Oxford's female computing pioneers:

Computing before the computer

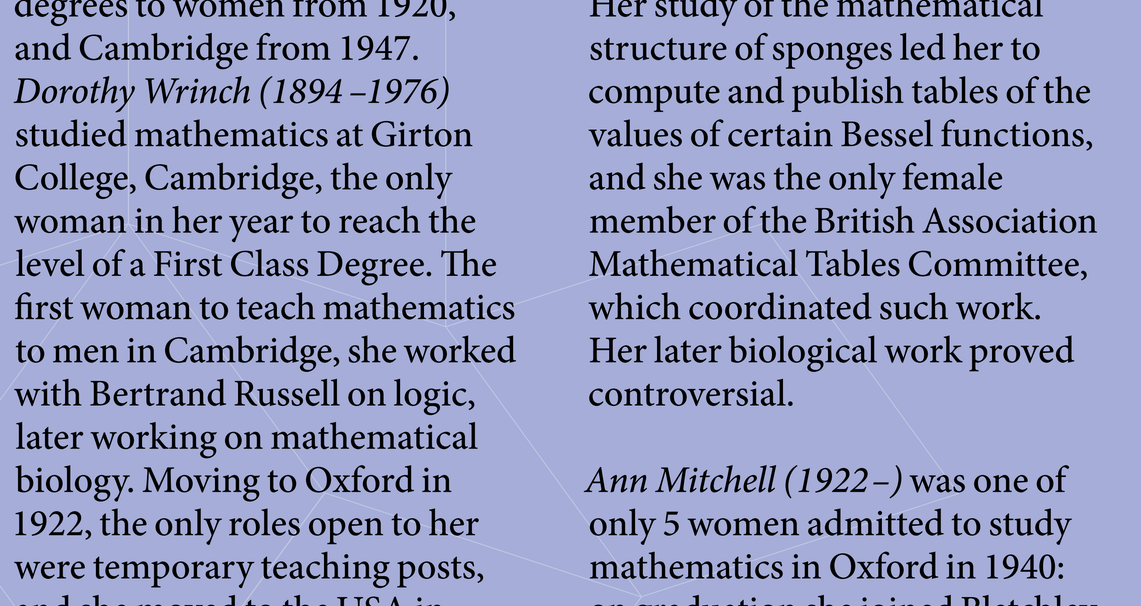
UNIVERSITY OF OXFORD
Mathematical Institute

For centuries, until the 1950s, a "computer" was a human who computed, initially entirely by hand, with mechanical calculators, and devices for collating data stored on punched cards, more common from the 1920s. Records are sparse, but there are many examples where the work was done by women, often uncredited and unpaid.

Florence Weldon (1858–1936), studied mathematics at Girton College Cambridge, and worked closely with her husband, Raphael Weldon, Oxford's Linacre Chair of Zoology, applying techniques developed by the statisticians Francis Galton and Karl Pearson to biological data.

For example, in 1892, 23 measurements were taken from each of 1000 adult female shore crabs from the Bay of Naples, and analysed to show that 22 of the 23 features were normally distributed, and one was bimodal. In his lifetime Weldon's papers did not mention his wife: manuscripts completed by Pearson after his death acknowledge "F. J. W.". Florence Weldon gave a significant collection of French paintings to Oxford's Ashmolean Museum, where a gallery is named for her.

Mary Blagg FRAS (1858–1944) was a self-taught mathematician living in Cheshire, who became interested in astronomy in her 40s, and worked, unpaid, with Oxford's Savilian Professor of Astronomy, Herbert Hall Turner, to analyse data on variable stars, and to catalogue features on the moon's surface. She noted the "very considerable labour" required in the reconciliation of substantial conflicting data sources. Likewise with no formal qualifications, *Ethel Bellamy FRAS (1881–1960)* was employed at the Radcliffe Observatory for over 50 years, working on star catalogues. From 1913–1946 she edited the International Seismological Summary, organising records from 600 earthquake observation stations around the world, and using this data to compute the epicentres of earthquakes.

