

## A Woman Engineer

Helen Rothenberg Sternheim, my wife, did not go to Bronx Science. She has, however, attended all of the in-person reunions, as well as most of the picnics at the home of Stanley and Bette Nitzky. She has helped me to organize the last four reunions in Sarasota, UMass, and Battery Gardens in Manhattan. By now we should consider her an honorary class member. This is her special story.

Helen Rothenberg Sternheim, my wife of over six decades, was a pioneering woman electrical engineer. Helen gained her first job experience when she was a student at Taft High School in the Bronx, New York. The job had no connection with engineering. The mind-numbing task was sorting used American Express travelers checks and putting them onto appropriate piles. It was a summer job in the prehistoric days before air conditioning. You could not use fans without blowing the checks around. It was not a pleasant experience.

Helen applied to Bronx Science, which had just begun accepting girls a year or two earlier. They were taking half as many girls as boys, and she didn't get in. She went to Taft Instead, where she excelled in math and science. At graduation in January 1951, she was happily surprised when she was awarded most of the science and math prizes.

Her college choices narrowed to Hunter and CCNY. She didn't want to go to Hunter, which was all girls, so she opted for CCNY. That venerable institution did then not allow females as majors in the School of Arts and Sciences, which housed the math and science departments, although the college did become completely coed a year later. Women could enroll in Education and, strangely enough, in Engineering. A CCNY history website cite states that girls had first been admitted to Engineering in 1938. The reason they were admitted, we have heard, is that the Engineering School charter called for persons of good character, not men as in the CCNY's original charter, and a court case led to the admission of women. It's a good story, but we don't know if it true.

Helen completed the four and a half year electrical engineering program and graduated in June 1955. She was the only woman in that year's engineering class of 192 grads. The NY Post published her photo in a front-page spread, proclaiming her as the "Queen of the Engineers." One other young woman had started with Helen, and she had dropped out. A yearbook photo shows fourteen members of the Society of Women Engineers; Helen was the only senior.

Helen and I met in a freshman physics class. She likes to brag that her lab partner was a future Nobel Prize winner, Arno Penzias. We started dating a year or two later. I graduated in January 1954 and returned to New York to be with my sweetheart after a brief stint at Bell Aircraft outside Buffalo. We were married shortly after her graduation, on June 19, 1955, and moved into an apartment a few blocks from Yankee Stadium. With the windows open on a warm day we could hear the crowd noise when Mickey Mantle hit a home run.

Soon after graduation Helen started carpooling to a job at Curtiss Wright Aeronautical in northern New Jersey, perhaps hired on behalf of an early effort at diversity. She found that there was little for her to do, and she had to look for work. She also discovered that she had made a mistake in lunching with the secretaries. They were uncooperative when she asked them to do something. They did not give her the cooperation that should have been attached to her job title.

For both reasons, after a year she applied for a transfer to Curtiss Wright Electronics, a separate corporate division, located in a different New Jersey town. There she had interesting work to do and ate lunch and played bridge with the male engineers and the draftswomen, but not the secretaries. Helen's group at Curtiss Wright Electronics was responsible for creating flight simulators used for pilot training. The simulators were very primitive compared to today's versions; it was in the days before digital computers and huge video displays. The engineers employed servomechanisms – devices that use feedback to control an output – and mechanical connections to operate dials. She was much happier with the work and the environment.

The job came with an interesting fringe benefit after she had been there a while: membership in a country club. We tried ice skating there, but I was never good at that sport. I pursued my physics graduate studies while Helen was at Curtiss Wright. During the first year of our marriage, I taught at Brooklyn College while finishing my NYU master's degree by taking courses at night. After that I worked on my doctorate at Columbia with the support of an NSF pre-doctoral fellowship.

Once I had finished my studies at Columbia, I got a postdoctoral position at Brookhaven National Laboratory, located on Long Island about seventy miles east of New York City. Helen left her job at Curtiss Wright Electronics, and her department threw her a farewell dinner. I was also invited. I remember her supervisor talking about when she had applied

to transfer there, and they had discussed the novel idea of hiring a woman engineer. They had decided that they had nothing to lose. We settled into a house in Southaven, a ten-mile drive from the Lab. It had a big lawn, tall trees, and large forsythia bushes that burst with bright yellow flowers in the spring. It was definitely a change from the Bronx.

We completed our move to the exurbs by acquiring a Bassett Hound puppy we named Snoopy who grew into a very large dog for his breed. Helen stayed home and kept him company. After two years I moved on to another postdoc position at Yale. We rented a comfortable house in Beacon Falls, a half hour drive from New Haven. It was less expensive and roomier than a small apartment in New Haven, and it was in an attractive location, across the road from a waterfall on a creek and a wooded area. The house was on a steep hill, and you had to make a turn up a steeper slope to reach the garage. Our experience with coming home in snowstorms taught us what to avoid later on.

Beacon Falls is located on the Housatonic River, which today is again a clear waterway, but it was then polluted with noxious discharges from the Naugahyde and other factories not far upstream. The town itself had a large, closed candy factory building. The attractive neighborhood near a closed plant and a polluted river were typical for Connecticut in those days.

