Profile

Sarah E. O'Connor

What inspired your interest in plant science?

Although I received my PhD in chemistry (with Barbara Imperiali), as I progressed through my training, I became more and more interested in biological systems. By the time I was ready to do my postdoc, I had decided that I wanted to learn more about the enzymes that are responsible for catalyzing the biochemical processes that take place in living organisms. I joined the group of Chris Walsh, a scientist who worked on an enormous range of enzymes over his career. Chris's lab at the time was focused on discovering and characterizing the enzymes that were responsible for the biosynthesis of microbially derived natural products. Thanks to Chris, I became hooked on the question of how nature synthesizes complicated molecules. I decided that I wanted to continue to work in natural product biosynthesis in my independent career. However, I knew that the field of microbial-derived natural products was very competitive. So, I began to search for natural product pathways that were less widely studied. From my reading, I learned that the biosynthetic pathways of many of the classic natural products – morphine, strychnine, and colchicine – had not been elucidated. I also realized that these molecules were produced by plants. So, I decided to work on plants.

Why did you decide to pursue a career in research?

I always liked science in high school and university, but compared to physics and biology, I liked chemistry best. As an undergraduate student, I was strongly encouraged to join a lab to do research, which I did. I started in a physical chemistry laboratory and quickly realized that I was not very good at building equipment, which is a big part of physical chemistry research. I was very discouraged and thought that maybe I was not cut out to be a scientist. But before completely giving up, I decided to try a different type of research. I went to work for a bio-organic chemist, David Lynn, where I synthesized compounds that were produced by the roots of maize. I realized that even though I was not great at physical chemistry, I was pretty good at organic chemistry. And then I never looked back.

Sarah E. O'Connor is one of the authors of the Priority report by Schotte *et al.* (2025; https://doi.org/10.1111/nph.70388). Sarah was also a keynote speaker at our inaugural new phytologist next generation scientists symposium, which supports early career scientists (see https://www.newphytologist.org/events for more information).

Box 1

Photo credit: Sebastian Reuter.

Sarah E. O'Connor received her degrees in chemistry from the University of Chicago, USA (BSc) and MIT, USA (PhD) and performed her post-doctoral work at Harvard Medical School, USA. She was a Professor and Project Leader in Biological Chemistry at the John Innes Centre, UK, from 2011 to 2019. She has been the Director of the Department of Natural Product Biosynthesis at the Max Planck Institute of Chemical Ecology, Germany, since summer 2019. Her research interests focus on plant (and recently insect) natural products, with a particular interest in iridoids and alkaloids. Her research group takes a broad approach to understanding biosynthetic pathways, ranging from gene discovery, mechanistic enzymology, and metabolic engineering. She has received the Prelog Medal (2024), Leibniz Prize (2023), ACS Ernest Guenther Award in Natural Products (2022), Royal Society of Chemistry Perkin Prize for Organic Chemistry (2019); and was elected to EMBO (2017), the Royal Society (2023) and Leopoldina (2024).

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

This job has many, many components – research, teaching, training, making a better research and working environment – and I am motivated to work on each of these things on a daily basis. But honestly, my favorite part of the job is when a student or a postdoc comes to my office and shows me a new piece of data that helps solve whatever research question we are working on. Partnering with my early career co-workers to answer these questions is the most fun part of this job.

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

Many people have inspired me over the course of my career; one of the great things about working in science is proximity to smart, creative, and driven people. But I want to take this opportunity to thank a few people who helped me at the beginning of my independent career. As I said above, I came from a background in microbial natural products, and so I knew very little about plants. It was a huge challenge to learn about this field as I was setting up my lab, and I never would have survived without the help of the plant science community. Carolyn Lee Parsons (Northeastern University, USA) showed us how to cultivate hairy root culture; Joe Noel (Salk Institute for Biological Studies, USA) and Jackie Shanks (Iowa State University, USA) were a source of encouragement and support; Joe Chappell (University of Kentucky, USA) and Dean Della Penna (Michigan State University, USA) included me in a major NIH consortium grant on medicinal plant transcriptomes; and Robin Buell (University of Georgia, USA), whom I met through that grant, taught me about plant genomics (and is still teaching me today through our long-standing collaboration). Of course, there are many others, and I have to thank the plant sciences community as a whole for being so welcoming.

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

New Phytologist is a wonderful journal that publishes work in all areas of plant sciences. It is hard to pick a favorite paper, but these, for one reason or another, have captured my attention recently.

Metabolic engineering and synthetic biology are essential for deeply understanding how plant metabolic processes work. The Tansley review by Patron (2020) is a fantastic update of the progress that has been made in incorporating plant-based systems into the world of synthetic biology. This review highlights the synthetic biology tools that have been developed for plants over the last decade, and also highlights some of the successes in plant synthetic biology that have been achieved. Moreover, this review clearly outlines what challenges still remain.

One of my favorite groups of plants is the Apocynaceae family, a plant family that harbors extraordinary chemical diversity. Members of this family produce monoterpene indole alkaloids (like the plant *Catharanthus roseus* that we work on), iridoid terpenes, cardenolides, and pyrrolizidine alkaloids, making this a fantastic system in which to explore how biosynthetic pathways are gained and lost. The research article by Livshultz *et al.* (2018), which is currently on my desk, explores how pyrrolizidine alkaloids evolved in the Apocynaceae. The authors show how the specific insect herbivores of these plants may have played a role in determining whether pyrrolizidine alkaloids or the terpenoid-derived cardenolides are synthesized by these plants.

Single cell RNA-sequencing has led to a step change in the quality and resolution of plant transcriptomes. We are working very hard to implement this approach in my laboratory to more effectively elucidate plant biosynthetic pathways. The research article by Kang *et al.* (2022) is one of the very first examples of applying single cell RNA-sequencing to elucidate the biosynthetic pathway of a plant natural product. The authors elucidated the biosynthesis of a volatile compound in tobacco flowers and showed how these genes are expressed in only specific cells. I have to declare something of a conflict of interest in endorsing this paper: I am very happy to say that the first author of this paper is now a postdoc in my group.

Fig. 1 *Catharanthus roseus*, or Madagascar periwinkle. Photo credit: Sarah O'Connor.

What is your favourite plant and why?

It would have to be *C. roseus*, or Madagascar periwinkle (Fig. 1), the plant that got my independent career started. This plant produces an extraordinary array of structurally complex alkaloids in its leaves, and it has been a joy to be able to unravel some of the chemical mysteries encoded within this plant. Also, this plant is easy to grow, and we have been able to develop a variety of tools using *C. roseus*, including single cell sequencing approaches with my collaborator Robin Buell (Li *et al.*, 2025). And *C. roseus* is a beautiful ornamental plant too. Outside of work, I love roses, just for their scent.

References

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