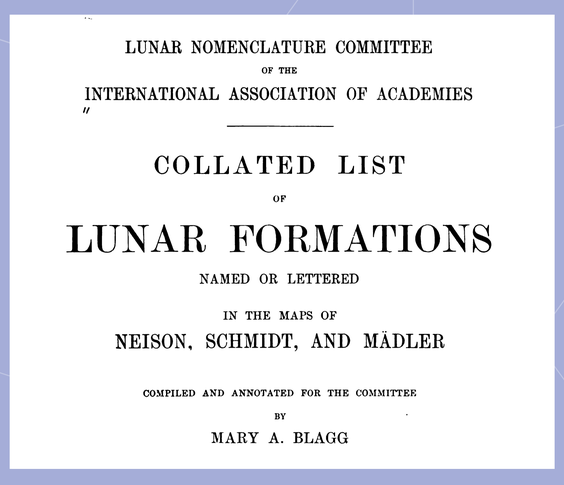


Crystallographers and pre-digital computing devices, CalTech, 1947

Oxford's first colleges for women opened in 1870: Oxford awarded degrees to women from 1920, and Cambridge from 1947. *Dorothy Wrinch (1894–1976)* studied mathematics at Girton College, Cambridge, the only woman in her year to reach the level of a First Class Degree. The first woman to teach mathematics to men in Cambridge, she worked with Bertrand Russell on logic, later working on mathematical biology. Moving to Oxford in 1922, the only roles open to her were temporary teaching posts, and she moved to the USA in 1938: in 1929 she was the first woman to receive an Oxford DSc. Her study of the mathematical structure of sponges led her to compute and publish tables of the values of certain Bessel functions, and she was the only female member of the British Association Mathematical Tables Committee, which coordinated such work. Her later biological work proved controversial.

Ann Mitchell (1922–) was one of only 5 women admitted to study mathematics in Oxford in 1940: on graduation she joined Bletchley Park, among 6000 women and 2000 men involved in every aspect of organising, decrypting and analysing German messages. Mitchell's work included scanning the possible decryptions suggested by the Bombe machines, to eliminate quickly those which did not correspond to the German language. She later worked as a social policy researcher in Edinburgh.

Florence Weldon, by Richard Murry, 1928



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Lunar formations, Mary Blagg, 1913

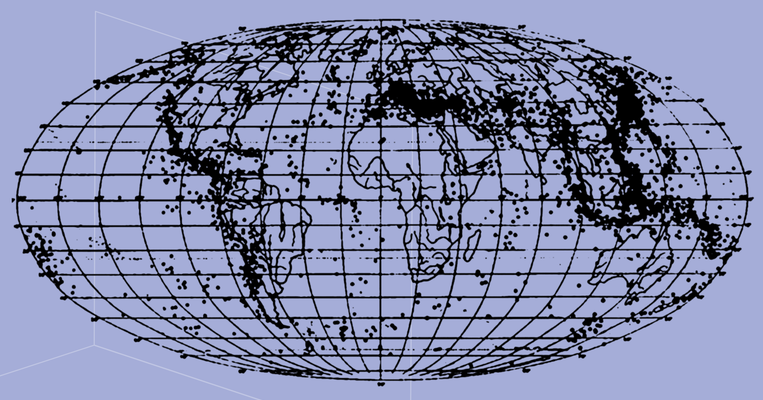

Table of epicentres, Ethel Bellamy, 1939

Dorothy Wrinch, about 1941

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Oxford's female computing pioneers:

The early days of Oxford computing

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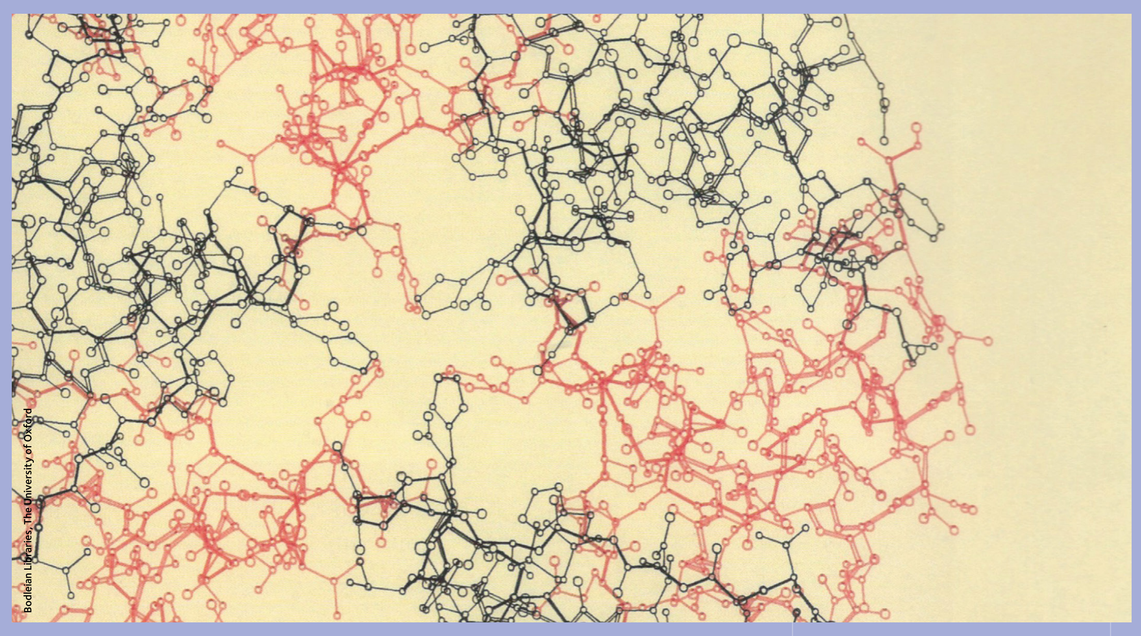
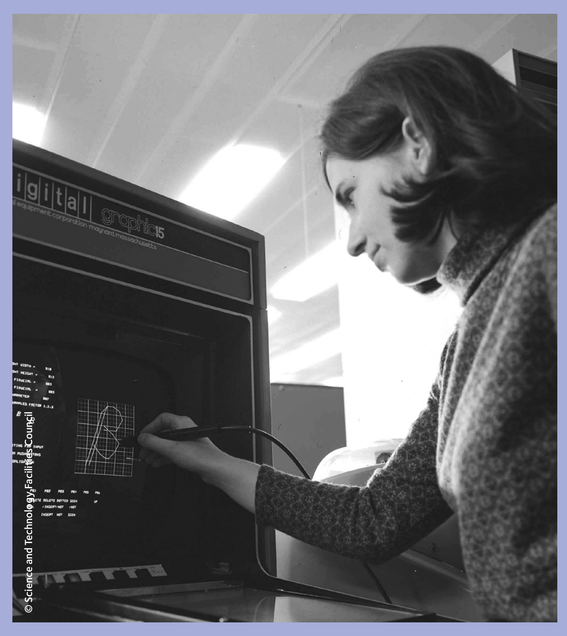
Right from the start of modern computing in Oxford, women were involved in every aspect of research, teaching, and providing computing support across the university.



