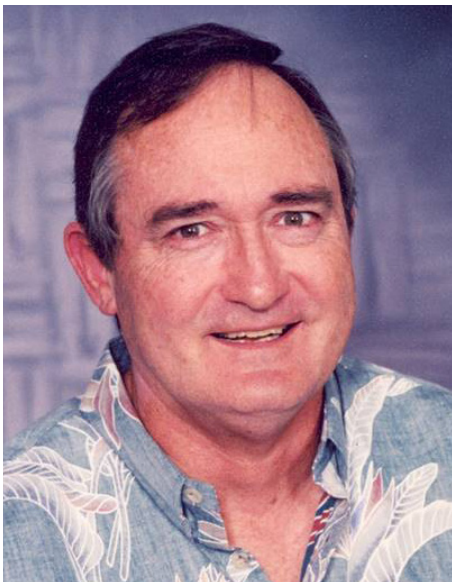
Robert E. Paull



How did you spend your career?

Upon completion of high school, I matriculated to Sydney University School of Agriculture in the agronomy program. I did not have a scholarship to cover fees, and my father offered to pay for my first year. The understanding was that if I did not get a scholarship at the end of the first year, I would complete my internship as a wool classer; I had already completed the necessary wool classing technical courses in high school. This was an era in Australian universities when the adage was that 50% of first-year students must fail, with a similar attrition possible in the second year. I successfully completed the first year and obtained a scholarship that allowed me to complete the four-year program. In the second year, we had botany and plant physiology, along with agronomy-related courses, and I was intrigued by the continuum from plant physiology through crop management.

Upon completing my BScAgr, I was appointed as the cotton agronomist at Narrabri, a town about 500 km northwest of Sydney, and I spent four wonderful years carrying out fertilizer and variety trials and working with plant breeders, pathologists, entomologists, and cotton farmers. The experiment station manager, Frank Cutting, was encouraging and offered advice on my research and how to avoid the pitfalls of dealing with the administration. He and I corresponded and sometimes spoke on the telephone for many years until his death.

In January 1979, I took up a research assistantship at the University of California (UC), Berkeley. My first advisers were Ted Broyer and Clarence Johnson in soils and plant nutrition, and we did research on the essentiality of micronutrients. The most memorable event was the inadvertent generation of nitroglycerin in the fume hood while digesting tomato seeds.

Broyer retired a few years after I arrived, and I was accepted into Russell Jones's laboratory, where I undertook research on the synthesis and secretion of maize root cap mucilage as a parallel process to the aleurone secretory pathway. This research instilled an intense and continued interest in cell wall synthesis, wall structure, and modification. I could not ask for a better thesis adviser; he gave me considerable freedom and support. After I graduated, I stayed on with Russell as a postdoctoral fellow and department lecturer teaching plant physiology and electron microscopy. In 1975, I spent a stimulating summer at UC San Diego with Maartin Chrispeels looking at glycoprotein secretion.

The U.S. Immigration and Naturalization Service (INS) began asking questions about my visa status, and it seemed I had overstayed my visa by nearly two years. This was before computers, when everything was done on paper and yearly postcards to the INS. I was advised that I might want to "disappear." I was offered and accepted a position with CSIRO's plant physiology group that was split between the Food Science Laboratory at North Ryde and Macquarie University, which is near my family's home in Sydney. My mentors at both laboratories significantly influenced and greatly expanded my research interests. I am greatly indebted especially to Doug Graham, Colin Brady, John Raison, Barry MacGlasson, and many others too numerous to mention, who encouraged me and provided significant feedback, at the mandated morning and afternoon tea breaks, regarding my research and just about everything else. Unfortunately, CSIRO was undergoing fiscal restraint, and the days of moving into a permanent position in CSIRO were coming to an end.

In 1978, I applied for a position as a researcher at the University of Hawaii at Manoa (UHM), with responsibility for postharvest physiology and handling, and I took up my appointment in January 1979. I have been at UHM ever since, and the overall theme of my research

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has been the application of basic plant physiology to horticultural production practices and management and postharvest physiology and handling of fresh tropical fruit, vegetables, and ornamentals. I was fortunate to develop close ties with growers, packers, shippers, wholesalers, and retailers, and this helped me understand the constraints and challenges faced by industry.

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

My position and funding provided a unique opportunity as an applied plant physiologist to address many challenges faced by industry, at the same time allowing me to take a more in-depth look at the underlying physiology and genetic regulation of fruit development and ripening. My fruit research, which has dealt with papaya, pineapple, banana, litchi, rambutan, soursop, atemoya, avocado, and breadfruit, showed that the regulation and softening of fleshy fruit during ripening varies widely between species, not just in the diverse fleshy tissues involved. The traditional model of changes that take place in ripening of these fruits, and especially cell wall degradation patterns and processes, has parallels to the model for other fleshy fruits, but the molecular, biochemical, and physiological systems are not universal across all fleshy fruits. This supported the conclusion that fleshy fruits are examples of convergent evolution that has coopted different preexisting systems to achieve the same goal of attracting frugivores for seed dispersal. Working with Francis Zee, curator at the USDA Germplasm Depository in Hilo, we developed a slow-ripening mutant line of papaya that takes twice as long to soften, and showed that this is potentially associated with a few genes. We have also made contributions to our understanding of source–sink relationships in papaya and the role of a cell wall invertase in sugar accumulation during late fruit development.

