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Esther Marly Conwell

Esther Marly Conwell, known for her groundbreaking work on semiconductors and her mentorship of women in science, was born in New York City on 23 May 1922 and died in Rochester, New York, on 16 November 2014. Over the course of her 70-year research and teaching career, she made foundational contributions to many emerging areas of science, including the electrical properties of semiconductors, light propagation in optical fibers, and charge motion in quasi-one-dimensional materials. She gravitated toward controversial and novel scientific areas and thrived on scientific debate. Her efforts were marked by a tenacity and focus that kept her involved in research throughout her life; at the time of her death, she still had papers out for journal review and was drafting an article on charge transport in DNA.

Conwell received her BS degree in physics from Brooklyn College in New York City in 1942. She was blessed with mentors who recognized her talent and encouraged her to continue with graduate education. Her master's thesis, on the theory of impurity scattering in semiconductors, was done with Victor Weisskopf at the University of Rochester. That highly influential work, now known as the Conwell-Weisskopf formula, helped underpin the development of the transistor and other semiconductor devices. Her PhD, completed in 1948 with Subrahmanyan Chandrasekhar at the University of Chicago, was on quantum computations of astrophysically important negative ions such as those of hydrogen and oxygen.

One of Conwell's favorite stories was about summer work she found as an assistant engineer during graduate school in New York. After some weeks on the job, she was informed that her position was not an existing job category for a woman, and she was reclassified as an engineer's assistant, with reduced salary. However obviously unjust that decision was, it was her temperament to take such treatment with equanimity and simply move forward.

After teaching physics at Brooklyn College until 1950, Conwell worked as

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Esther Marly Conwell

a postdoctoral fellow with William Shockley at Bell Labs and helped to develop the theory of hot electron transport in germanium. She continued her research on charge transport at Sylvania Research Laboratories and General Telephone Laboratories from the late 1950s through the late 1960s. Her monograph on high-field transport was influential in the development of semiconductor electronics. She also made important early contributions on wave propagation in optical fibers. During that period she began encouraging young women to become scientists. Conwell mentored one of us (Dresselhaus) in 1950 as a summer student at Sylvania when Dresselhaus was an undergraduate at Hunter College, and she subsequently spent 1971 visiting MIT with Dresselhaus as her host. One of Conwell's most enduring legacies is her mentoring and inspiring young women to become scientists.

Conwell moved to Xerox in Webster, New York, in 1972. She initially joined and ultimately led a program on integrated optics. When that program was relocated to Xerox PARC in California, she remained at Webster, where she joined a group for theoretical physics and chemistry and began studying the transport and optical properties of quasi-1D organic semiconductors such as TTF-TCNQ. Conwell played a crucial role in the emerging field of organic

electronic materials and published seminal papers on the theory of the mobility and optical properties of polaronic charge carriers in conjugated polymers and organic semiconductors. Her research was an important part of a substantial effort at Xerox to develop flexible-belt photoreceptors, which became the basis for a highly successful series of products in the 1980s and 1990s. She was known to her colleagues for her unwavering devotion to her ballet lessons every Friday morning and her preparation of popcorn all day, every day, at the office.

In 1989 Conwell helped bring to the University of Rochester the NSF Center for Photoinduced Charge Transfer, a collaborative effort of Xerox, Eastman Kodak, and the university. She later served as the center's associate director and became an adjunct faculty member in the university's department of chemistry.

After retiring from Xerox in 1998, Conwell continued working at the university, where she brought theoretical insight to the diverse experimental results on charge transport in DNA, another quasi-1D semiconductor. She promoted the controversial concept of polaronic charge conduction along DNA molecules and supported her ideas with quantum chemical calculations.

Conwell's exceptional scientific contributions were recognized with the IEEE Edison Medal in 1997 and the National Medal of Science given to her by President Obama in 2010. As a successful and highly influential woman in the physical sciences, she inspired and mentored countless young women to pursue and grow in scientific careers. The American Chemical Society acknowledged those aspects of Conwell's influence in 2008 with its Award for Encouraging Women into Careers in the Chemical Sciences. Her colleagues will miss her high standards, uncompromising honesty, forthright approach to science, and love of students.

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