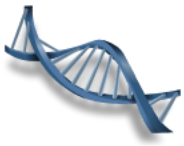
Modeling DNA Replication



Introduction

Within the **nucleus** of every cell are long strings of DNA, the code that holds all the information needed to make and control every cell within a living organism. DNA, which stands for **deoxyribonucleic acid,** resembles a long, spiraling ladder. It consists of just a few kinds of atoms: carbon, hydrogen, oxygen, nitrogen, and phosphorus. Combinations of these atoms form the **sugar-phosphate backbone of the DNA** -- the sides of the ladder, in other words.

Other combinations of the atoms form the four bases: **thymine** (T), **adenine** (A), **cytosine** (C), and **guanine** (G). These bases are the rungs (steps) of the DNA ladder. (It takes two bases to form a rung -- one for each side of the ladder.) A sugar molecule, a base, and a phosphate molecule group together make up a **nucleotide**. Nucleotides are abundant in the cell's nucleus. Nucleotides are the units which, when linked sugar to phosphate, make up **one side of a DNA ladder**.

During **DNA replication**, special enzymes move up along the DNA ladder, unzipping the molecule as it moves along. New nucleotides move in to each side of the unzipped ladder. The bases on these nucleotides are very particular about what they connect to. When the enzyme has passed the end of the DNA, two identical molecules of DNA are left behind. Cytosine (C) will "pair" to guanine (G), and adenine (A) will "pair" to thymine (T). How the bases are arranged in the DNA is what determines the genetic code.

When the enzyme has passed the end of the DNA, **two identical molecules of DNA are left behind**. Each contains one side of the original DNA and one side made of "new" nucleotides. It is possible that mistakes were made along the way -- in other words, that a base pair in one DNA molecule doesn't match the corresponding pair in the other molecule. On average, one mistake may exist in every billion base pairs.

Objectives

The replication of DNA before cell division can be shown using paper templates for the components of DNA nucleotides.

Procedure:

DNA Molecule:

1. Construct DNA model using the following sequence to form a row from top to bottom - cytosine (topmost), thymine, guanine, and adenine (bottommost).
2. Let this arrangement represent the left half of your DNA molecule.
3. Complete the right side of the ladder by adding the complementary bases. You will have to turn them upside down in order to make them fit.
4. Add the sugar and phosphate backbones (match the symbols to know where they go!)
5. Your finished model should look like a ladder.
6. Draw your model on your answer sheet.
7. Using the pieces you have in your envelope, create your own double stranded DNA.
8. Draw your model on your answer sheet.

DNA Replication

1. Reassemble the first DNA model.
2. To show replication, separate the left side from the right side, leaving a space of about 6-8 inches.
3. Use the remaining nucleotides to complete the molecule using the left side as the base.
4. Build a second DNA model by adding new nucleotides to the right half of the original piece of the molecule.
5. Draw the models of replication on your answer sheet.

Name:_____

DNA REPLICATION
STUDENT ANSWER SHEET

DNA Model 1:

DNA Model 2:

DNA Replication Model:

Questions

1. Where is DNA found?
2. What is the overall shape of DNA?
3. Of the 4 bases, which other base does adenine most closely resemble? (Think of the shape of the puzzle piece)
4. List the 4 different nucleotides.
5. Which 2 molecules of a nucleotide form the sides of a DNA ladder?
6. If 30% of a DNA molecule is Adenine, what percent is Cytosine?
7. What does the term replication mean?
8. What is another name for adenine and the phosphate and sugar molecules attached to it?
9. Describe the staircase structure of DNA. What are the rails, what are the steps?
10. What is the end result of DNA replication?