Professor Donald Michie and his former wife Dame Anne McLaren, distinguished scientists in separate fields that overlapped at one point, have died together in a car accident; Donald was 83.

He made contributions of crucial international significance in three distinct fields of endeavour. During the second world war, he developed code-breaking techniques which led to effective automatic deciphering of German high-level ciphers. In the 1950s, he worked with Anne on pioneering techniques which were fundamental in the development of in vitro fertilisation. Donald subsequently became one of the founders of the field of artificial intelligence, an area to which he devoted the remainder of his academic career. It was within this field that I came to know Donald as an inspirational supervisor of my PhD at Edinburgh - not only insightful, forceful and even heroic, but possessing a wicked sense of humour.

Donald was born in Rangoon. He attended Rugby school and was awarded an open scholarship to study classics at Balliol College, Oxford, in 1942.

In 1943, inspired by his father to do "something unspecified but romantic" behind enemy lines in China, Donald attempted to enrol on a Japanese language course for intelligence officers. On arrival at the School of Codes and Ciphers in Bedford, he was told that the course was full, and decided instead to take up training in cryptography. A fast learner, he was soon recruited to Bletchley Park in Buckinghamshire, and was assigned to the "Testery", a section working on solving the German high-level teleprinter cipher, code-named Fish.

Owing to recent declassification, it is now clear how profoundly important Donald's wartime research was. In April 1944 he invented a technique for using the Colossus computer, developed at Bletchley, to automatically decode the secondary wheel of the Lorentz machine, which the Germans used for encoding Fish.

The innovation, tested by Donald and Jack Good, endowed the machine with a degree of general-purpose programmability and led to a radical last-minute enhancement in the construction of Colossus II. The results were dramatic. Texts which previously had taken days to decipher could now be completed in hours, allowing repeated effective interception of enemy attacks.

During this period at Bletchley, Donald held frequent lunchtime discussions with Alan Turing on the possibility of building computer programs that would display intelligence. Before the war, Turing had developed the mathematical basis for modern digital computation, and was applying the principles he had developed in the decoding efforts at Bletchley. Both Donald and Turing were interested in programming computers to play chess, as well as developing programs which could learn automatically from experience.

Following the end of the war, Donald decided to take up his offer from Oxford. His wartime experience had diverted his former interest in classics into a passion to study science. Supported by a Balliol College war memorial studentship, he received his MA in human anatomy and physiology in 1949. During his subsequent DPhil degree at Oxford, Donald put his boyhood hobby of breeding pet mice to work in a series of genetic studies published in the journal Nature.

In Oxford, he married his fellow student Anne McLaren in 1952. The following year, he received his DPhil in mammalian genetics and went on to work with Anne on techniques related to in vitro fertilisation, first at London University and then at Edinburgh. Donald and Anne were divorced in 1959.
While working at the department of surgical science in Edinburgh, Donald co-wrote one of the first introductory textbooks on the new science of molecular biology. However, his heart and mind were already elsewhere. From 1960, his attention returned to his wartime discussions with Turing, and in particular the question of whether computers could be programmed to learn from experience.

For demonstration purposes, he developed a noughts-and-crosses playing machine called Menace, for which he developed a general-purpose learning algorithm called Boxes. Since no computers were then available to him, he hand-simulated the Boxes algorithm, using a device made from an assembly of matchboxes. By 1963, Donald had assembled a small artificial-intelligence research group at Hope Park Square in Edinburgh. With the support of the Edinburgh vice-chancellor, Sir Edward Appleton, Donald established the experimental programming unit in 1965.

In 1966 he was joined in Edinburgh by Richard Gregory and Christopher Longuet-Higgins, both interested in the development of a brain research institute. The following year, he was appointed to a personal chair of machine intelligence and became the first director of the department of machine intelligence and perception.

The period up to 1973 is widely perceived as one of the most fertile in the history of artificial intelligence research, and its history is documented by the frequently cited Machine Intelligence book series of which Donald was editor.

His crowning achievement was the development, under a team he led, of Freddy II, the world's first demonstration of a laboratory robot capable of using computer vision feedback in assembling complex objects from a heap of parts. Unfortunately, a series of events conspired to bring this period of rapid achievement to an end.

Disagreements concerning the priorities of the field broke out between Donald, Longuet-Higgins and Gregory. At the same time, the growing economic crisis at the beginning of the 1970s was cutting into the budget of the Science Research Council, which was starting to look for savings.

Sir James Lighthill, a well-known British fluid dynamicist, was commissioned by the Science Research Council to analyse the prospects for the high-cost robotics project in Edinburgh. The resulting report, published in 1973, called a halt to artificial intelligence research in all but two areas.

The robot program was discontinued with knock-on effects for similar research programs in the US. The resulting dissolution of Donald's research group in Edinburgh left him isolated in the research unit. There he continued his research studies into computer chess and machine learning for the remainder of the 1970s.

By the early 1980s, automated assembly robots in Japan were outstripping traditional methods of manufacturing in other countries including the UK. Additionally, computer systems which imitated the decision-making of human experts were becoming increasingly successful. As a consequence, governments in the UK, Europe and US resumed large-scale funding of artificial-intelligence projects in response to the Japanese Fifth Generation project.

In 1986, as head of the Turing Trust in Cambridge, Donald founded the Turing Institute in Glasgow, in honour of his former colleague's key contributions to the field. Under Donald's leadership, the institute conducted advanced, industrially oriented research in machine learning, robotics and computer vision.

Following his retirement in the early 1990s, he continued actively in research on machine learning with his third wife, Jean Hayes-Michie. They had married in 1971, but she died from cancer in 2002, after which he resumed his friendship with Anne. His first marriage, to Zena Davies, had ended in divorce in 1949.
Donald is survived by his son Chris, from his first marriage, and by his daughters Susan and Caroline and son Jonathan from his marriage to Anne.

Donald Michie, MA, DPhil, DSc(Oxon), HonDSc(NCAA, Salford, Aberd), HonDUniv(Stir). Born 11 November 1923. Elected FRSE 1969. Died July 7 2007