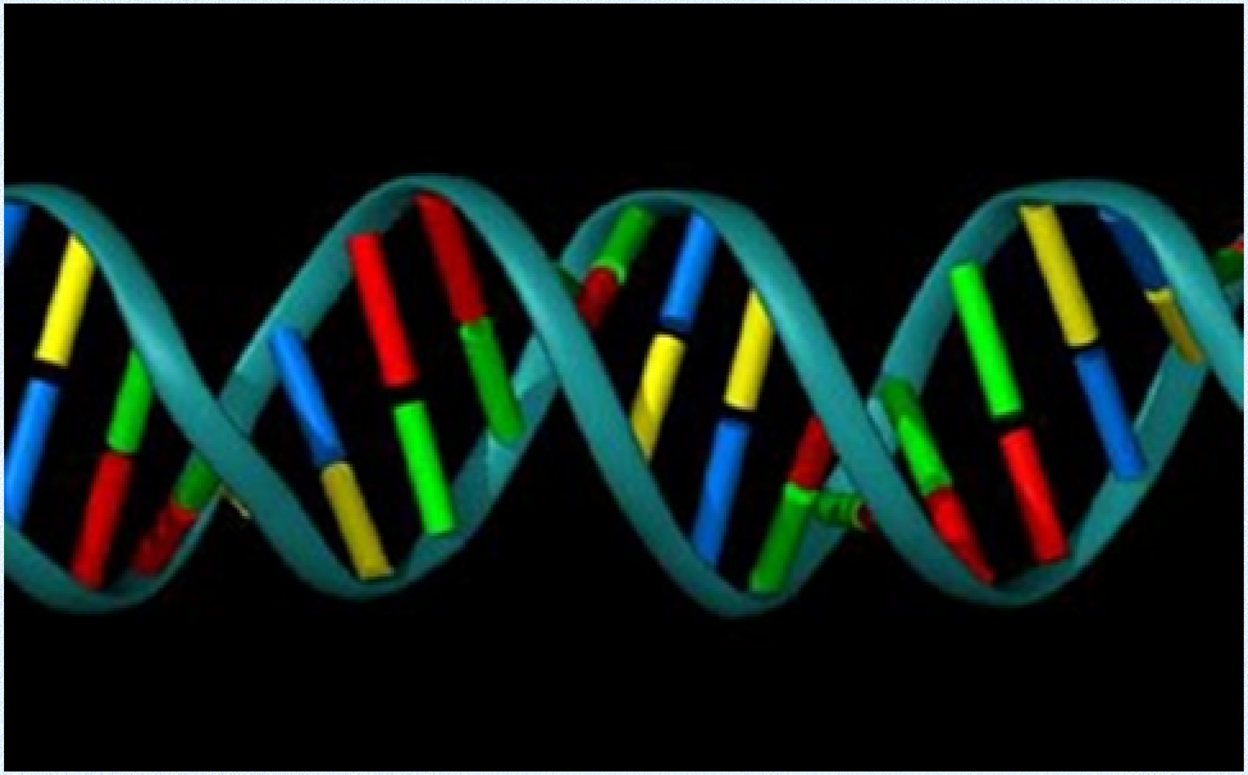


Unit 5- Concept 1

DNA REPLICATION

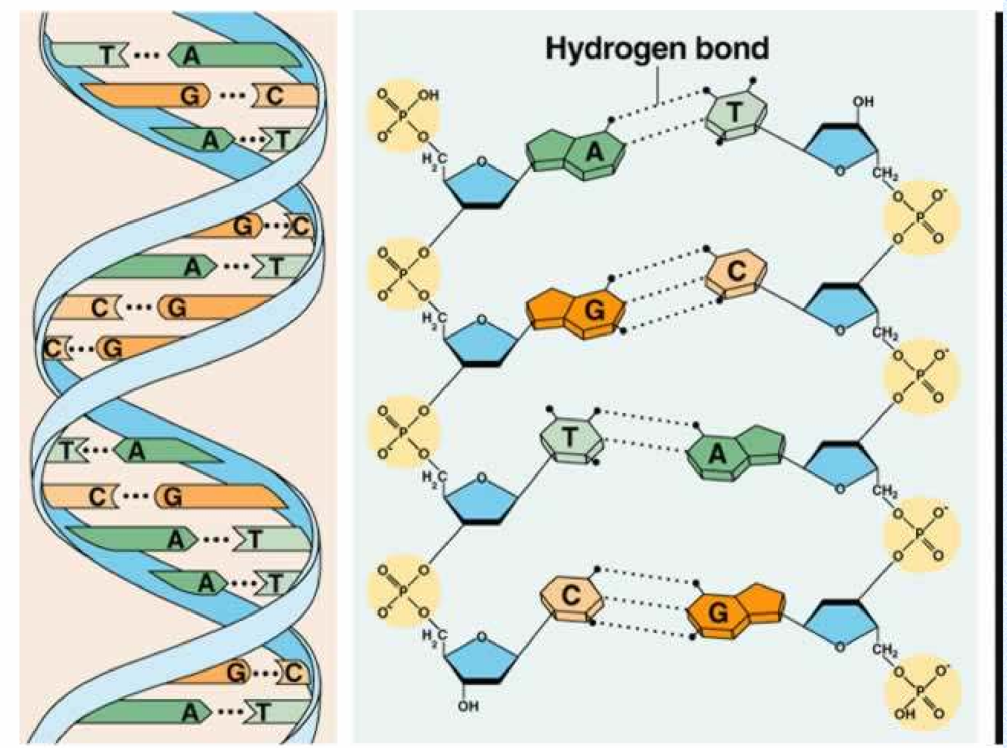
The Double Helix

- Proving the correct structure of DNA helps explain how DNA is so useful in the living things

- Storage and retrieval: Code carrying
  - Base paring rules; always similar ratios
- Transmission: Replication
  - Copies made
- Response: Transcription
  - Codes for RNA

