Argonne NATIONAL LABORATORY

The Remarkable Career of

Margaret Butler:

From "Computer" to Senior Computer Scientist

presented by

Lois Curfman McInnes

30 Years of Parallel Computing at Argonne

May 14, 2013

U.S. DEPARTMENT OF ENERGY

Margaret Butler: One Woman's Life in Science

by Holly Stump

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2 Comments

46 years in Computing, 1945-1991

Margaret (Kampschaefer) Butler was a pioneer in technology, a ground-breaking woman who graduated with a B.S in Mathematics and Statistics in 1944, and followed a fascinating career path in the public sector starting in the earliest days of computers and nuclear energy. One of the early female "computers," she worked on the first atomic submarine. She also spent time overseas after WW II as an employee of the U.S. military. At Argonne National Laboratory, where she spent many years, Margaret worked with the AVIDAC, ORACLE, GEORGE, UNIVAC, and more, in the formative days of computing. Her experience spanned a technical management track in public service, as Director of the National Energy Software Center, which does R&D for a spectrum of Atomic Energy Commission issues. Margaret was the first woman Fellow at the American Nuclear Society, and is an Honorary Lifetime Member. Margaret draws on decades of success as well as setbacks, to provide a perspective on computer technology and women technologists. This is a story, for all scientists, that deserves to be told… and a celebration of her life, which passed on March 8, 2013…

http://www.semiwiki.com/forum/content/2128-margaret-butler-one-woman%92s-life-science.html

The formative years: 1924-1945

In Evansville with the family pet

Margaret and roommate at Indiana Univ

- Margaret Kampschaefer: born March 27, 1924, in Evansville, IN
- BS in Mathematics and Statistics, Indiana University, 1944
- Graduate work at U.S. Department of Agriculture Graduate School, University of Minnesota, and University of Chicago

Margaret's early career was thrilling

1945: Statistician with the Bureau of Labor Statistics in Washington, DC.

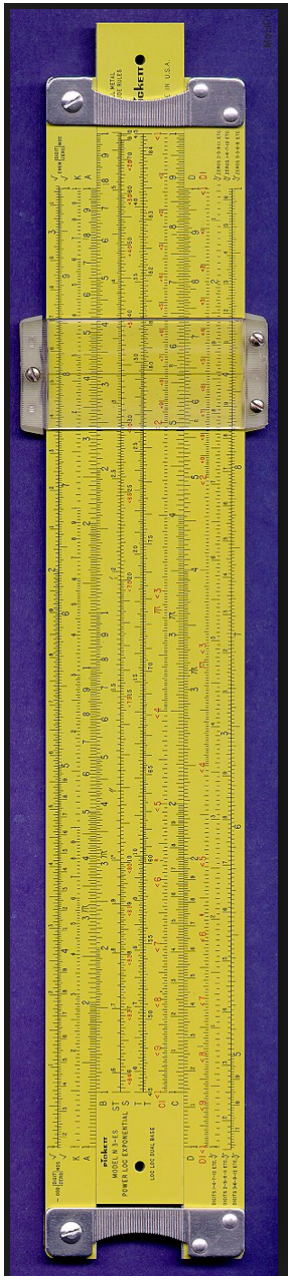
1946-1948: U.S. Air Force Statistician in Europe

Margaret believed in taking calculated career risks and recommended it to others. She believed that work, adventure, and trying out new opportunities help in exploring each person's own traits, capabilities, preferences, and values.

Margaret began her career at Argonne as a "Computer"

- **1948-1949: Junior Mathematician in the Naval Reactors Division**
  - helped to designing a prototype for the Navy's nuclear submarine reactor

- **Early work as a "Computer"**
  - an individual who performed computations required to solve mathematical physics and engineering problems using
    - slide rules
    - tables of integrals and special functions
    - electromechanical calculators
  - historical info:
    http://www.cnn.com/2011/TECH/innovation/02/08/women.rosies.math/



Career excitement at Argonne in 1951

- 1949-1951: Bureau of Labor Statistics, St. Paul, MN
- 1951: Assistant Mathematician in the Reactor Engineering Division
- 1951: Married Jim Butler, a mathematician at Argonne
- Argonne had obtained Atomic Energy Commission funding for construction of a digital computer, or "electronic brain," in the parlance of the day, to put at its disposal "the most modern means of scientific computation."

