

UNIT 6:
DNA/RNA/PROTEIN
SYNTHESIS

RECALL WARM-UP

- **Draw** and **label** a single nucleotide
- Provide the complementary base **sequence** for CAGGTAACT.
- Provide a brief **description** of the following scientists' achievements:
Chargaff; Griffith; Watson & Crick; Hershey & Chase; Franklin
- What makes up the backbone of DNA?
- If a particular organism contained 27% adenine, **how much** guanine would be present?
- What **bond** holds the nitrogenous bases together in a molecule of DNA?

TOPIC 2: DNA REPLICATION

By the end of this topic, you should be able to...

- *Identify the purpose of DNA replication*
- *Identify and order the steps involved in DNA replication*
- *Explain the purpose of molecules (enzymes) used in DNA replication*

DNA REPLICATION



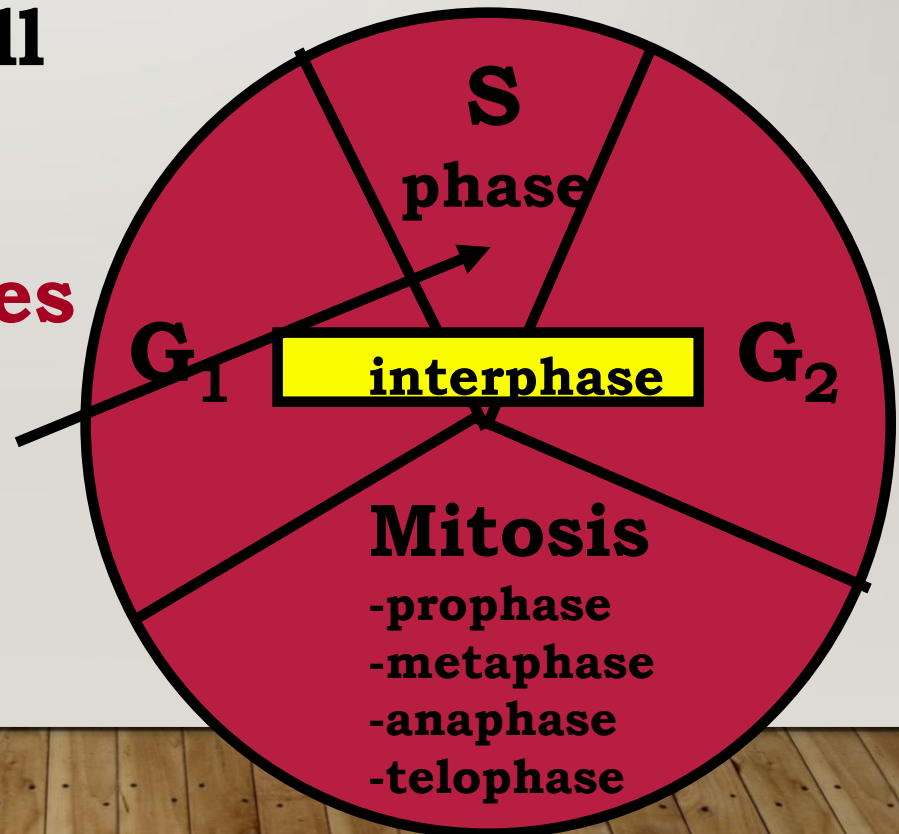
REPLICATION FACTS

- **DNA has to be copied before a cell divides**
 - **Each daughter cell needs a complete genome**
- **DNA is copied during the S or synthesis phase of interphase**
- **New cells will need identical DNA strands**

SYNTHESIS PHASE (S PHASE)

- **S phase during interphase of the cell cycle**
- **Nucleus of eukaryotes**

DNA replication takes place in the S phase.