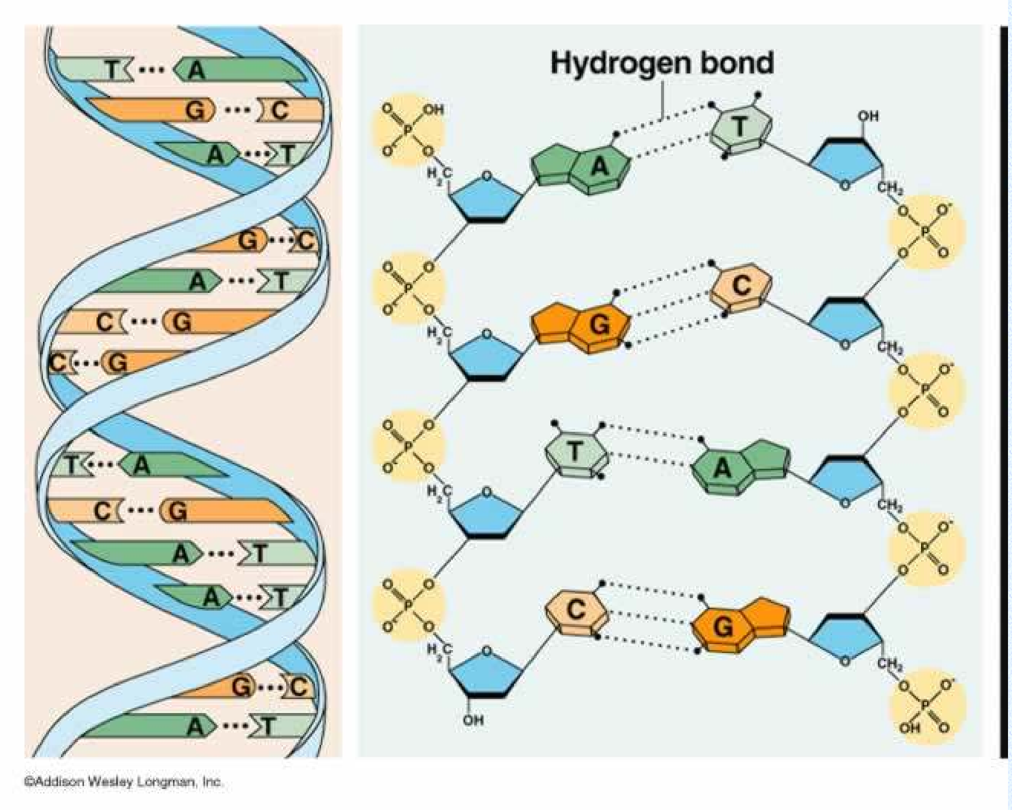
DNA replication

- What is DNA replication?
- DNA is copied to form an additional molecule



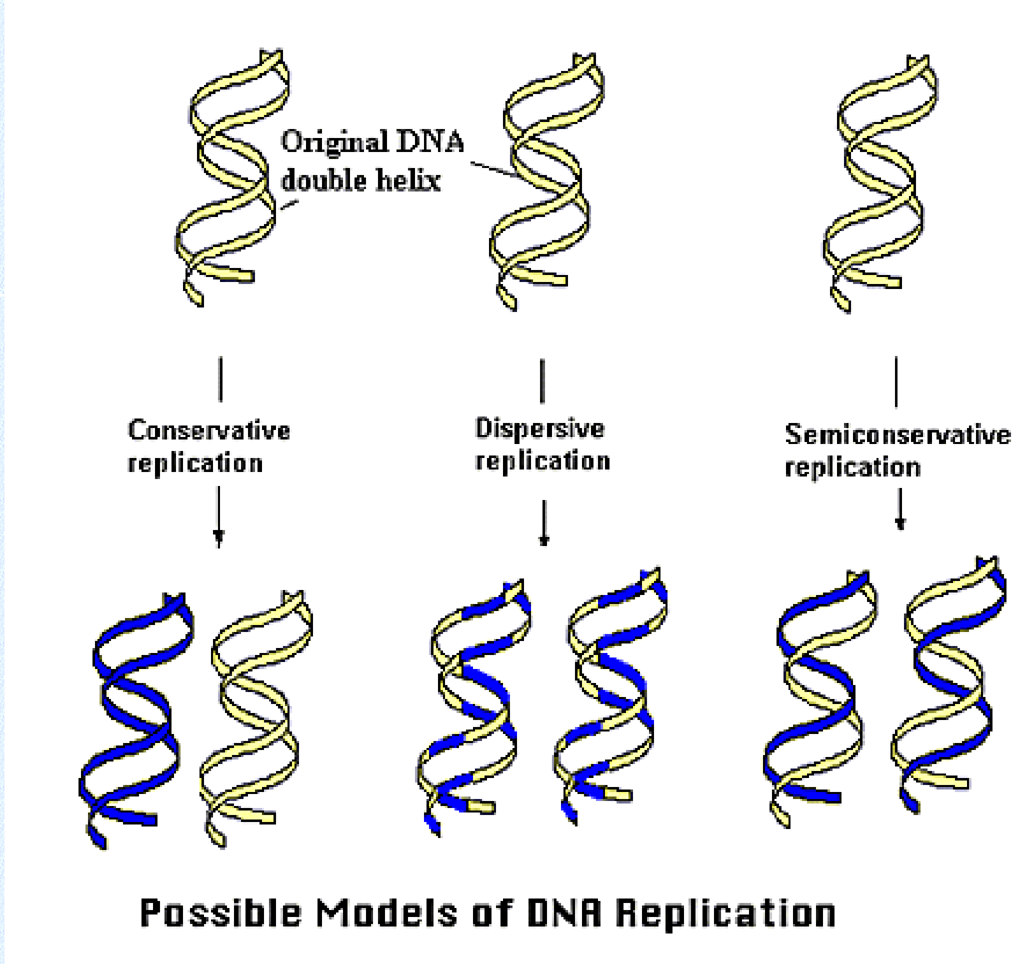
DNA replication

- Why does DNA need to be replicated?
- Why is it important that DNA replication is precise?
- How can DNA make a copy of itself?
- Any potential challenges?
- Hypothesis?

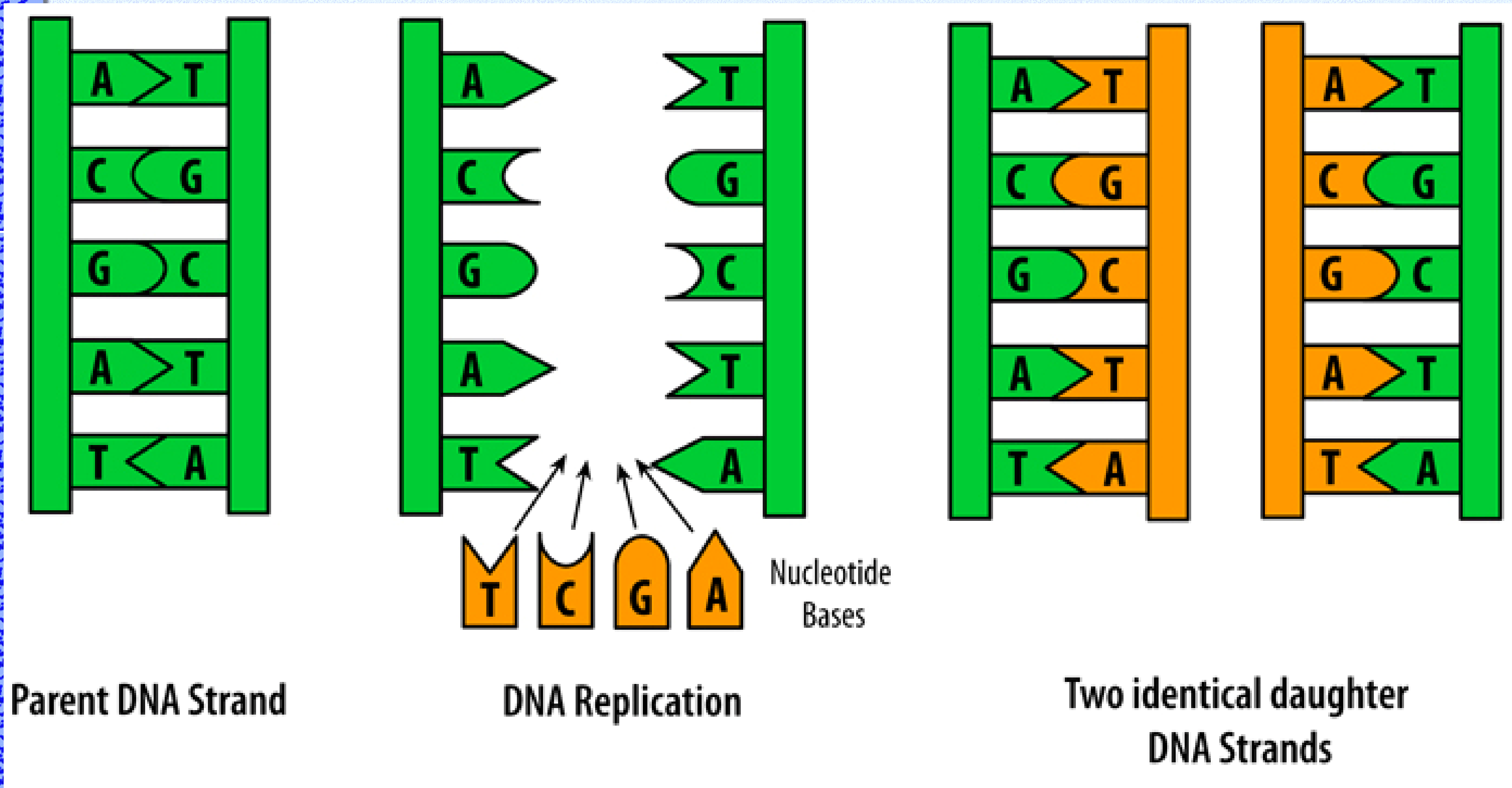


DNA replication

- How is it possible?
- Semiconservative replication
  - One strand serves as the template for the new complementary strand



DNA replication



Some cool facts!

