Russell Jones

How did you spend your career?

Since childhood I have been fortunate to be influenced by exceptional people. I grew up in rural Wales, where almost all my family role models were farmers whose attitudes toward the land influenced me greatly. I left my rural high school at 16 because it did not offer programs in botany and zoology, and I attended a local college where I was mentored by an outstanding teacher. Because the college was 25 miles away from home, I was a resident in a dorm with a group of much older students who were a source of great encouragement and support. To complete my BS and PhD degrees, I attended the University of Wales campus in Aberystwyth, where Philip Wareing was professor of botany. Wareing was an inspirational teacher, and his lectures on plant hormones inspired me to study gibberellins (GAs) for my PhD under my very supportive mentor, Dai Phillips.

When I was pursuing my PhD in 1964, I attended the International Botanical Conference in Edinburgh and listened to the international luminaries of plant physiology: Anton Lang, J. van Overbeek, Folke Skoog, F. C. Steward, and Kenneth Thimann, among others. But it was Hans Kende, also at the Edinburgh meeting, who influenced me most; he told me about the then-new Plant Research Laboratory (PRL) at Michigan State University (MSU), and he encouraged me to join the lab as a postdoc after my PhD thesis was submitted. In 1965 I became a postdoc at the PRL, a very dynamic outfit whose faculty included Joe Varner, Phil Filner, John Scandalios, Peter Wolk, and Jan Zeevaart, in addition to Hans Kende and Anton Lang; my contemporaries at the lab included Maarten Chrispeels and Jake Jacobsen. I simply loved my time at the PRL, and it had a great influence on me as a scientist. MSU was also very influential, introducing me to life in the United States. Had I gone directly from Wales to Berkeley in 1965, my impressions would have been radically different.

I was a postdoc with the PRL director, Anton Lang, but I quickly fell under the sway of Joe Varner. I had used barley half grains as a bioassay for GAs in my PhD work, using a method developed by Leslie Paleg in Australia. We measured reducing sugars released from the starchy endosperm in response to GA. Varner simplified this system by removing the aleurone layer from the starchy endosperm and measured α-amylase activity directly. Varner and I published a paper using this system as an improved bioassay for GAs.

Berkeley 1966! After my postdoc, I was appointed assistant professor in the Department of Botany at Berkeley, and, to say the least, my first few years were exciting. The campus was in turmoil as a result of the Free Speech Movement and opposition to wars in Vietnam and Cambodia, but there was ferment everywhere at Berkeley, not merely political, and the intellectual ferment has persisted until now. I retired in 2010 and no longer run a lab, but I still come in daily and enjoy meeting with my colleagues and providing service to the university.

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

Joe Varner's influence led me to work on the cereal aleurone, and I chose a cell physiology approach using various types of microscopy, fluorescent reporter dyes, patch clamping, organelle isolation, and biochemical methods to understand how GA and abscisic acid (ABA) regulate aleurone function. We documented in detail the changes in aleurone cell organelles, in particular the prominent protein storage vacuoles and lipid bodies, and established the central role of endoplasmic reticulum proliferation in enzyme synthesis. Using patch clamping and indicator dyes, we probed transporters on the tonoplast and monitored acidification and protease activity in intact, functional vacuoles, changes that

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require GA. We also measured changes in cytosolic calcium and showed that these were required for the GA response. Calcium, together with calmodulin, is a key player in regulating membrane transporters in aleurone cells.