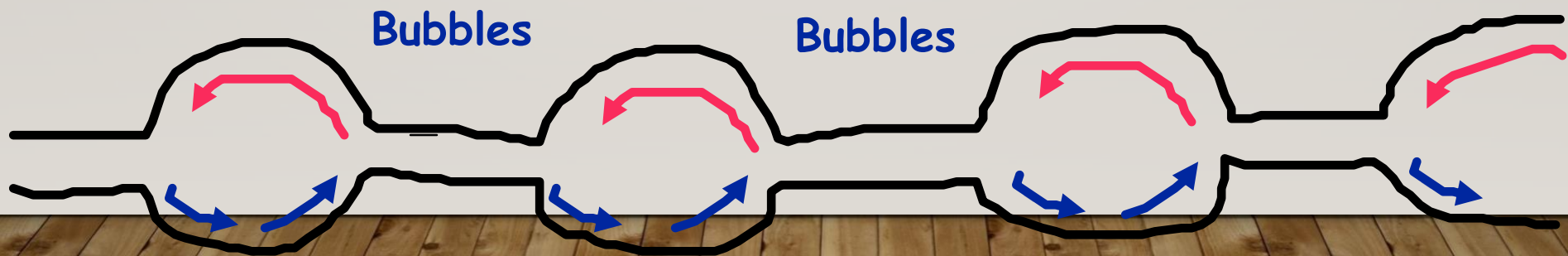
DNA REPLICATION

- **Begins at Origins of Replication**
- **Two strands open forming Replication Forks (Y-shaped region)**
- **New strands grow at the forks**



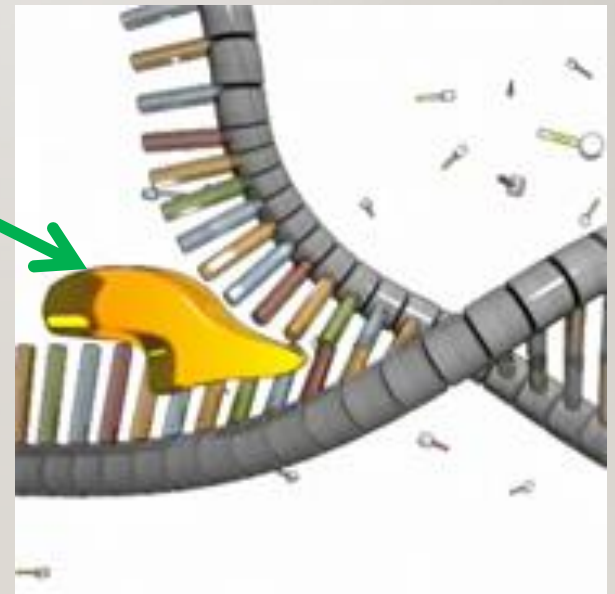
DNA REPLICATION

- As the 2 DNA strands open at the origin,
Replication Bubbles form
- **Prokaryotes** (bacteria) have a **single** bubble
- **Eukaryotic** chromosomes have **MANY**
bubbles



STEPS OF DNA REPLICATION

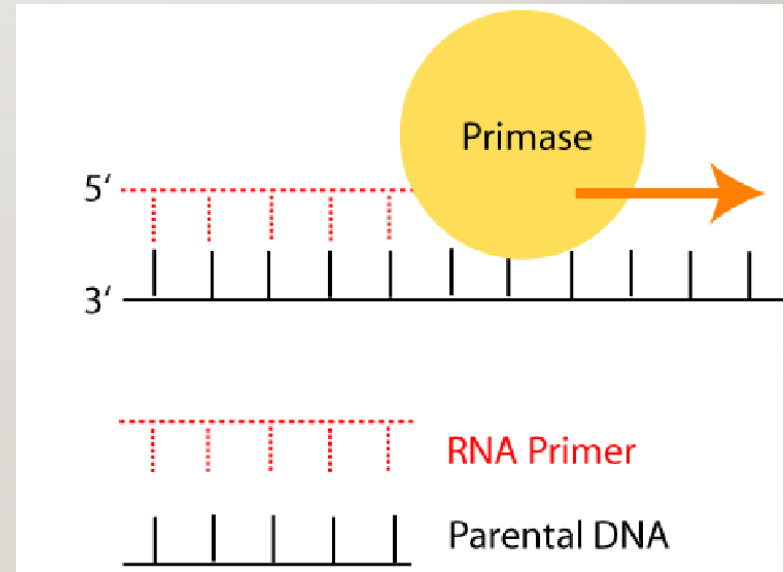
1) Enzyme Helicase
unwinds and
separates the 2
DNA strands by
breaking the **weak**
hydrogen bonds



