Editorial

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EDITORIAL

Volume 61 of *Biographical Memoirs* contains 26 accounts of Fellows and Foreign Members who died recently. This is a greater number than has been the case for some years. Of the 26 memoirs, 20 come from the physical and engineering sciences and only 6 from the biomedical sciences, but one of the former group, Michael Fasham, is partly biological. However, the latter group includes two outstanding scientists and Nobel laureates. Fred Sanger, whose memoir was written by George Brownlee, was a committed molecular biologist who uniquely won the Nobel Prize twice, once in 1958 for protein sequencing and again in 1980 for the sequencing of nucleic acids. He stimulated our understanding of the chemistry of many proteins and enzymes and, moreover, his ingenious DNA sequencing method revolutionized molecular biology. Robert Edwards’s memoir was written by Richard Gardner, who explains that Edwards was responsible for the most significant advance in the treatment of human fertility, the development of *in vitro* fertilization (IVF), for which he was awarded the Nobel Prize in 2010. He persisted in his work in spite of vehement opposition from all quarters. However, the first of many IVF successes came in a live birth in 1978. Edwards was also noted for the diagnosis of genetic disease and the use of stem cells in regenerative medicine.

Within the realm of the physical sciences, Jacques Friedel’s memoir was written by Adrian Sutton and Olivier Hardouin Duparc, who emphasize the important role played by Friedel in condensed matter physics and the physics of materials, including dislocation theory. He became a Foreign Member of the Royal Society and President of the French Academy of Sciences. Another scientist who worked on materials was Anthony Kelly, whose memoir is due to A. Howie; he emphasizes Kelly’s contributions on metal crystals and their imperfections, ceramics and composites. Kelly was a long-serving and influential Vice Chancellor of the University of Surrey. David Cockayne, as described by Peter Hirsch, was very distinguished in the use of electron microscopy in materials science, including the dark-field, weak-beam technique of transmission electron microscopy, by means of which crystal lattice defect geometries could be studied. His influence was great in Australia, where he became Director of the Sydney electron microscope, as well as in the UK. William Schneider was a Canadian whose research focused on gas laws, phase changes and critical phenomena. However, later, as explained by Allan Reddoch and Willem Siebrand, he switched to nuclear magnetic resonance, and subsequently became President of the National Research Council of Canada. A New Zealander, Daniel Walls, is the subject of a memoir by Peter Knight and Gerard Milburn, who write of Walls as specializing in quantum optics and non-classical light, leading a group in theoretical quantum optics in New Zealand and thereby developing worldwide active and productive research collaborations.

Wallace Sargent, whose memoir is by Donald Lynden-Bell, was an astronomer distinguished for the use of telescopes to determine the origin of the elements and the cosmological evolution of primordial gas clouds. By use of spectroscopy he showed that helium was formed...
in the Big Bang, thus helping to determine the photon:baryon ratio. We move now to the Earth sciences, where the memoir of Michael Fasham was contributed by Thomas Anderson and Harry Bryden. Fasham was distinguished for his development of marine ecosystem models for nutrient and carbon cycling in the ocean, and for the Fasham–Ducklow–McKelvie model. He straddled the physical and biological fields and led the Joint Global Ocean Flux Study to coordinate field work, synthesis and modelling. Also an Earth scientist was Michael O’Hara, whose research, described by David Rickard, made him a leading igneous petrologist, identifying rocks from the deep mantle, developing mathematical models of igneous rock formation and treating magma problems. He became a leading national science administrator who played a significant role in the profile of UK university research and teaching in the Earth sciences. Another Earth scientist was Edward Irving, whose memoir has been written by Roy Hyndman. Although born in the UK, Irving spent the major part of his life in Canada, becoming an influential figure in the use of magnetic remanence in ancient rocks to treat geological questions. He was a leader in showing that continental drift was a real phenomenon, and studied secular changes in the Earth’s magnetic field. He was a Foreign Associate of the US National Academy of Sciences.

