# OBITUARIES

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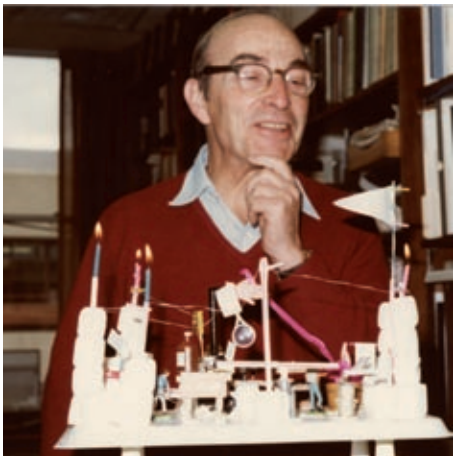

## Arthur Kornberg

Discovered DNA polymerase, the enzyme that switches on DNA replication

Arthur Kornberg, a prolific researcher who described his career as a "love affair with enzymes," discovered DNA polymerase, an enzyme critical to DNA replication.

For his discovery, he shared the 1959 Nobel Prize in Physiology or Medicine with Severo Ochoa, who discovered RNA polymerase. Kornberg's discovery helped to launch the biotechnology revolution. Downstream discoveries include several genetically engineered drugs used to treat cancer, AIDS, viral infections, and autoimmune diseases. It also laid the groundwork for gene sequencing and the development of laboratory techniques such as the polymerase chain reaction, or PCR.

Kornberg was born in 1918 to immigrant parents from eastern Europe who owned a small hardware store in New York. Although he was a precocious student and graduated from high school at the age of 15, he showed no early special interest in science.

After graduating from medical school in 1941, Kornberg served as a ship's doctor on a US Coast Guard vessel—and had frequent quarrels with the ship's captain. Although he had intended to stay with the coast guard until the second world war was over, he left his position for a research post at the National Institutes of Health (NIH) in 1942.

While still in medical school, Kornberg had studied Gilbert syndrome, a disorder he himself had. His report, published in 1942, captured the attention of military medical officers and senior medical officers at the NIH who were concerned with an outbreak of jaundice caused by the yellow fever vaccine. They offered Kornberg a research position at the NIH.

Although Kornberg had no formal research training, he took the post and studied fatal blood disorders induced by sulphur antibiotics in rats, discovering that they caused folic acid and vitamin K deficiencies. Since many vitamins serve as components of enzymes or co-enzymes, he studied the "philosophy and practice of enzyme purification." In 1946 he took leave to study with Severo Ochoa at New York University. There, he learnt the painstaking techniques of separating a target enzyme from thousands of other enzymes and proteins.

The synthesis of co-enzymes led him to an interest in the biosynthesis of nucleic acids and DNA. Even before Crick, Watson, and Wilkins described the structure of DNA, Kornberg's fascination with enzymes led him to work on the "machinery" that allowed cells to replicate DNA. But the task of isolating the single enzyme responsible for DNA replication was considered so daunting that many scientists thought it impossible at the time.

After leaving the NIH in 1953 to become professor and chair of the department of microbiology at Washington University, Kornberg accomplished the feat: in 1956 he isolated the enzyme now known as DNA polymerase I from *Escherichia coli*.

But Kornberg's discovery was nearly overlooked when he submitted his findings to the *Journal of Biological Chemistry* in October 1957. A row broke out after some of the journal's referees wrote scathing critiques of his work. One referee insisted on proof that the DNA synthesised by Kornberg actually had genetic activity—a proof not met by most researchers at the time. Kornberg was disgusted by the reviews and withdrew the two papers. He resubmitted them when a new editor took over the journal, and they were published in May 1958.

After becoming chair of the new biochemistry department at Stanford University School of Medicine in Palo Alto, California, in 1959, Kornberg continued to study DNA polymerase. He discovered that the enzyme could not only trigger replication of DNA but also degrade DNA and even repair mismatched nucleotides, thereby averting disastrous errors.

Later work on DNA polymerases by Kornberg and other scientists raised questions about the role of DNA polymerase I in DNA replication. But subsequent work by other researchers and two of his sons, Tom and Roger, helped to elucidate the interplay among several DNA polymerases that allows replication, degradation, and repair of DNA. Roger won the 2006 Nobel Prize in Chemistry for unravelling the mechanism for cells to make proteins using genetic instructions.

While at Stanford, where he remained for the rest of his career, Kornberg worked to develop a genetically active DNA. In 1967 he synthesised a form of circular DNA from a small phage that infects *E coli*. This led President Lyndon Johnson to announce, "Some geniuses at Stanford University have created life in the test tube." Kornberg was reportedly "dismayed" by the comment and said such a characterisation was inaccurate since viral DNA has no life outside a larger system.

In 1991 Kornberg began an intensive period of research—which lasted until his death—into inorganic polyphosphate, which he dubbed "Poly P." This is a polymer of phosphates that are responsible for motility and virulence in some of the major pathogens.

He was widely revered for his teaching style and open sharing of research findings. He wrote several books, including *For the Love of Enzymes: The Odyssey of a Biochemist*, and most recently a children's book, *Germ Stories*.

Kornberg was married in 1943 to Sylvy Ruth Levy, a biochemist who worked closely with her husband and famously quipped, "I was robbed," after she learnt that he had won the Nobel prize. Levy died in 1986, and Kornberg married Charlene Walsh Levering in 1988. Levering died in 1995. He then married Carolyn Dixon in 1998. He continued his research and teaching activities at Stanford until just a few days before his death.

