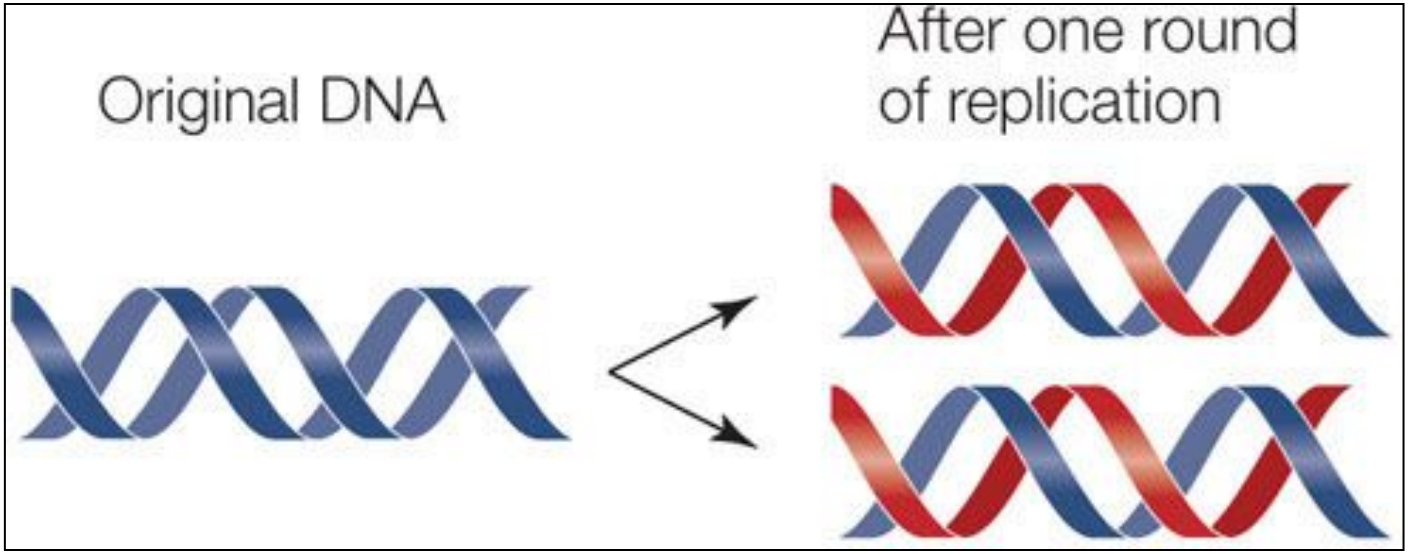
DNA replication in Prokaryotes



DNA replication in Prokaryotes

- All living cells are capable of giving rise to a new generation of cells by undergoing

- DNA replication and cell division. During cell division in eukaryotic cells, the replicated DNA is equally distributed between two daughter cells.

- During replication process the hydrogen bonds between complimentary strands break and allow the DNA helix to unzip. Each strand of unwound DNA acts as template to build complimentary strand.

DNA replication in Prokaryotes

- DNA Replication in prokaryotes is **Semi Conservative.**

  Each strand of template DNA is being copied.
- DNA Replication is **Semi Discontinuous.**