John Westcott is the only engineer to appear in this year’s volume, in a memoir written by David Mayne. During World War II he was closely involved with the development of 3 cm radar. Afterwards he spent a period of time at Massachusetts Institute of Technology, where he came under the influence of Norbert Wiener. Later, Westcott became a leader in the field of automatic control, bridging the transition from classical to modern control theory. He led research projects in a variety of fields, including engineering and the UK economy, a remarkable tribute to his broad vision.

Alan Katritzky was a chemist who pioneered heterocyclic chemistry, as John Boulton describes in his memoir. His research contributed greatly to the synthetic work of the pharmaceutical and agrochemical industries and those industries that involved dyestuffs and polymers. He was a most energetic researcher within a large team, which he stimulated, from around the globe. Christopher Moody has written about Charles Rees, who also researched on heterocyclic chemistry, the rings composed of carbon, nitrogen, oxygen and sulphur atoms. DNA bases, the building blocks of life, are indeed heterocyclic molecules. His scientific work was dominated by electron-deficient species, such as carbenes, nitrenes and arynes, and novel aromatic systems. He was a distinguished and popular colleague. A third chemist was Nicholas Handy, whose memoir has been contributed by David Clary, Peter Knowles and David Tozer. He was a computational chemist who contributed significantly to the application of quantum mechanics to molecules. Professor Handy developed very important computational methods to turn quantum chemistry into a central tool for our understanding of molecular science.

We turn now to the mathematical sciences, where there are seven memoirs, two of which are in pure mathematics, one in statistics and four in applied mathematics. David Rees, whose memoir is due to R. Y. Sharp, completed his undergraduate studies in the summer of 1939, but in three months of postgraduate studies he produced a characterization of 0-simple semigroups that has remained very influential in semigroup theory. However, the war intervened and he moved to Bletchley Park until 1945 to work as part of the team that broke the Enigma code. After the war he returned to work on semigroups, but also on non-commutative algebra. He is regarded as a founding father of semigroup theory. A second pure mathematician was Ambrose Rogers, whose memoir has been contributed by Kenneth Falconer, Peter M. Gruber, Adam Ostaszewski and me. He was extraordinarily broad in his mathematical interests,
reflecting the need for several authors. Thus his research covered the geometry of numbers and discrete geometry, Hausdorff measures, convexity and topological descriptive set theory. He was influential more generally in setting up the LMS–EPSRC Durham Symposia during his presidency of the London Mathematical Society; the Durham Symposia remain a fine tribute to him. In statistics, George Box, as described by Adrian Smith, made seminal contributions to the theory and practice of quality control, time-series analysis and Bayesian inference. It was during World War II that he came to realize the importance of statistics when, with his interests in chemistry, he was required to conduct biochemical experiments on the effects of mustard gas. This interest in statistics led to his move to the USA, where he founded the Department of Statistics at the University of Wisconsin–Madison. On the applied side of mathematics we come to the work of Gerald Whitham, as explained by A. A. Minzoni and N. F. Smyth, who was so deep in his understanding of nonlinear waves, including hyperbolic waves, shock waves and water waves. His early research, for example, dealt with supersonic flow past a projectile and the propagation of spherical blast. Moreover he developed his theory to include traffic flow along crowded highways, using conservation laws based on the density of cars. It was verified by observation of traffic! His great work on linear and nonlinear waves remains the standard reference, and he led the formation of the Department of Applied Mathematics at the California Institute of Technology, which has been very influential. B. D. Sleeman and I. D. Abrahams write about the creative research of Douglas Jones, whose contributions to the theory of electromagnetic and acoustic waves have been so important with his development of powerful mathematical techniques to study them. Jones used these methods to solve problems of practical and social importance, such as those of radar antennae, stealth aircraft, sonic booms and noise shielding. His techniques included multidimensional generalized functions, the Wiener–Hopf method and powerful numerical schemes. The influence of his work is all around us! Rodney Hill is the subject of a memoir by Michael Sewell, who was a research student of Hill, and describes how, after graduating from Cambridge, Hill volunteered for war service and did research on ballistics in the Cambridge Mathematical Laboratory and on plasticity of metals in the Cavendish Laboratory. In 1943 he moved to the Armament Research Department at Fort Halstead, where he investigated the armour penetration by projectiles. This led to his great work, *The mathematical theory of plasticity*, which was published in 1950 and remains an important reference source today. Thus was laid the foundations of Rodney Hill’s great influence in solid mechanics, which persists and justifiably so. The memoir of Anthony Spencer was contributed by P. Chadwick, A. H. England and D. F. Parker, who indicate that Spencer’s major interest was in the mechanical behaviour of advanced materials. He formulated constitutive equations to develop new models of materials for composites, granular materials and laminates. In his early career he had visited the group at Brown University and gained much experience (with Ronald Rivlin) of algebraic invariants in continuum mechanics. On his return he worked at Aldermaston on the ground effect of explosions. Later, at the University of Nottingham, he formed the Department of Theoretical Mechanics, which gained a high reputation in research and teaching due to Spencer’s influence.

