



As the fiftieth anniversary of the discovery of DNA's structure approaches, Dr Clare Sansom reflects on the life of Rosalind Franklin and her lasting legacy at Birkbeck

ROSALIND FRANKLIN A LIFE IN CLOSE-UP

More controversy surrounds Rosalind Franklin than any other female scientist. She is thought by many to have played a crucial role in the discovery of the structure of DNA, but it was her male colleagues who received the recognition. The debate about whether she was robbed of this prize due to sexism in science, in a climate where her colleagues frequented men-only pubs, continues to cloud her reputation.

The discovery of the structure of DNA in 1953 may have been the most significant in twentieth-century biology. Yet when, nine years later, the principal scientists involved – James Watson, Francis Crick and Maurice Wilkins – were awarded the Nobel Prize for Medicine, one person's name was conspicuously absent from the ceremony, that of Wilkins' colleague at King's College London, Rosalind Franklin. She could not be awarded the Prize as she had died four years earlier: what was unforgivable was that her name was scarcely mentioned.

She had achieved enough in her short life to do justice to a career over twice as long. Born into an upper middle-class Jewish family, she was educated at St Paul's School, London, where – unusually for a girl in the 1930s – she was able to study physics and chemistry at an advanced level. She first decided that she wanted to be a scientist at the age of 15. Her father, though decidedly against the higher education of girls, relented and, although her studies at Girton College, Cambridge, were disrupted by the Second World War, she was awarded a PhD in physical chemistry in 1945. She then spent four very productive years at the Laboratoire Central des Services Chimiques de L'Etat, in Paris. There she learned the techniques of X-ray crystallography (or diffraction), firing beams of X-rays at crystals and using the

patterns to investigate the structures of the molecules. In 1951, Franklin returned to London as a research associate in John Randall's lab at King's. The next two years were both the most significant – and the most unhappy – of her working life. Randall appointed her to work alongside Wilkins studying DNA, but Wilkins never appreciated the value of her role. Franklin could be a difficult colleague, and it is clear she was treated extremely badly. Yet, as Brenda Maddox wrote, 'The fact is that...working in isolation except for [her PhD student assistant, Raymond] Gosling, in a field new to her, she [came] within two steps of solving the most exciting question of post-war science'. With Gosling, she obtained the clearest X-ray diffraction photographs of DNA crystals yet seen. JD Bernal, who was later her boss at Birkbeck, described these as 'among the most beautiful X-ray photographs of any substance ever taken'.

Franklin's photographs showed for the first time that there were at least two different crystal forms of DNA. It was March 1953, and she was writing up her interpretation of these photographs before the move to Birkbeck when, without her knowledge, Wilkins showed one to Watson, visiting from Cambridge. This was 'Photograph 51', the clearest example of the 'B' form of DNA. The distinct cross shape of this diffraction pattern struck Watson as a revelation: indisputable evidence of a helical structure. He wrote in his autobiography, *The Double Helix*, published in 1968, "The instant I saw the picture my mouth fell open, and my pulse began to race."

Franklin's paper was published in *Nature* back-to-back with Watson, Crick and Wilkins' famous description of the double helix, but the contribution her meticulous observation made to the discovery was only grudgingly acknowledged. Watson compounded the sidelining of Rosalind by painting a caricature of her as (in Maddox's words) 'a termagant who hoarded data she didn't understand': an image that poisoned her reputation for decades.

Franklin described the move from King's to Birkbeck as going "from a palace to a slum". But during her five years as a Birkbeck research fellow (1953–1958) she thrived in the non-sectarian atmosphere and achieved recognition. She established a group to work on the structure and assembly of tobacco mosaic viruses with Aaron Klug, John Finch and Ken Holmes. She also began work on the polio virus.

Although she had a gift for inspiring close colleagues, she could often be difficult to approach. Alan Mackay, then an assistant lecturer at Birkbeck, describes her as "exacting", and adds, "you had to do your best to answer her correctly".

Rosalind travelled extensively, particularly in the United States. However, it was only during her last illness that she was able to put her group on a firm financial footing with a substantial grant from the US National Institutes of Health. Her co-workers all became distinguished crystallographers, with Klug winning the 1982 Nobel Prize for Chemistry. He paid a moving tribute to his former supervisor in his Nobel lecture: "It was Rosalind Franklin who set me the example of



tackling large and difficult problems. Had her life not been cut tragically short, she might well have stood in this place on an earlier occasion." She died in London on 16 April, 1958.

Three decades after the publication of *The Double Helix*, Franklin is finally getting the recognition she deserved. The Royal Society has established a Rosalind Franklin Award, her portrait hangs in the National Portrait Gallery, and there is a blue plaque on the wall of her flat in South Kensington. Perhaps most significantly, King's College has named the refurbished warehouse that now houses its Department of Life Sciences the Franklin-Wilkins Building. Thus, the name of a professor who served the college faithfully for over 50 years is linked with that of a research associate who left after only two: and it is Franklin's name that appears first.

In Birkbeck's School of Crystallography, the Rosalind Franklin Laboratory now houses over 20 structural biologists in four research groups. It is also a base for the Bloomsbury Centre for Structural Biology; the Centre's director, Professor Helen Saibil, was Maurice Wilkins' last PhD student at King's in the mid-1970s. "We may be in the post-genomic era of 'Big Science' but we study structures for the same reason as the pioneers: simple intellectual curiosity," says the lab's academic director, Renos Savva.

There is one further connection between Franklin and the work of the Birkbeck laboratory named after her. Mutations in two genes that pre-dispose individuals to breast and ovarian cancers are quite common in people of Ashkenazi Jewish descent. Franklin, an Ashkenazi Jew, was only 37 when she died of ovarian cancer. Now, Nicholas Keep, one of the principal investigators of the Franklin Lab, is studying the properties of the protein encoded by one of these genes.

Much of the information in this article comes from Brenda Maddox's acclaimed biography, *Rosalind Franklin: The Dark Lady of DNA* (Harper Collins, 2002). I acknowledge my debt to Ms Maddox in the preparation of this piece.

Left: Rosalind Franklin at Microscope by Henry Grant, courtesy the American Society for Microbiology Archives. Above: Birkbeck's Franklin lab today, which houses over 20 structural biologists in four research groups. It is also a base for the Bloomsbury Centre for Structural Biology.