

The Sublime Cow and the Maltese Cross

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Ava Helen Pauling, wife of esteemed Chemist Linus Pauling, described early x-ray images of DNA (Figure 1) as such: “From the bull’s-eye, a striking arrangement of short, horizontal smears stepped out along the diagonals in the shape of an X or a Maltese cross.”

The image is titled “Photograph 51”, taken by Rosalind Franklin in 1952.

It was also the most sublime image of a cow ever to be published at the time

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The ceiling of The Eagle pub in Cambridge, England, boasts an impressive example of crystallised history: the warm and inviting wood is adorned with notes scribed with lighters, candles and lipstick by World War II veterans. It’s a thought-provoking sight. The chaotic swirl of signatures and messages screams with an almost desperate need; the forgotten dead seem to rise out of their graves and strain to be remembered.

Unfortunately for the soldiers, on 28, February 1953, their graffiti was overshadowed by another piece of history solidifying under their special ceiling. The Eagle’s patrons would have recognised two of the regulars: an Englishman whose unmistakeable and hard-to-miss “booming enthusiasm” outstripped his frame, and a lanky 25-year-old with protruding ears and a prominent Adam’s apple, who looked

vaguely Irish, but was in fact American. The former was Francis H. C. Crick, a lesser-known theoretical physicist with an energetic fascination for how X-rays could be used to understand “the chemical physics of biology”. His colleague was James D. Watson, an inexperienced geneticist who had gained his Ph.D. only three years ago. It is unlikely that any of the pub’s Saturday morning customers expected their lunch to be interrupted by Crick’s powerful voice announcing: “We have found the secret of life.”

The pair was talking about DNA (or deoxyribonucleic acid), the heritable genetic material that is found in all living organisms. Watson and Crick had managed to develop a model for the three-dimensional structure of this vital macromolecule: two antiparallel backbones of sugar-phosphate twisting and coiling each other into a double-helix, with the organic bases adenine, cytosine, thymine and guanine nestled within.

The paper that the two scientists published the following April was deceptively brief, a mere one page. “The omissions in the paper by Watson and myself are also striking,” Crick later wrote, reviewing his own paper. “The structure is produced like a rabbit out of a hat with no indication as to how we arrived at it.” Indeed, the formulation of the double helix structure was an arduous process,

and according to Crick, “...partly a matter of luck, and partly good judgement, inspiration and persistent application.”

Luck played a significant part in the DNA drama: during a short stint in Naples in 1951, Watson chanced upon another English physicist, Maurice Wilkins, and learned that the highly-organised DNA molecule could diffract X-rays as if it were a crystal. Unsettled by this knowledge, Watson quickly grew bored of his new postdoctoral fellowship studying protein structures at the Cavendish Laboratory in Cambridge. Watson found that Crick, whom he met at Cavendish, shared his idea that uncovering the structure of DNA was of paramount importance.

It is perhaps lucky for the pair that Crick’s loud exuberance created friction within the lab. Crick had seriously upset the head of the lab, Sir Lawrence Bragg, by suggesting that his own ideas, and not Bragg’s, had spurred the discovery of a novel method of protein analysis. As a result, Watson and Crick moved further away from proteins and spent more time with DNA.

However, “that fall of 1951, we had no reason to hope that we would be more than minor players in DNA research,” wrote Watson. It was here that luck played another major role.

Rosalind Franklin, a Cambridge-trained scientist, had joined Wilkins’ lab the previous year. Thick eyebrows and a subtly masculine face hid an exceedingly sharp mind; Franklin soon began producing startlingly clear X-ray images of DNA, and positing her own theories of the molecule’s structure with admirable mathematical rigour.

Watkins and Franklin had a distant relationship, despite working in the same lab. When Watson was visiting Wilkins in London, Wilkins retrieved from his desk her Photograph 51, the clearest X-ray image of DNA to date, and showed Watson what he thought was undeniable evidence of the shape of DNA. Wilkins had not gained Franklin’s permission to reveal her images.

The images sparked something in Watson. According to Ava Helen Pauling, “the pattern shouted helix.”

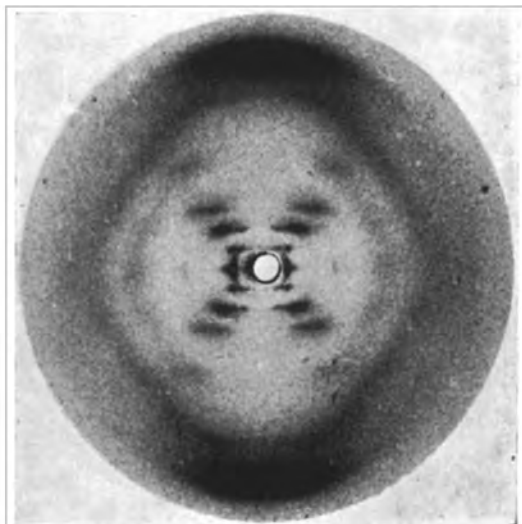


Image courtesy of <http://1.bp.blogspot.com/-c5NcwJRPi2E/Tjg408F4ePI/AAAAAAACwg/wj0TjmlEp4/s1600/DNARosalindFranklineFoto51MEU.jpg> (accessed 21 May 2012)

Figure 1: Rosalind Franklin and an X-ray diffraction image of DNA. Franklin produced the clear X-ray images of DNA that Watson and Crick used to determine the structure of DNA.



Image courtesy of A. Barrington Brown. Retrieved from <http://fineartamerica.com/featured/watson-and-crick-a-barrington-brown-and-photo-researchers.html> (accessed 21 May 2012)

Figure 2: James Watson and Francis Crick with their DNA model at the Cavendish Laboratories in 1953.

The photograph proved critical to informing Watson and Crick's understanding of the DNA molecule. Nevertheless, shouting or not, the precise helical structure of the precious molecule evaded the pair for another fourteen months. Inspired by Wilkins' revelation, the pair built physical models of the constituents of DNA and agonised over how the organic bases were paired, whether the sugar-phosphate chains were on the inside or the outside, and what stabilising forces

were present. However frustratingly elusive the structure may have been, boring it was not. One of Watson and Crick's greatest fears had been that the DNA molecule would end up being "dull". Fortunately, Watson wrote, "the finding of the double helix thus brought us not only joy but great relief. It was unbelievably interesting..."

On April 25, 1953, scientific powerhouse-journal *Nature* published three different papers on the structure of nucleic acids, among them, the now famous

"Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid", by J.D. Watson and F.H.C. Crick. Nine years later, Watson, Crick and Wilkins shared a Nobel Prize in Physiology, for their contributions to the understanding of DNA and genetics.

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The New York Times of 1953 called Photograph 51 "a whirlpool of light and shade". It depicts DNA taken from a cow thymus. In a way, it depicts the entire animal; it is the most perfect possible snapshot of a cow, complete with every detail of the cow's anatomy, life-processes and habits. It is also a symbol. It depicts the human quest to understand life.

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