



DNA

Biology
Book Ch 8
Standard 4

History and Structure of DNA

Chapter 8.1 pg 226-229

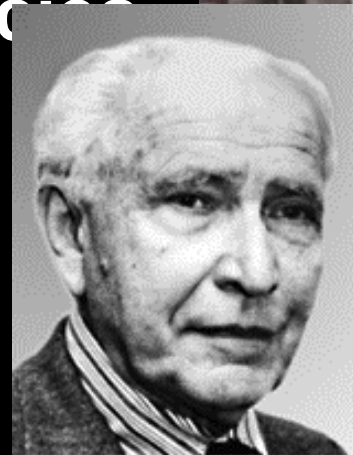
1. Hershey & Chase → proved DNA is the genetic material found in cells



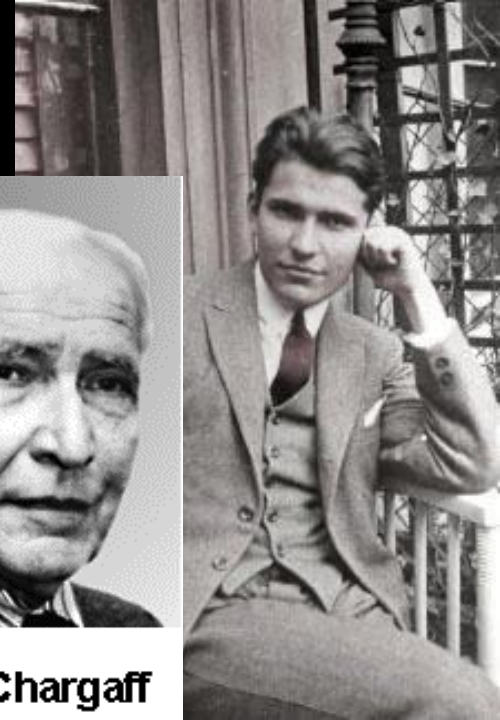
Erwin Chargaff

DNA composition

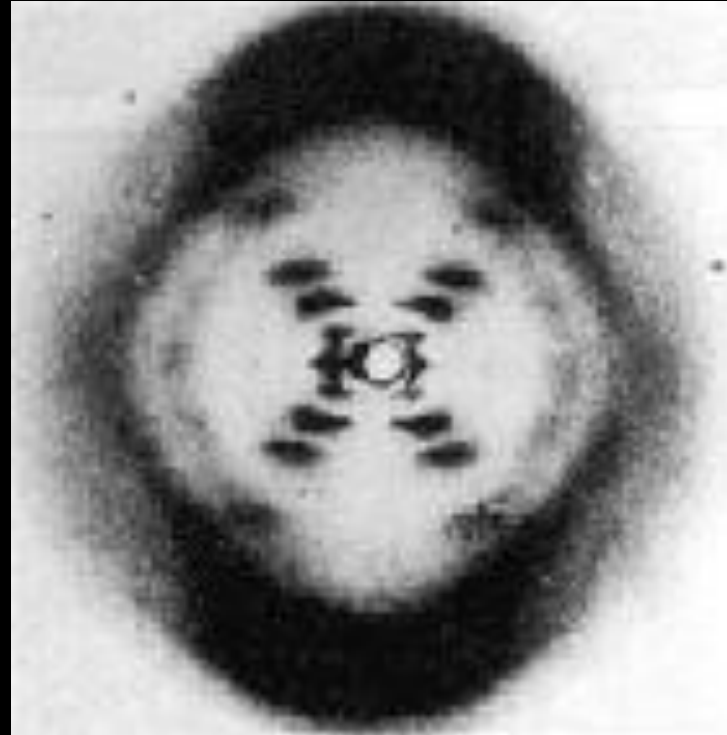
- all 4 bases (Chemicals) not in equal quantity
- bases present in characteristic ratio
 - $A = T \sim 40\%$
 - $G = C \sim 60\%$
- varies from species to species



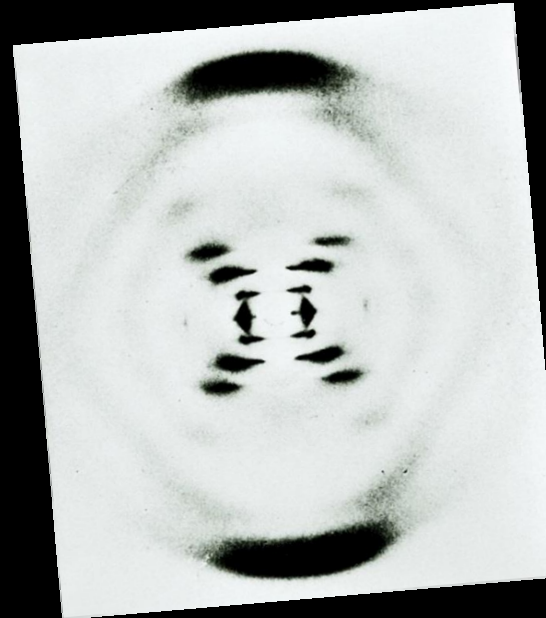
Erwin Chargaff



Rosalind Franklin → took x-ray photos of DNA that showed it's 3-D structure



- Rosalind Franklin
- Watson and Crick's discovery built on the work of Rosalind Franklin and Erwin Chargaff.
 - Franklin's x-ray images suggested that DNA was a double helix of even width.
 - Chargaff's rules stated that $A=T$ and $C=G$.

