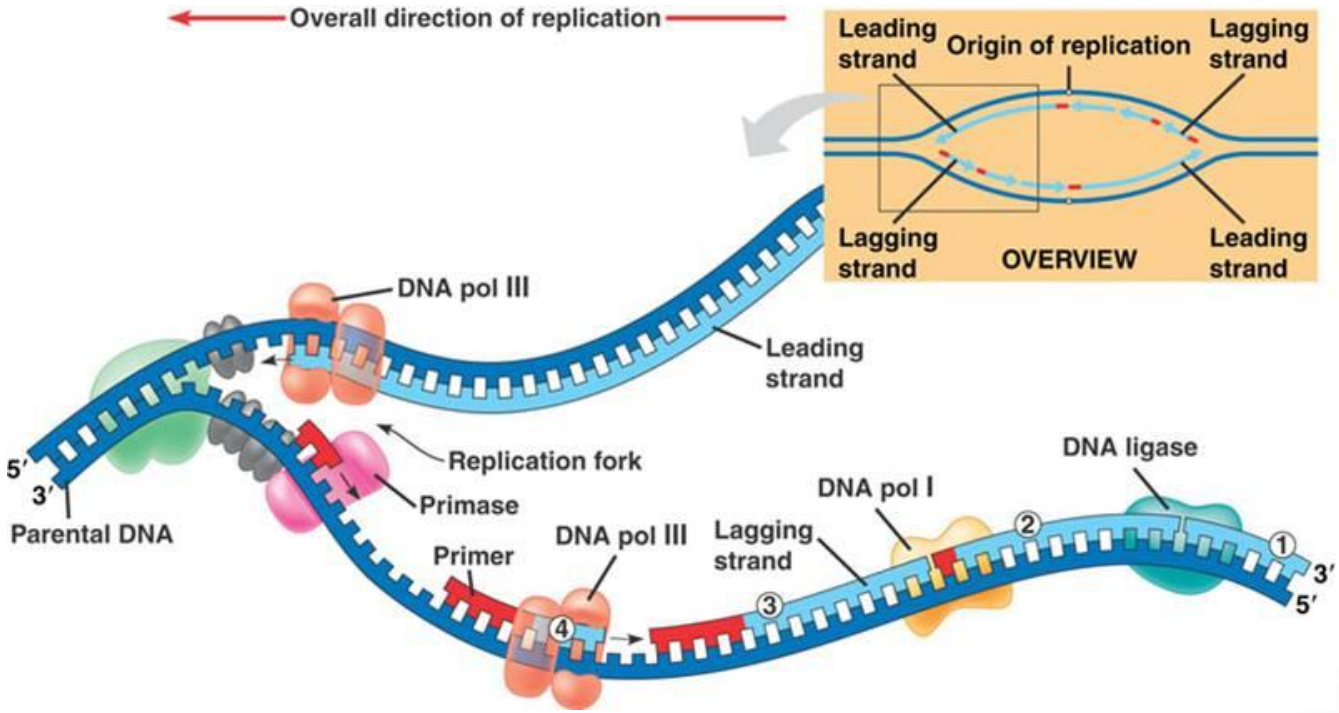
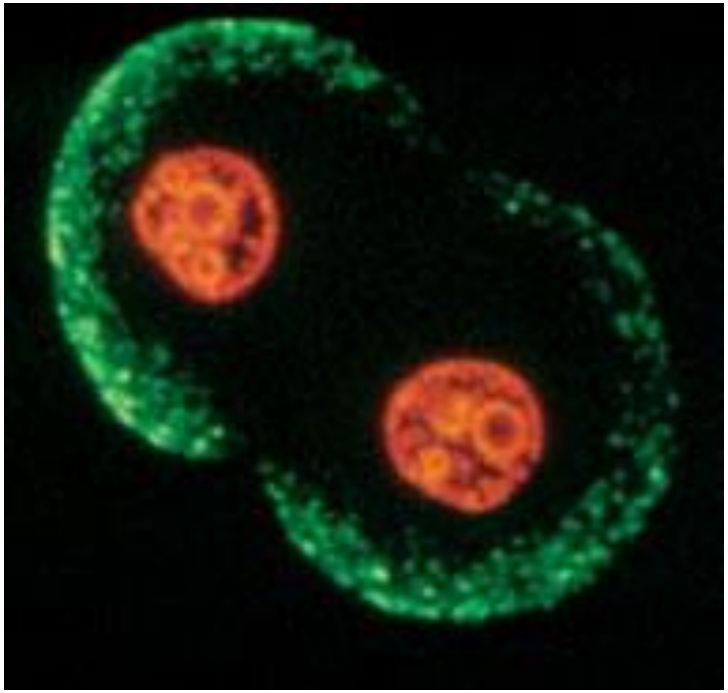
DNA Replication