STEPS OF DNA REPLICATION

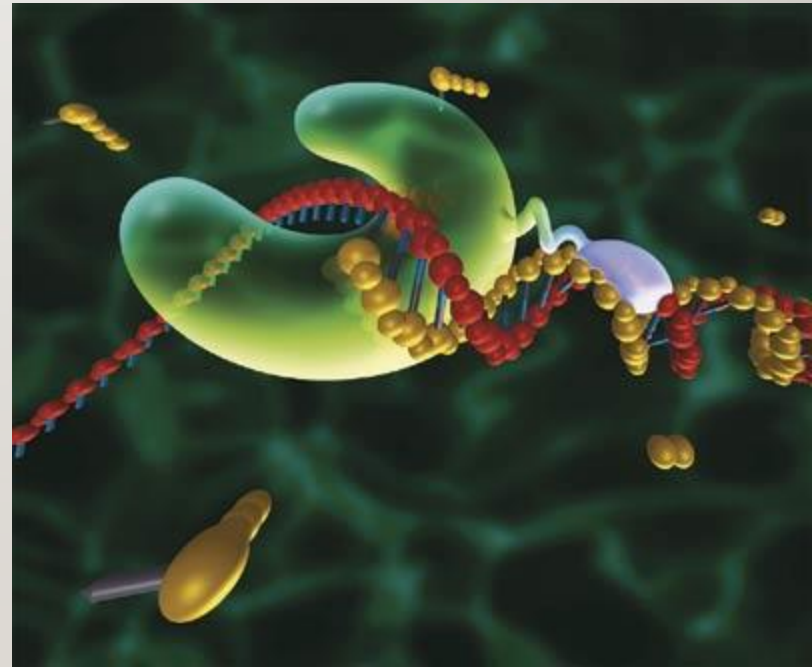
2) **Primase** gathers **nucleotides** and brings them into the replication fork.

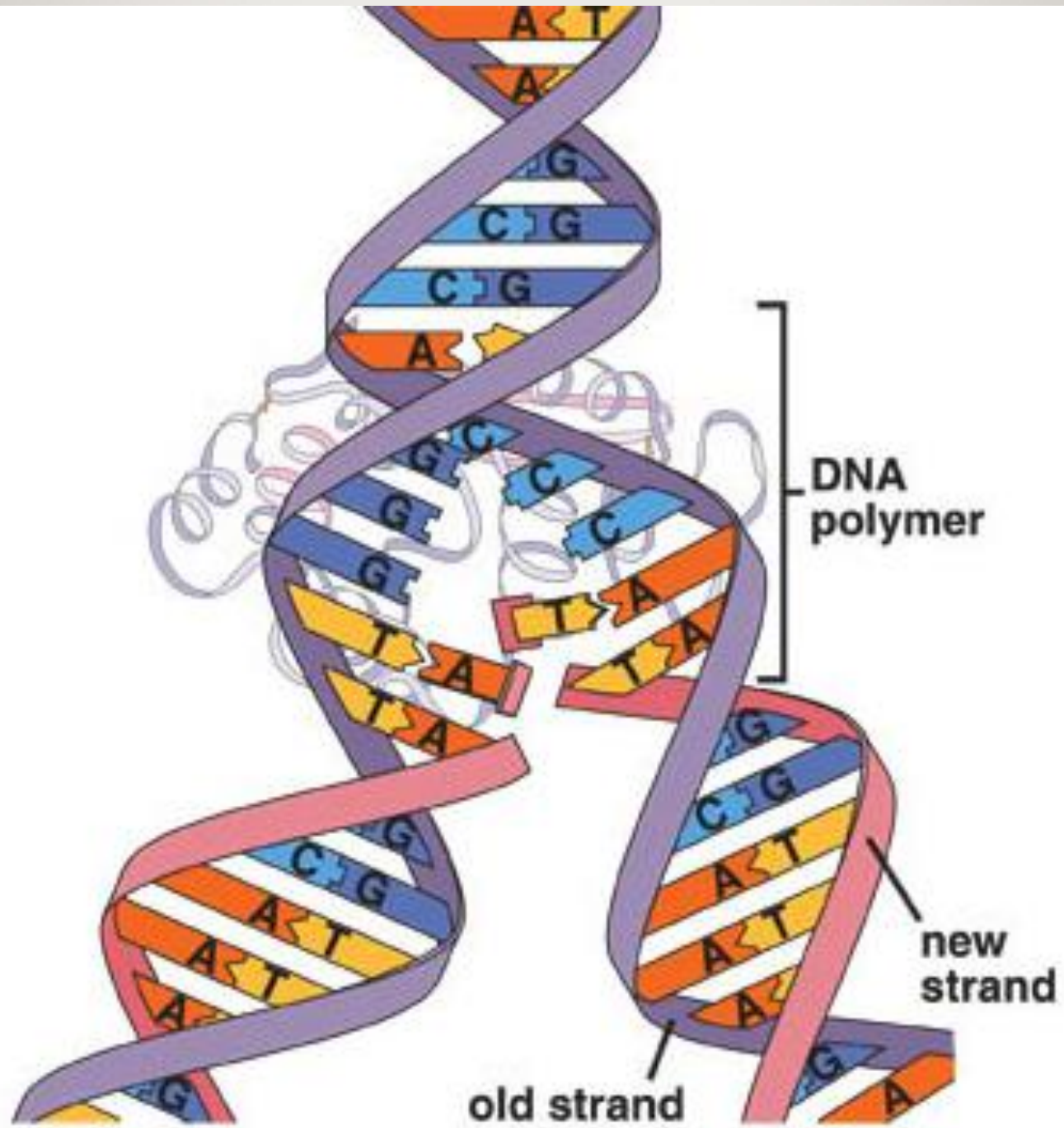
A “**primer**” is created to start the new strand.

