Section 1

Terms to Learn

DNA
nucleotide
adenine
thymine
guanine
cytosine

What You'll Do

- Describe the basic structure of the DNA molecule.
- Explain how DNA molecules can be copied.
- Explain some of the exceptions to Mendel's heredity principles.

What Do Genes Look Like?

Scientists know that traits are determined by genes and that genes are passed from one generation to another. Scientists also know that genes are located on chromosomes, structures in the nucleus of most cells. Chromosomes are made of protein and **DNA,** short for deoxyribonucleic (dee AHKS ee RIE boh noo KLEE ik) acid. But which type of material makes the genes?

The Pieces of the Puzzle

The gene material must be able to do two things. First it must be able to supply instructions for cell processes and for building cell structures. Second it must be able to be copied each time a cell divides, so that each cell contains an identical set of genes. Early studies of DNA suggested that DNA was a very simple molecule. Because of this, most scientists thought protein probably carried hereditary information. After all, proteins are complex molecules.

In the 1940s, however, scientists discovered that genes of bacteria are made of DNA. How could something so simple hold the key to an organism's characteristics? To find the answer, let's take a closer look at the subunits of a DNA molecule.

Nucleotides—The Subunits of DNA DNA is made of only four subunits, which are known as **nucleotides.** Each nucleotide consists of three different types of material: a sugar, a phosphate, and a base. Nucleotides are identical except for the base. The four bases are **adenine, thymine, guanine,** and **cytosine,** and they each have a slightly different shape. The bases are usually referred to by the first letters in their names, A, T, G, and C. **Figure 1** shows diagrams of the four nucleotides.

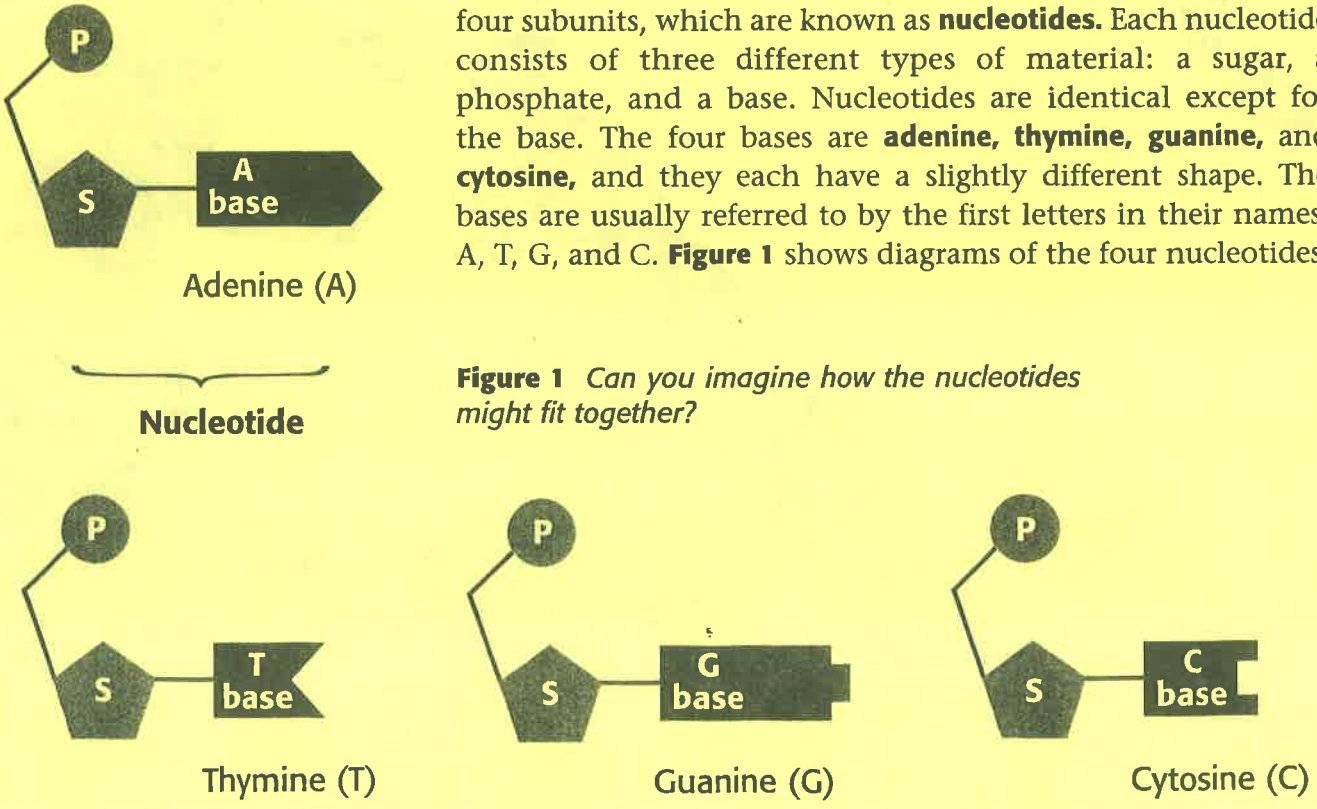

Figure 1 *Can you imagine how the nucleotides might fit together?*

DNA Structure

The twisted ladder, or double helix, shape is represented in **Figure 4.** As you can see in **Figure 5,** the two sides of the ladder are made of alternating sugar molecules and phosphate molecules. The rungs of the ladder are composed of a pair of nucleotide bases. Adenine on one side always pairs up with thymine on the other side. Guanine always pairs up with cytosine in the same way. How might this structure explain Chargaff's findings?

