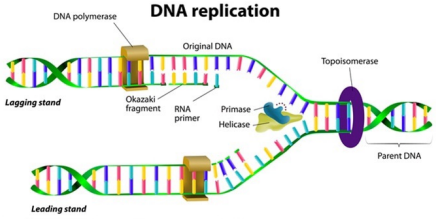
DNA Replication

- Before a nucleus divides, its DNA must be replicated. This is to ensure that all the daughter cells have the genetic information to produce the enzymes and other proteins that they need.

Semi-conservative replication

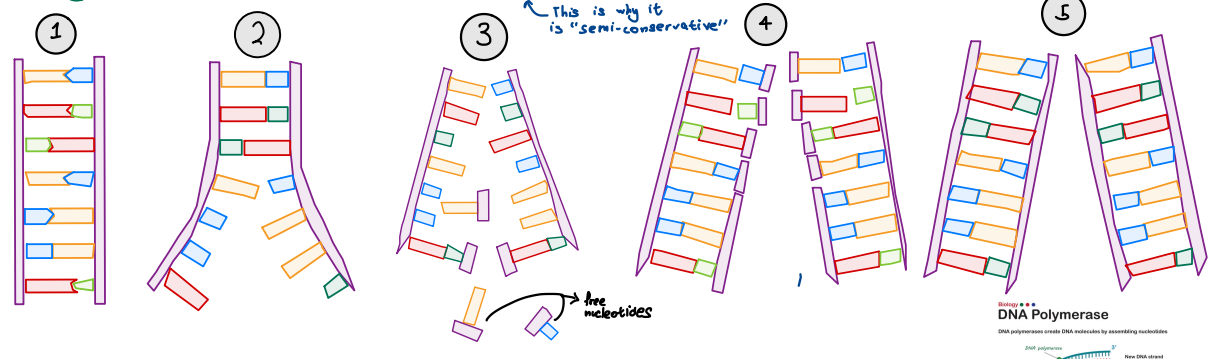


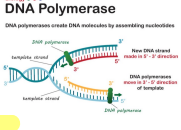
Requirements

- The four types of nucleotide (with bases A G C T) must be present.
- The enzymes DNA polymerase is required.
- A source of chemical energy to drive the process.
- Both strands of the DNA molecule act as a template for the attachment of these nucleotides

Process

1. The enzyme DNA helicase breaks the hydrogen bonds linking the DNA base pairs.
2. Hence, the double helix separates and unwinds.
3. Each polynucleotide strand (opened up) acts as a template to which complementary free nucleotides (bases not connected) bind by specific base pairing.
4. The new strands of nucleotides are joined together in a condensation reaction by the enzyme DNA polymerase. Hydrogen bonds form between the bases on the original and new strands.
5. Now, each new DNA molecule contains one strand from the original DNA molecule and one new strand.





Why is the action of DNA polymerase different on each strand of DNA?

- The two polynucleotide strands in DNA run in opposite directions to each other – they are antiparallel.
- The directions are named according to the position number of the carbon atoms in the pentose sugar of each nucleotide.
- During DNA replication the active site of DNA polymerase is only complementary to the 3' end of the newly forming DNA strand. (it only starts at the 3' end)
- Hence the DNA polymerase moves down the template strand in a 3' to 5' direction.
- The new strand is made in a 5' to 3' direction. (as 3' end is at the opposite)
- As the double helix are antiparallel, the DNA polymerase working on one of the template strands moves in the opposite direction to the DNA polymerase working on the other template strand.