Penny Gowland: **Visualizing the body in action**

INTERVIEW BY **WALTER BLOCK**

In the conversation below Dr. Penny Gowland of the University of Nottingham discusses her career path, from her burgeoning interest in MRI in the mid 1980s, to her pivotal contributions in quantitative MRI, and her most recent contributions in body imaging. Penny had an interesting vantage point in MRI, as she was hired by Sir Peter Mansfield, who inspired her and others to develop the field of real-time body imaging.

Last year, her work was recognized by the ISMRM when she was asked to present the Mansfield Lecture at the annual meeting in Hawaii. In the conversation below, she called for the field to move beyond qualitative measures to connect MRI with underlying biology, calls which are being echoed more and more throughout our field. But the conversation often turned to her gratitude for the generous mentoring provided by Sir Peter Mansfield and the supportive environment he and others created at Nottingham.

Penny Gowland

Wally: How did you get involved in MRI?

Penny: I did my degree in physics and astronomy, and in between A levels and university studies I spent a stopgap year nursing. While I was finishing university, I thought I wanted to study medical physics and so I did a Masters of Science program in medical physics at the University College of London. This was back in 1985; an instructor showed this amazing image of a spine from MRI, but said it would never catch on because the scan took a half hour. But then we had another lecture taught by Paul Tofts, who still works in MR in Brighton. He taught me about relaxation time measurements and clinical imaging at the time, and that was it. I was caught! It was that picture of the spine that captured my attention.

Wally: What did Dr. Mansfield see in you as you came to the end of your PhD studies?

Penny: I honestly have no idea. I wrote to his lab and I was invited for an interview on the same day that Prime Minister Thatcher visited the lab! I came from the Institute of Cancer Research in London where they had the first 1.5T imaging system in the UK that looked similar to today's scanners. At Nottingham everything was made of string and tape and to some extent remains that way. We had to bring patients into what was basically a garage in the back of a building and it took a bit of Tender Loving Care to do that. I had a feeling he thought my nursing experience might come in handy! Mind you it took a bit of Tender Loving Care to keep the scanners going too, but honestly I have no idea why he hired me.

Wally: What do you want the MR community to know about the environment that Peter Mansfield created at Nottingham?

With Elena Kleban on the MRI console at the Sir Peter Mansfield Imaging Centre.

I knew Dr. Mansfield for 28 years. We saw him on the 13th of January, 2017 at the rededication of the centre named after him, 25 years after its original opening. He came and really enjoyed himself during a lovely day, staying with us for 9 hours. He died 3 weeks later.

It is only when someone dies that you realize what you've lost. I went to Nottingham to work with Peter Mansfield. I knew it was a good lab, but I didn't quite understand the power of the lab until I got there. When he retired, he was so generous in the way he handed over a significant part of his research to myself and a colleague, Richard Bowtell. He just gave it to us, and he never interfered ever again. He could've interfered and we could never have developed our own research areas but he was just there for advice if we wanted it.

The concept of imaging the body in action was something that was very close to him. We called it snapshot imaging at the time. He really had an insight into the power of EPI, high speed imaging for looking at dynamic processes in the body. At a time when MRI and CT were very much static imaging techniques he had a vision for how MRI could be used to study the functions of the body. But he gave us the room to take his vision and build our own careers. I want others to be aware of his generosity.

Wally: What was the lab like back at the start of your career? Was it aware of the history and future impact that it was likely creating?

Penny: Very friendly and very exciting. We were in an experiential physics environment with a scanner that we could do anything with (as long as it was based on EPI!) Obviously many people created that environment, particularly Paul Glover and Richard Bowtell who were already there well before me, but I think one of the reasons we've kind of kept going at Nottingham is that we aren't weighed down by our history, and maybe again that resulted from Mansfield leaving us to it; we just keep on moving forward from where we were.

It is funny for me, preparing the Mansfield lecture by going back and reading the history of fMRI and how central EPI became to fMRI. We lived through it, we worked on it, it was the ultimate use of EPI in dynamic imaging and we knew everything that was going on across the world. But we didn't really notice that history was being made at the time. I strongly believe that the way to work and live is to look after today. Tomorrow and yesterday don't matter.

Wally: Can you comment on the challenges that the field is facing and your vision for quantitative MRI in the future?

Penny: Peter was very interested in MRI serving as a basic physiological measurement, a scientific tool beyond being a clinical diagnostic tool. I am a physicist, so I like to measure things precisely and accurately. Beyond the brain, there are so many areas of the body that need repeatable, reproducible, quantitative measures. For example, I'm looking at the relationship between histology and MRI signal in the liver, specifically in the information MRI signals provide on fibrosis and finding MRI markers for glycosaminoglycans and collagen. I think that's probably the next frontier, actually understanding how relaxation time mechanisms link histology to MRI data. Now it's time to do that.

I have focused a lot on the use of MRI to develop understanding of physiology, which was exciting. But I think now we also need to drive it back towards clinical utility. Much of what we present at the ISMRM is often too difficult or slow to insert into everyday patient care. This is what I am looking to do now in my career.

I think the other problem with quantitative measurements is that physicists like me sometimes overcomplicate things. We need to work out what we need to measure and not just measure everything.

Wally: But you have had quite a lot of success in your collaborations in asking the right questions. Can

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> –Penny Gowland

Current and previous members of the Sir Peter Mansfield Imaging Centre after Penny's Mansfield Lecture at ISMRM 2017.

you expand on how you look at developing the right questions?

Penny: The collaborator is absolutely crucial and so the reason I worked in these areas is because I have really good collaborators. For example, our work on the gastrointestinal system is led by an extremely insightful clinician, Robert Spiller, who has a passion to understand functional bowel disorders. At the moment, we're looking at colonic motility. The common thinking is that constipation is caused by a reduction in contractions but it's just being realized that it can alternatively be caused by disorder in the contractions. There is no real way to see what is happening without perturbing the system, except with MRI. Robert understood that and encouraged us to develop the methods needed to assess it.

Wally: The ISMRM leadership has been discussing a lot about our need to communicate outside the ISMRM, with scientists, physicians, patients, and the community at large. You are teaching a course in communicating science at Nottingham now. How do you see the importance of communicating science today and the opportunities for ISMRM in this area?

Penny: Within my role as a teacher in physics in Nottingham, I do a lot of outreach in the local community and also run a module where undergraduate physics students go into schools and teach. Communicating science is extremely important, and it's more important today than it was even a year or two years ago. It's essential to make people understand the power of rational approaches to problems.

MRI is producing some fantastic information about what everybody is interested in, namely their own bodies. As Peter [Mansfield] realized decades ago, the ability to visualize the body in action is something which fascinates people. And so ISMRM has a particular opportunity to communicate science in general because of its links between physics and medicine.

Wally: How has being a woman, often in labs where the numbers are dominated by men, affected your career?

Penny: You know honestly I don't feel it has affected me at all. When I came to Nottingham I was the only woman in the group but I just never really noticed it and no one else seemed to either. I had done a degree in physics; there weren't many women in the class, it was normal to me. Some of my happiest memories as a young adult came from being totally integrated into the group. We obviously have a lot more women now and that's a good thing. It makes the subject more representative, which matters because the questions women and men ask can sometime be different. I have two children who are now young adults. My husband is a physicist, and he works in London, so our life was complicated. Looking back, Peter Morris, Richard Bowtell and other colleagues were really supportive all the way through when my children were growing up. But at the time I never felt like I was being 'supported'; it was just accepted as normal. ■

Penny's husband Paul Marsden and daughters Joanna and Katie.