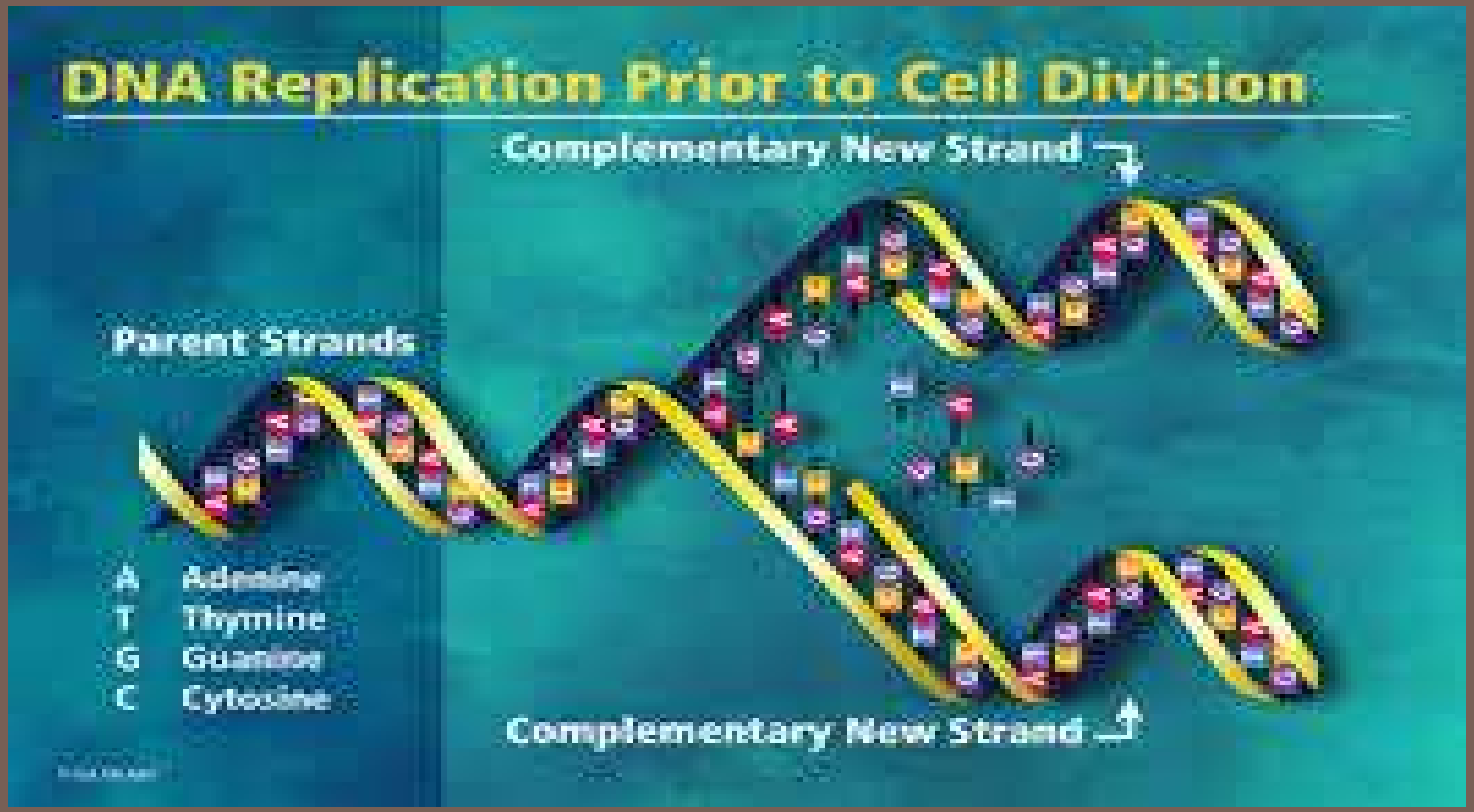
Warm-Up

- The DNA of all organisms contains the same 4 bases. What are those 4 bases and their base pairing rules?
- What are nucleotides?
- The shape of DNA is described as what? What molecules make up DNA?

Warm 10-27

- ☐ Explain the function of DNA replication
- ☐ Explain how DNA serves as its own template during replication



8.3 DNA REPLICATION

Why and when does DNA replication occur?

- Replication occurs when new cells are formed

1. During development of an organism during conception
2. Growth of an organism—infant, puberty, adulthood
3. Replacement of damaged tissue

- Replication occurs in the nucleus of the cell and occurs right before mitosis (cell division).

