

The July 2018 update adds forty-three articles (including one family article and one reference group article), containing forty-five biographies, accompanied by seven portrait likenesses. Twenty-six of the newly-added lives are of women. They include lives of women engineers who were active in the first half of the twentieth century, many of them founders or early members of the Women's Engineering Society (1919). Their biographies have been curated by Anne Locker, Library and Archives Manager of the Institution of Engineering and Technology.

Introduction to the update by Anne Locker

Recent research into the role of women in the First World War has helped to uncover the early stories of women in engineering and technology in the United Kingdom. It has been an interesting and illuminating experience to help identify and bring together a selection of the stories of these early pioneers, whose lives span the period before the First World War to the 1990s. These biographies show the remarkable ingenuity and disregard for convention (and in one case, the law) shown by women who decided to enter a working space which had previously been closed to them. There are many firsts here, including: the first women to be elected as members of the Institute of Automobile Engineers and the Institution of Civil Engineers; the first woman Fellow of the Royal Aeronautical Society; and the first Student Member of the Institution of Electrical Engineers. We see how traditional engineering networks were starting to open up to women, and the start of women entering industry outside of wartime. Not only did women work to join established networks, they also set up their own to support each other, notably the Women's Engineering Society, which was founded in 1919 and which will celebrate its centenary in 2019.

The biographies included in this update show a variety of experience and engineering sectors. It was difficult for women to enter traditional routes into engineering, such as industrial apprenticeships, so new paths had to be found. Some came to engineering through their marriages with prominent engineers or support from their parents, such as Margaret Moir and Rachel Parsons. Many took advantage of increasing access to further education for women, studying engineering or mathematics at universities and women's colleges. Some, like Margaret Partridge, became consulting engineers, while others, like Laura Willson and Ethel Jayne, set up their own businesses. There were opportunities in the new fields of aviation and automobiles for the pilot Hilda Hewlett and the motorist Cleone Benest. The world of engineering did change and adapt. In 1943, the Amalgamated Engineering Union finally voted to admit women as members. In 1927, the civil engineer Dot Buchanan was provided with a lady chaperone for her professional interview, but by 1948 Molly Fergusson had become the first woman partner in a civil engineering firm. Women engineers were here to stay.

--Anne Locker

Women in Engineering

Several of the lives record the founding generation of the Women's Engineering Society. The first woman student at Cambridge, **Rachel Mary Parsons (1885–1956)** had been influenced by her mother, Katharine Parsons, Lady Parsons, who ensured that she received the best possible education. During the war years, Rachel Parsons became a director of her father's firm, the

Parsons Marine Turbine Co. at Heaton, where women were extensively employed. She and her mother opposed the restoration in 1919 of pre-war industrial practices which excluded women from employment in roles they had taken during the war, and were among the co-founders of the WES. Another of the WES founders, **Margaret Bruce Moir, Lady Moir (1864–1942)** had watched the construction of the Forth Bridge from her family home in South Queensferry. She was involved in the engineering ventures of her husband, Sir Ernest Moir (whose life is also included in this update), accompanying him on site. During the First World War she trained and worked as a lathe operator in munitions factories during the First World War, and promoted training schemes for women workers in engineering. After the war, she became a member of the Electrical Association for Women (EAW), believing ‘that electricity offered the key to women’s domestic freedom’.

