down, he invited me to take on the role. It was through my involvement that I truly came to appreciate the vital role that journals play in the scientific community. They serve as a central forum for researchers, providing an essential platform for scientists to share and disseminate their most important work.

Ergin: I met Matt Bernstein for the first time in 1994. I wrote an article for MRM, and the then Editor-in-Chief sent it to Matt as a reviewer. At the time, he wasn't yet the journal's Editor-in-Chief. In my article, I argued that my method was significantly better than the one described in one of Matt's papers. Naturally, he wasn't too pleased! However, he responded in a friendly manner, even signing his own name on the reviewer form. Despite this initial conflict, we became very good friends. When Matt became the Editor-in-Chief of MRM, he invited me to join the Editorial Board. Then, in 2021, I was honored to be invited by Peter Jezzard to take on the role of Deputy Editor.

Kannie: This year marks my 15th anniversary with the ISMRM, and I feel truly honored and fortunate to be part of such a supportive community. Being a part of this community has played a significant role in the growth of my career. I have been actively involved in reviewing manuscripts for conferences, abstracts, and various other submissions. These opportunities have allowed me to engage with the Society from different perspectives and deepen my understanding of its operations. Through these interactions, I have had the privilege of meeting many experts in the MRI field, including renowned physicists and clinicians. Then, I was invited by Peter Jezzard to serve as a Deputy Editor, overseeing manuscripts for CEST/MT. Moriel Vandsburger was handling many of the CEST paper before me. This role has further strengthened my involvement with the Society and has deepened my appreciation for its importance.

MRMH: What are the main responsibilities of a Deputy Editor?

Susie: As a Deputy Editor, my main responsibility is to evaluate manuscripts that Peter assigns to me within my area of expertise. Sometimes, Peter provides comments, but often, he simply sends the manuscript my way and asks me to assess it. I start by reviewing the paper and its abstract to understand its main focus. The key part of my role is assigning appropriate reviewers for the manuscript, ensuring that the paper is evaluated by experts with the most relevant expertise. Once the reviews are submitted, I carefully read through the reviewers' comments and make a preliminary decision regarding the manuscript. The final decision is made by Peter, who typically adds his own suggestions or comments.

Ergin: When Peter receives the articles, he assigns them to one of the Deputy Editors, who then determines who can handle each article. Once I receive the invitation, I check for potential conflicts of interest before accepting it. After that, I select a few reviewers for the article and send out invitations. Once the reviewers respond, I read their comments and assessments. Based on their feedback, I make a recommendation regarding the paper's status. Ultimately, Peter makes the final decision on whether the article is accepted or rejected. My role is to provide Peter with a recommendation on whether the article should be accepted or rejected.

Kannie: When Peter assigns manuscripts related to my expertise, I am responsible for identifying experts best suited to provide feedback as reviewers for the manuscript. Once I've selected the appropriate reviewers, I will invite them to provide their comments and suggestions. Then, I will carefully review the feedback that comes in and provide recommendations based on the reviewers' comments for Peter's final decision.

Kannie and her team at the ISMRM 2023 closing ceremony

MRMH: What's the part that you like the most?

Susie: What I love most about this role is the opportunity to read a wide range of papers in my field. It allows me to stay updated on the latest developments and discoveries, which is incredibly gratifying.

Ergin: The papers I receive are typically within my area of interest, and I often get more papers than regular reviewers. While I don't do the full review, I always read the abstract to gain a better understanding of the study and its focus. Reviewing the comments from other reviewers is also quite interesting to me, as it gives insight into their perspectives and allows me to learn more about the work of others in the field. This process is incredibly valuable for my career, as it helps me stay connected with the latest research and developments.

Kannie: I have the privilege of reviewing cutting-edge scientific findings in MRI. Taking care of manuscripts and collaborating with other editors within the MRM community is particularly rewarding. We meet annually at the ISMRM conference, and it is a fantastic opportunity to share our experiences in handling manuscripts and to offer suggestions to one another. This is the aspect I value the most. Personally, I love exploring different cultures, and these gatherings also provide the opportunity to mingle with other MRM colleagues, and talk about both work and leisure. I truly enjoy these interactions.

MRMH: Is there anything else you would like to tell our readers?

Susie: I believe journals like MRM and JMRI play a crucial role in advancing our field. I encourage researchers to consider submitting their most exciting and groundbreaking work to us first, as these journals are integral to the growth and dissemination of knowledge in the MR community.

Ergin: I want to acknowledge the crucial role that Shannon Stepanian, the Managing Editor of MRM, plays during the review process. Her thorough reading of the articles, early identification of potential problems, and seamless management of communication with referees and authors were incredibly helpful. Shannon is remarkably dependable, and I greatly appreciate her assistance throughout the process.

Kannie: I would like to take this opportunity to encourage researchers to review for MRM and JMRI, as they are the cornerstones for our scientific community. I've had the pleasure of doing work that I'm passionate about while sharing my knowledge with the broader MR community. Through ISMRM, I have been able to connect with other researchers, helping me to grow both professionally and within the Society. And I would like to thank all ISMRM staff, the Central Office, Roberta and Anne-Marie, for their efforts and contributions for the growth of our community! ■

Transforming Access to MR Education across Africa

'Democratizing MRI – There's no one size fits all solution.'

INTERVIEWS BY **GLENN CAHOON** AND **SHAWNA FARQUHARSON**

MRI education is widely accessible in many parts of the world, but in Africa limited healthcare infrastructure and expertise create significant challenges.

Inspired by ISMRM Past-President Prof. Derek Jones' challenge at the ISMRM & ISMRT Toronto Meeting (2023) to democratize MRI, discussions with African mentees revealed that there's no one size fits all solution and that many well-intentioned education initiatives were compounding challenges in low- and middle-income countries (LMICs). In response, Dr Shawna Farquharson designed and developed the ISMRT Future Leaders Program, which officially launched in 2024 with support from the Bill & Melinda Gates Foundation and the ISMRT Future Leaders Taskforce. Built on three pillars, the program provides a scalable model for education and training to empower MRI professionals in underserved regions.

Pillar One: Local Advocacy & Empowerment

The Future Leaders Fellowship & Mentorship Program is a grassroots initiative designed to foster ISMRT communities, mentor future leaders, and develop MRI educators and practitioners in each region. In its first year, the program expanded rapidly, achieving:

- Mentorship teams now active in 16 countries
- 114 MRI professionals being awarded merit-based ISMRT Future Leaders Fellowships
- 50+ MRI education sessions facilitated across Africa – each tailored to regional needs

Pillar Two: Global Outreach with Impact

The Global Masterclass Outreach Series delivers ISMRM & ISMRT expert-led education sessions tailored for MRI in low-resource settings. Each lecture is supported by interactive Q&A sessions that attract hundreds of MRI professionals, with ISMRT Fellows moderating expert panel discussions while addressing regional knowledge gaps and challenges.

The 2025 Masterclass with Vera Kimbrell and Dr Michael Steckner on MRI Safety for Low-Resource Settings and the 2024 session with Prof. Martin Graves on MRI Fundamentals received over 4,000 registrations from 70+ countries.

Pillar Three: Expanding Access Through Virtual MRI Training

Partnership with Corsmed enabled the ISMRT Future Leaders - Simulation Technology Education Program (STEP) for Advancing MRI in Practice. The program, specifically designed to build on the MRI Fundamentals Masterclass series, provides practical 'hands-on' courses using simulation technology - from basic to advanced levels.

A Scalable Model for Success

The ISMRT Future Leaders Initiative is shaping MRI in Africa – one leader at a time. Fellows are making an international impact and supporting transformative training programs. **Cliff Mokua (Kenya)** and **Emily Amos (Malawi)**, top STEP graduates, have joined the STEP leadership team and are now training radiographers across Africa to advance MRI in practice. In addition, the following Fellows are 2025 ISMRT annual international meeting award recipients: 2025 JAK Award for Professional Development:

- **Karabo Mokoena (South Africa)** - Paediatric Tumoral Calcinosis: A Rare Case Study

2025 ISMRT Poster Award Winners:

- **Ivy Ohuma (Kenya)** - Providing MRI Access in Low-Income Countries
- **Patricia Maishi (South Africa)** - Advancing Cardiac MRI Skills in Uganda

Another important milestone for the region, is the official formation of the first ISMRT Divisions in **Malawi, Nigeria, Kenya, South Africa, Rwanda and Burundi.** (Read on to see how this has shaped MRI education and leadership in these regions.) The Future Leaders model is paving the way for ISMRM & ISMRT to expand MRI education in emerging regions. Beyond training, it builds community, strengthens leadership, and empowers healthcare professionals to affect real change.

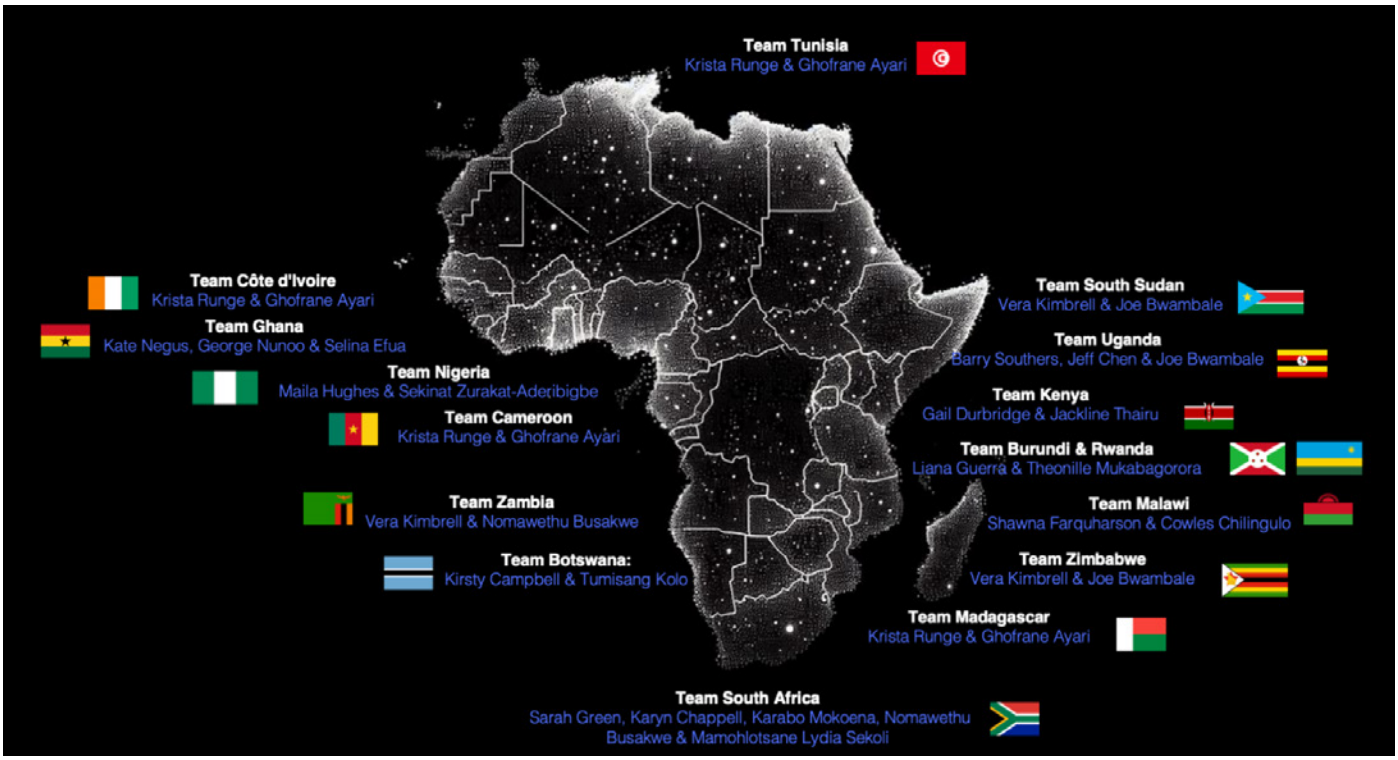
SPOTLIGHT ON

Cowles Chilingulo

'At the heart of Malawi's MRI community is Cowles Chilingulo - widely referred to by many across Malawi as their 'MRI Father'.

A few years ago, an MRI community in Malawi seemed unimaginable. For over a decade, Mr Chilingulo was Malawi's only MRI radiographer, working with Consultant Dr Karen Chetcuti to serve a population that grew from 14 million to nearly 20 million.

Cowles Chilingulo



2024-2025 Leadership Teams – Africa

Today, with support from the ISMRT Future Leaders Program and his mentor, Dr Shawna Farquharson (AUS), Mr Chiningulo's vision for an ISMRT Malawi Division is a reality.

MRMH: What does the ISMRT Division mean for MRI in Malawi?

Cowles: This program comes at a critical time, as recent government and philanthropic investments in MRI infrastructure make capability-building more urgent than ever. To fully utilize these MRI systems and deliver essential diagnostic services, investing in people and education is key. This program has launched a new era for MRI in Malawi. With 15 ISMRT members and over 50 radiographers, clinicians and students attending monthly MRI sessions, we are building a strong community. With our education framework and mentorship model in place, we are nurturing the next generation of professionals.

MRMH: What challenges does the division face?

