Women engineers and scientists still making inroads

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By Judy Peet

Karen Spindel, 62, of Clifton, looks into a computer as she works at her home in Clifton. About 40 years after federal law mandated equal rights for women scientists and engineers, they still have a long way to go. Engineer Karen Spindel was there in the beginning, when she wasn't even allowed in factories. (Mitsu Yasukawa/ The Star-Ledger)

It happened in 1969, but for the bitter anger Karen Spindel still feels, it could have been yesterday. She was a senior engineering student at George Washington University, on a field tour at Bethlehem Steel in Pennsylvania, held hostage on the bus by an armed steel company security guard. Her crime: her gender. "First they said it was my skirt, which women in college were required to wear back then," said Spindel, now a 62-year-old quality control manager in Clifton.

"Then they just refused to let me out of the bus and stuck a guard with a gun on the seat next to me. "Am I still bitter? You betcha," she said. "I spent most of my career as an outsider, with bosses who based raises on who they drank and golfed with. I was isolated, overlooked from promotions, and I'm not sure things have gotten that much better." Celebrating women's historic achievements is gratifying. But 30 years after President Carter signed the Science and Technology Equal Opportunities Act — mandating that women have equal opportunity in education, training and employment in scientific and technical fields — the party among women scientists has been a bit subdued.

Relatively, things have gotten better. Last year alone, five women were awarded the Nobel Prize, three in scientific fields, and a record number of women received the National Medal of Science. In 2007, more high school girls than boys won top honors in the prestigious Siemens Competition in Math, Science and Technology, for the first time in its history. There are now programs in almost every school district and university designed to encourage girls and young women to embrace science and technology. There are foundation grants offering child care to women traveling scholars and post-doctoral fellows. Women are now in every branch of science, and received 62 percent of all the biology undergraduate degrees, 52 percent of all the chemistry degrees and nearly half of all the mathematics and ocean science degrees awarded in 2006, according to industry statistics. The younger scientists are more assertive and understand the system. They are women like Treena Arinzeh, 39, a New Jersey Institute of Technology biomedical assistant professor who says networking and ease with male colleagues is "just part of what I grew up

with." Computer engineer Ziqian "Cecilia" Dong, 32, said, "I grew up not only encouraged, but expected by my family to use my talents in math, engineering and physics. Things may be harder for women, but it is our job to stand up for ourselves." "We are used to seeing girls and women in all jobs and we know we can do it," added Arinzeh, whose research is to create synthetic spinal scaffolding to help stem cells rebuild a damaged spinal cord. "But I tell my female students, go to the conferences, make the connections."

INEQUALITY REMAINS

Arinzeh said she "sees more balance" among men and women in her field, yet statistics show there is still inequity overall. Women comprise only 27 percent of the actual science and technology work force, and women engineering graduates actually declined over the past decade. Repeated studies show that women scientists and engineers are likely to make less, publish less, get less research grant money, fewer opportunities for promotion, and fewer patents. New Jersey ranks 16th for patents and is in the bottom 10 nationwide for science and engineering doctorates conferred, according to the Commission on Professionals in Science and Technology. The state’s universities all have active female recruitment and retention programs, but some researchers believe there is a backlash from women already in the industry sending back discouraging news to the younger generation. "Women in science and engineering can easily spend their entire careers on the periphery, far away from the flow of information that powers careers," said Nancy Steffen-Fluhr, director of the Murray Center for Women in Technology at NJIT. "It’s not necessarily the bald discrimination that women faced years ago," added Steffen-Fluhr, who has spent more than a decade studying the

subtle ways career women are sidelined. "It is the small things, the little biases that accumulate into enormous disparities over a career." Take salary, for example. Women in computer and math professions make an average salary of $62,000, the U.S. Census reports. That is nearly twice the median for all working women, but about 20 percent less than men make in those fields. Many women say salary is the least of their issues. "It’s about getting the grants and the patents and getting to the top of the ladder," said Gert Clarke, 78, a retired nuclear physicist, science teacher and chair of the New Jersey Inventors Hall of Fame. "Things are getting better now, but we are nowhere close to parity." There are exceptions. Yvonne Claeys Brill, the 2009 New Jersey Inventors Hall of Fame inductee, is one of them.

