DNA Replication Lab

Objectives: 1. To build a DNA model using pop beads. 2. To model DNA replication

Materials:

Pop Beads
- Red (phosphate)
- White five-hole (deoxyribose sugar)
- Yellow (adenine)
- Orange (thymine)
- Green (guanine)
- Blue (cytosine)

Plastic connectors for hydrogen bonds

Procedure:

Build a DNA Molecule

1. Put together two chains of pop beads to create the "backbone" of your molecule. Each chain should be 32 beads long, alternating red (phosphate) and white (deoxyribose sugar).

2. Build the DNA molecule below by snapping the correct color bead into the holes in the white sugar molecule.

   5' G T A C T T C G A A G C C T G A 3'
   3' C A T G A A G C T T C G G A C T 5'

3. Attach the two strands using the plastic connectors which represent hydrogen bonds. Be sure that each bead is attached to its correct complementary base.

4. Draw your DNA molecule.

5. Twist the molecule counterclockwise to show the double helix shape of the molecule.

Replicate a DNA Molecule

6. Lay your model back out flat on your table.

7. Twist a pipe cleaner around the molecule between the 9^{th} and 10^{th} bead from the 5' G end to simulate a centromere.

8. Begin to "unzip" your DNA molecule by removing the hydrogen bonds holding them together at the 5' G end. Stop when you reach the "centromere". This creates a replication fork in your molecule.

9. Begin DNA replication of the leading strand by adding complementary bases, one at a time, starting with the 3' CAT end of the molecule. Stop when you reach the replication fork.

10. Begin DNA replication of the lagging strand by adding bases, one at a time, starting at the replication fork and working toward the 5' GTA end of the molecule.

11. Untwist your pipe cleaner and complete the rest of the leading strand, adding one base at a time.

12. Complete the lagging strand by adding bases, one at a time, starting at the 3' TGA end of the molecule and working toward the section you already built. Connect the two sections together to form a continuous molecule.

Analysis Questions

1. If 4 guanine molecules are in a DNA molecule, how many cytosine molecules would be in that same molecule?

2. Compare the two new double stranded DNA molecules you just produced. How are the similar to the original DNA strand? How are they different?

3. How many adenine and thymine nucleotides are in each DNA strand?

4. Describe how the leading strands and lagging strands are built differently from each other.

5. What enzymes are used in cells to complete this process? Describe the function of each.

6. Describe how DNA replication makes it possible to produce two identical cells from one parent cell.