Mildred Dresselhaus (1930-2017)
Gene F. Dresselhaus (1929-2021)

Mildred “Millie” Dresselhaus was born in 1930, during the Great Depression, in the Bronx. Her parents had immigrated to New York from Poland. The family was poor, but Dresselhaus and her brother possessed rare musical talent. She was an exceptional violin player and received a scholarship to a music school where she befriended children whose academic school environment far exceeded the educational opportunities at Dresselhaus’s neighborhood school. The divide motivated her, at age 13, to apply for a spot at the competitive Hunter College High School for Girls. Attending the school was a turning point in Dresselhaus’s life. It was there that she met Roslyn Yalow, a physics teacher and future Nobel laureate, who encouraged her to consider a career in science. Dresselhaus graduated from Hunter in 1951 and accepted a Fulbright Fellowship at the University of Cambridge in England. She then earned a master’s degree from Radcliffe College in 1953 and a Ph.D. from the University of Chicago in 1958. In 1953 Dresselhaus took a course from and befriended Enrico Fermi, who had been honored with The Franklin Institute’s Franklin Medal six years earlier. Though Fermi would pass away soon after, he would remain a powerful influence on Dresselhaus throughout her career.

In 1960 Dresselhaus joined the Lincoln Lab at MIT, where she diverged from her graduate study on semiconductors and turned her attention to the properties of graphite. After disappointing initial experiments, Dresselhaus persevered to obtain data that provided the most accurate characterization of carbon’s electronic band structure that had ever been achieved. Her research success led to an appointment as a visiting faculty member in the Electrical Engineering Department at MIT under the Abby Mauze Rockefeller Fund, established to promote the scholarship of women in science and engineering. Her talent and devotion to science were clear and, in short order, her position evolved into a tenured professorship in 1968, making Dresselhaus MIT’s first tenured female faculty member in engineering.

Throughout the 1970s, Dresselhaus built her scientific reputation with her study of graphene intercalation compounds. Graphene is composed of sheets of carbon atoms connected in a hexagonal structure. Intercalation compounds introduce elements between the carbon layers, inducing unique electrical properties like superconductivity. Her extensive research of these materials resulted in a better understanding of fundamental quantum concepts which Dresselhaus used to update theoretical equations as they apply to nonmaterial systems.

A decade later, Dresselhaus's group pursued new carbon materials by blasting graphite with lasers. The ablation produced large carbon clusters of 60 or 70 atoms. Richard Smalley, who was independently performing similar experiments, identified the clusters as fullerenes, more commonly called buckyballs. (Smalley would go on to win The Franklin Institute's Franklin Medal for this work in 1996.) Dresselhaus spent the remainder of her career calculating the intricacies of carbon nanotubes, which she determined could be formed by elongating the fullerene structure instead of terminating it into a buckyball. She showed that the electrical properties of the carbon nanotubes changed with the orientation of the hexagonal structure. Her calculations of these electrical properties revealed that carbon nanotubes could be applied as either metals or semiconductors.

As a female researcher in the physical sciences, Dresselhaus was a trailblazer, inspiring innumerable girls and women to follow in her footsteps. In the early 1970s, she co-founded the Women's Forum, which met weekly to discuss topics relevant to working women. In addition to being the first woman at MIT to achieve the rank of tenured professor, in 1990 she became the first woman to receive the National Medal of Science in engineering. Among her many accolades are the National Medal of Freedom, the Kavli Prize in Nanoscience (the first solo recipient in Kavli Prize history), the U.S. Department of Energy's Enrico Fermi Award, the Weizmann Women and Science Millennial Lifetime Achievement Award, and 36 honorary doctorates. She has also served in many important leadership roles, including president of the American Physical Society and of the American Association for the Advancement of Science and director of the U.S. Department of Energy Office of Science.

Millie was widely known as the "Queen of Carbon and remained a powerful figure with tremendous impact spanning physics, engineering, and materials science and had an unparalleled career, making crucial advances in the understanding of the thermal and electrical properties of carbon nanomaterials during her nearly 60 years at the MIT. Perhaps her most powerful contributions that extended far beyond her technical achievements was her role in training and inspiring generations of scientists and engineers of many disciplines who keep her legacy alive through their own work.

Millie passed away on February 20, 2017, at age 86. Her life remains an indelible source of inspiration to pursue one's passion despite any obstacle. Millie was also a close research collaborator of her beloved husband, Gene Dresselhaus. Gene was a partner in every aspect of Millie's life and himself was a brilliant scientist and will be remembered as the discoverer of the Dresselhaus effect and for his pioneering ideas that shaped modern band theory. They had four children: Marianne, Carl, Paul, and Eliot; and five grandchildren. Gene passed away on September 29, 2021, at age 91.