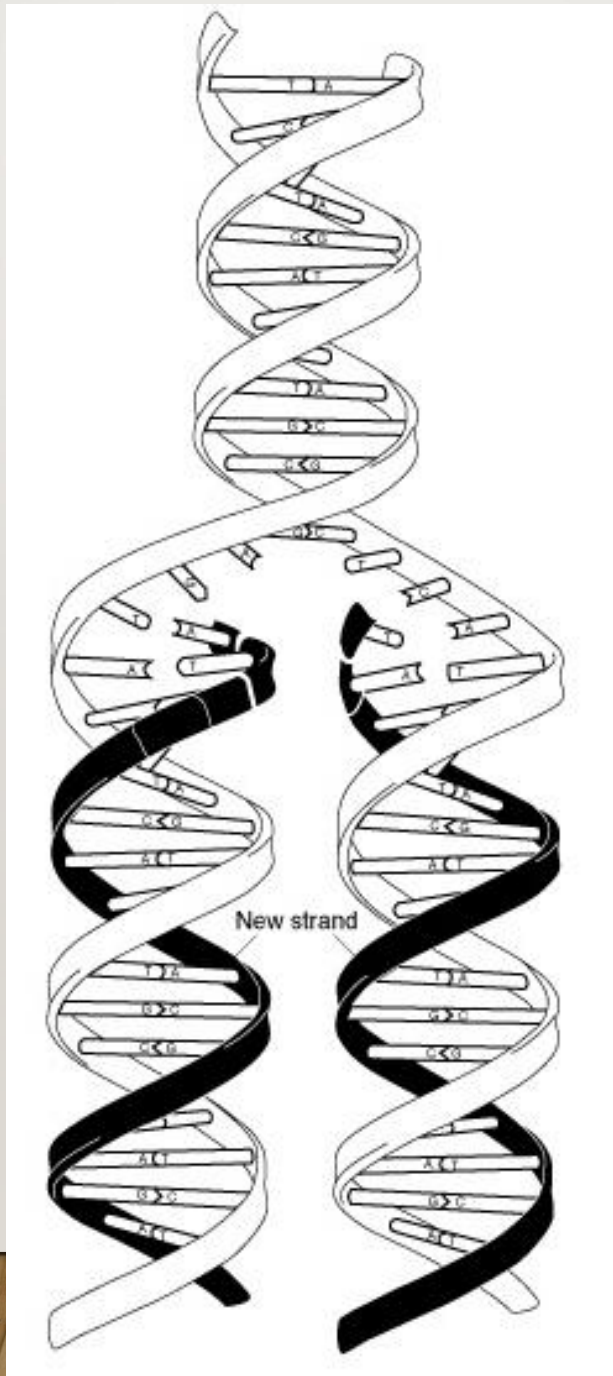


STEPS OF DNA REPLICATION

3) The enzyme **DNA Polymerase** matches free nucleotides with the correct base pairs on the **template (parent) strands**.