A member of both the WES, of which she became president in 1926, and the EAW, **Laura Annie Willson (1877–1942)**, had been a suffragette, and was twice imprisoned in 1907, but as joint director with her husband of a lathe-making factory in Halifax, supported the war effort by manufacturing munitions. She was concerned for the welfare of women employed in engineering during wartime, and her welfare practices were seen as a model. In the 1920s she foresaw opportunities for women engineers in rural electrification. Two other early WES members took up this idea. **Margaret Dorothea Rowbotham (1883–1978)**, who had taken the mathematical tripos at Cambridge, trained in engineering workshops during the First World War, and was superintendent of the Tongland Works, Kircudbright, envisaged in 1917 as an ‘engineering university for women’. Also a founding member of the WES, she was dismayed by the displacement of women from engineering, and subsequently joined a business involved in rural electrification in Devon. She did so in partnership with another early WES member, **Margaret Mary Partridge (1891–1967)**, who had studied at Bedford College, London, and graduated in mathematics. During the war she worked as an engineer and supervisor in munitions, but with few openings available in peacetime, moved to Devon as a consulting engineer and joined the WES. She became EAW organizer for the south west, where she was responsible for rural electrification schemes, employing and training other women engineers. After studying physics at Manchester University, **Gertrude Lilian Entwisle (1892–1961)** worked on the design of electric motors and generators at British Westinghouse during the First World War, became the first woman student member of the Institution of Electrical Engineers (IEE) in 1916, and joined the WES in 1919. She spent her career in electrical engineering, was on the executive of the EAW, and became president of the WES in 1941. Another early member of the WES, **Cleone de Heveningham Benest (1880–1963)**, who had been an early motorist and car mechanic before 1914, undertook war work as an aircraft engine inspector. Under her pseudonym C. Griff, she wrote in 1915 on the need in Britain to enable women to practise as professional engineers. After the war she set up a metallurgical business in Birmingham, and gave broadcast talks on electricity.

During the First World War the Cambridge-educated mathematician **Letitia Chitty (1897–1982)** undertook stress analysis on experimental aircraft for the Royal Flying Corps, and went on to work on airship structures. She became a lecturer in civil engineering at Imperial College, London. Her major work was on the structure of dams, and in 1947 she became the third woman to be made an Associate of the Institution of Civil Engineers. In 1927 **Dorothy Donaldson [Dot] Buchanan (1899-1985)**, who had studied civil engineering at Edinburgh University, and served a pupillage with the steelwork contractors Dorman Long (contractors on the Sydney harbour bridge and the King George V bridge on the Tyne), became the first woman to be elected a member of the Institution of Civil Engineers, though her professional career was soon cut short by marriage. A graduate of Edinburgh University, whose mother Helen Brown Shaw was an MP, **Annie [Anne] Gillespie Shaw (1904–1982)** joined the WES in 1935. In 1936 she was the first woman elected to membership of the Institute of Production Engineers, having become chief supervisor of women workers for the Metropolitan-Vickers Electrical

Company in Manchester. She became an expert in motion study, advised on work methods in aircraft production in the Second World, and in 1945 set up her own consultancy business. Like Dorothy Buchanan, **Mary Isolen [Molly] Fergusson (1914–1997)** was a graduate in civil engineering at the University of Edinburgh, and spent her career in Edinburgh, becoming in 1948 the first woman partner in a civil engineering consultancy, Blyth and Blyth. She encouraged young women into the profession, including through work with the WES.

The lives of three women whose activities brought them in contact with engineering are also included in this update. The Institution of Mechanical Engineers possesses a set of photographs of the construction in the mid-nineteenth century by Victorian engineers of the Bhor Ghat section of the Great Indian Peninsular Railway. After previous failures, the contract for the incline was let to the railway contractor **Solomon Tredwell (1823-1859)** who, however, died very shortly after arriving in India. His wife, who had accompanied him to India, **Alice Tredwell (bap. 1823, d. 1867)**, whose father and brothers were railway contractors, remained in India for a period after his death, and took on responsibility for the contract, appointing engineers as her agents to carry out the work, before returning to England. When the line was opened, in 1863, tributes were paid to her public spirit in ensuring that the business of the contract was carried through. The aviator and aircraft manufacturer, **Hilda Beatrice Hewlett (1864–1943)**, escaped the constraints of her father's vicarage first through a bohemian marriage, then by a partnership with the French engineer Gustave Blondeau. She became the first woman to obtain the Royal Aero Club's aviator's certificate (1911) and went on with Blondeau to construct airframes at Luton during the First World War, where they employed equal numbers of men and women. She was reluctant, though, to publicize her war work, and spent her later years in New Zealand. The steam laundry owner and women's welfare organizer **Ethel Clara Basil Jayne (1874–1940)** was apprenticed in laundry management after completing her education, and set up a laundry in Harrow. She promoted laundry management as employment for professional women, and ran a successful chain of laundries. During the First World War she organized welfare for women workers in armaments factories. She was appointed OBE in the first honours list for the newly-created order (in August 1917), which was from its inception open to both genders. Moir and Willson were similarly honoured in the early honours lists.