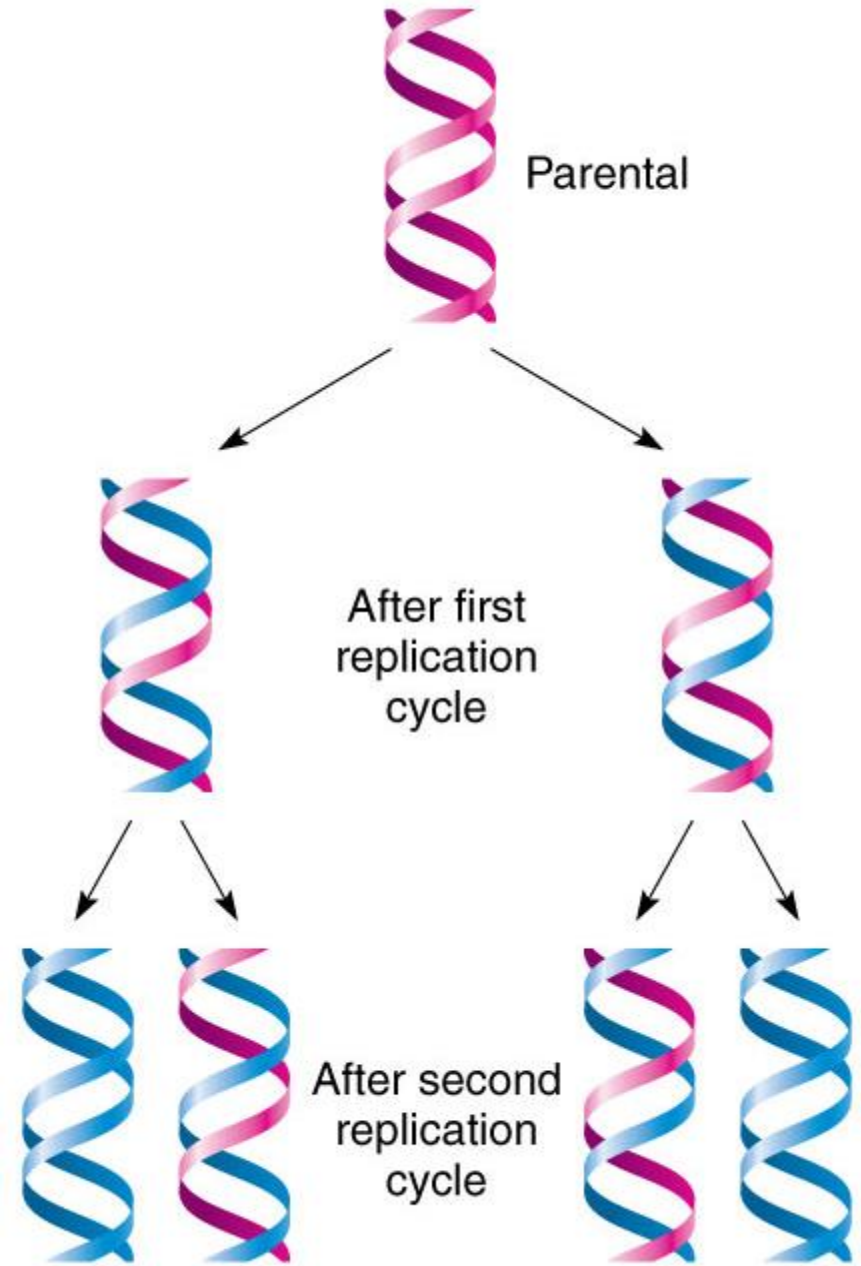
When it Occurs

- During interphase.
- Prior to mitosis.
  - Need another copy of DNA before cell divides



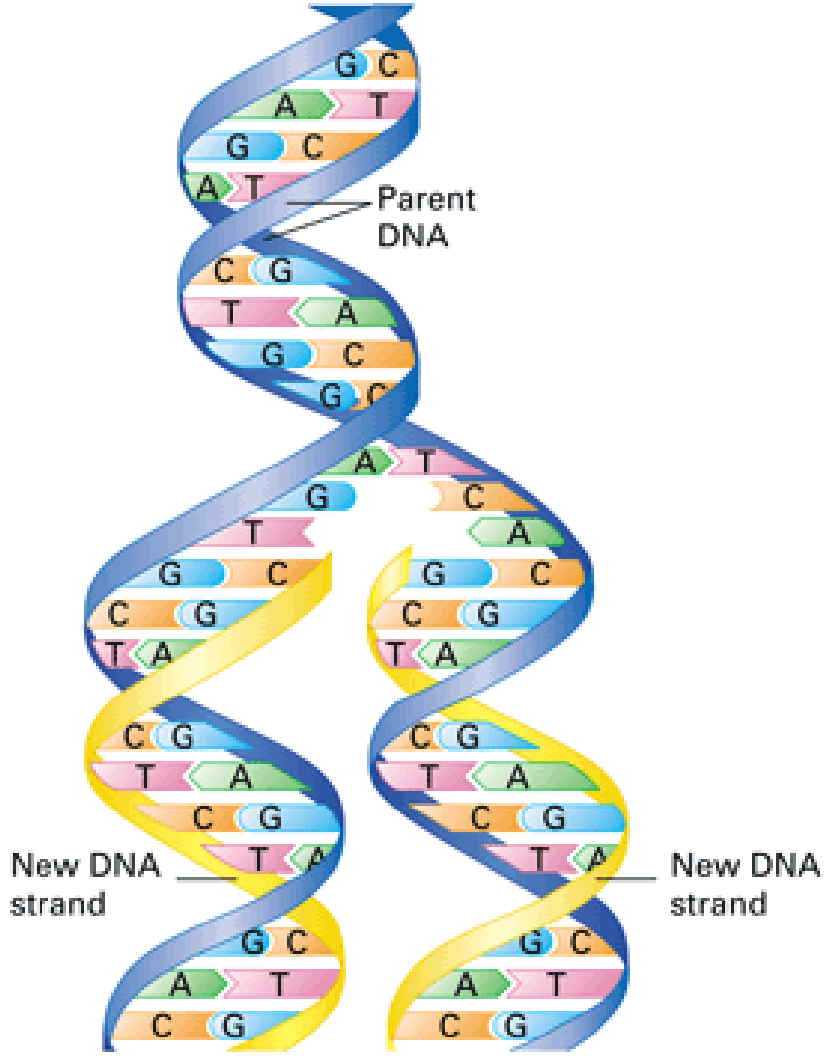
Semiconservative Replication

- Each strand is a template.
- New DNA molecule has one **parent** strand & one **daughter** strand.



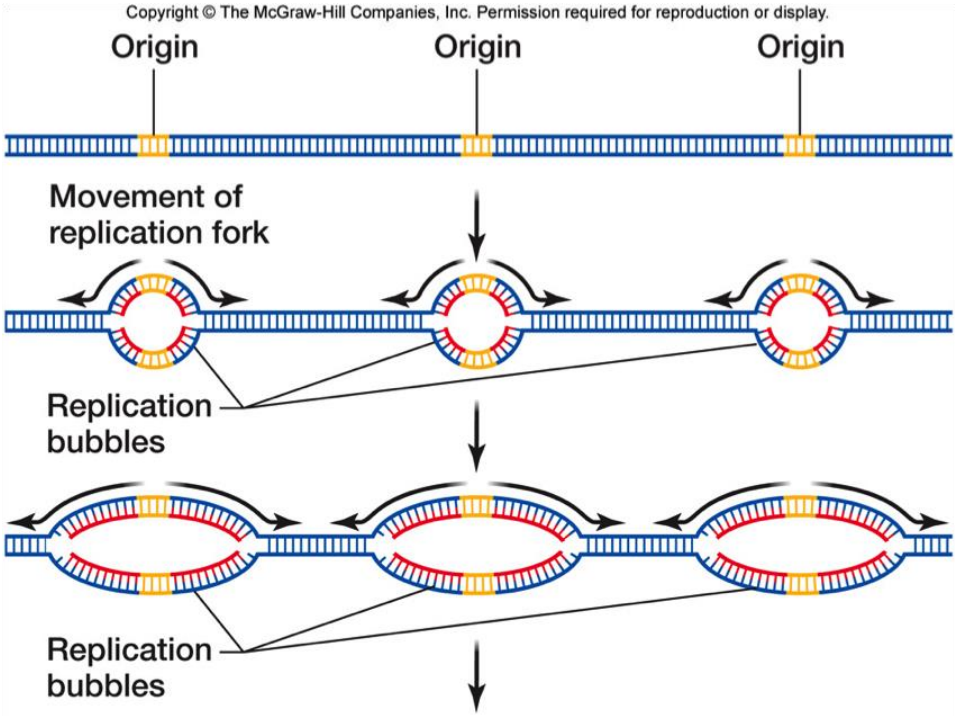
Process of Replication

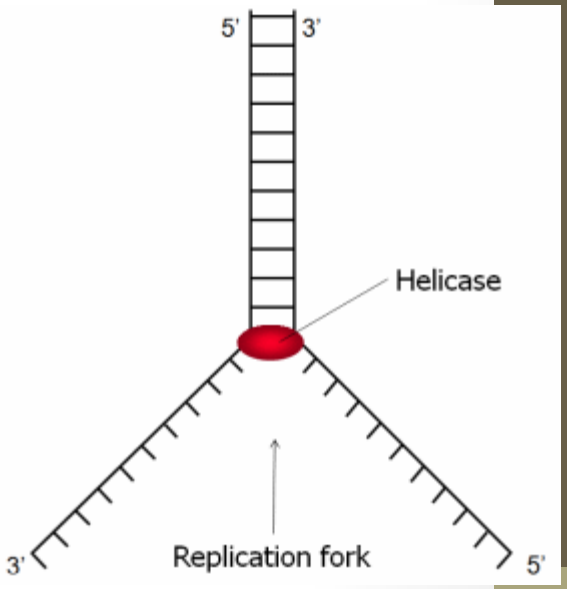
1. Separation
2. Building
3. Proofread & Repair