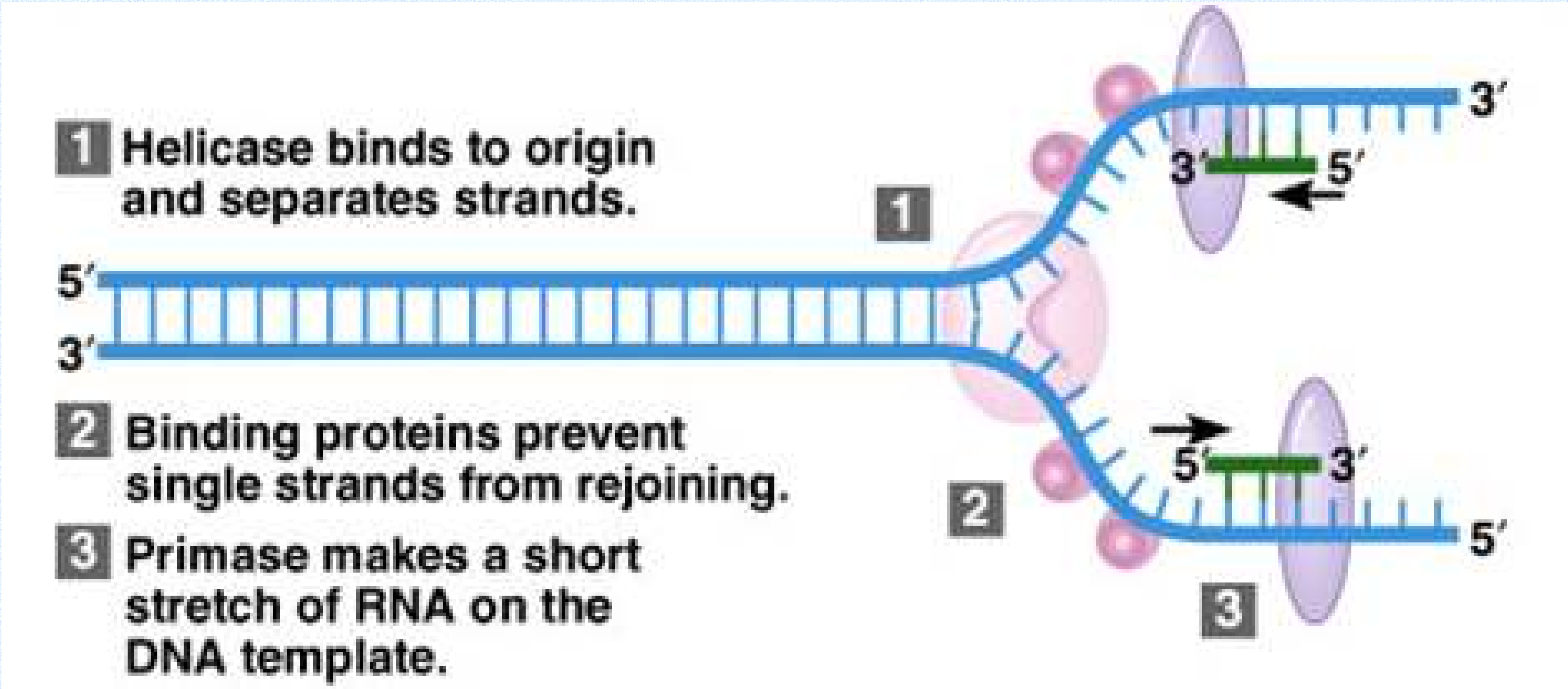
- Your cells each contain about 6 billion base pairs
  - Imagine 1200 text books!!!

- This DNA can be copied very quickly(a few hours) with very few mistakes
  - 1 in every 10 billion
  - 50 nucleotides copied per second in people, 500 per sec in bacteria

Replication steps

- These next few slides show the basic steps in DNA replication. I would walk through each step and make sure you can see what is going on in the picture
- This goes along with **section 16.2** in your book. It would be a good idea to follow along in your book at the same time as you do these slides.

Detailed Steps in DNA Replication:

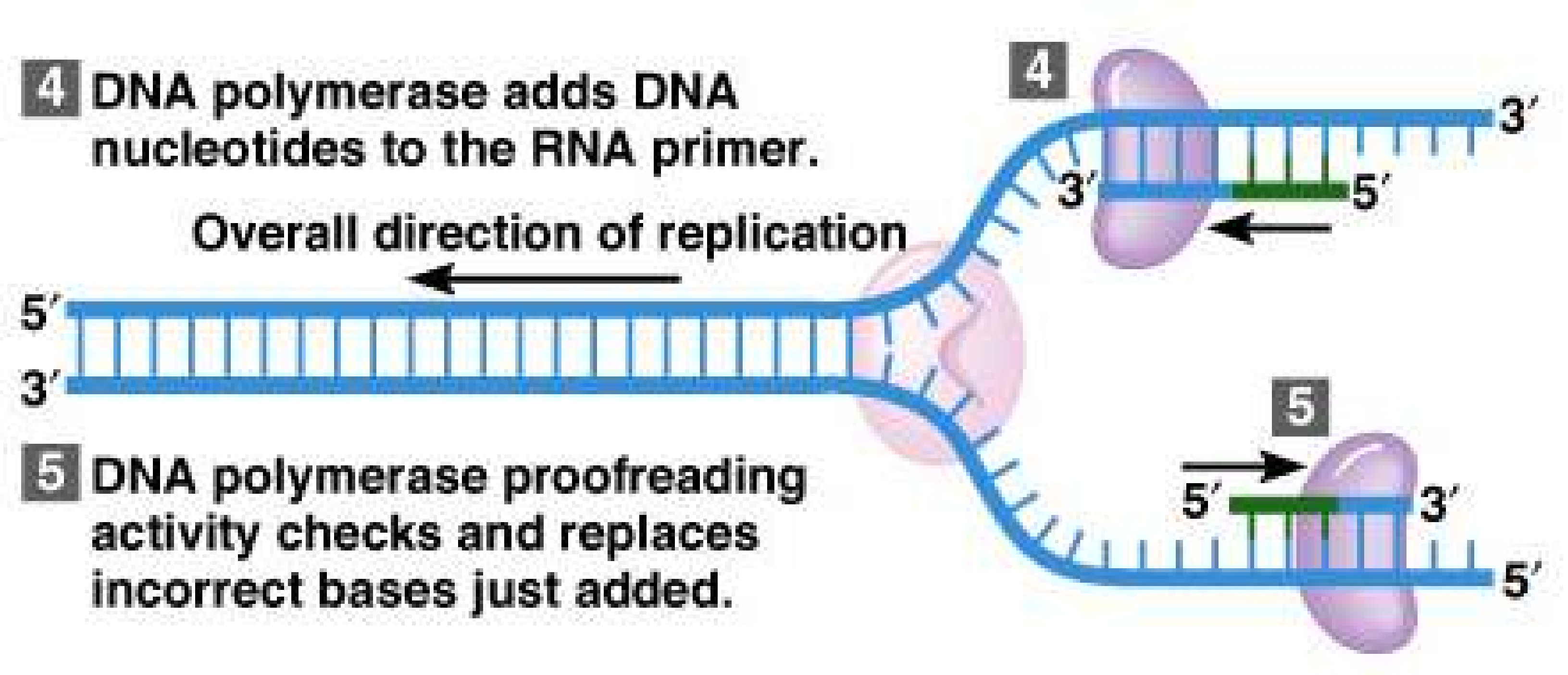


❶Helicase breaks hydrogen bonds.

Topoisomerase corrects overwinding ahead

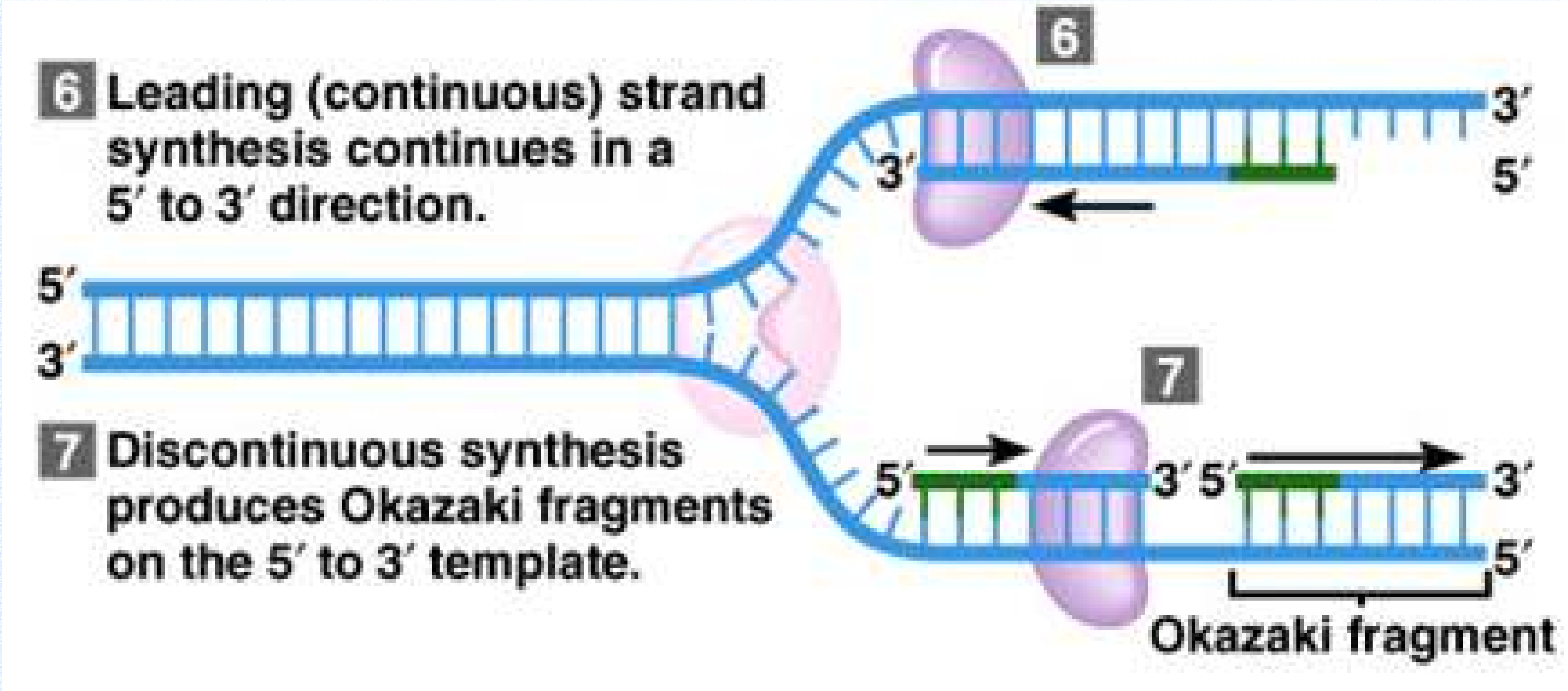
❷Single-strand binding proteins stabilize strands; prevent them from rejoining.

