Joan Argetsinger Steitz: Pathfinder for Women in Molecular Biology

By Laura L. Mays Hoopes

Figure 1. Joan Steitz at Yale University in 2008.

When it comes to breaking through barriers for women in molecular biology, Joan Argetsinger Steitz was an early heroine. In 1963, she was the only female graduate student, in a class of ten people, admitted to the Biochemistry and Molecular Biology program at Harvard University. She was also the first female graduate student under James Watson, one of the two men who discovered DNA's double helix.

Joan Argetsinger went to Northrop Collegiate School, a girls' high school in Minneapolis, Minnesota. It was a forward-thinking institution where women taught mathematics and science. She attended Antioch College, and the school's co-op program sent her to work with Alexander Rich at MIT, where she first encountered the new field of molecular biology. In the summer of 1963, she worked in the laboratory of Joseph Gall and discovered her passion for research. Gall communicated the excitement of science and gave Joan ownership of her project, in which she investigated whether basal bodies of cilia contained DNA. Joan was so interested in research that she wanted to pursue a Ph.D. in biochemistry, but there were very few women who went to graduate school.

Looking back on those days, Joan muses that there was one female science faculty member at Antioch in biology and none in chemistry. Joan didn't see any women running laboratories during any of her co-op terms, so she never considered becoming a science professor. She knew female doctors so, she applied and was admitted to Harvard Medical School in 1963.

The committee of faculty members from different departments that ran the Harvard Biochemistry and Molecular Biology program included James Watson, who, during the time of Joan's degree work, wrote his memoir, *The Double Helix*. The administration was informal, but the program was rigorous, challenging, and exciting. Joan knew she was a good student, and she was enthusiastic about searching for DNA in basal bodies of cilia. She suggested collaborating with a famous male cell biologist to study cilia via electron microscopy, but he hemmed and hawed and said he wasn't sure he had space. He asked if she meant to get married and have children and looked uneasy. Joan fled in embarrassment.

She considered her options. Watson had become a friend when she worked at MIT; he had even left her daffodils in a beaker on one occasion. He had also helped with the red tape when she had decided at the last minute to switch from medicine to graduate school. However, Watson wasn't interested in DNA in basal bodies. Joan had begun to be interested in ribosomes. She could always return to looking for DNA in basal bodies at another time. So she asked, and Watson accepted her. She was not told until later that she was the first female graduate student he had ever accepted into his laboratory.

In the laboratory, she felt like one of the guys. Differences between genders did not come up; everyone was expected to do the same things, pass the insanely difficult physical chemistry examinations, work day and night, and read all the literature with a critical eye. Giving a talk on her research in Watson's group was an ordeal at first, but not a gender-specific one. He demanded that everyone start with the big picture, then turn to the supporting evidence, and finally recapitulate the whole story from the big-picture perspective. He was not shy about interrupting the speaker to demand his ideal presentation style. Joan says he also indoctrinated his students with the ability to select important problems. That skill has been useful to her throughout her career.

While she was pursuing her Ph.D., many speakers came through Harvard and almost all were men. A woman lectured in one of her classes only once. It was Marianne Grunberg-Manago, a French scientist who had purified and characterized polynucleotide phosphorylase in the early 1960s. Joan says that Severo Ochoa won the Nobel Prize for Grunberg-Manago's work. Ochoa was laboratory director, and it was the custom for the director to take credit for all the discoveries made in his laboratory. There is no doubt that many women failed to achieve recognition in science because of this custom.

During the first year of graduate training, Joan dated various men, and in 1966, she married a fellow graduate student, Tom Steitz. Tom had finished his Chemistry Ph.D. in 1966 and remained in the laboratory of his mentor, Nobel prize-winner Bill Lipscomb, for another year. This allowed Joan to complete her research, which fo-

cused on a bacterial virus that uses ribonucleic acid (RNA) for its genetic material, write her dissertation, and receive her Ph.D. Joan's work was well-regarded, she was well-published, and she was invited to give talks on her work.

Tom studied structural biology using x-ray diffraction, the method Rosalind Franklin had used to study the structures of DNA that had inspired Watson and Crick's model. He was offered a postdoctoral position at the Medical Research Council (MRC) Laboratory of Molecular Biology in Cambridge, England, famous for both structural and molecular biology. Watson's graduates generally went to Geneva for postdoctoral work, but since Tom was coming to Cambridge, Watson suggested that, Crick take Joan as a postdoctoral fellow. Crick agreed, remembering that Joan and her three female roommates had once entertained him for dinner when he visited Harvard.

