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What is DNA Replication?

DNA replication is the process by which DNA makes a copy of itself in the S-phase of Interphase before cell division begins.

The first step of DNA replication is to unzip the double helix structure of the DNA molecule. This unzipping is carried out by an enzyme called helicase, which breaks the weak hydrogen bonds holding together DNA's complementary bases (ATCG). The separation of the two strands of the double helix creates a "y" shape called a "replication fork". Each of these strands will act as a template for building a new complementary strand of DNA. Because DNA is a large molecule, it unzips at multiple points in both directions along the double helix. This unzipping at multiple points creates "replication bubbles"-unzipped fragments of DNA between replication forks.

The next event that occurs in DNA replication uses an enzyme called DNA polymerase. DNA polymerase enzymes bind to the unzipped strands of DNA and "walk" along the strands adding in new complementary nucleotide bases to the other side to create a new matching side of each template strand. This continues throughout all of the replication bubbles until the entire length of the original DNA molecule has been replicated.

Q4
Once the DNA polymerase enzymes have added these new nucleotides to synthesize two new complementary strands, the DNA polymerase enzymes then proofread to check for errors. Q5
This improves the error rate from an initial 1 error in 10,000 base pairs to an error rate of 1 in 1 billion base pairs.

Finally, an enzyme called DNA ligase seals together the sugar-phosphate backbones of all of the newly replicated "bubbles" of DNA, so that the new complementary side of each molecule is one smooth strand.

The result of DNA replication is two identical DNA molecules. Each molecule is double stranded and consists of one new and one old chain of nucleotides. This is why DNA replication is described as semi-conservative--half of each of the double helix molecules is conserved and the other half is brand new. Following DNA replication, the new DNA molecules automatically recoil into a double helix.

DNA Replication Lab

Name _____

PART 1: CONSTRUCT A DNA MOLECULE

1. Cut along the dotted lines on sheet A to separate the two halves of a double helix.
2. Trim around the "backbone" and "rungs" of each half to remove excess paper.
3. Use GLUE to attach the complementary bases to each other to form a complete molecule of DNA.

STOP!!-ANSWER THE FOLLOWING QUESTIONS ON THE REPORT SHEET

Q1-What does the glue you used in step 3 represent?

Q2-How many nucleotides are present in your model?

PART 2: REPLICATE YOUR DNA MOLECULE

4. Use scissors to CUT through the hydrogen bonds in your model.
5. Cut out each of the "free-floating" nucleotides on sheet B by trimming around the edges of each to remove excess paper.
6. Glue these free-floating nucleotides to their complementary bases on each half of your original model to construct complementary strands.
7. Glue these two double helices on the report sheet in the space provided.
8. Label the backbones of both double helices with the following terms: "original strand" and "new strand."

STOP!! READ THE ARTICLE TITLED "DNA REPLICATION" ON THE BACK OF THIS SHEET.

Answer the following questions on the report sheet.

Q3-What did the scissors you used in step 4 represent?

Q4-What did the glue that you used in step 6 represent?

Q5-Refer to question 4. What is the other function of the molecule mentioned in your answer?

Q6-What enzyme was NOT specifically represented in the lab AND what is its function?

Q7-Use the context clues in the article to sketch AND label a "replication fork" and a "replication bubble."

Q8-Explain the term "semi-conservative."