Two further lives extend the Dictionary's coverage of engineering. Created a baronet in 1916 for his work at the Ministry of Munitions, the civil engineer **Sir Ernest William Moir, first Baronet (1862–1933)**, was noted for his feats of underwater engineering, dating from his appointment in 1888 as resident engineer on the Hudson and Manhattan tunnels. His invention of a medical airlock considerably reduced fatal casualties from decompression among the workforce employed in underwater tunnelling. He went on to design and construct the Blackwall tunnel under the Thames, and as a director of S. Pearson & Son went on to transform the firm into the leading British civil engineering contractor in the early twentieth century. After graduating in mechanical sciences at Cambridge in 1939, **(William) Austyn Mair (1917–2008)** began secret research on high-speed flight at the Royal Aircraft Establishment, Farnborough, where he was involved in setting up the experimental wind tunnel. There he solved the problems of instability encountered by early jet fighter aircraft. In the post-war years he undertook aerodynamic research at Manchester University, and then at Cambridge, where he was involved in major developments in the structure of the university's engineering courses.

Lives in science and mathematics

This update also adds the lives of six women employed on scientific projects. On her clergyman husband's death, **Mary Edwards (b. ?1741/1742, d. 1815)** took over his work as computer for the *Nautical Almanac*, which she had already been mainly responsible for compiling. This involved providing computed astronomical data, published by the Board of Longitude, to assist navigation. Resident in Ludlow, Shropshire, Mary Edwards was one of the Board's most prolific

and efficient computers. The daughter of a mathematician and physicist, **Alice Everett (1865–1949)** attended lectures at Queen's College, Belfast, when it opened to women students in 1882, and after studying at Girton College, Cambridge, worked at the Royal Observatory, Greenwich, as a computer for the International Astrographic Catalogue, and during the First World War worked at the National Physical Laboratory.

After studying mathematics at Bedford College, London, where she went on to teach mathematics and physics, **Alice Elizabeth Lee (1858–1939)** impressed the biostatistician Karl Pearson, under whom she carried out doctoral research into the correlation of skull sizes. She was employed in his eugenics research at University College London, contributing to scientific papers. Ill-health brought her resignation in 1907. Her successor, the statistician and eugenicist **Ethel Mary Elderton (1878–1954)** belonged to a family of mathematicians. She was recruited to Karl Pearson's Galton Eugenics Laboratory at London University, where she undertook studies of the influence of parental alcoholism on offspring, and on trends in the birth rate in northern England, as well as compiling a primer on statistics. The medical statistician **Frances Wood (1883–1919)** was one of seven sisters educated at Notting Hill High School. After studying at University College, London, where she graduated in chemistry, she took up a research post at the Lister Institute of Preventive Medicine, and moved into the field of medical statistics, and had a 'brief yet meteoric' statistical career. In 1915 she became the first female member of the council, of the Royal Statistical Society. For her war work in the Ministry of Munitions Central Statistical Department, she was appointed MBE in the first such honours list in 1917. She died following childbirth in 1919. The medical statistician and epidemiologist **Hilda Mary Woods (1892–1971)** had originally trained for a career in music, but after the death of her fiancé on the Western front, took employment in the welfare section of the Ministry of Munitions, collecting statistics from factories employing women, publishing a report on the incidence of industrial accidents. Her only degree, a London University DSc, was awarded on the basis of her investigations on medical statistics and epidemiology, subjects which she taught to medical students at the London School of Hygiene and Tropical Medicine.

