

Q: How did you get in the MRI field? What was your educational background? Why did you choose MRI research?

Steven Wright: My Dad, Robert Wright, was an interventional radiologist at the hospital in my home town. While I was working on my PhD in computational electromagnetics, one trip back home he told me that the hospital was considering purchasing an MRI scanner. I had never heard of it, but, he told me that it involved radio waves, and we began discussing it. He took me along with him to the RSNA to look at scanner exhibits. I got very interested. A year or so later the hospital had purchased a scanner, and my dad was going to the radiologist to start it up. It would be the second Siemens scanner delivered to the US. At the time, they were still an investigational device, and you had to be doing research, as I understood it. My dad and I talked about their attempts to find an appropriate physicist. Long story short, they had trouble finding one (there weren't many in those days). So, I threw my hat in the ring and got the job. I later found out that one Neurosurgeon adamantly opposed me, as I wasn't an MR physicist. Turned out we were co-authors on many of my first publications. He was a smart man, may have been right in opposing my hire, who knows. Been dedicated to MRI ever since.

Q: When was your first SMRM/SMRI/ISMRM Annual Meeting? What is your memory of it?

Steven Wright: First meeting was London in 1985. It was my first MR meeting and my first time out of the country. Great memories of the meeting. I recall walking around the poster sessions (still my favorite part of the meetings) and being amazed at the breadth of work. So much to learn.

I also recall Raymond Damadian giving an informal discussion about his work at the beginning of a plenary session and Tom Budinger reminding him of the young people in the audience. I remember being a bit amazed, thinking- "This is fantastic." I'd never seen anything like the energy.

After the technical meeting, I decided to rent a car and drop in at to visit the first clinical scanner, I believe, run by Dr. Francis Smith in Aberdeen. Unannounced, no appointment, I just dropped in and asked for Dr. Smith. As I recall he was very gracious, or whoever I spoke with was, and said that they happened to have a former postdoc visiting that could give me a tour. That was Bill Edelstein. He spent the rest of the day giving me a tour and discussing the construction of that scanner. There really aren't any words to describe how much I appreciated this from Bill. I recall the last time I saw him at an ISMRM, when he told me he had cancer and was in his last days. So typifies what has been my most solid memory of our community: generosity and openness.

Q: Back then,

- were there many trainees (or they were all mostly senior researchers)?

Steven Wright: Good question! I certainly feel that the field has pivoted to much younger people making up the majority of the presentation rooms at the ISMRM. But I do feel that the field is now far more full of young trainees. There are now so many more students learning and using MRI and MRS in their research.

- **how easy/hard was it to get involved in SMRI/SMRM/ISMRM activities as a trainee?**

Steven Wright: I was given a break when in 1997 when Brian Ross reached out to me to give a talk in an educational session, and to write a paper based on the talk. I in turn reached out to Larry Wald, then a newly minted postdoc I believe, to collaborate by providing some spectroscopy results from his work with Dan Vigneron at UCSF. That paper remains my most cited paper. This is a real attribute of our society, the fact that it is so broad, people reach out to bring in expertise in emerging areas. It connects new people to more established people and helps build careers. Our society has continued to cultivate the trainees bringing them in as session moderators, educational speakers, etc. This is a wonderful opportunity to a trainee.

- **what educational programs were available at the time?**

Steven Wright: I honestly don't recall from the first few years, but I've been participating in these for many years. We always encourage our trainees to attend them, and I am always amazed at who is in the room. Seasoned experts will sit quietly in the room taking notes. I recall when Hiroyuki Fajita, founder of the QED coil company, was in the room during one of the educational sessions. I asked him why he attended talks about building RF coils. He told me that you just never know what you don't know, and he always learns something.

- **what was the ratio technical VS clinical innovations in terms of ISMRM abstracts?**

Steven Wright: Not the right guy to ask. I was interested in the technology. But my recollection is that the first few years the meeting was a bit more focused on basic science and clinical applications than it is now. It is possible that the meeting is now sufficiently large that I just get absorbed in the technical aspects and don't get to see quite as much of the clinical/basic science.

Q: What was the work you presented?

Steven Wright: My first year, my work was rejected ... The abstract was on actively detuning surface coils rather than using passive diodes. I was a bit puzzled as I thought that might be important. But then when I got to the meeting two guys had abstracts accepted on similar work. I already knew them by their work, Bill Edelstein and Ed Boskamp.

