# ASPB Pioneer Member

## Anthony Kinney

**How did you get started in plant biology?**

I grew up in a coal mining town on the Derbyshire-Nottinghamshire border in the UK, an area that would be very familiar to readers of D. H. Lawrence. Many of my family members worked for the mines, including my father, who was an electrical engineer at a nearby colliery. In high school I was very fond of physics and was fully intending to study that in college. My plans changed abruptly, however, after revelatory school trip to a residential field study center at Preston Montford Hall in Shropshire. After an intense week of hands-on botany, zoology, soil science and ecology, I was convinced my future lay in the life sciences. I became an undergraduate at Sussex University, which I chose because of its strength in the biological sciences but also for its lovely campus, with striking Minoan-inspired architecture, situated in the bucolic South Downs and conveniently close to cosmopolitan life in Brighton.

At Sussex I became fascinated with plant physiology and plant biochemistry. I spent a summer as a student worker in John Hall's lab investigating membrane transport in pea roots and, after John connected me with David Clarkson at the Agricultural Research Council's (ARC) Letcombe Laboratory and Brian Loughman in the Botany Department at Oxford University, I accepted an ARC graduate scholarship to study jointly with them. Under their supervision, in both Letcombe and Oxford labs, I investigated the effects of temperature on phosphate transport, membrane structure, and membrane synthesis in rye roots. Early in my graduate studies I was fortunate to attend a Royal Society lecture by George Palade and left impressed by his use of very diverse technologies, from ultracentrifugation to electron microscopy, to pioneer the science of cellular molecular biology. Thus inspired, I explored with the help of many talented colleagues at Letcombe and Oxford, as well as my external mentor John Harwood at Cardiff University, various techniques such as radio-labeled pulse chase experiments, cell fractionation, enzymology, membrane lipid analysis, and electron microscopy – all in an attempt to figure out how rye plants acclimated to large differentials in temperature between their roots and shoots.

As I worked on understanding rye root membranes, I became very interested in membrane phospholipid biosynthesis and how it was regulated in plants. This led me to a post-doc with Tom Moore in the Botany Department at Louisiana State University in Baton Rouge, where I studied the regulation of phospholipid biosynthesis in developing castor bean endosperm. I joined the ASPB (then ASPP) Southern Section and attended their meetings with my plant science colleagues from the Botany, Plant Pathology and Biochemistry Departments at LSU. There I got to know many plant scientists from the extended Southern region (including my future wife, Alison Mack). Meanwhile as a DJ on LSU's campus radio station, KLSU-FM, I spent every Friday night in the guise of my alter ego, Mad Dog the Englishman, delivering edgy British underground music to the bayou. In 1984, the ASPP held its annual meeting at LSU with an organizing committee led by Tom. Observing the intense work and planning needed for a meeting of this scale was a significant learning experience for me, as was the realization of its rewards: several days of exciting plant science—not to mention amazing Cajun/Creole food and music by Zydeco legend Rockin' Dopsie, who played at the closing banquet thanks to contacts I made at KLSU. Over the decades since then, ASPB meetings have continued to fuel my love of plant science.

After bidding LSU a fond farewell, I continued my postdoctoral work in George Carman's lab in the Food Science Department at Rutgers University, where I further explored the regulation of phospholipid biosynthesis, this time in the honorary plant *Saccharomyces*. I learned the art of purifying membrane-bound enzymes, such as those involved in phospholipid biosynthesis, and was fortunate to learn state-of-the-art plant molecular genetics (*circa* 1987) from Dan Klessig and Jo Messing, who graciously let me sit in on their

graduate lectures at the nearby Waksman Institute.

In 1989, I accepted a research scientist position with DuPont and moved to the Experimental Station in Delaware to begin a 35-year career in agricultural biotechnology.

**What do you consider to be your most important contributions to science?**

The most exciting thing about working at a company like DuPont (later to become DuPont Pioneer and now Corteva) is exploring basic science, then translating it into products that can benefit society. Success in these efforts requires large teams with diverse expertise to work together, and also to collaborate with colleagues in academia. When I joined DuPont, the company had recently decided to focus its plant science efforts on output traits; one major area of interest was the idea that we could manipulate the seed composition of soybean, canola, and corn for human food and animal feed, in order to improve their nutrition and health properties. As someone with experience in plant lipids, I had been hired to join a project to improve the fatty acid composition of seeds to make healthier oils for human consumption. With my colleagues Bill Hitz, Susan Knowlton, Naren Yadav, and their teams, I took advantage of the T-DNA tagged *Arabidopsis* mutant library created by Ken Feldman at DuPont and, collaborating with John Browse and his lab at WSU, was able to clone the first membrane-bound fatty acid desaturases to be discovered from any organism. The most important of these desaturase genes from a seed composition perspective, the *fad2* and *fad3* genes, encode the omega-6 and omega-3 desaturases controlling the formation of the bulk of seed's polyunsaturated fatty acids. With the *Arabidopsis* genes in hand, our team quickly found the equivalent genes in soybean, which allowed us to create the first transgenic high oleic crop plant. This chain of discoveries ultimately led to the development of Plenish™ high oleic soybeans, which produce healthy, *trans*-free and lower-saturated fatty acid oils. Plenish™ soybeans are currently grown on more than one million acres across the US.

Continuing to explore soybean seed composition, our team discovered desaturase-related enzymes that control formation of unusual fatty acids with multiple uses: in human and animal nutrition; for non-food purposes; and for manipulating the protein, oil and amino acid composition of the bean. We were the first to demonstrate that oil and the protein content of soybean seeds could simultaneously be increased, at the expense of indigestible carbohydrates. All previous attempts to increase soybean protein content had reduced oil content (and *vice versa*).

I also hope that my quarter century as a monitoring editor at *Plant Physiology* had some positive impact on the quality of peer-reviewed plant science publications in that key journal.

**What important advice would you give to individuals at the start of their career in plant science?**

As you begin a career in any type of science, I believe it is important to make lots of scientist friends. There are many kind, gracious and generous plant scientists out there, some of them very distinguished. Don't be afraid to approach someone you admire and ask for their advice or help. You will usually find that they are more than happy to assist, encourage, and even collaborate with you. I have been very fortunate to meet many such people in my life. You can, too. But don't tolerate toxic situations; your professor, supervisor or collaborator might be very eminent and experienced but if they make you miserable, find someone else to work with or something different to do that will make you happy.

Some scientists will tell you that the only way to be successful in science is to devote all your waking hours to it, at the expense of all other pursuits (including family). I've found that there are many paths to success in science beyond abject devotion, and that a love of science, while necessary, need not be obsessive. If you wake up most days ready to head for the computer, lab, greenhouse, or field, then you are likely to have a successful career in the plant sciences.