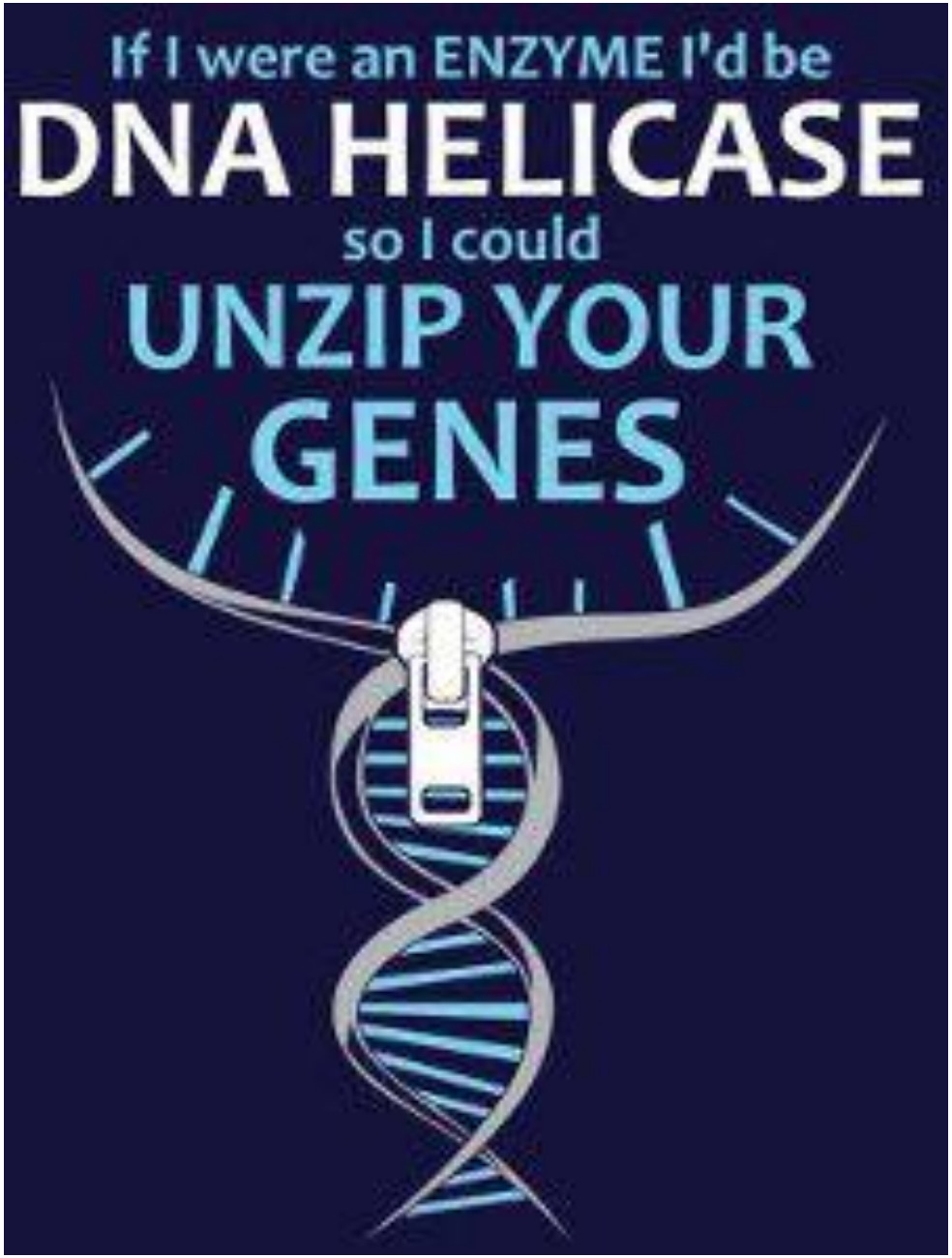


1. Strand Separation

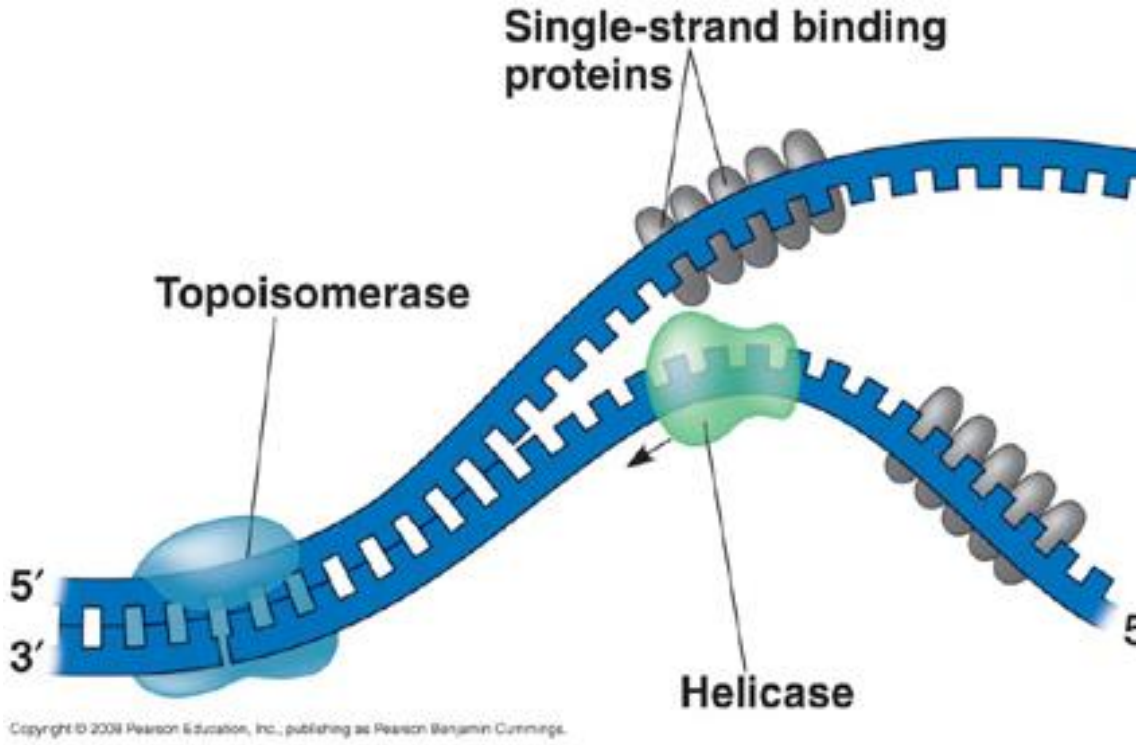
- **Origin of replication –** staring point
- **Helicase** breaks hydrogen bonds and unwinds strands of DNA.
- Point of separation – **replication fork**
  - Forms a **replication bubble.**



