

# Who cares about the double helix?

Collective memory links the past to the future in science as well as history.

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Science is about building the future. Discovering new mechanisms that operate in nature, inventing new tools of investigation and elaborating new concepts are the core of scientific practice. Then why do past scientific events, such as the discovery of the DNA double helix<sup>1</sup>, still receive attention 50 years after they took place? Are they simply scientific folklore, and their commemoration merely entertaining rituals? Or is it that our collective memories of the past play a crucial contemporary role by sustaining experimental designs, research programmes, funding channels and collective identities? In other words, when we refer back to a discovery today, it is because we want to say something about the present?

It is too early to assess the deeper meaning of this year's DNA double-helix commemorations — how they will shape our collective memories of the discovery and for what current agendas they are being used. A critical look at these rituals as they take place will allow us to witness collective memory in the making. With the history of the double helix in mind<sup>2</sup>, we can learn something about the values and ideals that make science what it is today.

We usually think that the double-helix model acquired immediate and enduring success. On the contrary, it enjoyed only a "quiet debut"<sup>3</sup>. Only when the role of DNA in protein synthesis became clearer, in the late 1950s, did biochemists, for example, take a serious interest in it. Even in Cambridge, UK, where the structure was discovered, it seems to have had "only a subordinate role" in negotiations over the future of the laboratory in the late 1950s<sup>4</sup>. So when did it become so immensely popular in the scientific community? The 1960s? 1970s? 1980s? None of these. Not until the 1990s (Fig. 1).

## Prizes and popularity

True, when James Watson and Francis Crick (with Maurice Wilkins) were awarded the Nobel prize in 1962, their seminal work received increased attention the following year (see Fig. 1) which coincided with the tenth anniversary of their discovery. However, after that time, the 1953 paper followed the familiar declining citation pattern. Even Watson's bestselling book, *The Double Helix* (1968), did not stimulate citations of the original paper, perhaps because of the scandal it provoked in some scientific circles. Yet in the early 1990s, something changed — citations began to rise dramatically to the point where 2003 promises to be an all-time record. Of course, the double helix achieved

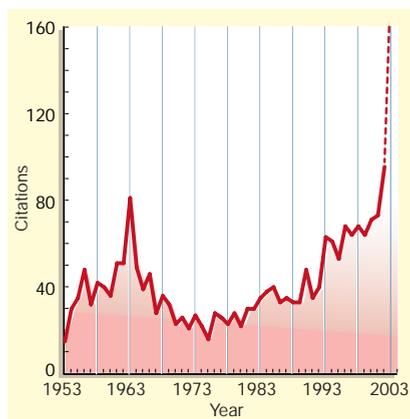


Figure 1 Citations per year of Watson and Crick's first 1953 *Nature* paper in scientific journals (English language only). The value for 2003 is extrapolated linearly from data available as of 31 March 2003 (40 citations). Source: ISI Science Citation Index.

iconic status well before the 1990s, attracting many artists during the past 50 years. However, of the numerous examples used in a recent account of this "Mona Lisa of modern science"<sup>5</sup>, only one is before the 1990s. DNA seems to have become a central theme in contemporary art since only the 1990s<sup>6</sup>.

In scientific circles, the double helix did much in the late 1950s and 1960s to bring together crystallographers, biochemists and phage geneticists around a new identity — 'molecular biology', as they called it. This new social grouping could take place around the helix as it was a discovery to which the different communities believed they had contributed. The DNA double helix became a 'totem' for the widely diverse tribe of molecular biologists. The retrospective account of the discovery as being at the origin of molecular biology was constructed in the 1960s by molecular biologists themselves to promote their discipline<sup>7</sup>.

Why did the popularity not only of the double helix, but of Watson and Crick's discovery of it, escalate at the end of the twentieth century? Citing Watson and Crick's first 1953 paper contributes to the construction of collective memory — social groups' shared representations of their past. Historians now pay much attention to how collective memories (of the Holocaust and of the French Revolution, for example) shape identity, and how they are constructed and transmitted through commemoration and oral tradition. It is not surprising that a similar process exists in science<sup>8</sup>.

Collective memory is directed towards

the past as much as towards the present. Narratives about past science can be used to illustrate or justify existing modes of research organization and specific experimental approaches — sometimes even bringing them into being. For example, the collective memory of penicillin, the wonder drug of the Second World War, has promoted a specific way of thinking about therapy and a specific manner of conducting therapeutic research.