Cowles: Malawi is a low-resource setting with an innovative healthcare community. We navigate challenges like intermittent power, limited digital infrastructure, and costly internet to deliver healthcare. In some areas, an unlimited data plan costs a year's salary, making internet access outside work hours difficult. Attending training while on duty is also challenging, and power outages add to the struggle. Yet, we remain committed to overcoming barriers and advancing our professional development.

MRMH: Despite these challenges, what successes have you achieved?

Cowles: With no formal MRI training, our members learn on the job. We're building a community to bridge knowledge and practice gaps, holding monthly education sessions on MRI Physics, Safety, Pediatric Brain Imaging, and prevalent diseases like Tuberculosis - plus advanced topics like functional MRI for pre-surgical planning. It's inspiring to see our members gaining in confidence and becoming the educators we need, and even representing Malawi at international sessions."

MRMH: What's next for the division?

Cowles: This is just the beginning! We now have two 1.5T MRI scanners, with two more being installed, making this program vital for Malawi. In the future, we hope to have established a critical mass of MRI experts, practitioners and educators to be able to support the formalization of nationwide training programs and standards of practice for Malawi.

SPOTLIGHT ON

Jackline Thairu

"Connecting Kenyan radiographers to our global community of MRI experts shows them that their potential is limitless."

For Jackline Thairu, ISMRT Mentor Gail Durbridge (AUS), and the ISMRT Kenya Division, this initiative is about breaking barriers and creating opportunities for all.

MRMH: Why is this initiative so meaningful to you?

Jackline: My journey in MRI has been one of perseverance, learning, and mentorship. I've been fortunate to receive guidance from incredible individuals who have shaped my career. But I know my experience is not the

Jackline Thairu

norm. Many MRI radiographers in Kenya face challenges, including limited training and mentorship. The ISMRT Kenya Division is changing this by connecting radiographers with the knowledge and resources they need to thrive.

MRMH: What challenges do MRI professionals in Kenya face?

Jackline: A major challenge is the lack of postgraduate programs and practical training. Financial constraints further limit access to specialized education and MRI conferences, making it harder to stay updated. Without these opportunities, providing best patient care and contributing to research is difficult.

MRMH: How does the ISMRT Future Leaders Program help?

Jackline: This program tackles these challenges by providing mentorship, collaboration and training in leadership. Connecting local and global MRI communities has enhanced education, increased clinical research participation and supported evidence-based policy development. Ultimately, it has empowered radiographers to become leaders, mentors, and researchers helping shape the future of MRI across Kenya.

MRMH: What is your vision for the ISMRT Kenya Division?

Jackline: I see it as a beacon of opportunity, representation, and empowerment. This division connects Kenyan radiographers to the global MRI community, showing them that their potential is limitless. It's not just about professional growth - it's about fostering a spirit of fearless learning and ensuring no one walks this journey alone. Together, we rise.

SPOTLIGHT ON

Sekinat Zurakat-Aderibigbe

"Bridging gaps in healthcare education programs and clinical practice across Nigeria."

Nigeria's MRI education landscape is rapidly evolving, and at the forefront of this transformation is Sekinat Zurakat-Aderibigbe, Chair of the ISMRT Nigeria Division. With the support of ISMRT Mentor - Maila Hughes (AUS), Sekinat is leading efforts to bridge gaps in education and clinical practice for Nigerian radiographers.

MRMH: What does this mean for Nigerian radiographers?

Sekinat: MRI in Nigeria is evolving, with radiographers eager to enhance their skills and patient care. However, progress is hindered by limited hands-on training, restricted access to MRI systems, and a shortage of specialists.

MRMH: How is the ISMRT Nigeria Division addressing these challenges?

Sekinat: The ISMRT Nigeria Division offers radiographers a vital opportunity to connect with a global network of professionals, stay informed on the latest research, and enhance their MRI skills. The program provides a platform to develop leadership capabilities and equip radiographers with the knowledge and expertise to strengthen clinical services and advance research across Nigeria.

Sekinat Zurakat-Aderibigbe

MRMH: What is your vision for the future of MRI in Nigeria?

Sekinat: My vision is to build a thriving MRI community in Nigeria - skilled, knowledgeable, and empowered to shape the future of MRI practices. Through dedication and strategic partnerships, we are striving to transform access to MRI education and ensure better access healthcare services for all. The ISMRT Nigeria Division is at the forefront of this mission. I'm proud of what we've accomplished so far, and excited for what lies ahead.

SPOTLIGHT ON

Theonille Mukabagorora

"Advancing MRI in practice through virtual education and simulation training."

Led by Theonille Mukabagorora and ISMRT mentor Dr Liana Sanches (Brazil), the ISMRT Rwanda-Burundi Division's vision is to expand the limited access to MRI education and professional development to support healthcare needs across the region.

MRMH: What are some of the challenges MRI radiographers face in Rwanda and Burundi?

Theonille: The University of Rwanda offers MRI theory modules, but a scarcity of equipment limits practical training. This lack of hands-on training and the shortage of experienced MRI professionals in the region, reduces mentorship opportunities and perpetuates the cycle of limited expertise.

MRMH: How does the ISMRT Future Leaders Program help address these challenges?

Theonille: A unique feature of our division is four members lecturing in the undergraduate medical imaging program, which

Founding ISMRT Future Leaders Taskforce

Theonille Mukabagorora

amplifies knowledge for many. Two of our team members completed the ISMRT Future Leaders - Simulation Technology Education Program (STEP), marking a pivotal moment for the region. This achievement demonstrated that virtual hands-on training programs can be powerful tools in countries with limited digital infrastructure and highly beneficial in limited resource settings.

MRMH: What are the goals of the ISMRT Rwanda-Burundi Division moving forward?

Theonille: Our primary goal is to unite MRI radiographers in Rwanda and Burundi by fostering a supportive community of healthcare professionals passionate about MRI. Through training, research, and professional development, we aim to strengthen MRI education at all levels. By working with universities and partners, we hope to advocate for lasting progress and foster growth throughout the region.

SPOTLIGHT ON

Lydia Sekoli

"Our Vision Extends Beyond Learning."

For the ISMRT South Africa Division, it's more than professional growth – it's a commitment to improve MRI expertise, advance research, and strengthen the community of South African MRI radiographers.

MRMH: What are some of the challenges & opportunities MRI radiographers in South Africa?

Lydia: Like many regions, we face limited access to advanced MRI technology and professional development. These barriers impact MRI practices but also hinder our ability to improve patient care and outcomes. The ISMRT Future Leaders program have bridged this gap - connecting us with mentors who share our mission of advancing MRI education while providing access to the latest knowledge and technologies. This empowers us to implement best practices, drive radiographer-led research, and strengthen MRI clinical services and research across South Africa.

MRMH: What is your vision for the ISMRT South Africa Division?

Lydia Sekoli

Lydia: Our vision extends beyond learning; for us, it's about fostering a culture of excellence through knowledge-sharing and continuous growth. True fellowship means gaining and actively sharing knowledge. Through collaboration and mentorship, we aim for a future where South African radiographers rise to be leaders in the global ISMRT community.

MRMH: Any final thoughts?

Lydia: We're excited about this journey and look forward to working with MRI professionals worldwide. This is a collective effort, and I acknowledge the support from our ISMRT Mentor - Kate Negus (AUS) and the contributions of all the South African Future Leaders. Together, we're creating a lasting impact on MRI education and practice in our region! ■

Acknowledgments

ISMRT Future Leaders Program: *This initiative would not be possible without the ISMRM & ISMRT Mentors and Mentees, The Program's Supporters and Partners, and the dedication of ISMRT Future Leaders Taskforce - whose commitment, passion, and leadership are shaping the future of MRI education globally.*

Humble Reflections on the Future Leaders Program: From Tiny Acorns to Mighty Oaks

By Derek Jones

As the immediate Past President of the ISMRM, I have had the privilege of witnessing some extraordinary milestones in our field. Yet, there are a few initiatives that truly stand out, and one of them is the Future Leaders Program. It's often said that "from tiny acorns, mighty oak trees grow," and I've had the incredible honour of witnessing how a small idea can blossom into something truly remarkable. Reflecting on its success fills me with a deep sense of humility, as it has exceeded even my most optimistic expectations.

I'll never forget sitting in the EDI Forum at the ISMRM Annual Meeting in London, listening to the heartfelt pleas of people from various parts of the world. The message was clear: what many regions, particularly in Africa, needed most was not more equipment, but access to training that would empower them to maximize the use of the equipment they already had. That moment was a turning point for me. I was deeply moved by this plea, and it became my mission to do something.

Serendipity, as it often does, played its part. Soon after that meeting, I found myself on a plane with the Bill & Melinda Gates Foundation, traveling to Ethiopia, Kenya, Uganda, and Malawi as part of the UNITY program. These travels opened my eyes to the overwhelming need for MRI training and the vast opportunities for growth in Africa. It was during this time that the idea for the Gates of Opportunity funding scheme was born—a Gates-funded programme designed to bring 100 people to the annual ISMRM meeting in Toronto, people who would not otherwise have had the chance to attend.

As we all know, any great tree, like the mighty oak, needs strong roots to support it. In the world of MRI, these roots are the radiographers—the lifeblood of all successful MRI units. So I was especially keen to ensure that a significant portion of the fellowships went to radiographers. My role then became connecting these radiographers with mentors—visionary leaders who could guide them toward even greater success.

During my travels across Africa, I had the privilege of meeting Cowles Chilingulo, ('the MRI Father of Malawi' - see above). I couldn't help but wonder what might happen if Cowles were paired with another visionary leader in the ISMRM—Shawna Farquharson. I introduced the two, and that meeting sparked something extraordinary. The chemistry between this 'dynamic duo' was immediate, and from that first exchange, I knew we were on the brink of something remarkable. By the end of the night, the excitement on the smiley faces of those who saw this partnership as the beginning of the Future Leaders Program was clear.

The testimonies from those involved (see above) are both moving and inspiring. Most importantly, they've reassured me that the ISMRM/ISMRT is fulfilling its mission of uniting the world of MRI, creating a true society without borders. At a time when our world is troubled by politics and uncertainty, especially in the realm of research funding, it is so reassuring to witness these 'good news' stories. Watching the success of this programme has truly been one of the best 'good news' stories of my career.

I want to extend my heartfelt congratulations to everyone involved in the Future Leaders Program. The energy, commitment, and passion you have poured into this initiative are nothing short of inspiring. As they say in many walks of life, "you don't get many perks in this job"—but witnessing the growth of this phenomenal movement has undoubtedly been one of the greatest perks of my presidency.

So, what have I learned from all of this? First and foremost: if you're moved by what you hear during a conference, your travels, or even in everyday life, and you think, "someone, somewhere, should do something about this," please don't wait for that 'someone' to step forward. That someone is you! Give that ball a gentle push, and you'll quickly see momentum build. Others, much stronger than you, will join in, and before you know it, those tiny acorns will grow into mighty oak trees, which will drop new acorns, and those acorns…. well, you get the idea!

It all begins with that initial push—never underestimate the power of that first step. ■

The ISMRM EMTP Study Group's Progress and Global Engagement

INTERVIEW BY **KWOK SHING CHAN**

Dr Kwok Shing Chan, current trainee representative of the ISMRM Electro-Magnetic Tissue Properties (EMTP) study group (SG), interviewed several SG members (**Drs Xu Li, Mauro Costagli, Stefano Mandija, Carlos Milovic, Simon Robinson, Ferdinand Schweser, Sina Straub, Beata Bachrata,** and **Cristian Montalba**) about recent progress within the study group and the latest EMTP workshop in Santiago, Chile. This workshop marked the first dedicated EMTP workshop hosted in South America by Dr. Carlos Milovic, Chair of the newly formed Latin American chapter of the ISMRM.

MRMH: Let's start with the first consensus paper recently published by the Study Group. Can you give us an overview of what it is about?

Xu Li: Yes! The recently published Quantitative Susceptibility Mapping (QSM) consensus paper is a major milestone for the EMTP study group. It provides comprehensive recommendations for implementing QSM in clinical brain research, aiming to standardize methodologies and improve consistency across studies. This was truly a collaborative effort from the entire study group, and it marks our first big step toward ensuring QSM is applied in a more reliable and reproducible way.

The consensus covers best practices across all key stages of the QSM workflow—data acquisition, processing, analysis, and reporting. Some of the key recommendations include using a monopolar 3D multi-echo GRE sequence, saving properly coil-combined phase images in DICOM format for exact unwrapping, combining multi-echo phase images before background field removal, and incorporating phase-quality-based masking. For background field removal, techniques like V-SHARP or PDF are suggested, followed by dipole inversion using sparsity-based regularization. It's also recommended that susceptibility measurements be referenced to an internal reference region. Importantly, the

EMTP Study Group Leadership featured in this article

paper emphasizes the need to report detailed acquisition and processing parameters to improve reproducibility across studies.

With these guidelines, we hope to provide researchers with a clear and practical framework for implementing QSM in clinical research. Ultimately, our goal is to facilitate broader adoption and integration of QSM in clinical settings, where it has the potential to play an important role in diagnosis and disease monitoring.

MRMH: How do you think the community will benefit from current and future QSM research in clinical settings?