Pen-plotter diagram of insulin structure, programmed by Eleanor Dodson around 1971



Susan Hockey defining fonts on the PDP15 at Atlas Computer Centre, about 1970

In 1966 *Christopher Strachey (1916–1975)* joined Oxford, founding the Programming Research Group: an early research assistant, in 1969, was *Julia Dain*, who had learned to program in a gap-year job at Marconi, before her Oxford maths degree, and worked on Strachey's pioneering compiler for BCPL, a forerunner of C. Oxford's MSc in Computation started in 1979, then, as now, attracting students from all over the world: *Leonor Barocca* recalls how, politics having disrupted her education in Portugal, her 1984 MSc shaped the rest of her life.

Dorothy Hodgkin and family, 1947

Dorothy Hodgkin (1910–1914), a fellow of Somerville College and later Wolfson Research Professor, received the Nobel Prize in Chemistry in 1964 for her work on the structure of penicillin. Initially making use of facilities elsewhere, Hodgkin chaired the committee to advise on Oxford's first computer purchase, insisting in 1952 that the pioneering Cambridge and Manchester machines did not have enough memory for her.

Around 1970, while in charge of computing for Hodgkin, *Eleanor Dodson FRS*, later a Professor at York, adapted early plotter software to produce one of the first machine drawings of the structure of insulin.

In 1957 *Leslie Fox (1918–1992)* was appointed Oxford's first Professor of Computer Science, and Director of the Computing Laboratory. The Lab installed Oxford's first large computer, a Ferranti Mercury, in 1959, and became a leading centre for research in scientific computation, as well as offering computing facilities across the University. In 1960 *Joan Walsh (1932–2017)*, Fox's first DPhil student, was awarded Oxford's first DPhil in Computer Science for her thesis "Numerical solution of partial differential equations using a high speed computer".

In 1970 Walsh, with *Brian Ford*, *Linda Hayes* and *Shirley Lill* (now Carter), developed a pioneering library of machine independent software, the cornerstone of the present Numerical Algorithms Group Ltd. Walsh was later a Professor at the University of Manchester, Lill founded two database companies which became key to many e-commerce sites, and Hayes stayed in Oxford, holding senior roles in Oxford University Computing Services, now IT Services.

OUCS brought computing resources and training to the rest of the university, and Oxford was a pioneer in what is now called digital humanities: *Susan Hockey*, later a professor at University College London, whose first degree was in Egyptian with Akkadian, developed some of the first screen-based fonts, and co-authored the pioneering Oxford Concordance Program.

Mary Sheeran, 2019

An Oxford MSc student, coming top in her exams at a major North African University, ruefully saw a coveted scholarship to study in Europe offered to the male runner-up, before funding was swiftly found for them both. Early students did pioneering work: in 1984 MSc student *Hanan Mohamed* wrote an expert system for intricate Sudanese inheritance law. *Mary Sheeran*, now a Professor in Sweden, was the first woman awarded the MSc, in 1981: in 1984 her DPhil developed new programming languages for computer hardware, and she became Oxford's first female Tutorial Fellow and University Lecturer in Computation.

NAG staff summer party, 1986

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