

## The man behind the CAT scanner

*Imagining the Elephant: A Biography of Allan Macleod Cormack.* By Christopher L. Vaughan. Pp. 304. Imperial College Press, £26, ISBN 978-1-86094-988-3; and in southern Africa by UCT Press, R225, ISBN 978-191-989-5086. 2008.

Allan Cormack's story is worth telling, as that of one of three 'scientific' Nobel prize-winners to whom South Africa can lay some claim. Born in Johannesburg in 1924, he was educated at Rondebosch Boys' High School and at the universities of Cape Town (UCT) and Cambridge. Appointed to a lectureship in the Physics Department at UCT in 1950, Cormack spent the next six years honing his skills as a stimulating teacher and struggling, with very limited facilities, to establish his research reputation. In 1956 he was asked to act in a part-time capacity as a medical physicist at Groote Schuur Hospital in Cape Town. He started to think about the fundamentals which lay behind the problem of calculating in detail the dose distribution in human tissues subject to X-ray bombardment, and he realised immediately that the problem was a mathematical one. In 1957 he did a simple experiment in the Physics Department at UCT on a 'phantom' comprising a cylinder of aluminium surrounded by an annulus of wood, and the results confirmed the theory he had worked out for the case of spherical symmetry.

Cormack then moved from Cape Town to a post at Tufts University, Massachusetts, where he worked intermittently on the problem over the next six years. In 1963 he did an experiment on a phantom without spherical symmetry and obtained quite good agreement with the more complex theory he had by then developed. He published the results in two papers in 1963 and 1964 in the *Journal of Applied Physics*, entitled 'Representation of a function by its line integrals, with some radiological applications.' With hindsight it seems astonishing, but there was virtually no response to these publications, and Cormack turned his attention to other research and to teaching and administration. In 1972 the situation changed. Godfrey Hounsfield, at the EMI laboratories in England, developed the CAT scanner, and in 1975 a paper appeared in the journal *Science* which drew attention to the fact that Cormack had already, in a 'remarkable paper of 1963', developed the basic theory.<sup>1</sup> In 1979 Cormack shared the Nobel Prize for Physiology or Medicine with Hounsfield for the development of computerised tomography.

C.L. (Kit) Vaughan has now written a biography of Allan Cormack, entitled *Imagining the Elephant*—a reference to an

Indian legend in which six blind men observe an elephant, taken as an analogy to computerised tomography. Vaughan has benefited from the close cooperation of many members of Cormack's family, as well as many of his friends and associates. A prodigious effort has gone into this book, and the result is a comprehensive work of reference which will be a valuable source for those interested in the history of science and medicine. It is well-indexed and has several convenient appendices, including Cormack's publication list and his Nobel lecture. A criticism is that some of the background historical detail is only distantly relevant: if you feel you already know as much as you need to about the history of northern Scotland or the founding of Cambridge University, these sections can be skipped.

The anecdotes about Cormack himself, are, on the other hand, mostly pertinent and insightful, and some are fascinating. Who could resist Aaron Klug's description of a climb up Table Mountain with Allan Cormack in 1947? Klug was not only a postgraduate colleague of Cormack's in the Physics Department at UCT at the time, but thirty-five years later he joined Cormack as a Nobel Laureate, in his case in chemistry. He recounts how one weekend the two of them were climbing Africa Face. Allan, an accomplished climber, was leading, when Aaron slipped and swung into space but was held and pulled up to safety by Allan. The image of two future Nobel Laureates in such a precarious situation is certainly worth recording! A particularly insightful item illustrating Cormack's sense of humour and his pragmatic attitude to life's vicissitudes is the account of the collapse of his doctoral research at Cambridge in late 1949. This had been subject to many problems, and the last straw came when someone else published a result on the problem he had been working on. Cormack's comment: 'Then there was nothing to do but bugger off'. Which he did, back to the lectureship at UCT—with an essential diversion to Boston where he married his wife, Barbara, whom he had met in Cambridge.

The book pays appropriate attention to Cormack's mentors. Notably, there was A.A. Jayes, the brilliant teacher at Rondebosch who inspired a generation of aspiring scientists. Then there was the legendary Professor R.W. James. There must be few scientists in the world who can number

two Nobel Laureates among the students they have produced, and the fact that James did so in the relative scientific isolation of South Africa in the mid-twentieth century is remarkable. Cormack's contemporaries also play an important role, and there is a heart-warming account of his membership of the 'Nuclear Nit-Wits Club' in Cambridge in the late nineteen-forties. Comprising only five members, postgraduate students in nuclear physics and all from the Dominions (an Australian, two Canadians and two South Africans), they found they had limited access to their supervisors and felt at a disadvantage compared to their fellow graduate students in the Cavendish Laboratory. So they met regularly as a private group, discussing recent publications in nuclear physics and each contributing according to his or her own special talents. The group not only filled the lacuna in supervision, but created a life-long cameraderie between the five.

A later chapter tells how in 1971 Cormack stumbled across a reference to a paper published in 1917 by Johann Radon, a young Austrian mathematician. This rekindled his interest in the line integral problem and its application to radiological physics, and the result was fruitful: many of Cormack's publications over the last two decades of his life involved the 'Radon transform'. Equally interesting is the description of the development of the CAT scanner by Cormack's co-laureate, Hounsfield. The contrast between the patent-driven approach of Hounsfield's employers, EMI, and Cormack's approach, driven essentially by curiosity and an addiction to problem-solving, is striking. Cormack's own words, in a 1997 interview, sum up his attitude: 'You know, I went into physics to do physics, and not to make money or that sort of thing.'

One final comment: don't miss the two appendices, translated from the Japanese, which have never before been published in English. The second of these, 'A Teenager's Odyssey', written by Cormack at the invitation of the editor of a magazine for teenagers, is charming in its informality, and gives an accurate impression of Allan Cormack the man: not only a particularly clear-thinking and highly talented scientist, but a warm, irreverent human being with a great sense of humour.

1. Ledley R.S., Di Chiro G., Luessenhop A.J. and Twigg H.L. (1974). Computerized transaxial X-ray tomography of the human body. *Science* 186(4160), 207–212.

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