Margaret and Jim Butler at Argonne Distinguished Service Awards Ceremony, 1986

AVIDAC: Argonne's Version of the Institute's Digital Arithmetic Computer: 1949-1953

"Moll" Flanders, Director
Jeffrey Chu, Chief Engineer

- **AVIDAC: based on prototype at the Institute for Advanced Study in Princeton**
- **Margaret wrote AVIDAC's interpretive floating-point arithmetic system**
  - Memory access time: 15 microsec
  - Addition: 10 microsec
  - Multiplication: 1 millisec
- **AVIDAC press: @ 100,000 times as fast as a trained "Computer" using a desk calculator**

Early work on computer architecture

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.

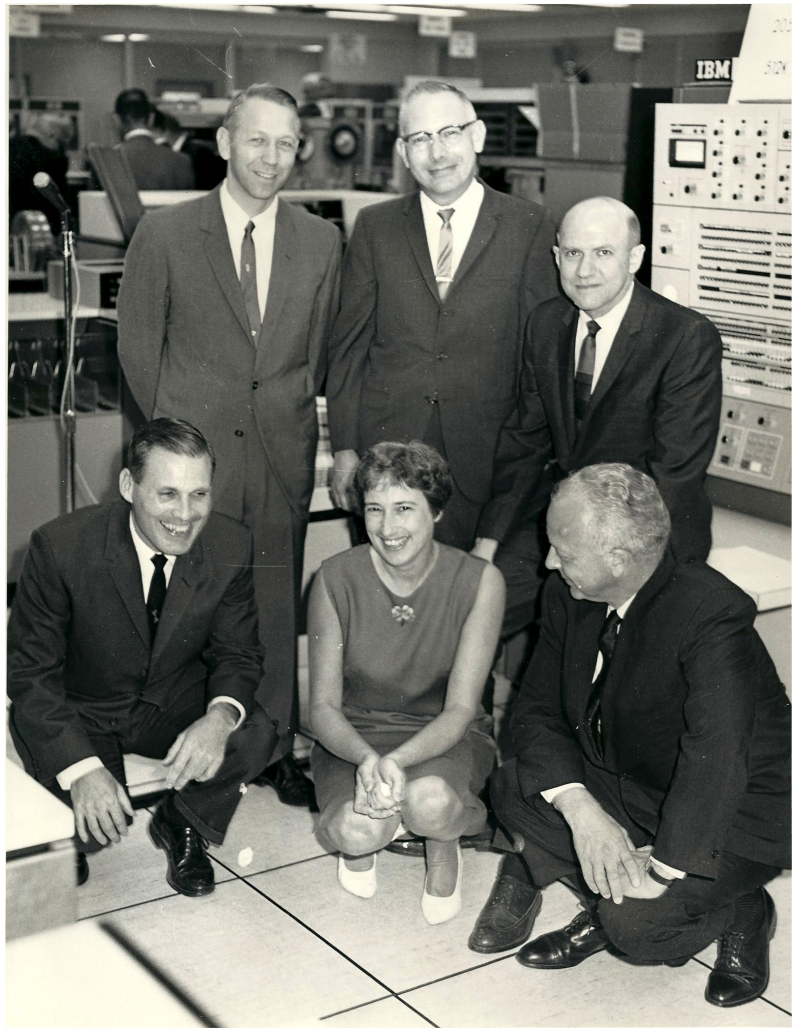
Quote from Margaret: "It was the best of times!"

Arithmetic unit (right) and memory unit (left) for GEORGE

- **Margaret was a member of the logical design team for GEORGE, the second ANL computer**
- **She wrote mathematical subroutines, system software, reactor applications, & utilities for**
  - AVIDAC (1949-1953)
  - ORACLE (1950-1953)
  - GEORGE (1955-1956)
  - UNIVAC (1954-1958) – at NYU
  - IBM 704 (1957)
- **1957-1959: Margaret led the Reactor Computing Group**

Margaret learned, then taught, computer architecture and programming before there were courses available in any schools on the subjects, as university computer science courses had not yet arrived.

