MICHAEL D. DUNCAN/AIP ESVA

A 2007 portrait of Mildred Dresselhaus.

Thoroughly modern Millie

For the first time, in 2023 the annual awards ceremony at the APS March Meeting will include the Mildred Dresselhaus Prize in Nanoscience or Nanomaterials. Born in 1930, Dresselhaus spent 57 years at MIT. After seven years as a researcher at the university-operated Lincoln Laboratory and one year as a visiting professor in an appointment designated for women, she broke tradition in 1968 when she became the first female tenured full professor in the department of electrical engineering. In 1983 she received a joint appointment in the MIT physics department.

Dresselhaus's research had many practical applications for semiconductors, conductors, and superconductors, but she most enthusiastically studied the fundamental electrical and thermal properties of materials. When investigating alkali metals such as potassium or sodium, for example, she sought to determine whether they could be inserted (or intercalated) between graphite layers of carbon atoms to make a superconducting system. Her evolving specialties were graphite, carbon fibers, large carbon clusters such as fullerenes, and by the 1990s, tubular fullerenes—now known as carbon nanotubes.

Two coauthored 1992 papers on nanotubes, for example, showed that they conduct differently depending on their diameter and the orientation of their carbon hexagons around the tube or cylinder. By the early 2000s, Dresselhaus had been nicknamed the "queen of carbon science," as indicated in the title of this engaging and inspirational new biography by Maia Weinstock.

A writer and lecturer on the history of women in science, Weinstock met Dresselhaus only once, in 2014, a few days before Dresselhaus received the Presidential Medal of Freedom from Barack Obama: one of many awards, prizes, honorary degrees, and elected professional offices that she received before her death in 2017. Weinstock's biography nonetheless skillfully makes use of interviews, oral histories, and published materials. The fast-moving chronological narrative offers a clear account of Dresselhaus's scientific research and valuable insights into the building of her successful career as a woman scientist.

The child of a financially struggling Polish Jewish immigrant family, Mildred "Millie" Dresselhaus (née Spiewak) spent her early years in inadequate and gang-ridden public schools in Brooklyn and the Bronx. With determination, hard work, and a keen intellect, Millie was accepted into Hunter College High School, which at that time was an all-girls institution, from which she continued to Hunter College. A Fulbright Fellowship took her to the University of Cambridge for a year before she began graduate studies at Radcliffe College. She finished her PhD at the University of Chicago, where she found less prejudice against women than in Harvard Yard.

Teachers helped shape the curious and unflappable Dresselhaus. Her mentor at Hunter College was Rosalyn Yalow, who would later be awarded a

Carbon Queen

The Remarkable Life of Nanoscience Pioneer Mildred Dresselhaus

Maia Weinstock
MIT Press, 2022. $24.95

share of the 1977 Nobel Prize in Physiology or Medicine. Yalow told Millie that she was perfectly capable of graduate work in math and science and did not have to settle for a "female" trajectory of high school teaching or nursing school. At Chicago she boarded for a year with another future Nobel winner, Maria Goeppert Mayer, and came to know as teacher and mentor a third Nobelist, Enrico Fermi, whose habits of hosting student dinners and giving out handwritten notes before lectures she later adopted.

Most important was Gene Dresselhaus, a young theoretical physicist who made his first mark while in graduate school at the University of California, Berkeley, by discovering that electron spin can affect the range of energies of an electron in a solid material. Millie and Gene met at Chicago and married in 1958. They then moved to Cornell University, where he had a faculty job and she took an NSF postdoc. After Cornell's faculty made it clear that they would not hire her or even let her teach without pay, the Dresselhauses left for MIT's federally funded Lincoln Laboratory. Gene stayed at Lincoln until 1976, but Millie left after she was told to stop bringing their young children to the lab.

Because of her experiences, Dresselhaus saw one of her roles at MIT as being a voice for the university's few women students and faculty. She worked steadfastly with the food scientist Emily Wick, the aeronautics engineer Sheila Widnall, and others to further opportunities for women and to advocate for their equal treatment at MIT. Dresselhaus and Widnall also created an undergraduate course titled What Is Engineering to help students, especially women, learn how to make progress and to find engineering jobs. She continued such efforts throughout her career.

By the time of her death, Dresselhaus had published some 1700 research articles and eight books. Most of those were coauthored with a large array of coworkers, students, colleagues, and her husband, whose MIT position was in her research group. In their research together, he was the theoretician, she the experimentalist, she the writer, and he the editor. They became known as the materials-science power couple.

Although *Carbon Queen: The Remarkable Life of Nanoscience Pioneer Mildred Dresselhaus* ranges from the 1930s to the 2010s, little attention is given to how the political and social events of those decades (such as 1960s equal-opportunity legislation and the 1972 prohibition on sex-based discrimination in education) influenced Dresselhaus's life and career. Nevertheless, Weinstock's biography will appeal to a wide audience in science, engineering, gender studies, social studies of science, and sociology of science. Considerable attention, both scholarly and popular, has been paid to the dilemmas faced by women in the sciences. *Carbon Queen* provides an inspiring story of one very capable woman's response.

Mary Jo Nye
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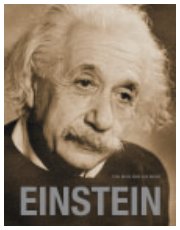
NEW BOOKS & MEDIA

A Traveler's Guide to the Stars

Les Johnson
Princeton U. Press, 2022. $27.95

Although people have been dreaming of space exploration for decades, visiting and settling other worlds is still the stuff of science fiction. Nevertheless, in *A Traveler's Guide to the Stars*, the physicist Les Johnson, a long-time proponent of interstellar travel, discusses what it will take to reach for the stars. After first providing a brief history of spaceflight and pondering potential destinations, Johnson launches into the core of the book: the technology challenges that will need to be met, which include revolutionary advancements in spacecraft propulsion, communications, navigation, and life-support systems. Rather than discourage, however, Johnson aims to encourage readers from all disciplines, not just science and engineering, to "think big." —CC

Einstein



The Man and His Mind

Gary S. Berger and Michael DiRuggiero
Damiani, 2022. $70.00

Nearing 70 years after Albert Einstein's death, the mystique surrounding the physicist shows no signs of abating. Probably the first celebrity scientist, his name alone is synonymous with genius. This new coffee-table book published by the Italian art press Damiani reproduces over a hundred Einstein-related items—including photographs, letters, and offprints of his scientific articles—from the private collection of Gary Berger. It distinguishes itself from the realm of kitschy Einsteiniana in how the documents illustrate the physicist's human side: The letters and the inscriptions on the photos show how even after decades in the US, Einstein's social circles remained dominated by Germanophone émigrés such as the photographer Lotte Jacobi. —RD

Engines

The Inner Workings of Machines That Move the World

Theodore Gray; photographs by Nick Mann
Black Dog & Leventhal, 2022. $32.00

This new large-format book by Theodore Gray, an author and chemistry enthusiast, is a tinkerer's dream. Featuring images, cross sections, and diagrams of engines and motors of all varieties, *Engines* delves into how those ubiquitous devices function. A particular highlight is Gray's deep dive into the diesel-powered hydraulic motors used by the Amish, who generally eschew electricity but still need to produce furniture on an industrial scale: They retrofit commercial electric devices to use compressed-air motors. The book mainly focuses on steam engines, internal-combustion engines, and electric motors, and a final chapter examines a grab bag of devices such as linear motors and sewing machines. —RD PT