Replication Copies the Genetic Information

- Every time a cell divides, DNA must first be copied
- Remember the rules of base pairing: A pairs only with T, G pairs only with C
  - If one strand of the double helix is known, then so is the other
  - What would be to complement strand to AACTGCGATTCGTAGCGGTTTT?
    - This means one strand can be used as a template to form the other

- Replication assures that every cell has a complete set of identical genetic information

- This is why forensic scientists or crime scene investigators can identify people based off just a strand of a hair, a drop of blood or a tossed away coffee cup

Proteins Carry Out the Process of Replication

- Enzymes and proteins (*employees) do all the work when it comes to replicating DNA
- DNA's only job is store information and give instructions (*Boss)

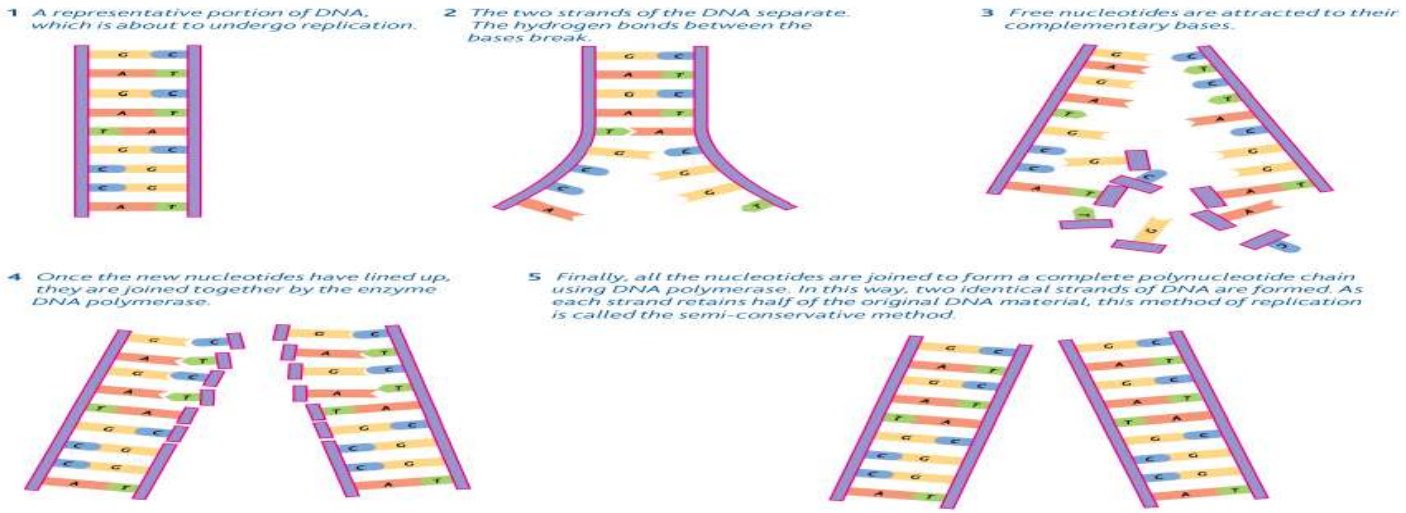
The Replication Process

1. Enzyme called DNA Helicase unzips the double helix
   - The hydrogen bonds are broken and bases are exposed
   - Where it begins to unzip is called the origin of replication

The Replication Process

2. free-floating nucleotides pair one by one with the newly exposed bases

DNA polymerase links the nucleotides together.



The Replication Process

3. Two identical molecules of DNA result. Each molecule has one original strand and one new strand.
   - For this reason, replication is considered semi-conservative
   - replication video
   - watch replication occur

Replication is Fast and Accurate

- In humans, 50 nucleotides are added every second to a new strand of DNA
- Even at this rate it would take several days to replicate the whole molecule
  - This is why there are numerous origins of replication (hundreds along one molecule)
  - Only takes a couple of hours to replicate DNA this way

Proofreading for Accuracy

- Sometimes the wrong nucleotide gets added to a new strand of DNA
- DNA polymerase can detect errors, remove the incorrect nucleotide and add the right one
  - In this way, replication errors are limited to about 1 per 1 billion nucleotides

Questions

1. How does replication ensure that cells have complete sets of DNA? (Think about cells needing to divide)
2. In step 1, how does the DNA unzip?
3. In step 2, how do the new strands compare with the template strands?
4. What enzyme is important in step 2?
5. How does step 3 of replication show that DNA acts as a template?
6. What is the result of DNA replication?
7. Why is it important for the cell to correct any errors that occur during replication?
8. Why does a cell need to replicate it's DNA quickly?