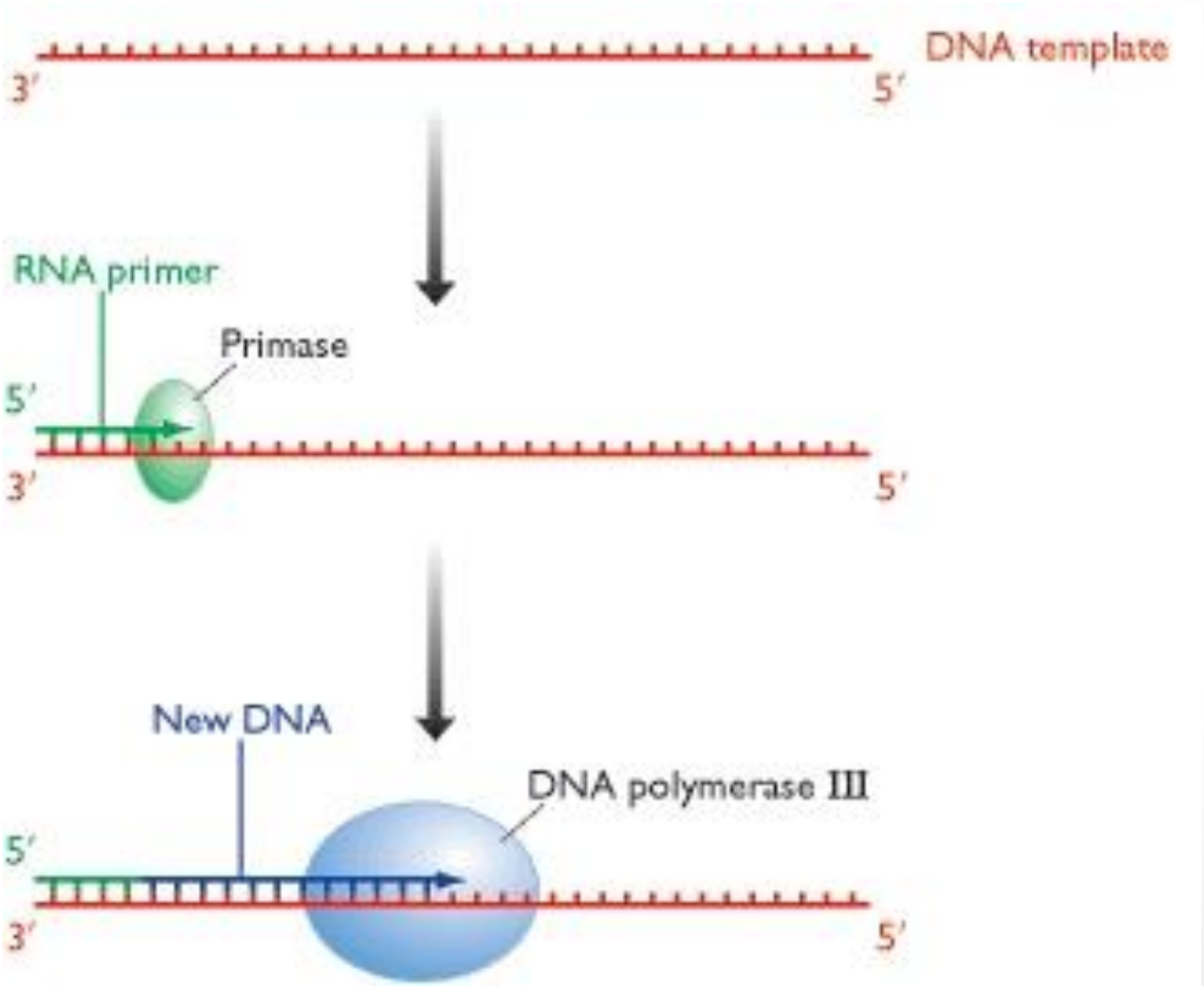



If I were an ENZYME I'd be
DNA HELICASE
so I could
UNZIP YOUR
GENES

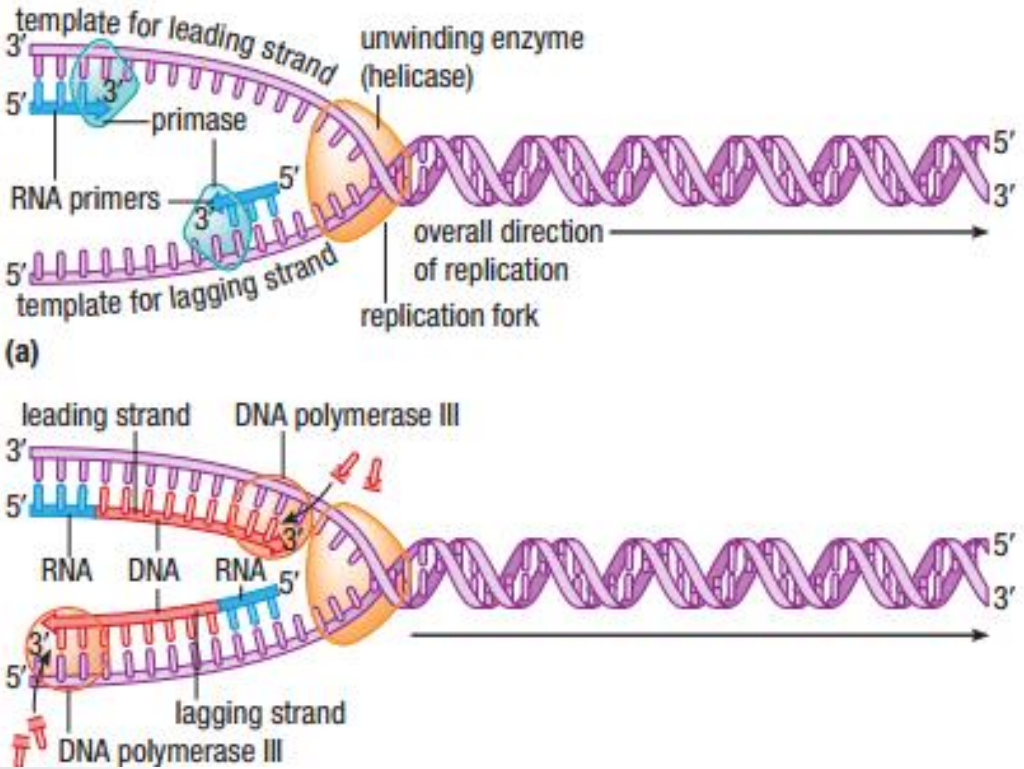
- **Single-stranded binding proteins (SSBs)** bind to exposed bases.
- **DNA gyrase (topoisomerase)** relieves tension from the unwinding DNA.

