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AP Biology Mr. Collea

***Race for the Double Helix***

Alternate title: Life Story, BBC Television (1986)

**Introduction:**

"By the early 1950s, the greatest unsolved mystery in science was the secret of life itself - the process which all living things have reproduced themselves, generation upon generation, since the beginning of life on Earth. Although the mystery had a name, the 'gene', nobody knew what it was or how it worked." This movie details the research and personal interactions leading to the discovery of the structure of the molecule DNA.

The film opens in 1951, when the young American biologist **James D. Watson** (1928- ), attending a conference in Italy, is jolted into active pursuit of the structure of DNA by an X-ray diffraction image of a DNA sample presented by the English biophysicist **Maurice Wilkins**. Since Wilkins’s image reveals the regularity of a crystal, Watson is convinced that DNA might be analyzed by straightforward methods that have previously succeeded in solving the structure of other types of crystals. This conviction carries Watson to England, where the technique of X-ray crystallography is most advanced. However, since various attempts (including an introduction to Watson’s sister) have failed to impress Wilkins, Watson does not join Wilkins at King’s College, London, but instead goes to Cambridge University, where he teams up with **Francis Crick** (1916-2004 ), another physicist who has turned his attention to problems in biology. The Cavendish Laboratory at Cambridge, where Watson and Crick work, is headed by **Sir Lawrence Bragg** (1890-1971), who shared a Nobel Prize in physics with his father in 1915 for their research in X-ray crystallography. The crucial steps in applying the technique of X-ray diffraction to DNA research, however, take place at King’s College, London, through the expertise of **Rosalind Franklin** (1920-1958) - an expertise she acquired through the study of coal. Although Franklin and Wilkins find it difficult to work together, the possibility of their collaboration heats up the race to discovery, as Watson and Crick see it. They are already worried that the American chemist Linus Pauling (1901-1994) is closing in on a solution.

By the first week of March 1953, Watson and Crick have won the race. In the model they construct that week, DNA (deoxyribonucleic acid) takes the shape of a spiral staircase (a "double helix," in geometrical terms), with the steps composed of pairs of molecules known as bases, and the formed by chains of sugar and phosphate molecules. Because the same types of bases always pair together (adenine with thymine, guanine with cytosine), one half of the DNA staircase (the sequence of bases attached to either sugar-phosphate chain) contains enough information to reproduce the entire structure (the basis for biological reproduction). Moreover, the sequence of bases along the sugar-phosphate chain makes up a code of genetic information. An alphabet of only four letters, A, T, G, C (the initial letters of the names of the bases), produces enough variations in genetic information to account for the great diversity of all living things, including human beings.

Although he did not win the race for the double helix, **Linus Pauling** won a Nobel Prize in chemistry in 1954 for his work on the nature of chemical bonding. In 1962 (the same year Pauling won the Nobel peace prize for his advocacy of nuclear weapons control), Watson, Crick and Wilkins shared the Nobel Prize in physiology or medicine for their work on the structure of DNA. Rosalind Franklin was not considered for that prize because the rules require that recipients be living at the time of the award, and Franklin had died four years earlier.

**Take Notes While Viewing and be Prepared to Discuss:**

**1.** This movie depicts two different philosophies of scientific discovery.

 Comment on the way in which the structure of DNA was discovered. Discuss the method used by Watson and Crick, and compare and contrast it with the method used by Rosalind Franklin.

 Which method was more appropriate?

 Should scientific exploration be a “race”?

 What are the pros and cons of such a race?

 How do you feel about Watson and Crick having the “glory” associated with discovering the structure of DNA?

 **2.** Several times in the movie, the politics of science were discussed.

 Explain how politics played a role in the discovery of DNA structure.

 Do you think the science of today is more or less political than it was during the 1950s?

 Discuss one example of modern research that is affected by politics, and how it is affected.

 **3.** Discuss the methods Watson and Crick used to determine the structure of DNA.

 What do you think was good about their methods?

 What do you think was NOT good about their methods? Why?

 Do the same for Franklin’s scientific methods.

 **4.** What were your first impressions of the main characters?

 James Watson

 Francis Crick

 Rosalind Franklin

 Maurice Wilkins

**5.** Compare the research approaches/ styles/ attitudes of Watson and Crick with those of Franklin .

**6.** Do you think Franklin should have shared her information more freely with the others?

 Do you think she should have worked more closely with Wilkins? Why? Why not?

**7.** Do you think Watson may have had a valid point when he told Rosalind that a "fresh" look " at her work may be what was needed?

**8.** What important relationship between DNA nucleotides did Watson and Crick discover?

 What methods did they use to accomplish this?

**9.** When Franklin finally had the opportunity to look at the DNA double-helix model constructed by Watson & Crick, what was her response?

 (write a couple of sentences summarizing what she felt and what she said)

 What was Wilkin’s response?

**10.** What were your later impressions of the main characters?

 James Watson:

 Francis Crick:

 Rosalind Franklin:

 Maurice Wilkins:

**11.** Why is this movie called “Race for the Double Helix”?

 Do you think scientific research should be a race? Why or why not?

**12.** Who was awarded the Nobel Prize for the discovery of DNA stucture?

 In your opinion, were the Nobel Prizes awarded fairly? Why or why not?

**13.** Which person do you think played the most important role in the discovery of DNA structure? Explain your answer.

**14.** Which person do you think played the least important role in the discovery of DNA structure? Explain your answer

**15.** Which character did you like the best? Why?

**16.** Which character did you like the least? Why?

**17.** What did you learn from the movie that you didn’t previously know?

**QUOTES from the movie:**

(from Access Excellence / Donald Bockler, Arlington HS, MA)

*"The less data the better... Truth is pretty... We listen, but we don't obey...like gossip."*

*“Satisfaction comes not from knowing the solution, but from knowing why it’s the solution”*

*"Do you know what I like about our kind of work? You can be happy or unhappy; it makes no difference. It doesn't matter if you like what you find or hate it. You look at it and say, 'So that's how it is!'... Sometimes I feel like an archaeologist, breaking into a sealed tomb. You just want to look..."*

*"You know how I work, Francis. Anyone can come into my lab anytime they like. Science is a communal activity. I have always said that."*

*"So we got it 2400% wrong... Anyone can make a mistake."*

*"That's what Science is like; it's not all cold reason. There has to be excitement. Science is like love. You can't be told, 'Love this woman, don't love that woman.' You follow your heart."*

*"Do you read detective stories? You don't read the ending first to see who did it. It destroys the book. Satisfaction doesn't come from knowing the solution. It comes from learning WHY it's the solution."*

*"It doesn't matter. THIS (DNA model) is what matters. Life is the shape it is for a purpose. When you see how things really are, all of the hurt and waste fall away. What is left is the beauty."*