Yvonne Brill (R) and Gert Clarke, physicist and chairwomen of the NJ Inventors Hall of Fame (L) at last year's induction ceremony. photo credit: Jim Cummins

In the 1940s, when Brill applied to study engineering at the University of Manitoba, she said she was denied because "there were no accommodations for women at the required outdoor engineering camp." She studied math and chemistry instead. Graduate work took her to California, where she got a job at Douglas Aircraft. It was, she recalls, "an exciting time. It was the birth of aerospace." "Nobody had the right degrees back then, so it didn’t matter. I didn’t have engineering, but the engineers didn’t have the chemistry and math. We all learned together." After breaks for three children, Brill ended up at RCA in Princeton where she pioneered rocket propellant studies. In 1972, she patented the hydrazine resistojet propulsion system. The first communications satellite using that system was launched in 1983. It is still being used. Brill was named to the state’s

inventors hall of fame last year. She is the first women so honored.

DISCOURAGEMENTS

Asked why so few women receive the kudos they deserve, Brill, who still consults and mentors young scientists, shrugged: "In order to get an honor, you have to be nominated. It rarely occurs to men to nominate women." Brill said she is discouraged not only by the lack of women scientists, but the state of science in general: "We need all the good minds we can get. The ratio of lawyers to scientists in this country is ridiculous." Women scientists said that today, unlike 40 years ago, there are role models, such as women astronauts, inventors and physicists. But there are still not enough mentors. Biologist Carol W. Greider, who received the 2009 Nobel Prize for her work in telomeres, was asked by the Nobel organization why so many women scientists are working in telomeres, but not in other fields. "It's the founder effect," she replied. "Women researchers were fostered early on by (pioneering Yale researcher Joseph) Gall, and they got jobs around the country and they trained other women." That is in contrast to Jill Tienjin, past president of the Society of Women Engineers and former dean of engineering at the University of Colorado. "Most of my career, I was the only woman." "Breakthroughs and inventions are often collaborative efforts. Men collaborate with each other, but who are the women collaborating with?" One answer may be each other, but only if the pool is enlarged. That is the goal at women-only Smith College, which has the only exclusively female engineering program in the country. "I call it the 80/20 factor. When men outnumber women, women's voices get drowned out. That is why we want to teach them the skills they need to compete in the marketplace," program director Linda Ellen Jones said

of women. "They need the technical skills, but we also teach negotiation, assertiveness and the reality of the workplace culture." Growing up in Beijing, Dong said she was strongly urged to follow her talents in science and technology, an attitude driven in part by China's acute need for growth in those fields

RECEIVING SUPPORT

"I was a little surprised when I came to NJIT how few other women there were in my engineering classes," said Dong, now pursuing post-doctoral studies in computer engineering at Stevens Institute of Technology while teaching at NJIT and Monmouth University. "There were some not-so-pleasant experiences, but it is my job to fight for myself against discrimination, and at NJIT I got a lot of support from women on campus and the Society of Women Engineers," added Dong, who was honored by the New Jersey Inventors Hall of Fame last year for her work in computer switches. "I am happy to see more women in the computer and engineering classes I teach," she added. "We know we can do the work. We just have to push harder." The key — and the hope for future scientists — is networking, according to Steffen-Fluhr. "Networks are the social capital that powers career success. It is how you discover hot research topics, receive grant invitations and get published, but networking is a weakness among women scientists of our generation," she said. "The good news is the next generation is better at it." Another key factor is sheer determination, Spindel said. "I might not have been allowed on that tour of Bethlehem Steel, but I got a job there when I graduated. I eventually changed careers, but not until I made senior engineer at AT&T," she said. "Parity is possible, but women have got to get together and insist on it."