

DNA Replication

Big Picture

DNA replication occurs during the S phase (synthesis phase) in the cell cycle for each strand of the double helix parent DNA. As cell divide and replicate, more DNA must be made. Because each complementary strand run in different directions, the process of DNA replication works differently for each strand.

Key Terms

DNA Replication: The process in which a cell's entire DNA is copied.

DNA Helicase: The enzyme that breaks the hydrogen bonds holding the two DNA strands together during DNA replication.

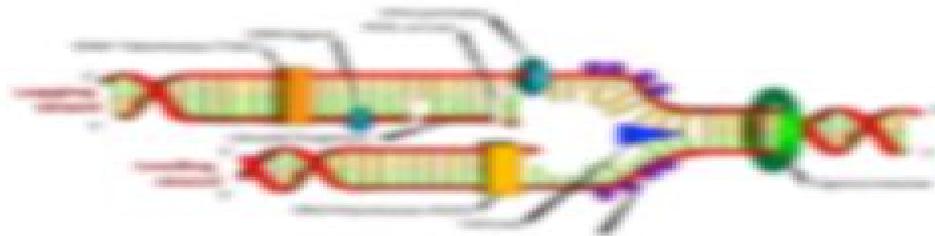
DNA Polymerase: The enzyme that builds a new DNA strand during DNA replication.

Leading Strand: The DNA strand that DNA polymerase constructs in the 5' → 3' direction.

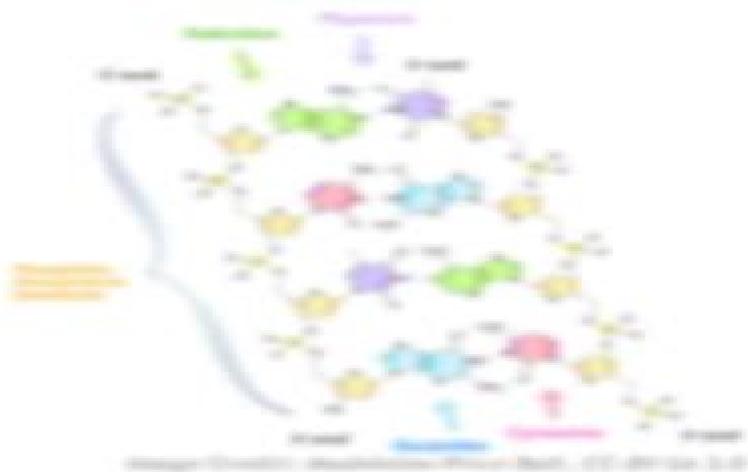
Lagging Strand: The DNA strand at the opposite side of the replication fork from the leading strand.

Primase: An enzyme that builds a short RNA primer on the lagging strand during DNA replication.

Okazaki Fragment: Short fragments of DNA that comprise the lagging strand.



How It Works



In DNA replication, the parent DNA strands must be unwound by DNA helicase, which breaks the hydrogen bonds holding the two strands together. Helicase breaks the DNA unwinding the strands from inside both origins, and as a result, a replication bubble forms. The bubble that forms for DNA to replicate is called a replication fork.

DNA polymerase creates the complementary DNA strand in the opposite direction of the parent DNA.

Primase: This enzyme builds a short RNA primer on the lagging strand.

DNA polymerase continues with a new DNA base being added, creating a new complementary strand and the lagging strand.

Each DNA molecule is "discontinuous" because DNA polymerase can only synthesize DNA in the 5' to 3' direction.

Okazaki fragments are short segments of DNA that are synthesized in the 3' to 5' direction.

DNA polymerase only creates the new DNA strand in the 5' → 3' direction, so it needs

alternately depending on which strand it is on. On the leading strand, which runs from 5' → 3', DNA polymerase will work continuously as the replication fork goes.

What Happens Next

The daughter strands of the original DNA separate, with the lagging strand, DNA polymerase cannot work continuously in the 3' → 5' direction. To create this complementary strand, the complementary strand, polymerase builds a short RNA primer. DNA polymerase then creates the small sugar-phosphate units in the 3' → 5' direction. As this happens, the new DNA strand takes its place. The process then repeats and the rest of the lagging strand is created. These small DNA fragments are called Okazaki fragments.

Dna Replication Study Guide

Christopher K. Mathews, Harry Ako



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