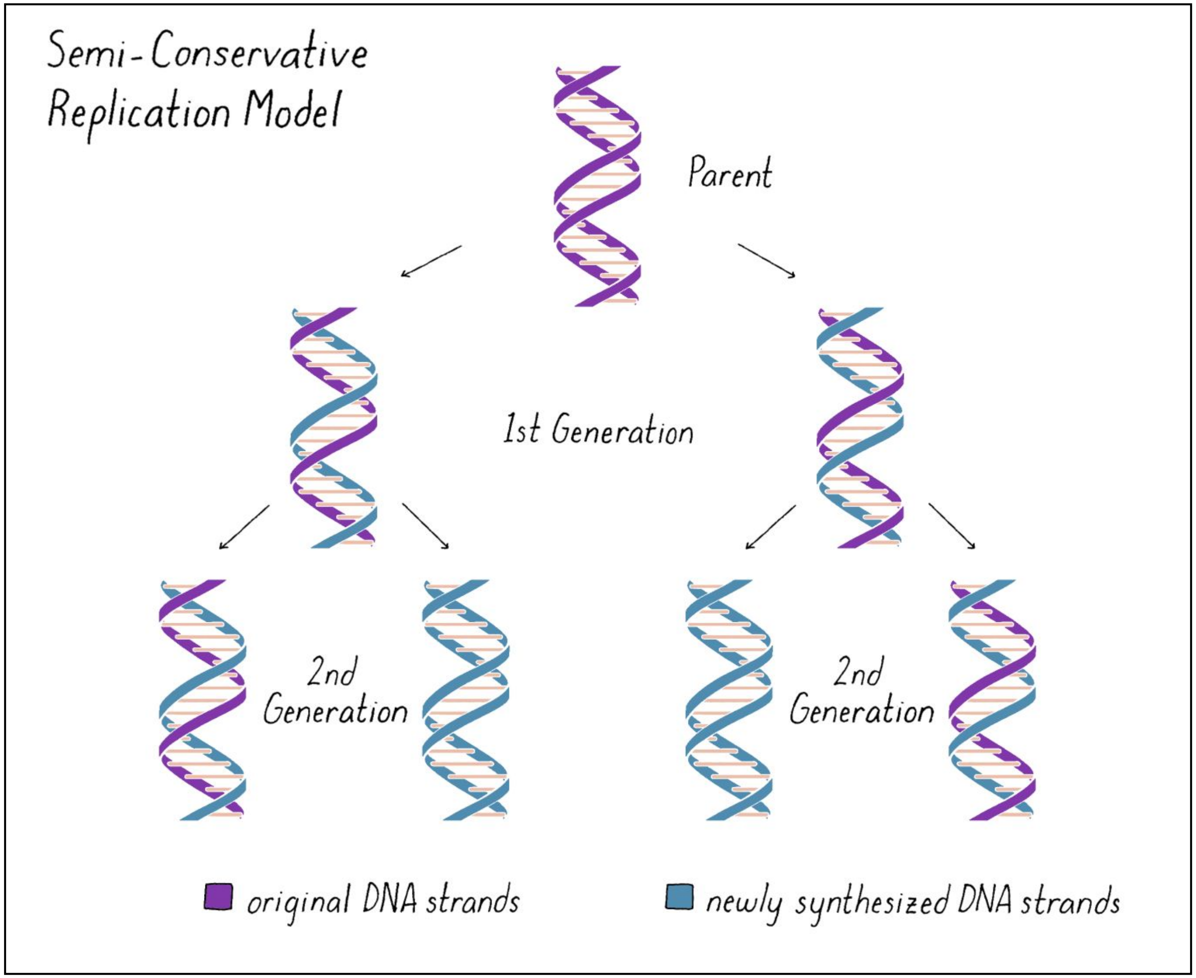
  The leading strand copies continuously

  The lagging strand copies in segments (Okazaki fragments).
- DNA Replication is **Bidirectional.**

  Both in clockwise direction and in anticlockwise direction.

DNA Replication are semiconservative :

Semiconservative replication would produce two copies that each contained one of the original strands of DNA and one new strand.



The Role of Enzymes in DNA Replication

Enzyme	Function
DNA Gyrase (Topoisomerase)	Stabilizes DNA helix as it is unwound by Helicase
Single Stranded Binding Proteins	Hold unzipped, single-stranded sections of DNA apart during replication
Helicase	Unwinds DNA helix and unzips strands by breaking Hydrogen bonds
DNA Polymerase III	Adds new DNA nucleotides in the 5′ → 3′ direction
DNA Primase	Adds primers of RNA nucleotides to the lagging strand as starting points for replication
DNA Polymerase I	Replaces RNA primers with DNA nucleotides
DNA Ligase	Joins Okazaki fragments on lagging stand

DNA Replication Process in Prokaryotes

DNA is always synthesized in the 5'-to-3' direction. The DNA replication in prokaryotes takes place in the following place:

Replication Fork Formation

- The two strands of DNA unwind at the origin of replication.
- **Helicase** opens the DNA and replication forks are formed.
- The DNA is coated by the **single-strand binding proteins** around the replication fork to prevent rewinding of DNA.
- **Topoisomerase** prevents the supercoiling of DNA.