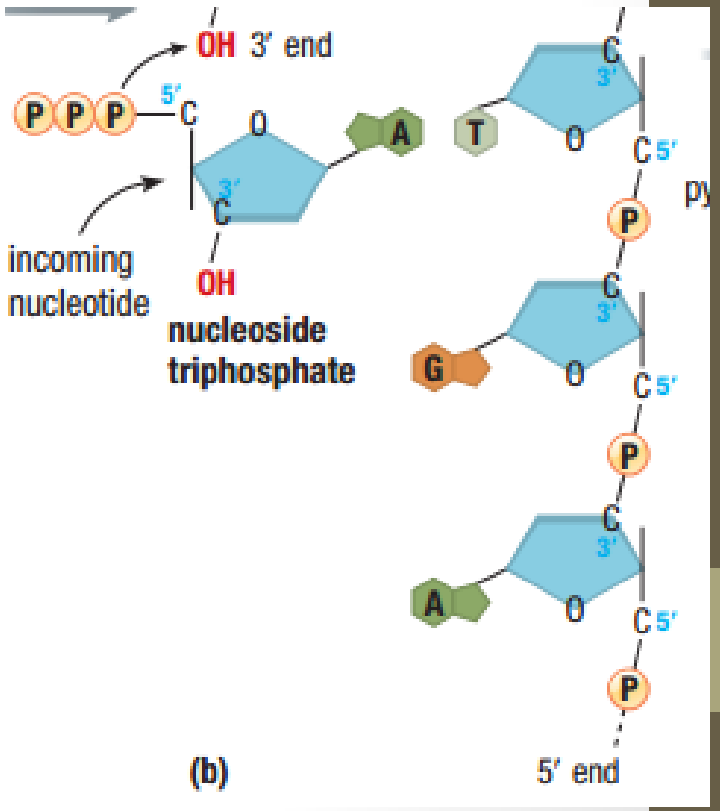


2. Building Complementary Strands

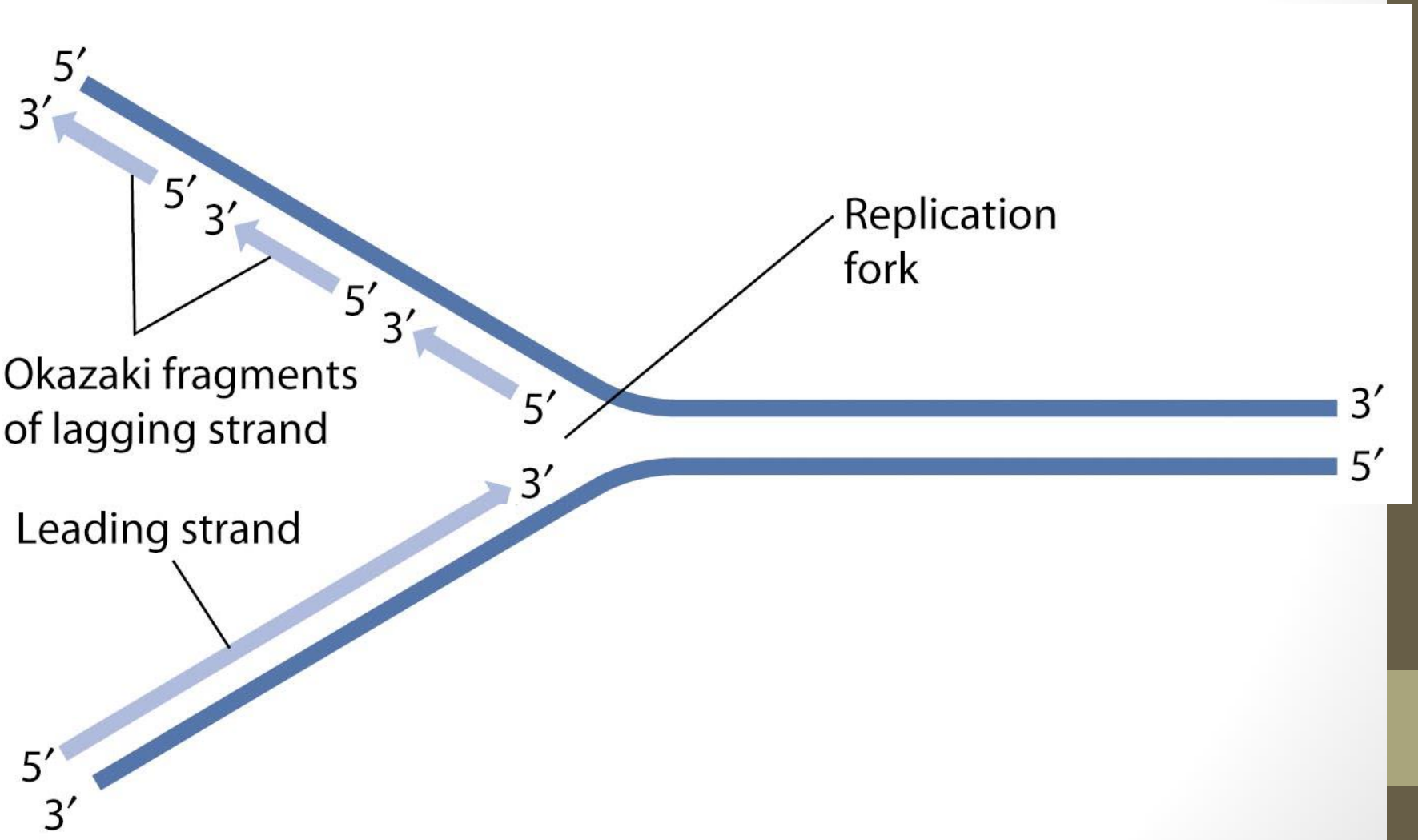


- **Primase** makes **RNA primers** at the 3’ end of the parental strand
- **DNA polymerase III** uses the RNA primer as a starting point.
  - Adds nucleotides to the 3’ end of the daughter strand.
  - Nucleoside triphosephate