Mauro: Not every center has personnel with expertise in incorporating QSM for clinical research. The guidelines will undoubtedly be able to assist the implementation of a complete QSM pipeline in these settings. Indeed, adopting the consensus recommendations should also facilitate the interpretation of results obtained by different groups, and enable further meta-analysis in a broader community of interested researchers. Increased research activity in clinical applications using a pseudo-standardized QSM approach will deepen our understanding of its true potential and current limitations, guiding further advancements in QSM methodologies. This creates a continuous, reinforcing cycle: it is a circular process where the whole, interdisciplinary community of researchers, including physicists, engineers and clinicians, plays different crucial roles.

MRMH: I know the SG is also preparing another consensus and some guideline papers for electrical properties tomography (EPT). How does this address the current challenges facing the field?

Stefano: Indeed, we are planning to publish the results of the MR-EPT challenge, which highlighted the strengths and weaknesses of state-of-the-art reconstruction methods for brain EPT reconstructions. We learned a lot from this challenge. Extending from this work, three Study Group guidelines are in preparation: one is on acquisition strategies, one is on phantom preparation, and the last one is about standardization of MR-EPT reports, analyses, presentation of results in publications, etc. This is a very important work that enables the objective comparison of reconstruction performances between

Group photo of the 2024 EMTP workshop in Santiago, Chile

various methods in the future. To this end, a Delphi process is currently ongoing. We believe these Study Group guidelines together with the MR-EPT challenge results will provide reference points for future developments in the field.

MRMH: Let's switch gears to talk about the Joint QSM and EPT workshop in Chile last year. Unfortunately, I wasn't able to attend. Can you give us some highlights of the workshop?

Carlos: More than 60 attendees gathered at Campus Oriente, Pontificia Universidad Catolica de Chile, for a three-day conference in September 2024. Half of the participants were trainee members, who were encouraged to actively engage in all activities. Most trainees presented either full talks or power pitches. The program featured traditional oral sessions, including invited educational talks and presentations on technical developments and clinical applications selected from 58 submitted abstracts. To foster interaction, we also organized three poster sessions and four discussion panels. The main topics were: "Challenges in the Field from a Clinical Perspective," "QSM: Beyond Bulk Susceptibility," "Are Deep Learning Techniques Delivering on Their Promises?" and "Future goals and challenges for the EMTP community". Additionally, a pre-workshop session at Campus San Joaquin focused on the main challenges in our field. The conference wasn't all about work—attendees enjoyed a welcome gathering at a local brewery and a closing party featuring traditional dances and a Latin-American rock band. We hope everyone had a memorable experience and look forward to our next meeting, tentatively scheduled for September 2026 in Annapolis, USA, chaired by Dr Xu Li. For more details and to access the online proceedings, please visit our homepage at www.emtpchile.cl.

MRMH: I heard there were a lot of exciting initiatives discussed during the workshop. I am sure many people are interested in learning how our Study Group would move forward. Can you give us a brief summary of these initiatives?

Simon: Something that came out of the pre-meeting discussions was the feeling that the QSM field is at what Ferdinand described as an 'inflection point'. We have reached quite a tight consensus about how to perform QSM, and the tools to perform QSM have become much more robust and easier to use, but we have not yet seen the wide-scale adoption of QSM in a clinical setting. The seven initiatives we came up with are targeted at identifying the remaining obstacles to clinical adoption and overcoming them. They begin with identifying the clinical value of QSM in a number of clinical applications, such as the imaging of candidate targets for deep brain stimulation, the value of QSM in imaging multiple sclerosis, the swallow-tail sign in Parkinson's disease, and others. There were also suggestions to work on a consensus for how to perform QSM in clinical applications, how to assess and improve the reproducibility of QSM, identify artifacts in QSM, build up an atlas or database of normative values and assess the vendors' recent packages for QSM.
The initiatives were outlined at an ISMRM Virtual Study Group meeting (which is available online under https://www.ismrm.org/virtual-meetings/archive/ and https://cds.ismrm.org/protected/Members/virtual_meetings/2024-12-17-EMTP/) and we put together a Member-Initiated Session for the ISMRM Annual Meeting. It's called "Bridging the Gap: Clinical Applications & Unmet Needs in Quantitative Susceptibility Mapping (QSM) of the Brain" and will take place from 13:45 – 15:45 on Monday during this year's ISMRM meeting.

MRMH: One of the hot topics in our field is to democratize MRI and make education more accessible. How do you think these initiatives and our Study Group activities can help achieve this?

Simon: That's a great question. It wasn't actually the topic of the initiatives, but generally the EMTP community has tried to make EMTP more accessible as a field by setting up a website at https://www.emtphub.org/ which lists events, software, data repositories and key papers.

Carlos: The EMTP workshops provide an excellent opportunity to focus on the current challenges in our field, foster networking, and initiate new collaborative projects. Notably, impactful initiatives such as the EPT and QSM challenges and the development of consensus papers were either conceived or significantly advanced through these workshops. These efforts contribute to the democratization of MRI by being led by committees composed of members from diverse research centers and career stages. Additionally, rotating the workshop locations has positively impacted the hosting research communities, increasing visibility and access to cutting-edge discussions.

Looking ahead, I believe greater coordination with various ISMRM chapters and study groups is crucial to further expand our reach and engage with individuals who face travel constraints. Collaborating with the newly formed Latin American, African, and Brazilian chapters can help overcome significant challenges related to resource limitations and vast geographical distances. By strengthening these connections, we can make MRI education and research more inclusive and accessible to a broader audience.

MRMH: As Simon mentioned, translating QSM from research to clinical practice remains a significant challenge. What are the key steps needed to bridge this gap, and what role does our Study Group play in this process?

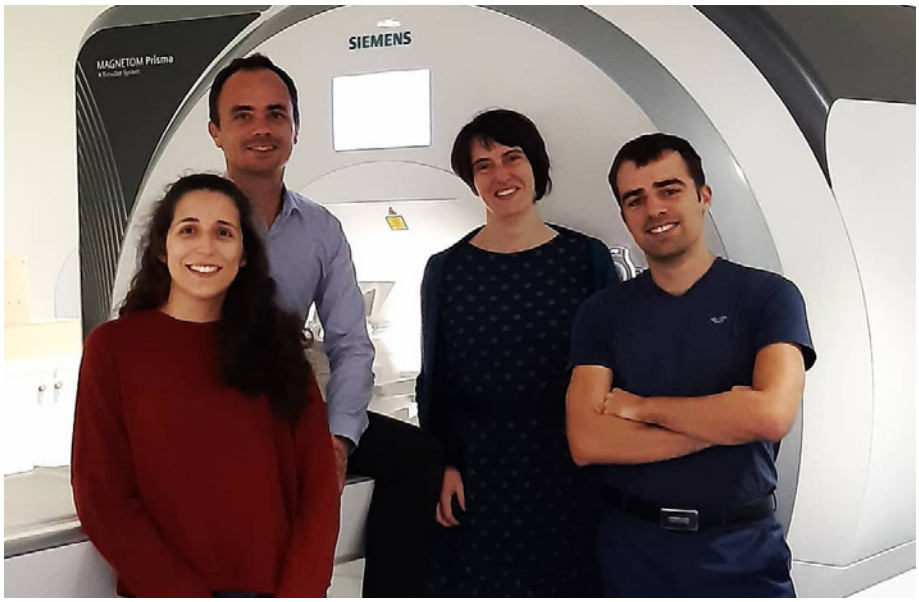
Ferdinand: Overcoming barriers to clinical translation is a central goal of ISMRM, and our study group plays an active role in this effort. An essential first step is to determine which applications of QSM would have the most clinical impact and what obstacles clinicians face in adopting it. The upcoming Member-Initiated Session mentioned by Simon emerged from our Study Group as a platform to address these questions by bringing together clinicians, methods developers, and vendors. I hope many who share our interest in clinical translation will join the session and take part in the study group's ongoing efforts to identify and solve key challenges in making QSM more widely available. With broad engagement, we can take meaningful steps toward establishing QSM as a valuable clinical tool. ■

A characterization of cardiac-induced noise in R2* maps of the brain.

INTERVIEW BY **MARIA GUIDI**

EDITOR'S PICK FOR JANUARY

This MRM Highlights Pick interview is with **Quentin Raynaud** and **Antoine Lutti**, researchers at the Laboratory for Research in Neuroimaging, Department for Clinical Neuroscience, at the University of Lausanne in Switzerland. In their paper "A characterization of cardiac-induced noise in R2* maps of the brain", Quentin, Antoine and colleagues investigated the effect of cardiac pulsation on brain maps of R2* using a dedicated sampling strategy that involves acquiring multi-echo data at 12 intervals through the cardiac cycle. This work lays the ground for the subsequent design of acquisition strategies that mitigate cardiac-induced noise observed in the case of in vivo data.



The Laboratory for Neuroimaging Research (LREN) team (left to right): Ana Rita Oliveira, Antoine Lutti, Giulia Di Domenicantonio, Quentin Raynaud

MRMH: Could you tell us something about your past and how you ended up doing research in MRI?

Quentin Raynaud: When I was a student in physics at EPFL, I took a course on biomedical imaging given by Prof. Rolf Gruetter, and I think that's really what got me into MRI. I couldn't understand anything at that time and I thought it was so complicated: magnetic field gradients, radio frequencies, k-space trajectories, and so on. I was so frustrated not to be able to understand it fully. So then I started a PhD in MRI, and understood how interesting and cool the whole field is. Now that I just finished my PhD, I am really glad that I chose this field. It's a nice playground for physicists, I love that I can start coding a sequence, and then run it on the MR scanner, and get an actual image of the brain I can work with.

https://onlinelibrary.wiley.com/doi/full/10.1002/mrm.29853

Antoine Lutti: Me, well, I started off during my PhD, working on NMR physics in Prof. Paul Callaghan's lab in New Zealand. Back then I was working on diffusion in liquid crystal systems. With these systems, you can push data acquisition and modeling a lot further than you would do in vivo because they are not as complex as biological systems.

I did the shift to MRI later in my career after my PhD, when I went to UCL in London. One of the reasons I moved to MRI is because it's a lot broader and more widely applied than NMR. Even though the physics is the same, the challenges are completely different because of the complexity of biological systems and the limitations in hardware. I really love the versatility of MRI: with the same scanner you can look at brain structure, function, physiology, all sorts of things. And by combining multiple contrasts you can get a lot of information about the brain. I think that's where the beauty of MRI really lies.

Having said that, I still keep an eye on the literature about NMR and diffusion, although I don't do much diffusion anymore.

MRMH: Before digging into the paper, what was the event or observation that gave you the idea to perform this study?

Quentin: The main goal of my PhD was to find a way to mitigate the impact of cardiac pulsation on quantitative MRI data in the brain. Quantitative MRI aims at measuring parameters that correlate with the underlying tissue microstructure. In this paper, the parameter of interest was R2*, which is important because of its correlation with iron and myelin concentration in the brain. Maps of R2* can be quite noisy, especially in subcortical areas, the brain stem, and the cerebellum. Noise can compromise quantification and make the technique insensitive to the subtle changes that take place in the brain due to disease. Apart from cardiac pulsation, common sources of noise include breathing and motion, which are in a way easier to

mitigate, for example with motion correction and navigators. But when it comes to cardiac noise, there's no clear way to get rid of it. So we wanted to do something about it. The first step of this endeavor was to establish a fingerprint of cardiac-induced noise in quantitative MRI data, to then subsequently design adequate mitigation strategies.

Antoine: Well, what gave us the idea in the first place was simply because we saw it in the data. When you look at relaxometry data, and anatomical data in general, you do see manifestations of it, for example streaks corresponding to local pulsatile flow in the arteries that propagate across the field of view of the image. And also it accounts for a large part of data variability in inferior brain regions. In functional MRI, the correction of cardiac-induced noise is common practice. It follows that cardiac-induced noise should also be a concern in gradient-echo relaxometry data. It is harder to tackle for relaxometry because data acquisition takes place over a longer timescale (minutes vs seconds), but the effect is still present. Our goal was, as Quentin said, to obtain a fingerprint of the noise behavior to then design tailored mitigation strategies in a second step.

MRMH: Could you give us a brief overview of your paper?

Quentin: In this work we aimed to resolve the changes of the gradient-echo data, in k-space and image-space, across the cardiac cycle. To do so, we designed a tailored data acquisition strategy able to provide multi-echo data at different phases of the cardiac cycle, and ensure the incoherent sampling of other dynamic effects such as respiration or scanner drift. We modelled cardiac-induced noise from the Fourier series decomposition of the change of the data across the cardiac cycle. In lower brain regions, we found that cardiac-induced noise accounts for roughly 35% of the overall variability. We also noted that most of the cardiac-induced noise impacts the very center of k-space. The k-space center should therefore be the target of potential mitigation strategies - it is only a small subset of the data required to generate images!! We also saw that the first quarter of the cardiac cycle is noisier, which makes sense, because it corresponds to the systolic period of the cardiac cycle. We are now focusing on new ways to acquire the data that allow the mitigation of cardiac-induced noise.

MRMH: What was the biggest challenge that you faced in the realization of this work?

