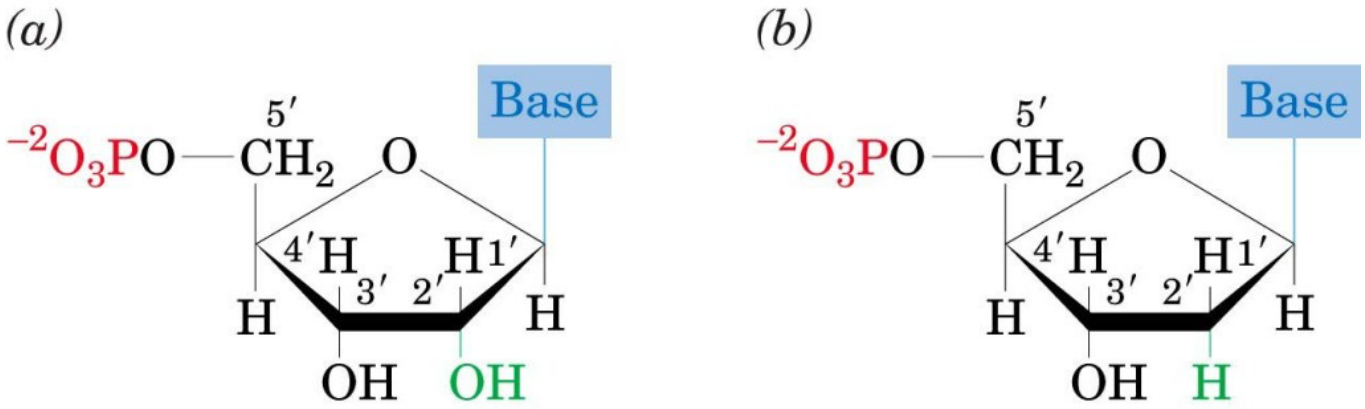
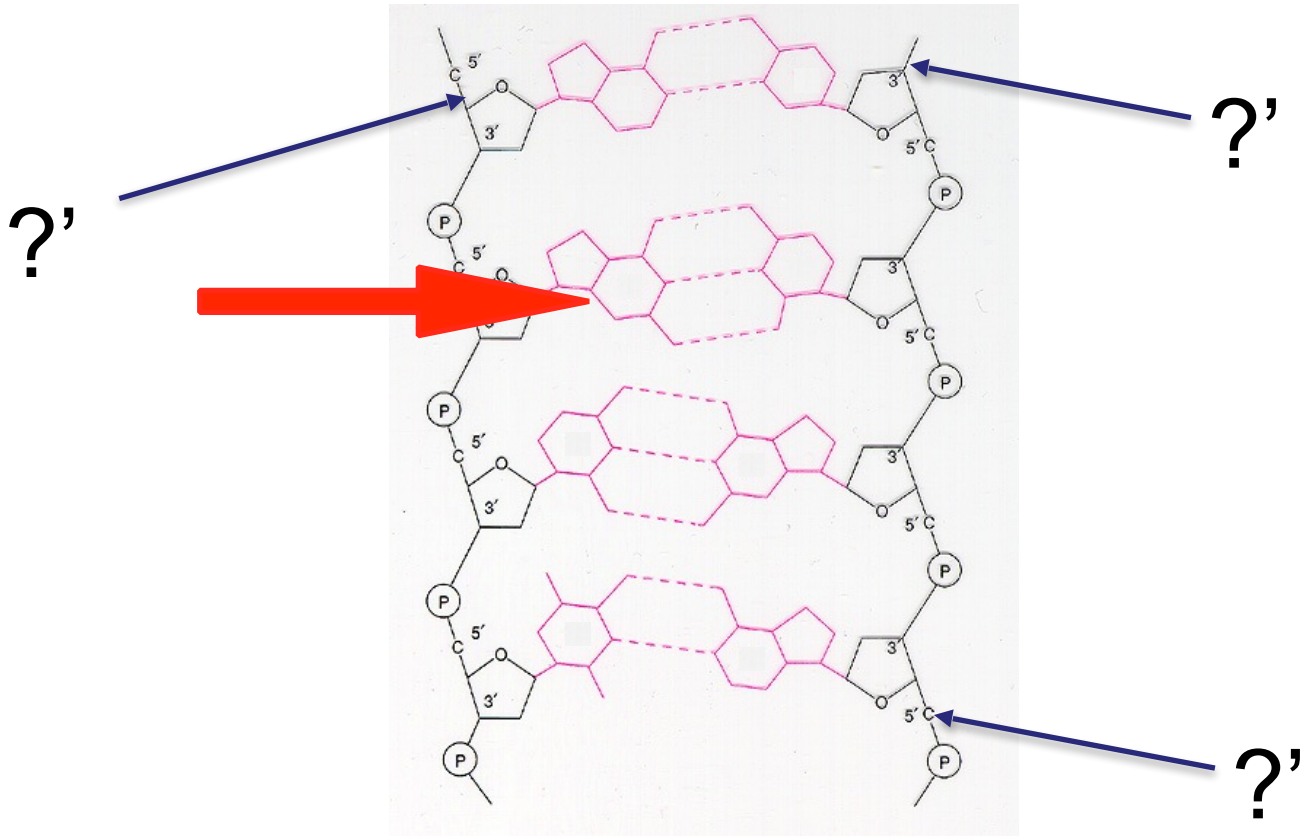
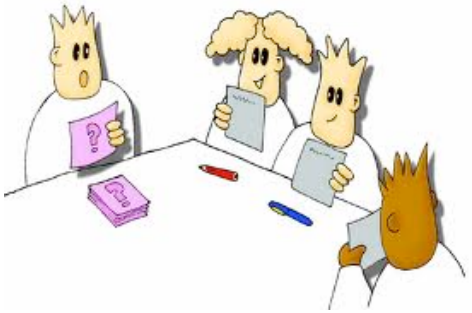
DNA Replication

7.1

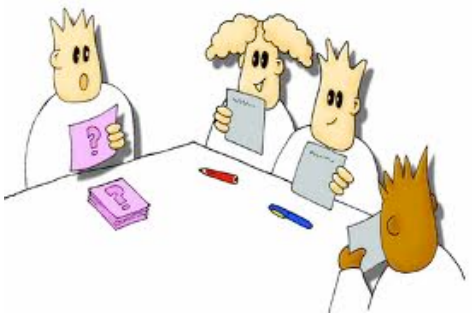


Which of these nucleotides could be uracil?

