OBITUARIES

Anne McLaren (1927–2007)

Inspiring reproductive biologist and mammalian geneticist.

On 6 July, Anne McLaren spent a busy day at the Gurdon Institute in Cambridge, where she had worked since 1992. She prepared a talk for a meeting in Germany and answered a large number of e-mails. In the afternoon, she attended a group leaders' meeting, as always paying close attention and ready to offer sensible advice. Towards the end of the day, she chatted with colleagues and asked questions about some recent stem-cell publications. She left promising to continue the discussion. Sadly, this was to be her last working day.

Anne McLaren had an extraordinary life, both personally and professionally. The daughter of industrialist Henry McLaren, Second Baron Aberconway, and his wife Christabel McNaughten, in 1945 she embarked on the study of zoology at the University of Oxford because for her this was an easier option than reading English, for which the entrance examination required too much reading in too little time. She completed her doctoral studies in 1952, and moved to University College London. There she began her studies on mouse genetics and reproduction with her colleague Donald Michie, whom she married that same year.

Initially, McLaren's research interest was in the interactions between genes and the environment. One of her findings — now often ignored in bioassays and drug testing in mice — demonstrated that, compared with the offspring of a cross-strain mating, inbred strains of mice showed greater variability in their response to stress. These ideas were elegantly recaptured in a review, "Too late for the midwife toad", written more than 40 years later. The article encompasses not only Conrad Waddington's theories of canalization and the inheritance of apparently acquired characteristics, but also the recent molecular explanations for morphological evolution based on studies in flies.

But McLaren's abiding interest in "everything involved with getting from one generation to the next" began with an observation on the differences in the number of lumbar vertebrae in two strains of inbred mice. She wanted to know whether such variability was due to inherent differences between the embryos of the two strains or because of differences in their uterine environments. To answer this question, McLaren and her colleagues induced ovulation in mice, retrieved fertilized embryos from one strain and transferred them into females of the other. They found that the uterine environment influences the outcome.

This work was the precursor to a collaboration with John Biggers, with whom she showed that early mouse embryos could be cultured for a day or two *in vitro* and go on to develop into adult animals after transplantation into the uteri of surrogate females. This study was to capture the public imagination. And it provided an essential backdrop to reproductive research in humans that led to the development of *in vitro* fertilization.

McLaren continued her flourishing work on reproductive biology and early development at the ARC Unit of Animal Genetics in Edinburgh, and in 1974 she returned to University College London as the director of the newly established MRC Mammalian Development Unit. During this period, she wrote two highly influential books: *Mammalian Chimaeras* (1976) and *Germ Cells and Soma* (1981). She became increasingly interested in germ cells — the cells involved in reproduction — which she described as "the most fascinating cells of all". She was also interested in sex determination, genetic imprinting and the X chromosome.

McLaren's knowledge and wisdom made her a valuable member of many societies and committees. Of particular significance was her membership of the Warnock Committee, which advised the British parliament on potential developments in reproductive medicine and subsequently led to the 1990 Human Fertilisation and Embryology Act. For ten years, McLaren served with the Human Fertilisation and Embryology Authority, which regulated the practice of human *in vitro* fertilization in Britain, and she continued to participate in many important debates on the ethics of reproductive technologies and stem cells. However, her concerns were not restricted to human welfare — she was also a co-founder of the Frozen Ark Project, which aims to collect the DNA and cells of endangered animals before they become extinct.

McLaren held many prominent offices. She was the first female officer of the Royal Society, serving as its foreign secretary from 1991 to 1996. In this capacity, she travelled extensively to stimulate and promote excellence in science. No matter where she went, she travelled with a single rucksack and a plastic bag full of research papers. Among many other offices, she was president of the British Association for the Advancement of Science, the Association for Women in Science and Engineering, and the British Fertility Society. In all of these capacities, McLaren particularly enjoyed the opportunity to engage with young and aspiring scientists. Indeed, she was an enthusiastic and popular teacher at the annual Mouse Embryology Course at Cold Spring Harbor Laboratory in New York.

She received many awards and prizes for her work; she was elected to the Royal Society in 1975 and received its Gold Medal in 1990. She was also a joint recipient of the Japan Prize, and of the March of Dimes Prize in Developmental Biology.

Anne McLaren was frugal in her personal life, but displayed great generosity towards those who sought her help; she always had a spare bed for a visitor or student who needed a refuge. She was passionate about social justice, and frequently emphasized that scientific advances should be for the welfare of all. She was a member of the Communist Party of Great Britain during the cold war, was committed to socialism, and enthusiastically participated in anti-war demonstrations. At the ceremony at which she received her joint award of the Japan Prize, Anne chose to hear *Where have all the flowers gone?* sung by Joan Baez as "a lament for all wars", and John Lennon's *Imagine*, which she said is "about a world of

peace and love and social harmony".

McLaren and Michie had three children together. Although they had divorced in 1959, they remained good friends and started to live together again in 2005. They died together in a car accident on 7 July 2007, while travelling from Cambridge to London. Memorial funds in support of young scientists have been established in their memories.