❸Primase makes an <u>RNA primer</u>.

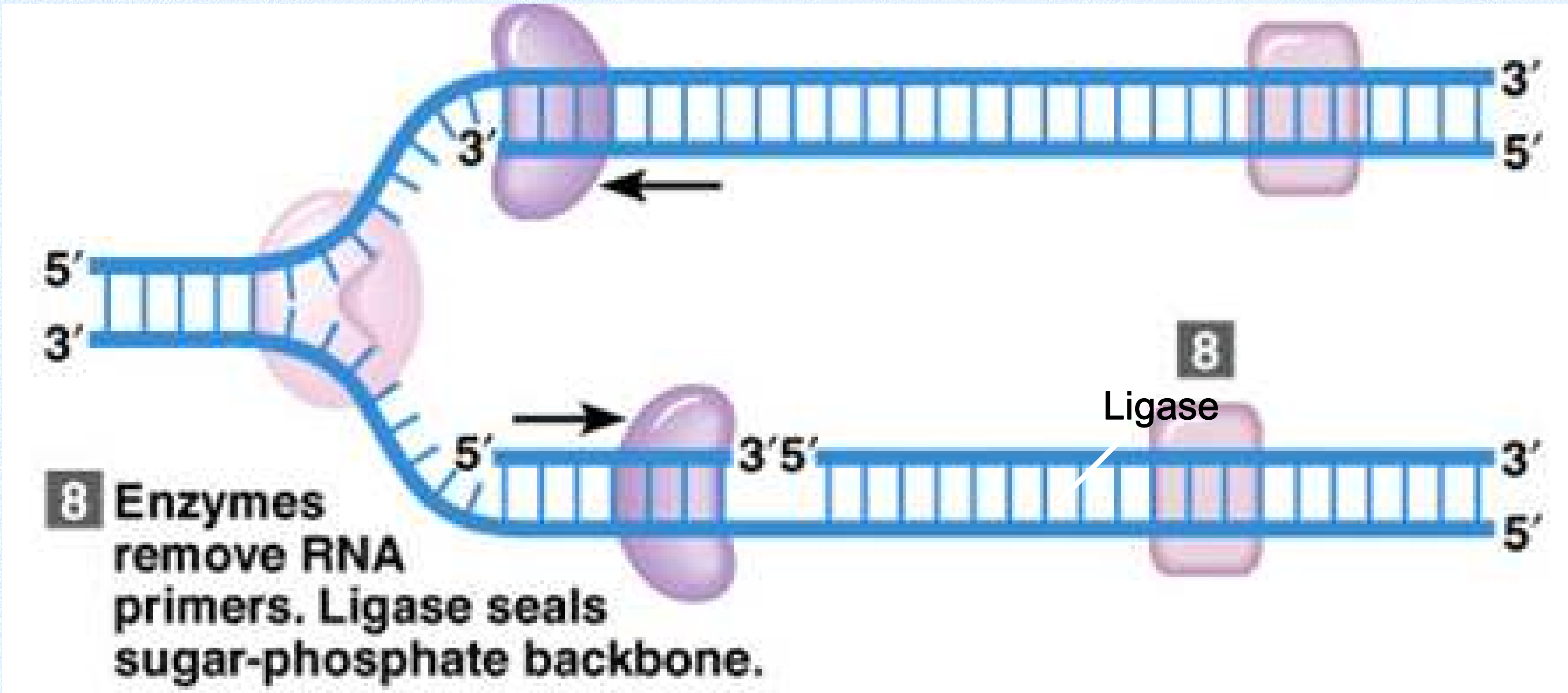


❹Free nucleotides move in & H-bond; DNA polymerase III links nucleotides to each other starting at primer & working in the 5’ to 3’ direction

❺DNA polymerase “proofreads” new strand (replaces incorrect bases); leaves errors 1/1,000,000,000 base pairings

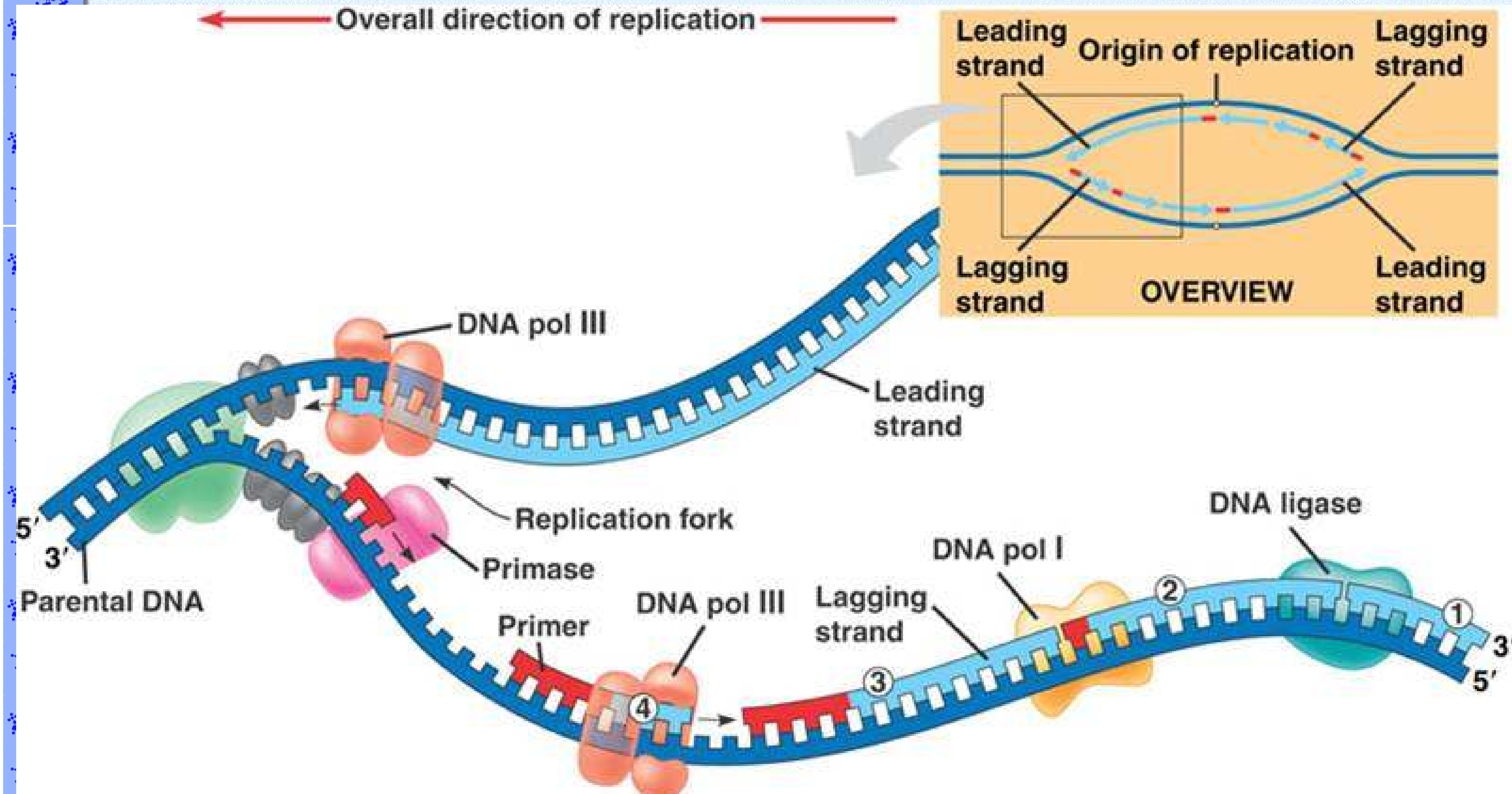


- ❻DNA replication is continuous on one strand (leading strand)
- ❼DNA replication is discontinuous on other strand (lagging strand), producing <u>Okazaki fragments</u>