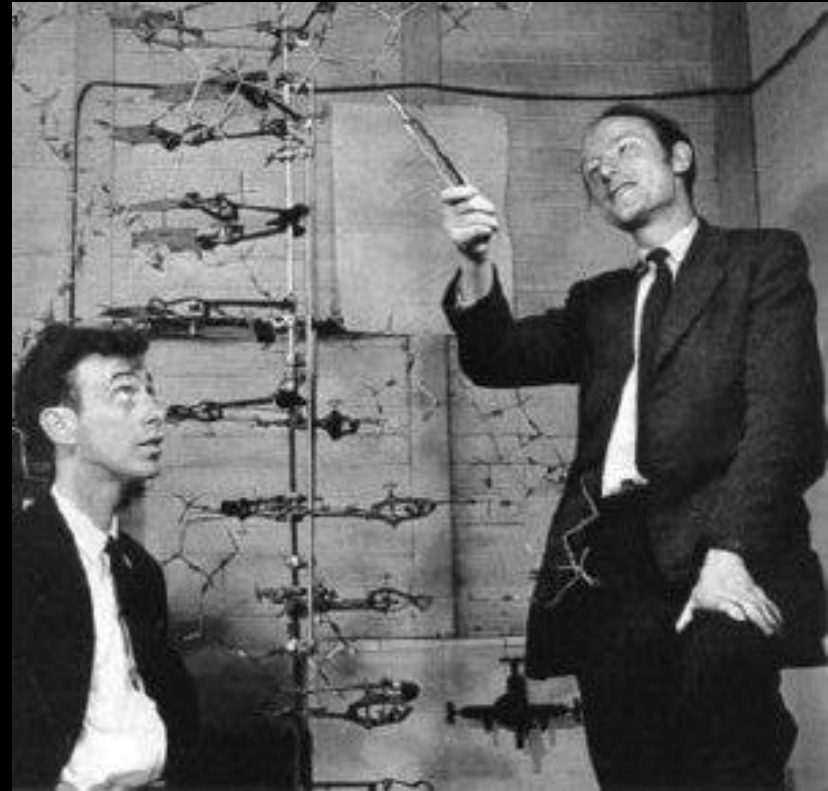


Watson & Crick

- made the first 3-D model of DNA in 1953
- Won the Nobel Prize in 1962

But.....they took information
From other scientist
Who figured out how
It was all organized!!!!!!

Who were the others?



Why is DNA important?

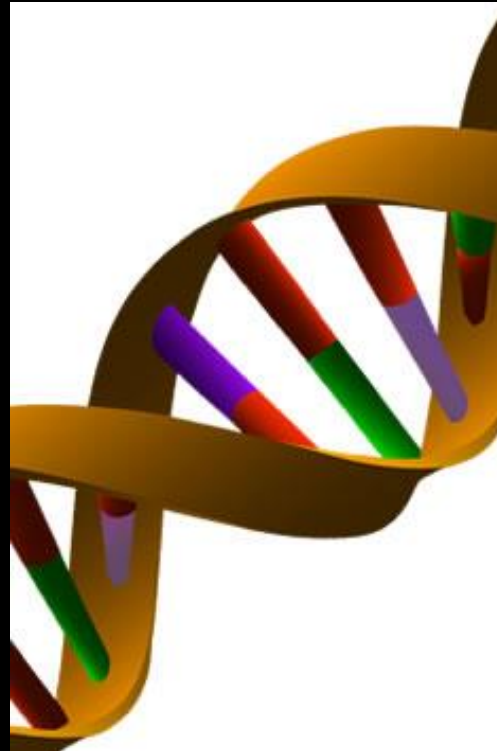
It stores genetic information in cells & this information is used to make proteins



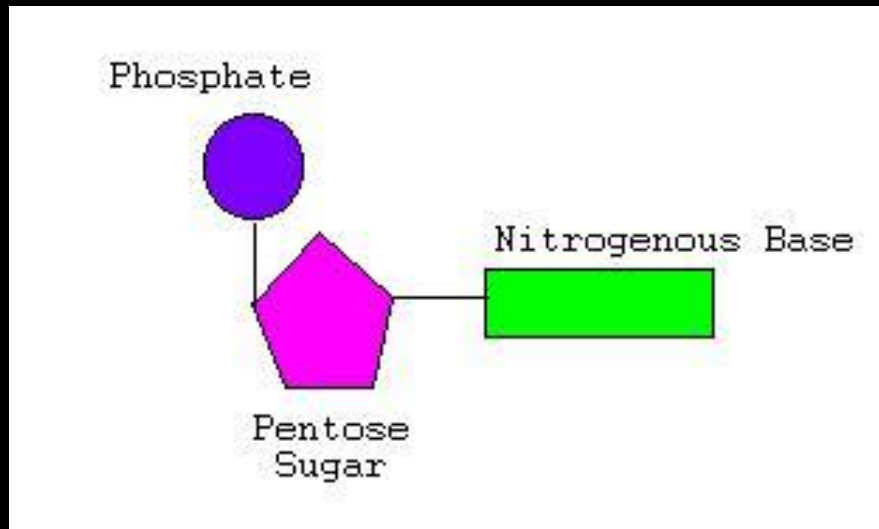
Chapter 8.2 pgs 230-233

DNA Structure

DNA is a double helix (twisted ladder)