Margaret headed the Applications Programming Section of Argonne's Applied Mathematics Division: 1959-1965



She developed programming teams for

- reactor physics
- chemistry
- biology
- high-energy physics
- management applications

Back Row:

- **Robert L. Logan**, Lead of AMD Systems Section
- **Wayne R. Cowell**, Lead of Digital Computing Center
- **David Jacobsohn**, Lead of AMD Engineering Section

Front Row:

- **Richard King**, Applied Mathematician
- **Margaret Butler**, Lead of AMD Applications Programming Section
- **J. Wallace Givens**, Director of Applied Mathematics Division (AMD)

Computational Science and Software: 1960-1972

- **Margaret performed research on benchmarking, performance measurement, and image processing**
  - CDC3600 (1963)
    - When the CDC3600 was delivered, a subroutine library accompanied the machine, but there was no documentation.
  - IBM360 (1964-1967)
  - CHLOE (1963-1970)
  - ALICE (1970)
- **Margaret founded the Argonne Code Center**
- **First female Fellow of the American Nuclear Society, 1972**

Margaret was an influential role model and mentor

- President of Chicago Chapter of the Association for Women in Science, 1982
- Paved the way for Argonne's
  - WIST Program
    - https://blogs.anl.gov/wist/
  - Science Careers in Search of Women Conference
    - http://www.anl.gov/articles/program-has-inspired-women-science-careers-last-25-years

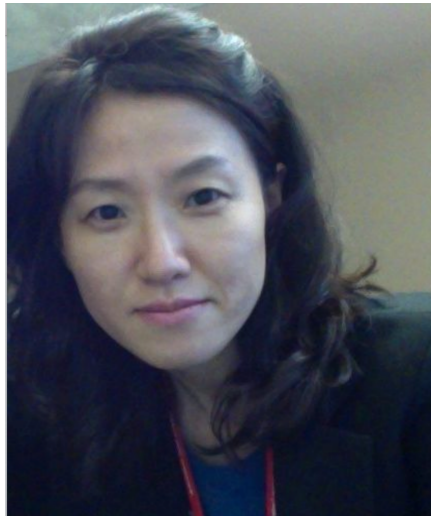
MCS research leaders: Pushing into the future with cutting-edge mathematics, computer science and computational science

Elizabeth Marland Glass
Computational Biologist

Metagenomics, bioinformatics, comparative and evolutionary analysis of metabolic processes, high-throughput analysis of genomes (RAST, MG-RAST)

Kate Keahey
Computer Scientist

Virtualization, resource management, cloud computing (Nimbus: Clouds for Science and the Ocean Observatory Initiative)



Misun Min
Computational Scientist

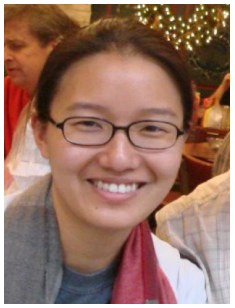
NekCEM (spectral-element DG electromagnetics), NekLBM (spectral-element DG lattice Boltzmann fluid solver)

Boyana Norris
Computer Scientist

Performance analysis and tuning (Orio), program analysis and source transformations (automatic differentiation)

Technical Women in MCS

May 2013



Van Thi Bui
Predoc

Lisa Childers
Technical Product Manager

Zichao (Wendy) Di
Postdoc, coming soon

Elizabeth Marland Glass
Computational Biologist

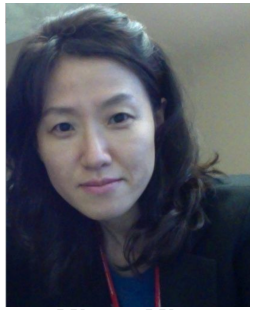
Rinku Gupta
Senior Software Developer

Katherine Heisey
Computational Assistant

Jungho Lee
Postdoc

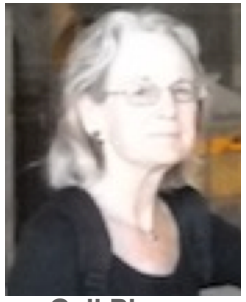
Kate Keahey
Computer Scientist

Lois Curfman McInnes
Senior Computational Scientist



Misun Min
Computational Scientist

Boyana Norris
Computer Scientist



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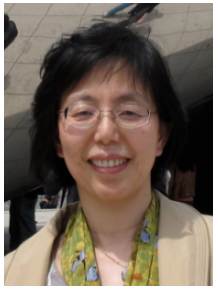
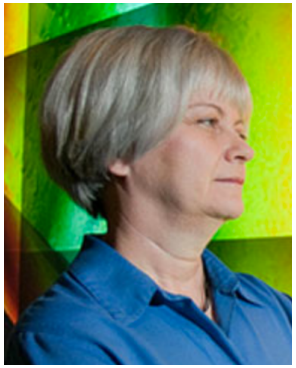


