Book Reviews

'The feminine technology': a study of pioneering women in nuclear physics

by Jessica Primack

Kernenergie: Die weibliche Technik (Nuclear Energy: The Feminine Technology)
by Jonathan Tennenbaum
Dr. Boettiger Verlags-GmbH, Wiesbaden, 1994
397 pages, paperbound, DM 28.80

I opened this book with initial skepticism. How would it be different from other biographies of a few of the important women in the field of nuclear science? The answer became clear quite quickly.

Tennenbaum states the theme of the book as the "double revolution" of the "atom women." This double revolution was the discovery of radiation, opening a whole new field in natural science, and the breakthrough in the recognition of women as scientists. The author re-creates the process of discovery in such a vivid way that the reader shares the joy experienced by the scientist.

I will present a few of the people whom Tennenbaum introduced me to, and a bit of their life's work. The "atom women" who are discussed in the book include: Marie Curie, Irène Joliot-Curie, Ida Noddack, Maria Goeppert-Mayer, Lise Meitner, Elisabeth Rona, Ellen Gleditsch, Marguerite Perey, Chien-Shiung Wu, and Dixy Lee Ray.

Mendeleyev and the music of the elements

The book starts with a short history of the development of the understanding of matter. One of the most important steps along the way to mankind's ability to utilize nuclear energy, was the revolutionary discovery by Dmitri Mendeleyev of the periodic system of the elements. What was particularly important, was Mendeleyev's method of discovery. He gathered the sparse knowledge of the elements known in the 1860s, and worked from an ordering principle. Mendeleyev describes it: "Simply the lumping together of facts . . . does not deserve to be called science of a higher form. The building of science needs not only building material, but also a concept, a harmony." His special genius was that he used his hypothesis to correct the characteristics (weight, atomic number, reaction with other elements) of the known elements, and even dared to leave holes in his system and to predict the characteristics of the missing elements. The predictions that Mendeleyev made were proven to be true in the decades to come. His periodic system became the frame of reference for future research in chemistry and physics.

Marie Curie and the method of hypothesis

The 1890s were the decade of "rays." Roentgen discovered X-rays, and Bacquerel, radioactivity. Bacquerel was trying to find out what these rays were; it seemed as if the element uranium had "an energy of its own." This unexplained phenomenon is what Marie Curie decided to write her doctoral dissertation on. Her objective was "to examine the origin of the tiny amount of energy that was sent out, through rays, of the element of uranium." After much tedious work, she published her findings. She hypothesized correctly many of the characteristics of the elements (polonium, radium) that she had not yet discovered. "All matter examined containing uranium," she wrote, "is active based on the ratio of uranium contained in the substance. . . . It is interesting to note that the two most active elements, uranium and thorium, are also the elements which have the highest atomic weight. . . . Two minerals containing uranium are much more active than uranium itself. This very notable fact leads to the hypothesis, that these minerals contain another element, that is much more active than uranium." She also pointed out that uranium is radioactive within all chemical compounds, that the element itself is radioactive.

Mrs. Curie's work was based on a continuous hypothesis. As Tennenbaum explains, the process of hypothesis which enables the scientist to ask fruitful questions, the which is no longer found in modern science textbooks, is the "subjective aspect" of science. The generation of Marie Curie did not only assess facts, but studied by working through the original works of great scientists, and learned

the process of discovery.

Unfortunately, the very fruitful work of Pierre and Marie Curie was suddenly interrupted by the death of Pierre.

It is important to understand under what conditions the "atom women" worked, and the prejudices they had to deal with. In 1900, for example, Dr. Paul Moebius wrote a book called *The Mental Deficiency of Women,* which was reprinted 12 times until 1920. According to him: "It is proven that those parts of the brain which are essential for mental activity, being the flaps of the forehead and temples, are less developed in women than in men, and that this difference is from the time of birth." One can just imagine what Marie and Pierre thought of such statements!

After the death of Pierre, Marie spent more time in the laboratory because, as she said, "that is all I can do." A horrible witchhunt was started against her. Just four months after the death of Pierre, Lord Kelvin, the infamous scientist from England who got his title from marrying into the aristocracy, wrote a nasty letter to the London *Times,* claiming that radium is not a new element at all, but probably a mixture of lead and helium. It is interesting to note that Lord Kelvin did not write his letter to a scientific magazine, but to a popular newspaper. Marie Curie felt obliged to produce pure radium from radium chloride. It took four years of strenuous work, but she finally produced pure radium and had proof of the validity of her life's work.

Ida Noddack, the daring young scientist

Tennenbaum introduces the reader to one of the most interesting "atom women," who unfortunately is much less well known. In 1934, Enrico Fermi received Ida Noddack's open letter, printed in the magazine *Angewandte Chemie*. Her letter criticized the conclusions he had come to involving experiments in which neutrons were shot at uranium; the results of those experiments could not be explained by the chemistry of the time. Fermi had concluded that when uranium was shot with neutrons, the neutrons became protons and created "transuranium." Noddack demonstrated that his thesis was not sufficiently well researched, and she predicted the splitting of uranium. She had correctly hypothesized atomic fission, five years before Otto Hahn and Fritz Strassmann discovered it.

