The Journal of Experimental Biology 216, 930-931

doi:10.1242/jeb.082867

OBITUARY

Charles David

11 June 1948 – 28 September 2012

Charles Thomas David was born in Guernsey and came from a long line of Guernseymen. There he attended Elizabeth College and his interest in natural history (insects, in particular) developed. This interest was aided by an extraordinary retention of facts, dates, locations, species names and morphology. In 1966 Charles set off for the UK mainland and higher education at Reading University, where he obtained a first-class BSc in Zoology.

Not far from Reading University lay Silwood Park – the Field Station of Imperial College of Science and Technology (then part of London University with its main campus in South Kensington). Silwood Park was home to many members of Imperial's Department of Zoology and Applied Entomology, headed by Professor Richard Southwood. On the far side of the grounds, in Ashurst Lodge, Charles found an Insect Physiology Group recently established by J. S. Kennedy and A. D. Lees. Charles began his PhD studies with John Kennedy on insect behaviour, specifically scent and light orientation by foraging ants, *Myrmica scabrinodis*. Thus began a passion for understanding how insects move and use volatile chemical cues to guide their behaviour. His ant studies led to a job in California (with D. L. Wood at the University of California, Berkeley) on a project to discover why giant redwood trees were falling over – it turned out not to be the ants' fault.

Charles returned to Silwood Park in 1976 as a post-doc to work on a new project that concerned one of the great puzzles of animal behaviour – how do insects manage to control and guide their flight? Charles had a knack for designing experiments that allowed the insects to behave naturally whilst revealing underlying mechanisms. One of his studies focused on how male moths managed to find their mate using volatile sex pheromones. Males have exquisitely sensitive antennal receptors to detect the pheromones, but how did they manage to locate the female? Charles decided use an outdoor site with a gentle, grassy slope topped by a tall, but rickety, tower, on which he mounted a video camera. The pheromone source was at the base of the tower, next to a toy bubble machine emitting a constant stream of soap bubbles. Thus patches of pheromone-laden air showed up on the camera as they moved along with the bubbles. Male gypsy moths were released downwind of the pheromone and their flight paths were tracked. The moths had a simple rule – as long as they could detect pheromone they flew upwind and as soon as they lost the scent, they cast sideways across the wind until they recovered it. This turned out to be a highly effective mechanism to locate a female, particularly after Charles used smoke puffs to show that odours would drift in a straight line from a source and not in a sinuous motion, as thought by entomologists, but not meteorologists, at that time.

Charles had a seemingly intuitive grasp of computers and electronics and learned rapidly. Back in the 1980s he anticipated breakthroughs that could be made using primitive computers and basic electronic circuitry. His ingenuity, resourcefulness and access to a large Meccano set resulted in many a piece of kit that often looked rudimentary but was highly effective. Using electronics and stepper motors to move visual backgrounds near which *Drosophila* were flying, linked to video techniques to track the insect and the visual stimuli, Charles gained insights into how insects used optomotor responses to control flight manoeuvres. In his barber's pole wind tunnel, rotating spiral stripes wrapped around a transparent cylinder mimicked backward and forward movement of the visual environment to *Drosophila* induced to fly upwind inside the cylinder by the smell of a ripe banana. Thus, in a series of seminal studies, Charles applied ingenious behavioural paradigms to explore basic flight mechanisms controlling a fly's heading, height and ground speed, even in wind, under well-controlled and yet naturalistic free-flight conditions. His keen insight into both insect behaviour and the technologies serving to study it was far ahead of its time and his papers are still cited.

One of Charles' last major projects at Silwood Park was to automate the vertical flight chamber devised by John Kennedy to observe aphid flight behaviour – at the time this required continuous manipulation of wind speed by hand in order to keep a single aphid flying. Using video tracking and servo control *via* a micro-computer plus visual stimuli presented automatically, aphids could be flown for many hours, their flight paths recorded and the data analysed with only the aphid in the room.

His colleagues all expected him to go on to a brilliant conventional scientific career. But things were changing; the Insect Physiology Group, now with both Kennedy and Lees retired, was reviewed in 1987 and disbanded with a proviso that Charles' talents should be retained. However, Charles's nostalgia for Guernsey was growing and when the first attempt to refloat the funding was unsuccessful, he decided to sell up and move back to the island with his family.

The same skills that made Charles an unusual and gifted scientist – his intuitive grasp of complex systems, and his ability to think laterally when confronted with an apparently insoluble problem – were invaluable to the various organisations he worked for in Guernsey. He certainly never gave up doing science. He was well known in Guernsey for contributions to the study of the natural history of the island, but he was never just a collector and lister, there was always a hypothesis in the background. He became a leading member of La Société Guernesiaise, being at various times President, Vice-President, a Member of Council, Editor of the Society's Transactions, Secretary to the Marine Biology Section and Head of the Entomology Section. His most recent publication is a *Field Key to Channel Island Mosses and Liverworts* and Charles had become the Guernsey recorder for the Botanical Society of the British Isles.

Charles recognised the need for detailed mapping of biodiversity to inform any conservation efforts, and given his return to the island that he knew so well, he began to map locations of the insect species he found on primitive maps on micro-computers. Later, in 2003, and now in collaboration with Digimap, he was responsible for the formation of the Guernsey Biological Records Centre (BRC). Members of the UK National Biodiversity Network (NBN) were amazed at what Charles had accomplished early on, albeit on a relatively small scale. The mapping systems used by the UK NBN and Guernsey BRC were incompatible but now work is underway to integrate Channel Islands and UK data. Charles' contribution to the Guernsey BRC will provide a long-lasting legacy to biodiversity and conservation science.

On 28 September 2012, Charles died suddenly while walking on the neighbouring island of Sark. Our condolences go to his wife, Catie, to their children, Richard and Thomas, and to their families.

Jim Hardie
Department of Life Sciences, Imperial College London
j.hardie@imperial.ac.uk

Stephen Young
Natural Resources Institute, University of Greenwich