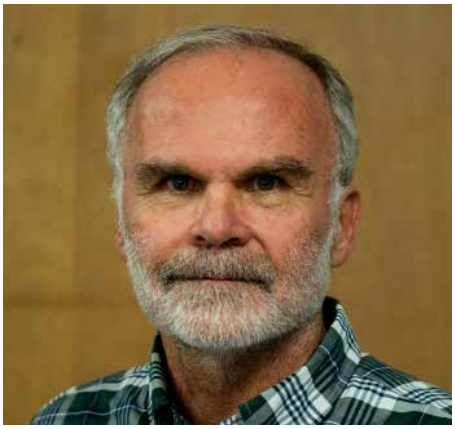
Tom Sharkey



How did you spend your career?

As an undergraduate student, I did research on mouse brain development that was published. After getting my BS, I applied for two technician jobs (I needed to stay in East Lansing, and my application to a limnology grad program was rejected). One of these was to work in a mouse lab, and although it didn't pay as well, I thought I was sure to get that position. But instead, I was offered a position studying gas exchange and photosynthesis in Klaus Raschke's lab in the Michigan State University–DOE Plant Research Laboratory (PRL). As an undergraduate, I had had a course in plant physiology cotaught by Hans Kende and Jan Zeevaart. Rounding out just how lucky I was, there was a postdoc in Klaus's lab named Graham Farquhar. Klaus went on sabbatical six weeks after hiring me, so I had his whole, very well equipped lab to explore any gas exchange question that came to mind. Two years later, I started as a graduate student in Klaus's lab. Soon after, Klaus took a position in Germany, and once again I had the run of the lab for over a year. I believe this independence was crucial to my scientific development.

After getting my PhD at the PRL, I went to the Australian National University to work with Graham Farquhar again. The gas exchange research by the environmental biology group there was possibly the best in the world. Graham and I authored an *Annual Review* on "Stomatal Conductance and Photosynthesis" that has had a lasting impact; its peak yearly citation rate was in 2018, 36 years after publication.

I followed Barry Osmond to the Desert Research Institute in Reno, Nevada, where I met Frits Went. I did an experiment with Frits in Reno in his very simple but excellent greenhouses and phytotron (sealed, air-conditioned greenhouses). Five years later, I went to the University of Wisconsin–Madison. Folke Skoog liked that I knew "old man Went," for whom Folke had the greatest admiration. In Madison, I had the freedom to pursue my interest in isoprene emissions from plants, which is one of the gas exchange questions I had begun to explore in 1978 while on my own in Klaus Raschke's lab. Whereas most plant scientists know Frits Went for his discovery of auxin, atmospheric scientists know Frits Went because of his studies on volatile emissions from plants, some of which lead to a blue haze that Frits said was the reason so many mountains are known as "blue."

After 20 years in Madison, I was recruited back to Michigan State University to be chair of the Biochemistry and Molecular Biology Department. Neither of my degrees was in biochemistry, and I had never been a member of a biochemistry department, but I am grateful to have had the opportunity to serve that department (still my academic home) for nine years. But feeling it is important to move on before everyone around you agrees it is time for you to move on, I stepped down as chair in 2017 and moved to the PRL. I am now across the hall from the lab in which I began studying gas exchange 46 years ago. Asking and answering questions about the biophysics and biochemistry of gas exchange in plants is, if anything, even more of a passion than when I started.

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

The diffusion of carbon dioxide into leaves where it is fixed is critical for understanding photosynthesis in C_3 plants. I devised a system for measuring the CO_2 concentration in the air spaces inside leaves and was able to confirm that the standard calculation used over the previous 20 years worked quite well. The next question was how to estimate the diffusion resistance from the air space inside the leaf to Rubisco, where the CO_2 is used. Together with Joe Berry, I developed a way to measure the instantaneous discrimination against $^{13}CO_2$ by leaves, and we used the modeling of carbon isotope discrimination by Joe and Graham Farquhar to estimate the diffusion resistance from the air spaces to Rubisco. We were joined

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by John Evans, who saw the project through to the first publication.

A major theme of my research can be called the carbon metabolism of photosynthesis after the Calvin–Benson cycle. Over multiple years, I have studied many aspects of starch and sucrose synthesis and also lesser known metabolism such as the simultaneous operation of the oxidative pentose phosphate pathway with the Calvin–Benson cycle. Carbon metabolism after the Calvin–Benson cycle can explain the strange gas exchange behavior of C_3 leaves, in which increasing CO_2 decreases the rate of photosynthesis.

The other major research thread I have been pursuing is isoprene emission from plants. After my long-cherished hypothesis that isoprene could dissolve into membranes and strengthen them was proven very unlikely, attention has now turned to how isoprene might act as a signaling molecule in pathways important for several plant hormones.

When did you become a member of ASPP/ASPB?

I joined ASPP in 1975, while a technician in Klaus Raschke's lab. The Midwest Section was very strong at that time, and I remember presenting my research there even before I was a graduate student.

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

In the early part of my career, ASPP/ASPB meetings were far and away the best way to meet people in my field and other plant scientists as well. In addition, the journal *Plant Physiology* was then, as now, one of the best places to publish my research. I also think the advocacy efforts by the Society are very important, and I served on the Public Affairs (now Science Policy) Committee for several years. There has been a proliferation of journals and meetings vying for the attention of plant researchers, but I think ASPB will continue to be the most important organization to enhance plant science and to enable plant scientists to work toward the goals of the community.

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

Strike a balance between independence and teamwork. This issue appears to be growing. Assistant professors looking to get tenure must negotiate a fine line between participation in large, multi-investigator projects and single-investigator projects in which tenure-deciding committees will more easily recognize their input. This does not mean shying away from multi-investigator projects, only that you need to think about how you will demonstrate your intellectual contributions. In industry, I would advise that scientists work to ensure they understand the larger goals of their company and to contribute to setting those goals when possible.

I think it is also important to consider what other careers might be open to you. I am very proud that at least two people who have been in my lab went to law school and are now practicing attorneys. Careers in policy-making positions, whether in government or nongovernmental organizations, can also be rewarding, and your knowledge of plants can help inform policy recommendations.

I did not feel my career path was easy at the time, but in hindsight I had tremendous advantages. Capitalize on any advantages you have, and try to make your own luck. Get to a position that suits your talents and personality, and then make the most of it.

Academic Family Tree
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