Name:_____ Date: _____

SKILL and PRACTICE 10.1

James Watson and Francis Crick

On February 28, 1953, Francis Crick entered the Eagle Pub in Cambridge, England and excitedly announced, "We found the secret of life." James Watson and Francis Crick cracked the puzzle that several other researchers tried so hard to solve—the structure of DNA. The two researchers were an unlikely pair with different educational backgrounds and a 12-year age difference. However, their enthusiasm for science and strong wills led to one of the greatest discoveries in molecular biology.

A whiz kid on Quiz Kids

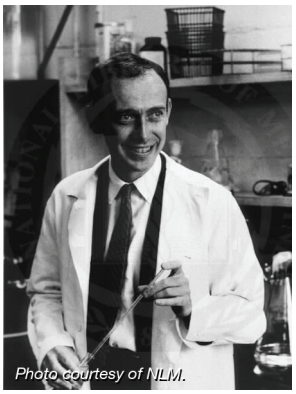
Photo courtesy of NLM.

James Dewey Watson was born in Chicago, Illinois on April 6, 1928. He was a very intelligent child who enjoyed spending his free time bird watching. By age 12, Watson starred on the popular radio show of the 1940s, The Quiz Kids. On the show, young contestants answered difficult questions. Watson finished high school in 2 years and entered the University of Chicago when he was only 15 years old. In 1947, Watson graduated with a degree in zoology (the study of animals).

In 1950, Watson earned a doctorate in zoology from Indiana University. Although Watson still had a strong interest in ornithology (the study of birds), he pursued research in genetics and microbiology. Between 1950 and 1951, Watson went to Copenhagen, Denmark where he studied bacterial viruses.

A first glimpse of DNA

In the spring of 1951, Watson attended a conference in Naples, Italy. Watson met Maurice Wilkins, a researcher from King's College in London. At the meeting, Wilkins presented photos of DNA using a special x-ray technique called x-ray crystallography.

To Watson's eye, Wilkins' blurry picture of DNA showed a regular, repeating pattern. This first glimpse of the molecule marked the beginning of Watson's quest to find the structure of DNA.

Two great minds team together

After the Naples conference, Watson tried to talk his way into Wilkins' research lab. However, Watson was denied entrance because he didn't know much about x-ray crystallography. In October 1951, the 23-year old Watson began working at the Cavendish Laboratory in England where there were many x-ray crystallography projects underway.

Already working at the laboratory was a researcher named Francis Harry Crick. Crick was born on June 8, 1916 in Northampton, England. In 1937, he received his degree in physics at University College, London. He then began his doctorate degree, but stopped at the outbreak of World War II in 1939. During the war, Crick designed mines for the British Admiralty.

In 1947, Crick left the Admiralty and decided to study biology and organic chemistry for the next several years. In 1950, Crick began his doctorate for a second time at Caius College, Cambridge. Crick was part of the Medical Research Council Unit at the Cavendish Laboratory of Cambridge.

Newcomer Watson had much to learn about x-ray crystallography. He was assigned to share an office with Crick who knew a lot about the subject. Although the two men seemed an unlikely pair because of their 12-year age difference, a strong friendship and working relationship began. Watson's biology background and Crick's expertise in x-ray crystallography was a perfect partnership.

The race begins

By 1951, Crick had been already interpreting the x-ray patterns of proteins. Within a few days of arriving at Cavendish Laboratory, Watson talked with Crick about using this technique on DNA. Crick became excited by the idea.

Meanwhile, the Nobel Prize winning chemist Linus Pauling had already published his model of proteins using x-ray crystallography. He found that many proteins spiral like a spring coil—an alpha helix. Pauling's next goal was to solve the structure of DNA. Watson and Crick decided that they would imitate Linus Pauling's work and crack the structure of DNA before Pauling did.

Two other scientists at King's College in London were also searching for the structure of DNA. One was Maurice Wilkins, whose DNA photo Watson had seen at the Naples Conference. The other scientist was Rosalind Franklin. Watson decided to attend a lecture given by Franklin to learn more about her research.

Watson returned to Cambridge with a sketchy memory of Franklin's presentation. Watson and Crick created a model of DNA using this information, but it failed miserably. Watson and Crick's supervisor told them to stop their DNA research, but the two refused to give up.

Discovering the double helix

Although Franklin and Wilkins were conducting similar research, the two did not get along. Therefore, Franklin mostly did her research alone. She suspected that DNA had a helical shape, but wanted more evidence to support her theory. Wilkins was growing impatient with Franklin. Without Franklin's permission, he decided to show Watson her data. This was the key information that Watson and Crick needed to solve the DNA puzzle.

Watson and Crick took Franklin's data and realized that DNA was made of two chains of nucleotides forming a double helix. They found that one chain went up, while the other went down. They had also recently learned about matching base pairs (adenine, thymine, cytosine, and guanine) and added this concept to their model. The matching base pairs interlocked in the middle of the double helix, which kept the distance between the chains constant.

Watson and Crick also showed that each chain of the DNA molecule was a template for the other. When the DNA strands separate during cell division, new strands are built off of the existing strands.

On February 28, 1953 Francis Crick entered the Eagle Pub in Cambridge, England to share in their exciting news. He announced, "We found the secret of life."

A Nobel Prize is awarded

Watson and Crick's DNA model fit perfectly with the data and was quickly accepted. In 1962, Watson, Crick, and Wilkins were awarded the Nobel Prize for physiology and medicine.

Despite providing key data about DNA's structure, Franklin did not share in the prize. Unfortunately, she had already died of cancer in 1958 at the age of 37. The Nobel Prize can only be given to living recipients and can only be shared among three winners. The question remains whether Franklin would have been awarded the prize if she were still alive.

Life after solving the puzzle

After solving the DNA puzzle, Watson and Crick's careers took them in different directions. In 1956, Watson started his 20-year position as professor of biology at Harvard University. In 1968, Watson also served as director of Cold Spring Harbor Laboratory of Quantitative Biology in Long Island, New York. The laboratory became a key research center in molecular biology.

In 1968, Watson published his book *The Double Helix*, which described his firsthand account of the DNA discovery. From 1988 to 1992, Watson headed the National Center for Human Genome Research at the National Institutes of Health. Today, Watson continues to give public speeches and is chancellor of Cold Spring Harbor Laboratory.

Crick remained at Cambridge for 20 years and continued to study DNA. He made major contributions in solving how genetic information is coded. In 1962, Crick became director of Cambridge University's Molecular Biology Laboratory. He also held several visiting professor positions in the United States during this time. He later joined the Salk Institute for Biology Studies in La Jolla, California.

In 1966, Crick wrote *Of Molecules and Men*, which described the impact of recent biochemistry discoveries. He also developed an interest in neurobiology and did research on vision and the function of dreams. Crick died in July 2004 at the age of 88.

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Reading reflection

1. What first prompted James Watson's desire to solve the structure of DNA?
2. Why were Watson and Crick considered both an unlikely pair and a perfect team to solve the structure of DNA?
3. Who were the other researchers "racing" to find the structure of DNA?
4. How did Rosalind Franklin's data help Watson and Crick with their research?
5. When did Watson and Crick receive the Nobel Prize and why were there only three recipients?
6. **Research:** Describe the technique of x-ray crystallography.
7. **Research:** What is Chargaff's Rule and how did this support Watson and Crick's double helix model of DNA?