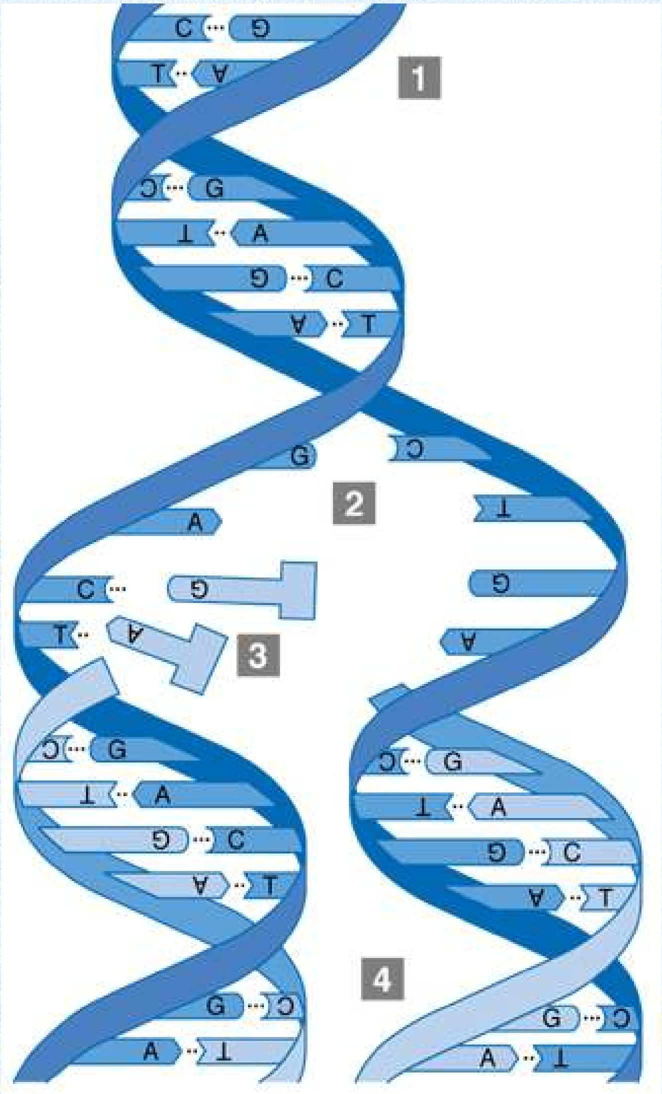
❽DNA Pol I remove RNA primers; DNA Ligase connects Okazaki fragments.

Detailed Replication Summary



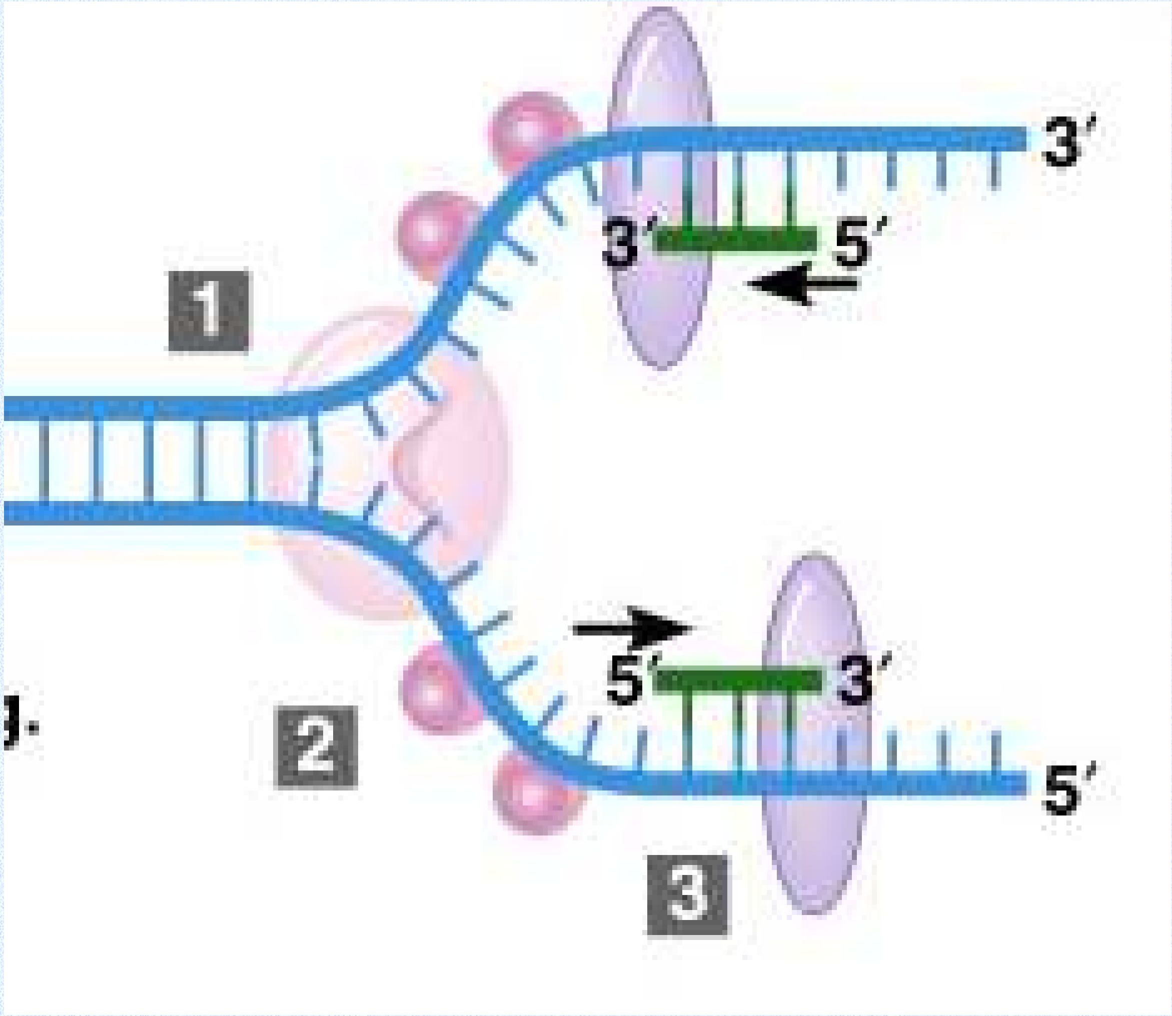
Details of how it works

Ok, so how does it actually happen?

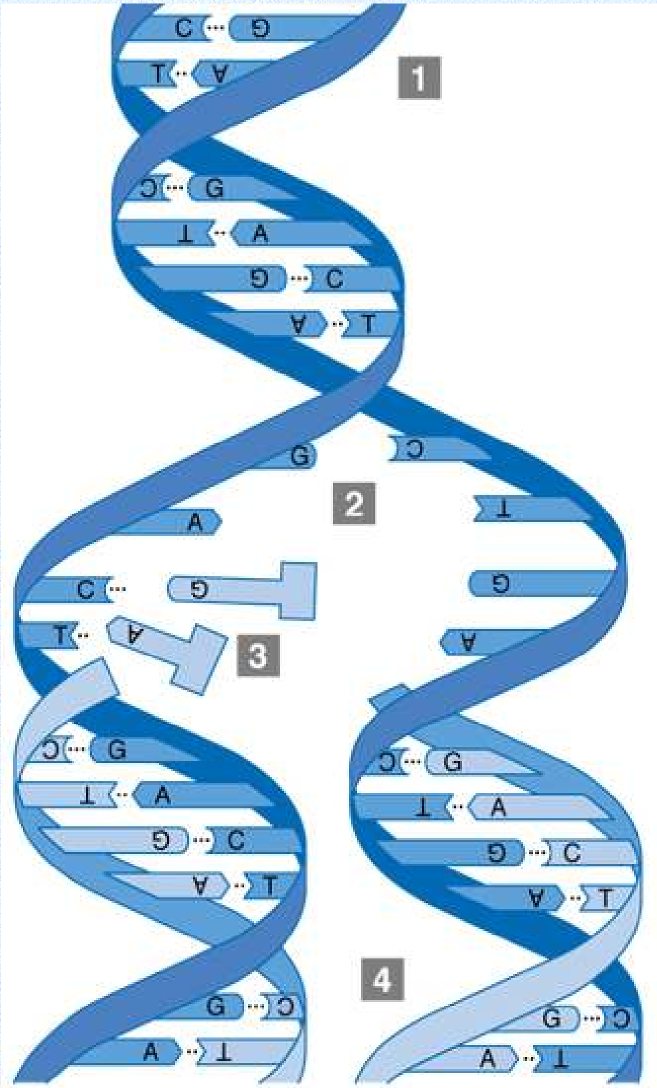


- DNA strands are "unzipped" at several points creating *replication forks*. ❷
- What does the "unzipping"?
- Enzyme: Helicase
  - Breaks Hydrogen bonds