Figure 4 *The structure of DNA can be compared to a twisted ladder.*

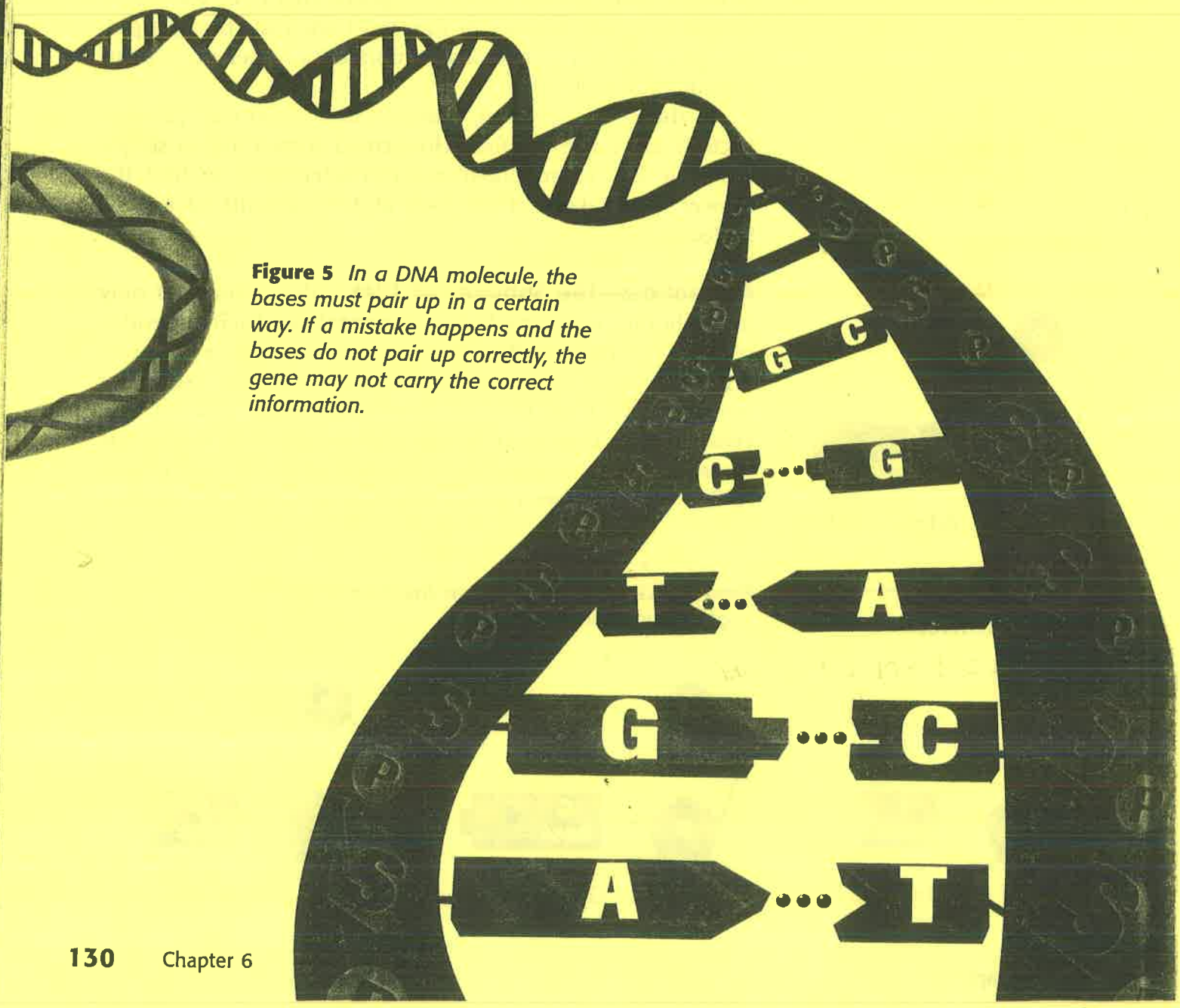

Figure 5 *In a DNA molecule, the bases must pair up in a certain way. If a mistake happens and the bases do not pair up correctly, the gene may not carry the correct information.*