The microbiologist **Frederick Griffith (1877-1941)** undertook his most important work while a civil servant working for the Ministry of Health in a small laboratory in central London. A medical graduate of Liverpool University, Griffith was originally recruited to the Local Government Board as a medical bacteriologist, studying the microbiology and epidemiology of infectious diseases. His work during the 1920s on the pneumococcus, a major cause of pneumonia and morbidity in the early twentieth century, led to the paper, published in 1928, which was his lasting contribution to biological sciences and which included his observation 'that material from one dead cell could be used to alter permanently the properties of a living cell'. His work did not receive widespread notice at the time of his death, but subsequently his 'beautiful experiments describing transformation have been increasingly recognized as one of the first key steps in our understanding of DNA as the genetic material.' After studying biochemistry, **John Yudkin (1910-1995)** developed an interest in nutrition, and as professor of physiology at King's College of Household and Social Science, introduced the first course in nutrition in the UK. His research demonstrated a statistical relationship between sugar consumption and the incidence of cardiovascular disease, though his findings were overshadowed at the time by those which indicated that a high intake of animal fat was the important link. His views were the subject of a televised debate, broadcast in 1974. Although he received few honours in his lifetime, the significance of his work has been posthumously recognized. At the University of Manchester and, from 1961, Imperial College, London, the electrical engineer **Eric Roberts Laithwaite (1921-1997)**, undertook work on linear induction motors, whose applications to transport he enthusiastically promoted to television audiences. During 1966-7 he gave the first complete televised Royal Institution Christmas lectures. His scientific career stalled, however, when his Royal Institution Christmas lectures for 1974-5 challenged Newton's third law of motion, and as

this was done in a lecture series aimed at children, his views were considered especially damaging.

An earlier generation of popularizers of science is recorded in this update. Between the 1830s and 1850s **Rosina Maria Zornlin (1795-1859)** wrote at least nine books on the physical sciences, many of them aimed at children. Her works were notable for their encouragement to readers to take part in the activity of scientific discovery. A near contemporary, **Anne Wright (1793-1861)**, from a Quaker family, took up natural history after a period of illness. Devoutly religious, she grounded her writings in traditional natural theology. After an unhappy marriage as an army wife ended in divorce, **Alice Bodington (1840-1897)** married a doctor specializing in mental illness and helped him to run a private asylum in Kingswinford. After they settled in Canada, she started contributing articles on biology, among other subjects, which she gathered together in a book on evolution aimed at the general reader, synthesizing recent biological research. Poor health forced the clergyman **Henry Neville Hutchinson (1856-1927)** to give up pastoral work, and he took up science writing for a popular audience, with a focus on geological topics. He introduced fossil discoveries to the public. Like earlier generations of clergyman-naturalists, he was concerned to reconcile Christianity and science, and promoted evolutionary theory, though adopted a modified view of natural selection.

In 1804 the Cambridge mathematician (ranked eleventh wrangler in the mathematical tripos) **John Toplis, John (bap. 1775, d. 1857)**, complained of the neglect into which 'mathematics and the sciences dependent upon them' had fallen in Britain. An advocate for the introduction of the continental calculus into Britain, he undertook a translation of the work of Laplace, which he completed in 1814 while headmaster of a school in Nottingham, though it was not a commercial success. Another Cambridge wrangler a century later, **Eric Harold Neville (1889-1961)** was appointed to the chair of mathematics at University College, Reading, in 1919. He was principally remembered for his contribution to mathematical education, and he was a leading figure in the Mathematical Association and contributor to its chief publication, the *Mathematical Gazette*. The early research of **Harold Stanley Ruse (1905-1974)**, undertaken at Edinburgh University, was 'at the frontier with physics, with articles on general relativity, tensor calculus, and space-time configurations'. He went on to hold chairs at University College, Southampton, and the University of Leeds, where he became head of the school. **Edwin Arthur Maxwell (1907-1987)** spent his career at Cambridge, where he pursued research interests in geometry, but was mainly interested in mathematical education, writing textbooks, and also popular works on the subject, including *Fallacies in Mathematics*, which 'used humorous examples of fallacious reasoning to instil in its readers an appreciation of the importance of logical and mathematical rigour'. Influenced at Cambridge by Wittgenstein, **(Reuben) Louis Goodstein (1912-1985)** was professor of mathematics at Leicester University for nearly thirty years, having become (in 1948) the first mathematical logician to be appointed to a British university chair. He is known for 'Goodstein's theorem', set out in a 1944 publication on number theory.

