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Daphne Preuss

Daphne Preuss — the 1998 Junior WICB awardee — grew up in Akron, Colorado, a town of 1,800 people often not found on maps. Very few people in the community had advanced degrees, let alone graduate degrees in science. Despite the lack of any role model, Preuss had a natural inclination to find out how things worked.

Preuss' parents, Edward and Mildred Peed, moved the family when Daphne was young from a rural farm to Akron where they ran a small hardware store. Eventually the family moved their store to Denver where Preuss and her brother Jason worked growing up. Her brother stayed on working alongside his parents until their retirement.

At first, her parents did not encourage Preuss' interest in science. But she attended a small school where each student could demand and receive special attention, so she gravitated to the school librarian for help in explaining the natural world. An avid reader and self-described "tomboy," Preuss found role models in historical figures, reading everything she could find about Thomas Edison and Benjamin Franklin. "That was the kind of life I wanted to lead," Preuss recalls.

College for Preuss was by no means assured. By high school the family had moved to Denver and she was attending an overcrowded public school with gang violence, drugs, and almost daily visits by the police. The teachers were "more worried about the kids who go to jail than who go to college." It wasn't until late in her senior year that she began to think about college. She explains that, "there were serious financial concerns," and there was no one to even tell her how to apply. To her great credit, Mildred Peed saw the potential in her daughter, and despite her own lack of education, took her daughter to the Chemistry Department at the University of Denver and boldly declared to the Department Chairman, "we have to get her into college."

Preuss was accepted there and received a scholarship to pay for tuition, while living at home. Among her 1,000 classmates she was one of only eight Chemistry majors, allowing her to get the individual attention she needed as well as the opportunity to participate in actual research. Even within this small group, Preuss was unique because she wanted a career in research. The faculty identified with her and was eager to foster the rare student with academic aspirations.

Having spent a summer working for the U.S. Geological Survey testing pH levels, Preuss realized that she "wanted more than a bachelors degree." The summer following her junior year, Preuss and her father took a tour of East Coast graduate school programs, much the way most students do before going to college. She left the University of Denver with two Summa Cum Laude degrees, in Chemistry and Natural Sciences, and chose MIT for graduate school.

Going to MIT exposed Preuss to new experiences even beyond science: she learned how to navigate the T, which she used to commute to Cambridge from Arlington, and learned to feel comfortable with her classmates, also top college students, but who had come from more research intensive schools. She thrived in this highly-charged intellectual environment and was excited to have "competitors". "It was wonderful to have fellow students who shared the same enthusiasm for science; they were real peers." Preuss also feels very fortunate to have had David Botstein as an advisor. "I will always be grateful to David; he was the best mentor I could have had." Botstein returns the admiration. Of Preuss he says, "from the start of her graduate career, Daphne excelled in every way." One incident stands out in Botstein's mind: when Preuss was a teaching assistant for a course Botstein taught with Gerry Fink, "we had suggested a problem for the students based on a letter to Nature pointing out an error in an earlier paper... Daphne came back the next day with proof that Fink and I had overlooked the fact that the letter was itself wrong." Preuss mostly recalls being concerned about telling her professors they were mistaken.

As Preuss was finishing her Ph.D. in 1990, Botstein moved to Genentech, where Preuss was the only graduate student who chose to move there with him. This was a dicey decision because she was still finishing up her thesis, but in retrospect she feels that the experience was extremely beneficial. "I learned what it is like in the biotechnology realm and was able to see first hand if I wanted to pursue a career in industry." It was also an experience relevant to her growing fascination with plants: "plant research is an area where biotechnology has a lot of interest." Preuss remembers the whole lab found it difficult to make the switch to California: "I think we all got traffic tickets the first month we were out there." Daphne's husband, Ted Preuss, a free lance photographer, happily moved his business to San Francisco.

Characterizing herself as "too rebellious," Preuss left Genentech and the corporate world after less than a year for the freedom of the academic environment, and took a postdoc with Ron Davis at Stanford. "I didn't want any one telling me what to do," she said of the choice to return to a university lab, preferring to be able to chase interesting ideas as needed. She was not disappointed in Davis' lab. He told Preuss, "I

don't care what you do, just do something worthwhile," so she took the ball and ran with it. "I could not imagine two better mentors than David Botstein and Ron Davis; each one came at the right time for me."

Following completion of her postdoc in 1995, Preuss was offered an Assistant Professorship at the University of Chicago in the Department of Molecular Genetics and Cell Biology where her work now focuses in two areas of plant cell biology. She has worked on pollination in plants since she started her postdoc, and she continues to investigate this area. The focus is on interactions between male and female cells in Arabidopsis. Preuss is using genetic and biochemical approaches to identify the mechanisms that these cells use to recognize each other. The exchange of signals during pollination allows plants to discriminate among the many types of pollen in the environment, ultimately choosing the best mates. How do the female cells in the plants know each pollen type, how do they interact favorably with the right type and unfavorably with the wrong type? Preuss' lab has defined genes and proteins that enable the female cells in the flower to identify the most appropriate pollen. Such genes control processes ranging from cell adhesion to the exchange of small signaling molecules. Ultimately, this work could make it possible to interbreed plants of different species, presenting important implications for the world's food supply. It will also help to answer basic questions about how cells that are surrounded by carbohydrate walls can establish communication.

Preuss' work led to an unexpected mutation that has made new genetic techniques possible in Arabidopsis, including the definition of the chromosomal regions that function as centromeres. "We were fortunate to find a mutant that we have called quartet. In quartet mutants, the four daughter cells formed during pollen meiosis are packaged together. So, what we essentially have done is turn Arabidopsis into something more like yeast. That was very satisfying to me because I had worked with yeast in the past; with this mutation, we can do yeast style genetics in a multicellular organism. With quartet mutants, we can use tetrad analysis to find the genetic location of centromeres, and to define their DNA sequences." All aspects of Preuss' lab deal with heredity; an improved understanding of centromeres in Arabidopsis could have implications for chromosome assortment in other species as well.

Tony Mahowald, the Chair of Preuss' department, points out that Preuss has been an active member of the ASCB for many years and has served on the editorial board of Molecular Biology of the Cell for the last three. He describes Preuss glowingly as "a strong role model for ... students at every level."

Most of Preuss' research funding has come from the National Science Foundation. She is particularly pleased with the plant genome project sponsored jointly by the NSF, USDA, and the DOE. She credits Delill Nasser of the NSF for seeking out young plant geneticists and encouraging them in their careers. Preuss is inspired by the ongoing Arabidopsis genome project, which will be complete by the end of 2000. Once the genome is complete, she and others can efficiently explore the many genes involved in cell signaling and ultimately to begin to manipulate the process.

Despite the distance between Chicago and the ocean, Preuss and her husband love scuba diving and try to get away to indulge their pastime as often as possible. Recently they dove in the China Sea, where Preuss could also explore her curiosity about marine biology. One of Preuss' goals is to scuba dive in every ocean on earth. "I am excited by all life forms."