Quentin: The main challenge was data acquisition. We ended up with a lot of data because in addition to the three spatial dimensions, the datasets had one dimension for the multiple echoes and one dimension for the cardiac phase. We needed to ensure sufficient filling of this 5-dimensional space and minimize the spurious contributions from other dynamic effects such as breathing or scanner drift. We first tried to acquire heavily undersampled data and reconstruct them with advanced reconstruction techniques. But that was not working well because the cardiac effects were quite small compared to the artifacts coming from the undersampling. So we opted for a lower resolution and acquired continuously for one whole hour (yes, that was unpleasant for the participants). In order to have a sequence specific to cardiac noise, we worked quite a lot on the sampling strategy to make any non-cardiac noise source incoherent. So yes, that was quite a tricky part.

MRMH: What are the main limitations of the study?

Quentin: There are mainly three things that I can think of. The first one is that in this paper we focused on cardiac-induced noise but we could have applied the methods for studying, for example, breathing or other types of noise to get a full picture. The second thing is that we estimated the effects on R2* computed from magnitude data but we know that phase data are also affected. So we could have also included quantitative susceptibility mapping. And finally, the estimates of the amplitude of R2* changes across the cardiac cycle depend on the set of parameters used for the acquisition, such as image resolution and echo times. Anyways, I think that the main findings should hold. For example, cardiac-induced noise should always be predominantly located near the center of k-space. The fraction of cardiac-induced noise to the overall noise might vary from those estimated in the paper but it should remain substantial.

Antoine: I also think that the fraction of cardiac-induced noise to the overall noise depends on the protocol settings. In fMRI, the amount of physiological noise in the data depends on resolution: the higher the resolution, the less physiological noise you get. I think there is probably a similar effect here. And there is also a dependency on echo time obviously, with physiological noise increasing with echo time. So there is an unavoidable link between the level of cardiac-induced effects and protocol settings.

MRMH: What was the result of this study that you found most surprising?

Antoine: The most striking finding to me was the amplitude of the noise, accounting for up to 35% of the overall variability in lower brain regions. It is quite substantial, and especially so given that those values are specific to cardiac-induced noise only. We're quite confident that all other sources of noise were correctly accounted for, because the data were acquired randomly regarding other cyclic noise sources such as respiration. So it's really a large impact, more than I would have thought.

MRMH: To finish off, how do you spend your time when you're not in the lab?

Quentin: I have to say I'm quite a nerd so I do stereotypical nerd things. I play a lot of video games, D&D, Magic, etc. I have two 3D printers at home that I use to print miniatures, and I paint them too. I love painting miniatures because it's a very calm and chilled activity. During a large part of my PhD I wasn't able to do sports because of time limitations, but about a year ago I started again to workout, hike, and play squash. I'm still not very good at squash; my girlfriend is much better and beats me every time.

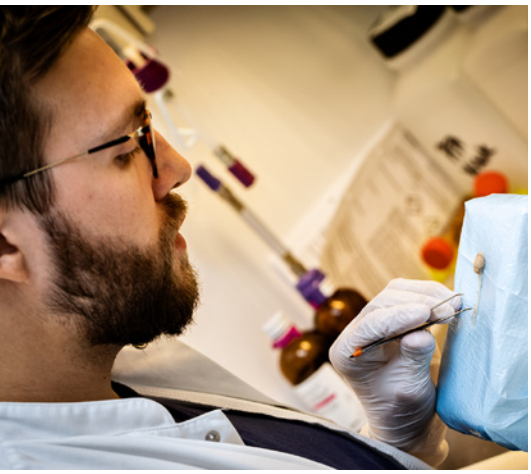
Antoine: In my free time, well, I basically raise a family. I have two daughters who keep me busy outside of my working hours. And I play classical guitar, I have done so for a very long time. Sometimes I exercise or go out for a walk. Switzerland is a really great place for hiking and outdoors! ■

Incorporating the effect of white matter microstructure in the estimation of magnetic susceptibility in ex vivo mouse brain

INTERVIEW BY **CHRISTIAN LANGKAMMER**

EDITOR'S PICK FOR FEBRUARY

This month, we feature an interview with **Anders Dyhr Sandgaard** and **Sune Nørhøj Jespersen** from Aarhus University, Denmark, conducted during the ISMRM Diffusion Workshop in Japan. Their paper was selected for its innovative approach to improving quantitative susceptibility mapping (QSM) by integrating the influence of white matter microstructure. By combining multi-gradient echo and diffusion MRI, they account for orientation-dependent frequency shifts without requiring sample rotations. This advancement enhances the accuracy of susceptibility measurements and paves the way for broader clinical applications.



Anders Dyhr Sandgaard

Sune Nørhøj Jespersen

PHOTOS: TONNY FOGMAR, AUH

MRMH: Could you tell us a bit about your background?

Anders Sandgaard: I studied physics at Aarhus University, initially focusing on accelerator physics with the goal of contributing to particle therapy. My passion has always been applying physics to health sciences. Fortunately, I discovered Sune's neurophysics group, which aligned with my interests by offering a theoretical approach to MRI within health sciences. I completed both my master's and PhD there, and after finishing my PhD, I was able to continue with Sune as a postdoc.

Sune Jespersen: I completed my PhD in theoretical physics and continued with a postdoc in the same field before deciding to return to Denmark. That was quite a few years ago! I remember taking a course in imaging for biological sciences, where MRI was introduced, and it really fascinated me. Then, an opportunity arose, and a mix of luck and interest led me into this field.

https://onlinelibrary.wiley.com/doi/10.1002/mrm.29867

MRMH: Can you tell us about your research group and interests?

Sune: Our group primarily focuses on diffusion MRI and microstructure modeling. We've worked on various projects, including diffusion imaging in the brain, capillary transit time heterogeneity in perfusion, hyperpolarized kinetics, denoising, and more recently, QSM. Our team is based in Aarhus at the Center for Functionally Integrative Neuroscience, a leading brain research center.

MRMH: What motivated you to explore QSM and the microstructural effects in white matter?

Anders: When I joined Sune's group, QSM emerged as an exciting new research direction. The focus was on magnetic susceptibility effects and how microstructure influences white matter MRI signals. Initially, I worked on simulations of microstructure and its effects on the Larmor frequency, extending previous studies to include susceptibility anisotropy. I also had access to 3D microscopy data, which allowed me to examine dispersion effects in more detail. Presenting my first findings at a QSM workshop made me consider the relationship between dispersion and diffusion—and how both modalities might be linked through shared structural information.

Sune: From my perspective, QSM microstructure was a relatively underexplored area in MRI, making it a natural avenue for investigation. I was also familiar with Dmitry Yablonsky and Valerij Kiselev's work, which inspired us to venture into this direction.

MRMH: Can you briefly describe the content of your paper?

Anders: Our ex vivo study builds on a model

we published a year earlier. The aim was to apply this model to ex vivo data, incorporating frequency shifts caused by white matter structural anisotropy. By integrating these shifts into the QSM inversion algorithm—using structural information from diffusion MRI—we were able to estimate only magnetic susceptibility, separating it from microstructural effects.

We analyzed the impact of microstructural frequency shifts on susceptibility values and found that they could alter measurements by up to 25% in the most anisotropic white matter regions. Additionally, we assessed the feasibility of our model by addressing confounding factors such as iron content and validated our approach through simulations. These simulations demonstrated that microstructural frequency shifts could explain susceptibility tensor findings that had previously been attributed to susceptibility anisotropy.

MRMH: Your study used ex vivo mouse MRI data at an extremely high field of 16.4 Tesla. Why did you choose this approach?

Anders: My co-supervisor, Noam Shemesh at Champalimaud Research, had access to these ultra-high-field scanners, primarily used for rodent studies. However, working with such high field scanners allowed us to conduct a highly controlled experiment. Had we started with clinical data, there would have been too many uncontrollable variables. This setup provided a clean, textbook-like acquisition, establishing a solid foundation for future studies.

Sune: Anders was already developing a more comprehensive theory incorporating susceptibility tensors, but it required rotations to be fully explored. Now, we're looking at ways to broaden adoption of this method, as it only requires adding a diffusion MRI scan to standard QSM acquisitions.

MRMH: Is standard DTI sufficient, or do you need higher-order diffusion models?

Anders: Ideally, a high b-value shell with multiple orientations is best. Studies suggest that 15–20 minutes of scanning with b ≈ 5000 and 60 gradient directions provides optimal results. However, to increase accessibility, we are also exploring whether lower b-values—such as those from standard DTI datasets—could approximate the method effectively.

MRMH: Is your model available for download?

Anders: It is currently available upon request, but we are working on making it openly accessible. Our goal is to integrate it into existing toolboxes as an optional module, allowing users to compare results with and without our model. This would help researchers better understand how algorithmic choices influence QSM outcomes.

MRMH: How does your work relate to χ-separation methods?

Anders: The field is moving toward multi-dimensional susceptibility modeling, and our approach could be integrated with χ-separation methods to improve susceptibility estimation by accounting for microstructure-induced frequency shifts. Another exciting direction involves diffusion filtering to extract anisotropic susceptibility information without requiring multiple sample orientations. Inversion problems in QSM are often challenged by division by zero, which can destabilize the process. However, incorporating sub-voxel frequency components introduces non-zero elements along the diagonal of the inversion matrix, which actually helps stabilize the problem.

MRMH: What are the next steps?

Anders: We are conducting validation studies using Monte Carlo simulations on realistic substrates. We recently published the first part, validating our model for the ex vivo study. The next step is to assess how realistic WM microstructure impacts transverse relaxation. We are also performing a validation experiment with pig optic nerve in PBS, similar to Wharton and Bowtell's 2015 MRM study. In our case, we estimate both susceptibility values and measure fiber orientation distribution functions (fODFs). Our model then predicts the unaccounted-for frequency shift from microstructure and we compare it to the residual frequency shift in the tissue, which could not be explained by QSM.

Another promising direction is using diffusion filtering to extract anisotropic susceptibility without acquiring multiple sample orientations, which can be challenging in clinical settings. I am working on integrating my model into the standard model of diffusion in white matter, which describes intra- and extracellular diffusivity at long diffusion times. This framework now accounts for orientation dependent Larmor frequency shifts and transverse relaxation.
Nature has been kind in providing orientation dispersion. When we apply diffusion filtering, we effectively filter axons with different B_0 orientations. By leveraging diffusion gradient filtering, we can selectively target axons based on their orientation relative to B_0, allowing us to modulate anisotropic effects in both Larmor frequency shifts and transverse relaxation.

The key idea is that, even from a single B_0 orientation, we can extract both the anisotropy of the Larmor frequency shifts and transverse relaxation. By combining spin-echo and gradient-echo sequences, we obtain rotation-invariant parameters, meaning the results do not depend on the sample's orientation relative to the scanner.
Sune: Essentially, we are conducting multi-dimensional experiments. We vary both b-value and echo time in gradient or spin-echo sequences. By adding extra dimensions, we can separate effects that would otherwise be indistinguishable. The idea is that a single acquisition could provide complementary information—structural insights from diffusion, magnetic properties from transverse relaxation, and Larmor frequency shifts—all within one protocol.

MRMH: We're conducting this interview while you're attending the Diffusion Workshop in Japan, one of the most successful ISMRM workshops, with almost 400 participants. How has your experience been, and what are your plans afterward?

Sune: The workshop was fantastic! Despite our tight schedule, we managed to explore Kyoto and enjoy some delicious local cuisine. Anders will be staying longer to go hiking in the mountains and visit Osaka and Tokyo before heading back.■

Prospective motion correction for brain MRI using spherical navigators

INTERVIEW BY **SOPHIE SCHAUMAN**

EDITOR'S PICK FOR APRIL

In this interview, we speak with **Maria Drangova** and **Miriam Hewlett** about motion correction in MRI, with a focus on their work using spherical navigators for prospective motion correction. They discuss the challenges in the field, and their approaches to addressing these challenges.

Maria Drangova

Miriam Hewlett

MRMH: Can you tell us about your background and how you got into MRI research?

Maria Drangova: I have a PhD in medical biophysics from Western University. I've had a long-standing interest in medical imaging. My PhD was in computer tomography. I graduated in '93. I got into MRI when I went to do a postdoc at Stanford with Norbert Pelc and did some cardiac MRI with him. I've stayed in both imaging modalities since then, doing a little bit more MRI than tomography.

Miriam Hewlett: My background is in physics. I did my undergrad at Acadia University in Nova Scotia. I had some experience in theoretical physics, which led to my interest in pursuing grad studies. I knew I wanted to do something more experimental and application-focused. I first started working in MRI during my master's degree at Dalhousie University. One of the things that interested me most about MRI is its sensitive to a lot of factors, which can make it a complicated technique, but it's also what makes it a very versatile tool for diagnosis and other applications. I continued down this path of MRI research with Maria, doing my PhD at Western, where I focused on motion correction, specifically for neuroimaging.

MRMH: What do you think about motion correction, and what are the hardest problems in MRI motion correction?

Miriam: One big limitation in having a widespread implementation of motion correction for neuroimaging is that there are a large variety of sequences used, and there isn't really a good one-size-fits-all solution. External devices can be sequence-independent, but they're not widely available and might not be able to detect secondary effects like motion-induced changes in magnetic field inhomogeneity. MR navigators, like we used, can measure motion along with its secondary effects using the scanner itself, but then the optimal choice of navigator depends on the sequence and application.