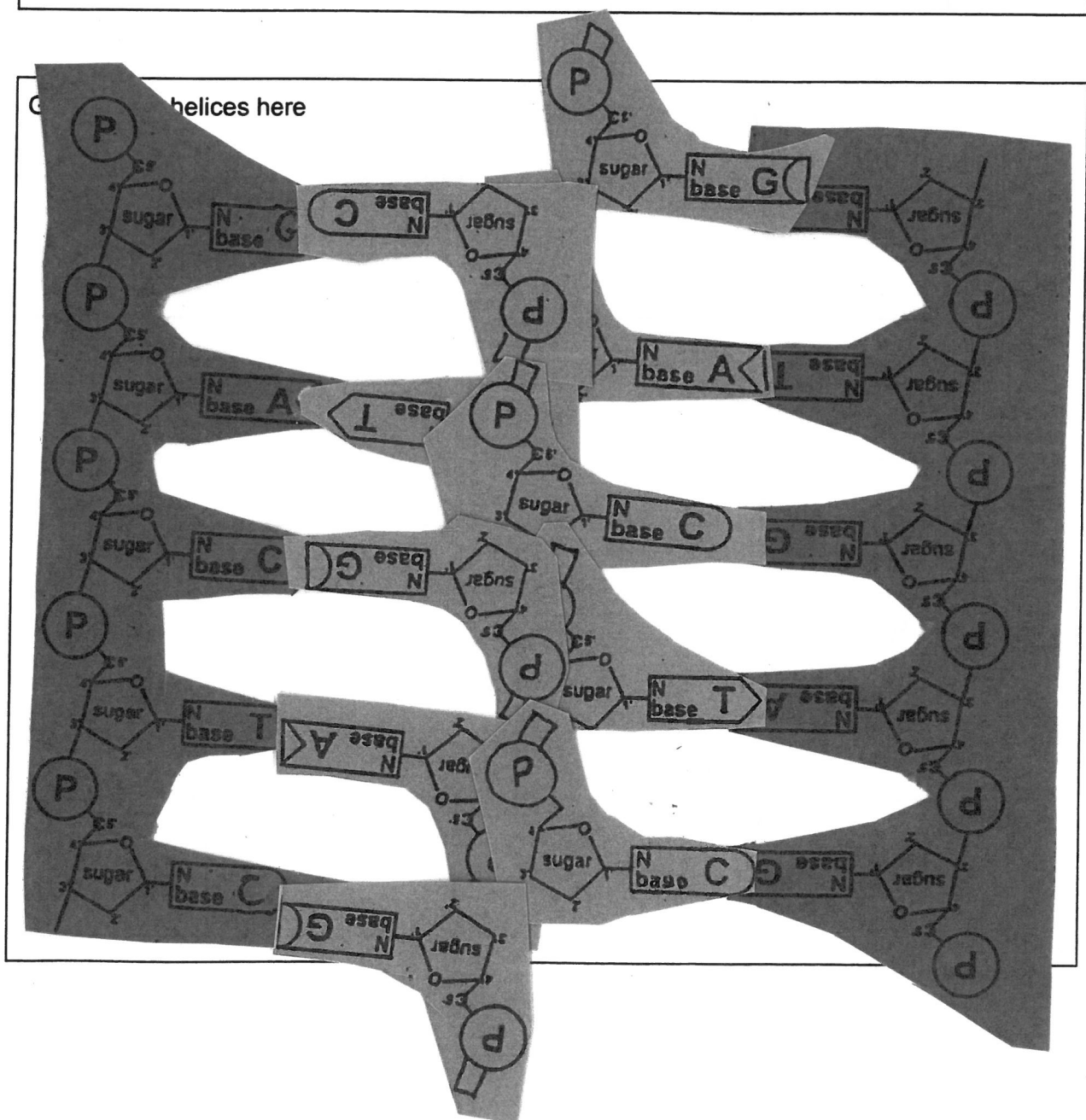
Q9-When does the process that you modeled today occur?

DNA Replication Lab Report Sheet

Name _____

Q1 Hydrogen Bond

Q2 10



Q3 Unzipping

Q4 Polymerase enzymes have added the new nucleotides to synthesize two new complementary strands . . .

Q5 DNA polymerase enzymes then proofread to check for errors.

Q6 Ligase seals together the sugar phosphate back bones

Q7



Q8 Half of each of the double helix molecules is conserved and the other half is brand new

Q9 In DNA replication