DNA is made of nucleotides



3 nucleotide parts

1. Deoxyribose sugar

2. Phosphate

3. Nitrogen base

- *adenine (A)*

- *thymine (T)*

- *guanine (G)*

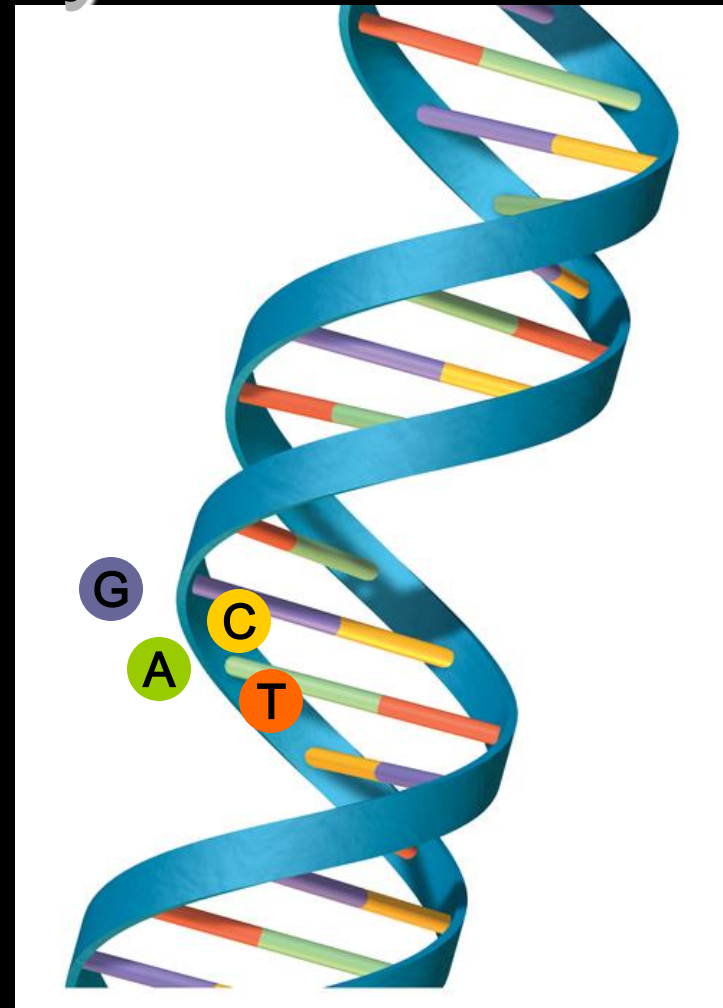
- *cytosine (C)*

Nucleotides always pair in the same way.

- base-pairing rules

A pairs with T
G pairs with C

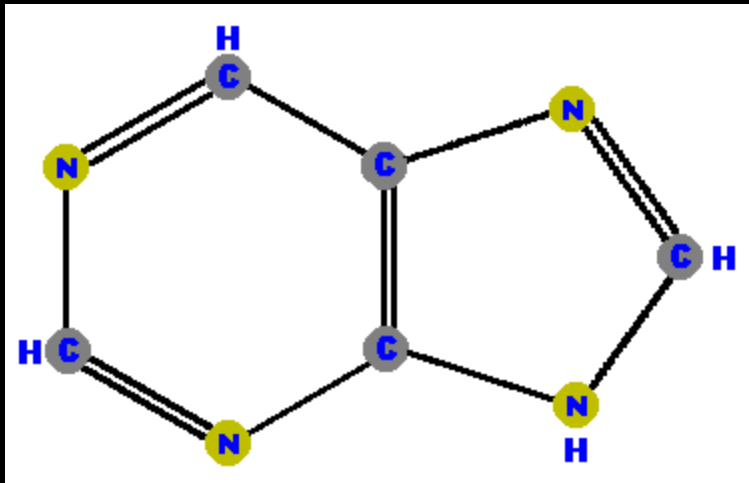
Purines with Pyrimidines
Double ring single ring



Close look at Base Pair Shape

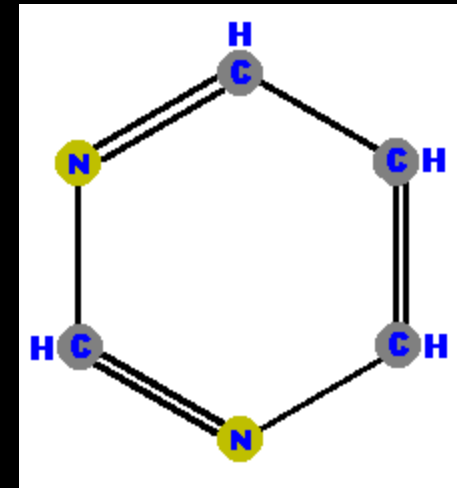
Purine

Double ring bases
(Adenine or Guanine)



Pyrimidine

Single ring bases
(Thymine or Cytosine)

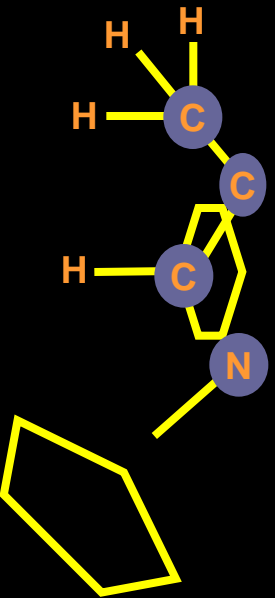


Difference in their shapes causes the DNA to twist

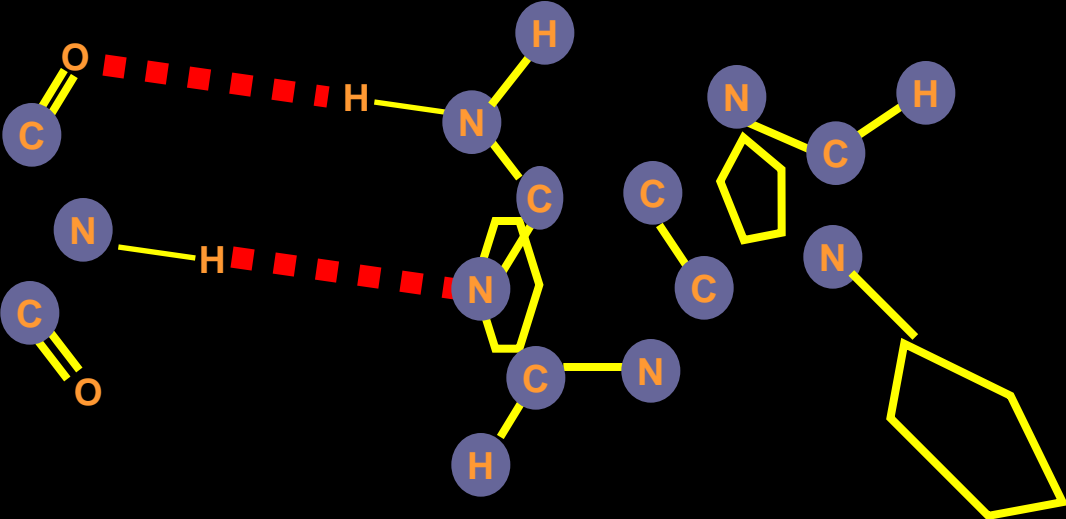
Each Base Pair is made of one Purine and one Pyrimidine