Similarly, Linus Pauling's famous 1949 paper on sickle-cell anaemia became a citation classic<sup>9</sup> very much in the same way as Watson and Crick's. Over the past 50 years, Pauling's research on sickle-cell anaemia has been incorporated in very different — often incompatible — narratives constructed by diverse scientific communities. In its most recent version, the collective memory of sickle-cell anaemia as a 'molecular disease' has sustained a particular kind of therapeutic research, targeting the haemoglobin molecule itself or the gene responsible, instead of some other step along the chain of events that lead to the pathological consequences affecting the patient. Citing Pauling's work is an efficient way to obtain justification to counter sceptics of gene therapy. In this sense, not only does history become transformed into memory, but memory makes history. Collective memory links the past with the future.

## Linking back

To understand the construction of our collective memory of the double-helix discovery we need to know who is citing Watson and Crick's paper today, in what context and why. If we exclude the strictly commemorative citations of this year — more on these later — most citations are to be found in editorials and the discussions of research papers. As it does not convey any new information to the reader to mention that DNA has a double-helix structure, reference to it must serve different purposes.

One of these is to construct genealogies, a long-standing favourite way to draw boundaries around social (academic) territories<sup>7</sup>. Authors in an unprecedented variety of fields, from neurosurgery to plant physiology, cite the 1953 paper in an attempt to appropriate the current prestige of molecular biology for their own speciality by underlining (sometimes far-fetched) historical affiliations with the double helix. "The early 1950s," wrote Edward Wood in 2001, "saw biochemistry give birth to molecular biology. James Watson and Francis Crick's paper on the molecular structure of nucleic acids was published."<sup>10</sup> The fact that Watson and Crick knew very



**Tribal totem:** the DNA double helix serves as a unifying symbol and provides a collective identity for many different areas of science.

little biochemistry when they built their DNA model gives a curious twist to this argument. For David Miska, working in a biotech-pharmaceutical consultancy: “The intellectual parent of the biotechnology industry has its own birthday in April 2003, which marks the 50th anniversary of the epochal publication of the structure of DNA by Watson and Crick.”<sup>11</sup> In a broad sense, the biotechnology industry largely predated 1953. In a narrower sense, as a DNA-based industry, it owes more to the discovery of restriction enzymes and recombinant DNA technology than to the discovery of the molecule’s double-helical structure. The authors of these accounts are not professional historians, and such historical inaccuracies are relatively benign. There are more interesting avenues to be explored.

The key to understanding the renewed fame of the double helix at the end of the twentieth century is the Human Genome Project (HGP), which began in 1990. It brought the double helix, and Watson and Crick’s discovery of it, to centre stage as never before. The HGP, of course, has an inherent if intangible link with the earlier discovery, namely the fact that DNA is the central object being investigated. Other events have reinforced this association — James Watson was the first director of the HGP; the HGP was a US–UK effort (Watson and Crick were a US–UK team); and the HGP was supported by US and UK funding agencies.

The promoters of the HGP have gone further in strengthening their association with the double helix. For example, in 1998 Francis Collins, the HGP’s subsequent director, announced the project’s goal: “Finish the complete human genome sequence by the end of 2003. The year 2003 is the 50th anniversary

of the discovery of the double helix structure of DNA by James Watson and Francis Crick. There could hardly be a more fitting tribute to this momentous event in biology”<sup>12</sup>. When the draft sequence was published in *Nature* in February 2001, *Science*’s short history of the HGP, which accompanied its publication of the draft sequence produced by Celera Genomics of Rockville, Maryland, began by mentioning Watson and Crick’s 1953 discovery<sup>13</sup>. It soon became common to read assertions such as: “The most significant event in biology since the 1953 publication of the Watson and Crick paper describing the structure of DNA was the publication in *Science* and *Nature* earlier this year of the sequence of the human genome.”<sup>14</sup>

This deliberate comparison of the HGP with the double-helix discovery by participants and supporters of the project helped to lift its scientific stature above criticisms that it was an unimaginative piece of applied science. Setting the double helix as the highest standard of scientific creativity<sup>15</sup> helped to make the descriptive genome sequencing project look less tedious. After all, both were attempts at describing the structure of DNA and would result only in a guess at the possible “genetic implications”, as Watson and Crick had put it. For the

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promoters of the genome project, the discovery of the double helix provided a very useful cultural bridge towards public acceptance and identification of its goals. The association reinforced the image of the public consortium project as a piece of fundamental research, above industrial interests and patent disputes, unlike the similar project carried out by its competitor, Celera Genomics. The double helix worked as a marker of an age of (lost) innocence, when youth, intelligence and self-assurance were sufficient to make great discoveries in science. For many, Watson and Crick not only provided a model of DNA, but also a model of scientific practice, where creativity and hard evidence share in the construction of scientific knowledge. ■

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