# Reading the Code

## Description of Activity

*Reading the Code* focuses on the work of scientists and research teams who determined how the DNA code works. Students must identify the questions being addressed in several key experiments. They are also asked to think about the data and determine its role in resolving the code question.

## Learning Outcomes

Students will:

1. understand that scientists work together to solve problems.
2. appreciate the contribution each scientist made to our understanding of DNA.
3. recognize the basic questions being addressed by a scientific investigation.
4. learn to read through a description of an investigation and select the evidence that answers the question being addressed.
5. understand that DNA code is based on a sequence of three nucleotide bases.
6. know that the code stored in DNA flows through mRNA to tRNA which assembles the amino acid chain at the ribosomes.
7. explain how mutations result in corresponding changes in protein.
8. be skilled in using the genetic code chart.

## Assumptions of Prior Knowledge

Students should know that DNA is a double helix and that the code has something to do with the order of nucleotide bases. A familiarity with the concept of the Central Dogma would be helpful.

## Misconceptions

Students often think that an amino acid is coded for by only one codon. This leads to the idea that a mutation will always result in a change of an amino acid in the protein sequence.

## Implementing the Lesson

Become familiar with the *DNA Interactive (DNAi)* web site (www.dnai.org) and how to navigate through it. Provide students with information about navigating the site, and how to play animations and video clips.

**Before class:**

Photocopy enough sets of the student pages so that each student has one.

**During class:**

Before starting this activity, ask students what they know about codes…*secret* codes, bar codes, codes used by the military, computer code, Morse Code, etc. Ask if they ever talk in code or have sent notes written in secret code. This can lead into a discussion of DNA code and the scientists who conducted numerous experiments to decipher it.

## Further explorations

*Role play*

Assign teams of students specific experiments from **www.dnai.org > Code > Reading the Code**. Have them create a scientific poster that follows the format required for a professional conference presentation. Students can use information from the *DNAi* web site and other sources. Have the student teams present their posters to the class. Follow each presentation by a question and answer session.

*Coding and decoding*

Provide students with a copy of the Morse code (see resources). Give them a sentence written in Morse code and have them translate it.

Have students develop their own codes, use their code to write a short sentence, and challenge other students to decipher it. The code-breakers should be able to obtain clues by asking the code-makers specific questions. The code-makers should only have to answer relevant questions.

## Glossary

Crossing over

*E. coli*

Frame shift mutation

messenger RNA (mRNA)

Mutation

Point mutation

Ribosome

Template

## Resources

### Web

Access Excellence @The National Health Museum (1994-2003). *ae@nhm: the Site for Health & Bioscience Teachers and Learners*, www.accessexcellence.com

Cold Spring Harbor Laboratory (2002). *DNA From the Beginning: an animated primer on the basics of DNA, genes, and heredity*, www.dnaftb.org

Richard Everitt, 9M2/G4ZFE (2002). *Morse code alphabet*, http://www.babbage.demon.co.uk/morseabc.html

Woodrow Wilson National Fellowship Foundation (2002). *Leadership Program for Teachers: Teacher Resources > Core Websites*, www.woodrow.org/teachers/Teacher_Resources/CORE/core.html

### DVD

*DNA Interactive* (2003). NTSC version produced by Cold Spring Harbor Laboratory and Red Green & Blue Company; funded by Howard Hughes Medical Institute. Available at www.dnai.org

### Books

Alberts, Bruce et al. (1994) *Molecular Biology of the Cell, (3rd Edition)*, Garland Publishing Inc., New York.

Campbell, Neil and Reece, Jane (2001). *Essential Biology*, Benjamin Cummings, San Francisco.

Micklos, David A., Freyer, Greg A., and Crotty, David A. (2003). *DNA Science: A First Course, (2nd Edition)*, Cold Spring Harbor Laboratory Press, New York.

Watson, James D., with Berry, Andrew (2003). *DNA: The Secret of Life*, Alfred A. Knopf, New York.

## Next pages include:

Student worksheets.

Answer sheets.