Hydrogen Bonds

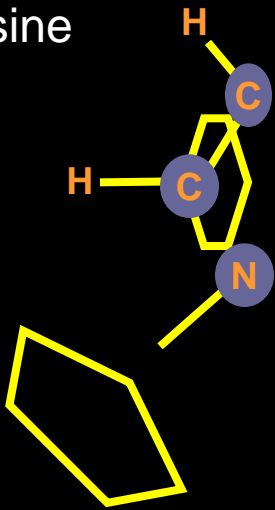
Thymine



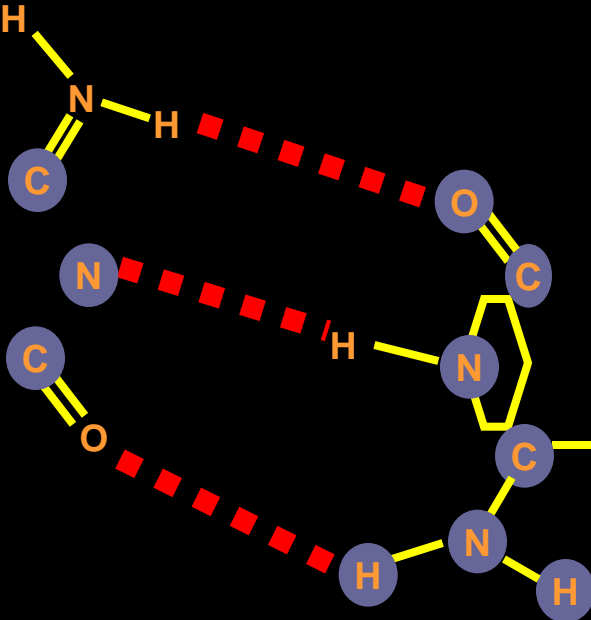
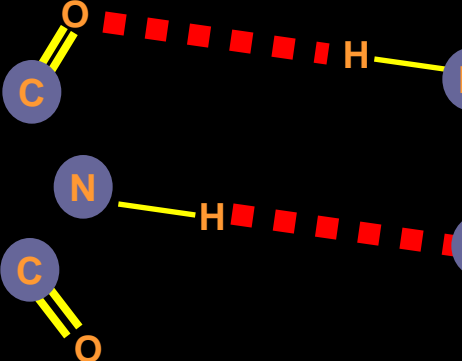
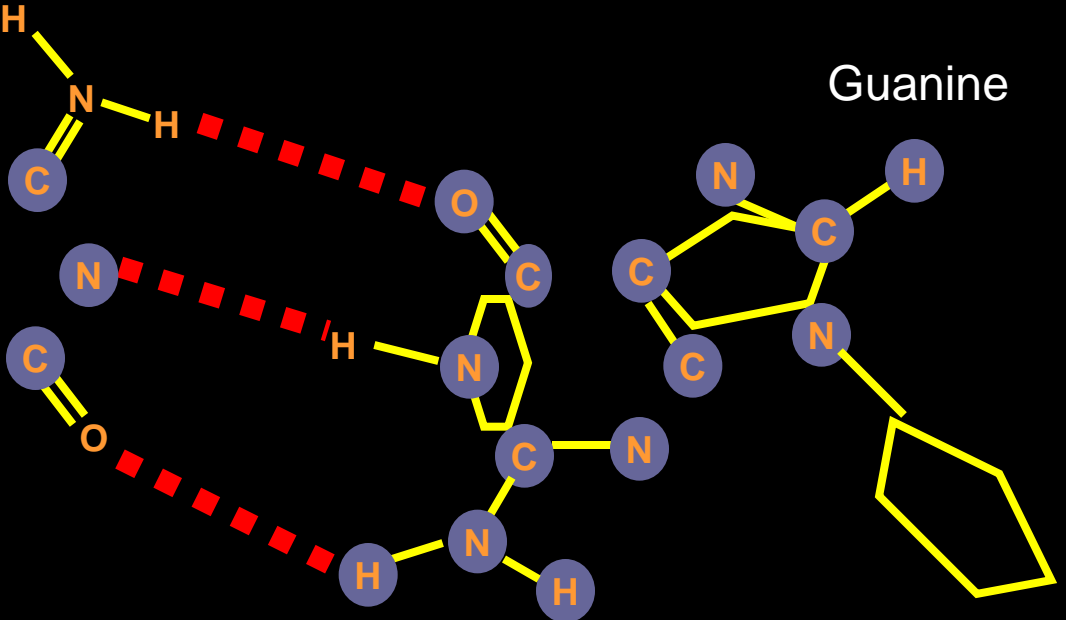
Adenine



