*New Phytologist* Profile pro forma

Your name: Martin McAinsh

Please answer the questions below, keeping your answers to under 200 words, if possible.

1. What inspired your interest in plant science?

I grew up watching wildlife documentaries on TV made by inspirational conservationists and filmmakers such as Jacques Cousteau and David Attenborough which at an early age stimulated my interest in the living world, both animals and plants. However, corny as it may sound, it was my Mum who was responsible for my fascination in all things living becoming focused on plants. With no formal training in plants science, she was nevertheless an avid gardener who could answer any plant-related question a young boy asked. Therefore, holidays spent walking with her in The Lake District in the north-west of England became an education in plant biology and identification fuelling my developing curiosity in the environment and the diversity of plant life that could be found within it. Her quiet passion was contagious and undoubtedly played a key part in my decision to go on to study biology at high school and subsequently to study biology at university specializing in plant ecophysiology during my Bachelor’s degree. For Patricia 1927-2020.

1. Why did you decide to pursue a career in research?

I first experienced the excitement of research at an early age. My Dad and Granddad were both research engineers whose careers spanned the development of colour TV through to satellite communications. In my early childhood there was always what appeared to me to be an excitingly weird piece of equipment in the house surrounded by electronic components. As children we even had our own ‘space ship’ – a muddy gap in the hedge with a broken old marine radio receiver for the spaceship’s controls. I believe it was the obsessive joy which they both derived from tinkering with things that made it inevitable that I would follow in their footsteps although it was a surprise to everyone except my Mum that it was plant biology research for which I developed a passion. I was extremely fortunate during my PhD to have supervisors who allowed me the space to develop my research in the areas of plant stress biology that most fascinated me, no matter how eclectic they might have appeared at the time, firmly planting the seed of a career in research. However, it was during my postdoctoral research that this seed firmly took root. My research provided me with the opportunity to develop and apply novel cell imaging techniques to address an exciting new research question in plant biology and could almost have been conceived to give me carte blanche to tinker. What more could I want from my future career?

1. What motivates you on a day-to-day basis?

Other than tinkering in the lab, which is something I’ve done very little of during the global Coronavirus pandemic, I’m motivated on a day-to-day basis by new opportunities and challenges. And every day brings a new set of challenges which means a career in science is always stimulating. Whether it’s helping my undergraduate students grapple with scientific concepts, the most difficult for them often being the ephemeral nature of scientific knowledge, or working to maximise the real-world impact of the science performed in my lab there’s never a dull day. And if, along the way I can help inspire the next generation of scientists in the same way that my role models and mentors have inspired me in my scientific career, then it’s been a good day at work.

1. Is there anyone that you consider to be a role model?

I consider many of my current PhD students, along with the early career scientists with which I work or for whom I am mentor, to be some of my most important role models at present. Their passion for scientific discovery continues to be an inspiration to me as has been the tenacity they have shown throughout the global Coronavirus pandemic. However one of my early role models was Professor John Maynard Smith FRS (1920-2004); his enthusiasm and passion during undergraduate lectures were totally compelling and something I have aspired to emulate when communicating science to others. As an early career scientist I was fortunate to be mentored by two amazing scientists. I was privileged to work in the laboratory of Professor Alistair Hetherington as a PhD student and postdoctoral researcher. Of the many skills he taught me during that time, and subsequently, those of self-belief and determination have been instrumental in enabling me to succeed in a career in science. As one of my postdoctoral advisors, Professor Colin Brown was generous in sharing his enthusiasm for cell biology with me. I learnt so much during the hours we spent tinkering with bits of equipment measuring intracellular ion concentrations in his lab at the MBA in Plymouth (UK); my students are continually amazed by the excitement I still derive from watching real-time changes in cytosolic calcium in cells. I am also grateful for the tolerance and support Professor Enid MacRobbie FRS and Professor Terry Mansfield FRS have both shown me over the years and which, in turn, I try to extend to the earlier career scientists I myself now mentor.

