

Margaret Butler, the first woman named a fellow of the American Nuclear Society, of which she was also an Honorary Lifetime Member, passed away in Illinois on March 8, 2013, at the age of 89. Deeply involved in the mathematics and numerical computations for the design of the Navy's first nuclear submarine reactor, Margaret subsequently became part of the logical design team for several early computers at Argonne National Laboratory. She later headed the first operating system used at Argonne for the IBM 704, was leader of the Applications Programming Section in Argonne's Applied Mathematics Division, and served as the director of the National Energy Software Center. Margaret was widely recognized for her contributions to computer architecture and programming, benchmarking and performance measurement, and software standards. She remains an inspiration to anyone interested in working in the computational sciences.

Like many students, Margaret was at first unsure of her career goals. As an undergraduate at Indiana University, she enrolled in the typical basic courses, such as philosophy and social science. But she found them frustrating. One could, she claimed, simply argue different sides to a question. She preferred subjects where one could get the "right" answer. It was when she enrolled in mathematics and statistics courses that she found her lifelong love—she majored in mathematics and graduated with a bachelor's degree in 1944.

Her first job was with the Bureau of Labor Statistics as a statistician in Washington, DC. This was soon followed by a three-year position as a statistician in the U.S. Air Force in Europe. Margaret often spoke of these early experiences, urging young people to take advantage of opportunities to travel and gain a better understanding of their abilities and interests.

On returning to America, Margaret began her long career at Argonne National Laboratory—initially as a "computer." At the time, a computer was a far cry from the giant architectures of today. In fact, a computer was a person, one who carried out numerical calculations—on a slide rule—needed to solve complex engineering problems. Margaret's work involved solving eigenvalue problems, applying relaxation methods to PDEs, and finding Bessel functions for nuclear reactor design studies. She found the work fascinating, though sometimes tedious, she admitted, because the same calculations had to be repeated to verify the results. Such insistence on rigorous testing, as well as perseverance in a task, became an important part of her work ethic, and one she often stressed to those new to computational science.

In 1949, Margaret was invited to join a special project at the Bureau of Labor Statistics. Feeling that her gender and lack of a PhD would make further advancement at Argonne difficult, she decided to accept the invitation. Rather than being discouraged by the obstacles at Argonne, Margaret jumped at the new adventure. We all have a lot of choices, she said, and that is what makes our lives interesting.

Upon completion of the project at BLS, Margaret returned to Argonne to work in the Reactor Engineering Division—the Applied Mathematics Division would be created only much later. Her choice this time was both personal—she married Jim Butler, an Argonne mathematician (with whom she later had a son, Jay)—and professional: her new title was

assistant mathematician.

The next two decades were an exciting time for Margaret. One of her earliest assignments in her new position was to write the floating-point arithmetic system for the AVIDAC computer. Floating-point hardware had not yet been built into computers. Nor were any courses available on computer architecture: She had to learn along with her colleagues—and then teach the material to newcomers! Some would have found it difficult. Margaret called it “the best of times!” After AVIDAC, Margaret moved on to Argonne’s next two computers, GEORGE and ORACLE, for which she wrote mathematical subroutines, systems software, reactor applications, and utilities.

Margaret’s skills in interacting with scientists and engineers, coupled with her technical expertise, earned her promotions, to group leader for the Reactor Computing Group in 1957 and head of the newly formed Applications Programming Section in 1958. She worked with scientists not only in reactor physics but also in other scientific disciplines and management applications. Creating effective team environments was a critical key to her success.

Margaret also found time to conduct original research. Particularly challenging was the development of an automatic system for analyzing metaphase chromosome images using Chloe, a new film-scanning and image-processing system developed at Argonne. Another project involved measuring fragmentation residues on films from chemical engineering studies of physical and chemical interactions between reactor structure and fuel materials.

But Margaret may be most remembered for her contributions as director of the National Energy Software Center (NESC), from 1972 to 1991. Under her leadership, the center expanded from its small beginnings as the Argonne Code Center to become the software exchange and information center for the U.S. Department of Energy and the Nuclear Regulatory Commission. For almost two decades, Margaret led an ever-expanding staff responsible for collecting, packaging, and distributing software. Her role was not without controversy. Her insistence on rigorous testing was viewed by some as just a way to slow the use of their products. Today, this very insistence on testing has become paramount!

After “retiring” in 1991, Margaret wrote a book titled *Careers for Women in Nuclear Science and Technology*. She was deeply interested in the role of women in science; acknowledging that women still did not constitute a critical mass in computer science, she exhorted them to work hard, take lots of math courses, and participate in activities of professional societies. A mentor and role model herself, she continued to work at Argonne from 1993 to 2006 as a special-term appointee. With colleagues, she formed the Chicago-area chapter of the Association for Women in Science, which sponsored career conferences for middle-school and high-school students, and helped pave the way for Argonne’s annual event, Science Careers in Search of Women.

Margaret certainly faced challenges. Without an advanced degree in mathematics, she was initially hired as a “junior” mathematician, a title she found galling. Even after becoming section manager, she was passed up for higher promotion as a researcher. But she persevered. The work itself was exciting, and she was able to find joy in her position

as full-time director of NESC. Her motto: Onward and Upward!

Margaret will be remembered as a pioneer, from her work as a “computer” to her achievements as a computer scientist. Her analytical talents, vision, and drive led to a lifetime of scientific contributions—and helped build a foundation for the emergence of computational science as a peer in the process of scientific discovery with experimental and theoretical research.\*

In memory of Margaret Butler, the Argonne Leadership Computing Facility (ALCF) has created a new postdoctoral fellowship that offers computational scientists an opportunity to work at the forefront of high-performance computing.

ALCF invites outstanding postdoctoral candidates, both male and female, to apply for the Margaret Butler Fellowship in Computational Science, a one-year appointment that can be renewed for a second year. As one of two leadership-computing facilities supported by the U.S. Department of Energy, ALCF provides the computational science community with a world-class computing capability dedicated to accelerating breakthrough science and engineering discoveries for humanity. Additional information can be found at <http://www.alcf.anl.gov/margaret-butler-fellowship-computational-science> .

\*For further details, see *Margaret Butler: One Woman's Life in Science*, by Holly Stump, SemiWikiForum, 2013, <http://www.semiwiki.com/forum/content/2128-margaret-butler-one-woman%92s-life-science.html>

**Draft captions:**

[head shot, young Margaret]: Margaret’s career in mathematics began at Indiana University, where she graduated with a bachelor’s degree in 1944.

[assembling computer]: Margaret helped assemble the ORACLE computer with ORNL engineer Rudolph Klein. In 1953, ORACLE was the world’s fastest computer, multiplying 12-digit numbers in .0005 seconds. Designed at Argonne, it was constructed at Oak Ridge.

[pic at computer] Margaret may be most remembered for her contributions as director of the National Energy Software Center from 1972 to 1991.

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