Maurice Hugh Frederick Wilkins

Maurice Wilkins, who shared the 1962 Nobel Prize for Physiology or Medicine with Francis Crick and James Watson, died in London on 5th October, 2004. He was a major player in one of the greatest scientific discoveries of the 20th Century, the discovery of the structure of DNA.

Wilkins was born in Pongoroa New Zealand on 15th December 1916, where his parents had moved from Dublin. His father was a doctor who became New Zealand Director of School Hygiene. The family moved to England when Maurice was six years old and he was educated at King Edward’s School, Birmingham. As a child he was interested in science and, in a workshop built by his father, he developed technical and experimental skills, particularly in telescope construction.

He studied Natural Sciences at St John’s College, Cambridge, which had many distinguished members of staff. He said that he was especially fortunate in his first year to receive one hour a week of the undivided attention of his supervisor, Marcus Oliphant, who was then Ernest Rutherford’s deputy. In his second year his supervisor was John Cockroft.

At Cambridge Wilkins became fascinated with J D Bernal’s X-ray diffraction studies, so much so that he gave a talk on Seeing Structures, based on Bernal’s work, to the Natural Science Club. He also became influenced by the Cambridge Scientists Anti-War Group and became involved in their activities.

After graduating in 1938 Wilkins became research assistant to J T (later Sir John) Randall in the Physics Department, Birmingham University, where Oliphant was Head of Department. With Randall, he studied the luminescence of solids and obtained his PhD in 1940 for work mainly on a study of the thermal stability of trapped electrons in phosphors and on the theory of phosphorescence. He applied these results to war-time problems such as improvement of cathode ray tube screens for radar. This was the time when Randall and his colleague Harry Boot were developing the cavity magnetron, which played such a vital part in the war effort. Wilkins then worked with Oliphant on the mass spectrographic separation of uranium isotopes for use in the atom bomb, and eventually moved with Oliphant’s group to the Manhattan Project in Berkeley, California, to continue these studies. There he found that the greatest pleasure was in sharing knowledge and working with a group. Following this he was strongly of the view that science should be a cooperative activity, with an open dialogue between participants.

After the war, disillusioned by the use of the atom bomb, and inspired by Erwin Schrödinger’s book What is Life?, he was keen to start work in biophysics. Randall had been appointed Professor of Physics at St Andrews University and was also interested in biophysics, so Wilkins accepted an invitation to join him as a lecturer in physics in 1945. The stay at St Andrews, however, was brief and when Randall was offered the Headship of the Physics Department at King’s College, London, Wilkins moved with him in 1946. Here he was a member of the Medical Research Council Biophysics Unit which had been set up within the Physics Department. Randall was Director of the Unit and Wilkins became Assistant Director in 1950, Deputy Director in 1955, and Director in 1970.

Wilkins’s first biophysics studies were on the genetic effects of ultrasonics but soon changed to development of reflecting microscopes for ultraviolet studies of nucleic acids in cells. He also studied the arrangement of virus particles in tobacco mosaic virus crystals, using visible-light microscopy, and he applied interference microscopy to measure dry mass in cells.

Then, in 1950, with great foresight, Wilkins started his structural studies of DNA. He received a preparation of calf thymus DNA from the Swiss chemist Rudolf Signer, and from gels of this material he was able to draw thin fibres showing sharp extinction between crossed polarizers. With the assistance of Raymond Gosling, Wilkins obtained X-ray diffraction photographs from these fibres indicating a high degree of crystallinity. They achieved this by keeping the fibres moist during the exposure. It was one of these diffraction patterns that Wilkins showed at a conference in Naples in 1951 and so excited James Watson who was in the audience. Alec Stokes, working with Wilkins, pointed out that the diffraction patterns indicated a helical structure.

In 1951, Rosalind Franklin was recruited to King’s to help in the DNA studies. Unfortunately, Wilkins and Franklin did not get on and this seems to have been more than merely a clash of personalities. Whilst Wilkins had assumed that there would be collaboration between Franklin and himself, she had been told by Randall, without Wilkins’s knowledge, that only she and Gosling would be involved in the X-ray studies. Thus the seeds of future discord had been sown at the very beginning. Details of the situation at King’s are described in Wilkins’s autobiography The Third Man of the Double Helix which was published in 2003. The situation led to two groups at King’s working independently.
Wilkins had handed over the Signer DNA to Franklin, hoping that he could obtain other preparations of the same quality. However, it was some time before he was able to obtain these and show that DNAs from different sources had the same basic structure.

