

Mathematics at Greenwich

Greenwich has a rich mathematical history. Our lecture theatre today is named after the pioneer of group theory, **William Burnside** (1852-1927), Professor of Mathematics at the Royal Naval College for 34 years. Burnside's name is attached to a number of results in group theory and his original statement of what is now known as the Burnside Problem (still not fully solved after over 100 years) can be found on the plaque in the lecture theatre.

The story of mathematics at Greenwich began with the foundation of the Royal Observatory in 1675. Built at the command of King Charles II, in the hope of solving the problem of finding a way to determine a ship's longitude at sea, the building was designed by **Christopher Wren** (1632-1723) and **Robert Hooke** (1635-1703), and cost £520 9s 1d. The first Astronomer Royal was **James Flamsteed** (1646-1719), who was paid a salary of £100, from which he had not only to pay his assistants but also to equip the observatory: instruments were not included in the King's budget!

Flamsteed and his assistant **Weston** can be found on the ceiling of the Painted Hall (in the left-hand corner immediately as you enter. (Other mathematicians in the Painted Hall include **Archimedes**, **Copernicus** and **Tycho Brahe**, while **Newton** is represented not by a portrait but by some of his geometrical diagrams.)

Flamsteed's observations of the stars were the most accurate of his time, but he was reluctant to publish them. Newton, who had previously fallen out with Flamsteed, arranged for the publication of the data, against Flamsteed's will, in an edition edited by **Edmond Halley** (1656-1742) under the auspices of the Royal Society, of which Newton was President: but when George I became king, Flamsteed successfully petitioned for the recall of this edition and he burnt the books in Greenwich Park. After Flamsteed's death a lovingly-prepared copy of his star catalogue (with illustrations by Thornhill, the artist of the Painted Hall) was published by his assistants **Crossthwait** and **Sharp**.

Flamsteed was succeeded as Astronomer Royal by Halley, who was given a grant of £500 to re-equip the Observatory as Flamsteed's widow removed all the instruments (not unreasonably, since Flamsteed had had to pay for them personally). As Astronomer Royal from 1719 to 1742, despite his age, Halley observed the moon nightly for eighteen years, hoping perhaps that these observations would allow the calculation of longitude by the method of lunar distances and that he would win the £20,000 prize offered by Parliament in 1714 for the solution of the problem.

This prize was eventually won by William Harrison (1693-1776) in 1765 for his invention of the chronometer. Harrison's four prototypes can be seen today in the Observatory in an excellent free exhibition. As readers of Dava Sobel's *Longitude* will remember, Harrison was opposed by the fifth Astronomer Royal, **Nevil Maskelyne** (1732-1811), who preferred the method of lunar distances and felt that the chronometer was too expensive to be a practical solution: indeed, it was not until the nineteenth century that the chronometer became cheap enough to be carried on every ship, and navigators relied on the astronomical data published in the *Nautical Almanac*.

Another prominent Astronomer Royal was **George Bidell Airy** (1801-1892), who is remembered, rather unfortunately, for his failure to search for the planet Neptune when its existence was predicted by John Couch Adams in 1845 and for his opposition to the calculating machines of Charles Babbage, but who also deserves his reputation as a brilliant administrator.

Two nautical educators at Greenwich were **Edward Riddle** (1788-1854), mathematics master at the Royal Hospital School from 1821 to 1851, and author of an important book on navigation, and his son **John Riddle** (1816-1862), also a master at the Royal Hospital School, who had a high reputation as a teacher.

In 1873 the Royal Naval College was established. The first Director of Studies was the distinguished mathematician **Thomas Archer Hirst** (1830-1892). Burnside was appointed Professor of Mathematics in 1885 and remained at Greenwich until his retirement in 1919.

Another pioneer at Greenwich was **Leslie Comrie** (1893-1950), who ran the Nautical Almanac Office in the 1930s. Comrie set up what has been called the world's first computing laboratory (a computer in those days being a young woman with a mechanical calculator), and he announced in 1924 his intention to abolish the use of logarithms in calculation: in 1948, he claimed to have succeeded! After leaving Greenwich, Comrie went on to mechanise the processing of football pools so that the winner could be quickly found.

This summary has mentioned only a few of the mathematical characters who worked at Greenwich. The University of Greenwich, Department of Mathematical Sciences is proud that this tradition is continuing, with present-day research in areas such as fire safety engineering, computational modelling and applied statistics and operational research. The Fire Safety Engineering Group has received many prizes, including the Queen's Anniversary Prize for Higher Education, for its life-saving work in modelling and visualising the evacuation of buildings, aircraft and ships in emergencies. And a current project with a strong nautical and local flavour is our mathematical modelling of the current work restoring the *Cutty Sark*, where we are using the latest mathematical and computing techniques to calculate the effect of various methods of preservation.

Mathematics at Greenwich is still going strong after 330 years!

Further reading:

Dava Sobel, *Longitude*, Fourth Estate, 1996 (and various other editions: I recommend *The Illustrated Longitude*)

Emily Winterburn, *The Astronomers Royal*, National Maritime Museum, 2003

Peter M. Neumann, A.J.S. Mann and Julia Tompson (eds), *The Collected Papers of William Burnside*, Oxford University Press, 2004.

David Singmaster, *The British Society for the History of Mathematics Web Gazetteer*,
<http://www.bshh.org/zingaz/London.html>

The MacTutor History of Mathematics website,
<http://www-history.mcs.st-andrews.ac.uk/history/>

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