Instead of preparing to become a professor, she focused her reading and thinking directly on the problem she was studying throughout her postdoctoral period at Cambridge. She had obtained a few feet of bench space in the area assigned to Mark Bretscher, a young MRC staff member. She chose an important, risky project that had only a small chance of being successful, but that did not matter since she would not have to be in the job market for several years. She noticed that her male colleagues in the MRC Division headed by Francis Crick and Sydney Brenner had broader interests because they were planning for future teaching. That was not her goal; instead, she focused on becoming a research associate.

Joan knew that many professors had research associates, typically women who conducted research as specified by their professors. To extend her two-year funded stay in Cambridge and provide funds for her transition back to the U.S., Joan applied for, and received, a Jane Coffin Childs Fellowship. While Joan was in England, some important variables in American society began to change. Betty Friedan's book, The Feminine Mystique, had been a best seller in the U.S., following the earlier lead into feminism by Simone de Beauvoir. Female faculty members in the sciences were becoming more commonplace. Meanwhile, anti-nepotism was breaking down; most U.S. universities had repealed rules against married couples' dual employment as faculty members.

Joan herself became a celebrity by making an important discovery at Cambridge. She found the sequences of three start sites on a virus-derived messenger RNA where particular proteins began to be produced and published her data in the premier journal Nature. She had identified the spacer sequences between genes for the first time, and this breakthrough was heralded as the beginning of understanding how genes work, a foundation for today's molecular medicine advances. Also, Sydney Brenner from Cambridge MRC had toured the U.S. touting molecular biology. Molecular biology had become the new must-have subject area, and Joan was a hot commodity, having made exciting discoveries with both Watson and Crick.

Tom came to the U.S. to begin his faculty position at the University of California, Berkeley, and along the way, he and Joan gave research talks at many universities. The informality of the hiring process in those days meant that Joan wasn't sure which universities were considering her for positions. Although Berkeley made no faculty-level offer to Joan, she and Tom both received written offers of Assistant Professorships from Princeton and Yale.

At Berkeley, where Joan conducted research in the laboratory of Bruce Ames, Tom showed the written offers from Princeton and Yale to his department chair and requested that they make an offer to Joan. The chairman told Tom that women liked to be research associates and asked if she wanted to do that instead. He did not plan to offer her a faculty position. Tom told Joan and made it clear that he thought she deserved to be on the faculty. Joan talked with possible supervisors at Berkeley and mulled over her future.

Today we may wonder, why didn't she jump to accept one of the written offers of professorship? Joan felt conflicted and somewhat unprepared. She knew she hadn't read as widely as the men who trained alongside her at Cambridge and never expected to face this choice. She feared lecturing on subjects she didn't know thoroughly, but she realized that she had a chance to open an important door for women and could be a role model for others. She knew it would be hard, but she would have Tom for support. Plus, Yale had an ace in the hole. Her mentor, Joseph Gall from Minnesota, was now on the Yale faculty. Joan and Tom accepted the offers from Yale.

Joan was still uneasy about her preparation. She worked on RNA. Almost all RNA was transcribed from DNA, so she thought she would be fairly comfortable at a scientific meeting about transcription. During a trip home to visit her ill mother, she attended a transcription meeting at Cold Spring Harbor Laboratory, where Watson had become the director. Joan was appalled to find how hard it was to follow papers at the forefront of the field of transcription. It did not matter that it was not her field; if she became a professor, she would surely have to teach it. She could not keep pretending she could be a professor, so she went to talk to Watson, crying. He told her that she could do it, that lecturing was never easy, even for him, and that she should not worry; she would be just fine.

Watson was correct. Joan learned to teach Biochemistry and has enjoyed it ever since. One undergraduate commented that there are two biochemistry courses at Yale, one for mortals and one for gods. Her course is the latter. Many former students have approached her at meetings to thank her for how much they learned in biochemistry.

Joan has received numerous awards for her research on RNA, including the National Medal of Science and the Albany Medical Center Prize in Medicine and Biomedical Research, America's largest prize in medicine. The Albany Medical Center Prize was awarded in 2008 to Joan Steitz and Elizabeth Blackburn of UCSF, the first women to receive the award. Joan is one of the few women who have been elected to the National Academy of Sciences as well. Breaking the boundaries for other women in science did not make life easy for Joan. She looks back and recalls that she was terrified at times, but she affirms that it was for the best. Now she revels in the success of women scientists and hopes for a day when men and women in science will be treated exactly the same. ■