Ida Noddack was born on Feb. 25, 1896 in a small town in Germany. Her father owned a varnish factory, so she was probably exposed to chemistry at an early age. She studied in Berlin and received her doctorate in chemistry in 1921. She was especially interested in chemistry's fundamental questions. At that time, there were still holes in Mendeleyev's periodic table of elements. She and her future husband decided to join "the hunt for the elements."

Their method of approach allows one to understand why Mrs. Noddack was able to predict the fission of atoms. It became clear to them that all the other chemists were looking

in the wrong places for elements. Mrs. Noddack described their work: "Already in 1871 Mendeleyev predicted three of his system's missing places, whose characteristics he derived from their vertical and horizontal neighbors. . . . But it seems that Mendeleyev, who had a wonderful imagination, did not dare to predict other empty spaces. . . . Among these few holes it was especially noticeable that there were two directly below manganese. . . . We soon realized that the few textbooks available at that time were not sufficient for our work. . . . We had to work through papers of the original literature of the past 100 years. . . . We realized that in the vertical group of the system there were not only somewhat steady changes, but also jumps, and for analogous reasons, these jumps must take place between manganese and the ekamanganese which lies directly underneath it."

The Noddacks scientifically guessed the charter of elements and then began their hunt for the very rare elements. Because they worked from an ordering principle, their guesses were correct. After many years of work, they published the findings of the two elements: number 43, masurium, and number 72, rhenium.

Something unbelievable then happened: a total denial from the scientific world! How could two young chickens have found the elements that for years had eluded so-called great scientists? The Noddacks decided to look for rhenium in its pure state, and travelled to Norway to collect the mineral. They succeeded, and proved that rhenium is element number 72. Unfortunately, masurium is so rare that they were unable to prove its existence. The element was later produced artificially and given the name technetium.

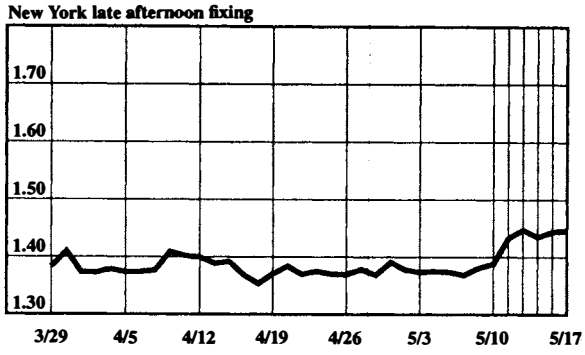
Tennenbaum opens up the world of science and the joy of discovery to those of us who generally think of it as dull, simply a matter of memorizing facts. If I were a science teacher, this book would be the first book the children would read.

Beyond that, there is an urgent political dimension. In Germany, the Green party, which is totally opposed to all advanced technology, especially nuclear energy, is now considered the third-strongest party. Without nuclear power, not only will industrial nations like Germany become impoverished, because energy costs will be so high, but also developing-sector nations will lose whatever chance they would have had to become industrialized. These Greenies, who, in the name of "feminism," are preventing Third World women from developing their nations, have also done horrible things to the youth of Germany. As this author can attest from her recent years' attendance as a student in a German *Gymnasium*, the Green ideology has become predominant among German youth, and has inserted itself as a central component of the German education system. The Greens have taken away young people's ability to be excited about discovering something, as these women scientists did, which can change the lives of people all over the world. This book is a necessary antidote to this Green disease.

Currency Rates

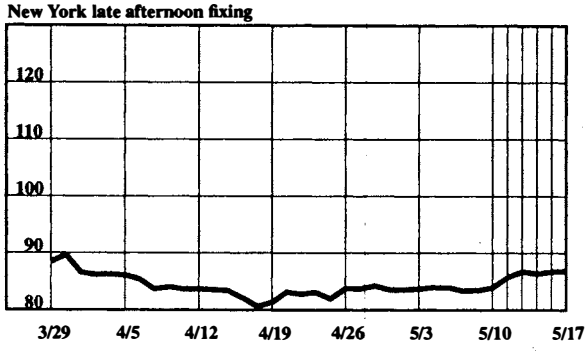
The dollar in deutschemarks

New York late afternoon fixing



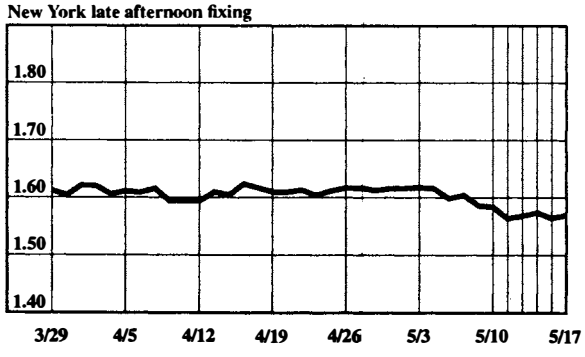
The dollar in yen

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing