Editorial

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EDITORIAL

BY MALCOLM LONGAIR* CBE FRS FRSE

Welcome to volume 63 of Biographical Memoirs of Fellows of the Royal Society, the 2017 edition. To remind myself of the effort involved, I have co-authored two of the memoirs in this volume, bringing home to me how much we owe to the authors of the other 21 memoirs, the range and quality of which are truly excellent. I thank these authors most sincerely for their unstinting and dedicated efforts to do justice to those commemorated.

As indicated last year, one of the major tasks which Helen Eaton and I have undertaken over the last year has been to start to catch up with the backlog of memoirs which have yet to be commissioned for deceased Fellows. Our aim is to be as comprehensive as possible and we have been endeavouring to commission as many memoirs as are feasible for Fellows who have died since 2000. Our greatly expanded Editorial Board, consisting of 30 members, has been very supportive of this initiative and there are now over 100 memoirs in the process of being written. We are also very appreciative of the suggestions that we receive for potential authors from the families, the Fellowship and other colleagues.

This exercise has been so successful that by August 2017 we had already published online the 23 memoirs contained in this volume, with many more in an advanced state of preparation. To cope with the increased rate of publication of memoirs, we are most grateful to the Royal Society for agreeing to allow us to publish two volumes next year, one in the Spring and one in the Autumn of 2018. With the present rate of commissioning, we should be able to provide a much more complete set of memoirs over the next few years. Also, with over 60 Fellows being elected each year, it is clear that in the steady-state we will need to continue to produce two volumes per year to provide a more-or-less complete record.

Some of the memoirs in this volume are appearing quite long after the death of the Fellow. It should be emphasized that this is not due to any lack of diligence by the authors. The most extreme case is the splendid memoir of Francis Crick who died in 2004. Mark Bretscher and Graeme Mitchison stepped up to the challenge last year when, for a variety of reasons, the original commission could no longer be fulfilled. In the case of Anatole Abragam, the memoir had been largely written but lay dormant for some years until our investigations resulted in the memoir reappearing. We are continuing our efforts to fill in the gaps with the excellent support of the Editorial Board. We are giving some priority to more recent deaths while memories are still fresh.

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Again, let me record my pleasure in learning of the achievements and characters of those celebrated in this volume. In a number of cases, the struggles against adversity are moving and inspiring while in others the sheer ability to achieve so much in a lifetime is staggering.

One important initiative this year has been my letter to Fellows of the Society, asking them to provide biographical materials which will lighten the task of a future biographer. These materials are extraordinarily valuable and I am most grateful for the positive response of the Fellowship. Of course, this cannot be a high priority for many Fellows who are, in my experience, chronically over-tasked and single-minded in their pursuit of their scientific pursuits and other commitments, but the provision of even a recent CV and list of publications is immensely valuable.

Memoirs are published on the Biographical Memoirs website as they are ready, before collection into the printed volumes, so please look out for new essays throughout the year.

**Biographical Memoirs 2017**

There are 23 memoirs in the 2017 volume of Biographical Memoirs, spanning a huge range of the sciences. The following notes are intended to act as a guide to the different disciplines represented, with brief summaries of the achievements of the Fellows, largely taken from the memoirs’ synopses. These, and previous volumes, can be accessed on the Royal Society’s website [http://rsbm.royalsocietypublishing.org](http://rsbm.royalsocietypublishing.org).

**Astronomy**

**Geoffrey (Geoff) Burbidge**'s career spanned the tumultuous years when astronomy was transformed from a purely optical science to a multi-wavelength discipline through the development of radio, X-ray, γ-ray astrophysics and cosmic ray physics. He made many pioneering contributions, particularly in the synthesis of the chemical elements, the physics of extragalactic radio sources, the dynamics of galaxies, the physics of accretion discs and the origin of cosmic rays. He promoted less popular causes such as non-cosmological redshifts and was sceptical about the standard Big Bang.

**Biochemistry and physiology**

**Hugh Huxley** devoted his life to understanding how muscles contract. He began X-ray research on living muscle with John Kendrew and showed that skeletal muscle is made of a hexagonal array of thick and thin filaments. He invented the sliding filament hypothesis with Jean Hanson and subsequently proposed the swinging cross-bridge model. In his last work, he found incontrovertible evidence for his tilting lever-arm model.

