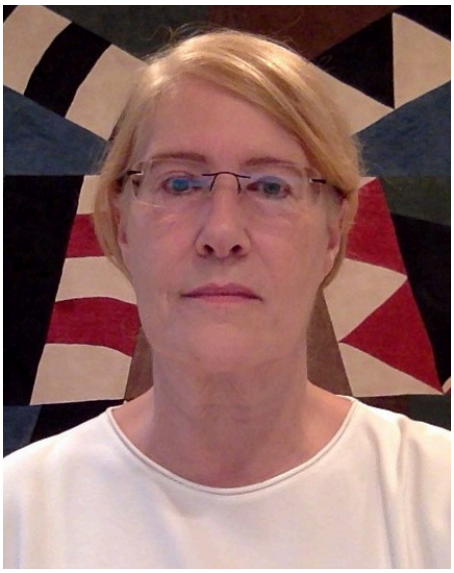
Jane Silverthorne



How did you spend your career?

Looking back on my career, I realize that I became a scientist in large part because of my childhood. I was born in Somerset, England, when my father was stationed at the Royal Naval Air Station in Yeovilton. My family, which eventually grew to include a sister and a brother, moved every two years to my father's new postings. As a result, I was exposed to a wide range of environments and school systems. My parents came of age during the Second World War and both left school at fourteen. While neither had the benefit of formal higher education, they were both intelligent, artistic, curious, and adventurous. They wanted us to experience the world and to get an education that would give us the freedom to do whatever we wanted to do in life.

I was fortunate to attend good schools, and at the Verdala Royal Naval School in Malta I had an excellent science teacher, Mr. Woodhams, who changed the way I thought about the world. He taught his class of nine-year old children through a combination of lectures and experimentation that introduced deductive reasoning. His lessons prompted me to ask questions about the world around me and to take an interest in living things. However, I didn't think of myself as a scientist until much later, and by that time I was more interested in art and literature. It was the beauty of the molecular structure of living things and understanding how structure determines function that eventually set me on the road to becoming a scientist.

After several additional moves, I settled into Farnham Girls' Grammar School in Surrey, which was founded in 1901 to prepare girls for higher education. While the school was small, comprising only about 450 students at that time, the teaching staff was excellent, and the academic standards were high. Here, I first became interested in plants and started reading articles in Scientific American as well as undertaking plant projects in the surrounding fields. The chemistry and mathematics A-level classes at FGGS used the Nuffield curriculum, which focused on discovery approaches to understanding and learning, rather than memorization of facts. I found this approach fascinating and it shaped my search for a university course.

As I progressed through my O-Levels and A -Levels, I set my heart on attending the University of Sussex in Brighton, England. I was attracted to the modern curriculum and teaching through coordinated lectures, tutorials, and laboratories. I was overjoyed to be accepted and joined the Biology B.SC. degree program in 1972 as one of about 70 students. Plant science was strong at Sussex and integrated into a single Biology department, which included research groups working on a wide range of problems, from animal behavior to bacterial restriction enzymes. My three years at the University of Sussex were very happy, and I enjoyed weekly meetings with my tutorial group, where we discussed our lecture and laboratory class assignments. As part of the graduation requirements, I had to conduct a year-long independent research project in both a science and an arts topic. For the arts project, I researched the literature and wrote a senior thesis on the rise and fall of the Minoan civilization in Crete, and for the science project I undertook laboratory research with Dennis Baker on phloem transport in castor bean. He was a wonderful mentor who gave his students the freedom to explore their ideas and make mistakes, while keeping them on track.

I really enjoyed laboratory research and looked forward to continuing as a Ph.D. student. I was accepted to Professor R. John Ellis's group at the University of Warwick in Coventry, which included lecturers Drs. Martin Hartley and John Bennett, as well as other graduate students, postdoctoral

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research fellows and technicians. As the newest student, I was assigned the least desirable bench space, next to a water bath illuminated by very bright lights, nicknamed "The Beast". When it was in use, dark glasses were a necessity. Here, I worked on light regulation of chloroplast gene expression during development of spinach seedlings. I grew my plants hydroponically in a growth room next to the laboratory, gave various light treatments, and then isolated mRNA for assay with *in vitro* protein synthesis extracts. In those days, translation extracts were not something that could be ordered from a catalog and had to be prepared from scratch in the laboratory. I became adept at preparing *E. coli* and wheat germ extracts, traveling down to London by train to buy the freshest untreated wheat germ from Harrod's food hall. John Ellis was a thoughtful and committed advisor, meeting with all his students regularly to discuss proposed experiments to ensure that they could communicate effectively in talks and in publications. It was an exciting time in plant biology when molecular tools were becoming available enabling more mechanistic approaches to answering questions of structure and function. I stayed on as a postdoctoral researcher during and after completion of my thesis.

