Matthias Stuber, Ph.D., is the Head of the CIBM MRI CHUV-UNIL Section and is a Full Professor at the University of Lausanne, Switzerland, Visiting Professor at the Johns Hopkins University, Baltimore, MD, USA , and an Invited Chair at Liryc, Bordeaux, France. He studied electrical engineering at the ETH in Zurich, Switzerland, where he also obtained his Ph.D. on cardiac MRI in 1997. From 1997 to 2002, he worked at the Beth Israel Deaconess Medical Center in Boston, MA, USA, both as a clinical scientist for industry and a faculty at Harvard Medical School. From 2002 to 2009, he directed a research team as an NIH-funded principal investigator at the Johns Hopkins University School of Medicine, where he advanced to Full Professor and was awarded tenure.

In summer 2009, Matthias Stuber returned to his native Switzerland. He has authored more than 220 peer-reviewed original articles, holds 11 patents, and has been awarded 40 research grants so far. He served as an elected board member of the International Society for Magnetic Resonance in Medicine (ISMRM) from 2013 to 2016, and is a Past President of both the Society for Magnetic Resonance Angiography (SMRA) and the Society for Cardiovascular Magnetic Resonance (SCMR). He has been distinguished as both a Fellow (FSCMR) and a Master (MSCMR) of SCMR in 2018 and 2020, respectively. Since 2021, he is a member of the research council of the Swiss National Science Foundation (SNSF). Professor Stuber has received many awards for his research, including a "Fellow Award" of the ISMRM at the 2010 annual meeting of the society in Stockholm, Sweden. In 2021, he became a recipient of the prestigious Gold Medal Award, the highest distinction bestowed by SCMR, for his research and his contributions to the field.

Dear readers and colleagues,

Welcome to San Diego, the "Birthplace of California", and to this exciting new edition of MAGNETOM Flash, which is dedicated to the 26th annual scientific sessions of the SCMR, the leading global event that brings together a highly diverse and dedicated group of CMR professionals from all four corners of the world. The theme of the 2023 SCMR is dedicated to "Changing Global Clinical Practice", a most fitting theme as you can see below.

When holding this most recent issue of MAGNETOM Flash in our hands, we cannot but reminisce about the reasons for MRI being such a powerful modality for the management of cardiovascular disease. A relatively sober explanation might include:

> *"MRI is powerful because it provides detailed images of the heart and blood vessels without the use of ionizing radiation. It can be used to evaluate the structure and function of the heart and its major blood vessels and to detect a wide range of cardiovascular conditions, including coronary artery disease, heart failure, and abnormalities of the heart valves. MRI is also useful for guiding interventional procedures, such as stenting or catheter-based treatments for heart disease. Additionally, MRI can be used to monitor the effectiveness of treatment for cardiovascular disease over time."*

Except – this explanation was neither provided by the undersigned nor as a consensus by a group of experts, but it was rather given by *ChatGPT*, an artificial intelligence chatbot that many of you may have gotten to know by now. This unequivocally documents the staggering progress of technology and opportunity that is happening all around us – as much as it should give us reason to pause and reflect on how to best harness this enormous potential for CMR.

At this juncture, major improvements will undoubtedly come from optimized workflow, ease of use, and scan efficiency. Related advancements will critically improve the utilization of CMR. Paired with emerging concepts in telemedicine and low-field MRI, more global dissemination

to geographical regions and settings that have not traditionally had access to CMR is imminent.

In this issue of MAGNETOM Flash dedicated to CMR, we find very exciting content that precisely touches upon these above-mentioned challenges and opportunities.

As for harnessing the seemingly endless power of AI, this is intriguingly exemplified in the article by Théo Pezel and coworkers from Massy, France, in which they convincingly demonstrate that we are at a crossroads of harnessing the potential of CMR in a way that was neither previously possible nor practical. In a large cohort of patients referred for Stress CMR, inducible ischemia was assessed using fully automated, AI-powered global circumferential strain (GCS) measurements[1] during vasodilator stress. The AI algorithm was trained using 3,000 patients from the UK Biobank. Simultaneously, a sophisticated and highly optimized workflow on two parallel scanners that run 55 hours per week is reported and an exam duration of well below 30 minutes has been achieved. Stress GCS was found to be independently associated with cardiovascular events during a five-year follow-up. Taken together, this is a testimony to what AI integration, workflow improvements, and scan efficiency – with a big scoop of dedication mixed in – can accomplish.

