Melvin J. Oliver

How did you spend your career?

After completing my MSc in biochemical genetics and PhD in plant biochemistry in 1983 at the University of Calgary, Alberta, with Derek Bewley, I moved to the Biology Department at Washington University in St. Louis for postdoctoral research with Roger Beachy. After two years at Washington University, I became a faculty member at New Mexico State University (NMSU) with a joint appointment between the Department of Biology and the Plant Genetic Engineering Laboratory. During my fourth year there, I was recruited for a position at the Plant Stress Laboratory of USDA/ARS in Lubbock, Texas, and after waiting a year for my citizenship, I joined ARS in 1990.

This was an interesting switch for me, but I was used to switching. I had gone from Drosophila genetics (MSc), to desiccation tolerance in the bryophyte *Tortula ruralis* for my PhD, to the molecular biology of tobacco mosaic virus (TMV) movement protein function in transgenic plants (postdoc), to genetic engineering and back to desiccation tolerance at NMSU. My work with ARS gave me the opportunity to use my biotechnological skills to solve specific problems associated with agriculture, as well as to take what I had learned from bryophytes to transition to stress tolerance mechanisms in crops. In Lubbock, my horizons were broadened by interactions with producers and agricultural companies, as well as by work in a diverse multidisciplinary team characteristic of ARS laboratories. I also gained an appreciation for administrative pursuits, and in 2005 I successfully applied for the ARS position of research leader, similar in many ways to a being a department head, in the Plant Genetics Research Unit in Columbia, Missouri, where I again had to switch course to study drought tolerance in maize and desiccation tolerance in a resurrection grass.

Despite sojourns in lipid metabolism, Drosophila genetics, transgene containment strategies, and TMV, my research program at New Mexico State University and throughout my career in ARS was focused on dehydration and desiccation tolerance. Drought, or lack of adequate soil moisture, is the primary abiotic stress factor limiting natural ecosystem and crop productivity worldwide. Drought events are increasing in frequency as a consequence of changing global climates, so the urgency is growing to understand how plants cope with water loss, from loss of growth and productivity under mild water-deficit stress to survival after extensive dehydration, including desiccation. Bryophytes have a very limited capacity to limit water loss from their photosynthetic cells (primarily through clump hydraulics) and so are prime targets for understanding how cells cope with dehydration. We chose to work on a bryophyte that is adapted to survive desiccation and studied how protein synthesis and gene expression are altered during both desiccation and rehydration to try and understand cellular protection and recovery processes.

To transition my research into angiosperms and thus relate more to crop species, we chose to work with the resurrection grass *Sporobolus stapfianus,* which has desiccation-tolerant young leaves and a desiccation-sensitive sister species, *Sporobolus pyramidalis,* that serves as a phylogenetic contrast for comparative studies. With these two species we were able to elucidate new aspects of desiccation tolerance using all the tools of transcriptomics and genomics, proteomics, and metabolomics. Along with colleagues at the University of Missouri, I was able to extend my research to investigate the physiology and genetic aspects of root growth maintenance in maize in response to water-deficit stress.

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

This a really difficult question, because ultimately it is something

continued on next page

others will judge, and only time will really tell. When I first embarked on what would become the main focus of my career, my project was to determine whether the desiccation-tolerant moss now called *Syntrichia ruralis* actually responded to desiccation and rehydration, as it appeared to be so well adapted that it seemed unfazed by the stress. I was able to show, using functional polysome isolations, poly A^+ RNA isolation, in vitro protein synthesis, and 2D gel electrophoresis (all state-of-the-art techniques then), that the moss did not alter the pattern of protein synthesis during dehydration. The moss qualitatively maintained the mRNA population during drying by storing mRNAs in mRNPs during dehydration. However, upon rehydration the pattern of proteins synthesis changed very rapidly, leading to the conclusion that gene expression is controlled at the level of translation during the response of the moss to drying and rehydration.

Our later work confirmed these findings, and we were able to isolate the mRNPs and quantify the changes in gene expression at the level of protein synthesis using radiolabeling techniques. These were important studies that have become pertinent in recent years as interest in mechanisms underlying the plasticity of the desiccation tolerance phenotype in mosses has increased. I also hope that my more recent work in the use of the grass phylogenetic sister contrasts, and that application of comparative genomics to understand the adaptive aspects of the mechanisms of desiccation tolerance in angiosperms, makes for a useful contribution to the field.

In my postdoctoral research, I was able to clone the gene encoding the 30kD movement protein of TMV and express it in transgenic tobacco and, along with a fellow postdoc, Mike Deom, to demonstrate its role in the cell-to-cell movement of the virus. The plants I produced were used by a group of very talented people, William Lucas and his group, to unravel the mysteries that surrounded the functions and properties of plasmodesmata. I claim no credit for the advances made in this area, but simply mention it as an example of "you never know where things can lead" in science.

When did you become a member of ASPP/ASPB?

I became a member of ASPP in 1986, when I was able to secure a permanent position in the United States (I had originally planned on returning to England, but marriage changed that idea). However, while in Canada I was an active member of the Canadian Society of Plant Physiologists' graduate student cohort. That was an exciting time in plant biology, which was in the midst of the explosion in molecular biology and technology, and hopes for major advancement were high. I later became an active member of the Southern Section of ASPP after being invited to talk at one of their symposia in Roanoke, Virginia, an event that led me on a path of significant involvement in the Society, which I have grown to cherish.

How did the Society impact your career, and what motivated you to become a Founding Member of the Legacy Society?

ASPB had a massive impact on my career. The flagship journals were always a goal for publishing my research, spurring me on to go the extra mile, and publishing in *Plant Physiology* kick-started my career. The networking opportunities the Society offers, which have allowed me to build lifetime friendships and collaborations, have had such an impact on my career and research. The annual meetings were always, and still are, where I go to be inspired and learn and come back full of new ideas, some of which have actually turned into publishable research.

Early on I was afforded the opportunity to become actively involved in the Southern Section of ASPB and was blessed by working with some amazingly dedicated people to help continue the growth of the Southern Section into—and I am biased—what was at that time the best section of the Society. This also provided me the opportunity to join the Executive Committee at the national level as the Southern Section representative and then Membership Committee chair. Working with the amazing people on the headquarters staff and with the Society leadership, who were all prominent and talented scientists, was one of the greatest privileges I have been afforded in my career. I learned so much from all of them, not just about how to run a large operation but also about how to be

continued on next page

a better member and representative of my chosen profession.

ASPB made me fully aware of how good a profession I had chosen and how the people in it are truly exceptional. ASPB also allowed me to be a part of taking the Society forward internationally through the Global Plant Council, working with amazing plant scientists around the world; for that I will be forever grateful. It is for this reason, and many others, that becoming a member of the Legacy Society was a no-brainer.

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

There is no easy way—it takes hard work and dedication along with imagination and curiosity—but the rewards are many, and being a plant scientist is a great career. I am glad I moved into the plant sciences, as it is a smaller community and one that treats you like family. There is always someone willing to help and guide you on your way, so do not isolate yourself: become an active part of your profession (and ASPB!). With that in mind, give back to your community and those coming along behind you.

Remember that you are not always the smartest person in your lab (something Brian Larkins once said to me). Collaboration is no longer just an option; it is a necessity in order to progress as the field becomes more interdisciplinary. It is impossible to be an expert in every aspect of your research. Listen to others, whoever they may be, and be willing to share your ideas and thoughts even though there is competition (a very healthy thing); collaborating with your competitors is better than fighting them!

Academic Family Tree
https://academictree.org/plantbio/tree.php?pid=809763