The next year we presented work on using an array of coils to improve SNR, and that may have been part of the big push to use array coils.

Q: How did that research started? How did that impact the field?

Steven Wright: Many of us did early work in RF coil arrays. The biggest contribution was no doubt the work by Peter Roemer and the rest of the team at GE that was actually a true phased array system. Their work on isolating preamplifiers is still the foundation of RF receiver array technology. It is interesting that in principle it is not needed, and there have been a number of papers and discussions on that. The reality is that this is a huge contribution that is still used in essentially all receive array coils.

Our work on the topic was motivated by a clinical problem. I worked at a hospital on what was, I believe, the second Siemens scanners installed in the states. At that time there were very few RF coils provided with the system (I believe just a head coil). Based on the great early work by Joe Ackerman and many others, I started working on developing surface coils. The problem was that I quickly got bored building a family of coils of different sizes. So, the idea of a “reconfigurable” coil made sense. I wrote my first research grant to the local medical school, as an engineer, and it got funded. That opportunity really got me started into research, and I'll forever be grateful.

We built an array of small loops, inductively coupled to a larger, long loop, at the length of the spine. By activating one or more of the small loops, we could tailor the field of view of the coil. Then, we built a control system that tuned the coils, stored the tuning solutions for each configuration, and could switch between configurations between slices.

We sent that work in to the ISMRM in 1987 (New York). When I got to the meeting, Hermann Requardt of Siemens and Ed Boskamp of Philips at the time had very similar, reconfigurable coil systems, which we call arrays. But, Peter Roemer and the team at GE really did it right the next year. They had a poster accepted on their “Simultaneous Multiple Surface Coil NMR Imaging”, but as I recall, Sir Peter Mansfield gave up part or all of his platform presentation to let them discuss this! Again, another example of how amazing this society, or community, is!

In 1989 at the eighth SMRM we presented an abstract on image acceleration using a two-element array. It has not been forgotten, and we appreciate that. I worked with Richard Magin and Jim Kelton on that project. This was part of Jim's MS thesis work, and we did the initial proof on phantoms. The big influencers were Dan Sodickson and Mark Griswold for SMASH and GRAPPA and Klauss Pruessmann and his team for SENSE. Joe Carlson and our group did some of the earliest work, but it is the power of those that effectively disseminate and excite the field that have

the ability to move things forward! Oddly enough much of my earliest work was in pulse sequences. The work I did that may have the most visibility in everyday MRI is multiplane scout scan. That work actually won an “honorable mention award” at the 1986 RSNA, which is where I met Herman Requardt, both of us standing next to our posters. He went on to be one of the triumvirates leading all of Siemens, I believe. In addition to some original pulse sequence work like that, I recall spending nights in the MR suite implementing pulse sequences I’d read about. One was flow imaging. I added flow sensitization to a spin echo sequence and tested it on a phantom. Told the radiologist (my dad) about it, and he acknowledged it, but wasn’t too excited. Many months later he poked his head in my office- “Steve, I’ve got a patient coming up, can we use that slow flow sequence”? I was amazed. An example of how radiologists store information, I thought. I remember the patient to this day. We used that sequence to demonstrate patency of a CSF shunt. This was about 1986, and I tell students about that to this day in my MR classes: an attempt to point out that technology isn’t useful just because it exists, it relies on people finding an application and using it. But, those early years we presented work on electromagnetic modeling, system modifications to enable array coils (multiplexing), coil designs for parallel imaging and microscopy, some of my favorite work. Those were extremely fun years, and most of our publications were actually in the form of ISMRM abstracts. We weren’t really good about getting things into papers. Like today, the posters were very effective means of communicating with colleagues about ideas.

Q: Are there funny stories that came up while doing that research?

Steven Wright: The use of clinical facilities at hospitals to do research in the early days certainly led to some amusing incidents. I recall the time we were investigating contrast agents in a rat model with Richard Magin back at Saint Francis Medical Center in Peoria. Suddenly we stopped getting images, and assume our coil had broken (I’d built it). When we went in to take a look there was no rat in the coil! It had woken up and relocated itself. That led to a lot of scrambling and searching; but, we did finally find it and averted a potential big problem the next morning.