A steady stream of visitors came through the laboratory during this period. One memorable visitor was Dorothy Crowfoot Hodgkin, winner of the Nobel Prize for Chemistry, who had recently retired to a nearby village. It was inspiring to meet a pioneering structural biologist who was genuinely interested in what we were doing. Several of the other visitors were American plant scientists, including Sam Wildman and Charles Arntzen. I met Elaine Tobin during one such visit, and we discussed the possibility of me conducting postdoctoral research in her laboratory at the University of California, Los Angeles. I was excited by the possibility of being in a department with multiple plant laboratories and delving deeper into the photoreceptors responsible for regulating plant gene expression.

I arrived in Los Angeles on a rainy day in early March 1981, and the roof of the tent housing the temporary international terminal was leaking. Having grown up in the UK, I was under the impression that it never rained in Southern California, and it was quite a shock to realize that all the TV shows I had watched growing up didn't show the whole picture. I quickly settled into laboratory life in the basement of the old herbarium, with co-workers that included Willem Stiekema, another postdoctoral researcher who had just arrived from the Netherlands, as well as Chuck Wimpee, a graduate student. George Karlin-Neumann, Leslie Leutwiler, Bruce Kohorn, Susan Flores, Patricia Okubara, David Kehoe, and Takashi Yamada also joined the group while I was there. We were working on phytochrome regulation of several nuclear genes in Lemna and Arabidopsis, using genomic libraries to isolate probes for members of individual gene families. While I was focused on Lemna transcription assays using these probes, others were doing the hard work of making the libraries, isolating the genes, and sequencing them. I spent many hours in "reagent grade" darkness isolating nuclei and performing transcription assays with large amounts of radioactivity, while in the company of escaped cockroaches from a nearby laboratory.

There was tremendous camaraderie among the Tobin laboratory members, and I remember Saturday afternoons working at the bench while listening to A Prairie Home Companion. We interacted a lot with the members of Philip Thornber's group, who were located upstairs from us, and since Philip was British, our meetings included tea on Friday afternoons. Although Robert Goldberg's and Bernard Phinney's groups were in other buildings, their plant science students and postdocs interacted frequently at seminars and social events. Ideas and techniques were shared freely, and I don't think it is a coincidence that several of the researchers from this time frame ended up as government science administrators, including myself, Judith Verbeke, Parag Chitnis and Sharlene Weatherwax.

In April 1986, I entered a tenure-track position at the University of California, Santa Cruz. While there

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were fewer plant research groups than at UCLA, these included Kenneth Thimann, Harry Beevers, Lincoln Taiz, and Robert Ludwig. I was one of three appointments made after a seven-year hiring hiatus, and together we new hires worked to set up a graduate rotation program and introduce new undergraduate and graduate molecular biology courses. My research group focused on phytochrome regulation of gene expression in conifers and Gingko. During this period, we participated in the Bay Area Regional Photomorphogenesis (BARPh) meetings, established by Winslow Briggs at the Carnegie Institution at Stanford, and included Peter Quail from the USDA Plant Gene Expression Center in Albany, CA, and Clark Lagarias at UC Davis. I also collaborated with Masamitsu Wada, who I had met at a Yamada Conference in Okazaki, Japan in 1986, and I spent time with his group at Tokyo Metropolitan University working on joint projects, while also hosting his students jn my lab. I developed a deep appreciation for Japanese science, art, and culture during these visits, and that has stayed with me ever since.

As a faculty member, I strove to be a good citizen and served as a reviewer for papers and grant proposals whenever I could. I first met Machi Dilworth, who was then Division Director for Biological Infrastructure and Mary Clutter, who was then Assistant Director for Biological Sciences, at a National Science Foundation (NSF) panel meeting in 1998. I subsequently served on several site visits for projects under consideration for funding. It was a revelation to see how NSF peer review worked from the inside, and I greatly enjoyed participating in the process. Machi asked me if I would be interested in serving as a rotating Program Director for the Plant Genome Research Program (PGRP). For me, this meant planning to take a leave of absence from UC Santa Cruz for a year or two and working at NSF "on loan" through the Intergovernmental Personnel Act (IPA) program. I was initially hesitant to take this on, but after discussion with my students and colleagues, I eventually said yes and joined NSF in 1999. What followed was probably the most exciting phase of my career.

Being a Program Director meant seeing all the new ideas being submitted for funding and getting a sense of the direction of the field at a very early stage. The job was much more than just managing the peer review process, since I also participated in development of program solicitations that set the direction of the program as well as interagency coordination with other plant genomics programs. In addition, I managed the funded projects, several of which were large community resource development efforts, including genome sequencing projects. I read everything that came in as well as relevant research literature, and my ability to read at a high speed turned out to be a critical skill.