Maria: To re-echo what Miriam said, you need a different type of correction for every pulse sequence and every implementation. It has certainly been a frustration in my career that it's very challenging to implement anything that works very well in a broad range of pulse sequences. This is applicable to both prospective and retrospective approaches. There are way too many options to consider.

MRMH: Can you summarize your paper and how you address these issues?

Miriam: This paper was the first demonstration of prospective motion correction using spherical navigators. Spherical navigators are a k-space-based navigator acquired on the surface of a sphere in k-space, which allows us to directly quantify rigid motion. Previous work in Maria's lab had demonstrated using these navigators for retrospective motion correction, and we wanted to extend them to prospective applications since performing motion creation in real time prevents secondary spin history effects, and it also

https://onlinelibrary.wiley.com/doi/10.1002/mrm.29961

provides you with the corrected images immediately after the scan.

Maria: Being able to implement them prospectively has been very valuable. Since the paper came out we have implemented the prospective correction in a multi-echo sequence in a second paper which just came out. In that particular paper we have implemented it with a technique that allows us to obtain susceptibility-weighted contrast in the images.

MRMH: What were the biggest challenges that you encountered during this research?

Miriam: In order to perform motion correction in real time, as opposed to retrospectively, you need to obtain the motion estimates very quickly. With prospective correction, it's also very important to maintain highly accurate motion estimates since, if there's any noise, that can introduce unwanted artifacts in your acquisition, even if there is no actual motion. One of the bigger challenges in this work was optimizing the processing of our navigator data such that the motion estimates could be obtained with low latency but still be accurate enough to prevent any unwanted artifacts.

Maria: We've been working on spherical navigator motion correction for close to 20 years, and a lot of things have improved in terms of processing speed and some of the techniques that we have developed to actually make the processing of the navigator echoes remotely feasible for real-time motion correction. Implementing it within a pulse sequence and making sure that you have all the timings right and making sure that you're maintaining steady state throughout the whole sequence and validating it is, of course, challenging.

MRMH: What is the approach that you took to overcoming the challenge of getting good estimates quickly?

Maria: Spherical navigators rely on the ability to register the data that you obtain from the surface of two spheres in k-space, and traditionally it was done with iterative registration, which could take upwards of 20 minutes if not longer per data set. We implemented a lookup table-type approach that allows us to obtain a set of baseline navigators at the beginning of the sequence that represent different rotations of the head and then match those baselines to the data that is acquired throughout the pulse sequence.

Miriam: In order to get it from the baseline approach, working retrospectively to prospectively, the biggest time-limiting factor is probably actually the processing of the baseline scan itself. But we were able to implement that in an efficient enough way where we could do prospective correction.

MRMH: If someone saw this and wanted to try it on their own scanner or wanted to keep building on these prospective correction methods using spherical navigators, what would your advice be?

Maria: The first thing I would say is work in an institution where you have strong collaboration with the industry partners because if you don't have access to the pulse sequences, then obviously that is the number one barrier to being able to implement this.

Miriam: We made the sequence with prospective correction available for our latest work, and the sequence and the retrospective processing pipeline for prospective correction we've shared in this highlighted paper as well. So, if anyone's using a Siemens scanner, they're welcome to take a look at that on the CTP exchange platform. Otherwise, I think the best advice I can give is just don't hesitate to reach out. I think Maria and I would both like to see this technique tested more widely and we're happy to help out.

MRMH: Do you think it is easy or hard to replicate other people's work, and what are the main barriers to that or anything that would make it easier?

Miriam: It's generally pretty hard, especially in sequence development. Even though we've gone through some steps in order to make the sequence available for certain Siemens systems, there are other software versions and different vendors that all require varying levels of effort in order to re-implement this kind of work.

Maria: In the MRI field, I think it was possibly a little bit easier 20-30 years ago. Not hugely easy, but the vendors were willing to take more risk in translating something, but right now I feel like you're beholden to them. There is, as far as I could tell, no real pathway to get anything moving forward, even to your colleagues who might want to test it out.

MRMH: Would you say the ball is in the vendors' corner to make it easier for researchers to share their work, especially on the pulse sequence side?

Maria: Absolutely. I mean it's nearly impossible to do MRI development research without very strong connections with the vendors and we have been very lucky that Siemens was able to provide the help that they have at the beginning. But it's very challenging, especially for smaller labs. If you're in a large institution that has been doing work with a particular vendor for a very long time you are a little bit more open to making sequences available but getting the code out to everyone is really challenging. They're trying, I think, but obviously to get it to product there are huge hurdles and I understand it. I wish we had an easier path where there was more opportunity to do research at different sites once something has been shown to be valuable and useful.

Miriam: I'd also add that I think because of this issue with getting source code and translating sequence development between different scanners, in the past few years there's been more effort into developing tools like Pulseseq. I'm not super familiar with it and I'm not sure if real time feedback is supported. But I feel like I should mention that as a way the field is moving to try and make these things more accessible and replicable.

MRMH: Finally, why did you choose to use a pineapple as your phantom in the paper?

Miriam: Pineapples are pretty useful 'cause they're fairly head-shaped, and also importantly they have features that are asymmetrical, which is important when you're using k-space-based navigators. An added bonus is that I like to eat pineapple, so it was nice to take it home after the scan and have a little treat! ■

A community-endorsed open-source lexicon for contrast agent–based perfusion MRI:

A consensus guidelines report from the ISMRM Open Science Initiative for Perfusion Imaging (OSIPI)

INTERVIEW BY **AGAH KARAKUZU,** TRANSCRIPTION BY **ANAIS ARTIGES**

EDITOR'S PICK FOR MAY

In this interview we speak to **Ben Dickie** from the University of Manchester, UK, and **Ina Kompan** from the German Cancer Research Center in Heidelberg, Germany, about their consensus paper on an agreed lexicon to be used in contrast agent-based perfusion MRI. This paper forms one of a series of articles from the ISMRM Open Science Initiative for Perfusion Imaging (OSIPI) that cover all aspects of perfusion MRI.

Ben Dickie

Ina Kopman

MRMH: First, can you tell us a bit about your background and how you got involved with MRI research?

Ben Dickie: I did a physics degree at the University of Manchester and got excited about the applications of physics in medicine and healthcare. Then, I did a medical imaging Master in Leeds with Steven Sourbron, looking at kinetic modeling using dynamic contrast-enhanced (DCE) MRI in the kidney. Then, I did a PhD in Manchester, where I worked on DCE MRI and tumors. Following this, I did a few postdocs and now lead a group looking at methods to image blood brain barrier permeability in the brain. I got involved with OSIPI about two to three years ago, just by chance. I was interested in the topic of standardization and was becoming more and more concerned that we weren't making much progress in this area as a community. My previous Master's supervisor, Steve, was helping to spearhead it all. I got in touch, and he pointed me in the direction of the lexicon Taskforce, which has resulted in this consensus publication.

Ina Kompan: I studied physics at the University of Heidelberg, where I encountered a lot of theoretical physics. I quickly knew that I wanted to do something more applied, and I liked the idea of working in the clinical field. Then, just by luck, I ended up doing a Master's thesis with Matthias Günther in perfusion MRI. Back then, I worked on arterial spin labeling (ASL). Then, I did my PhD, also with Matthias, at Fraunhofer MEVIS, on the pharmacokinetic modeling of DCE MRI. After my PhD, I ventured out a bit into industry, but I noticed that I missed research, and I came back working at German Cancer Research Center as a postdoc in the department for medical imaging. There, I don't do direct MRI Research anymore, but I work in a group that at least partially supports other groups that do imaging research with IT and software solutions. I still work on MRI research by proxy, and I still like that, but I also enjoy seeing the world through the eyes of a computer scientist.

MRMH: How was the Taskforce 4.2 team established? Who are the agents of this team, and where do they come from?

Ina: When I joined the German Cancer Research Center, the head of our group asked me if I could use DICOM parametric maps to store the data from the perfusion analysis done in our open software, MITK. Since the current version of DICOM did not fully support our pipeline, my with colleagues Charlotte Debus and Ralf Floca, we came up with the lexicon idea. Steven Sourbron and Laura Bell from the perfusion study group said that this idea fitted in nicely with the wider Open Science Initiative they were thinking about, which became OSIPI in 2020. Therefore, the DCE/DSC lexicon was part of the OSIPI strategy from the very beginning. All the people initially involved also stayed as members of the Taskforce. There was a member-initiated symposium and a kickoff meeting for OSIPI at the ISMRM in Montreal in 2019. Then, a questionnaire was sent out asking for volunteers to participate in OSIPI. Ben Dickie, David Buckley, Jonathan Arvidsson, Petra van Houdt, Rianne van der Heijden, Zaki Ahmed, Chad Quarles, Michael Thrippleton and Ingomar Gutmann joined. We were lucky to come up with a very motivated and multi-disciplinary team ncluding MRI physicists, computer scientists, experts of the DICOM standard, and also clinicians. Ben now leads the current Taskforce, and the members have changed partially.

Ben: We're now running the second 2-year roadmap, focusing more on getting people to use the lexicon. We've had new members come in, with different skills to improve the website.

https://onlinelibrary.wiley.com/doi/full/10.1002/mrm.29840

It's interesting how the membership has had to change because the objectives of the Taskforce have evolved. With the lexicon now 95% complete, we're starting to go back to the original start point of trying to encode this information within a compiler matchup map. We've come full circle, and starting now, we've got the tools to address the original problem.

MRMH: What do you think about an integration with BIDS?

Ben: We now want to implement the lexicon or get people who write software and vendors to use it. For example, when vendors output DICOM parametric maps, we want to be able to use the lexicon to populate the fields of those DICOM parametric maps so that every vendor uses the same terminology. But the BIDS format is emerging, particularly for ASL as a research standard, and we'd like to extend it, creating a DCE or DSC BIDS extension where we encode everything with the lexicon's terminology.

MRMH: The sections in CAPLEX aim to standardize the reporting conventions. Why is this key for reproducible perfusion imaging? How did you come up with this conceptualization?

Ben: The sections define the different categories of things that we want to report within a DCE or DSC analysis pipeline. We've got a quantity (Q) section for quantities that have physical units like perfusion, cerebral blood flow, or Ktrans. We could have stopped there with the lexicon but we we thought it would be better to be able to describe the entire analysis pipeline in a standardized way to improve the general reproducibility. So, we decided to extend the lexicon with three other sections: models (M), general purpose processes (G), and perfusion processes (P). The processes refer to functions that modify a quantity, such as estimating the arterial input function. The models are any models that you might apply to the data, like a mathematical or a pharmacokinetic model. We tried to harmonize how those models are defined, as opposed to the variety of descriptions that can be found in the literature. Overall, with these four sections, we can now build up a standard description of what is done during any kind of perfusion analysis.

Ina: I'd like to emphasize that a key problem of DCE and DSC MRI is multi-center reproducibility. If you have different research groups or vendors, they all seem to do the perfusion analysis, report, and document it in their own ways. That makes it almost impossible to establish reproducible and comparable biomarkers. That was the motivation to come up with the standardized terminologies. We did a vast expansion of the standardized DCE quantities published by Tofts et al. 1999. We also came up with a standardized terminology for DSC MRI for the first time. We wanted to make sure that DCE and DSC are not seen as two separate methods but that they can be harmonized. This way, the lexicon can be used for many applications, such as in DICOM parametric maps or BIDS, or to improve reporting and publications. Hyperlinks and an XML pipeline format are available to make this process easy and structured.

MRMH: What were the main challenges that you faced during the development of this lexicon but couldn't find a place for in the article?.

Ina: It was a long and exhausting journey indeed, but it was also very rewarding. It was nice to see how it grew over time, how it evolved, and how there was a momentum building up from the community towards this project. One of the first challenges was to come up with a logical and sustainable structure for the lexicon. We had to make sure everything we put in there has got a place, but also that lexicon can be extended to other items that might come. For that, we took advantage of the vast knowledge about both fields of DCE and DSC MRI we had among our members. Another challenge was getting endorsement from the community. It was great to do that under the umbrella of OSIPI. We also got support from the ISMRM and its Perfusion Study Group. We were allowed to publish the paper for free and open access, which was amazing and an important step towards that. That challenge is still ongoing to make people use and accept this standardized terminology.

Ben: After Ina retired as lead, I took over, and we've developed a new roadmap. The main challenge that we've had going forward has been building momentum up again and trying to decide what the next challenge was. We needed a new skill set, and people to get involved. It has been a challenge to recruit new members and to drive things forward after the relief of the paper publication. Still, we're starting to develop a new roadmap around applying the lexicon and developing the DICOM parametric map standard to be able to encode pipelines better.

MRMH: Given that this is a community-driven project, how can other researchers contribute to the lexicon, and what are the minimum requirements to propose an extension?

Ben: We wanted people to be able to contribute easily to the lexicon. Towards the end of the roadmap, we decided to migrate the entire lexicon onto a web-based interface that was driven by GitHub, so that people could suggest changes to raise issues. Currently, anybody can view the lexicon source code, submit a change proposal, and submit an issue. All of these things wil get reviewed by the Taskforce at monthly meetings. To maintain a community-endorsed lexicon we now need to start thinking about building in the perfusion study group to review these changes. This is in development and we need to define exactly when that will happen, who will review, and how frequently. Within the next, hopefully six months, we'll have a more formal review process defined.