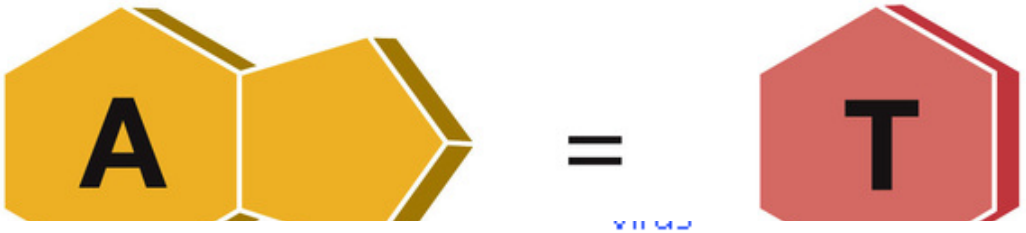


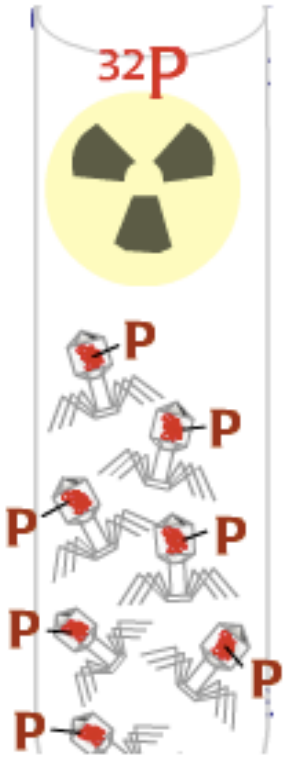


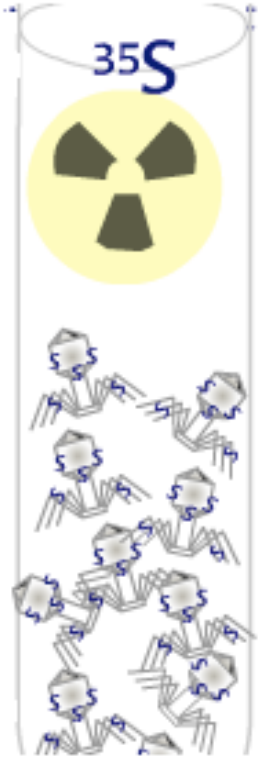
- A strand of DNA is composed of 1800 bases. How many nucleotides are thymine if 300 are cytosine?
- A strand of DNA is composed of 1800 bases **pairs**. How many nucleotides are adenine if 650 are cytosine?
- A strand of RNA is composed of 1500 bases **pairs**. How many nucleotides are Guanine if 350 are cytosine?



Who is responsible for ….





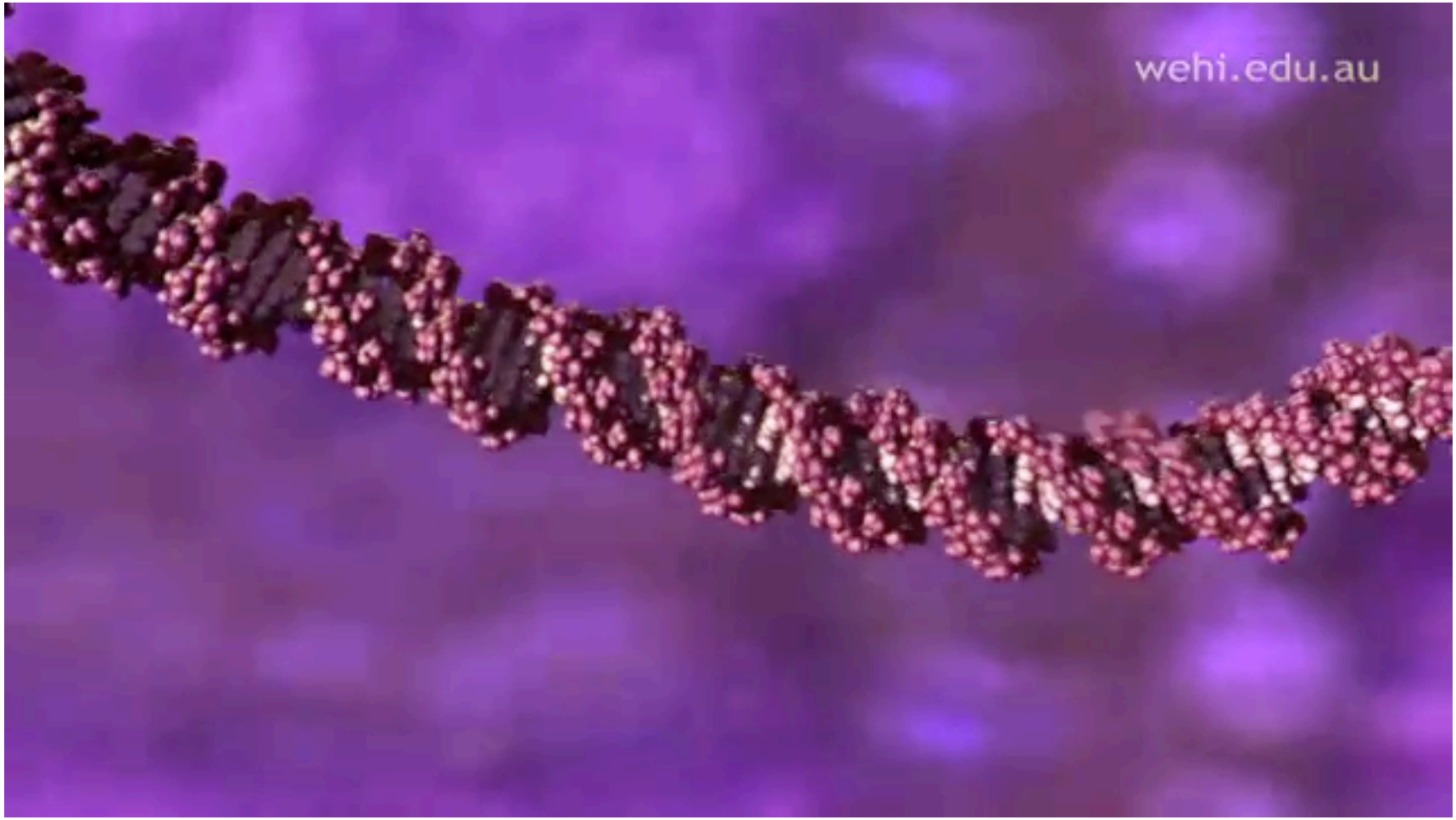



shutterstock

www.s


preterm newborn infants
term newborn infants (0 to 28 days)
infants and toddlers (> 28 days to 23 months)
children (2 to 11 years)
adolescents (12 to 18 years)