Helicase



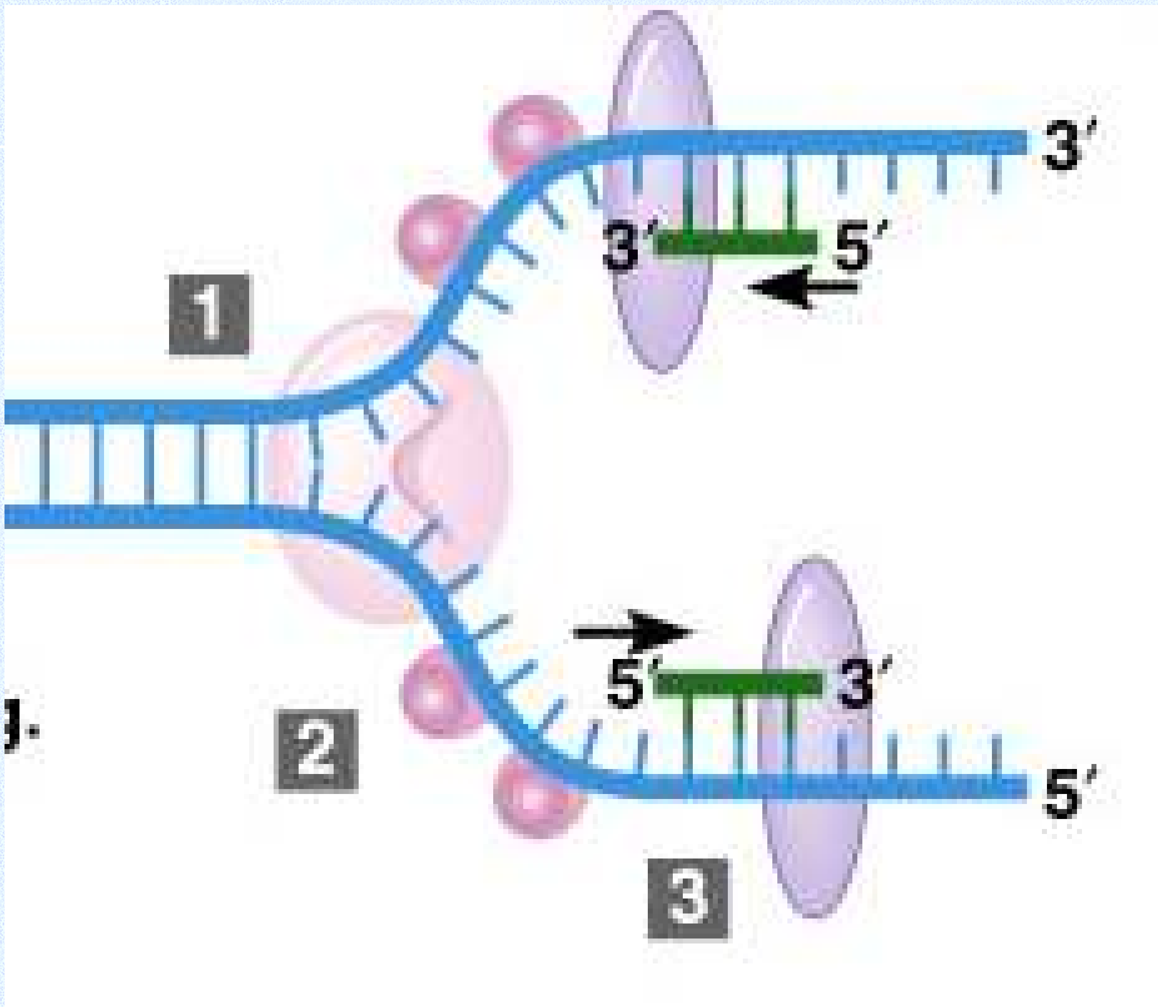
Ok, so how does it actually happen?



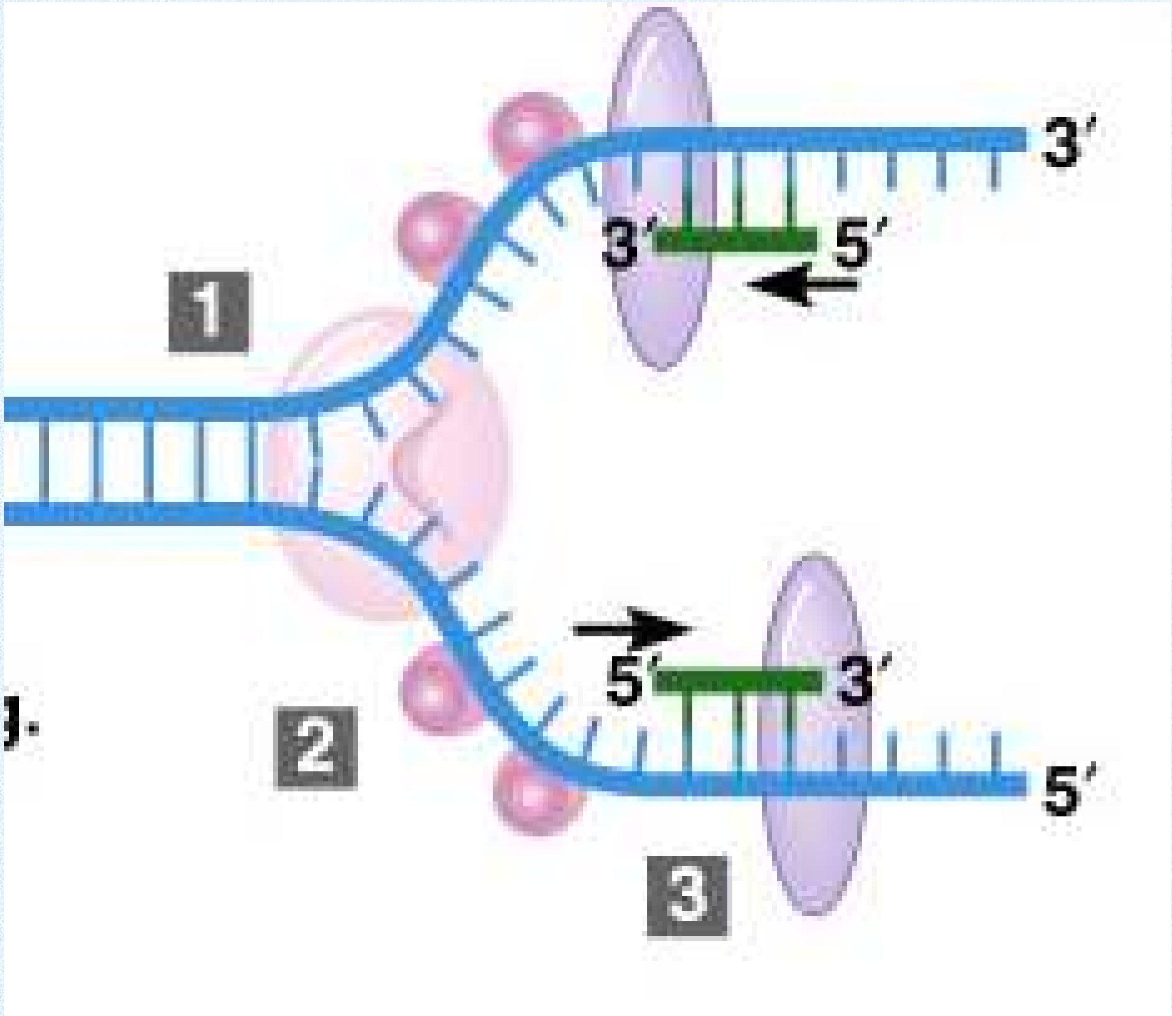
- Nucleotides are added forming a new strand ❸
  - Complementary
  - Hydrogen bonding
- Is there anything that helps the nucleotides bond?
- Enzyme: DNA polymerase
  - Adds bases moving from 5′ to 3′

DNA Polymerase

- Problem?