MRMH: Let's slowly wrap up this interview by asking you what you enjoy doing outside of work hours.

Ina: I've got two kids, aged three and seven, so there's not a lot of spare time to do anything, but it's also just nice to have lots of family time. I like running, but more in theory than in practice these days. One adventure I like is that my husband and I bought two years ago an old sailboat, and learning to sail it and to not make it sink is quite a time consuming hobby we found.

Ben: Similarly, I spend lots of time with the family. I've got two boys and my wife's pregnant with a third. So we are preparing for the chaos that will ensue. But I get to try and get out on my bike, and I also enjoy gardening. ■

Quantitative magnetic resonance mapping of the myelin bilayer reflects pathology in multiple sclerosis brain tissue

INTERVIEW BY **MATHIEU BOUDREAU**

EDITOR'S PICK FOR JUNE

This MRM Highlights Pick interview is with **Emily Louise Baadsvik**, **Markus Weiger**, and **Klaas Paul Pruessmann**, researchers at the Institute for Biomedical Engineering, ETH Zurich and University of Zurich. Their paper is entitled "Myelin bilayer mapping in the human brain in vivo", published in Magnetic Resonance in Medicine. They also recently published two related papers: "Mapping the myelin bilayer with short-T2 MRI: Methods validation and reference data for healthy human brain" and "Quantitative magnetic resonance mapping of the myelin bilayer reflects pathology in multiple sclerosis brain tissue."

In this interview, we discuss their innovative work in short-T2 MRI, the challenges and opportunities of imaging the body's "dark matter," and how their technique compares to other myelin imaging methods.

Emily Louise Baadsvik

Emily, Markus and their group at ETH Zurich

MRM Highlights: To start off, please tell us about yourselves and your backgrounds.

Emily Louise Baadsvik: I grew up in Norway but studied in the UK for my bachelor's and master's, focusing on quantum optical imaging (eg, single-photon detector systems). While I enjoyed the research, I didn't like the dark laser lab environment, so I started looking toward other imaging technologies. I got into MRI after applying for a PhD project in short-T2 MRI in Zurich, which was posted by Markus and Klaas. I've recently completed my degree and am a postdoc in the lab.

Markus Weiger: I studied physics in Stuttgart and Würzburg, with a year abroad in Edinburgh. After graduating, I wanted to go into industry, so I did my master's thesis at the Philips Research Lab in Hamburg, supervised by Peter Börnert. That experience got me hooked on MR, and I decided to stay in the field. Currently, I lead a project focused on short-T2 signals such as those from myelin, and Emily was one of the PhD students I supervised.

Klaas Pruessmann: I'm also a physicist, originally from Germany. I studied physics in Bonn and briefly attended med school before moving to Switzerland 30 years ago this year, which is disturbing [laughs]. I started with an undergrad project in MR and never reached escape velocity to leave the field. I've been in Zurich since (except for a short stint in Minnesota in 2003), where I've had the opportunity to start and lead an MRI research group.

MRMH: Thanks. Before diving into the paper, could one of you give a brief primer on short-T2 imaging and the HYFI sequence? How do they work, and what makes them unique?

Emily: Sure. Ultra-short T2 imaging focuses on capturing signals from tissues you don't typically see in standard MRI, like bone, teeth, tendons, or myelin. These tissues have very short T2 relaxation times, meaning their signals decay too quickly for conventional MRI to detect. To image them, we use specialized hardware—custom gradients with high duty cycles and an RF chain compatible with fast switching —along with sequences like zero echo time (ZTE) to capture the signal as early as possible.

HYFI is one of the strategies we use to fill in the missing data in k-space caused by the

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delay between excitation and acquisition. It's a hybrid approach, combining elements of PETRA (all single-point acquisitions) and WASPI (low-gradient radial readouts). HYFI uses radial readouts for the outer k-space and single-point imaging (SPI) for the center, balancing speed and allowed signal decay. This lets us image short-T2 tissues more effectively.

MRMH: Thanks. Let's jump into the paper. Emily, could you give us a brief overview of your study? What problem were you trying to solve, and what was the focus of the paper?

Emily: Our focus for this paper was to adapt a method we developed for myelin bilayer mapping ex vivo to in vivo. In our prior work, we used single-point imaging (SPI), which is too slow for in-vivo applications. So in this paper, we switched to the HYFI sequence. However, this introduces time modulation across k-space from the short-T2 components, so we had to verify by means of simulations if we still maintain quantitative accuracy.

We developed a protocol with 11 echo times and a 1.5-hour scan duration, prioritizing data quality over speed to ensure the results matched our ex-vivo findings. Along the way, we encountered challenges like non-uniform noise distribution due to HYFI's radial sampling, which resulted in a grainy appearance in our ultra-short T2 component images. We addressed this with k-space filtering and expanded k-space coverage, balancing noise correlation and resolution.

Ultimately, the study successfully demonstrated that our method could be translated to in-vivo imaging. The next steps are optimizing scan time and applying the protocol to study myelin anatomy in larger cohorts.

MRMH: What's the bigger vision behind your work with short-T2 imaging? What drives your research in this area?

Markus: Our broader goal is to image tissues that are typically invisible in standard MRI, like myelin and collagen. These tissues actually have a lot of signals from protons—it's not that they have very little, like when you work with other nuclei where your starting point is with low SNR. The challenge here is that their signals decay very rapidly. Initially, we were driven by the technical challenge, but we've realized the clinical potential, especially for diseases related to myelin. Collagen is another major focus, as it's abundant in the body and offers similar opportunities for imaging.

Klaas: As these short-T2 projects have progressed, I've become really fascinated by the thought that the body is full of stuff that we're never been seeing. To me, this work is about illuminating the "dark matter" of the body. Imagine being in the Sistine Chapel, but the lights only flicker on for microseconds—there's so much beauty and detail you never get to see. That's what it's like with short-T2 tissues in MRI. They're there, full of signal, but we've been too slow to capture them.

This isn't just about solving a technical problem; it's about expanding what MRI can do. With advancements in AI and machine analysis, we can now process this richer data in ways that weren't possible before. So, while some might say, "Let's do less MRI and let AI fill in the gaps," I believe the future lies in doing more MRI—uncovering deeper insights that AI can then help us interpret. It's about seeing the unseen and pushing the boundaries of what's possible.

MRMH: How does your technique compare to other myelin imaging methods?

Emily: Our method directly images the non-aqueous myelin signal, while others like quantitative magnetization transfer (qMT) and myelin water fraction (MWF) imaging rely on water signals in close proximity to myelin. qMT indirectly measures myelin through magnetization exchange between macromolecules and water, and MWF targets the reduction in T2 from trapped water within the myelin sheath. Both can use standard MRI systems, whereas our approach requires specialized hardware and sequences.

The benefit of our technique is that it provides a direct measurement of myelin itself, offering complementary information to methods like myelin water fraction which is more dependent on the structural properties of the myelin layers. Our technique could become valuable in validating and contrasting these other myelin imaging techniques, especially in diseases like MS, where cellular processes target myelin-producing cells rather than the water directly.

While our method is more technically demanding, it opens a new dimension for studying myelin, potentially revealing insights that other techniques can't.

Klaas: I'd echo one point: it would be exciting if direct bilayer mapping and myelin water imaging turned out to be equivalent—that alone would be a significant finding. But it's still early days. Myelin water imaging has been around for 20–25 years while we're just starting to explore how these methods complement each other. I suspect there's a lot of mutual information, especially in healthy tissue, but whether that holds in pathology is another question. It's too soon to say definitively, but I'm confident that at least one of these approaches will prove valuable—if not both.

MRMH: Any practical advice for those wanting to explore this technique?

Markus: You'll need strong gradients with a high duty cycle and rapid RF switching. Newer systems are starting to offer stronger gradients, but RF switching still lags behind. Push your manufacturer to implement these features—they're achievable and essential for zero echo time sequences.

Klaas: I'll second Marcus's call: readers, contact your favorite MRI vendor and demand faster switching and better duty cycles. We need to push the industry forward together.

MRMH: To end off, any highlights about Zurich for readers who haven't visited?

Klaas: It's a great mix of urban life, international culture, and academic institutions. Plus, the mountains are just an hour away. Highly recommended!

Markus: There is a lake in the city center that is perfect for swimming in summer—clean and just minutes away.

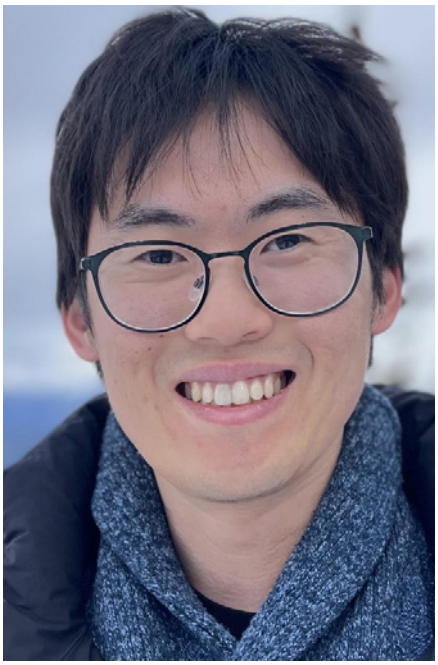
Emily: It's also centrally located in Europe, so weekend trips are easy. If it's raining here, you can hop on a train and find sun on the other side of the Alps. Great quality of life with clean air, water, and nature. ■

Any-nucleus distributed active programmable transmit coil

INTERVIEW BY **MALATHY ELUMALAI**

EDITOR'S PICK FOR JULY

In this Q&A interview, we discuss the latest paper authored by **Victor Han** and **Chunlei Liu** from the Electrical Engineering and Computer Sciences Department and the Helen Wills Neuroscience Institute at the University of California, Berkeley. They have developed a novel Any-nucleus Distributed Active Programmable Transmit (ADAPT) coil, which is capable of exciting arbitrary nuclei for 3T human MRI.



Victor Han

Chunlei Liu

MRM Highlights: Could you introduce yourselves and share what sparked your interest in the field of RF engineering?

Victor Han: I am an Assistant Project Scientist in Chunlei Liu's lab at UC Berkeley, where I have been happily working since my PhD years. My journey into RF engineering began during my undergraduate studies in electrical engineering at Caltech. When exploring different topics, I found that RF was often referred to as "black magic," which piqued my interest and seemed like a fun challenge to study.

Initially, I was planning to focus on microprocessor design or neuromorphic computing. However, during my PhD studies I took a class with Chunlei Liu, who introduced me to MRI. I found the field incredibly fascinating and decided to join his lab. One of my first projects involved exploring the idea of creating a wearable MRI device, which, although challenging, sparked my enduring interest in MRI technology.

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Chunlei Liu: I am a Professor of Electrical Engineering and Computer Sciences at UC Berkeley. My research spans two main areas: MRI and Magnetogenetics. Both fields utilize radio-frequency magnetic fields, which is where my interest in RF engineering began.

My academic journey started in physics, where I focused on solid-state NMR spectroscopy. During this time, I was introduced to the potential applications of MRI. I was always fascinated by how the brain works, and this curiosity was so compelling that I decided to transition from a PhD program in physics to one in electrical engineering, allowing me to delve deeper into MRI technology. It's been an exciting journey, and I'm thrilled to be working on innovations like the ADAPT coil.

MRMH: Can you explain what the ADAPT coil is and what inspired you to develop a unique coil capable of performing multinuclear MRI?

Victor: The inspiration for the ADAPT coil came from both power electronics and standard RF electronics. In power electronics, we have switching power converters that can convert DC to AC, with the AC frequency determined by the switching frequency. Additionally, we drew inspiration from a circuit in the RF integrated circuits literature called the distributed active transformer, which uses a loop of low voltage transistors to effectively add RF power, producing more power than what one transistor can provide alone. Consequently, the ADAPT coil uses many power switches in a loop to generate high RF currents at a frequency determined by their switching frequency. Essentially, the coil and RF amplifier are merged into a single device that directly converts DC power into RF fields at any relevant frequency.

Chunlei: Victor has a strong background and training in electronic circuits, particularly in designing circuits. When he decided to join the lab, it was very exciting for me. Specifi-

cally, for the ADAPT coil – he has been the driving force behind its design, implementation, and eventual publication.

From my perspective as an advisor, my role is to support and facilitate the progress of promising projects. The ADAPT coil is unique because it represents the first instance of a digitally programmable coil capable of performing multinuclear MRI. This innovation allows for greater flexibility and versatility in MRI applications. I think Victor can provide more insight into what inspired him to develop this technology.

MRMH: What aspects of the project did you find most exciting, and what were the biggest challenges you faced?

Victor: Besides the engineering challenges, I found the X-nuclei imaging particularly exciting. Prior to this project, I had never worked with it before. Although I had heard about it from others and it sounded intriguing, it wasn't very widespread. Additionally, we do not have a multinuclear scanner. Therefore, this project was my first opportunity to see it in action, which was very exciting for me.

The main challenge was not having a multinuclear scanner to begin with, so we didn't have a baseline for comparison or the necessary parameters. Additionally, much of the design work was done during a time when there were chip shortages, in the years following COVID. This meant that sometimes I would use one chip one week, but the next week it would be out of stock, forcing me to redesign some parts.