Recall the Organization of

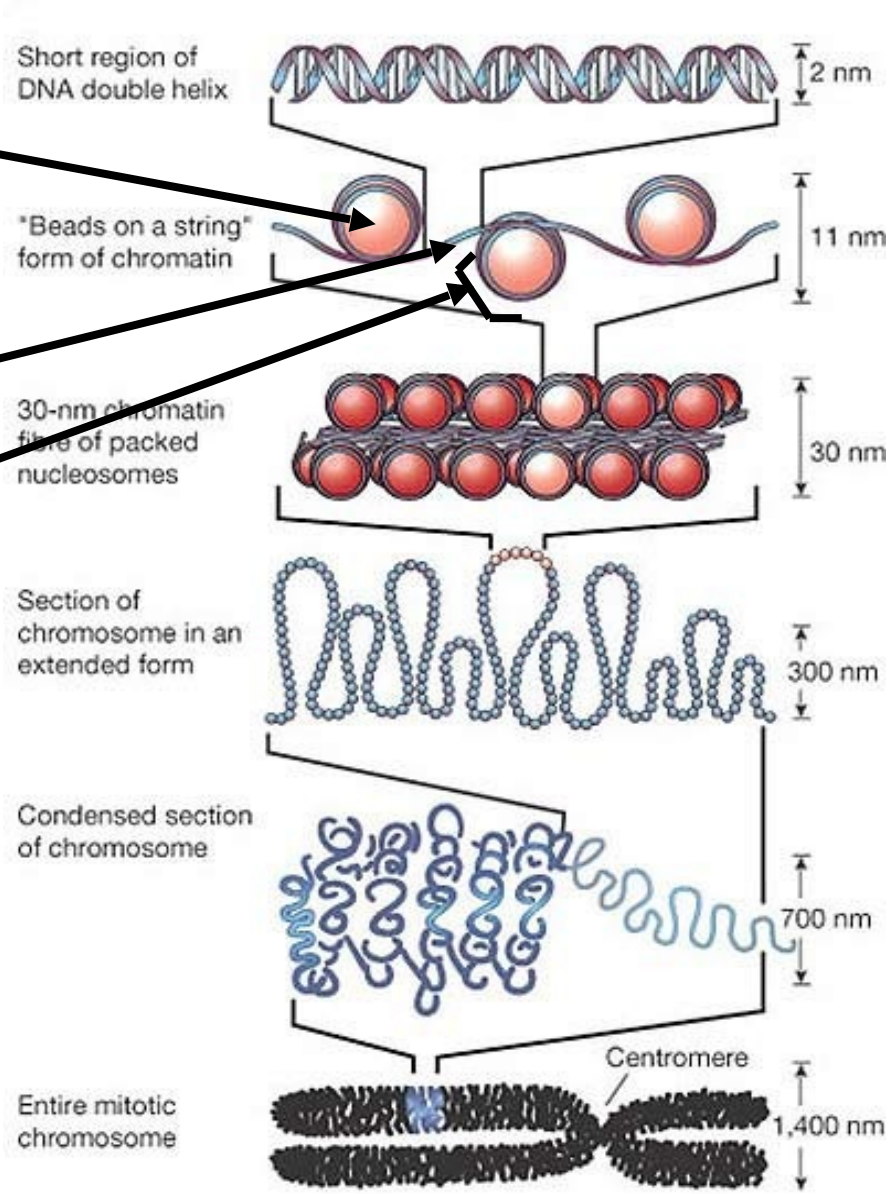


Recall the Organization of DNA

Histones

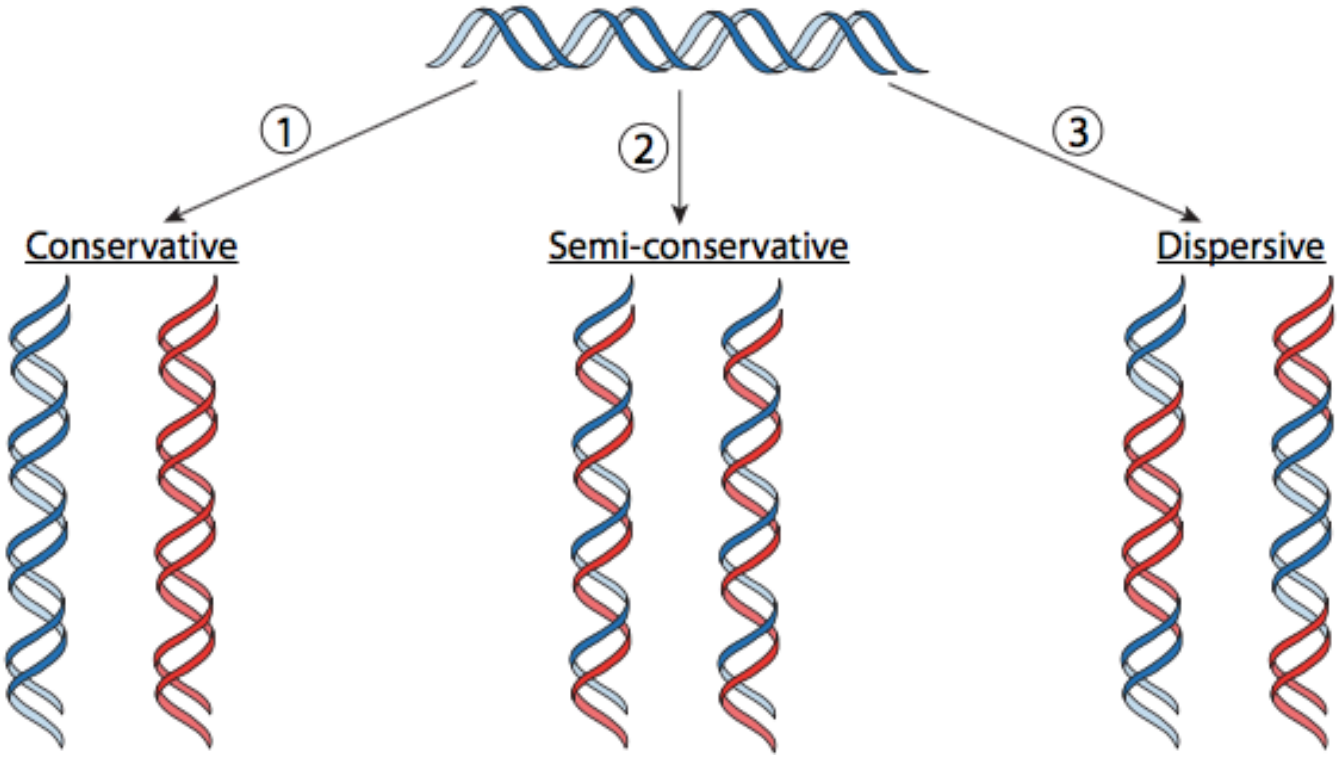
Linkers

Nucleosome
(8 histones)