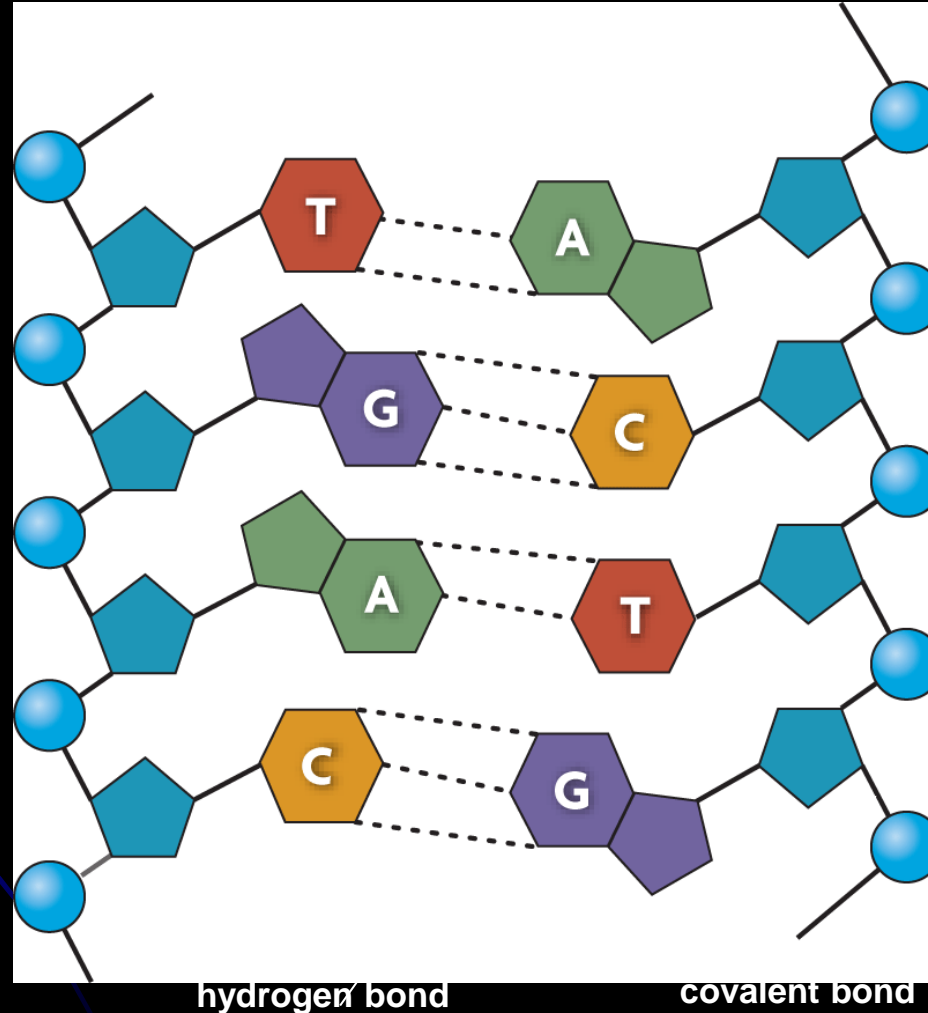
Cytosine



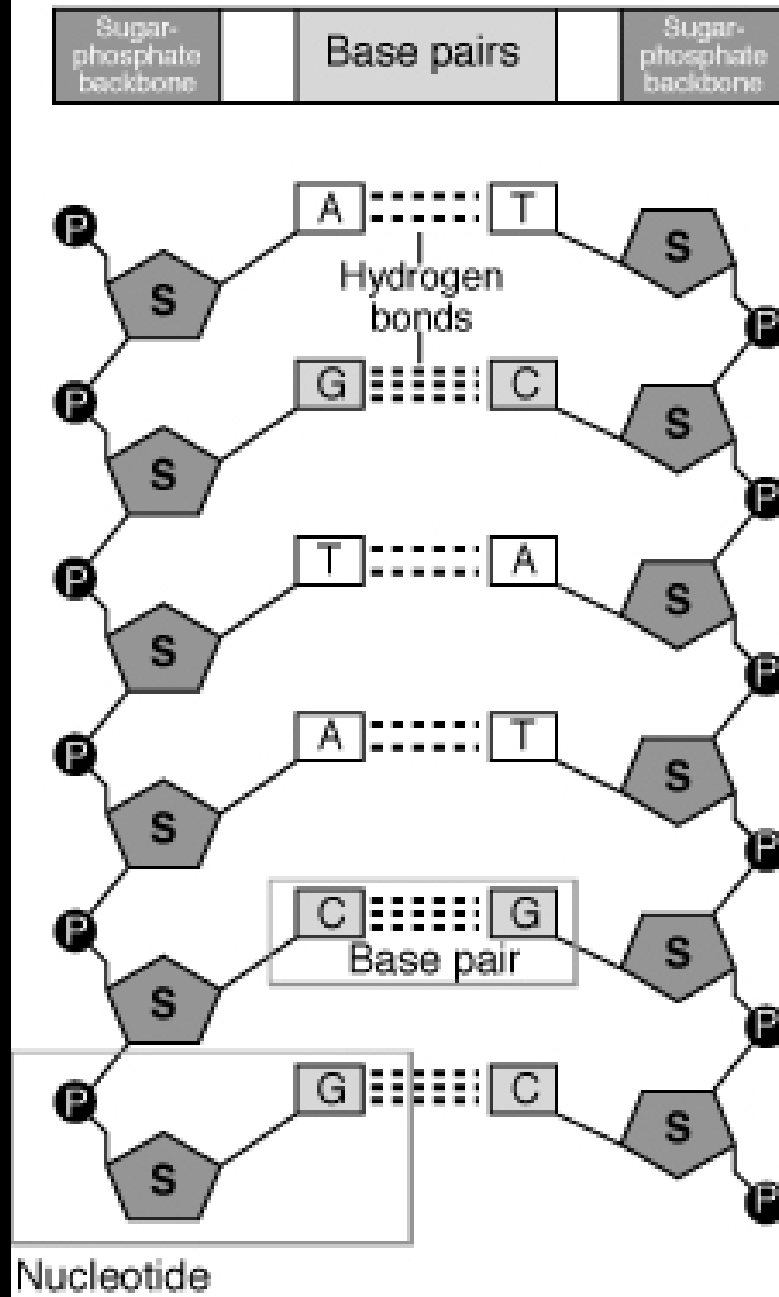
Guanine



- The backbone is connected by **covalent phosphodiester bonds**.
- The bases are connected by **hydrogen bonds**.



