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## You are what you eat

Joe McEntee visits Leeds to talk to Megan Povey about a career devoted to the science of food

It wasn't quite a rock-and-a-hard place decision, but it wasn't far off. On completion of a PhD with "significant military potential" back in the early 1970s, Megan Povey (or Malcolm as she was then – see box opposite) had no shortage of lucrative R&D job offers from leading US defence contractors. Trouble is, the American defence industry is not an obvious destination for an avowedly anti-war physics student and passionate advocate of the global civil-rights movement.

With a young family to support, Povey's next move, into the School of Food Science at the University of Leeds, UK, turned out to be the right one. It was the beginning of a lifelong investigation into the physics of food – from the macro- to the nanoscale, with the fundamental and applied aspects of acoustics a defining theme throughout. "I knew nothing about food [science] at the time," explains Povey, "only that I liked cooking it and eating it."

## Thinking and doing

From those scratch ingredients, Povey, who is now professor of food physics at Leeds, has built an international reputation on the application of ultrasound spectroscopy in food characterization and ultrasound processing in food manufacturing. More widely, her team's priorities span computer and mathematical modelling of foods, studies of fat-crystal nucleation and growth, and process-equipment innovation – all built on a solid fundamental understanding of physical processes, properties and materials behaviour.

"Mathematics is the language of science and I learned to speak it early on," says Povey. "Everything I do in food physics, I need a theoretical underpinning – a model – before moving onto the experimental aspects. I get such a thrill from doing the whole bloody lot – the thinking as well as the doing bit."

That "thinking and doing" mindset is being brought to bear in the fight against obesity of late. For manufacturers of sweets and confectionery, one promising line of attack is to reduce the calorific value of their food products by using edible oilbased foams (or oleofoams) to prepare aerated chocolate bars, mousses and the like. These oleofoams comprise a liquid oil phase, air bubbles and a high-melting-point crystalline phase to stabilize the bubbles – a complex microstructure that in turn determines the macroscopic chemical, physical and nutritional properties of the final food product.

To help manufacturers translate commercial potential into product innovation, Povey and her colleagues are pioneering the use of broadband ultrasound spectroscopy for *in situ* characterization of foams in the food-processing line. Initial studies are promising and show that the approach can be used to analyse fat composition, aeration protocols and bubble-size distribution – key parameters in reducing the energy content of commercial food products.

Another line of enquiry for Povey's team is the physics of digestion – and specifically the development of custom-made food products for older people. "A major reason why old people get ill is that they no longer salivate properly, to the point that they stop enjoying their food and in turn stop eating altogether," explains Povey. "The physics of flow, melting and texture – a wide range of physical processes and properties – can be used to inform the development of appropriate foods for this target group."

## Multidisciplinarians needed

In food science, of course, physics and physicists don't exist on an "island", rather as part of a wider research ecosystem addressing the inherently multidisciplinary science and technology challenges in food R&D and manufacturing. Those challenges range from designing safe, nutritious and great-tasting food, to the process technology and manufacturing know-how needed to deliver such innovation.

"As a food physicist, you're working in a multidisciplinary research environment spanning academia and industry, which is non-trivial," explains Povey. "You have to be a multidisciplinarian – an expert capable of working with other experts rather than a 'jack of all trades'. It's essential to be able to interact effectively with process engineers, industrial chemists, biochemists, nutrition experts as well as commercial and business development teams in industry."

In fact, Povey's close relationship with the food manufacturing industry is another defining theme of her four decades in food research. "Industry has always been important to me from a funding perspective," she adds, "though I have sourced research money wherever I could get it. The interaction with industry is crucial as far as I'm concerned: how can you do impactful research if you haven't got a clue what's going on out there in industry."

That affinity is perhaps natural for someone who sees no divide between theory, applied science, technology innovation and process engineering. "My father was a flour-milling engineer and I used to go around flour mills with him as a child," she explains. "I just love factories and what's going on inside them – and yet too often today their importance is either denigrated or despised. Without them, though, civilization would be scuppered."

Those close ties to industry were baked in when Povey was starting out as a postdoctoral researcher in the early days of the Leeds food-science programme. Back then, the department was dominated by chemists and biochemists and some of her ideas – including the use of ultrasound as a tool for investigating foods and their constituent materials – were initially met with scepticism from senior colleagues and research managers.