At a juncture where the link between COVID-19, mRNA vaccines, and myocarditis remains to be further elucidated, it is critically important to have time-efficient MRI tests at our fingertips for optimized patient management. Therefore, Erin Robins and Claire Harris from Perth, Australia, share their extensive experience on how common inefficiencies in CMR patient setup can be avoided and how the positioning of electrodes even at higher field strengths is no longer "magic" but can be broken down to a mechanistic, well-thought-out, and repeatable procedure that helps improve throughput through a sub-30-minute exam. While such insight comes from very experienced hands, this simultaneously triggers (no pun intended) the question:

> *"What might be a good alternative to ECG triggering in CMR?"*

When the *ChatGPT* oracle in its endless wisdom is queried again for finding an answer, it states with impressive assertiveness:

> *"One alternative to ECG triggering in CMR is breath-holding."*

Of course, we all know this is wrong, and a student would fail if they gave that answer during an exam. Therefore, my take-home message was that this marvel of technology is always certain but not always right – and that knowledge, insight, ingenuity, creativity, and perhaps a smattering of intuition and perseverance may still go a long way in helping move CMR forward.

This is very nicely exemplified by the two articles that grant the reader some precious insight into the inner workings of Siemens Healthineers and the thoughts of some of their very well-known innovators in the field. Peter Speier and Mario Bacher from Erlangen, Germany, and Annemie Steegmans from Brussels, Belgium, take us on a journey that tells a tale of innovation and dedication that led to the development productization, and commercialization of the BioMatrix Beat Sensor on an impressive timescale. The Beat Sensor technology obviates the need for ECG triggering, breath-holding, and navigators, and therefore challenges a decades-old convention in CMR and will undoubtedly help make a decisive step forward in terms of the above-mentioned and much-needed workflow, ease of use, and scan efficiency. Albert Szent-Georgi, a Hungarian biochemist who won no less than the Nobel Prize in Medicine in 1937 and who was the first isolating vitamin C, once quipped:

> *"Discovery consists of seeing what everybody has seen and thinking what nobody has thought."*

And this precisely applies to the invention of the Beat Sensor: It exploits existing hardware and the physical boundary conditions that reign in an MRI scanner, and it draws from knowledge about physiology, electrodynamics, and signal processing, and perhaps from intuition to equal degrees, to come up with a new solution. Peter Speier and Annemie Steegmans are probably right in that we have only begun to scratch the surface of the endless possibilities this provides us with. For starters, and as demonstrated in the article by Christina Karamarkou and coworkers from Essen, Germany, there is tremendous opportunity in using the Beat Sensor clinically for triggering. In patients with a propensity for frequent arrhythmias – a long-standing conundrum for CMR – the Beat Sensor performed extremely well and total scan times were decisively abbreviated when compared to conventional ECG triggering. This is corroborated in the article by Bianca Samsula, from Bremen, Germany, who has successfully used the Beat Sensor clinically in close to 100 patients at both 1.5T and 3T. As this new technology will decisively abbreviate setup time, minimize operator dependency, and maximize ease of use, it will also cater to improved throughput – all of which will be critical in the dissemination of CMR that is depends neither on highly trained personnel nor their

[1] *Work in progress. The application is currently under development and is not for sale in the U.S. and in other countries. Its future availability cannot be ensured.*

ZIP code, as aptly put by Jan Borggrefe, from Minden, Germany. He has ramped up an impressive CMR effort in a rural region of Germany that has not had easy access to CMR before, where AI, ease of use, and telemedicine are critically needed, and where helium-, energy-, and cost-saving low-field units will make a decisive difference.

Finally, Salim Si-Mohamed and co-workers from Lausanne, Switzerland, and Lyon, France, report on Ferumoxytol-enhanced 5D free-running MRI[1] in patients with congenital heart disease. This technology shifts the paradigm from prospective planning and sequence-parameter adjustment to a fully retrospective query of the beating 3D heart with millimetric isotropic resolution, where, owing to total self-navigation, ECG triggering, navigators, or breath-holds are no longer needed. Workflow, ease of use, and scan efficiency are optimized, the five-minute scan is initiated by a single mouse click, and preliminary results show exquisite agreement with the gold standard for the measurement of cardiac function.

Most importantly, at CHUV in Lausanne, this now obviates the need for general anesthesia and intubation during CMR in selected age brackets of congenital heart disease patients[2].

Taken together, the above examples provide abundant reasons for optimism and show that modern CMR is at the dawn of a more widespread global dissemination in the interest of "Changing Global Clinical Practice", the precise theme of the 2023 SCMR Scientific Sessions!

Looking forward to seeing many of you in San Diego and learning about the latest progress in the field of CMR!

Matthias Stuber

[1] Work in progress. The application is currently under development and is not for sale in the U.S. and in other countries. Its future availability cannot be ensured.
[2] MR scanning has not been established as safe for imaging fetuses and infants less than two years of age. The responsible physician must evaluate the benefits of the MR examination compared to those of other imaging procedures.

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