Primer Binding

- RNA primers are synthesised **by primase**. These primers are complementary to the DNA strand.

Elongation

- **DNA polymerase III** starts adding nucleotides at the end of the primers.
- On **leading strand** one RNA primer is attached at 3' end and complimentary stand is made uninterrupted.
- On **lagging stand** multiple RNA primers are attached to template strand and synthesize small fragments of complimentary strands. These fragments are known as **Okazaki fragments**.
- The leading and lagging strands continue to elongate.

Termination

- The primers are removed and the gaps are filled with **DNA Polymerase I** and sealed by **ligase**.

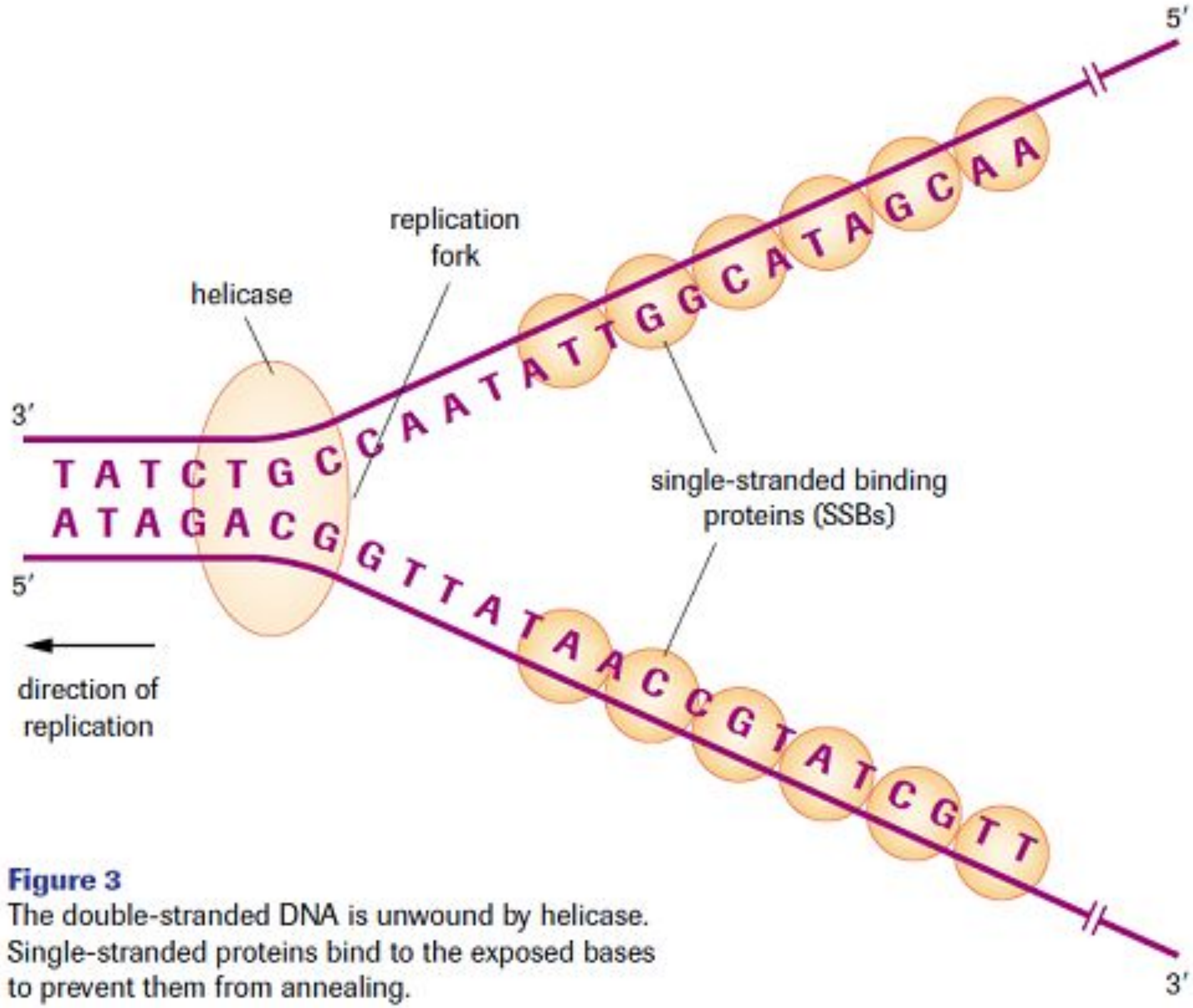


Figure 3
The double-stranded DNA is unwound by helicase. Single-stranded proteins bind to the exposed bases to prevent them from annealing.