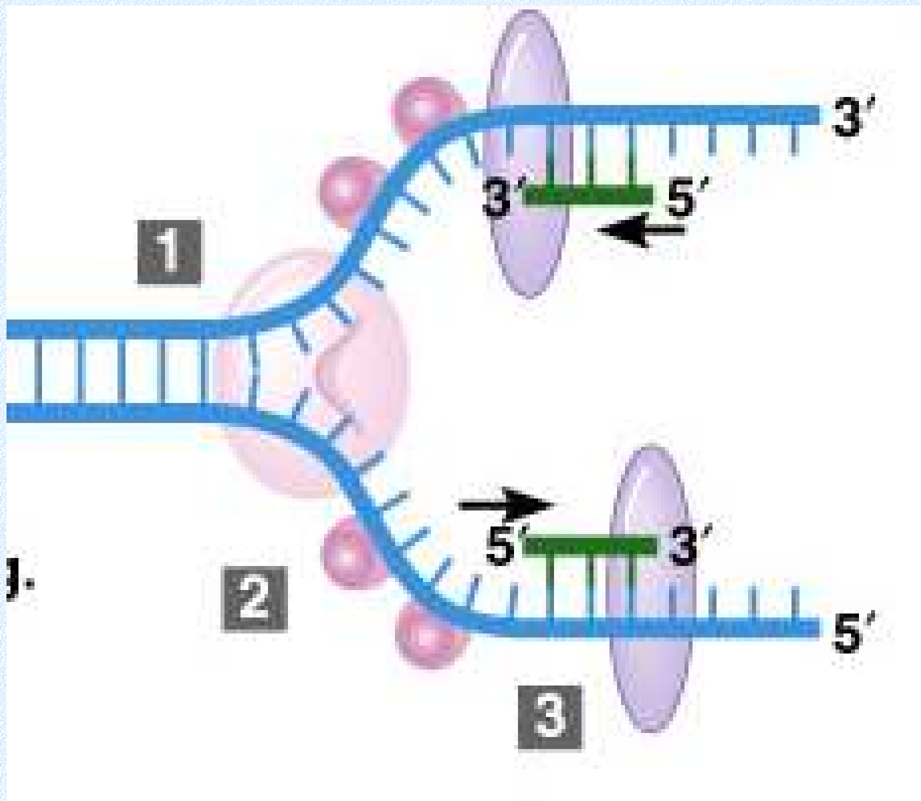


DNA replication has to go in two opposite directions



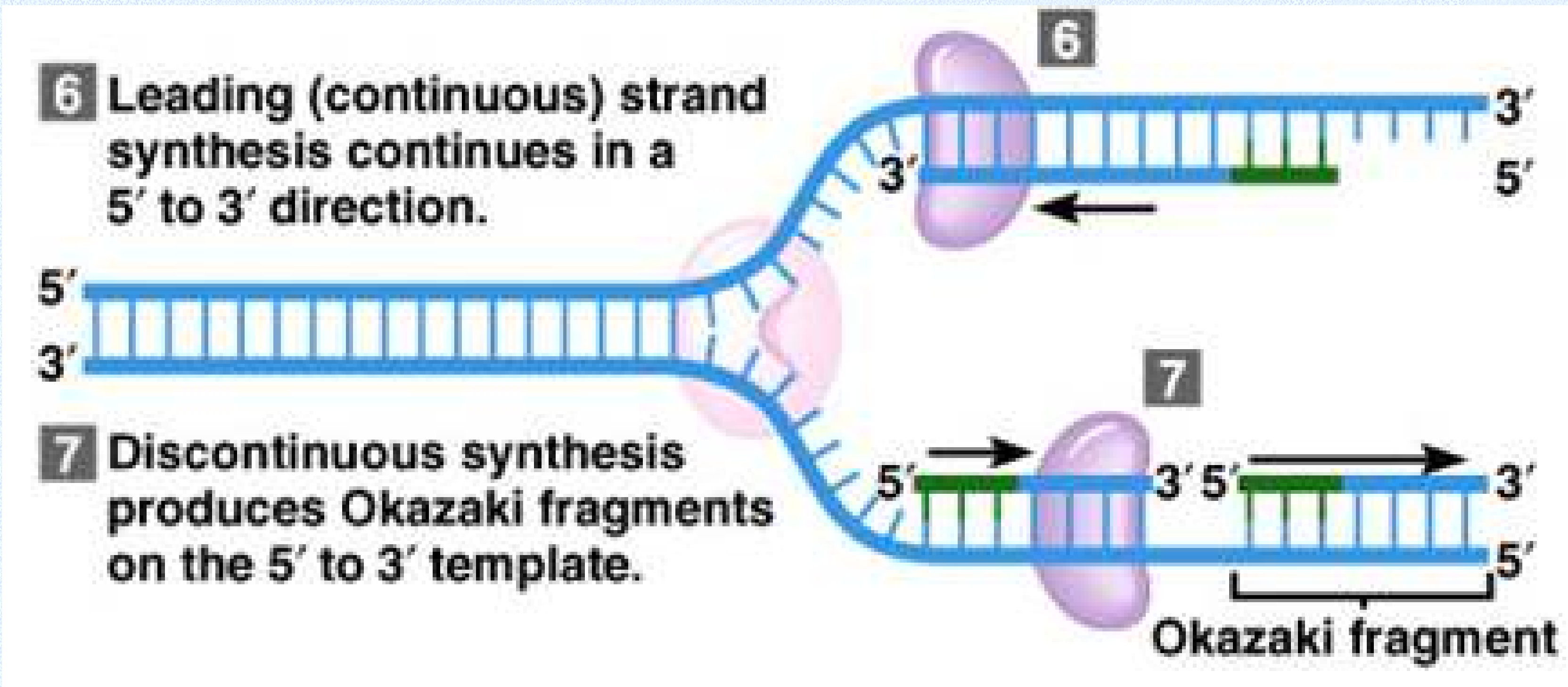
Each direction has its own name

- Leading strand
- Lagging strand



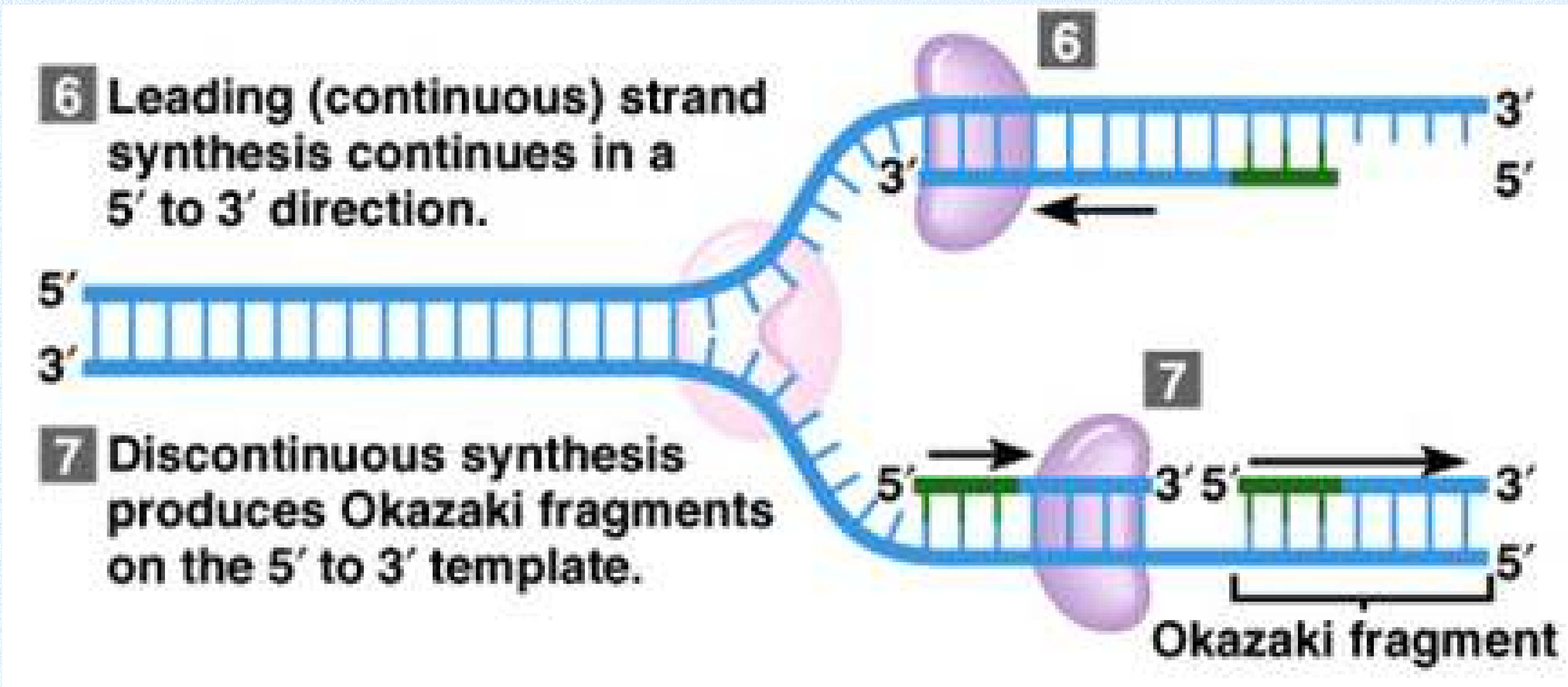
Leading strand

- Synthesized continuously
  - Moves towards the fork
  - No Problems



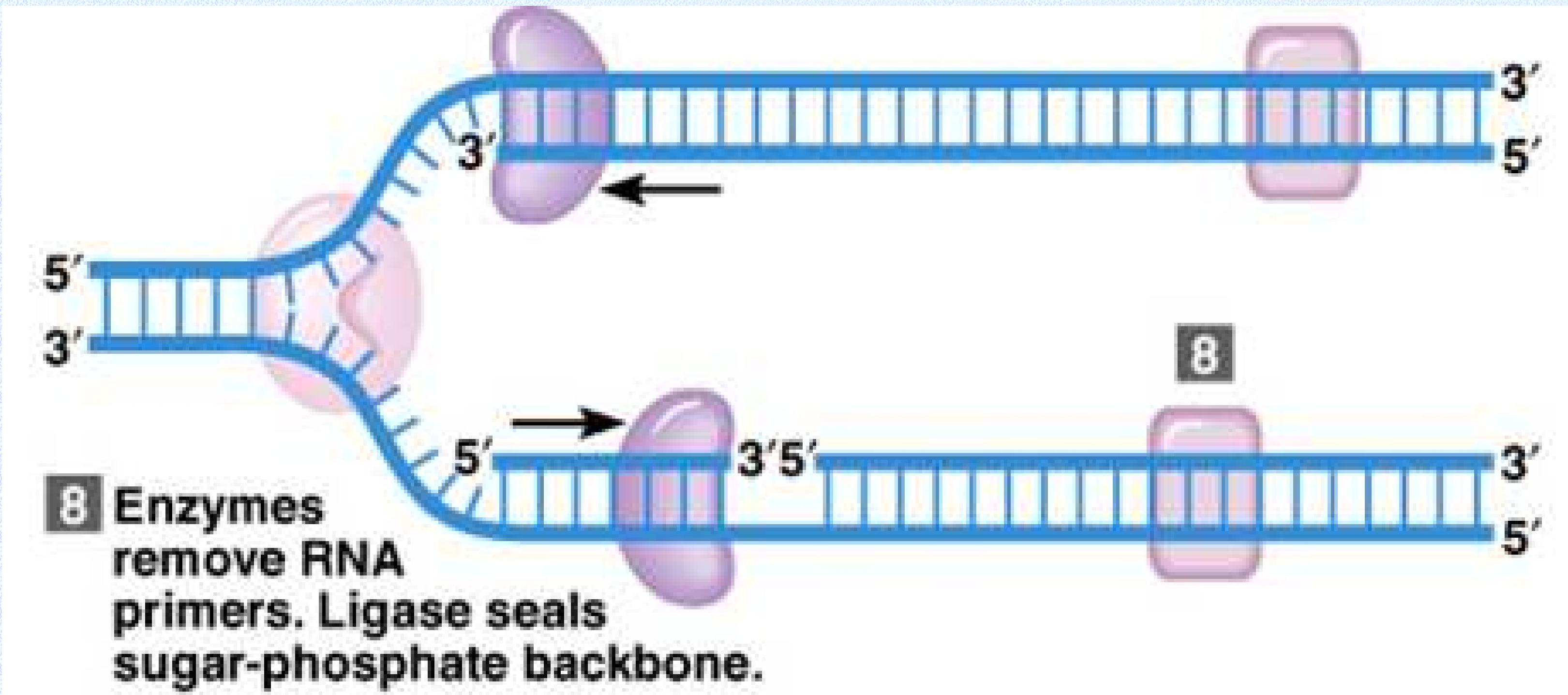
Lagging strand

- Moves away from fork
- Synthesized in fragments (Okazaki fragments)