Deoxyribonucleic Acid (DNA)



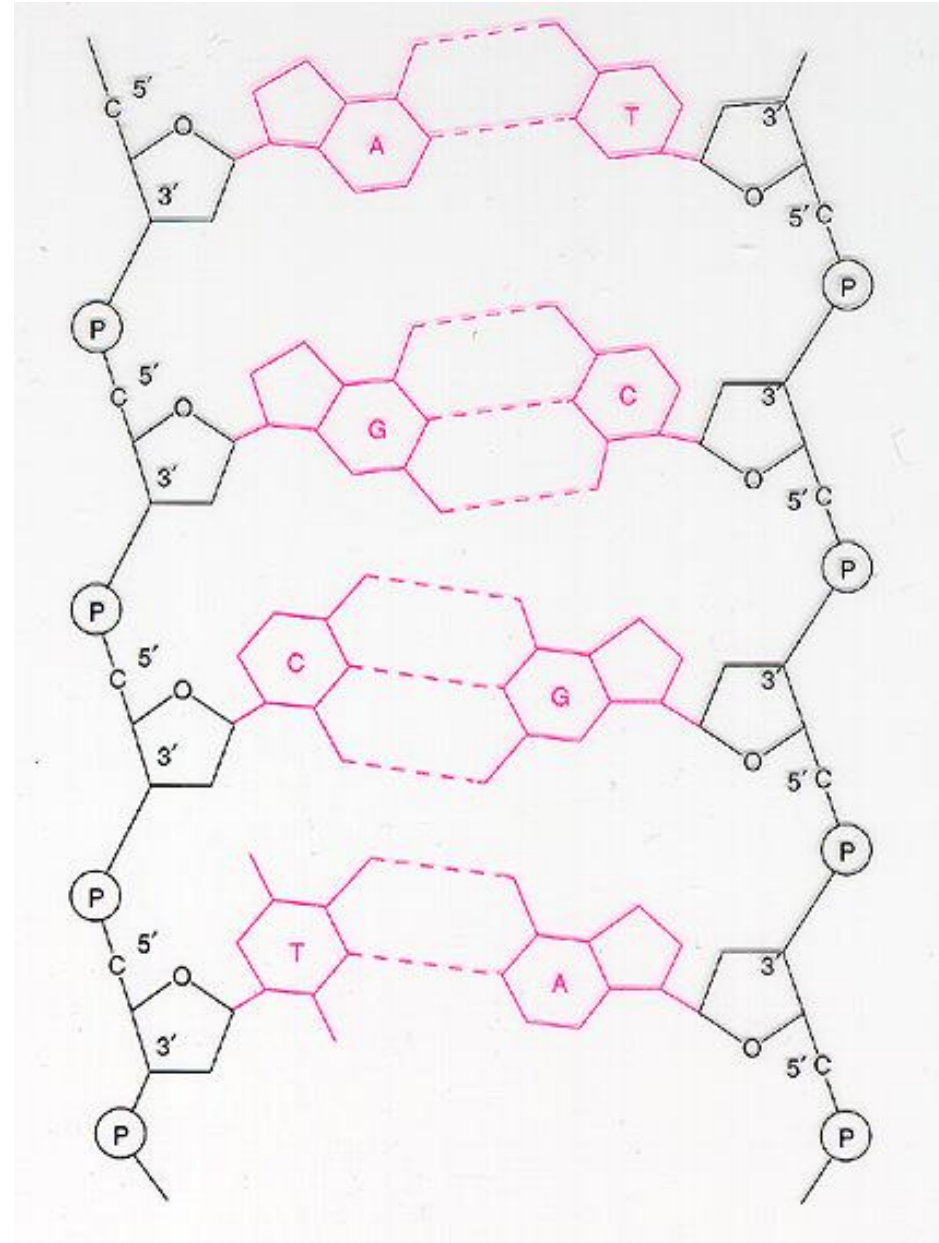
- **Deoxyribose Sugars & phosphates** make up the sides of the ladder
- **Phosphodiester bonds** hold the sugars to the phosphates
- **Nitrogen bases** are held together by **hydrogen bonds**
 - $A \rightarrow T = 2$ hydrogen bonds
 - $G \rightarrow C = 3$ hydrogen bonds
- The **Base pairs** make up the steps (rungs) of the DNA Ladder

Antiparallel DNA Strand

The two DNA strands are antiparallel to each other. Orientation of sugar and phosphate molecules in one DNA strand is opposite to sugar and phosphate molecules in the second DNA strand

<https://www.youtube.com/watch?v=qy8dk5iS1f0>

https://www.youtube.com/watch?v=BmDG_fKUTR8



Practice

If one side of DNA has this base sequence, what does the other side have?

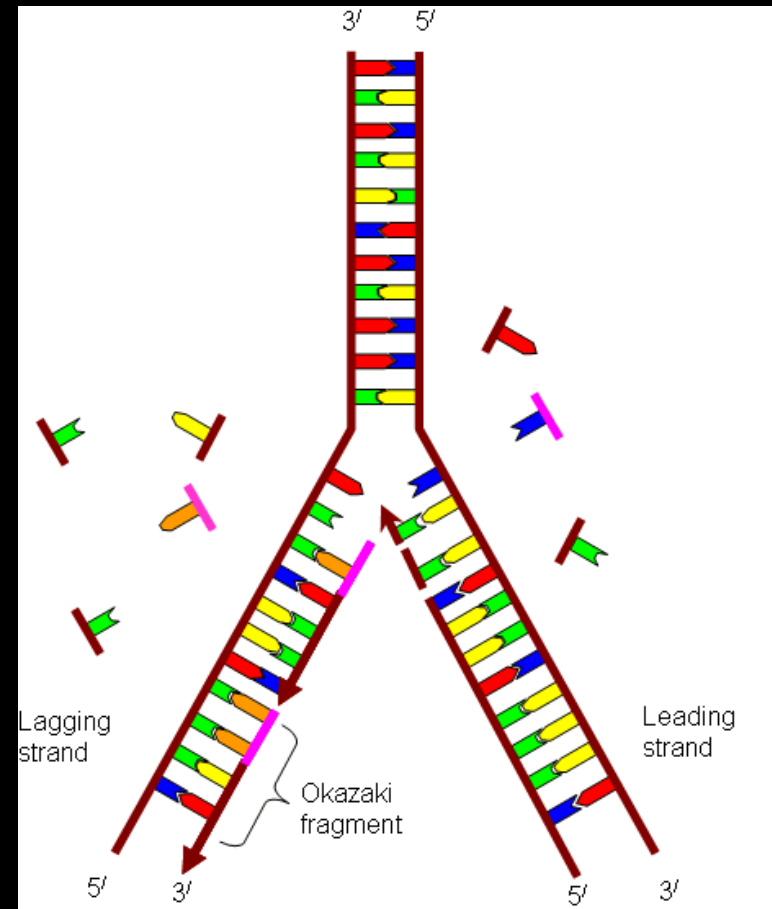
A T G G A C T A C
T A C C T G A T G

Vocabulary for Chapter 8.1 lecture:

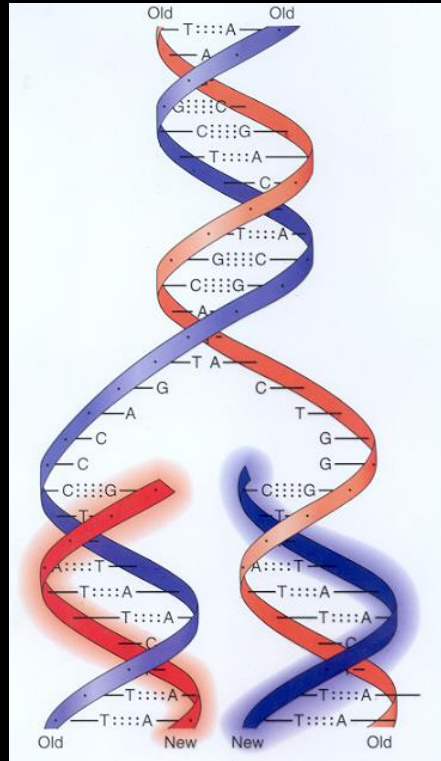
- DNA
- Hershey and Chase
- Edwin Chargaff
- Adenine
- Thymine
- Guanine
- Cytosine
- Franklin
- Watson & Crick
- Double Helix
- Nucleotides
- Pentose sugar
- Purine
- Pyrimidine
- Hydrogen bond
- Covalent bond
- Phosphodiester bond
- Antiparallel
- 5' and 3'

Chapter 8.2 pgs 235-238

DNA Replication



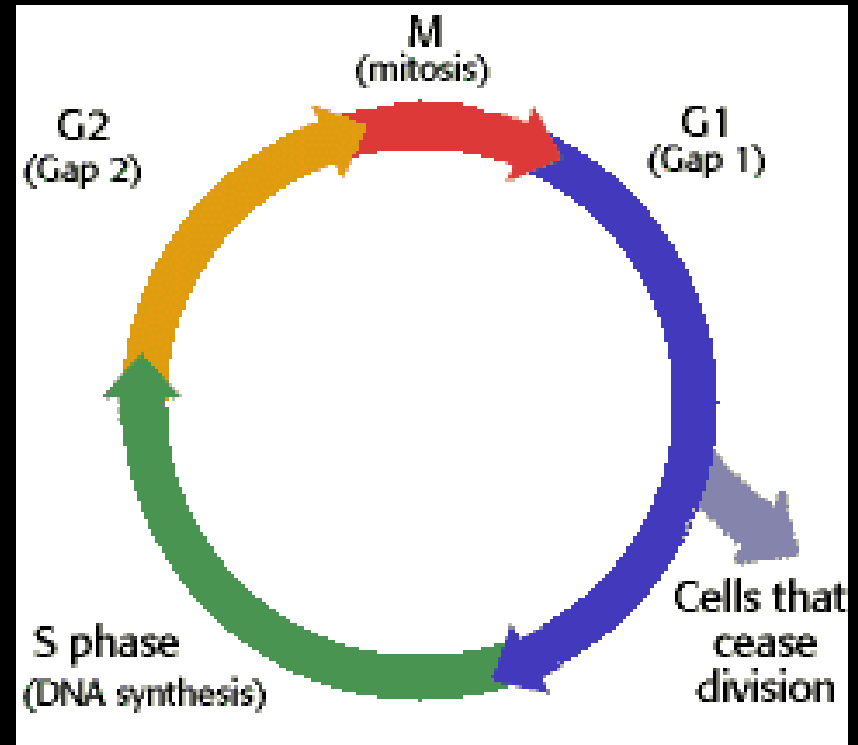
Why does DNA replicate?



So new cells
will have their
own copy of DNA

When does DNA replicate?

- During the cell cycle before mitosis & meiosis



How Does DNA Replicate ?

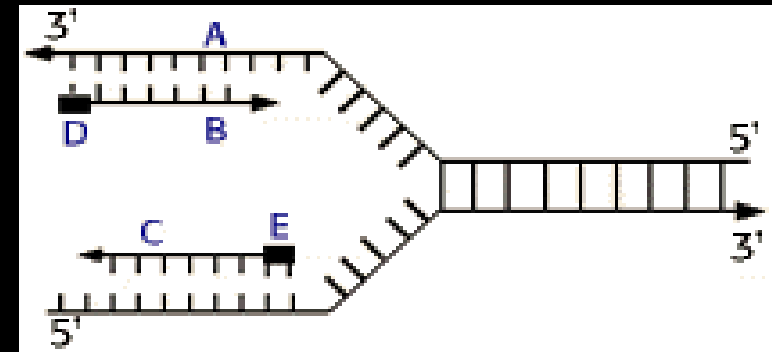
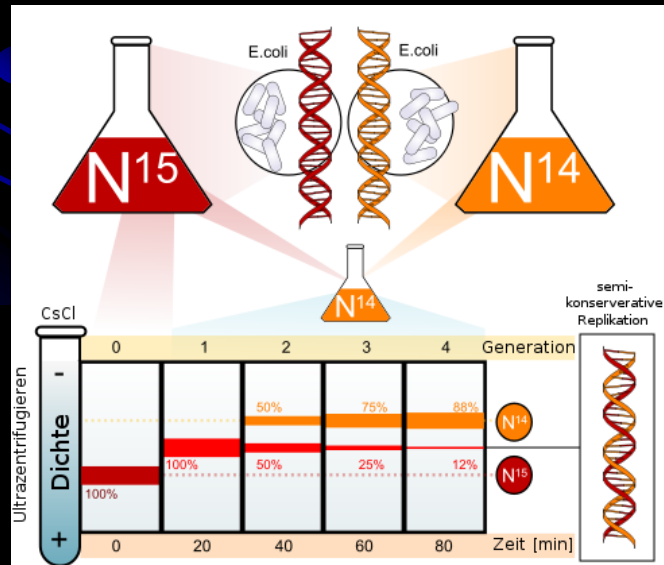
Process discovered by **Meselson & Stahl**

