AT A GLANCE FILM GUIDE

DESCRIPTION

The film *The Double Helix* describes the trail of evidence James Watson and Francis Crick followed to discover the double-helical structure of DNA. Their model's beautiful and simple structure immediately revealed how genetic information is stored and passed from one generation to the next.

KEY CONCEPTS

- DNA is a polymer of nucleotide monomers, each consisting of a phosphate, a deoxyribose sugar, and one of four nitrogenous bases: adenine (A), thymine (T), guanine (G), or cytosine (C).
- The relative amounts of A, T, G, and C bases vary from one species to another; however, in the DNA of any cell from organisms within a single species, the amount of A is equal to the amount of T and the amount of G is equal to the amount of C. This finding can be explained by the fact that in the DNA double helix, A pairs with T and G with C.
- Even before the structure of DNA was solved, studies indicated that the genetic material must be able to store information; be faithfully replicated and be passed on from generation to generation; and allow for changes, and thus evolution, to occur. The structure of the double helix immediately showed that DNA had these properties.
- Scientists use different techniques to measure things that are too large or too small to see. The structure of DNA was determined by combining mathematical interpretations of x-ray crystallography data and chemical data.
- Scientists build models based on what they know from previous research to derive testable hypotheses. Data from experiments are used to revise models and ask additional research questions. The ultimate goal is to find a model that is valid in all or most of the observations.
- The process of scientific discovery involves brainstorming and evaluating ideas, making mistakes, and rethinking those ideas based on evidence. Failure is an important aspect of scientific discovery.
- Communication among scientists plays a crucial role in scientific discoveries. To unlock the structure of DNA, Watson and Crick also relied on observations made by other scientists.

CURRICULUM AND TEXTBOOK CONNECTIONS

Curriculum	Standards
NGSS (April 2013)	MS-LS3.A, MS-LS3.B, MS-ETS1.B, MS-PS1.B, HS-PS2.B, HS-PS4.C, HS-LS1.A, HS.LS3.A, HS.LS3.B
AP (2012–13)	3.A.1, 4.A.1
IB (2009)	3.3, 3.4, 7.1, 7.2

Textbook	Chapter Sections
Miller and Levine, *Biology* (2010 ed.)	12.1, 12.2, 12.3
Reese et al., *Campbell Biology* (9th ed.)	5.5, 16.1, 16.3

SUGGESTED AUDIENCE

This film is appropriate for middle school, high school, and college-level biology and chemistry students. It presents multiple lines of evidence, including chemical bonding and x-ray data, which led to the discovery of the double-helical structure of DNA. The story provides a memorable example of the scientific process and the excitement of scientific discovery.

KEY REFERENCES

Watson, J. D., and Crick, F. H. C. 1953. A structure for deoxyribose nucleic acid. *Nature* 171:737-738.

Wilkins, M. H. F., Stokes, A. R., and Wilson, H. R. 1953. Molecular structure of deoxypentose nucleic acids. *Nature* 171:738-740.

Franklin, R., and Gosling, R. G. 1953. Molecular configuration in sodium thymonucleate. *Nature* 171:740-741.