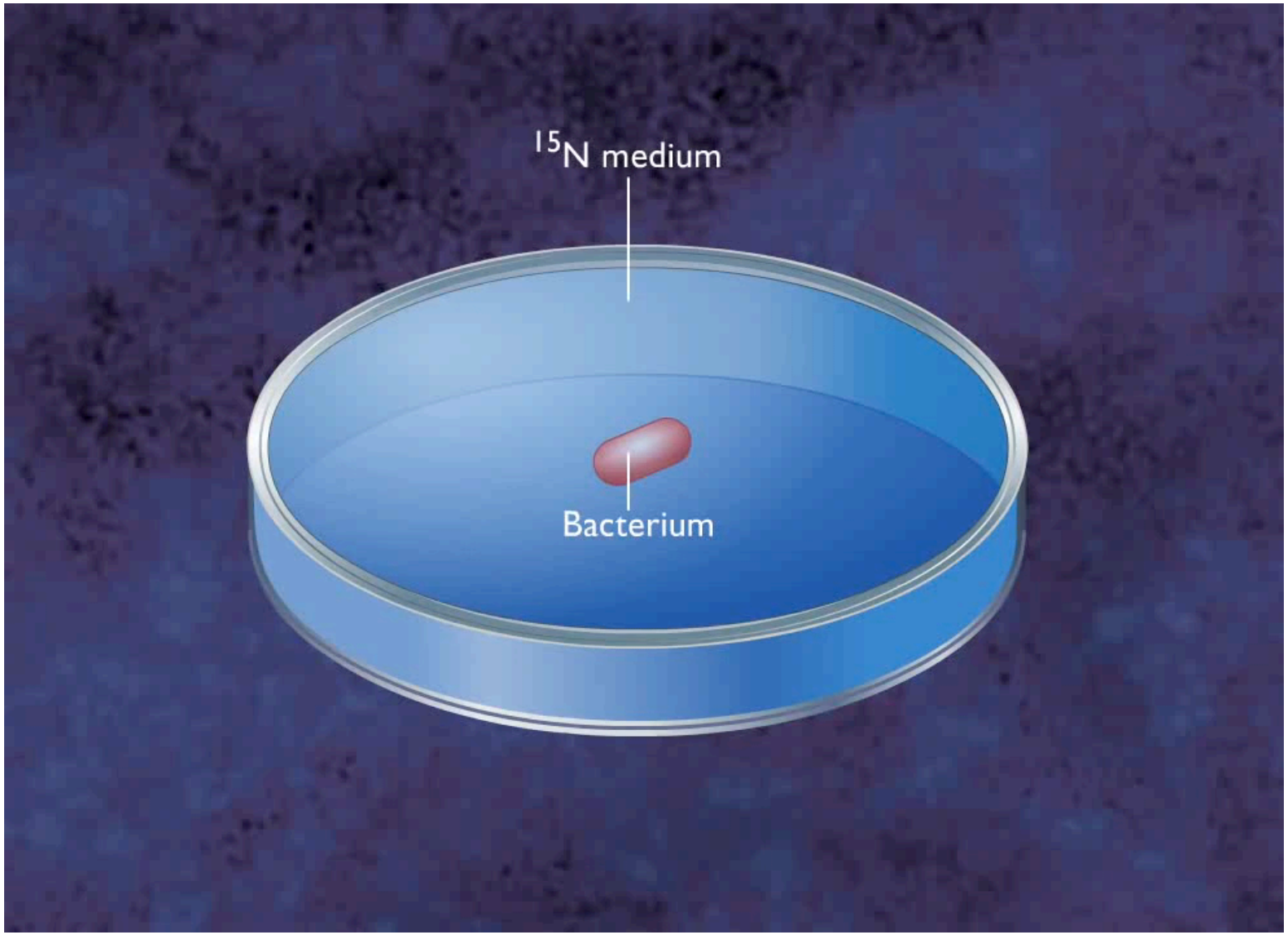


Meselson and Stahl

Their Question—> How does DNA replicate?



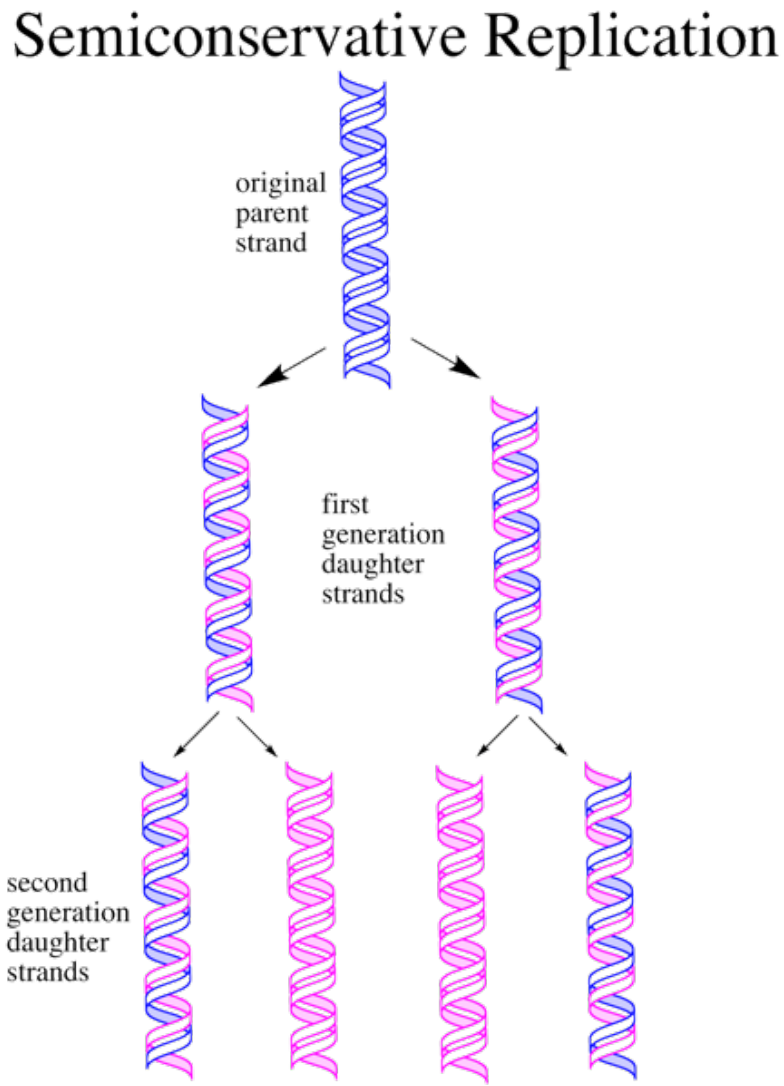
Meselson and Stahl



- DNA replication is **semi-conservative**

—> DNA splits and each strand forms a template for the regeneration of new DNA.

(Meselson and Stahl)

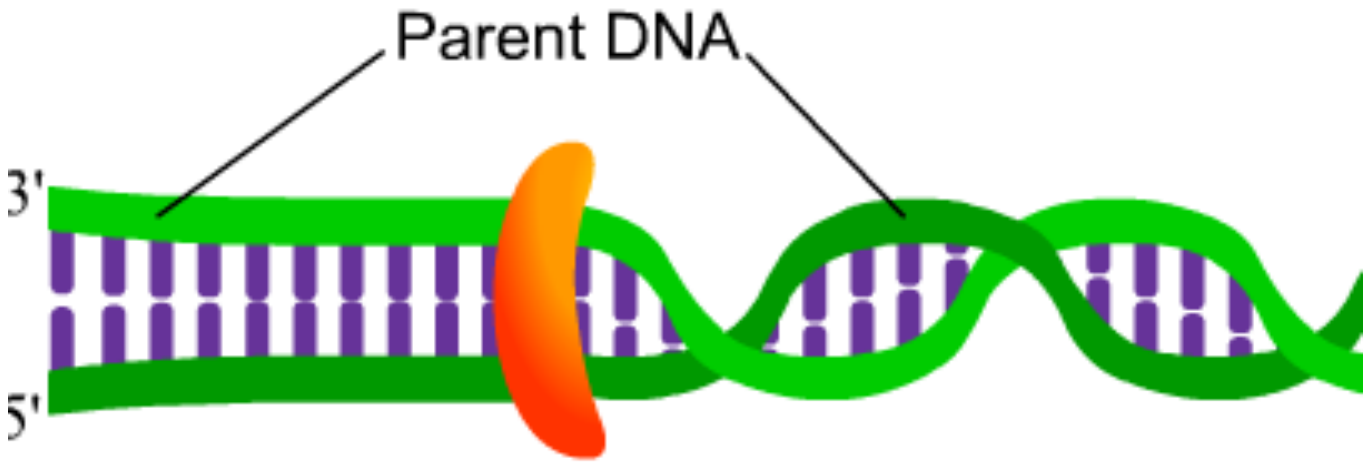


DNA Replication Enzymes

topoisomerases	RNA primase
DNA helicase	DNA polymerase I
DNA polymerase III	DNA ligase
DNA polymerase II	