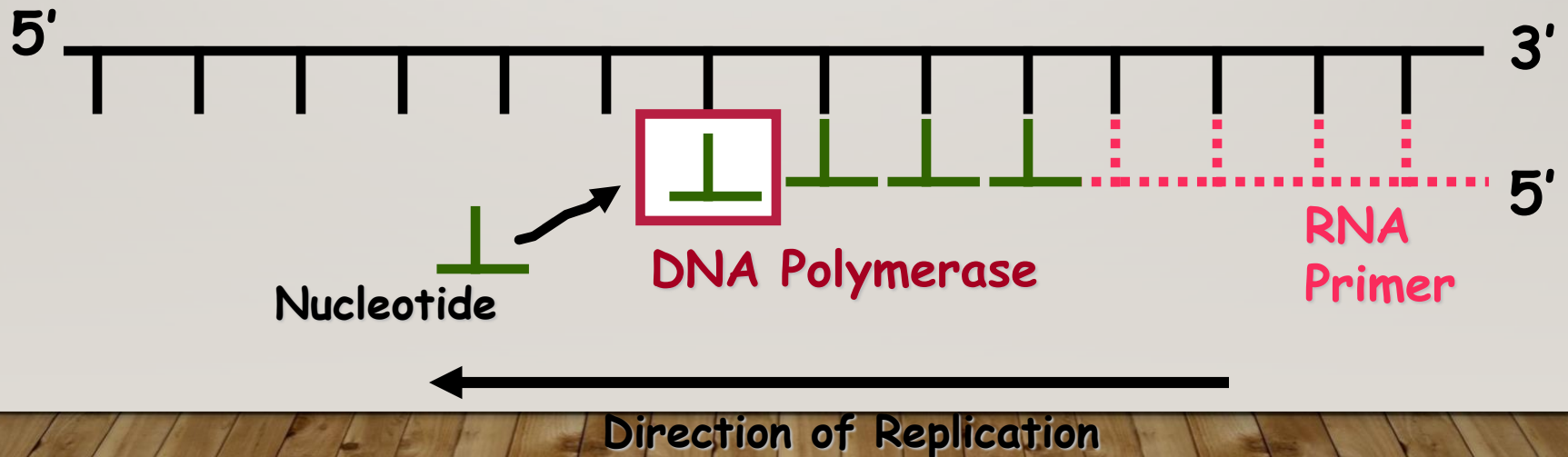


STEPS OF DNA REPLICATION

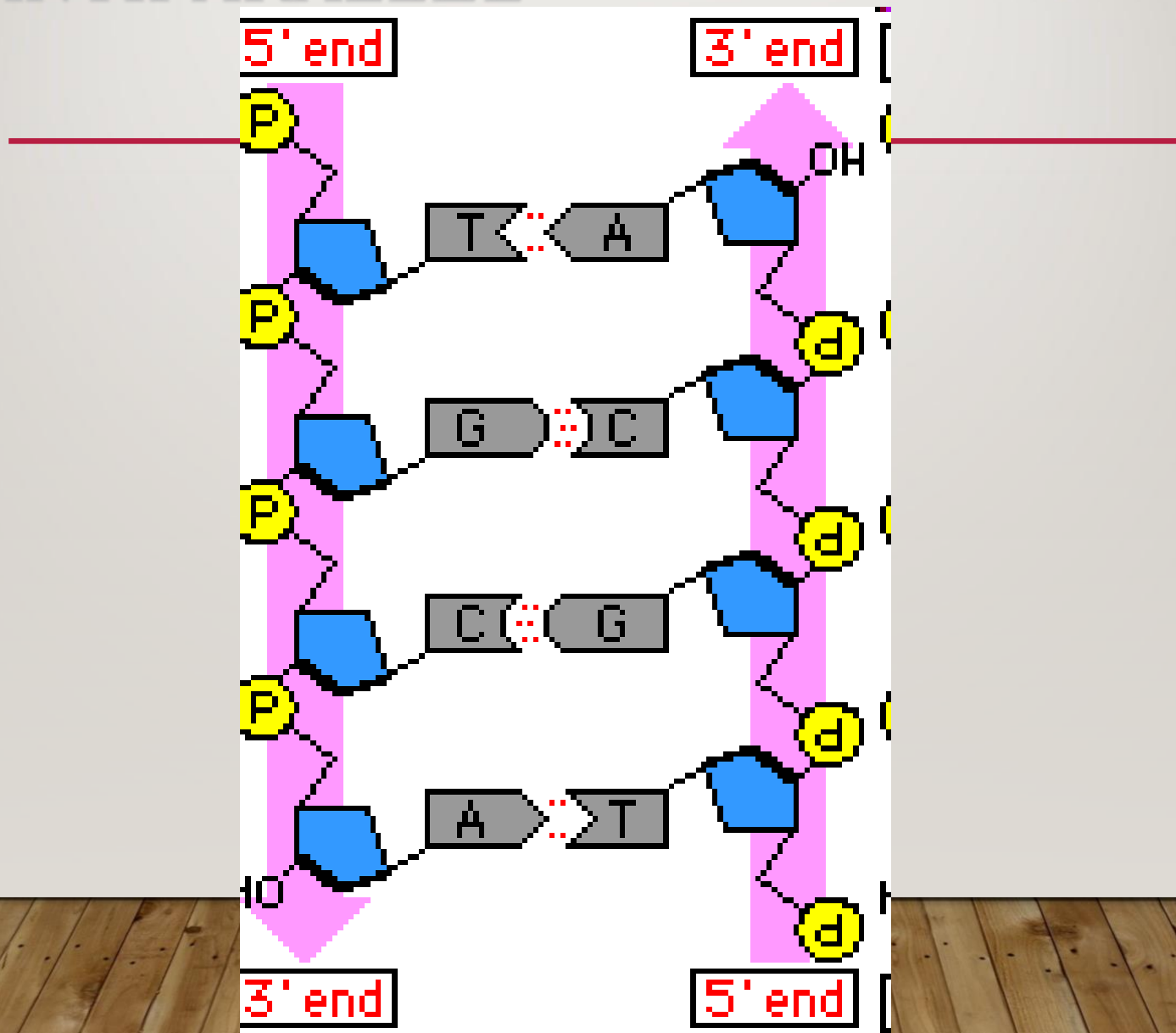
4) The enzyme **ligase** connects any “breaks” in the new strands and the 2 new strands **rewind** back together.