Arthur Kornberg, (active) professor emeritus Stanford University Medical School, Palo Alto, United States (b 1918; q University of Rochester, Rochester, NY, 1941), died from respiratory failure on 26 October 2007.

**Jeanne Lenzer**

## Esmond William Ball

Former consultant haematologist Selly Oak Hospital, Birmingham (b 1919; q St Bartholomew's Hospital, London, 1944; MD, FRCPath), died from congestive heart failure on 1 September 2007.

Esmond William Ball served in the Royal Army Medical Corps in the Middle East and Kenya before training as a pathologist. In 1965 he was appointed consultant pathologist at Selly Oak Hospital, where he remained for 20 years. As a singlehanded consultant he developed an outstanding laboratory based haematology service, applying innovative techniques, automation, and computer technology. He also helped to develop the postgraduate medical education centre, and form the West Midland Regional Haematology Committee, and he served on the council of the Association of Clinical Pathologists. After retirement he was active in Rotary International and became a student at the Birmingham Jewellery School. He leaves a wife, Jennifer; three children; and eight grandchildren.

**Keith Shinton**

## Thomas Christie Falconer

Former port medical officer Tyne Port Health Authority (b 1916; q Dundee (St Andrews) 1951; DPH, DIH), d 16 July 2007.

Thomas Christie Falconer ("Christie") had almost qualified as an actuary with Scottish Widows in Edinburgh when in 1938 he volunteered for active service in the 113th Field Regiment and served at Dunkirk, in North Africa, and in the Salerno landings, becoming captain. After six years and having received medical care while wounded, he decided to study medicine. He wrote a thesis, "Anthrax in bone meal workers," while medical officer, Port of Tyne. Aged 63, he joined a practice in Whitley Bay, retiring at the age of 70. He loved ships, many times acting as ship's surgeon. He leaves a wife, Mary; two sons; and four grandchildren.

**Alistair F Falconer**

## Donald Henry Gamage

Former general practitioner Swansea (b 1927; q Middlesex Hospital, London, 1951), d 9 August 2007.

After working in Swansea Hospital, Donald Henry Gamage ("Don") did his national service in the Royal Air Force. After two years he entered general practice in Swansea. During his practice and after retiring he carried out medical assessments for the Department of Works and Pensions. An active medical politician, he attended international conferences and was chairman of the West Glamorgan Division in 1987. Don was a member of his church for many years as a sidesman, and a keen gardener and supporter of rugby. He leaves a wife, Marion; two children; and five grandchildren.

**Paul Mellor**

## John Lanagan Kelly

Former general practitioner Glasgow (b 1921; q Glasgow 1944), died from metastatic colon cancer on 11 November 2007.

The son of a publican, John Lanagan Kelly entered general practice after serving as a captain with the Royal Army Medical Corps in Egypt. He was one of the last of a dedicated group of general practitioners in singlehanded practice in south Glasgow, retiring reluctantly from NHS work in 1991 but continuing to work with local alcohol rehabilitation services. A devout Roman Catholic, he remained active as a medical officer with the Glasgow Archdiocesan pilgrimage to Lourdes. Predeceased by his first wife, Mary, he leaves his second wife, Elizabeth; three children; and seven grandchildren.

**Damian J Kelly**

## Keith David Vellacott

Consultant surgeon Royal Gwent Hospital, Newport (b 1948; q The London Hospital 1972; MBE, DM, FRCS), died from metastatic colorectal cancer on 9 October 2007.

After research with Professor Jack Hardcastle in Nottingham, Keith David Vellacott ("KDV") continued his surgical training in south west England before joining the Royal Gwent in 1986 as a general surgeon with an interest in colorectal surgery. He introduced colonoscopy, endoscopic retrograde cholangiopancreatography, and laparoscopic cholecystectomy services and was active in adopting and promoting day case surgery in the region. He also started the hospital's laparoscopic colorectal surgery programme and participated in many national colorectal cancer studies. KDV carried on working despite five major cancer operations over eight years, but he died before being able to receive his MBE. He leaves a wife, Jinette, and two children.

**Miles Allison**
**Brian Stephenson**

## Ernest Want

Former general practitioner and honorary alderman Nottingham (b 1913; q Bristol 1936; FRSH), d 5 September 2007.

Ernest Want was in general practice in Nottingham from 1939 to 1985, and was an influential reformer of Nottingham's services between 1954 and 1971, when he served on the city council; he became an alderman in 1963 and lord mayor in 1971-2, as well as deputy lord mayor in 1970 and 1972. As a politician he participated in every facet of the NHS, including as chairman of the local health authority. He encouraged the development of Nottingham's new medical school, a programme to develop health centres, and the provision of mental health services. Predeceased by his wife, Jean, in 1997, he leaves two children.

**Christopher Kul-Want**

## Donald Drummond Webster

Former consultant psychiatrist St Luke's Hospital, Middlesbrough (b 1923; q Newcastle Medical School, University of Durham, 1945; FRCPsych), d 10 October 2007.

Deemed unfit for military service because of a mild chronic facial lupus, Donald Drummond Webster became an assistant medical officer in Cherry Knowle Hospital, Ryhope, County Durham, after qualifying. He was consultant psychiatrist at St Luke's Hospital, Middlesbrough, in 1959 until he retired in 1982, as well as consultant adviser in psychiatry to ICI in Billingham. An active member of the BMA, he taught at the department of psychological medicine in Newcastle for a time, was an expert in medicolegal cases, and participated in MRC clinical trials on drug treatment in depressive illness in the 1960s. He leaves a wife, Betty, and two children.

**Walton of Detchant**