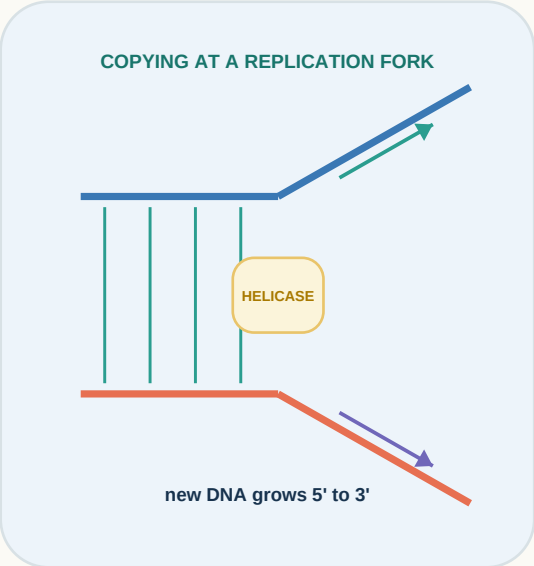
AP BIOLOGY | UNIT 6

TOPIC 6.2

DNA Replication

Before cell division, DNA is copied so each daughter cell can inherit a complete set of genetic instructions.



THE CORE CAUSAL CHAIN

UNWIND → helicase opens DNA

PRIME → primase starts strands

EXTEND → polymerase adds bases

JOIN → ligase seals fragments

BY THE END, YOU SHOULD BE ABLE TO...

1. Explain semiconservative replication.
2. Match replication enzymes to their roles.
3. Compare leading and lagging strand synthesis.

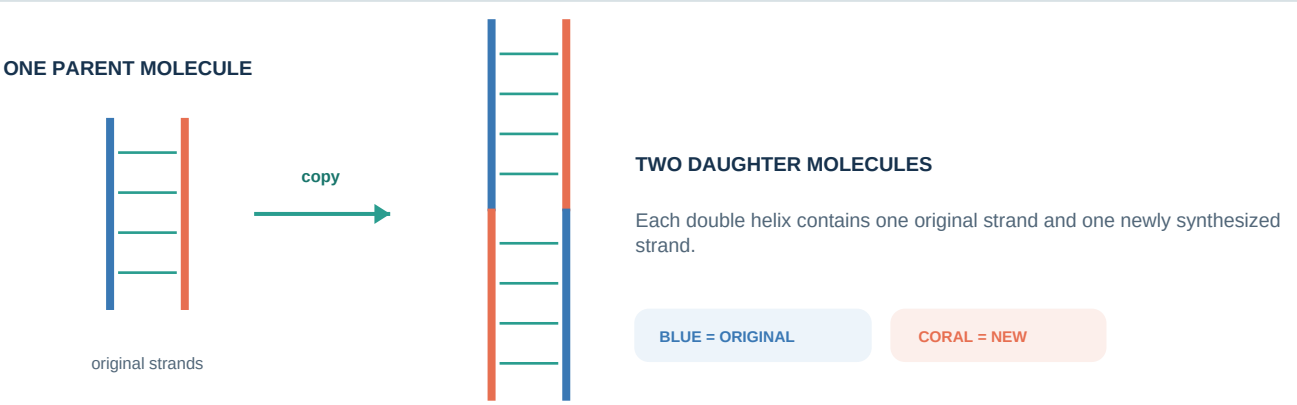
CENTRAL IDEA

Each original DNA strand guides a complementary new strand, producing two molecules that each contain one old strand and one new strand.

1 A template makes an accurate copy

Complementary base pairing lets each original strand specify the sequence of a new strand.

SEMICONSERVATIVE REPLICATION



THE ENZYME TEAM

1 HELICASE

Separates the two parental strands at the replication fork.

2 TOPOISOMERASE

Relieves twisting and strain ahead of the opening fork.

3 PRIMASE

Builds short RNA primers that provide a starting point.

4 DNA POLYMERASE

Adds complementary DNA nucleotides to a growing 3' end.

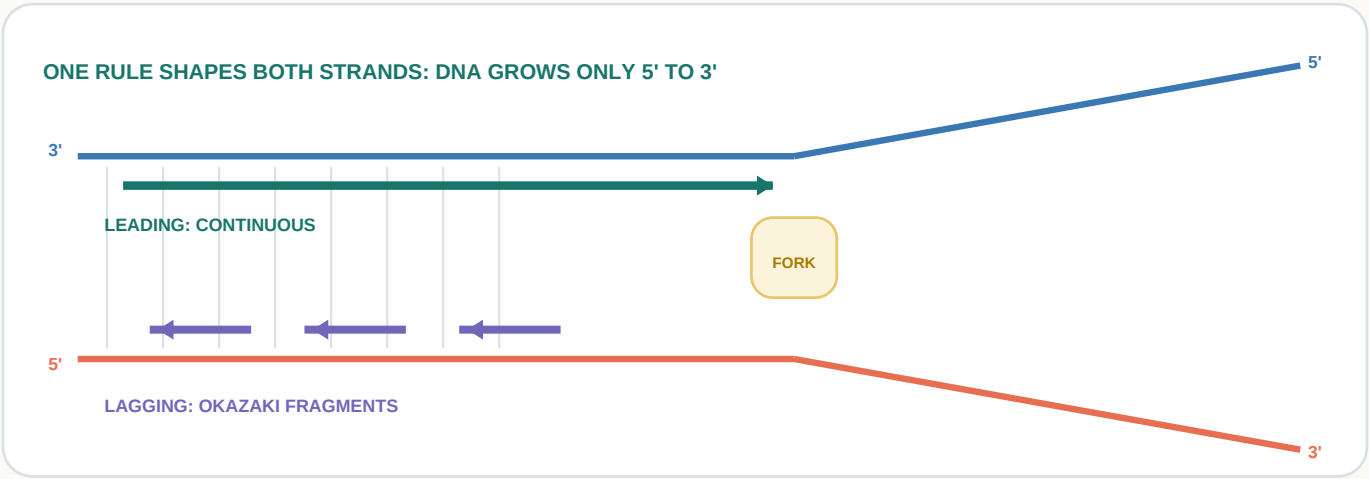
5 DNA LIGASE

Seals breaks in the sugar-phosphate backbone, joining Okazaki fragments into a continuous lagging strand.

2

The two new strands grow differently

Because parental strands are antiparallel and polymerase works only 5' to 3', one strand is continuous and the other is built in pieces.



LEADING AND LAGGING

LEADING STRAND

- made continuously
- grows toward the moving fork
- needs one RNA primer

LAGGING STRAND

- made discontinuously
- grows away from the fork
- many primers create fragments

FRAGMENT FINISHING

DNA polymerase replaces primer regions with DNA. Ligase then seals the remaining gaps between Okazaki fragments.

FINAL MAP

Unwind -> prime -> extend 5' to 3' -> replace primers -> seal fragments. The result is two semiconservative DNA molecules.