**François Jacob** came late to biological research entering the Institut Pasteur in Paris at the age of 30. Fifteen years later, he received the 1965 Nobel Prize in Physiology or Medicine with André Lwoff and Jacques Monod for the discovery of the mechanisms controlling gene expression in bacteria, the operon model. The impact of this discovery was immense, and triggered the conversion of molecular biologists to the study of higher organisms and their development.

**Edward (Bill) Slater** was one of the key players in the field of bioenergetics in the second half of the twentieth century. He discovered a new component of the mitochondrial respiratory
chain, the Fe-S protein, long known as the Slater factor. In 1953, he formulated his chemical hypothesis for the mechanism of oxidative phosphorylation that would dominate the field until displaced by the chemi-osmotic theory. In 1955, Slater moved to Amsterdam where he built up one of the largest and most successful biochemistry laboratories in Europe.

Chemistry

Malcolm Chisholm was one of the most creative and distinguished inorganic chemists of his generation. He was particularly renowned for the chemistry of compounds containing multiple metal-metal bonds and for showing how they could give insights into catalysts or be used in functional materials.

Alan Davison started his career at an exciting time for the field of organometallic chemistry. New developments in spectroscopy, instrumentation and techniques to manipulate materials in controlled environments to avoid reactions with water synthesis or oxygen were becoming widely available. As a result, he created many new and interesting organometallic compounds. With Professor Alun G. Jones, he made the first synthesis of technetium molecules which have the ability to locate selectively in human heart muscle, thereby vastly expanding the practice of nuclear medicine to a global community.

Harry Kroto was awarded the 1996 Nobel Prize in Chemistry for his discovery of several new allotropes of carbon and, in particular, for the now-famous C_{60} molecule, the atoms of which are arranged in the spheroidal shape of a truncated icosahedron, also known as buckminsterfullerene after the designer of geodetic domes. He was a passionate advocate of the public understanding of science, particularly for young children.

John Murrell was a theoretical chemist who made important contributions to the understanding of the spectra of organic molecules, to the theory of intermolecular forces and to the construction of potential energy surfaces. He established the University of Sussex as a major centre for research and teaching in theoretical chemistry.

Dudley Williams was a pioneer in the use of nuclear magnetic resonance spectroscopy and mass spectrometry to solve important structural problems in chemistry and biology. His 35-year quest to understand the structure and mode of action of the vancomysin antibiotics led him to fundamental thinking about the nature and thermodynamics of molecular recognition, in particular, the roles of solvation, flexibility, entropy, enthalpy and cooperativity.

Environmental science

David Jenkinson was one of the most influential soil scientists of his generation, bringing new insights into the transformations of organic matter and nitrogen in the soil. He spent most of his career at Rothamsted Research at Harpenden, UK. His studies were influential in understanding the role of soil carbon stocks in the context of climate change and the role of nitrogen fertilizer in delivering adequate supplies of food for a growing world population.

Genetics and molecular biology

Francis Crick was perhaps the most influential scientist who shaped and guided the revolution in our understanding of biology through the development of molecular biology. The discipline arose from the efforts of the physicists and chemists who studied the structure of proteins with X-rays and of the biologists studying viruses that infect bacteria. The great intellectual
achievement was to discover how information in genes is expressed and controlled. Crick was at the very heart of all these remarkable developments.

**John Edwards** was a human geneticist who pioneered the development of clinical genetics. His name is known to all in the field for his discovery of trisomy 18, the second trisomic condition to be described in humans after trisomy 21 in Down syndrome in 1959. He was an astute clinician and recognised that if other human chromosome aberrations were to occur, they would be associated with a similar pattern of multiple malformations and handicap.

**Inferential science**

**David MacKay** made pioneering contributions to information theory, inference and learning algorithms. His major achievements include reliable computation with unreliable hardware, approaching the Shannon limit using enhancements of Gallager codes. He developed communication systems for the disabled, including the Dasher code which he made freely available. His influential book *Sustainable Energy: without the Hot Air* resulted in his appointment as Chief Scientific Advisor to the Department of Energy and Climate Change.

**Materials science**

**Edwin (Ted) Smith** is best known for his analysis of continuous dislocations in deformed crystals and the application of this to understanding the conditions leading to plastic flow and fracture in metals. He applied his knowledge to a range of practical problems, particularly ones concerned with the structural integrity of key components in the nuclear power generation industry.

**Mathematics**

**Gerard Friedlander** was a mathematician who embraced both the European and British traditions. His work was marked by profound originality, by the importance of its applications and by the mathematical rigour of his treatment. His first papers from 1939 to 1941 concerned civil defence issues involving the effects of distant bomb blasts, while his late papers concerned more abstract topics in the theory of partial differential equations but with applications. Between these eras, he wrote a series of influential papers on the wave equation, including results for curved space-time.