Lives in Business

The entry on the **Chance family (act. 1793-1981)** of glass makers in the West Midlands, traces the family firm from the partnership formed in 1793 to the closure of the Smethwick works in 1981, and adds the lives of three family members, **Robert Lucas Chance (1782-1865)**, **William Chance (1788-1856)**, and **Sir (William) Hugh Stobart Chance (1896-1981)**. The firm, which was best known for supplying the rolled-plate glass panes for the 'Crystal Palace' to house the Great Exhibition in 1851, moved into optical glass production, and in the twentieth century also made domestic glassware. Apprenticed as a compositor in his native Saxony, **Friedrich Gottlob Koenig (1774-1833)**, inventor of the steam-driven printing press,

set up as a printer and bookseller, and began experiments with mechanization. From 1806 he was in London, where from 1810 he patented processes that harnessed steam power in printing, developing a cylindrical press that enabled *The Times* newspaper to be printed by steam-power, in November 1814. After disputes with his partners over infringements to his patents, he left London in 1817. **Henry Willett (1823–1905)**, ran the family brewery in Brighton, where he promoted the idea of a custom-built museum, which opened in 1873. In 1903 he presented to the museum his collection of British pottery and porcelain, assembled and organized with a view to telling the history of the British people through the decorative representations on the pottery which they kept in their homes. The veterinary surgeon **William Catton Branford (1835–1891)** had an unsuccessful spell as a professor of the subject in Edinburgh, where the students burned an effigy of him in 1870. He went into practice in the Cape of Good Hope, where he was briefly gaoled for running a fraudulent horse lottery, but went on to exploit nitrate resources that he had discovered there. He was the father of the sociologist Victor Verasis Branford. After a turbulent early life, during which she sold watercress to supplement the family income after her father's death, and subsequently to support her children from her violent first marriage, the watercress grower and entrepreneur **Eliza Fleet [known as Eliza James] (1855–1927)** traded under her own name in London in the early twentieth century. Known as the Watercress Queen of Covent Garden, she cultivated watercress beds in the parishes of Hurstbourne Priors and St Mary Bourne on the river Bourne, which flowed through the Hampshire chalk, providing ideal growing conditions. **Leonard Jay (1888–1963)** followed his father's occupation as a compositor, but became an instructor, and in 1925 was appointed the first head of the City of Birmingham School of Printing, the largest printing centre outside London. He wanted technical training to be responsive to the demands of commercial printing, and to show that quality bookwork was compatible with mechanized production.

Literature and the Arts

The release includes the lives of two literary authors. After the death of her clergyman father, the author and journalist **Catherine Jane Hamilton (1841–1935)** was obliged by financial difficulties to leave the Somerset village where she spent her childhood, to live with relatives in Queen's County, Ireland. Writing was a source of income and she produced didactic fiction for young readers. At the turn of the century, her collections of biographical essays on notable women, 'demonstrated a sophisticated understanding of the challenges that women faced in reconciling their professional, social, and artistic aspirations with the dictates of traditional domestic femininity'. The writer and poet **Sophie Suzanne Gaudier-Brzeska (1872–1925)**, brought up on her family's estate in Galicia in the Austro-Hungarian Empire, struggled to find employment after her father's bankruptcy. In 1911 she came to London with her husband, the sculptor Henri Gaudier-Brzeska, and after his death on the Western front in 1915 wrote her magnum opus, *Per Ta Très Chère Memoire*, 'a type of diary in which she mourned her loss and recounted her daily life'. Latterly she lived in Gloucestershire.

A reference group entry surveys the group of female designers and makers in the fields of fine and applied arts who, in 1907, founded the **Women's Guild of Arts (act. 1907-1939)** as a network of professional women. They worked at the highest standards, and perpetuated the ethos of the Arts and Crafts movement and of the Art Workers' Guild, from which women were excluded. The Guild offers a point of reference and comparison with the Women's Engineering Society.

The Oxford DNB is updated regularly throughout the year, giving you access to the most up-to-date and accurate information available. Full access to all biographies is available by subscription.