



BIOSPHERE

The Weekly Bulletin of Biology

No Colloquium this week.

Pioneer Women in Genetics¹

—Virginia Vandergon

Barbara McClintock (1902–1992). Barbara McClintock was born at a time when women did not go to college and a woman's worth was measured by who she married. McClintock made it clear that she wanted to attend Cornell University, and in 1918 she entered the College of Agricultural Science. She loved learning and soon became known as a bright and popular co-ed. She began her Ph.D. working in the newly founded field of cytology. It was there that she began her life's work studying maize chromosomes, in effect scooping her own boss in identifying them. After finishing her Ph.D., she stayed on at Cornell as an instructor. From the Cornell days McClintock established an enduring circle of geneticists friends. One of them, Harriet Creighton, became her research student. Creighton and McClintock worked closely to demonstrate crossing over in maize

chromosomes. Soon thereafter, McClintock got a part-time job at the University of Missouri where she began to look at the effect of X-rays on corn chromosomes. From these studies she discovered chromosomal translocations, inversions, and deletions. In 1936, she accepted an assistant professor position at the University of Missouri, but after 5 years she left following clashes with others because of her independent and "maverick" ways. Unable to decide what to do, McClintock took a research position at Cold Spring Harbor, where she worked up until her death in 1992. It was here that she was finally able to describe how the transposition of genes in maize chromosomes happened. She

was awarded the Nobel Prize in 1983 for her work on "jumping genes." In fact, McClintock was the first woman to win a solo Nobel Prize.



¹To commemorate Women's History Month, each issue of *Biosphere* in March is featuring profiles of female pioneers in biology.

Rosalind Franklin (1920–1958). Born in London, Rosalind Franklin knew by the time that she was 15 that she wanted to be a scientist. When she passed the exams to get into Cambridge, her father was outraged and refused to pay for her to go to university: *it was not what women did*. Her mother and an aunt took her side and her aunt offered to pay, but her father eventually broke down and supported her. She excelled at university and received her doctorate despite the start of WWII. To assist in the war effort, she studied how to use cola efficiently and published five papers on this work. After she finished her Ph.D., she went to France and worked at the Laboratoire Central des Services Chimiques de L'État, where she learned X-ray diffraction and started creating images of crystalized solids. She was the pioneer in this field, and though she loved France, she knew she had to return to England if she wanted to establish herself as a scientist there.



So in 1950 she began working in John Randall's laboratory. It was there that she met Maurice Wilkins, who also ran a small research group like hers. He originally mistook her as a technician and treated her as such. They both were working separately on the structure of DNA. Although they were actually peers, Maurice did not include Franklin in conversations with fellow scientists in male-only pubs. Franklin persisted, however, and produced some of the best X-ray crystallography photographs of DNA ever seen. She all but solved the structure of DNA, but Watson and Crick, who were shown her images by Wilkins, beat her to the punch. Their work was published in *Nature*, and Franklin's article was published as a supporting article. Franklin continued her work in X-ray diffraction, but left Cambridge and started her own research group at Birkbeck College where, because she was not allowed to continue her work on DNA, she switched to viruses. Her work pioneered the field of virology. She learned she had ovarian cancer in 1956, and despite having chemotherapy and surgeries, she continued to work up until a few weeks before she died in 1958 at the age of 37. Although her research contributed significantly to discovery of the structure of DNA, Watson, Crick, and Wilkins won the Nobel Prize for it in 1962.

Elizabeth Blackburn (1948–). Born in Tasmania, Australia to parents who were family physicians, Elizabeth Blackburn spent her youth exploring the beaches and countryside where she collected animals. She knew at an early age that she wanted to become a

scientist and was drawn to biology. She went to a all-girls school, where there were no physics classes, so she took physics in the evening at a public school. She learned to play the piano and continues to play today. Blackburn went to Melbourne University, where she earned a degree in Biochemistry. From there she did one year towards a master's degree working on rat metabolism to acquire the research experience she needed to be accepted into the doctoral program. She earned her Ph.D. at Cambridge University under the guidance of Fred Sanger. In his lab, she was part of the team that first sequenced bacteriophages. From there she did a postdoc at Yale University with her new husband, where she initiated her work on telomeres (the ends of chromosomes). Her husband landed a faculty position at UC San Francisco, and she followed, but without an official position at UCSF, she supported her research on telomeres in *Tetrahymena* (a ciliated protozoan) from grant funds. Blackburn eventually got a job as an assistant professor at UC Berkeley. Her lab continued working on the interesting tracts she was finding in telomere regions of *Tetrahymena*. Her careful studies eventually led to the discovery of telomerase and how it works to restore the telomere ends. This culminated in her being



awarded the Nobel Prize in 2009. In 2001 she was asked to serve on the newly created US Commission on Bioethics. While on this committee she was vocal about her stance on many issues, using science as evidence, but her views were not in accord with what the White House wanted, so President George W. Bush asked her to step down. She is currently a Professor at UCSF.

New Publications

Dr. **Jonathan Kelber** is a coauthor of "Procedures for the biochemical enrichment and proteomic analysis of the cytoskeleton," which was published in *Analytical Biochemistry*.

The *Journal of Pollination Ecology* has published "A test of density-dependent pollination within three populations of endangered *Pentachaeta lyonii*" by **Jocelyn Holt** and Drs. **Paul Wilson** and **Christy Brigham**.

Student Wins Garden Scholarship

Danielle Amoroso has been awarded the Toluca Lake Garden Club Scholarship.

Alumni News

Former biology student **Julieta Aguilar** (B.S. '05) earned her Ph.D. from UC Berkeley and is currently a UC Presidential Post-doc at UC San Diego.

Biosphere: The Weekly Bulletin of Biology

Department of Biology

California State University, Northridge

Editors: Paul Wilson and Robert Espinoza

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