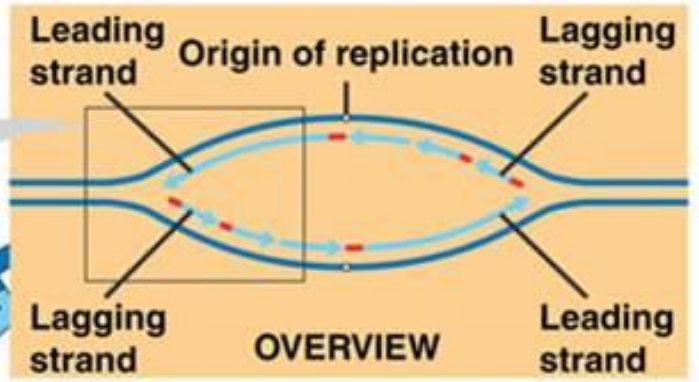


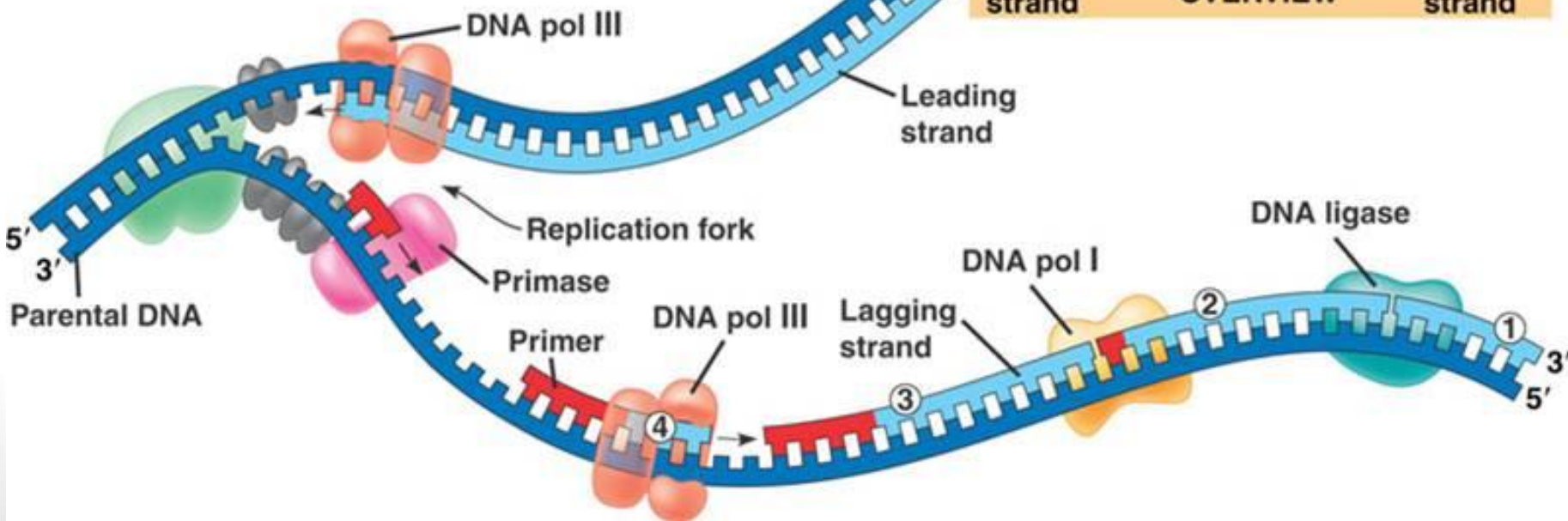


- Replication goes in both directions from origin

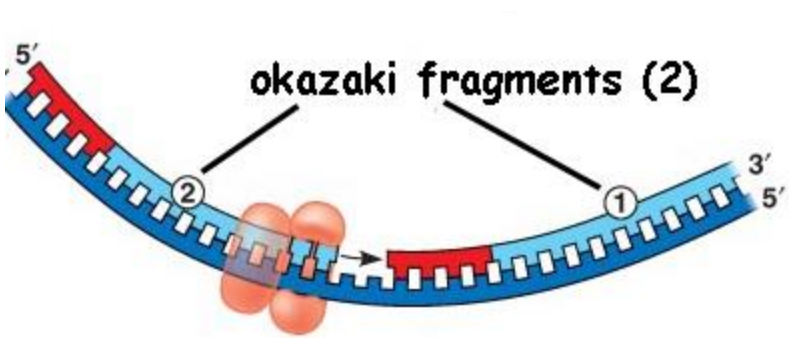


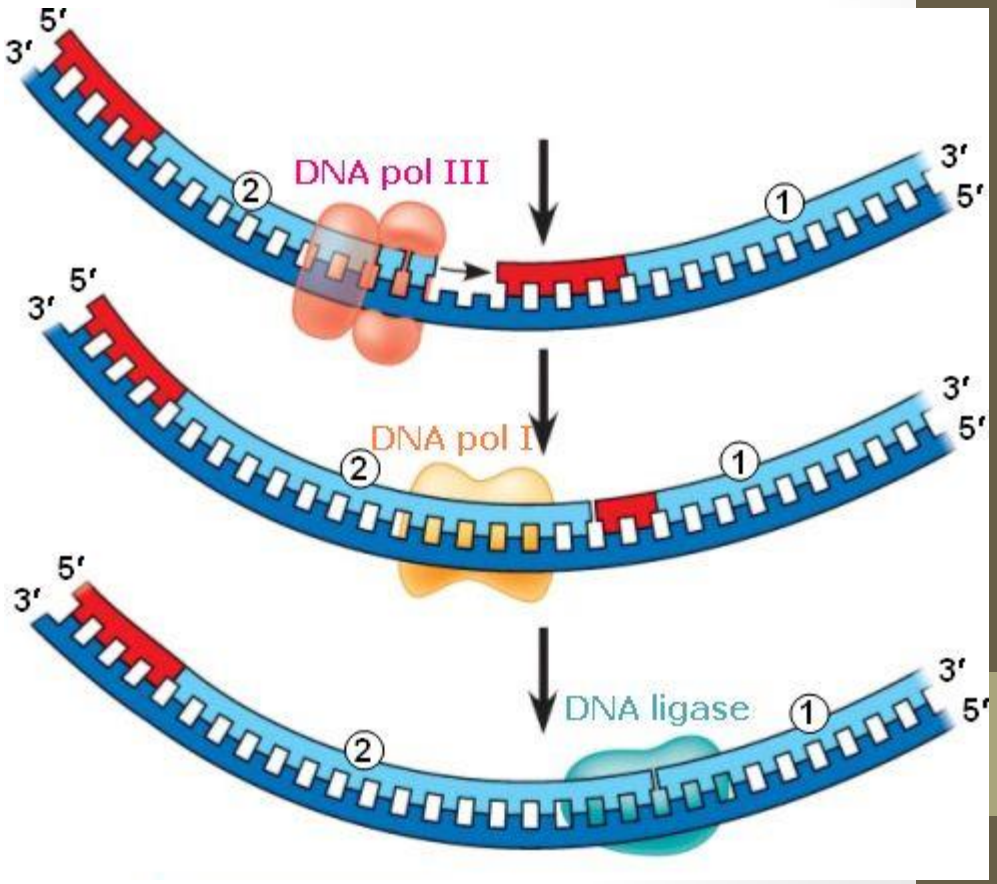
- **Leading Strand**
  - Built continuously toward replication fork.
  - Only 1 RNA primer needed.
- **Lagging Strand**
  - Built discontinuously away from replication fork in short (**Okazaki**) fragments.
  - Many RNA primers needed.