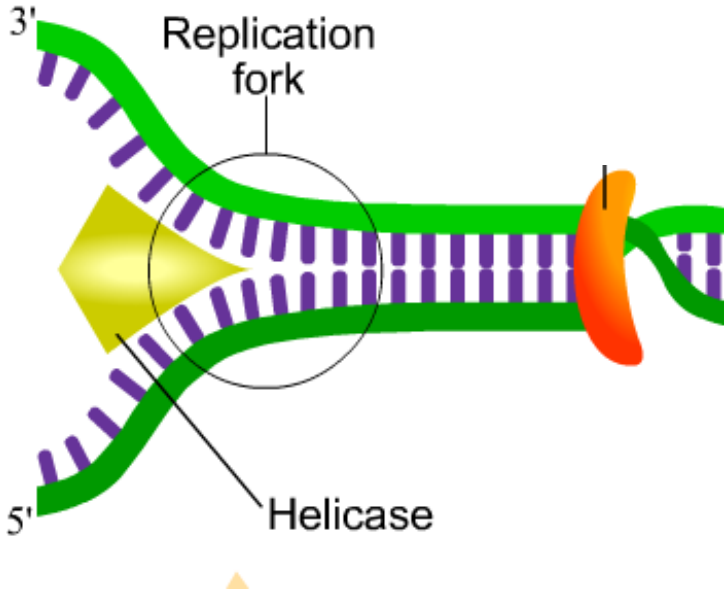
Step 1:Separating the Strands

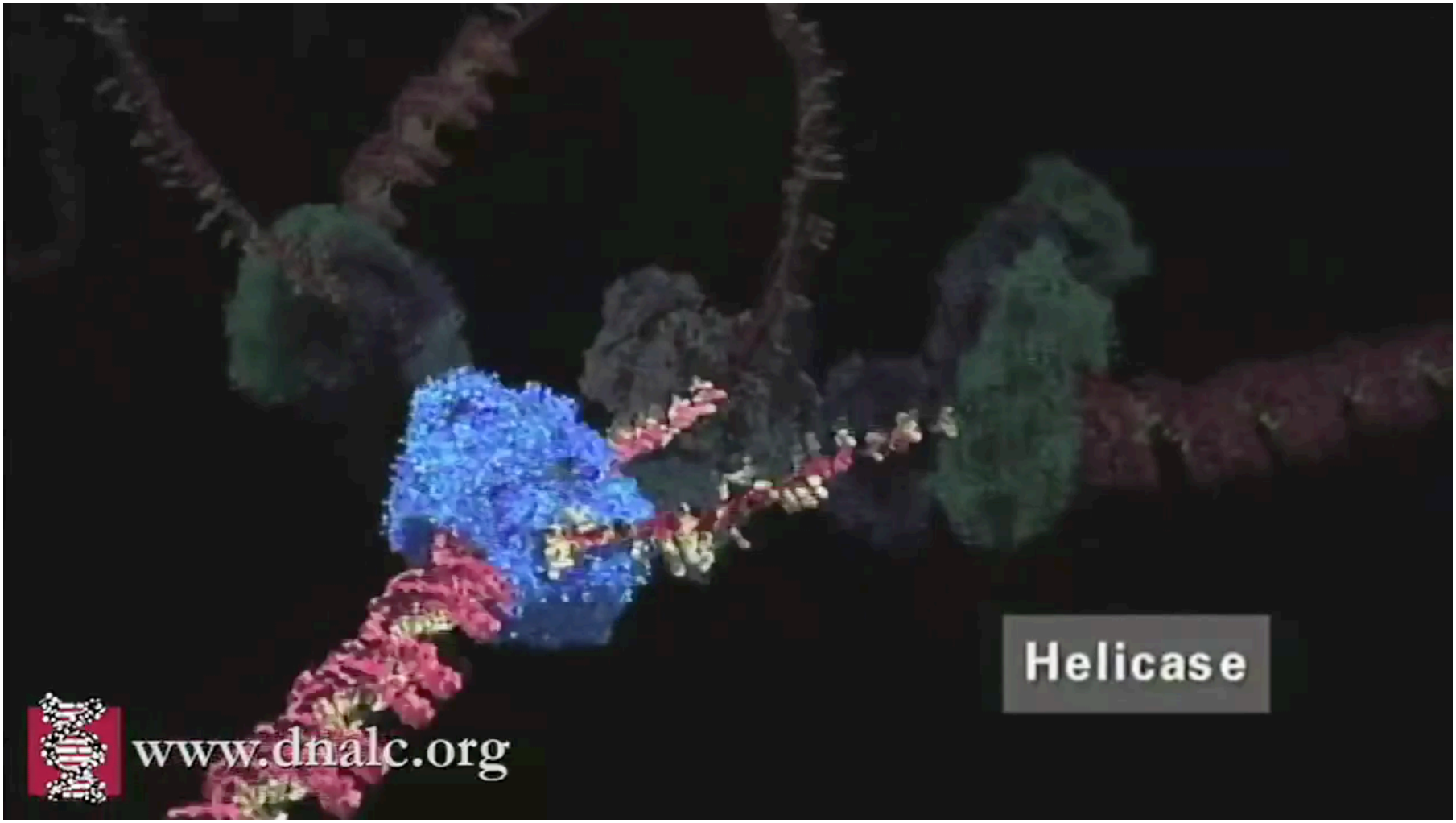
- **topoisomerases** relieve tension caused by the unwinding of the double helix
- they cut both strands and allow them to swivel around each other, then reseal them



Step 1:Separating the Strands

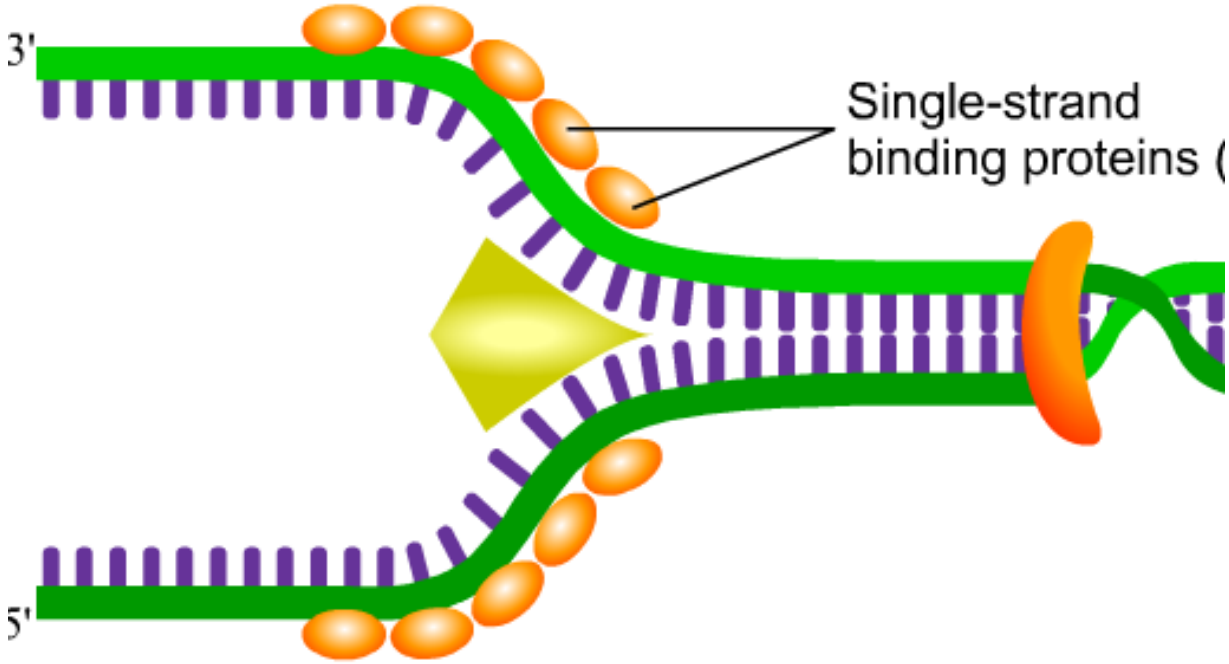
- **DNA helicase** breaks H-bonds between complementary base pairs, unwinding the double helix
- Donut shaped protein consisting of 6 subunits
    - one strand passes the centre on passes outside the donut




