Halley, Edmond

Born: November 8, 1656, in Haggerton, UK.
Died: January 14, 1742, in Greenwich, UK.

Edmond Halley was a major English astronomer, mathematician, and physicist, who was also interested in **demography**, insurance mathematics (*see* **Actuarial Methods**), geology, oceanography, geography, and navigation. Moreover, he was considered an engineer and a social statistician whose life was filled with the thrill of discovery. In 1705, he reasoned that the periodic comet – now known as Halley's comet – that appeared in 1456, 1531, 1607, and 1682, was the same comet that appears every 76 years, and accurately predicted that it would appear again in December 1758. His most notable achievements were his discoveries of the motion of stars, which were then considered fixed, and a scheme for computing the motion of comets and establishing their periodicity in elliptical orbits.

Edmond Halley, whose name was also spelled Edmund, was the eldest son of a prosperous landowner, soapmaker, and salter in London. He was tutored at home before attending St Paul's School, where he learned Latin, Greek, and mathematics, including geometry, algebra, the art of navigation, and the science of astronomy. In 1673, at the age of 17, he entered Queen's College, Oxford, and was introduced to John Flamsteed, who was appointed Astronomer Royal in 1676.

In November 1676, Edmond Halley sailed to the island of St Helena, where he cataloged the stars of the southern hemisphere, and incidentally discovered a star cluster in Centaurus, a constellation in the Southern Hemisphere. In 1677, he timed a transit of Mercury and of Venus across the sun and made rough calculations of the mean distance between Earth and the sun. In 1678, he published his results in Catalogus Stellarum Australium, was elected a fellow of The Royal Society, and received the M.A. degree from Oxford University. He married Mary Tooke in 1682, and they had three children – two daughters and one son. He established a home and small observatory center at Islington, and saw the comet of 1682.

Halley encouraged Newton to expand his studies on celestial mechanisms and contributed important editorial aid and financial support to the publication of Newton's major work, *Philosophiae Naturalis Principia Mathematica*, in 1686. From 1685 to 1696 he was assistant of the secretaries of the Royal Society, and from 1685 to 1693 he edited the *Philosophical Transactions of the Royal Society*. In 1698 he was the frequent guest of Peter the Great, who was studying British shipbuilding in England. He was the technical adviser to Queen Anne in the War of Spanish Succession, and in 1702 and 1703 she sent him on diplomatic missions to Europe to advise on the fortification of seaports.

Between 1687 and 1720 Halley published papers on mathematics, ranging from geometry to the computation of logarithms and trigonometric functions. He also published papers on the computation of the focal length of thick lenses and on the calculation of trajectories in gunnery. In 1684 he studied tidal phenomena, and in 1686 he wrote an important paper in geophysics about the trade winds and monsoons. From 1683 to 1692 he published two important papers in geophysics about terrestrial magnetism and made a chart of the variation of the compass. In 1716 he suggested that the aurora was governed by the terrestrial magnetic field.

Halley was a man of great curiosity who combined his astronomical knowledge to help in the dating of historical events. In 1691 he published a paper on the date and place of Julius Caesar's first landing in Britain, and in 1695 he published a paper on the ancient Syrian city of Palmyra. In 1695 he began an intensive study of the movement of the comets, using the hypothesis that cometary paths are nearly parabolic. In 1696 he became deputy controller of the mint at Chester. Between 1698 and 1700, Halley was appointed as a naval captain. He charted magnetic variations while crossing the Atlantic, and was the first to adopt isogonic lines to connect points of equal magnetic variation. In 1704 he was appointed Savilian Professor of Geometry at Oxford and was granted the degree of Doctor of Civil Law. In 1705 he published his cometary views in *Philosophical Transactions*, and *A Synopsis of the Astronomy of Comets*. In 1706 and 1710 he translated and published *Conics*, and *Sectio Rationis of Apollonius*. In 1712 Halley and Newton published *Historia Coelestis*, an edition of Flamsteed's observations, using material deposited at the Royal Society, and infuriated Flamsteed.

Although the major scientific interest of his life was astronomy, Halley wrote a seminal paper on **life**

tables. Since the end of the sixteenth century, registers of births and deaths by sex and age had been well kept in Breslau, Silesia. Caspar Neumann, a prominent evangelical pastor and scientist, used the data to combat some popular superstitions about the influence on health of the phases of the moon and certain ages (those divisible by seven and nine). Neumann sent his results to Leibniz, who in 1689 brought them to the attention of the Royal Society. Since the work of **Graunt** and **Petty**, members of the Royal Society were waiting to receive observations suitable for construction of a life table and sent the data to Halley for analysis. In 1693 Halley wrote the paper "An estimate of the degrees of the mortality of mankind, drawn from curious tables of the births and funerals at the City of Breslaw, with an attempt to ascertain the price of annuities upon lives." Halley assumed a constant number of births per year, mortality by age constant in time, and no migration. He did not present the data in detail, but he calculated a life table based on the number of survivors by year, including the first empirical distribution of deaths according to age. He used the life table to calculate the number of men able to bear arms from age 18 to 56, the **median** remaining lifetime for an individual of age x (*see* **Life Expectancy**), the total population size, and certain calculations relating to annuities. He found that the value of an annuity is the sum of the expectation of the payments made to the living, a concept later pursued by **Abraham de Moivre**. His expectation became the fundamental quantity in life insurance, today called the pure endowment. Having written an important paper on life tables, Halley never returned to the topic, which was far from his main interests.

In 1715 Halley published a paper on novae, and nebulae, and recorded ideas and experiences of living underwater. In 1720 Halley succeeded John Flamsteed in his appointment as Astronomer Royal. In 1729 he was elected a Foreign Member of the Academie des Sciences at Paris. By 1731 he had published a method of using lunar observations for determining longitude at sea. He also studied the question of the size of the universe and the number of stars it contained.

At his death, Edmond Halley was 86 years old and widely mourned. He was a famous and a friendly man of rare intelligence who was always ready to support young astronomers. As Joseph Laland said about Halley, he was "the greatest of English astronomers ... ranking next to Newton among the scientific Englishmen of his time".

For more complete information about Halley's life, see the following references.

References

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