Brian A. Larkins

How did you spend your career?

After completing my PhD in botany at the University of Nebraska in 1974, I moved to the Botany and Plant Pathology Department at Purdue University for postdoctoral research with Arthur Dalby and Charles Tsai. The following year I became a faculty member in that department, and I spent the next 10 years doing research and progressing through the professorial ranks. This was an exciting time, as traditionally trained plant scientists, including me, were learning how to apply molecular biology and gene cloning to their research projects. Besides chloroplasts, mitochondria, and *Agrobacterium tumefaciens* induction of plant tumors, seed storage proteins, which I worked on, were model systems and the focus of many national and international meetings.

In 1988, I was recruited to be head of the Department of Plant Sciences at the University of Arizona, where I had the opportunity to build an agricultural department that integrated molecular biology into its teaching and research programs. This was a novel concept at that time, and it proved to be a greater challenge than I had imagined. After six years as department head, I spent the next 18 years teaching and doing research in the Plant Sciences Department. When I retired from the University of Arizona in 2012, I was invited to become associate vice chancellor for life sciences at my alma mater, the University of Nebraska. In this position I had multiple challenges, including coaxing the deans and department heads of four different colleges to collaborate in their life science teaching and research programs and create interdisciplinary degree programs. This, too, turned out to be more challenging than I imagined!

My research program at Purdue and the University of Arizona focused on the regulation of seed development and the synthesis of seed storage proteins. Storage proteins are the most abundant proteins in seeds, and as such they are the principal determinants of the protein quality of grains. Storage proteins are generally deficient in several amino acids that are required in human and livestock diets. Consequently, increasing the levels of these essential amino acids has long been a goal of plant breeders and cereal chemists. A major focus of my research was quality protein maize. The *opaque2* mutation increases the content of essential amino acids in the maize kernel, but it also causes a soft, starchy endosperm that creates inferior grain quality. Genetic suppressors of *opaque2* (*o2* modifiers) were identified that ameliorate the negative phenotypic features of the *o2* mutation, but the genes responsible for modification were not well characterized. We studied how the *o2* mutation increases the lysine content of the grain and how *o2* modifiers restore the normal hard, vitreous kernel phenotype. We also investigated cell cycle regulation, particularly the process of endoreduplication, and the role it plays in endosperm development.

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

My PhD research project in 1971 required that I isolate functional polyribosomes from developing pea epicotyls. This was not easy, as ribonucleases released during plant cell breakage quickly sever the mRNA that holds the polysome together. At that time there weren't many good ways to inhibit ribonuclease, but several labs were experimenting with a chemical called DEP (diethylpyrocarbonate). DEP inhibits RNase, but it is highly acidic. To neutralize its acidity, I experimented with different concentrations of Tris buffer between pH 8 and 9. I discovered that high concentrations of Tris-HCl at pH 8.5 alone are sufficient to block RNase activity. I also found that divalent ions such as calcium, which can be abundant in some plant tissues, greatly reduce

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recovery of large polysomes. This problem could be addressed by including EGTA (ethylene glycol-bis [β-aminoethyl ether]), a strong chelator of divalent ions, in the buffer.

These serendipitous discoveries were valuable to my dissertation project, and they were key to my postdoctoral research project, which involved studying the synthesis of maize seed storage proteins, zeins. Within a short time after arriving at Purdue, I was able to isolate zein-synthesizing polyribosomes from developing maize kernels. When they were placed in an in vitro protein synthesis system I made from wheat germ, they produced zein proteins. Subsequently, I isolated zein mRNAs and used them to clone zein genes—among the first plant genes to be isolated. Seed storage proteins turned out to be valuable model systems for plant molecular biology and laid the foundation for subsequent research on plant growth and development.

When did you become a member of ASPP/ASPB?

I became a member of ASPP in 1972, when I attended the annual meeting in Calgary, Alberta. I was there with my PhD adviser, Eric Davies, and another graduate student, Joe Waldrum. We were newcomers to ASPP and hardly knew anyone there. But we met many people at the opening reception, an open bar funded by the Canadian Society of Plant Physiology. Before the night was over, we had met many new friends. For me, it was impressive to see famous plant physiologists whom I knew only from their publications, Hans Kende, Anton Lang, Joe Key, Tony Trewavas, and Derek Bewley among them. I gave a talk in a minisymposium on my polysome research: I was so nervous, I made multiple trips to the bathroom in the hour before the session began! It was valuable experience, and it launched my career.

How did the Society impact your career, and what was your motivation for becoming a Founding Member of the Legacy Society?

ASPB had a major impact on my career. The Society's journals were an effective and inexpensive way to publish the research coming from my lab. The annual meetings provided opportunities to meet with colleagues, and competitors, and learn about their research. I established many research collaborations at these meetings. The minisymposia described cutting-edge science and frequently were a source of inspiration for new research projects. The annual meetings were an opportunity to gain a global perspective on plant biology and a sense of what research agencies were funding. The meeting also provided an opportunity to recruit new postdocs and faculty members. I was given the opportunity to serve on editorial boards for *Plant Physiology* and *The Plant Cell,* as editor-in-chief of *The Plant Cell,* and as president of ASPP. This was a fair amount of work, but it was certainly educational and a rewarding experience! Serving on a variety of ASPP committees created many professional friends and provided me a chance to serve the Society that did so much for my career. So of course I didn't hesitate to become a member of the Legacy Society.

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

Becoming a professional plant scientist requires much time and a lot of work, but if you love biology and are curious and creative, you will find it to be a wonderful career and a great way to spend your life. The plant community is smaller and less competitive than the animal or medical community, and you will find teachers and colleagues who support you throughout your career. The following is the short and simple advice I give to graduate students and postdocs: (1) Never miss an opportunity at public speaking. (2) Begin a collaboration with your major competitor—that way, you'll know what they're doing, and they can't review your grant proposals. (3) Competition is your friend. (4) Follow your passion, but recognize an opportunity when it presents itself. (5) Don't be the smartest person in your lab. (6) Create a work environment that maximizes your students' and postdocs' innate abilities—if they're successful, you'll be successful.

Academic Family Tree
https://academictree.org/plantbio/tree.php?pid=632939