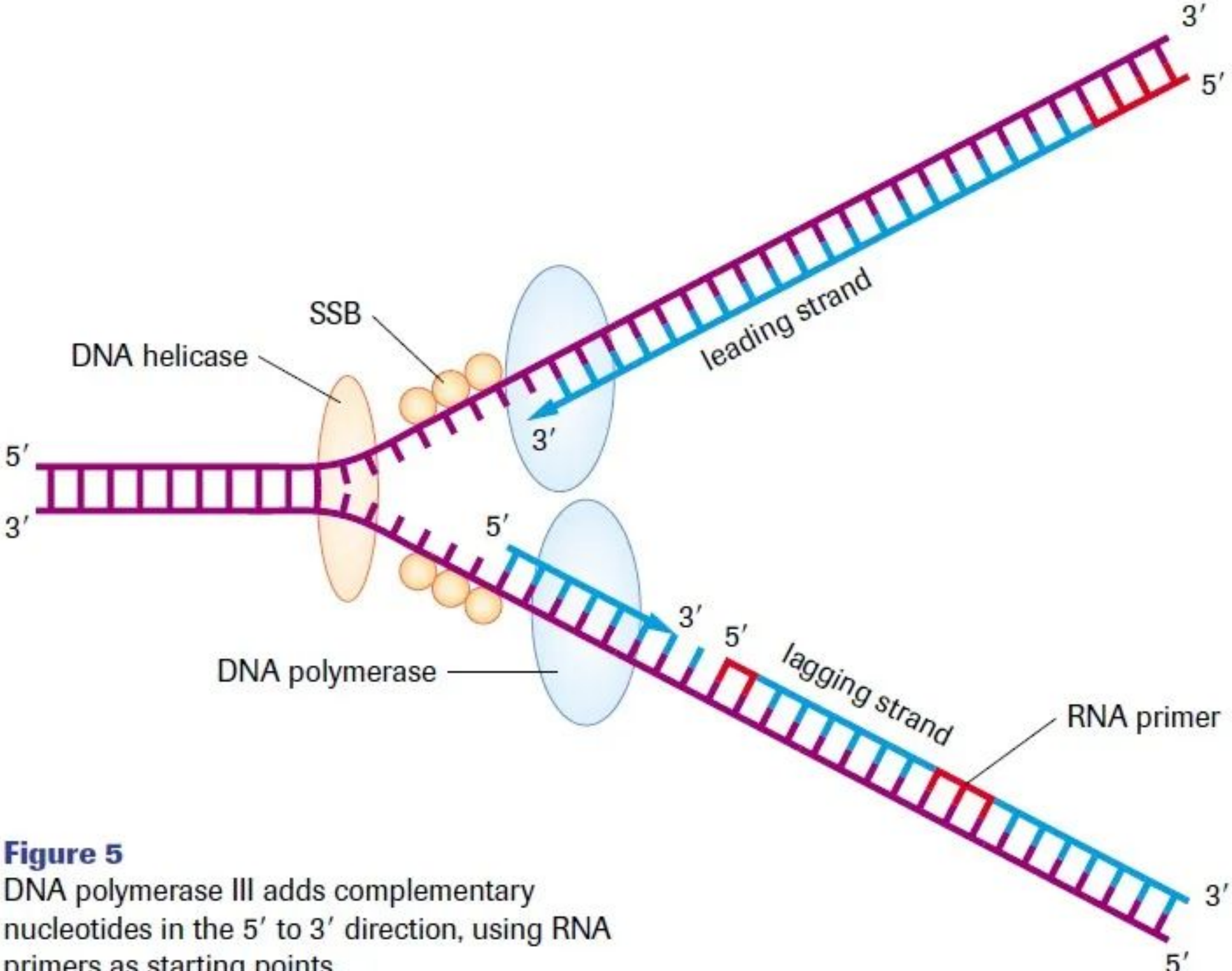
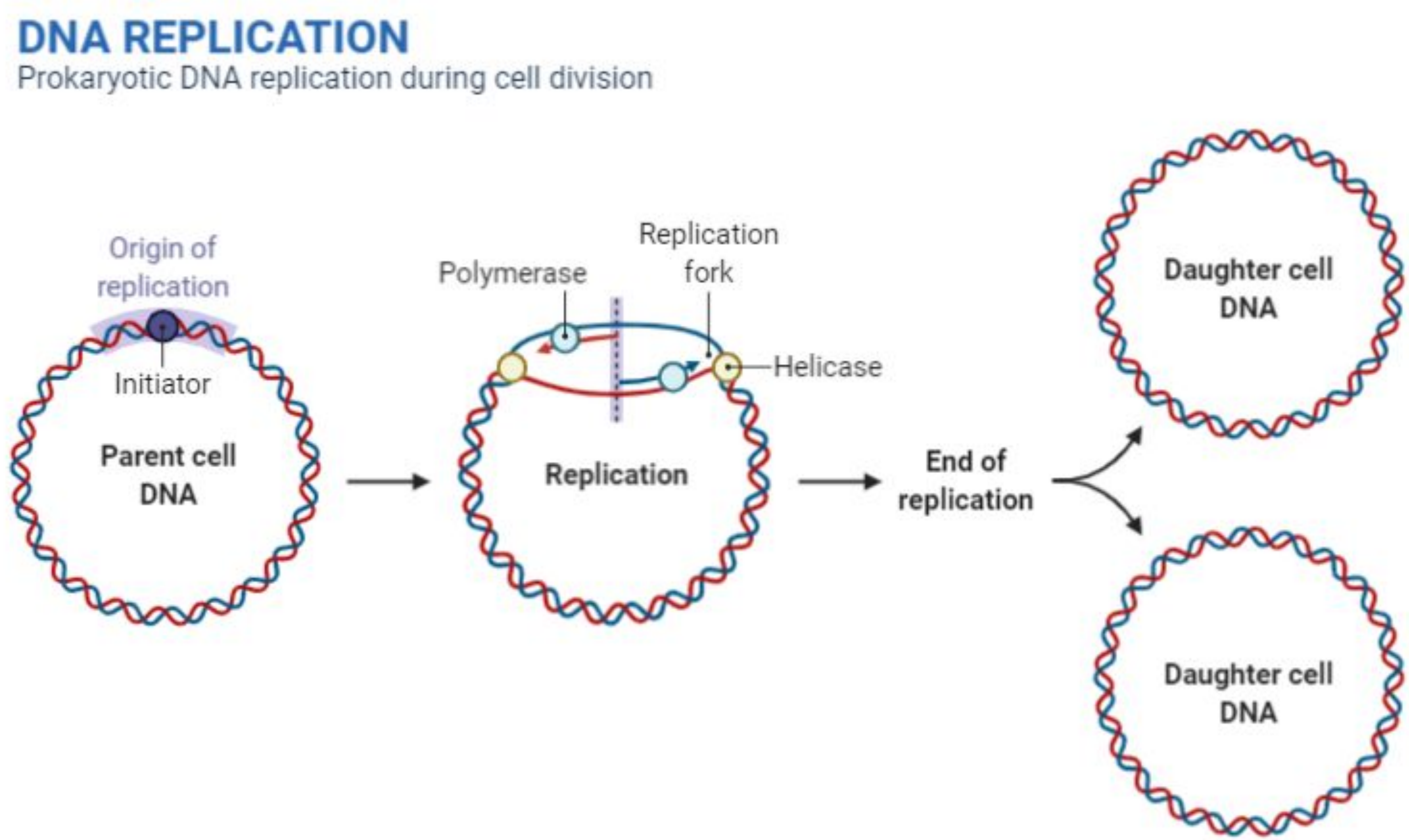


Figure 5
DNA polymerase III adds complementary nucleotides in the 5′ to 3′ direction, using RNA primers as starting points.

Overview of DNA Replication




Thank you!