Chunlei: The most exciting part of the project is that it represents a completely new way to design MRI coils. MRI technology has been around since the late 1970s, so it's rare to see something so different. The ADAPT coil allows us to move away from traditional LC resonator designs to something more digitally controlled and programmable. This innovation opens new design possibilities and technical challenges, which engineers love to solve, leading to many potential applications.

Victor has been leading the effort to solve these technical challenges, while my role has been to support him by discussing ideas and considering potential applications. The biggest challenge as an advisor is securing funding for the project, ensuring we have the budget to cover all expenses.

MRMH: You were both finalists for the I.I. Rabi Young Investigator Award. Can you share your experiences and what it meant to you?

Victor: Being a finalist for the I.I. Rabi Young Investigator Award in both 2020 and 2024 was a great honor and a significant confidence boost. The first time was in 2020, which was my first time attending ISMRM and I was very excited. Unfortunately, that year the conference became virtual due to COVID, so I didn't quite get the full experience. However, in 2024, I had the opportunity to attend in person and fully experience it. It was a great time, and I thoroughly enjoyed it.

Chunlei: I was a finalist for the I.I. Rabi Young Investigator Award in 2007, right after finishing my PhD. At that time, I began working on a parallel imaging reconstruction problem, which was the basis for my nomination. People were developing receiver arrays scaling up to 96 channels, making reconstruction significantly complex, and I focused on how to perform reconstruction with this massive number of receiver channels.

Being a finalist was exciting, as it allowed me to present my work at the conference, both in oral and poster sessions. I had the opportunity to meet and interact with people interested in my work, as well as the judges and other finalists. It was interesting to talk to fellow finalists, learn about their work, and build connections that have lasted over the years. Meeting people from various fields of MRI and discovering new aspects of the technology was a valuable and enriching experience.

MRMH: I hear the patenting process can be quite the adventure. With the University of California working on patenting your ADAPT coil, could you share some of the twists and turns you've experienced along the way with our readers?

Victor: I had a little bit of experience with patenting during an internship back in undergrad. For this project, the patent attorney has been great. I'm very impressed by how quickly she can grasp concepts and put them into legal language, guiding us through the process.

Chunlei: The University of California decided to file patent applications for the ADAPT coil. As researchers, we question whether to pursue a patent due to the time-consuming process. The university aims to protect intellectual property but has limited resources, so they can't file patents for everything. When we submit a disclosure, the university might not act or file a provisional patent. Due to budget constraints, they might still not pursue it if there's no clear return on investment. This uncertainty and effort are challenging, but it's exciting to see our work potentially make an impact.

We are interested in commercializing the ADAPT coil and are exploring different mechanisms, including startup companies. We are considering whether we can produce and manufacture it more efficiently and thoroughly. There are also options where the university can license the technology to other companies. We are actively looking at different strategies to bring this product to market.

MRMH: On a personal note, what do you do to de-stress, or what is your favorite hobby?

Victor: Well, I like to play tennis. I've been playing since middle school and try to play at least once a week. I used to play more often, but not as much now. Besides that, I enjoy playing the occasional video game. I've been playing video games since I was very young.

Chunlei: When I'm stressed, I usually take a 30-minute to an hour-long walk. I also love gardening in my backyard, trying to grow fruit trees like apple, peach, and cherry trees. It's been tough, though, with California's dry climate and wild animals digging up the roots.

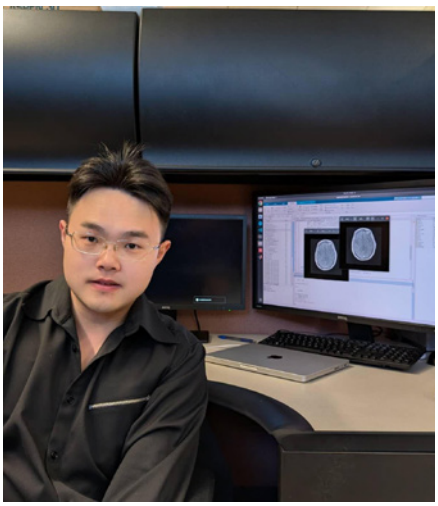
I've tried various fruit trees, but few have survived. Watering is an issue, and wild animals are a big problem. They dig up the roots, and the trees die. I try to solve these problems by using different techniques, like wrapping the hole in the ground with metal mesh. You have to choose the right size to avoid hindering root growth. That's my hobby. ■

The 'hidden noise' problem in MR image reconstruction

INTERVIEW BY **ANAIS ARTIGES**

EDITOR'S PICK FOR SEPTEMBER

The September 2024 Editor's Pick interview is with **Jiayang Wang** and **Justin Haldar**, from the University of Southern California. Their paper is entitled "The 'hidden noise' problem in MR image reconstruction".



Jiayang Wang

Justin Haldar

MRMH: Could you briefly introduce yourself and explain how you came to the MRI field?

Jiayang Wang: I'm currently pursuing my PhD degree in electrical engineering at the University of Southern California (USC). During my undergraduate studies at Tsinghua University in China I focused on signal processing. I was looking for research opportunities where I could apply my skills meaningfully and MRI quickly became very appealing. It's a field that relies heavily on advanced signal processing techniques, and I was excited by the potential to contribute to such an important area of healthcare.

Justin Haldar: I'm a professor of electrical and computer engineering at USC. I got into MRI by chance -- I was an undergrad studying electrical engineering at the University of Illinois, and knew I liked signal processing but had no awareness of MRI. My undergrad record caught the eye of Prof. Zhi-Pei Liang, who reached out to see if I might be interested to stay at Illinois for grad school. Zhi-Pei, who ended up being my PhD advisor, had an easy sell because Paul Lauterbur (also at the University of Illinois) had just won the Nobel Prize for inventing MRI. Zhi-Pei and Paul were very close, and it was clear that I was being offered the chance to be part of something special. Being involved in the subsequent Nobel Prize celebrations helped crystallize things.

MRMH: Could you explain the hidden noise problem in simple terms? What motivated you to focus on it?

Jiayang: Image reconstruction quality is often judged by comparing reconstructed images to supposedly "perfect" reference images. But these references have noise, which we call "hidden noise". Reconstruction methods can be ranked incorrectly if this noise is not taken into account.

Justin: For years, I've had concerns about our field's increasing reliance on quantitative image quality metrics like mean-squared error (MSE) and structural similarity (SSIM). PhD students from my group (Chin-Cheng Chan and Tae Hyung Kim) had previously shown that these metrics had limited correspondence with important things like spatial resolution. The hidden noise problem is just another demonstration that these metrics aren't perfect.

Notably, the MRI community didn't always use such metrics to judge reconstruction quality. Metrics gained popularity back in the mid-2000s because of their convenience, but we knew at the time that they were imperfect. Over the years, the community has increasingly come to embrace their convenience but has perhaps lost some awareness of their limitations.

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The problems with MSE and SSIM are also not easy to overcome with new metrics. There's a principle called Goodhart's Law, which states that "when a measure becomes a target, it ceases to be a good measure" — meaning that if you're trying to optimize a quantitative performance metric, there's a strong chance it might lead you in some undesirable directions.

MRMH: What's the most significant challenge you've encountered in this research?

Justin: Our biggest challenge was probably non-technical. Our work is a bit contrarian in the sense that we're raising concerns with something popular and widely-used in the field. We had to be delicate with the way we framed the message to make sure readers would be receptive.

MRMH: How straightforward is it to implement your alternative metric, the non-central Chi error (NCE), for MRI data?

Jiayang: We have a formula for calculating the NCE. The process is fairly straightforward, but it does depend on accurately estimating the noise distribution. So, if you have a reliable estimate of the noise distribution, the NCE calculation is quite simple.

Justin: The hardest part is probably noise estimation. This was a common skill that many people had a decade or two ago, but I get the impression that it's become a bit of a dying art more recently. That's unfortunate, and I hope that trainees today will take the time to learn it -- it's foundational for image reconstruction and image analysis.

MRMH: Did you explore alternative techniques to the NCE?

Jiayang: Given that the noisy reference images followed the non-central chi distribution, using NCE was a natural and straightforward choice. Our previous lab member, Divya Varadarajan, had also done a lot of work on the non-central chi distribution, which made everything easier.

MRMH: Going through the paper, the benefits of NCE are evident for the regularized reconstruction example, but the results of the machine-learning experiment are less clear. Were you surprised at these findings and do you have an idea of how to enhance the performance of the NCE in the machine-learning setting?

Jiayang: I think NCE showed clear advantages over more conventional metrics in all the cases we tried. There were certainly cases where none of the metrics were very good, and NCE was just the least bad option.

Justin: It's great if people want to add NCE to their toolbox, but as mentioned previously, all metrics are imperfect in the sense of Goodhart's Law. Rather than enhancing NCE, I am more interested in raising general awareness that it is unlikely that we'll ever find a single metric that captures every aspect of image reconstruction performance we might care about. Evaluating performance more comprehensively may require a shift away from the current paradigm.

MRMH: How do you think considering the hidden noise will influence research in image reconstruction and other related fields?

Justin: I hope that the broader community will start to recognize that image quality has many dimensions, and that we may be doing ourselves a disservice by ranking reconstruction methods on one-dimensional leaderboards. This is already recognized in other contexts like sports, where there are many different leaderboards capturing different aspects of performance. For example, Dennis Rodman is arguably one of the greatest basketball players of all time, but scored relatively few points and will not be found on any scoring leaderboards. He was nevertheless great at what he did -- some of his contributions are easily quantified and reflected in other leaderboards, while other contributions are celebrated but not so easy to quantify. It would be great if we could be more sensitive to this type of nuance in image reconstruction.

MRMH: More specifically about medical applications, how do you think, this new method for qualifying the quality of an image will affect pathology detection?

Jiayang: We haven't specifically investigated the effects on pathology detection, but the potential is there. We hope the awareness of the limitations of reference-based image quality assessment can drive the development of more robust evaluation techniques and ultimately improve the reliability of pathology detection.

Justin: It's useful to keep in mind that MSE, SSIM, and our new metric (NCE) are all global measures that look at average quality across an image. They provide certain types of insights, but may not capture spatial resolution and may not be very sensitive to errors in a handful of voxels. I probably wouldn't rely on any of these metrics by themselves if I was concerned about pathology detection applications, particularly when thinking about subtle or focal pathologies.

My larger hope is that our work inspires people to think about these issues more carefully. If I had to go to the hospital tomorrow, I would not want them to use a "state-of-the-art" reconstruction method, because the methods at the top of the MSE and SSIM leaderboards are not going to be state-of-the-art in ways that would be important to me as a patient.

MRMH: Given the growing interest in reproducible research, do you have any plan to make the code you used to calculate NCE available for the community?

Justin: I've been involved in open-source code sharing for many years. While I like many aspects of it and plan to continue releasing code, I'm also aware that code sharing can have some negative consequences. I'm a little hesitant to release code that has a strong chance of being used incorrectly. NCE requires some expertise to use properly, mostly on the noise estimation side. I think making people implement the code for themselves helps ensure that the method is being used by people who have developed some level of expertise. With the right background, it won't be hard to write the code. I'm also reminded of the old saying: "give a man a fish and he'll eat for a day, teach him how to fish and he'll eat for a lifetime." I worry a little that giving away too many "free fish" (in the form of open-source software) may be detrimental to our trainees in the long run. ■

CONTRIBUTORS

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***Magnetic Resonance in Medicine Highlights* Magazine Editor**

Maria Eugenia is an Associate Professor in Physics for Life Sciences at Magna Graecia University in Catanzaro, Italy. She completed her PhD and part of her post-doctoral experience working at the Institute of Molecular Bioimaging and Physiology of the National Research Council. Her work focuses on advanced methods for multimodal MRI fusion and on their application in the field of neurological disorders and healthy brain aging. Maria Eugenia is the proud mom of Federico and Michelangelo (tiny humans) and Pulce (a not-so-tiny cat), and in her free time enjoys listening to music, binge-watching TV series with her husband, and being a crazy-cat-lady.

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Atena is a postdoc at Western University (London, Ontario), which she joined after receiving her PhD from The University of Queensland (Brisbane, Australia). She is interested in high-resolution fMRI (laminar fMRI) and its applications in neuroscience using BOLD/non-BOLD MR contrasts. She supports open science and initiatives promoting women in STEM. In her free time, she enjoys playing sports, reading, and baking.

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After completing her PhD at Paris-Saclay University (NeuroSpin, France), Anais joined New York University (U.S.A) for a postdoc. Her work focuses on making MRI pulse sequences easier to develop and more accessible by building open-source tools such as GinkgoSequence and mtrk. She is enthusiastic about open science and open-source MRI initiatives. In her free time, she likes to practice Aikido, go on hikes, and cook for her friends.

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Emma is a Maria Sklodowska-Curie Actions Postdoctoral Fellow at University of Chieti-Pescara, Italy, which she joined after getting her PhD from University College London (UK) and after a two-year postdoc at the Paris Brain Institute (France). Her research focuses on developing quantitative methods for studying the glymphatic system, brain oxygen consumption and tissue magnetic properties with applications to neurodegeneration and neuroinflammation. She is passionate about impactful research that improves patient outcomes. Within the ISMRM, she has served as the Trainee Representative for the Electro-Magnetic Tissue Property and Quantitative MR Study Groups, and she now serves in the committee of the Italian Chapter. In her spare time, she enjoys reading, music (including playing the drums), and travelling/exploring.