We were invited to be participants in four plant genome projects: papaya, Asian pear, sacred lotus, and pineapple. Our role was to analyze and characterize the predicted genes involved in cell wall synthesis, degradation, and modification. The genome projects led to current projects on gene expression during the ripening of both pineapple and papaya, together with biochemical and physiological studies that indicate potential ripening control points. An in-depth transcriptome analysis is also being carried out on how ethylene induces flowering in pineapple.

Another key finding in our research was that the acridity (itchiness) in taro and other aroids that require cooking before eating is attributable to a protein on the barb-like raphides, rather than any abrasive effects of the raphides. We isolated purified raphides and found at least 28 unique proteins, five of which are predicted to be allergenic.

This basic research would have not been possible without the maintenance of an applied research and technology transfer program. We have had a number of successful achievements that include reduced chilling injury during postharvest storage of pineapple by the use of a selected fruit coating. Ken Rohrbach is due many thanks for introducing me to pineapple production and to this research. The same coating, with minor changes, is still used worldwide by the industry.

A number of studies on papaya have also shed considerable light on ways to reduce postharvest losses. In collaboration with other laboratories, we developed a robust and efficient pineapple transformation protocol to reduce precocious flowering and then field evaluated the transgenic lines developed. Although we were successful, because of market pressure the transgenic lines were not commercialized. Other projects dealt with pineapple fruit translucency and packing technology for litchi and rambutan to reduce postharvest fruit quality losses. The applied results have been incorporated in extension postharvest handling fact sheets available online for tropical fruits, vegetables, and ornamentals and implemented by industry.

In collaboration with colleagues in the United States and worldwide, I was invited to be a coauthor of a basic text *Postharvest Biology,* now available free online, and a two-volume undergraduate text on tropical fruit production that is now in its second edition. Both texts provide a solid plant biology footing that is critical to all horticultural production practices. This led to being asked to act as a coeditor on a number of other fruit books and the Centre for Agriculture

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and Bioscience International's *Encyclopedia of Fruit and Nuts*.

It has been an honor to be recognized by my peers; I was made a fellow of the American Society for Horticultural Science (2014) and the International Society for Horticultural Science (2014) and received a Superior Service Award from USDA (1992) and our college's Senior Outstanding Research Award (twice, in 2008 and 2019). This recognition would not have been possible without the support and collaboration of my peers and faculty colleagues, collaborators, research associates, technicians, and undergraduate and graduate students.

When did you become a member of ASPP/ASPB?

I joined ASPB in 1973 while a student with Russell Jones at UC Berkeley. In the years since then, I have seen the Society evolve and expand its scope and recognize the changing boundaries, if they ever existed, of plant physiology and biology. I have stayed a member even though some issues with the Society's journals have left me confused and bewildered, but then a paper will appear that provides direction and a potential mechanism for my own research.

Earlier in my ASPB membership, I frequently attended the annual conferences that were held on campuses. I also attended the horticultural societies' meetings, again when possible. Later the meetings moved off campuses for justifiable logistical reasons, and my attendance became spottier as the meetings became more spread out and less of an opportunity to meet others with similar interests. Gordon Conferences in senescence and postharvest physiology became preferred meetings. I do attend ASPB meetings in Honolulu, which are becoming a more regular event, and I try to shuffle attendance at international meetings more germane to my current research.

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

I have always seen my home as being in plant physiology and as a member of ASPB. The horticultural societies of which I am also a member are my applied plant physiology homes, and all have given me a broader appreciation of science. For these reasons, when I was asked to join the Legacy Society, there was only a brief hesitation as I saw the Legacy Society as contributing to science and to a community of plant biology scholars. The Legacy Society will allow ASPB to meet the challenges of the future and assist in the training of the next generation.

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

Many of my colleagues and peers have taken a career path that has led to their recognition and scholarship in a single area of plant biology that has been very rewarding. Others, after a period teaching and doing research, have gone into administration. I have had my brush with administration as a department chair for 15 years, though I have sometimes regretted the time I could have devoted to research and teaching. My career path has covered many areas of plant biology, and especially its practical application to real-world problems, that I have enjoyed, and still do. Membership in ASPB provides a home that will serve you professionally, as it has served me, throughout your career.

My advice is to take a broad view of plant biology and not to expect that you will be doing the same research after you complete your degree. If the opportunity arises, include in your planning international experience, be it as a Peace Corps volunteer or as an intern at a foreign university or international research center. The environment for future employment in plant biology is changing, and if you have the time, take courses in business management, accounting, and planning.

Academic Family Tree
https://academictree.org/plantbio/tree.php?pid=802292