We showed that programmed cell death in endosperm cells is very tightly regulated by GA and ABA, with ABA preventing cell death. We found that reactive oxygen species (ROS) were key elements in this process, and that one source of RO in aleurone is gluconeogenesis and, in particular, the action of the enzyme fatty acyl-CoA oxidase. Our earlier microscopy had shown that lipid bodies make up as much as 30% of the volume of the aleurone cell, and as in other fat-storing cells, lipids are readily converted to glucose with concomitant H_2O_2 production, a process stimulated by GA. In addition to increasing ROS production, GA stimulates cell death by downregulating the enzymes that normally scavenge RO, including ascorbate peroxidase, catalase, and superoxide dismutase. We showed that ABA maintains high levels of expression and activities of RO-scavenging enzymes. Isolated aleurone cells remained viable in culture in the presence of ABA for at least six months, whereas exposure of these cells to GA led to death in less than 48 hours. Cell death in barley aleurone cells is also stimulated by nitric oxide (NO), and we showed that NO is produced in aleurone cells by enzymatic and nonenzymatic pathways.

Arabidopsis seeds also possess an aleurone layer/endosperm that surrounds the embryo and is in part responsible for seed dormancy. Because of the availability of appropriate mutants, we used isolated aleurone layers from dormant Arabidopsis seeds as a model system to study dormancy and germination and the roles that ABA, GA, and NO play. This work confirmed what was known for barley and established that ABA, GA, and NO play crucial roles in germination and dormancy. In addition to the availability of well-defined germination mutants, the ability to assay a developmental response, namely germination, made Arabidopsis an ideal model system that we were able to exploit.

While a postdoc with Anton Lang, I also became interested in the role of GA in extension growth, and with one of my graduate students developed lettuce hypocotyls as a model system to examine the biophysical parameters of GA-induced elongation. Work with the GA response in lettuce established several important parameters that made the response to GA different from the response of plant tissues to indole-3-acetic acid, most notably that elongation in response to GA is not a result of cell wall acidification, as had been shown for auxin, although like auxin GA causes changes in wall extensibility that bring about an increase in the rate of growth. Importantly, this work also showed that neither cell division nor changes in cellular water potential are involved in GA-stimulated extension growth.

Sabbaticals provide researchers the opportunity to return to the lab bench, and Jake Jacobsen at CSIRO in Canberra, Australia, stands out for providing an inviting atmosphere in his lab for sabbatical leaves in 1980, 1996, 2001, and 2006. I also had very rewarding sabbaticals in Nottingham, U.K., in 1972 with Ted Cocking, who was a wonderful host. Cocking's lab specialized in protoplast biology, and after my visit aleurone protoplasts became important for our cell biology research. In 1986 I spent a year in Göttingen, Germany, with David Robinson. David is a first-class cell biologist who taught me to be critical in my thinking of cell biology, and especially in the care needed to interpret microscopy.

When did you become a member of ASPP/ASPB?

I became a member of ASPP in 1966, when I joined the Plant Research Laboratory. Early in my career I was invited by Marty Gibbs to join the editorial board of *Plant Physiology,* and this led to further engagements with the Society and its members that culminated in my service as president in 1993–94.

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

ASPB is a community of scientists that gives us strength and power—the Society is much more than the sum of its parts. It is not just membership with a group of like-minded people that is invaluable; ASPB also gives us an identity that enables us to network through national and regional meetings. ASPB has provided us with two outstanding, high-impact journals

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in which we can publish our peer-reviewed work and provides us with a collective forum to influence national policy makers. The Society also does good works that include promoting the involvement of younger scientists by encouraging the involvement of underrepresented minorities and by underwriting the cost of the publication of texts that support teaching and research in plant biology. I became a Founding Member of the Legacy Society because I strongly believe in ASPB's mission as well as in the need for its members to give back to the Society that has supported their achievements. What more can one ask?

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

Enjoy what you do. Experimental science can be a frustrating endeavor, and that means it is important that research be enjoyable. Almost all successful scientists I know love what they do. I was inspired to pursue a career in plant science by mentors such as Wareing, Lang, and Varner, who radiated enthusiasm for plant biology and inspired in me the challenge and joy of discovery. Networking with colleagues, students, and postdocs kept this appreciation for the rewards of science alive as my career developed.

Academic Family Tree
https://academictree.org/plantbio/tree.php?pid=690992