Hong Zhang
Consultant

Technical Women in ALCF

May 2013

Robin Graham
Deputy Associate Laboratory Director for Computing, Environment and Life Sciences
Acting Division Director, BioSciences Division



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Jini Ramprakash
Technical Support Analyst

Katherine Riley
Manager, Catalyst

Tisha Stacey

Tisha Stacey
Supervisor, HPC System & Network Administration

Emily Wolters
Nuclear Engineer, Catalyst

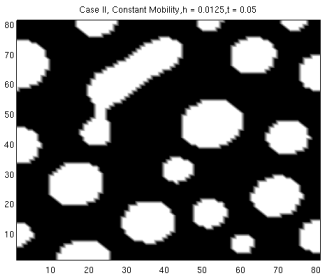
Margaret founded and directed the National Energy Software Center: 1972-1991

Software exchange and information center for DOE and the Nuclear Regulatory Commission

Focus: problems of program interchange and portabililty

Current snapshot of MCS mathematical software

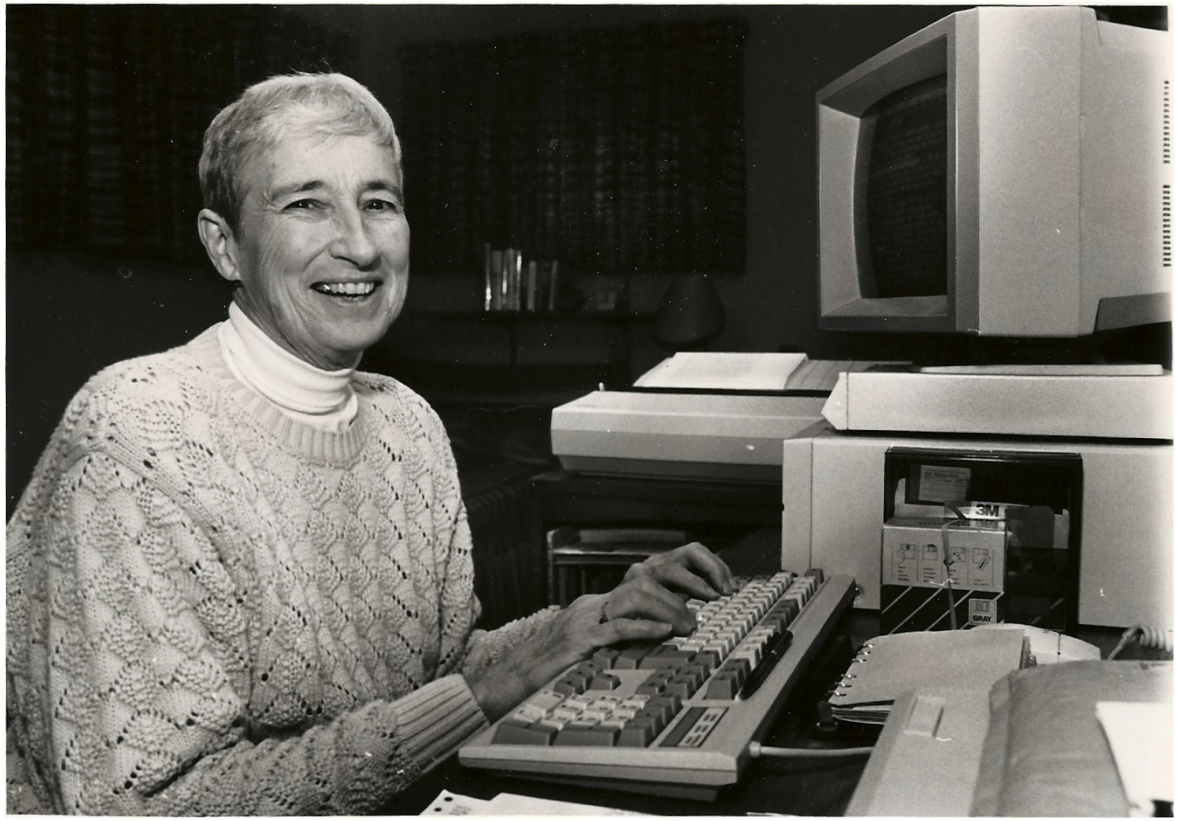
- **1991: Margaret retired**
- **1993-2006: Margaret worked as a Special Term Appointee**
  - Focus: intellectual property rights, copyright law issues affecting software sharing and technology transfer
- **Ongoing issues in mathematical software**
  - How we make our algorithms available to more applications
  - How we learn more about the requirements of applications
  - How we evaluate algorithmic choices in a consistent setting
  - How we exploit capabilities of emerging architectures for new scientific discovery