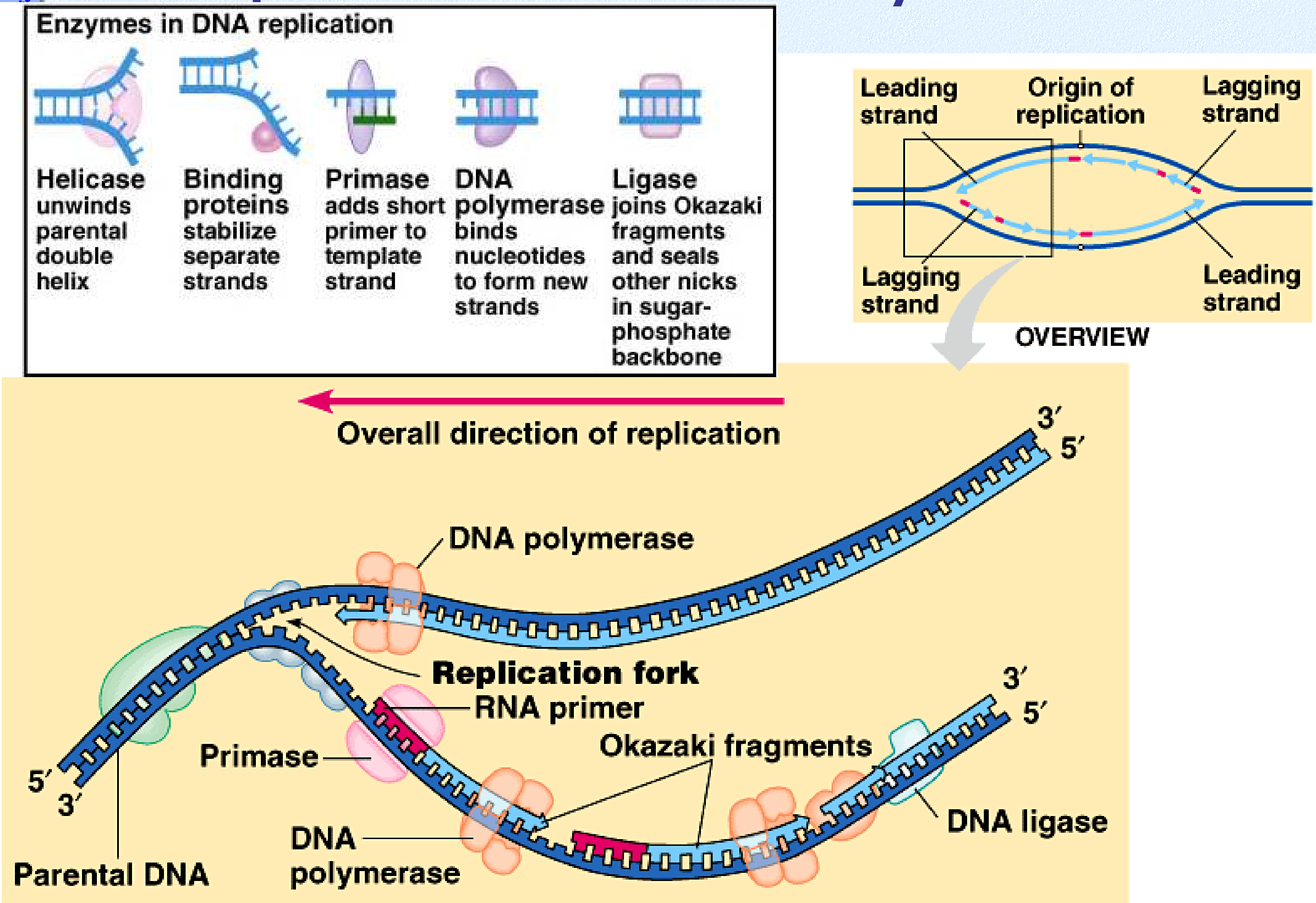


Lagging strand

- Later, the fragments are stitched together by another enzyme
  - Ligase



Replication Summary



Some videos!

- Click on each of these and check out the animations
- http://www.wiley.com/college/pratt/0471393878/student/animations/dna_replication/index.html
- http://highered.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::535::535::/sites/dl/free/0072437316/120076/micro04.swf::DNA%20Replication%20Fork