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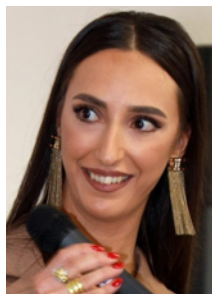
Katya is a final year PhD researcher who is working on patient safety during ultra high field MRI scanning. In her free time, she likes to climb, hike, cycle and pet cats.

Maria Celeste Bonacci



Maria Celeste Bonacci is a PhD student in Biomarkers of chronic and complex diseases at the Magna Grecia University of Catanzaro. Her research is focused on the discovery of new Biomarkers in neurological diseases, with particular attention to epileptic syndromes, through the analysis of multimodal MRI images and electrophysiological data (EEG and qEEG). In her spare time, she likes sports, watching TV series and loves to travel and have new experiences.

Laura Bortolotti

Laura (she/her) is a Post-doc at the Sir Peter Mansfield Imaging Centre (SPMIC) at University of Nottingham, England. Her work focuses on developing Motion Correction (MoCo) techniques for MRI. She developed a contactless head motion tracking method at 7 T using NMR field probes during her PhD and now she is transitioning on implementing a MoCo on a 0.5 T Upright scanner. Laura loves being involved in public engagement, and she finds difficulties in balancing enthusiasm for volunteering opportunities and working hours. She is an advocate for improving Equality Diversity Inclusivity (EDI) and sustainability in the workplace.

Glenn Cahoon

Glenn Cahoon is Lead MRI Radiographer at the Olivia Newton-John Cancer Center at Austin Health in Melbourne, Australia. His role is to support the introduction of an integrated MRI service within the Radiation Oncology department. Glenn has been an active member of the MRI community for over 25 years supporting the development and education of MR Radiographers and Technologists both locally and internationally. Glenn has served on the Governing Board of the International Society of MR Radiographers and Technologists (ISMRT) and is currently President of the Society. Glenn is a passionate supporter for extending the scope of practice for radiographers and has recently published on the current and future role of the MR Radiographer in Radiation Therapy. In his spare time he enjoys riding his Ducati on one of the many winding roads outside of town.

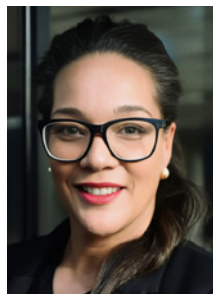
Alina Capatina

Alina Capatina is a Postdoctoral Researcher at the University of York, UK. She completed her PhD as part of the White Rose DTP scheme at the University of York, and is currently working in breast cancer research, employing multiparametric preclinical MRI to study the tumour ionic microenvironment. In her spare time, she enjoys traveling and drinking coffee with a view.

Malathy Elumalai

Malathy Elumalai is an Associate in Research at the National High Magnetic Field Laboratory (NHMFL), specializing in the development of MRI probes for pre-clinical imaging at 21.1T. Following the completion of her M.S. in Electrical Engineering, she has focused on designing and building MRI probe instrumentation, optimizing coil designs, and troubleshooting NMR/MRI electronics. In her spare time, she enjoys reading books and gardening. She is also passionate about STEM education and participates in outreach programs to inspire K-12 students.

Shawna Farquharson

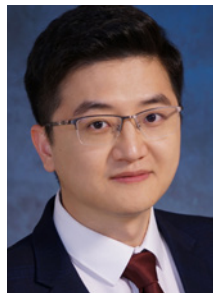


Dr. Shawna Farquharson is the Senior Scientist and National Coordinator for Magnetic Resonance Imaging (MRI) at the Australian National Imaging Facility (NIF). In her current role, she is responsible for providing national-scale coordination, optimisation and harmonisation of clinical-research studies across Australia's Advanced Imaging Network, to improve accessibility for researchers, health professionals, and industry. She has held numerous leadership and governance roles within the International Society of Magnetic Resonance Radiographers & Technologists (ISMRT) and the International Society for Magnetic Resonance in Medicine (ISMRM), including serving as the President of the ISMRT (2019-2020). Shawna is Co-Founder of the ISMRT Future Leaders Program and passionate about improving access education globally.

Maria Guidi

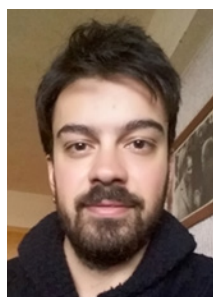
Maria is a senior postdoctoral researcher at INFN-LNS in Catania and Enrico Fermi Research Center in Rome. She obtained her PhD at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig working on methods for improving specificity in layer fMRI. Her research interests focus on quantitative fMRI methods (VASO, CVR, signal calibration) at both low and high resolution. She enjoys collaborative work and espresso macchiato.

Jianpan Huang



Jianpan Huang is an Assistant Professor in the Department of Diagnostic Radiology at the University of Hong Kong. He was selected as an ISMRM Junior Fellow in 2022. His research focuses on developing advanced methods for Chemical Exchange Saturation Transfer (CEST) MRI and exploring the applications of these methods in the fields of neurological diseases and cancer. Outside of work, he enjoys reading, playing basketball, playing guitar, and traveling with his family.

Agâh Karakuzu



Agâh is a Postdoctoral Research Associate at NeuroPoly Lab at Polytechnique Montreal. His research is centered on developing end-to-end measurement workflows for advanced quantitative MRI (qMRI) applications in neuroimaging, including multiparametric mapping and biophysics-driven microstructural imaging. He is an open science enthusiast and

plays an active role as a science communication contributor for several platforms including MR Pulse and OHBM blog. He enjoys graphic designing, skiing and exploring specialty coffee.

Christian Langkammer

Christian works at the Medical University of Graz, Austria, and his research focuses on iron and myelin in the brain, with a particular interest in post-mortem MRI and quantitative susceptibility mapping. Also, in his free time, those wonderful 1H protons are his favorite things in the world, in all their glorious states of matter: snow, ice, and water hold a special place in his heart.

Teresa Lemainque

Teresa is a researcher in the department for Diagnostic and Interventional Radiology of the University Hospital in Aachen, Germany. She started to work there as an MRI physicist after obtaining her PhD from RWTH Aachen University in 2021. Her current research interests are novel (quantitative) imaging methods and their application in body MRI. She loves interdisciplinary work and fostering exchange between natural and medical scientists. In her free time, Teresa enjoys playing the bass in a local metal band, which usually no one believes when talking to her.

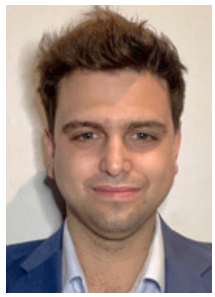
Thomas Lindner

Thomas is Assistant Professor at the Department of Neuroradiology at the University Hospital Hamburg-Eppendorf in Germany. He obtained his PhD at the Radboud University Nijmegen and is currently the team lead of the MRI research group supervising researchers from various backgrounds performing MRI experiments and supervises 2 PhD students. His main research focus is Arterial Spin Labeling sequence development and postprocessing. When not at work, Thomas enjoys time with his wife and daughter, his dog Kona, gardening, cooking and participating in long-distance triathlon events.

Melissa Lowe

Melissa is a Medical Physics Trainee at St Thomas' Hospital in London, specialising in Imaging with Non-Ionising Radiation. She earned a Master's degree in Physics from the University of Oxford before joining the NHS Scientist Training Programme. Her current research focuses on optimising motion robust T1-weighted imaging in fetal MRI and improving T1-mapping methods in the fetal brain. Outside of work, she loves metal music and spends her free time going to gigs and festivals.

Cristian Montalba



Cristian Montalba is a Medical Technologist. He is currently pursuing a Master's degree at the Pontifical Catholic University of Chile. Cristian has been actively involved in the global MRI community, being a member of ISMRM (2016) and ISMRT (2021). He served on the ISMRT Governing Board for 2021–2024 and represents the Society's Research and Electromagnetic Properties Study Group. Additionally, Cristian participates in different initiatives related by ESMRMB (European Society of Magnetic Resonance in Medicine and Biology), such as MRI Together and CAMERA (Consortium for Advancement of MRI Education and Research in Africa). Cristian's research interests are driven by improving MRI technology, particularly in brain imaging and the integration of artificial intelligence within the field in clinical settings. He actively contributes as a reviewer for JMRI and Radiology: AI journals. His work fosters global research collaboration and aims to push the boundaries of what MRI can achieve in clinical and research settings. Outside of his academic and professional commitments, Cristian enjoys extreme sports, swimming, going to the beach, watching TV series and his favorite hobby, traveling.

Sophie Schauman

Sophie is a postdoctoral researcher at Karolinska Institutet in Stockholm, Sweden. She completed her PhD at the University of Oxford, before spending some time at Stanford University broadening and deepening her expertise in advanced MRI acquisition and reconstruction methods. Now, her focus is on developing motion robust imaging methods in the interface between methods development and clinical translation. She also has a strong interest in spreading reproducible research and open science practices. Outside the lab she enjoys Brazilian jiu-jitsu, and spending time outdoors, and exploring new places.

Kwok Shin Chang

Kwok is a research fellow at the Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital. He is the trainee representative for the Electro-Magnetic Tissue Properties Study Group. His research delves into brain microstructure imaging, exploring how neural tissue composition and structural organisation contribute to MR image contrasts. He is also interested in open-source software development and wants to bridge the gap between advanced methodologies and practical applications. In his free time, he enjoys photography, running, and fencing.

Investing in the Future of MR

ISMRM
RESEARCH & EDUCATION FUND

The International Society for Magnetic Resonance in Medicine funds over 900 stipends annually to its student members to attend the ISMRM Annual Meeting, with a portion going to those ISMRM members from financially disadvantaged countries to ensure their participation. This program has been expanded to support educational stipends for student members to attend ISMRM workshops. Current stipend opportunities include:

Educational Stipend	For students, postdoctoral and clinical trainees.
Clinical Stipend	For junior clinical faculty.
New Entrant Stipend	For students, trainees, or researchers who are new to the field and might not be funded under the main educational stipend program.
E. K. Zavoisky Stipend	For scientists and clinicians who reside in financially restricted countries and have limited personal income.

ISMRM
RESEARCH EXCHANGE PROGRAM

The ISMRM Research Exchange Program aims to foster the exchange of ideas and promote the advancement of basic science, pre-clinical, and clinical magnetic resonance imaging and spectroscopy (MRI/S) research by supporting the exchange of researchers to alternate research sites.

ISMRM members affiliated with academic institutes with appointments at or below the level of Assistant Professor are encouraged to apply, and ISMRM Full Members that are principal investigators of an active MRI/S research group at an academic institute are encouraged to host applicants.

ISMRT
SCHOLARSHIP FUND

The ISMRT Scholarship Fund's priorities are directed to provide financial support for early career radiographers and technologists for high quality research, education related travel for in underserved countries, and financing the discipline of MR radiographers and technologists as a viable, competitive, contributory specialty that places MR radiographers and technologists in pivotal roles on the health care team.

Proceeds raised by the ISMRT Scholarship Fund are used for diverse initiatives from supporting education for MR radiographers and technologists in underserved countries to advancing the field of MR Imaging through the advancement of technology and research.

The ISMRM & ISMRT + One Membership Drives are an exciting and unique opportunity for members to invest in the future of the Society. Many of our trainee colleagues are experiencing economic challenges, and this is a barrier to the recruitment of the future our society—our youngest members.

For those who are able, you are invited to participate in either the ISMRM + One or ISMRT + One Membership Drive by considering an investment in the future of our Society by covering the US$50 ISMRM or US$30 ISMRT membership fee of one trainee. A contribution to this important initiative will help the trainees enjoy the wonderful benefits of being part of our global MR community.

To learn more, apply for a stipend or scholarship opportunity, or to donate to the ISMRM Research & Education Fund, visit www.ismrm.org

ISMRM **Workshops**

Mark your calendars for our global MR workshops!

ISMRM Workshop on Body MRI: Unsolved Problems & Unmet Needs

27-30 MARCH 2025
PHILADELPHIA, PA, USA

ISMRM Ultra-High Field MR & Brain Function Joint Study Group Workshop

30 MARCH-02 APRIL 2025
ANNAPOLIS, MD, USA

ISMRM Workshop on Breast MRI: Technological Advances & Clinical Applications

13-15 SEPTEMBER 2025
LAS VEGAS, NV, USA

ISMRM Workshop on MR Safety: From Science to Clinical Practice

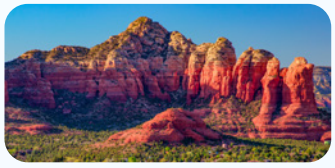
24-26 SEPTEMBER 2025
BERLIN, GERMANY

ISMRM Workshop on Unlocking the Potential of Prenatal MRI: Advances in Fetal Brain, Heart & Placenta Imaging

08-10 OCTOBER 2025
WASHINGTON, DC, USA

ISMRM Workshop on Frontiers in Metabolomics & Metabolomic Imaging in Medicine: Challenges & Opportunities

16-18 OCTOBER 2025
PADUA, ITALY



ISMRM Workshop on Data Sampling & Image Reconstruction

11-14 JANUARY 2026
SEDONA, AZ, USA

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