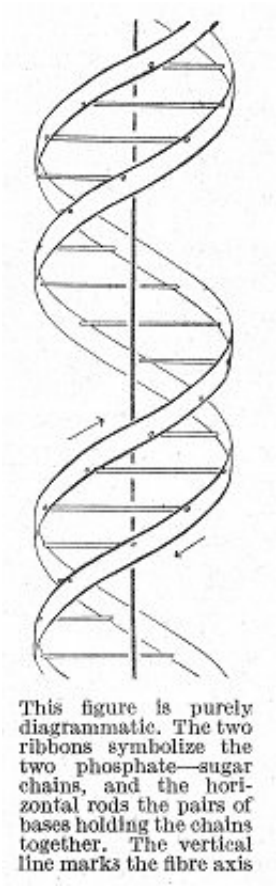
# The convoluted history of the double-helix

April 26 2018, by Elena Falco




The double helix, drawn by Odile, 1953. Credit: Nature: reproduced with permission

It's been 65 years since the paper "Molecular structure of nucleic acids," by James Watson and Francis Crick, was published in *Nature*. Or, more prosaically, the paper that first describes the structure of DNA as we know it today.

Before 1953, discovering the actual shape of DNA was the Holy Grail of a determined group of loosely related scientists, whose work culminated in the paper published in *Nature* by Jim Watson and Francis Crick. Getting there was a bumpy ride, involving embarrassment, misunderstandings and a certain dose of artistic talent.

By 1944, it was already known that genetic information was stored in DNA, and we were also aware of the existence of RNA, even though we didn't really know their function. In fact, in 1954, after Watson and Crick described the structure of DNA, Watson and physicist George Gamow founded a group with the aim of deciphering it. The group was a "disparate collection of Gamow's friends," with the number of members capped at 20 – like the amino acids, and yes, each person was a specific amino acid: Watson was proline, Crick tyrosine and physicist Richard Feynman, glycine.

The first DNA X-ray diffraction pattern was obtained by Florence Bell and William Astbury, in 1938, who described the corresponding shape as "a close succession of flat or flattish nucleotides standing out perpendicularly to the long axis of the molecule to form a relatively rigid structure." Basically, a comb.

Things changed dramatically in 1951 when Rosalind Franklin, who had been working on increasingly accurate X-ray diffraction patterns, showed pictures of DNA at King's College, in London. Jim Watson, then working with Francis Crick at the Cavendish Lab, in Cambridge, was present at the talk, and reported back to Crick. They quickly built a structure of DNA. It was shaped like a helix, but with three strands tightly twisted together and bases sticking out.

Crick and Watson were too excited about their own model to realise that it was wrong: Watson had misremembered the talk and their assumptions on water content were wrong, leading to the wrong shape. When they

invited a small crowd, including Rosalind Franklin, to see their shiny new model, they ended up embarrassed and banned by their head of laboratory, William Bragg, from working on DNA.

In 1952, a rival model was made by Linus Pauling and Robert Corey, which was similar in shape to their own, and equally wrong. Frustrated by the success of his rival, Bragg allowed the two to go back to working on DNA.

In 1953, they obtained new data, collected by Rosalind Franklin, through molecular biologist Max Perutz. Watson, misunderstanding the data once again, tried to build a strand that would form a half of a double helix, with a screw of 18°, while the data clearly implied that the screw should be of 36 °. Thanks to the comments of a then-Ph.D. student, Jerry Donohue, Francis started building a model with a 36° screw, fitting bases between the two strands of the helix. Watson, in his earlier attempt, had discovered that pairs of bases, AT and GC, had the same shape. Crick deduced from this that the chains had to be anti-parallel. The modern shape of the DNA was born.

Now they were ready for a second, and more successful, viewing: as well as Franklin, Bragg and Wilkins, Dorothy Hodgkin and Linus Pauling were present. The results were presented in *Nature* shortly after.

The Nature paper contained the first illustration of the double-helix, drawn by Francis Crick's wife, Odile, who was an artist. A golden double-helix came, eventually, to decorate the entrance of the Cricks' house, called The Double Helix, welcoming their frequent guests.

Nowadays, the DNA double-helix is not just a model of a microscopic organic structure: it symbolises the backbone of our current understanding of ourselves. It's the main pillar of evolution, which represents our history, influences our behaviour and gives us clues to our

future. In the current use, it has also come to mean what we could quaintly call an 'essence': saying that a trait is in someone's DNA is like saying that it's an inescapable part of that person. This fundamental nature is betrayed in its figurative use as well: metaphorically, DNA can be attributed to objects, companies, political and artistic movements. The symbol of DNA, that elegant twisted ladder that graces scientific publications worldwide, has become a powerful symbol of knowledge.

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