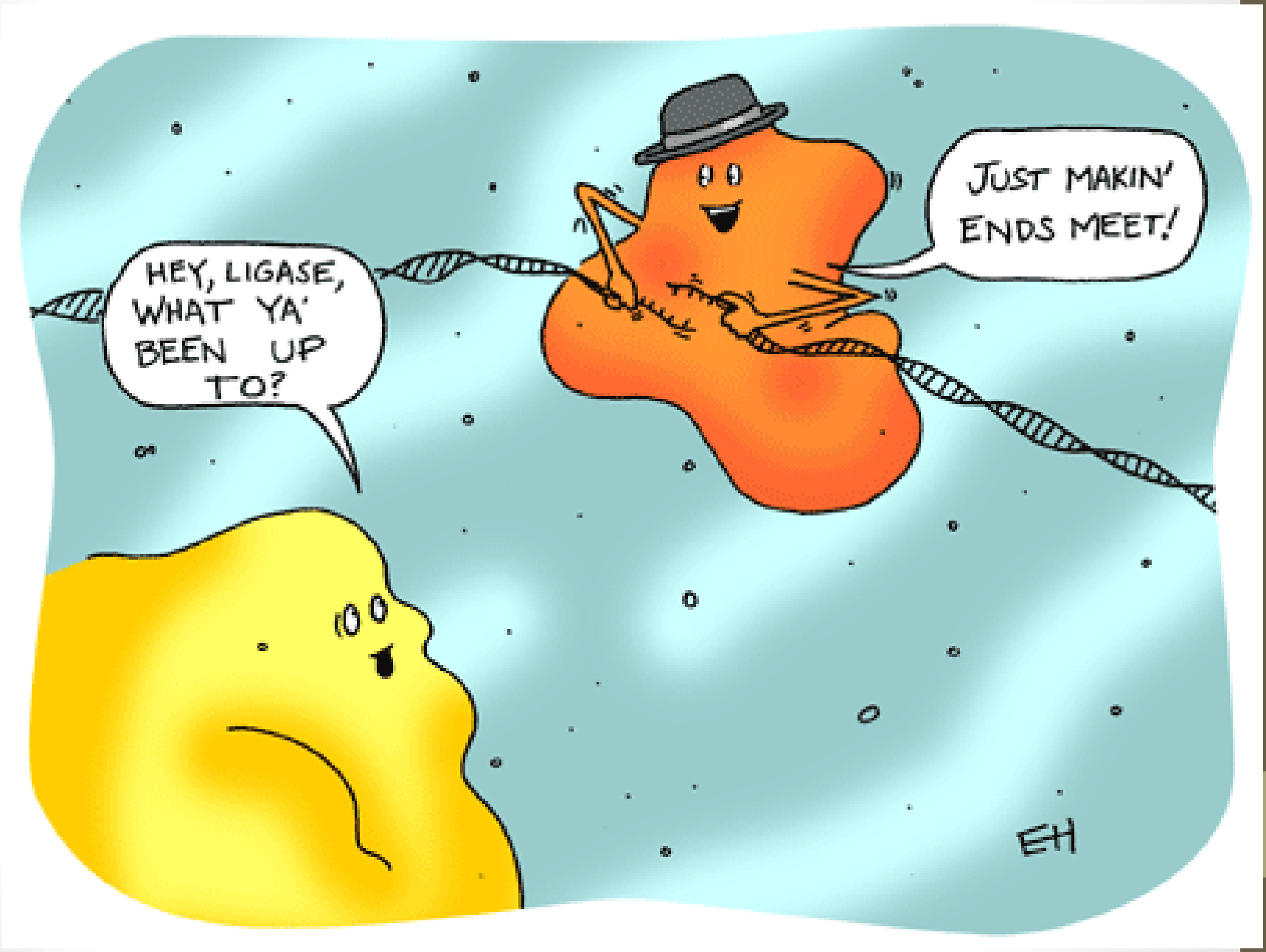




- **DNA polymerase I** removes RNA primers and replaces them with the appropriate nucleotides.
- **DNA ligase** joins Okazaki fragments together by forming phosphodiester bonds.

