

Chapter 12 DNA and RNA

Exploration

Modeling DNA Replication

Living cells make exact copies of DNA molecules that are passed on to each daughter cell during cell division. In this investigation, you will model DNA replication.

Problem

How is DNA replicated?

Materials

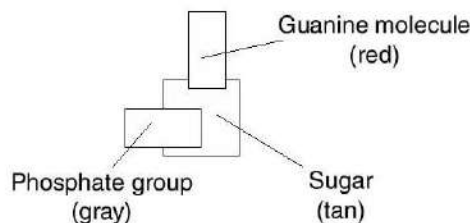
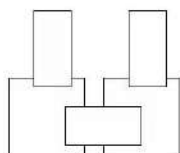
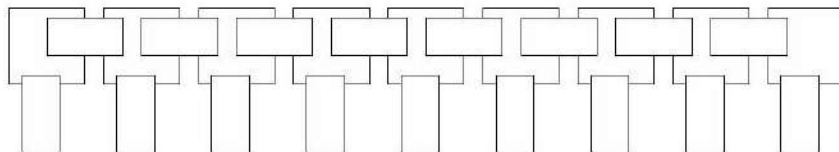
- construction paper (tan, gray, green, yellow, red, and purple)
- metric ruler

- scissors
- transparent tape

Skills Using Models

Procedure ✂

1. Cut out rectangles of construction paper of the size and color indicated below:
 Sugars: 36 tan pieces, each 2 cm × 2 cm
 Phosphates: 36 gray pieces, each 1 cm × 2 cm
 Adenines (A): 12 green pieces, each 1 cm × 2 cm
 Thymines (T): 12 yellow pieces, each 1 cm × 2 cm
 Guanines (G): 6 red pieces, each 1 cm × 2 cm
 Cytosines (C): 6 purple pieces, each 1 cm × 2 cm
2. To model a nucleotide, tape together a phosphate group, a sugar, and a guanine molecule (G). See Figure 12-5 on page 291.
3. Assemble eight additional nucleotide models with the following nitrogenous bases: 3 thymines (T); 3 adenines (A); 2 cytosines (C).
4. To model a single strand of DNA, tape the sugar of each nucleotide to the phosphate group of the next nucleotide in the following order: G T T A C A A T C.
5. Construct a strand of DNA that is complementary to the first strand. Tape the nucleotides of the second strand together as you did in step 4. Record the positions of the bases in both strands of your model in the data table below.



Data Table	
Position of Bases	
Strand 1	
Strand 2	

- Place the two strands side by side so that their complementary nucleotides face each other. Do not tape the two strands together. Write "original" on each strand.
- Separate the two strands. Simulate the action of DNA polymerase by constructing a new complementary strand for each original strand.
- Tape the bases of each new strand to the complementary bases of its matching strand.

Analyze and Conclude

- Comparing and Contrasting** Compare the new double-stranded DNA models with your original DNA model. Are their nucleotide sequences identical?

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2. Using Models After a cell's DNA is replicated, the cell may divide in two. Each new cell receives one copy of the original cell's DNA. According to your model, how are the new strands divided between the two new cells?

3. Drawing Conclusions How does the pairing of complementary bases help ensure that the nucleotide sequence is copied accurately during DNA replication?

4. Drawing Conclusions What problems would you expect to occur if DNA was not copied accurately as it is replicated?