Helen was ready to rejoin the work force. She searched for jobs all over the state, going north to Hartford, west to Connecticut, and east to Rhode Island, applying to perhaps fifty companies. At one firm somebody actually said they did not have facilities for women. "You don't have secretaries?" she asked. Finally, she reached the employment offices of Southern New England Telephone, aka SNET, which was hiring engineers. They had separate men's and women's employment offices, and she was referred to the men's office since engineering was men's work. She had good interviews with the personnel officer and with the engineer in charge of the department. They told her that an offer would shortly be forthcoming. Weeks went by without a response, and whenever she called, they were reassuring. Eventually she was hired; having a woman in a man's job had required additional time-consuming levels of approval. SNET bought its technology and equipment from other sources, and the relatively simple mission of its engineers was to make projections of future growth in demand and to plan installations accordingly.

Advancement in the company meant pursuing management positions, not high technology. Step one for promotion was an exam on basic math

and engineering material. If you did well enough you were eligible to attend multi-day training workshops offered at a distant city. Helen got a letter with her score and the statement that it was not high enough for the program. She checked with her colleagues and discovered that her score was higher than some who had been told they passed. She had no interest in attending the workshops, since she knew we would be moving on, but she had them correct the records. SNET may have been more welcoming than other companies, but sexism still persisted.

Helen became pregnant and company policy required pregnant women to leave. She didn't tell anyone about her pregnancy, and nobody asked her about it. Maybe they didn't notice since she was a large woman carrying a small baby, or else they pretended not to. Finally on December 16, 1964, after a visit to her obstetrician, she returned to her office and resigned. That evening our two-pound two-ounce baby, Laura, was born.

Several months later we moved on to UMass and bought a house in Echo Hill, an attractively wooded new Amherst development. Helen stayed home, raising our young family which soon included Amy and Jeffrey, and of course Snoopy. She became active in Round World Women, which helped foreign graduate student and faculty wives to adjust to life in Amherst. She also managed a blood bank and organized a program of gourmet dinners for the University Women group.

In 1983 I bought an early IBM PC and helped to form a user's group that enabled people to provide mutual support. Before long we had a computer in our basement office dedicated to running an electronic bulletin board program (bbs) with three phone lines and modems supporting simultaneous logins. It was open to the public and featured private email, echomail forums – essentially listservs – and shareware via the 30,000-node international Fidonet network. (Shareware was programs that could be distributed freely but requested a small payment if used.)

Our small-town high schools typically had just one physics teacher, so these people tended to be isolated. A bbs would connect them with colleagues and university faculty. I got a \$12,000 grant from the UMass President's office and the Physics Forum bbs went online in May 1987. We quickly uncovered multiple challenges to the program. Many physics teachers lacked computers, and if they had one, it was often an Apple IIe which meant that we needed to buy one to provide support. They also needed a modem and telecommunications software, which we

would provide. If the computer was at school, they usually had difficulty with access to a phone line. And finally, they needed training on how to use their software and the Forum.

This modest effort to help some teachers led to unplanned new career directions that would last over three decades for both of us. We soon invited any teachers to go online, not just physics teachers, and got a state grant to support an 800 line. We expanded to bbs computers at other sites and arranged for toll free access statewide. We gave demonstrations at teacher conferences and workshops. Helen provided training and telephone support; she copied and distributed telecommunications software. The bbs were eventually replaced by the UMassK12 internet service, which brought new support issues.

With the aid of several collaborators, I began writing NSF, NASA and state grant proposals for science and technology teacher programs that would eventually produce awards totaling over \$16 million. Helen helped in whatever additional ways were needed such as hosting buffet dinners for summer workshop participants, running credit cards for programs charging fees, and keeping financial records.

A generous retirement package motivated me to retire from my faculty position in December 1997, but we continued with our outreach efforts. By June 2019 Helen and I were ready to retire again. Our main collaborators had moved away or retired, grant funds were increasingly scarce, and we were both running out of energy in our mid-eighties. Our aging UMassk12 server went offline two years later, but our workshop materials and related documents were archived on Scholarworks and are available to the public.

Helen and I could not have chosen a better time to retire. Less than a year later the Covid virus would make major headaches for anyone running an in-person program. I would like to thank Helen for providing some of the information for this essay.

Addendum: I wondered how much the situation has changed in engineering. According to Google and the 2020 U.S. census, "Women working in engineering occupations increased from 3% in 1970 to 15% in 2019." Female students presently account for 22% of UMass engineering undergrads. These numbers represent modest progress. The situation in physics is a bit different. There were no women in my cohort of physics majors at CCNY, but it was a small group.

Little has changed in physics since I came to UMass over fifty years ago. Then about twenty percent of our majors were women. Nationally now the fraction is about twenty percent. It is the same today for UMass, although the total number of our majors is much larger. It's interesting to note the approximate equality of the present UMass engineering and physics student percentages. They are both low.

This may represent a fear of mathematics in girls, even though they score at least as well as boys on standardized math tests in high school. Medicine presents a much better picture. Women now account for slightly more than half of medical school students, up from a tiny fraction in earlier generations. They are a majority of biology undergrads, and at least at UMass, about half of the chemistry majors. I have no idea why chemistry has been more successful in attracting women than has physics.