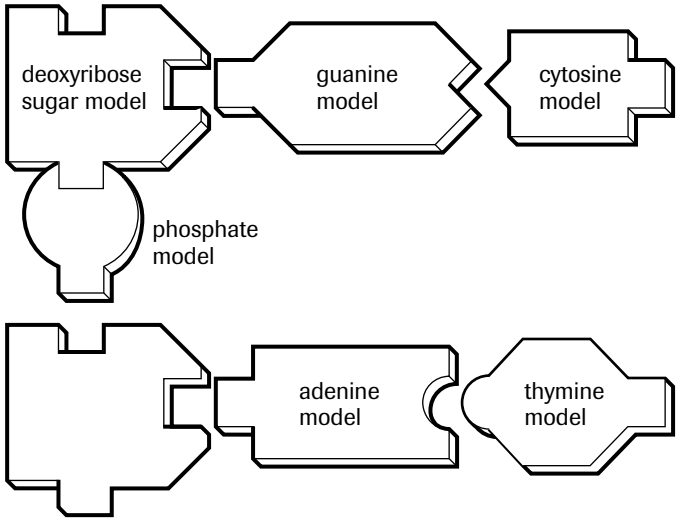
Additional Lab Exercise: Exploring DNA Replication

Objective

To investigate how the double helix of DNA replicates.

Background Information

The DNA molecule is made up of nucleotides, each comprising a deoxyribose sugar, a phosphate, and a nitrogen base. During the replication process, the double strands of DNA separate along the bonds between the nitrogen bases. Each parent strand serves as a template for the arrangement of new nucleotides. An enzyme joins the nucleotides into a complementary strand of DNA. A second enzyme checks the ordering of bases for errors.



Materials

scissors
toothpicks
transparent tape or glue
blank sheet of paper

Procedure

1. You will be supplied with a page of symbols representing the molecules that make up DNA. Cut out the individual molecules. The toothpicks will be used to represent bonds between the molecules.

(a) Why are the adenine and guanine molecules represented by larger shapes than the other two nitrogen bases?

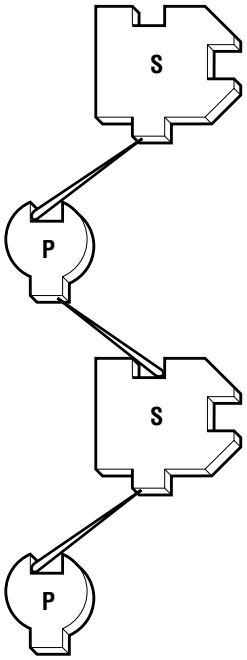
(continued)

2. Using a toothpick, bond the adenine molecule to a deoxyribose sugar molecule. Then use another toothpick to bond the phosphate molecule to the sugar molecule. Place the phosphate molecule along the left margin of a sheet of paper.

(b) What is this structure called?

3. Assemble four different nucleotides, as described in the procedure above. Keeping the phosphate molecules along the left margin of the page, attach each of the nitrogen bases to a different sugar molecule.

4. The phosphate molecules of the DNA bond with two different sugar molecules. Place a second toothpick on the phosphate molecule, and attach a second sugar molecule to the phosphate molecule.



5. Using toothpicks to represent bonds, attach a line of four nucleotides together.

(c) Record the genetic code by indicating the letters of the nitrogen bases, beginning from the top of the page.

6. Make a complementary strand of DNA by matching nitrogen bases. The complementary strand should have the phosphate molecules aligned along the right of the page.

(d) Record the genetic code of the complementary strand.

Additional Lab Exercise: Exploring DNA Replication, Solution

Laboratory

- Time required: about 30 min
- Molecular models for duplication are found on LSM 4.3-4.

Observation Questions

(a) They are double-ring structures; see **Figure 7**, page 213 of the Student Text.

(b) This structure is called a nucleotide.

(c) Answers will vary.

(d) Answers will vary, but complementary base pairs will be A–T and G–C.

Laboratory Application Questions

1. The geometry will not match. The shapes do not fit together.

2. The original strand of DNA provides the blueprint.

3. Joining the two large molecules (purine) would cause gaps along the ladder. The rungs joined by the smaller molecules (pyrimidines) would be too short to touch.

4. The geometry of the paired bases would prevent bonding, or two bases of inappropriate size would cause the strand to pull apart.

5. A genetic code would be altered by removing a sequence of bases. In the next chapter, students will be able to relate these changes to protein synthesis. This question is designed to start them thinking about the importance of a genetic code.