

BBC film: "DNA: Secret of Photo 51"

The **conventional history** is that

1. **JD Watson & FHC Crick** worked on the structure of DNA by constructing models of the bases. Watson discovered the base pairing of **A+T** and **G+C**, consistent with a two-strand model, bases inside.
2. **MHF Wilkins** showed Watson the famous "**Photo 51**" made by **R Franklin**, inspection of which confirmed the [double helical structure](#). *This was done without Franklin's knowledge or permission.*
3. Watson, Crick, & Wilkins received the Nobel prize in 1962. By that time Franklin was dead of cancer. Nobel Prizes are not awarded to more than three persons, nor posthumously.
4. Watson damaged Franklin's reputation by publication of his 1968 "*The Double Helix*", which portrayed her in a stereotypical misogynistic manner, and altered other facts. The book was wildly successful, as suggesting the manner in which Science is "actually done" as a cavalier enterprise
5. Watson went on to serve as Director of the Cold Spring Harbor lab, and the Human Genome Project. Crick went on to make substantial contributions to the realization of the Genetic Code. Wilkins spent a number of years verifying the proposed DNA structure, which accounts for his inclusion in the 1962 prize. Franklin left DNA research to do superb work on the structure of viruses. She died of cancer in 1958.

The **revisionist history**, as presented in the BBC film, is that

1. **Photo 51 was stolen** from Franklin: the photo in & of itself proves DNA double helical structure.
2. Franklin was denied proper credit for her discovery.
3. Franklin was the victim of anti-woman attitudes of the 1950s, particularly the culture at King's University, and is only now receiving credit for her past and subsequent work before her death.
4. Franklin should have received the Nobel prize, despite technical objections.
5. Watson was and is a doofus. His reputation has lately been tarnished, as a consequence of the revisionist narrative of DNA, and other indiscretions.

Points for Discussion:

6. *Parallels*: The narratives of the discovery of DNA structure in 1953, and the publication of the **C Darwin & AR Wallace** MSS in 1858, invite comparison. Note that author order of Watson & Crick was determined by a coin toss; author order of the July 1858 presentations by Darwin & Wallace to the Linnaen society was determined alphabetically. Can class differences in 1858 be compared to patriarchy in 1953? What are authorship rules?
7. If a supervisor directs a student to do an experiment that reveals a critical piece of evidence, who should get the credit? Is there a difference between a **BSc** honors student and a **PhD** or post-doctoral fellow? Does it make a difference who pays? Consult other Nobel controversies (cf. discovery of quasars).
8. **Consider the circumstances of the handover of Photo 51 very closely**: consult Judson. What is the hierarchy of
 - a. Professional obligations
 - b. Moral obligations
 - c. Professional courtesy
 - d. Moral courtesy
 - e. "Fair Play"
9. The mantra of many generations of genetics students is "*Two or three strands, bases inside or outside, and you've got **Chargaff's** Rules. How long can it take?*" Is this a fair statement of the problem?
10. Review HF Judson (1996) *The Eighth Day of Creation* (25th anniv ed), CSHL Press. See esp. pp **619-629**.

Some questions.

1. Does it make a difference on what **date** Gosling's Photo 51 made under Franklin's supervision was analyzed?
2. To what extent did the **severe personality conflict** between Wilkins and Franklin inhibit cooperation?
3. What are the **critical features of DNA** structure and who made them?
 - a. Several scientists had suggested a helical structure for DNA from the late 1940s onward. Wilkins had x-ray evidence before Franklin's arrival at King's.
 - b. **L Pauling** in fact published a three-strand model with bases on the outside.
 - c. **E Chargaff** had shown molar equivalence of bases, that **[G]=[C] & [A]=[T]**.
 - d. **P Levene's** tetranucleotide structure including phospho-diester bonds between ribose sugar and phosphate groups.
4. When Franklin moved to another laboratory, she directed Gosling to turn over her notebooks to Wilkins, with instructions to "*do what he wanted*" with them (see Judson 1996). Very shortly hereafter, Wilkins showed Photo 51 to Watson, who recognized the significance of the "**X**" pattern upon inspection.
5. Franklin could have made a detailed analysis of Photo 51 at any time, but did not. Does this reflect different approaches to science?
 - a. Franklin & Chargaff approached DNA structure as one of **physical chemistry**, to be drawn only after detailed experimental analysis. Gosling & Franklin made the critical measurements of Photo 51 only after seeing the Watson – Crick 3D model.
 - b. Watson & Crick knew that DNA was the **molecule of heredity**, thus a question of biology. Both expected that the structure itself would explain its hereditary function (see last line of Watson & Crick 1953).
 - c. Watson & Crick (1953) emphasized **base pairing** that implied a copying mechanism for genes. Franklin & Gosling (1953) emphasize the physical analysis of the **double helical structure**, including Photo 51.
 - d. Does it matter how you get there?
6. As regards the Nobel prize: are rules rules?
7. Did Franklin in the 1950s suffer from a misogynistic culture at King's?
8. Has Watson, as the last surviving member of the principals, suffered from 21st century Cancel Culture?