1. What are your favourite *New Phytologist* papers of recent years, and why?

One of the most exciting things for me about *New Phytologist* is the breadth of the topics it covers which makes it such a stimulating journal to read but which also makes it very challenging to choose my favourite papers. Paiva (2019), a Viewpoint paper, and Karabourniotis et al. (2020), a Research Review, were published in rapid succession and consider a topic which has fascinated me since I first looked at a leaf down the microscope and saw the epidermal cells packed with calcium oxalate crystals. Why are they present in cells and what do they do? These papers attempt to answer this intriguing question in which the authors discuss the evidence for a dynamic role for carbon-calcium inclusions within plants. Huang et al. (2019) considers another calcium-related topic that has been the focus of my research for many years, the role of cytosolic calcium changes in ABA-induced stomatal closure. Whilst most studies have been performed using stomata in epidermal peels or epidermal fragments this paper uses Arabidopsis expressing the new R-GECO1-mTurquoise calcium senser to study cytosolic calcium signals in guards in intact leaves allowing the authors to draw some intriguing conclusions. Cairne et al. (2019) is an inspiring piece of work that shows the potential for fundamental science, in this case research into the molecular mechanisms that control stomatal development, to have real-world impacts. The authors show that rice plants overexpressing the rice epidermal patterning factor OsEPF1 have fewer stomata, are drought tolerant, and use less water so that they should perform better under conditions of climate change thereby contributing to global food security. Segueing to another stomata-related topic, in their fascinating recent paper Lin et al. (2021) show that the salivary enzyme, glucose oxidase, secreted by the caterpillar *Helicoverpa zea* causes stomatal closure thereby inhibiting the emission of herbivore-induced plant volatiles involved in plant communication and defences. This observation shows that stomata play a more important role in plant-herbivore interactions than previously recognized. Finally, Malabarba et al. (2021) brings together the topics of calcium signalling and plant-herbivore interactions. This paper positions the ANNEXIN1 calcium channel‐like activity as a key player in Arabidopsis in both local and systemic defence responses against herbivorous *Spodoptera littoralis* larvae by mediating cytosolic calcium elevations, jasmonate level, and defence‐related gene expression, thereby extending our understanding of the molecular identity of calcium channels involved in the plant response to herbivory.

1. What is your favourite plant, and why? (If possible, provide a photo showing your favourite plant.)

I have three favourite plants the first being *Narcissus* which bring me great happiness when the wild daffodils flower in the springtime. My respect for this humble species goes beyond this however given its use throughout history in medicine. Hippocrates II and Pedanius Dioscorides both recommended narcissus oil as a treatment against cancer and today Amaryllidaceae alkaloids, from the Amaryllidaceae family to which Narcissus belong, are known to possess a wide range of pharmacological properties. The second is *Commelina communis*, or the Asiatic dayflower. I initially encountered this species, which has beautiful small blue flowers, during my postdoctoral research as a model plant for studying stomatal physiology and the mechanisms of guard cell signal transduction. As such, I own it a debt of gratitude for having helped shape my future career in research. The third is *Mimosa pudica*, or the touch-me-not, which folds its leaves when touched. Along with species such as the Venus flytrap, it is one of the few plants capable rapid movements. Long before I became interested in the molecular mechanisms underpinning plant movements, and in particular the movement of stomatal guard cells, I was fascinated by the speed at which the leaves of the Mimosa folded, a fascination that I have passed onto my children who refer to this species as the “touchy-feely plant”.

In addition:

Provide a photograph and a short bio, of 150-200 words.

Research Overview

My lab studies plant-environment interactions at the whole-plant, cellular and molecular levels focusing on the mechanisms by which plants respond to changes in their environment including drought, elevated carbon dioxide and ozone stress. Specifically, I am interested in understanding the cellular/molecular basis of how plants tolerate these environmental stresses and how this relates to agricultural sustainability and food security. I graduated from the University of Sussex (UK) in 1984 before moving to Lancaster University (UK) to study biotic-abiotic stress interactions in barley for my PhD followed a postdoctoral position studying plant calcium signal transduction. I subsequently moved to the University of Edinburgh (UK) as a Lecture before returning to Lancaster University as a Royal Society University Research Fellow in 1992 to set up my own lab investigating plant stress signalling mechanisms. I am currently working with agribusiness to apply this understanding to develop sustainable solutions for enhancing agricultural production and for reducing waste in the supply chain. I am an Editor for New Phytologist where he joined the Editorial board in 2019 and I had previously been a Co-Editor and an Advisor to the journal.

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References: list the papers selected in section 5.

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