Using a microfocus X-ray generator developed by Werner Ehrenberg and Walter Spear, and a micro-camera, and by controlling the relative humidity in the camera, Franklin and Gosling showed that at high humidity the DNA structure changed from a crystalline to a paracrystalline structure. They called the crystalline form A-DNA and the paracrystalline form B-DNA, and the A?B transition was reversible. One of the B-DNA diffraction patterns was of exceptional quality and better than similar ones obtained by Wilkins from other DNA preparations. Concentrating on analysis of A-DNA, Franklin believed that there was evidence that in this form DNA was not helical and this was confusing at the time.

The excellent B-DNA diffraction pattern, however, was highly characteristic of that from a helical structure, as Watson also appreciated when he was shown the photograph by Wilkins. But the question was, what kind of helix? This was answered by Watson and Crick when they built their double helix model. When they announced their discovery there were two accompanying papers from King’s giving experimental support for the model, one by Wilkins, Alec Stokes and Herbert Wilson and the other by Franklin and Gosling. All three appeared in Nature on 25th April 1953.

Wilkins had also obtained X-ray diffraction patterns from intact squid and cuttlefish sperm that were similar to those from B-DNA, showing that the structure existed in vivo. He also showed that DNAs from different sources gave essentially identical diffraction patterns.

The task of rigorously testing the double helix model against the X-ray diffraction data was undertaken by Wilkins and his colleagues and over the next eight years the analysis confirmed the basic 'correctness' of the model although details of the original model had to be modified and refined. It was for this, as well as his pioneering work, that Wilkins was awarded a share of the 1962 Nobel Prize with Crick and Watson.

Following the DNA studies Wilkins and his colleagues analysed the structure of double helical RNA and also the structure of nerve membranes. He was Professor of Biophysics and Head of Department at King’s College from 1970-82 and Director of the Neurobiology Unit of the MRC from 1974-80.

Wilkins had a highly developed social conscience and was President of the British Society for Social Responsibility in Science from 1969-91. He was an active member of the Pugwash Disarmament Group and he and his wife Patricia were active members of CND. At King’s College he had organised an undergraduate discussion course on the Social Impact of the Biosciences – a course that he was attending until a few months before his death.

Apart from the Nobel Prize, Wilkins was the recipient of many honours. He also shared with Crick and Watson the 1960 Albert Lasker Award of the American Public Health Association. He was awarded honorary degrees from the Universities of Glasgow, Birmingham, London and Trinity College, Dublin. In 1959 he was elected FRS; Honorary FRSE in 1994; was made a CBE in 1962, and a Fellow of King’s College in 1973. He was an Honorary member of the American Society of Biological Chemists and Foreign Honorary member of the American Academy of Arts and Sciences. His name is on two plaques at King’s College commemorating the 1953 DNA studies and on a plaque in Pongoroa, where he was born. His portrait hangs with those of Rutherford and Alan MacDiarmid, two other New Zealand Nobel Prize winners, at the Royal Society of New Zealand.

Most people found that Maurice’s initial rather reserved demeanour soon changed to reveal a warm and friendly personality. He was self-effacing and modest and strongly believed that science should be used for benefit to humankind and not for profit or personal glory. He had a life-long interest in the arts and many of his friends were artists. It was as a result of this interest that he met his future wife, Patricia Ann Chidgey, at the Institute of Contemporary Arts. To Patricia, his sons George and William, daughters Sarah and Emily, and five grandchildren, we extend our sympathy.

Herbert R Wilson

Maurice Hugh Frederick Wilkins. CBE, MA(Cantab), PhD(Birmingham), Hon LLD(Glasgow), Hon ScD(Birmingham), Hon DSc(London), Hon DUniv(Trinity), FKC, FRS, Hon FRSE, Nobel Laureate