A team of visiting scientists from consumer goods giant Unilever – which at the time was a world leader in research on fats – took a different view, providing the encouragement and funding Povey needed to develop her early-stage ideas on the use of ultrasound techniques to study fats in food processing. "It was industry that backed my ideas initially, not the research councils," she notes. "And because I was able to work closely with the leading scientists in the food industry, that gave me a bloody great leg-up – and still does."

Her advice for early-career researchers embarking on a career in food science today is to engage proactively from the off with colleagues in industry. "Go to conferences, talk to industry scientists, go around the factories, get interested in their problems," she advises. "But don't lock your research in exclusively with industry partners. You have to think it through, spread your bets, and have diverse sources of funding."

Povey, for her part, has always tapped into research-council funding and done basic research alongside her industry collaborations. "If you concentrate on the fundamental science, by and large you're free to publish," she notes. "In general, industry only really want to lock down applications and results with commercial significance."

### Fight the fight

Despite forging a research career in the multidisciplinary melting pot that is food science, it's clear that Povey remains a physicist at heart. A fellow of the Institute of Physics (IOP), she's a vocal

champion of the role that physicists can play in solving the systemic and complex challenges facing the food industry, not least the growing demand from policy-makers and public for a more sustainable food system that makes better use of water, raw materials, energy and land.

She was one of the founding members of the IOP Physical Acoustics group and, later, the Physics in Food Manufacturing group, with both channels proving instrumental for her and her team in terms of connection and collaboration with likeminded scientists in academia and industry.

"I've always felt that people need to know about physics and the fact that physics is really fundamental to our world," she concludes. "It has to be fought for, though, and being an active member of an organization that promotes and defends physics is important to me."

- Megan Povey will chair the IOP's Physics in Food Manufacturing (PiFM) conference at the University of Leeds on 15–17 January.

### **A question of identity**

For most of her life, Megan Povey coexisted in an uneasy, often distressing, truce with Malcolm Povey. Two sides of the same coin, but only one of them, Malcolm, permitted to be visible, present and self-evidently male in the wider world. That all changed in December 2017 when Megan came out to her family, telling them that for as long as she could remember she'd been a woman "inside her head". Here she talks to Physics World about her subsequent transition to Megan – the fear, the liberation and the support and encouragement she's had along the way.

#### **What was life like for you before your transition from Malcolm to Megan?**

I was never comfortable about who I was meant to be, to be honest. I'd hide away rather than meet people. It was easier in the workplace because I could relate to people entirely through my science. The female side of my personality was wanting to escape since I became conscious – and it's not like something you can switch off.

#### **That can't have been easy?**

It was quite lonely. I have been a woman inside my head for a very long time – and I don't have to pretend any more. Now that I've transitioned, I say to my female friends that I've suddenly discovered the other half of the world. And from their point of view, they could never have had the conversations with Malcolm that they now have with Megan.

#### **How did going public with your transition make you feel?**

It was very frightening, but I had to do it. The experience has been massively liberating because all my life – even from early school days – I've had to pretend I was somebody I wasn't. Ultimately, it's about intellectual honesty. Put that another way: staring at the gulf and pretending it isn't there is a non-starter for me. Because I always want to know – and you don't get to know by denying the existence of things. I don't think even five years ago I could have done this. The world has changed a lot of late, with more progressive approaches to gender equality, diversity and inclusion in the workplace and in society. I've benefited from all that.

#### **How have people responded to your transition?**

I've had lots of fantastic support from my family, the university HR department, plus my colleagues and collaborators have been amazingly accepting. I know my transition has had a positive impact

within the university, and I've got a lot of kudos for doing it at this stage of my career. There have been a few issues, with some male colleagues, funnily enough, still treating me as a man – or rather the man they used to know. There's also the fear of being outed as a transwoman in the street and being attacked – that's an ever-present concern.

**What advice would you give to others going through a similar experience?**

It's an individual choice, but just be true to yourself. Fundamentally, this is about self-identification and being brave – though obviously you have to worry about the impact on family and the people close to you. The social context matters, but I think people should come out if they can. The situation is perhaps more complicated for a younger person who's not yet established their own identity. For me, I want to claim my past and my work. I'm proud of it and it makes me who I am.

Joe McEntee is a contributing editor based near Bristol, UK