The Big Question: Why are there “breaks” in the new strands at all?!

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- **DNA polymerase** can only add nucleotides to the **3' end** of the DNA
 - This causes the **NEW** strand to be built in a **5' to 3' direction**

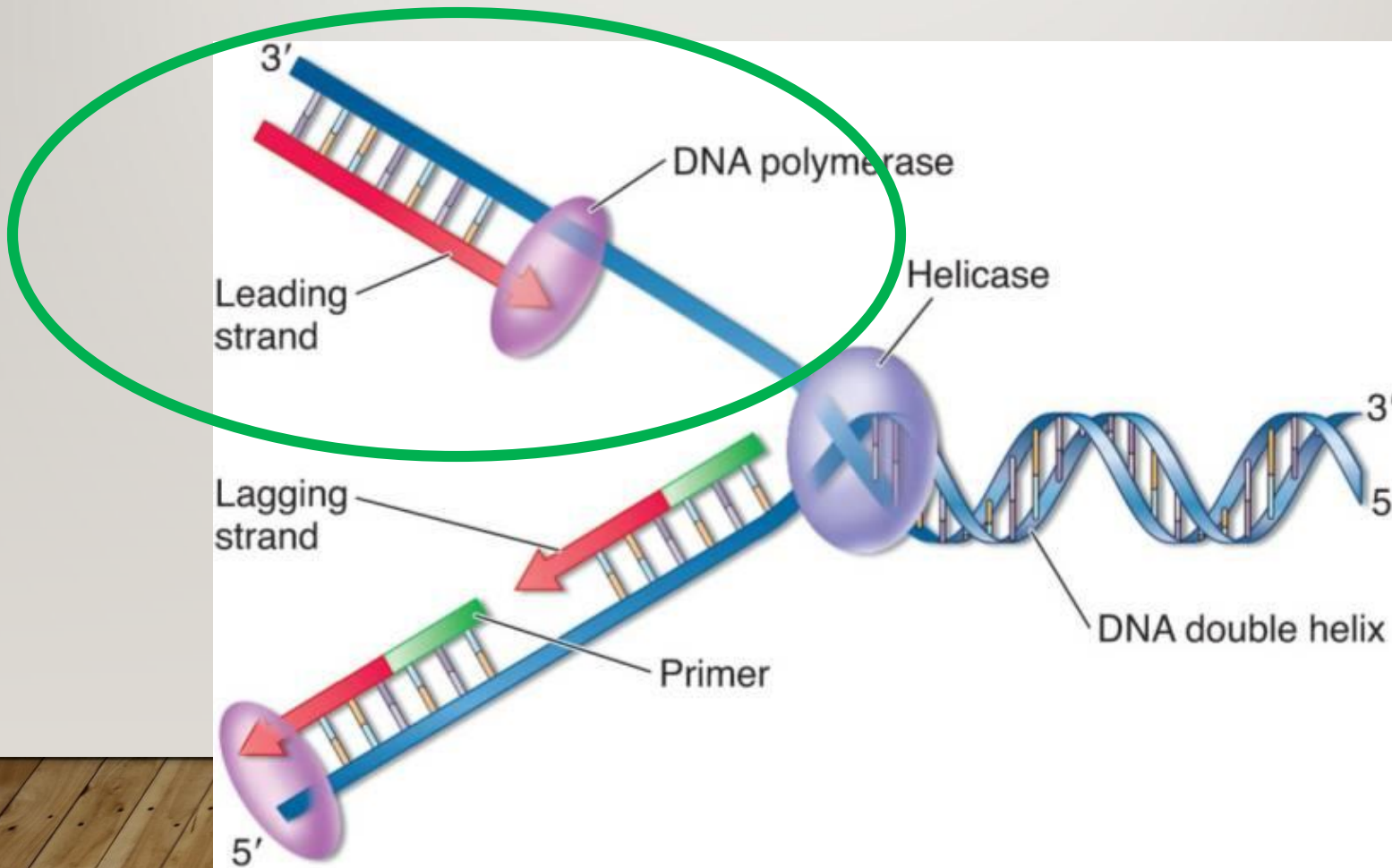


REMEMBER THE STRANDS ARE ANTIPARALLEL



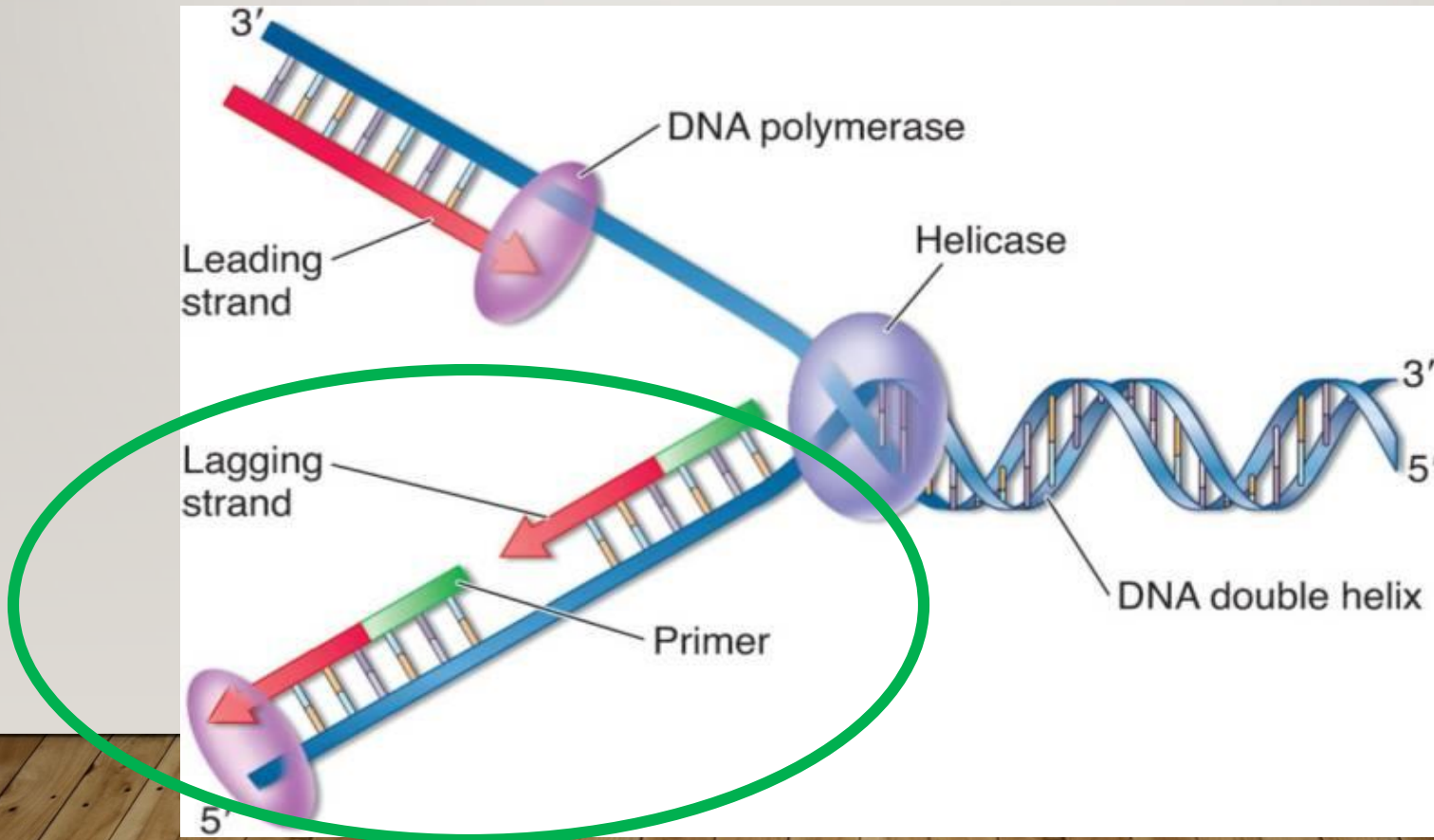
MAKING NEW DNA STRANDS

- The **Leading Strand** is built into the replication fork
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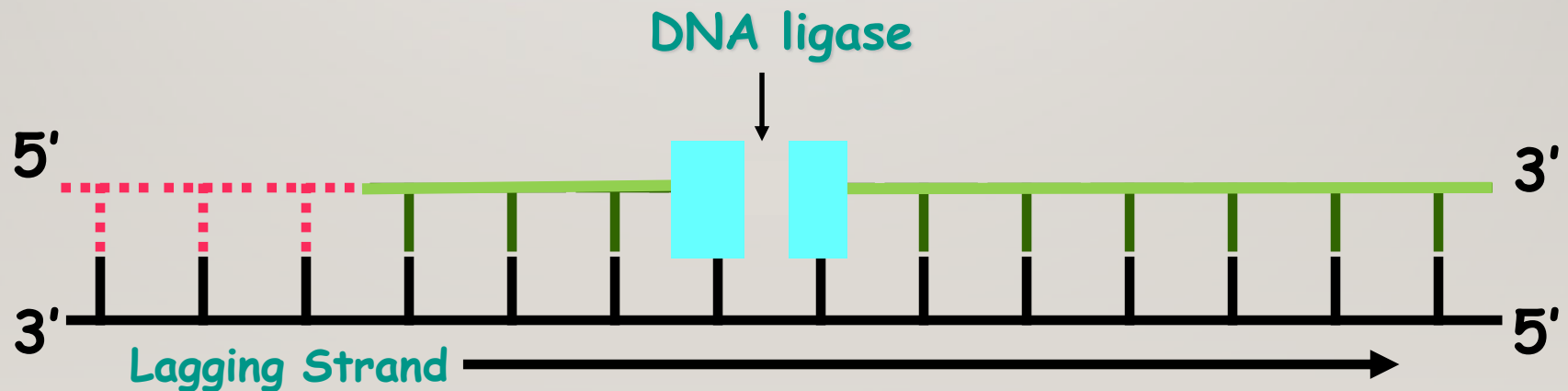
- The **Lagging Strand** is built in short sections in the opposite direction (out of the fork)

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- This causes the **“breaks”** in the strand.



JOINING OF FRAGMENTS OF DNA

- The enzyme **Ligase** joins the sections together to make one strand



PROOFREADING NEW DNA

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- **DNA polymerase makes about 1 in 10,000 base pairing errors**
 - **Enzymes proofread and correct these mistakes**
 - **The new error rate for DNA that has been proofread is 1 in 1 billion base pairing errors**

DNA DAMAGE & REPAIR

Chemicals & ultraviolet (UV) radiation

damage the DNA in our body cells

Types of Repair:

- 1) Excision repair** – when a repair enzyme removes damaged DNA
- 2) DNA polymerase and ligase** work together to replace and bond the new nucleotides together



DRAWING DNA REPLICATION

- Use the notes taken in class (the gray box) to illustrate the process of DNA replication. You need to show:
 - The enzymes involved (helicase, ligase, primase, polymerase)
 - The original DNA molecule being unzipped (identify 5' and 3' on each)
 - The new DNA strands (lagging and leading) being built (be sure to build in the correct direction)
 - Nucleotides being dropped off at the replication fork (primase)
 - Label **all** bases shown! Color code them as well