DVI formulations in materials science

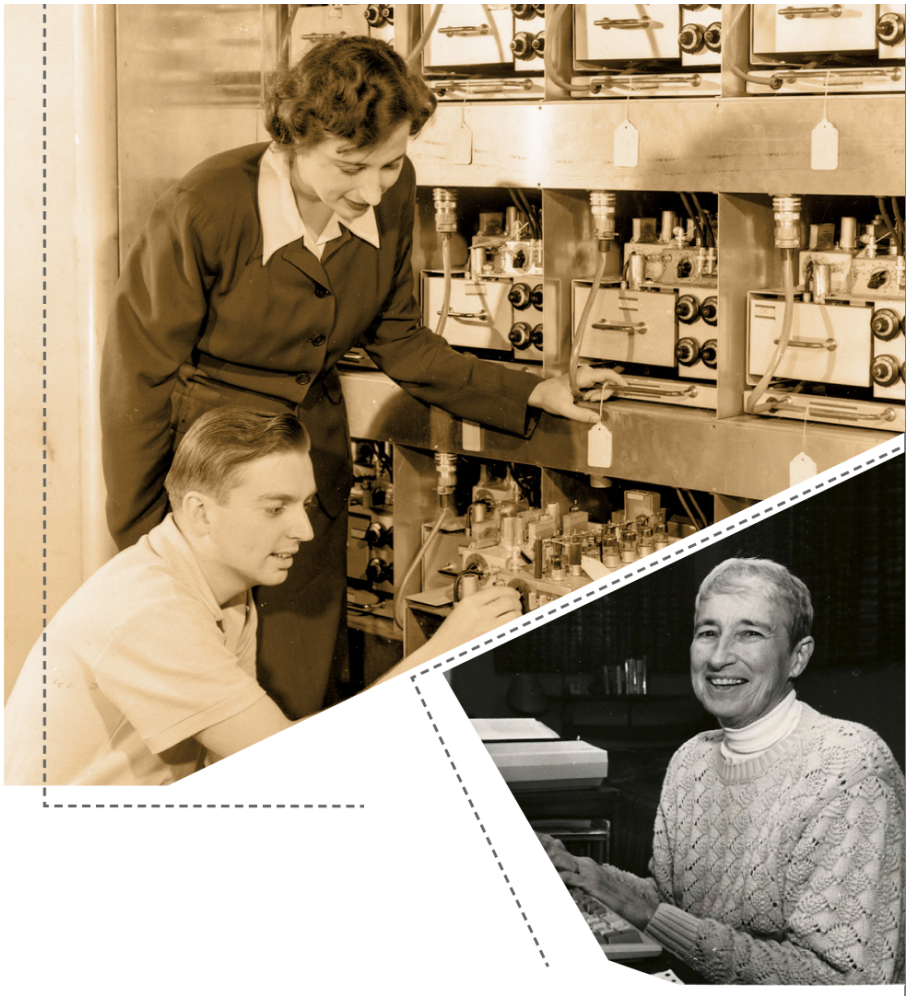
Onward and Upward!

Margaret's motto conveys her passion for computational science – and has inspired countless researchers in the quest for advances in architectures, modeling, algorithms, and software.



Margaret Butler: 1924 – 2013

The Margaret Butler Fellowship in Computational Science



Created in memory of Margaret Butler, a new fellowship at the Argonne Leadership Computing Facility (ALCF) offers computational scientists an opportunity to work at the forefront of high performance computing.

The new fellowship includes a highly competitive salary, moving expenses, and a professional travel allowance. Candidates must have received a recent PhD prior to the beginning of the appointment.

Special thanks to …

- **Jay Butler**

- **Holly Stump**
  - ***Margaret Butler, One Woman's Life in Science,***
    - *by Margaret Butler and Holly Stump, 2013*
    - http://www.semiwiki.com/forum/content/2128-margaret-butler-one-woman%92s-life-science.html

- **And also to:**
  - Judy Beumer
  - Catherine Eyberger
  - Paul Messina
  - Jorge Moré
  - Marianne Schiffer
  - Marion Thurnauer