After a four-year rotation at NSF, in 2003 I decided to stay permanently. My UC Santa Cruz colleagues were generous and understanding, allowing me to take an additional year of leave in case I changed my mind. NSF provided many opportunities for career development, including a detail to the White House Office of Science and Technology Policy (OSTP). From November 2006 to March 2008, I spent sixteen months at OSTP as a Senior Policy Analyst, serving as liaison for several subcommittees and interagency working groups under the Committee on Science, co-chairing the working group coordinating biotechnology regulation across the federal government, staffing a President's Council of Advisors in Science and Technology (PCAST) subcommittee on personalized medicine, and serving on the US delegation to the OECD Working Party on Biotechnology. I served 90% time in this position and in the evenings, I would go back to NSF for the other 10% of my time to continue management of ongoing large PGRP infrastructure projects. During this detail, I also participated in the review that led to the establishment of iPlant and worked on the proposal to the Bill & Melinda Gates Foundation to set up the joint Basic Research to Enable Agricultural Development (BREAD) Program. It was probably the hardest I have ever had to work in my life, but it didn't seem like work at all because I felt that I was making a difference.

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In the summer of 2007, while at OSTP, I went to the Federal Executive Institute in Charlottesville, VA, to take the month-long Leadership for a Democratic Society course. This course provides a training opportunity for career federal employees who are considering becoming senior executives. I learned a lot about leadership during this experience, including the importance of staying healthy and understanding the impact of personality traits on leadership style. In 2009, I joined the Senior Executive Service and became a Deputy Division Director in the Division of Biological Infrastructure. My subsequent leadership positions, including Division Director and Deputy Assistant Director built on everything I had learned from Mary Clutter and Machi Dilworth, my experiences as a Program Director, and the training I received along the way. From all of these perspectives, it is clear to me that the NSF "gold standard" peer review results from fair, transparent, and consistent practices at *every* level.

I have remained surprisingly busy since I "retired" in August 2017. While I didn't plan to continue working, I have ended up serving as a consultant for several organizations, as well as serving on boards and advisory groups. I also continue to travel a lot internationally and pursue my love of art.

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

Plants are central to life on Earth and yet their place in educational curricula is not commensurate with this importance. I hope that my work as a research scientist and as a teacher have helped to broaden the understanding and appreciation of plants and contributed to their integration into at least some courses. However, I think that my lasting contributions to plant science are likely to be the decisions I made in my various roles at the National Science Foundation, including funding recommendations, focus areas for solicitations, as well as development of new programs. These include the Comparative Plant Genome Sequencing Program, the Maize Genome Sequencing Program, the PGRP Young Investigator Award Program, the joint NSF/JST Metabolomics for a Low Carbon Society program, the BREAD program, the PGRP Postdoctoral Fellowships, and the joint NSF/BBSRC Ideas Lab programs on photosynthesis and nitrogen. There are many ways to contribute to a research field, and it is perhaps as important to have people with the vision to develop new programs, administer a fair review and select the best projects to fund as it is to have people to submit proposals.

When did you become a member of ASPP/ASPB?

I don't remember the exact year, but it would have been while I was a postdoctoral researcher in the Tobin Laboratory, probably in 1981.

How did the Society impact your career?

The Society brings together plant scientists at all career levels from a wide range of research interests and serves as their voice in policy issues. Increasingly, it is an important focal point for broadening participation in the plant scientists as part of its efforts to develop a community-wide science vision. Many ASPB members serve the plant community in diverse ways, including the peer review process for federal agencies. The ASPB journals have been central throughout my career, as a place to publish, to read about the discoveries and of course, to find reviewers and panelists. Consequently, I am honored to be recognized as an ASPB Pioneer.

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

My first piece of advice is that you gain valuable experience from every job you have along the way, not just the scientific ones. I honed my time management skills while working as a chambermaid during summers in high school and university. I also learned the importance of consistent and cheerful customer service as a general assistant in a hotel, from dealing with complicated lunch orders during busy periods to handling requests for obscure cocktails during the night shifts in the bar. I took these jobs to finance my travels at the end of each summer, and I think that my

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parents encouraged this because they knew that this experience would remind me how important my education would be to having good career choices. These experiences turned out to be far more valuable than I could have imagined.

The second piece of advice is to know from the outset that you won't have one career but many careers. Even if you stay in one position for a long time, what you do and how you do it will change radically over time. Increasingly, the old divisions between academia and industry are breaking down and you might start an academic career and end up forming your own company and becoming its CEO. Being open to a wide range of possibilities will make for an interesting career. I did not undertake my research training to eventually work at the National Science Foundation, but all the things I did before I arrived there contributed to my ability to make a difference.

Finally, people do science, not machines. By this I mean that a wide range of scientific personalities are involved in science, and you will meet many in your career. Two people can work on the same problem and come up with radically different approaches. You can learn a lot from observing and understanding how others tackle problems and generate ideas. If you are fortunate, you will get to work with truly innovative people who might be the polar opposite of you in personality, but who can teach you a lot. Personal connections build up over time and make you part of the larger scientific fabric. Sometimes it is less important to know a specific piece of information than to know who to ask about it. Your network will eventually include those people, and many more besides.