

## ASPB Pioneer Member

### HELEN STAFFORD

*(This biography was taken from the Women in Plant Science page - <https://aspb.org/wipb-pioneer-biographies/>)*

Helen Stafford was born in Philadelphia, Pennsylvania, on October 9, 1922, and attended Friends schools through high school. Her parents had both attended college, and Helen entered Wellesley College on a scholarship, where she earned her B.A. degree in Botany in 1944. She then spent one academic year (1945-46) at Cornell University as a research assistant to M. Knudsen and working with orchid cultures. Helen received a two-year assistantship with Richard Goodwin and transferred to the Connecticut College for Women in 1946, where she earned her M.A. degree in 1949. Her thesis research on the growth and xylary development of *Phleum pratense* seedlings resulted in her first publication in the *American Journal of Botany* (1948. 35: 706-715). Helen spent the next three years with David Goddard in the Botany Department at the University of Pennsylvania, where she received her Ph.D. in 1951. Her doctoral research showed cytochrome oxidase and succinic dehydrogenase in pea mitochondria and was among the first research on cellular localization of enzymes in plant tissues using differential centrifugation of cell-free homogenates. Her first review in the *Annual Review of Plant Physiology* (1959. 5: 115-132) entitled "Localization of Enzymes in the Cells of Higher Plants" and co-authored



with Goddard, established Stafford as an authority on this subject.

Helen's next three years were spent as a post-doctoral scholar at the University of Chicago where she worked with Birgit Vennesland studying NAD<sup>+</sup>/NADP<sup>+</sup> dependent dehydrogenases acting on hydroxyacids in plants. At that time, the relationship of these organic acids (found only in plants) to the di- and tricarboxylic acids of the Krebs cycle was not at all clear. During that time she also taught general plant biology, one of five sequential biology courses in the fabled undergraduate College at Chicago. Helen's research at Chicago resulted in several papers on plant dehydrogenases, including the first publication on alcohol dehydrogenase in plants.

Helen's ability both to teach bright science undergraduates and to conduct research publishable in leading journals, made her a prime candidate for an assistant professorship in the Department of Biology at Reed College in Portland, Oregon. She joined that department in 1954, at a time when the small biology program (three faculty) was being reorganized, slowly expanded, and its goals undergoing unique changes. Along with a few far-sighted colleagues, she helped design a highly successful, research-intensive

training program for undergraduates involving faculty members who also would maintain a vigorous research program. New staff members were chosen for their teaching abilities as well as for their potential to conduct research that was funded by NSF, NIH, and private sources. Helen obtained her first NSF grant in 1955, and received continuing renewals thereafter, until one year after she retired in 1987. With such support, Helen produced a body of excellent work in an institution that has no graduate degree programs. However, every student at Reed is required to do a senior's thesis, and most of her later co-authors were students who have gone on to graduate school and are now productive scientists in their own right.

At Reed, Helen continued working on organic acids in plants, especially the aromatic phenolic acids that serve as precursors of lignin. This directed her attention to that biopolymer for a few years. Following a sabbatical year (1963-1964) as a NSF Senior Postdoctoral Fellow in Ted Geissman's laboratory in Chemistry at UCLA, Helen's interests centered on flavonoids, especially anthocyanins. This research led to her second "annual review" article on the metabolism of aromatic compounds (*Annual Review of Plant Physiology*. 1974. 25: 459-486). Through examination at different levels—the enzymes involved, their cellular localization, the biosynthetic sequences involved, their physiological role(s)—her efforts have contributed major concepts to the better understanding of aromatic compounds. Helen was the first plant biochemist to postulate that secondary biochemical pathways can



## ASPB Pioneer Member

be compartmentalized within multi-enzyme complexes (Recent Advances in Phytochemistry. 1974. 8: 53-79). This was a major advance because such a hypothesis could account for the often-massive flow of carbon from photosynthesis into plant products without reactive intermediates undergoing wasteful side reactions. Helen also proposed that those pathways that involve metabolic "grids" offer opportunities for metabolic regulation. These two concepts are discussed in detail in her treatise on flavonoids (Flavonoid Metabolism. 1990. CRC Press).

In the preface to her book, Helen identifies a second major shift in her research interests to proanthocyanidins (condensed tannins) after she spent a sabbatical with T. Cheng at the Oregon Graduate Center in Portland. Two reviews, resulting from her numerous research papers on these complex substances in the following decade, have clarified information about their structures, biosynthesis (Chemistry and Significance of Condensed Tannins. 1989. R. W. Hemingway and J.J. Karchesky, eds., Plenum Press), and their relation to lignin (Phytochemistry. 1987. 27: 1-6). Because her career in plant biochemistry and physiology has been both broad and deep, Helen continues to write stimulating papers such as those listed at the end of this biography.

In addition to her teaching and research career at Reed, Helen Stafford has served the plant sciences in numerous ways. She was a member of the editorial board of Plant Physiology for nearly 30 years (1964-1992). She was a CUEBS Commissioner (1968-1971) and a

member of the NSF panel on metabolic biology (1973-1975). Helen has served as president of the Phytochemical Society of North America (1977-1978) and Editor-in-Chief (1989-1993) of its serial publication Recent Advances in Phytochemistry. This series has chronicled research in plant biochemistry for 32 years, especially in the area of plant natural (secondary) products. In 1996, Helen received the Charles Reid Barnes Life Membership Award of the American Society of Plant Physiology.

As a distinguished woman pioneer in plant biochemistry and physiology, Helen has been aware of unequal treatment for women in science. She was the first woman allowed to teach male botany students at the University of Pennsylvania in 1949. At Reed, she was the only female faculty member in the sciences (Mathematics, Physics, Chemistry, and Biology) for many years. Today there are three women among 10 faculty members in Biology.

In summary, Helen Stafford is not only recognized internationally for her research, but also as an influential teacher in one of the country's premier undergraduate colleges. She has shown her students the excitement, pleasure, and rewards of having a distinguished research career.

Eric C. Conn, University of California, Davis

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Some Papers of interest by Helen Stafford

Flavonoid Evolution: An Enzymic Approach (Plant Physiology. 1991. 96: 680-685).

Anthocyanins and Betalains: Evolution of the Mutually Exclusive Pathways (Plant Science. 1994. 101: 911-98). Metabolism and regulation of Phenolics: Gaps in our Knowledge (in: Phytochemicals and Health, Current Topics in Plant Physiology. 1995. 15:15-30).

Teosinte to Maize: Some Aspects of Missing Biochemical and Physiological Data Concerning Regulation of Flavonoid Pathways (Phytochemistry, 1998. 49: 285-293).

The Evolution of Phenolics in Plants (Recent Advances in Phytochemistry. 2000. 34: 25-54).