**Klaus Friedrich Roth** made fundamental contributions to different areas of number theory, including the Diophantine approximation, the large sieve, irregularities of distribution and what is nowadays known as arithmetic combinatorics. He was the first British winner of the Fields Medal, awarded in 1958 for his solution in 1955 of the famous Siegal conjecture concerning the approximation of algebraic numbers by rationals.

**Oceanography**

**David Cartwright** was one of the world’s leading authorities on the tides. Soon after the National Institute of Oceanography was set up, he made important contributions to the study of ocean waves, especially the calculation of their directional spectrum and wave climate. He developed the response method of analysing tides making use of the very long tidal records collected from Hawaii and Newlyn and he investigated the effect of tides on storm surges around the UK. In retirement he carried out what he considered to be his best work, successfully using Geosat altimeter data to generate accurate global maps of the tides.
Anatole Abragam had a profound and lasting impact on the field of magnetic resonance, both electronic and nuclear, through his discoveries and investigations. In nuclear magnetic resonance, especially, he brought to the field theoretical rigour and clarity. He was instrumental in changing the way physics was taught in France and in relaxing the rules for election to the Académie des sciences.

Daniel Bradley was a pioneer of laser physics and technology. He was internationally distinguished for his seminal work on broad-band, wavelength-tuneable lasers, the generation of ultra-short pulses, and the development of the technology that allowed the direct temporal characterisation of optical pulses with sub-picosecond resolution.

Paul Callaghan will be remembered internationally for his many seminal contributions to the foundations of magnetic resonance imaging as applied to the rheological analysis of a series of real world materials (paint, gels, polymer solutions). At home in New Zealand, he was the leading physical scientist of his day, who became a familiar science communicator through popular books, on radio programmes and the promotion of high technology as a part of New Zealand’s economy.

Roger Cowley was one of the leading solid-state physicists of his generation. Adept at both theory and experiment, he was a highly versatile scientist who made important contributions to the understanding of the motions of atoms in solids and liquids, of the mechanisms of structural phase transitions, and of a range of magnetic phenomena, especially in systems with quenched disorder.

Samuel Edwards was one of the leading physicists of the second half of the twentieth century. Remarkably, he made some of his most celebrated scientific discoveries, for instance, the theory of spin glasses and the rheology of high polymer melts, while serving as full-time head of the Science Research Council. At the same time, his deep scientific insights informed his leadership in advising government.

Lisa Jardine was a leading expert on Renaissance humanism and particularly Desiderius Erasmus. In the early 1990s, she became a notable broadcaster and public intellectual, her *Worldly Goods: A New History of the Renaissance* of 1996 becoming a best seller. She wrote biographies of Francis Bacon, Christopher Wren and Robert Hooke, as well as *Going Dutch*, a study of Anglo-Dutch relations in the seventeenth century. From 2008 to 2014, she chaired the Human Fertilisation and Embryology Authority.

Scientific biography and public engagement

First and foremost, we are enormously indebted to the authors of the memoirs in this volume for their outstanding work in producing biographies of lasting value. I am sure these will be widely enjoyed and appreciated. I am also personally indebted to the editorial and production team at the Royal Society whose names and roles are listed on the title page. Their outstanding efforts have enabled us to accelerate the rate of publication of the memoirs whilst maintaining the excellence of their content and high production values.
Malcolm Longair CBE FRS FRSE is Jacksonian Professor Emeritus of Natural Philosophy and Director of Development, Cavendish Laboratory, University of Cambridge. He has held many highly respected positions within the fields of physics and astronomy. He was appointed the ninth Astronomer Royal of Scotland in 1980, as well as the Regius Professor of Astronomy, University of Edinburgh, and the director of the Royal Observatory, Edinburgh. He was head of the Cavendish Laboratory from 1997 to 2005. He has served on and chaired many international committees, boards and panels, working with both NASA and the European Space Agency. He has chaired numerous committees for specific science projects, including the Planck and Euclid missions of ESA.

His main research interests are in high energy astrophysics, astrophysical cosmology and the history of physics and astrophysics. His book Maxwell’s Enduring Legacy: A Scientific History of the Cavendish Laboratory was published in July 2016. His current projects include editing with Helge Kragh A Handbook of the History of Modern Cosmology and creating a digital archive of historic photographs illustrating the history of the Cavendish Laboratory.