Helicase
www.dnalc.org

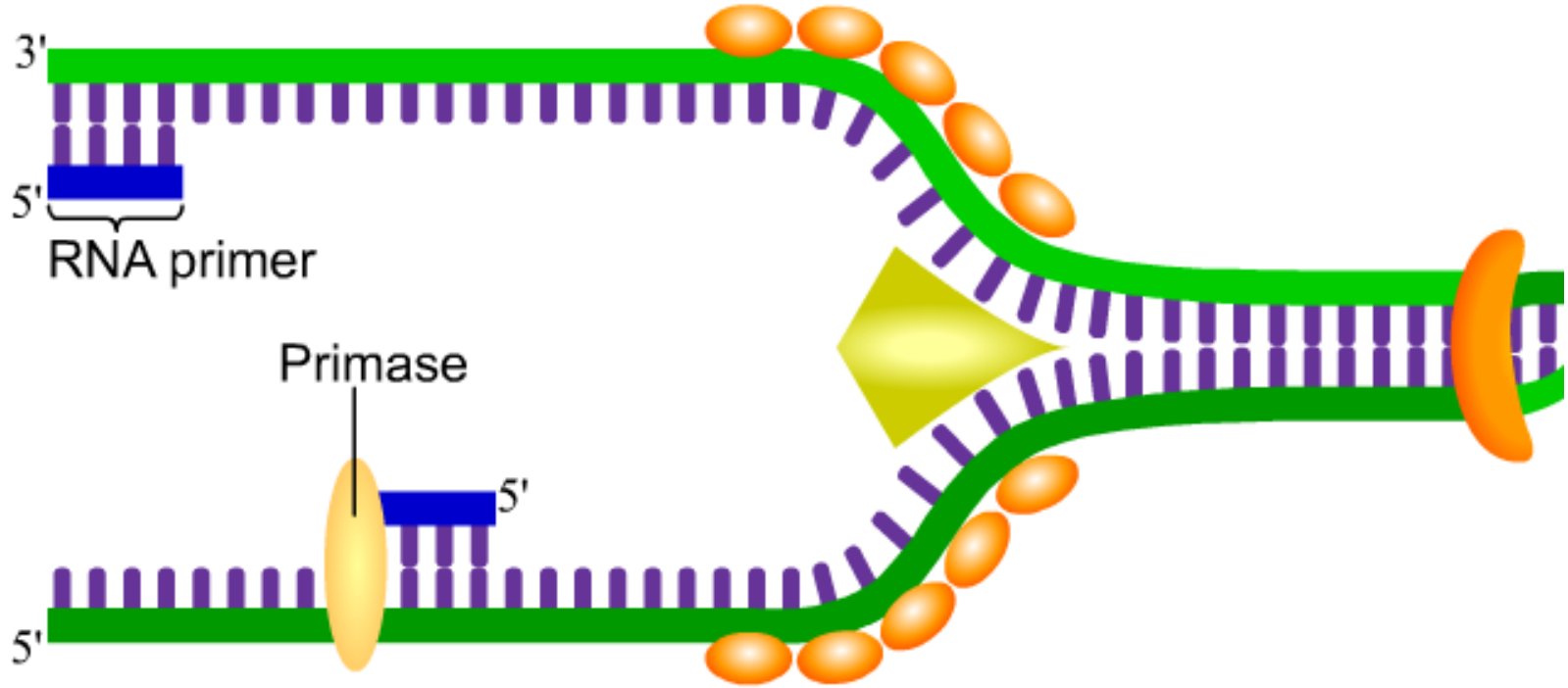
Step 1:Separating the Strands

- **single-stranded binding proteins (SSBs)** bind to the unwound single strands of DNA to prevent the H-bonds from reforming (anneal)



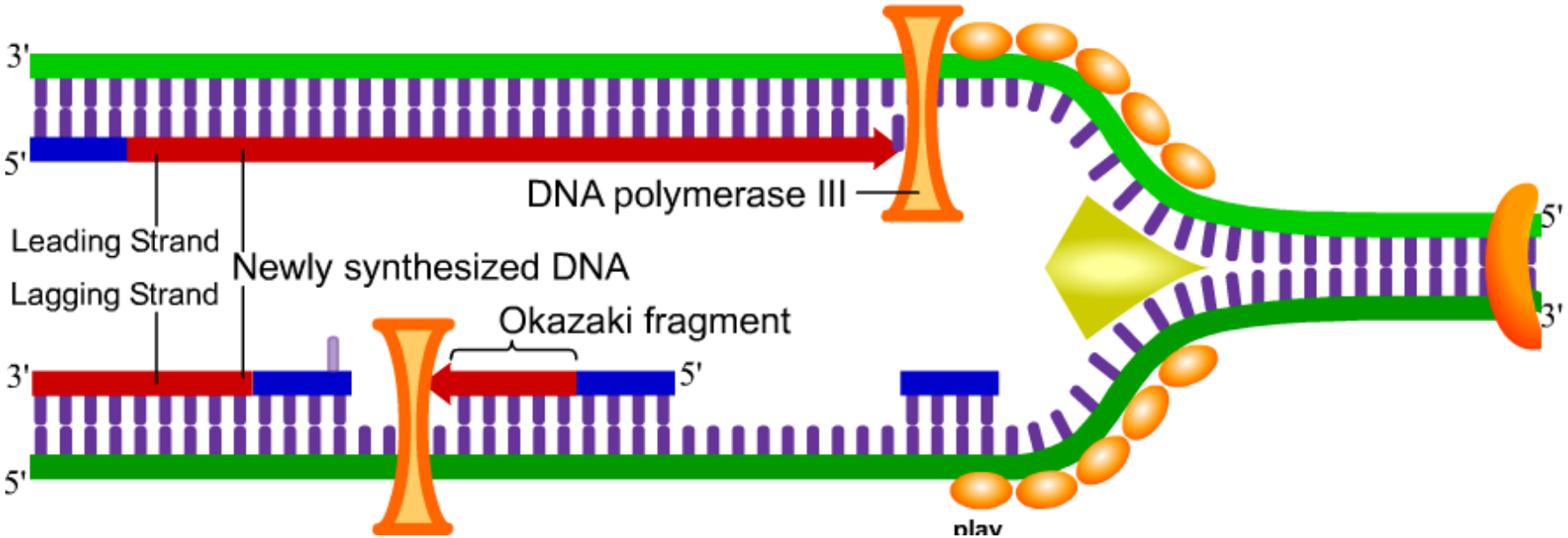
Step 2: Building the Complementary Strand

- **RNA primase** synthesizes an RNA primer of 10-60 base pairs to the template strands