We return now to the biological and medical sciences, having discussed earlier the memoirs of Fred Sanger and Robert Edwards. Rodney Quayle, whose memoir has been contributed by Christopher Anthony, was a microbial biochemist who used radioactive carbon compounds in the study of metabolic pathways. In particular he elucidated the pathways of carbon assimilation during microbial growth on compounds with a single carbon atom, such as methane and methanol. When he started, little was known about organisms such as
methylotrophs, but after his work such studies were pursued worldwide. Later he became a successful and popular Vice-Chancellor of the University of Bath. Patricia Clarke, whose account is by W. J. Brammar, studied Natural Sciences at Cambridge together with, among others, the aforementioned Fred Sanger. After completing the Tripos (I believe that Cambridge did not award degrees to women at that time!) she volunteered to join the Armaments Research Department, but then moved to microbiological research on bacterial toxoids. Eventually she joined the Faculty in Biochemistry at University College London, and did pioneering and seminal work on the directed evolution of bacterial metabolic capabilities. She was a passionate supporter of equal opportunities for women in education and science.

Struther Arnott is the subject of a memoir by Dai Rees, who explains that Arnott worked on structure determination by X-ray diffraction, initially for single crystals but then for complex disordered materials. Later he developed computer methods to tackle such problems, to very good effect. Then he joined the Medical Research Council unit at King’s College, London, and worked with Maurice Wilkins in studies of the double-helix DNA structure, to which Rosalind Franklin, who also was at King’s, made significant contributions. Eventually he moved to Purdue University in the USA as Professor of Biology before returning to Scotland as a very successful Principal and Vice-Chancellor of the University of St Andrews. Richard Laws, whose memoir is by John Croxall, Ian Boyd, Ian Parker and Geoffrey Cook, was the leading marine mammalogist of his generation. He developed new techniques for population studies of elephant seals and whales. Later, in Africa, he developed similar approaches to large land mammals, notably elephants. In due course he returned to the UK as Head of Life Sciences and then Director of the British Antarctic Survey (BAS), where he was a very inspired and inspiring leader. On retirement from BAS he became Master of St Edmund’s College, overseeing its transition to becoming a fully integrated college of the University of Cambridge. Richard Laws leaves a great legacy for the study of populations of large mammals and for the scientific conservation of the Antarctic.

I am indebted to many colleagues who have contributed to producing this volume, including Keith Moore, Librarian, Raminder Shergill, Editorial Coordinator, and Kelly Hutchinson, Production Manager, and to Bruce Goatly and others in Publishing. I thank all of them and also all the authors, some of whom offered their services as volunteers, who have given their time and efforts so willingly to these fine memoirs.

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