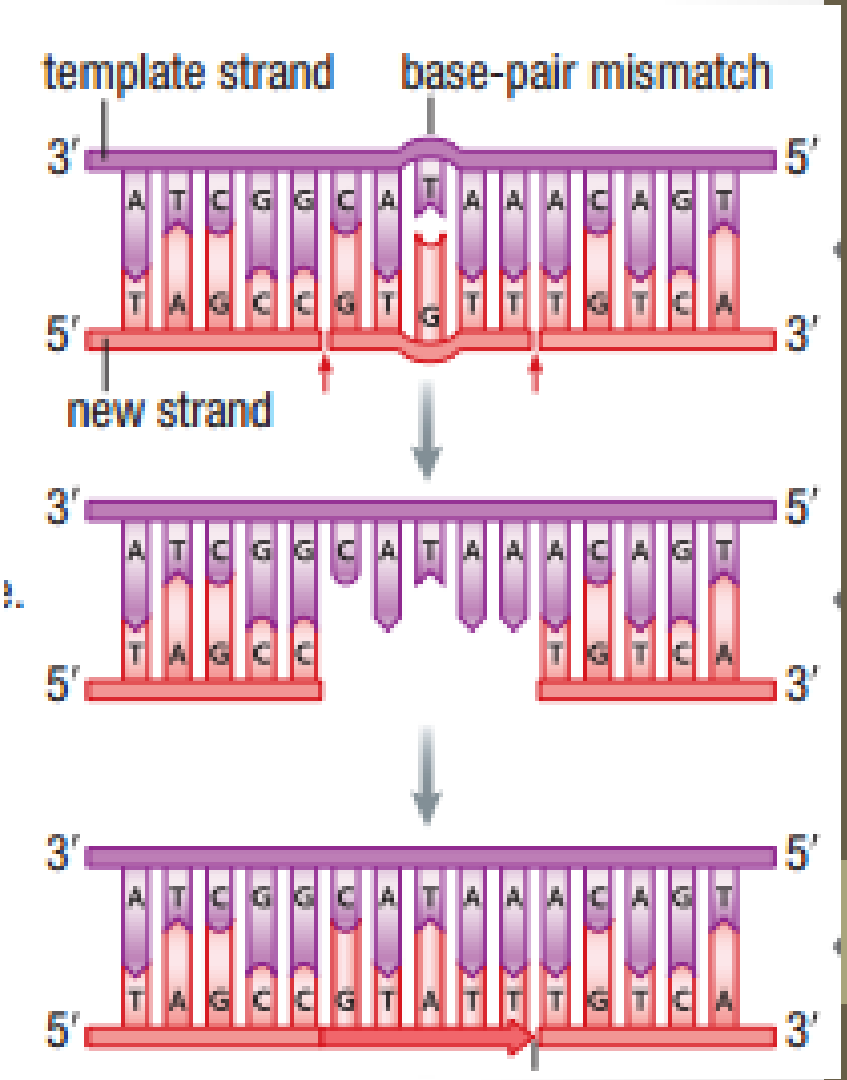





HEY, LIGASE, WHAT YA' BEEN UP TO?
JUST MAKIN' ENDS MEET!
EH

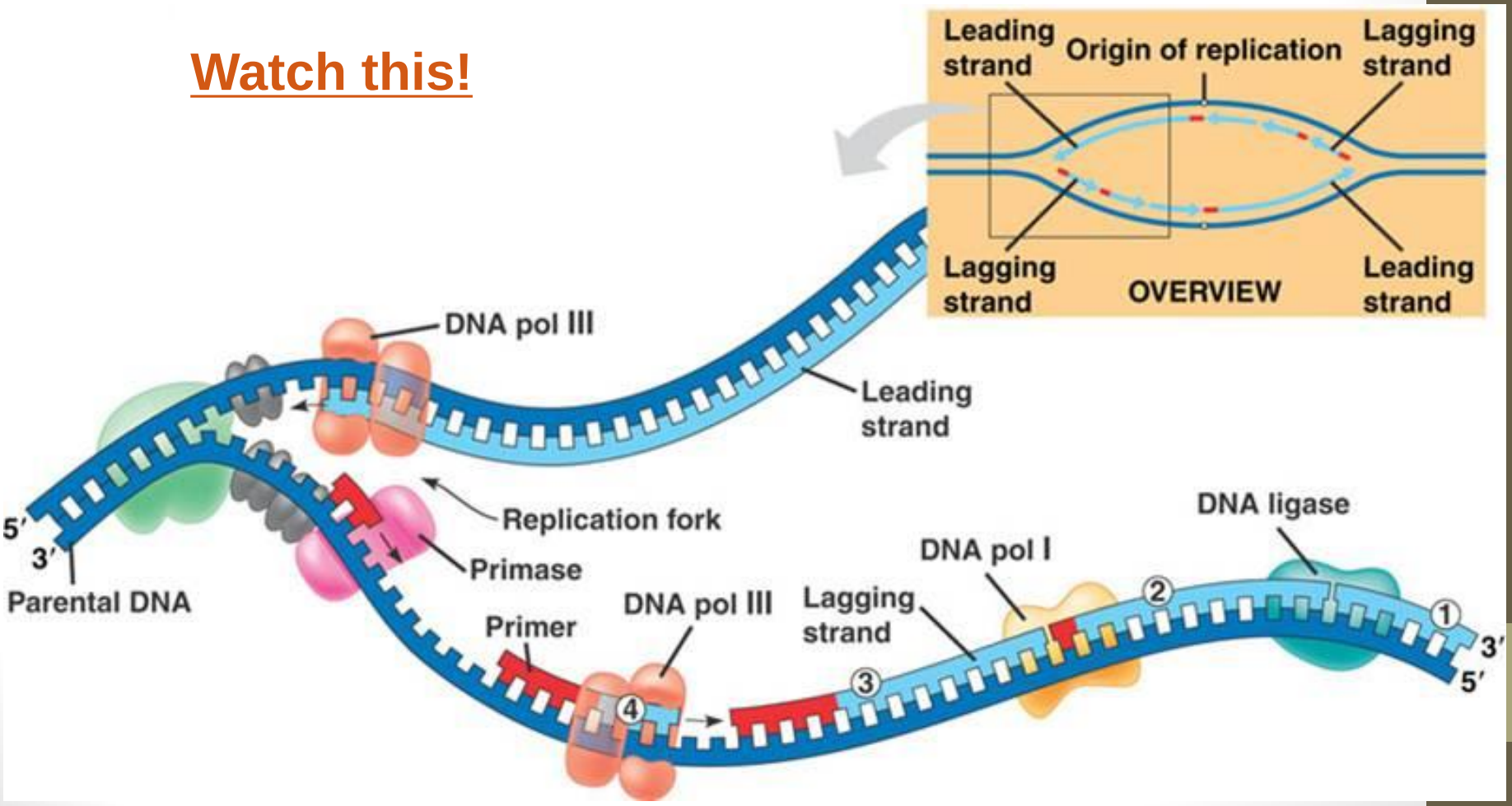
3. Proofreading & Repair

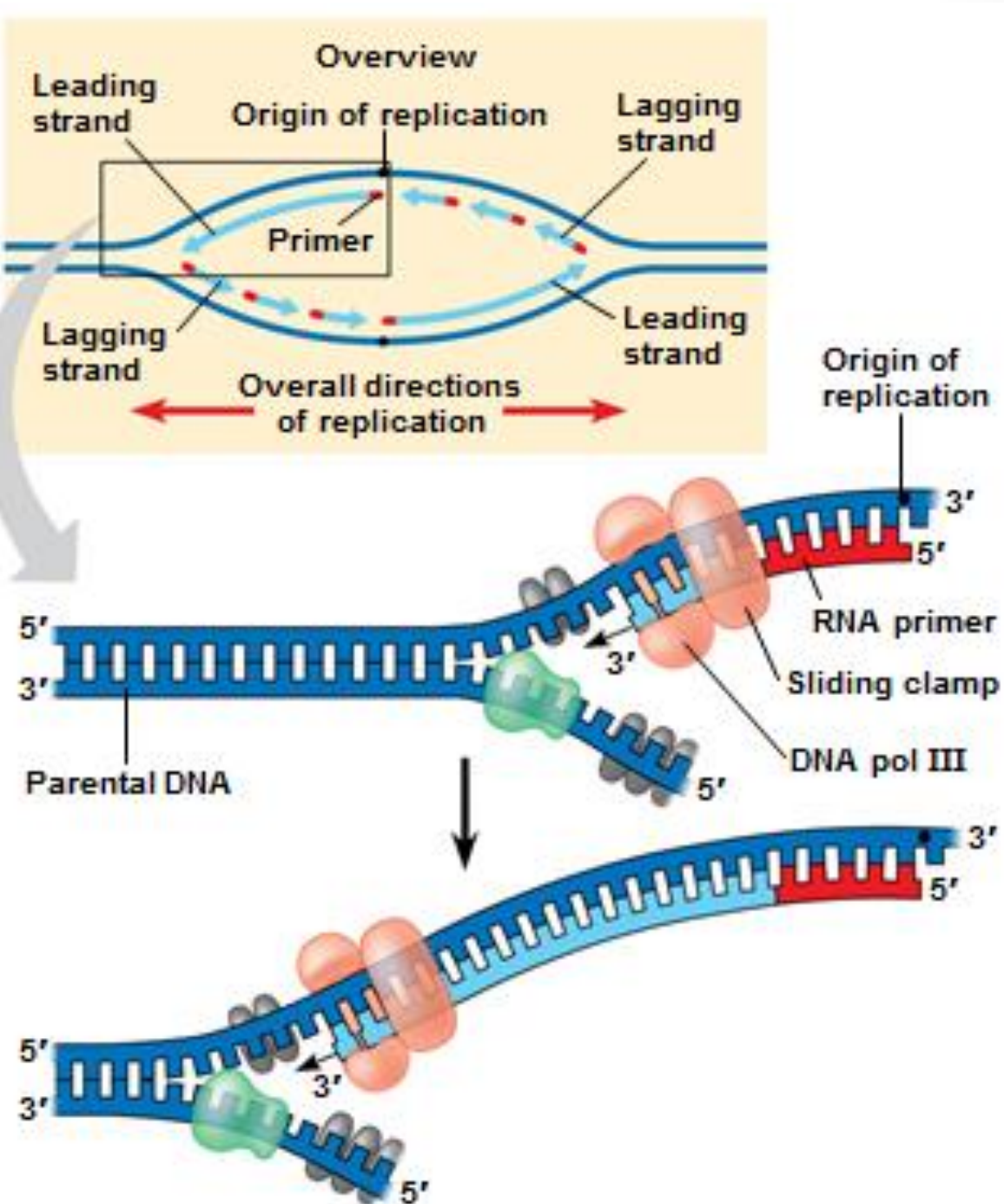
- **DNA polymerase I and III** act as quality control.
  - ‘Proofread’ sequence against template.
- Act as **exonucleases.**
  - Remove incorrect nucleotide and replace it with the correct one.



Process of Replication

Watch this!




Overview
Leading strand
Origin of replication
Lagging strand
Primer
Lagging strand
Leading strand
Overall directions of replication
Origin of replication
3′
5′
RNA primer
5′
3′
3′
Sliding clamp
Parental DNA
DNA pol III
5′
3′
5′
5′
3′
3′
5′

Process of Replication