About the same time, I was asked to sit in on an interview for Prof. Paul Lauterbur, then at Stony Brook, who was considering a move to University of Illinois at Urbana-Champaign. The medical school had the candidates interviewed at the satellite campuses apparently, and he was scheduled for a quick interview in Peoria. I was certainly the only one in the room that knew who Paul Lauterbur was, our radiologist (not coincidentally my father) was not there. They grilled him on what would he do, why should we want to hire you, the usual due diligence. I recall being a bit starstruck, and afterwards explaining to the interview committee that this guy was likely to get the

Nobel prize. Prof. Lauterbur was so nice and modest that he in no way betrayed the magnitude of his contribution. A few months later he came to Illinois, and I made an appointment to go visit to see about potential collaborations, or more accurately, to see if there was any way I could get involved. He spent a couple of hours with me, at one point asking if I'd had lunch and ushering me to the cafeteria where we stood in line to grab lunch. I think about this a lot. He had an amazing way about him, made you feel very comfortable and openly shared his thoughts. He was just another amazing part of the community, and for many years I'd go to the SMRM, ISMRM, whatever flavor and specifically look to see what he had done that year.

Q: What were the challenges 30 years ago VS now that the field evolved?

Steven Wright: The biggest challenge now is probably getting imaging time. When I started, I had the magnet to myself as soon as patient scanning was done for the day. Piotr Starewicz told me not to give up that position at the hospital, maybe I should have listened. But even when I moved to Texas in 1988, the hospital we worked at actually gave us a key to the MRI suite and scan room so that we could use it all we wanted on weekends. We had installed the first Siemens four channel system there. Of course, it was 90 miles away, which led to a lot of late nights. Today, access is naturally much more tightly controlled. Most of it is accounted and billed, at least at the sites we are associated with. It is understandable, but some work is hard to do in a few hours of scan time. We have been extraordinarily fortunate to work with some great sites and great people: people like Craig Malloy, Dean Sherry and Ivan Dimitrov and Sergey Cheshkov at UTSW that protected us from that growing trend.

Another difference is of course the availability of literature and modeling tools. The literature on MRI was very sparse in the 80s! And, there were not widely available Bloch modelers, EM simulators, or even image processing codes. If NIH Image was around, I certainly didn't know about it. The ISMRM served as a great resource: the abstract books were great resources. Gradually the literature built up, and today it is readily available but almost overwhelming!

Q: Do you have any advice you can give to young MRI researchers on how to make new ground-breaking research?

Steven Wright: Collaborate, don't be a silo. Establish and stay close to clinical partners. It is hard to make an impact on the community when you image phantoms. Centers with P41 grants actively seek outside investigators that can use their facilities to show 'push-pull' relations with their own research. Might be a good strategy to look up the P41 type award, see where you might contribute, and reach out.

Don't turn down opportunities to join committees in the ISMRM, to review, to get involved. Join study groups. Propose your own meetings. We started the MR Engineering Study Group as an outgrowth of a series of meetings called: "Little Rock Workshops on MR Engineering". Richard Magin, Zhi-Pei Liang, Andrew Webb, Greg Hurst, Jeff Duerk, all participated.

Q: Have you ever thought about other jobs outside the MR field?

Steven Wright: Sure, I was heading for a job with an antenna company before MRI came on the scene. But not since then. Been fortunate to make an interesting career out of MRI. It seems there is always something new and interesting.

Q: Do you have and can you share photos of these early meetings? Would be nice to collect and share few of them.

Steven Wright: Unfortunately, the photos I have are of the surrounding cities. We didn't have smart phones back then, or even small digital cameras!



I have attached one photo of a collection jar at a local pub in Scotland on my way to visit the Mark I scanner in Aberdeen. They were collecting at the pub to contribute to the town's effort to purchase a CT scanner. I was a recent entry to medical imaging, and this was very gratifying to see- made me realize the importance of our work. I also have a photo of the pub, but I could not locate it on Google- must be out of business.

Also attached are pictures from the predecessor meeting to the MR Engineering study group, the "Little Rock Meetings". One has attendees on the "little rock" and the other has just the rock. The meeting was held for a few years on a lake outside of Little Rock Arkansas, initially to host Richard Magin (UIUC) and my students but it grew and included Jeff Duerk, Greg Hurst, Andy Webb and others. Andy was at the first meeting, but others were not.