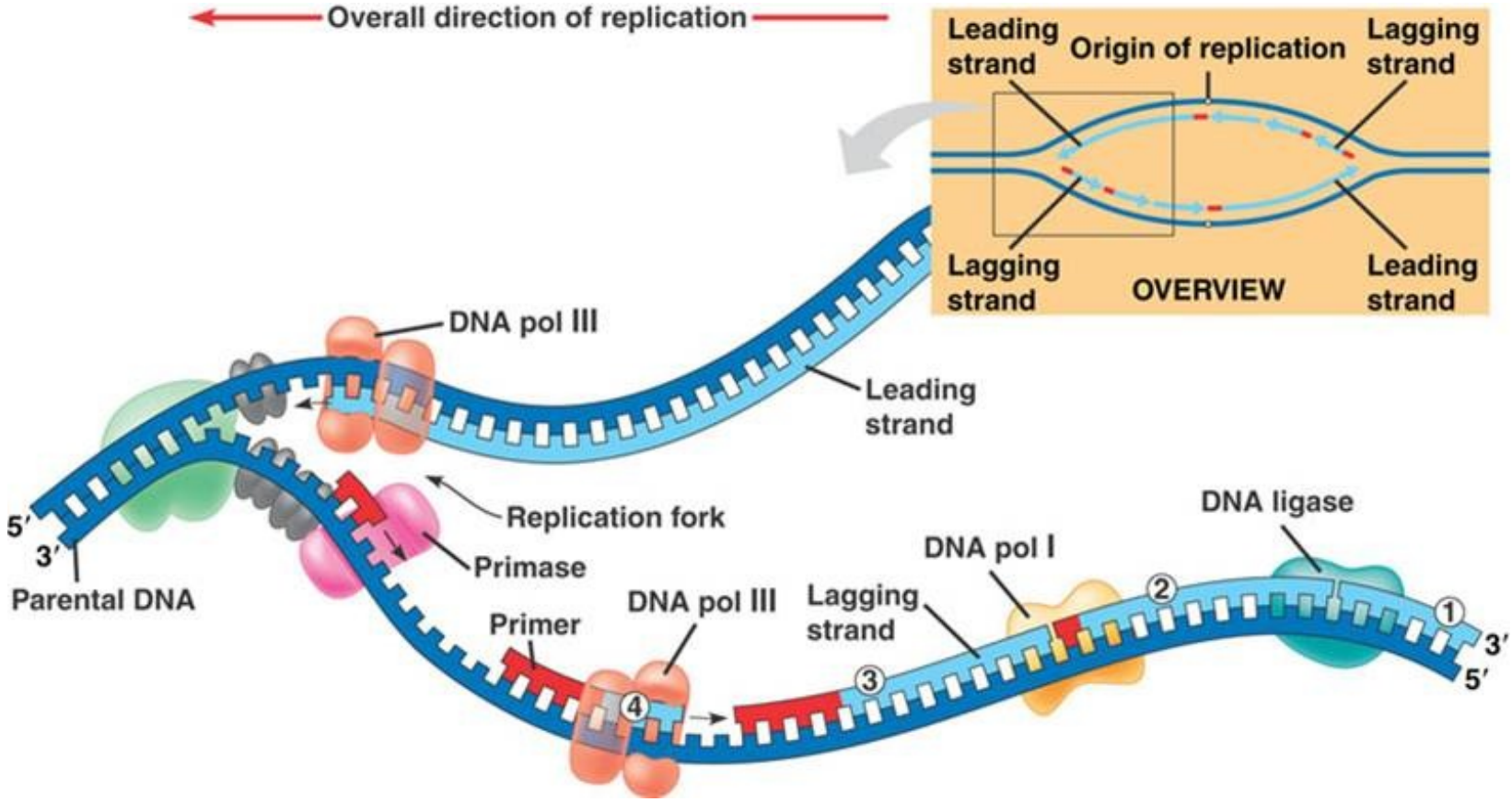
Step 2: Building the Complementary Strand

- **DNA polymerase III** adds complementary *nucleoside triphosphates* in the 5' to 3' direction to the away from the RNA primer



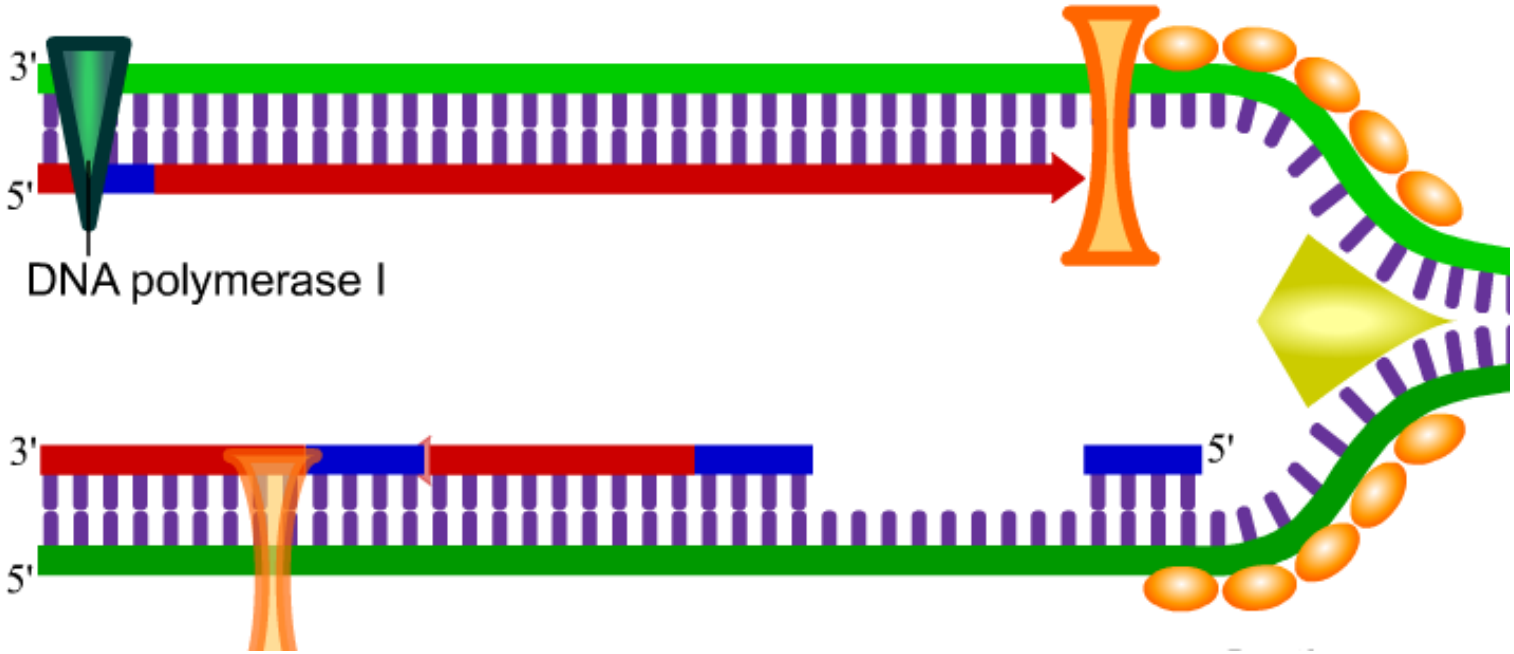
Step 2: Building the Complementary Strand

- bonds forming on the 3' growing side are *phosphodiester bonds*.
- the **leading strand** is built continuously toward the replication fork
- the **lagging strand** is built away from the replication fork, and is built in short segments called **Okazaki fragments**


Overall direction of replication
Leading strand
Origin of replication
Lagging strand
Lagging strand
OVERVIEW
Leading strand
DNA pol III
Leading strand
Replication fork
5′
3′
Parental DNA
Primase
Primer
DNA pol III
DNA pol I
DNA ligase
Lagging strand
1
2
3
4
3′
5′

