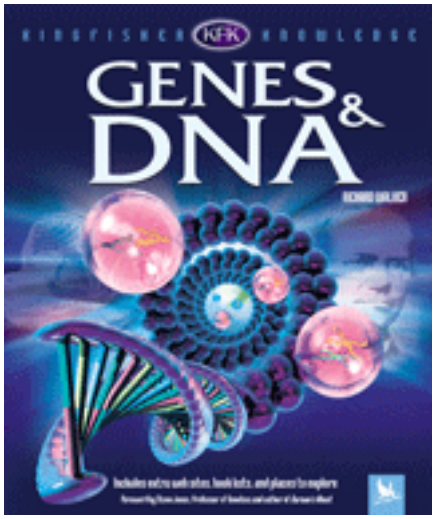

Genes & DNA

by Richard Walker

About the Book

The study of genetics is in the news. Your students hear about it on television, read about it in newspapers and magazines, and discuss it at dinner. The questions of cloning and stem cell research are discussed in the halls of Congress. *Kingfisher Knowledge Genes & DNA* will provide your students with the scientific foundation to understand these issues. You can use this book page by page as a teaching tool for biology lessons. It covers broad life-science curriculum standards:

- Principles of heredity and related concepts
- Structure and function of cells and organisms
- Biological evolution

The book will also serve as a reference resource for students. The activities in this guide extend the book to creative writing, literature, and ethics and values lessons.

Reading Comprehension

Give your students time to read the book on their own or in small groups. To get a sense of their understanding and how much they are learning and retaining, use the chapter summaries to open discussions. It is easy to turn the straightforward review sentences in these summaries into questions to pose to your students. For example:

- Chapter 1, page 24, "Genes and Inheritance": Start with some of the questions posed on the summary page. How do humans and other living

things inherit features from their parents? Why do we all look a little bit different? Then ask, What is meant by the term "nature or nurture"? What are some elements of the environment that can affect who you are? What are some features that are controlled by genes alone? How can the environment affect future offspring?

- Chapter 2, page 38, "DNA: The Molecule of Life": What did Francis Crick mean when he said that they had discovered the "secret of life"? Ask your students to discuss how a DNA molecule replicates itself. Besides looking for mutations, what is the purpose of the Human Genome Project?

- Chapter 3, page 58, "Genetic Technology": What is genetic technology and what impact will it have on our lives? How do forensic scientists use DNA to help solve crimes? How can genetic engineering be beneficial to mankind?

Standards:

Language Arts:

- Uses reading skill and strategies to understand a variety of informational texts.
- Summarizes and paraphrases information in texts.
- Draws conclusions and makes inferences based on explicit and implicit texts.
- Uses new information to adjust and extend personal knowledge base.

Science

- Understands the concepts of Mendelian genetics.

Science

Have your students look at the picture on page 9 of a girl rolling her tongue. The caption tells us that you either have this ability or you don't; there is no in between. Have your class do a survey of which students in your school can roll their tongues and which can't. Record the results and present them as percentages of the total number of students surveyed. They might also record the gender of each person surveyed to see if that represents a statistical factor.

Read "Gene Variation" on pages 16 and 17. Discuss the illustration and its caption on page 17. Using the same type of diagram, have your students work out and show the probability, or chance, that a child will have blue eyes if one parent's allele for eye color was Bb and the other parent's allele was bb. Do the same for one parent's allele being BB and the other's Bb.

Standards:

Science:

- Knows that many characteristics of an organism are inherited from its parents.

Language Arts / Writing

More and more, modern-day law enforcement agencies are using genetic technology to solve crimes that at one time were considered unsolvable for lack of evidence. This use of technology is being exploited in the popular culture with a spate of books, movies, and television programs that employ DNA fingerprinting as the mainstay of investigations. Have your class enter into the fray. After reading pages 40 and 41, talk about the popular television programs that employ the techniques discussed. Then have them write crime stories from the point of view of the forensic scientist solving a mystery through the identification of the suspect's DNA.

Standards:

Language Arts:

- Writes in response to literature.
- Writes narrative accounts; creates an organizational structure; uses an identifiable voice.
- Understands that a variety of messages are conveyed by visual media.
- Uses a variety of criteria to evaluate and form viewpoints of visual media.

Technology:

- Knows how technology has influenced history.

Ethics and Values

Genetic engineering, genetic testing, genetic therapies, stem cell research, and cloning pose ethical questions that society must deal with. Have your students discuss the following questions:

- We believe that every individual human is special and unique. How then do we feel about the possibility that someday there might be a cloned human being?
- It has been shown that mutations of specific genes can cause diseases such as diabetes, hemophilia, and heart disease. If it is discovered that a person has a mutated gene that causes him or her to have violent

behavior, should that person be held responsible and punished for his or her violent actions, or should it be treated as a disease with no legal consequence?

- With the advent of the Internet and advances in computer technology, privacy and confidentiality have become a major issue in our society. How should the information gathered from genetic testing of a fetus be protected? Who should own and control that information, and what should be done with it?

- Is it fair to burden parents with negative results of genetic testing of a fetus when there are no medical remedies for the defects discovered?

- Certain foods have been genetically modified (GM) to increase yield, retard spoilage, resist insect infestation, and improve nutritional value. Is it ethical to distribute these foods, especially to developing nations, while the long-term effects on the environment and human health are still unknown?

Standards:

Civics:
- Knows what constitutes personal rights.
- Knows contemporary issues regarding rights.

Science:
- Understands the ethics associated with scientific study.
- Knows that hereditary information is contained in genes.
- Knows that mutations and new combinations may have positive, negative, or no effects on organisms.

Literature

Two novels that deal with genetic selection and genetic engineering are the Newbery Award–winning book *The Giver*, by Lois Lowry, and *Dr. Franklin's Island*, by Ann Halam. Have groups of students read these books and write reports about the science in these science-fiction novels and the moral and ethical issues raised.

Standards:

Language Arts:
- Writes in response to literature.

Research

Genetics is a relatively new science. The Human Genome Sequencing Project successfully completed mapping the human genome in April 2003. Your students are living in this age of discovery, and the newspapers of the day are primary sources. Have your students research local newspapers and other periodicals available in the public library to see how the project was reported as news and/or in editorials. Newspapers are archived on microfilm and are catalogued by date. Weekly periodicals are catalogued by issue date. *The Reader's Guide to Periodical Literature* will lead students to articles on specific subjects.

Standards:

Science:

- Knows that hereditary information is contained in genes.
- Knows the chemical and structural properties of DNA.
- Knows ways in which genes may be altered.
- Knows features of human genetics.

Language Arts:

- Uses *The Reader's Guide to Periodical Literature* and other indexes to gather information for research topics.

Discussion

- Discuss with your class Darwin's theory of natural selection. Do they think that the human race is the final step in the evolutionary process or will humans eventually evolve into another life form?
- Most of us are so mystified and awed by science that we tend to believe that science and scientists can solve any problem. When genetic scientists tell us that each person 's DNA is unique and the use of DNA fingerprinting to solve crimes is foolproof, we accept this with little opposition. But is it? Is DNA sequencing the final stage or is it just another step in the process of finding a new theory that may invalidate current thinking? Have your students discuss this question. Should we accept scientific theory as fact?

Standards:

Science:

- Knows ways in which science and society influence each other.

- Knows that throughout history, many scientific innovators have had difficulty breaking through accepted ideas.
- Understands ethics associated with scientific study.
- Knows basic ideas related to biological evolution.

History:

- Understands that specific individuals had an impact on history.

