Jonathan Monroe

1) How did your career get started?

As a Botany major at the University of Michigan in Ann Arbor from 1979-1983, I was initially inspired to jump headlong into plants by Herb Wagner (Plant Systematics), Ed Voss (Taxonomy) and Hiroshi Ikuma (Plant Physiology). I still tell stories to my students about Hiroshi showing me how to make my first solution with a volumetric flask. My three summers at the University of Michigan Biological Station in Pellston were highly influential. In 1980 I took Ed Voss's Boreal Flora course, and he asked me back for the next two summers to be his teaching assistant. Had I not been daring enough to talk to my professors, that would never have happened. At the same time, I was getting excited about symbioses and became curious about an actinorhizal shrub, *Shepherdia canadensis*, that grew in a wide variety of habitats, from dry, calcareous sand dunes, to wet, acidic bogs in northern Michigan. Having read about finicky legumes, I wondered if *Shepherdia* formed root nodules in its varied habitats, and if so, were they active in N_2-fixation? Those questions turned into my honors thesis under the direction of Conrad Yocum and the answers to both questions were yes. That experience got me hooked on research, so the career choice was obvious. As an undergrad, I was friends with lots of graduate students, and I attended seminars, so I was familiar with what grad school was all about. Heading in that direction was a no brainer.

I was lucky enough to get accepted to Cornell University and the University of California, Davis for grad school, but family and friends in the East helped me decide between them. Cornell was a great place to study plant physiology and biochemistry, and I think my most inspirational instructors were Dick McCarty (clear explanations), Andre Jagendorf (the jokes), Roger Spanswick (membrane potential) and Carl Leopold (positive attitude). I recall developing a sense of independence under the hands-off direction of my research mentor, Tom LaRue, with whom I worked on pea root nodules, specifically investigating the role of respiratory O_2 uptake in maintaining the low internal O_2 concentration in concert with the cortical tissue diffusion barrier. Interestingly, it was Conrad Yocum's graduate student, John Tjepkema, at Michigan who first described the diffusion barrier as several layers of cells surrounding the nodule through which there were no air spaces.

In the late '80s my resistance to doing molecular biology was beginning to deteriorate, so after finishing up at Cornell I joined Jack Preiss' lab as a postdoc in the Biochemistry Department at Michigan State. Members of Jack's lab and Chris Sommerville's lab in the Plant Research Laboratory had isolated several starchless mutants of Arabidopsis, all of which seemed to have elevated activity of a cytosolic □-amylase, and my job was to figure out whether it was due to an activated enzyme (Chris's idea) or elevated expression (Jack's idea). I purified the protein from one of the mutants, and at a group lab meeting Chris wondered if that might be the first protein purified from Arabidopsis. I have not confirmed that as true, but if it isn't true, please don't tell me. Incidentally, Jack was right. I entered the job market without a long list of publications and without much teaching experience, so not surprisingly I only got one offer, and I took it. That offer, at James Madison University in VA, a primarily undergraduate institution (PUI), turned out to be a great choice.

2) What do you consider your most important contributions to plant science research?

Having spent my career (post-postdoc) at a PUI, one of my goals was to avoid too much competition (we do good work, just more slowly than at Research 1 universities), so I worked on projects I thought would be below the radar – a secreted alpha-glucosidase that we determined was actually an a-xylosidase) and a secreted a-amylase that is induced by ABA, stress, and senescence. Then, I realized that not many people were interested in these "below the radar stories", so I went back to my postdoc project on b-amylases (BAM) and that was a good move. Of the nine BAM genes in Arabidopsis, we made a quintuple mutant lacking all the predicted catalytically active enzymes, and found it had no measurable activity - whew! Of the two main enzymes, BAM1 functions during the day and BAM3 functions at night. We discovered they have temperature optima that are different by about 10 degrees C, which makes sense; to my knowledge, the observation of two such proteins encoded by one genome had not previously been made. We also discovered that BAM2 is catalytically active and has sigmoidal kinetics, unusual for a BAM. The coolest experiment we did on BAM2 was to change one residue that is conserved in it to a different residue conserved in all other active BAMs. This one change converted the enzyme from one having sigmoidal kinetics to one with more typical hyperbolic kinetics. We also discovered that BAM7 and BAM8 are nuclear-targeted transcription factors. The most interesting story out of my lab so far is also the most recent using different promoters and transcriptional start sites, a BAM7 gene in some monocots and basal eudicots encodes two functionally distinct proteins – nuclear-targeted BAM7 and chloroplast-targeted BAM2. This unusual dual function gene appears to be a relatively stable evolutionary relic that became duplicated and sub-functionalized in four land plant clades.

When did you become a member of ASPP/ASPB?

I joined ASPP and went to my first meeting in the mid 1980s. I kept going back because I could easily keep up with the friends that I had made at each stage of my career. I think I've only missed a few meetings since then. My active involvement with ASPB started with the PUI breakfast, which I helped lead long ago. I then served as the Mid-Atlantic Section Representative, and then Treasurer and member of the Board of Trustees. Because I worked at a PUI, I used my ASPB connections to strengthen my own undergraduate research mentoring skills, and to promote research at other similar institutions.

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

The biggest impact the Society has had on my career was in promoting and supporting my leadership skills. I'm an introvert that can be quite happy with a set of pipettors and a few feet of lab bench. Supported by the Society, I learned I could speak up, make suggestions, and help develop programs that benefitted others (e.g., SURF). The confidence I gained in those roles had a huge impact on what I was able to do at my home institution. Over the course of my career, I doubt if I would have accomplished half of what I did were it not for people at ASPB asking me to serve and then supporting me along the way. Realizing the important role that ASPB has played in my career, it made perfect sense to give back through the Legacy Society.

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

Congratulations on your decision to pursue one of the best careers there is, and for getting this far. The goal now, in my opinion, is to make a difference in the lives of others, by pushing forward our understanding of the world (science), and by helping others

realize their goals, whatever they may be (mentoring). On the science side, don't be afraid to ask for help, and always say yes whenever anyone asks for your help. When you write grant proposals, write for someone who doesn't fully understand your work and teach them carefully. Please don't forget to cherish the white space! As a mentor, be patient and kind. Some students will need more from you than others, so be prepared to give them all the help they need no matter who they are. In the end, the most important advice I can give you is to be nice to people.