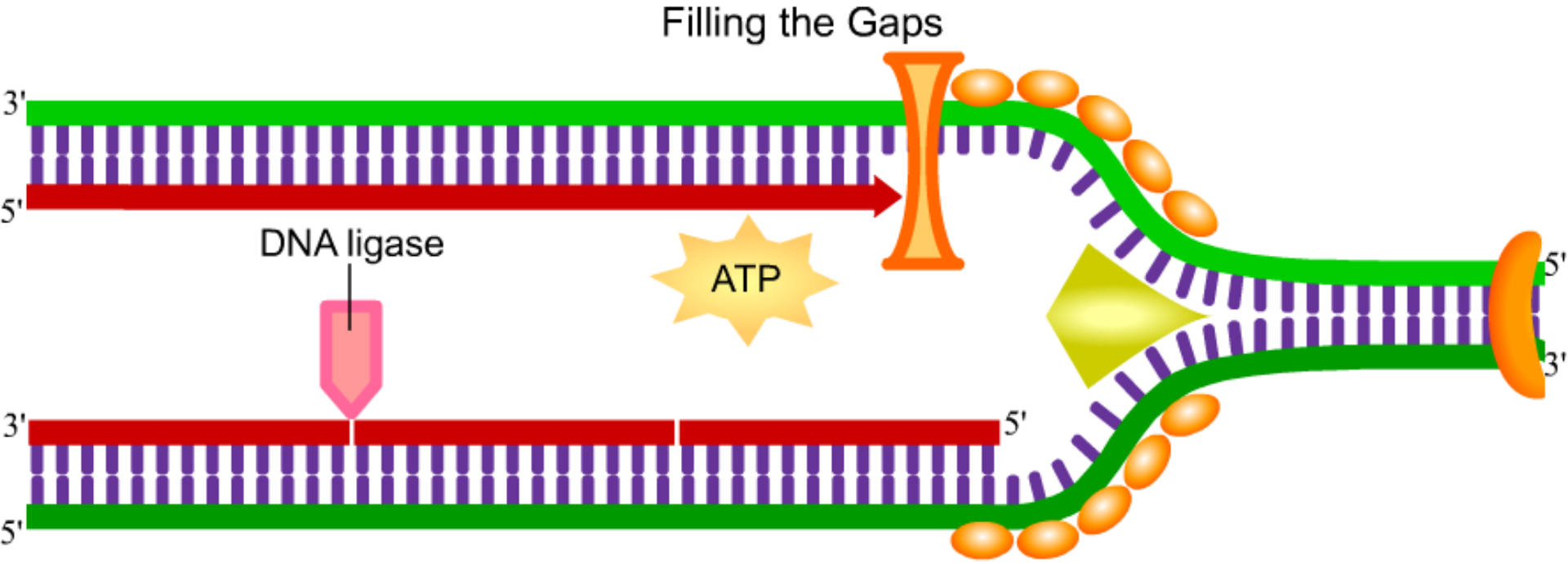
Step 2: Building the Complementary Strand

- **DNA polymerase I** removes RNA primers (from both the leading and lagging strands) and replaces them with DNA nucleotides.



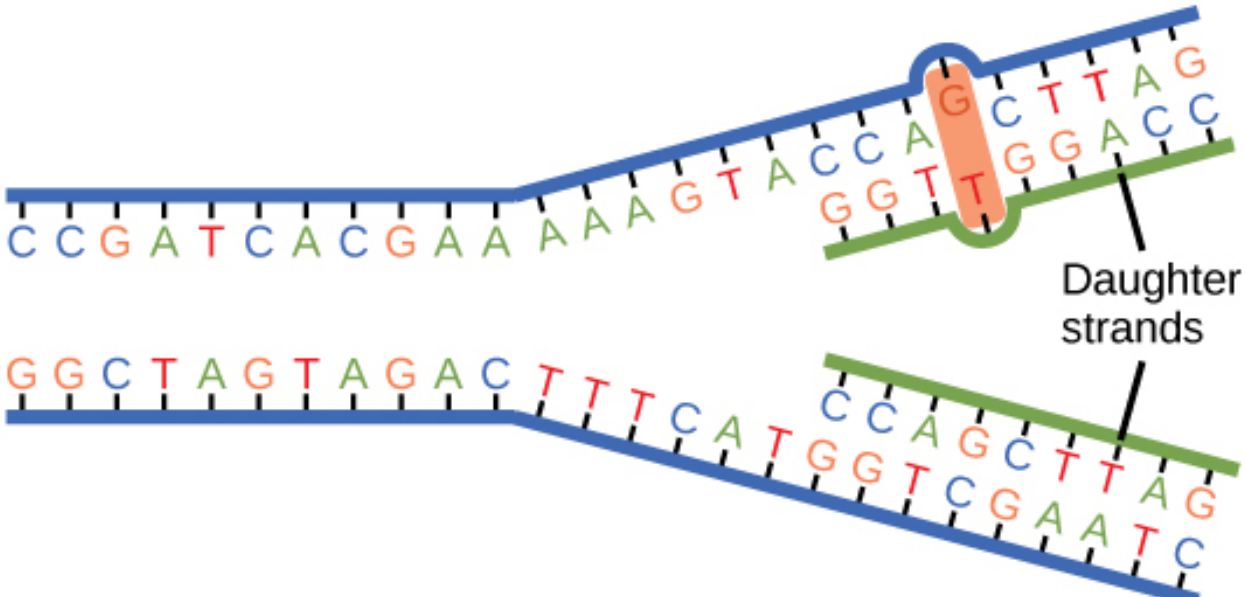
Step 2: Building the Complementary Strand

- **DNA ligase** joins Okazaki fragments on the lagging strand, through phosphodiester bonds



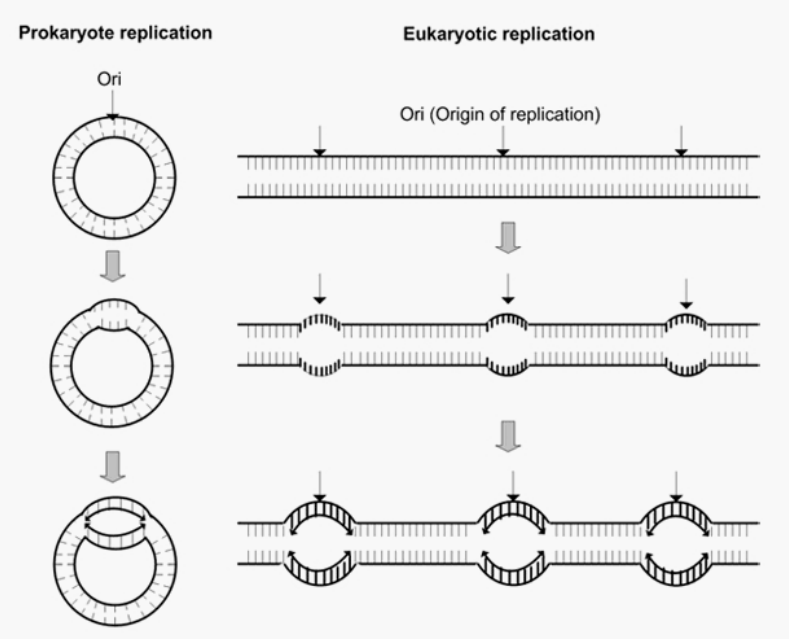
Step 3: Making Corrections

- **Errors** occur approx every 1 in a million base pairs.
- These incorrect bases make the strands bulge slightly
- **DNA polymerase II** *(and DNA polymerase I)* check new strands of DNA for errors
- they excise incorrect nucleotides and add the correct nucleotides to the strands



Differences between Prokaryotic & Eukaryotic Cells

- there is usually only one replication origin in prokaryotic DNA, and more than one replication origin in eukaryotic DNA



Differences between Prokaryotic & Eukaryotic Cells

- in prokaryotic cells, DNA polymerase I, II, and III function in replication and repair; in eukaryotic cells, there are more than 3 different types of DNA polymerase

Self-Study

- This interactive animation with questions is a good self-study tool.
- Click on DNA Replication:

http://www.wiley.com/legacy/college/boyer/0470003790/animations/animations.htm

Resources

- McGraw-Hill narrated animation of DNA replication:

http://highered.mcgraw-hill.com/sites/0072437316/student_view0/chapter14/animations.html

Homework

- Gizmo on DNA Replication
- DBQ on pg 113