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Donald Michie (1923–2007)

Father of artificial intelligence in Britain.

Donald Michie was a man of many parts, irrepressible energy and great personal charisma. His first significant scientific contribution came in the field of genetics. With his second wife Anne McLaren, tragically killed in the same car accident in which he died, he published research in the 1950s that helped lay the groundwork for modern reproductive technology, and later earned him a Pioneer Award, with McLaren, from the International Embryo Transfer Society. But even while developing those ideas, he became inspired by a very different scientific passion: intelligent machines.

He had first encountered this revolutionary idea in the company of Alan Turing at Britain's code-breaking centre, Bletchley Park, during the Second World War. The two did not cooperate closely, for whereas Turing was busy breaking the Enigma codes, Michie focused on using the Colossus computer to crack messages generated by the Germans' 'Tunny' teleprinter machines. They became friends nonetheless, and regularly played chess. They often discussed the possibility of intelligent machines that could play in their stead — and do mathematics, use language, interpret photographic input, learn, and even (Turing suggested) wander around the countryside unaided.

This shared vision of artificial intelligence (AI) became Michie's guiding principle, and by 1948 he was writing a paper-and-pencil chess program in his spare time. As he said years later, recalling how Turing's speculations had gripped him, "I resolved to make artificial intelligence my life as soon as it became feasible". He himself helped to do that, not only intellectually, but also commercially, writing the first marketable 'expert-system shell' for logic programming in the 1960s. In Britain, he founded AI virtually single-handed.

His first task was to overcome what he later called "the national computer-blindness". Even Britain's science minister in the early 1960s knew nothing of the wartime code-busting efforts, and thought that 'computing' meant desk calculators.

During his relentless lobbying, Michie persuaded the Royal Society to provide "a few hundred pounds" to enable him, with Bernard Meltzer, to set up a small AI research group at the University of Edinburgh in 1963. Its existence was made official as the Experimental Programming Unit in 1965, and in 1967 it became the Department of Machine Intelligence and Perception. Right from the start, the department received frequent visits from AI pioneers in the United States based at the Massachusetts Institute of Technology, Carnegie Mellon University and Stanford University. Its successor is still a leading centre in the field.

Those early years were not free of problems. The initial offer of a deconsecrated church as lab space was withdrawn when Michie's intention to build an intelligent robot became known. But he remained indefatigable, and in the ensuing years fought lustily for the infant discipline, confronting academia, research councils and industry. He also did much to raise the profile of AI with the general public, holding popular lectures and penning one-off articles for the press, as well as a regular column for the trade magazine *Computer Weekly*.

Sometimes his optimism and enthusiasm, for instance in describing the achievements and potential of the Edinburgh robot, went too far, and prompted a backlash from sceptics and rivals. One result was the UK Science Research Council's notorious Lighthill report of 1973, which in effect pronounced research in AI to be a waste of time and money. Its criticisms were so fierce as to cause a scandal. It was the only 'internal' research-council report to be published, together with extensive rebuttals — including nine pages from Michie.

The Lighthill report stalled AI research in Britain for a decade. Morale and funding reached a low ebb, with several prominent researchers fleeing to the United States. Michie was also sidelined at Edinburgh: a new Department of Artificial Intelligence was formed and inherited most of its predecessor's resources, whereas Michie was put in charge of an independent Machine Intelligence Research Unit, and forbidden to work on robotics.

Research in AI was officially rehabilitated ten years later, when in 1982 Japan launched its 'Fifth Generation project', a huge financial and industrial commitment to base its future economy on AI, predicting world supremacy as a result. The response, in Britain as in the United States, was an injection of government funds into both military and civilian AI research. Michie's urbane comment was that the Lighthill incident had been a "mishap of scientific politics" due to all-too-human frailties — specifically, "nothing but ignorance at the top".

Michie's contributions to the theory of AI began in the 1960s, when a colleague had insisted that learning machines were impossible, and had challenged Michie to prove him wrong. Edinburgh still lacked a digital computer, and so Michie built "a contraption of matchboxes and glass beads" to master the art of noughts and crosses (tic-tac-toe). He called it the Matchbox Educable Noughts And Crosses Engine, or MENACE. He followed that in 1968 with the first reinforcement-learning program, the 'pole balancer', involving a pole balancing on a cart. This was no simulation, but controlled a real pole balanced on a real cart. In the 1970s, he capped this with research into chess endgames.

Michie's pioneering Graph Traverser of the 1960s provided ideas that are now standard in heuristic search algorithms, and live on in widely used AI planning techniques. His last important contribution was his StatLog project of the early 1990s, a highly insightful comparison of various models for learning algorithms, from statistical approaches through symbolic tree-building to dynamical systems.

From his long career, Donald Michie has left a generous academic legacy: the establishment of AI in Britain. That was a product of his mercurial intelligence, but those who knew him personally will also remember his wide learning, his wit and his charm.

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