Semi-conservative replication

- ✓ Half old strand, Half new strand

Anti-parallel

- ✓ New strands are made in opposite directions

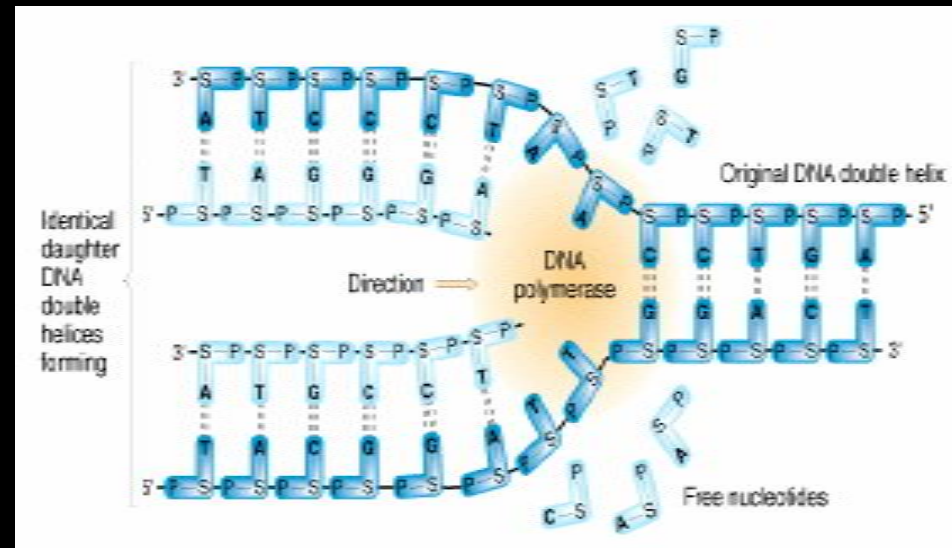


In eukaryotic chromosomes, DNA replication occurs at hundreds of places. Replication proceeds in both directions until each chromosome is completely copied.

The sites where separation and replication occur are called replication forks.

Six Steps of DNA Replication

- 1) DNA is unzipped by the Helicase enzyme (breaks hydrogen bond) DNA unzips!
- 2) DNA polymerase enzyme binds DNA and begins attaching complimentary nucleotides
- 3) Same thing happens on the other side, but in opposite direction



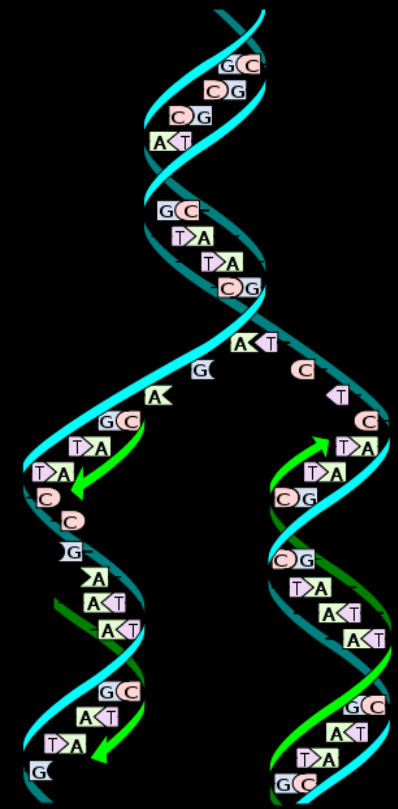
4) Bonds Reform

→ reforms Hydrogen bonds
reform(between bases)

→ Ligase enzyme reforms
Phosphodiester bonds
(sugar & phosphate)

5) DNA polymerase "proofreads"
checking each strand for errors.

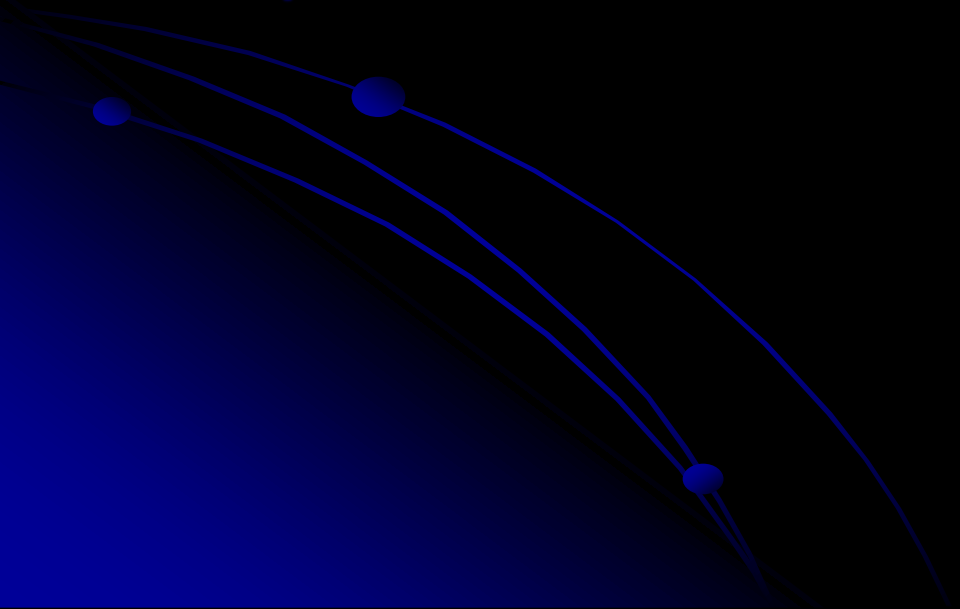
6) DNA rewinds itself into two
identical double helix strands

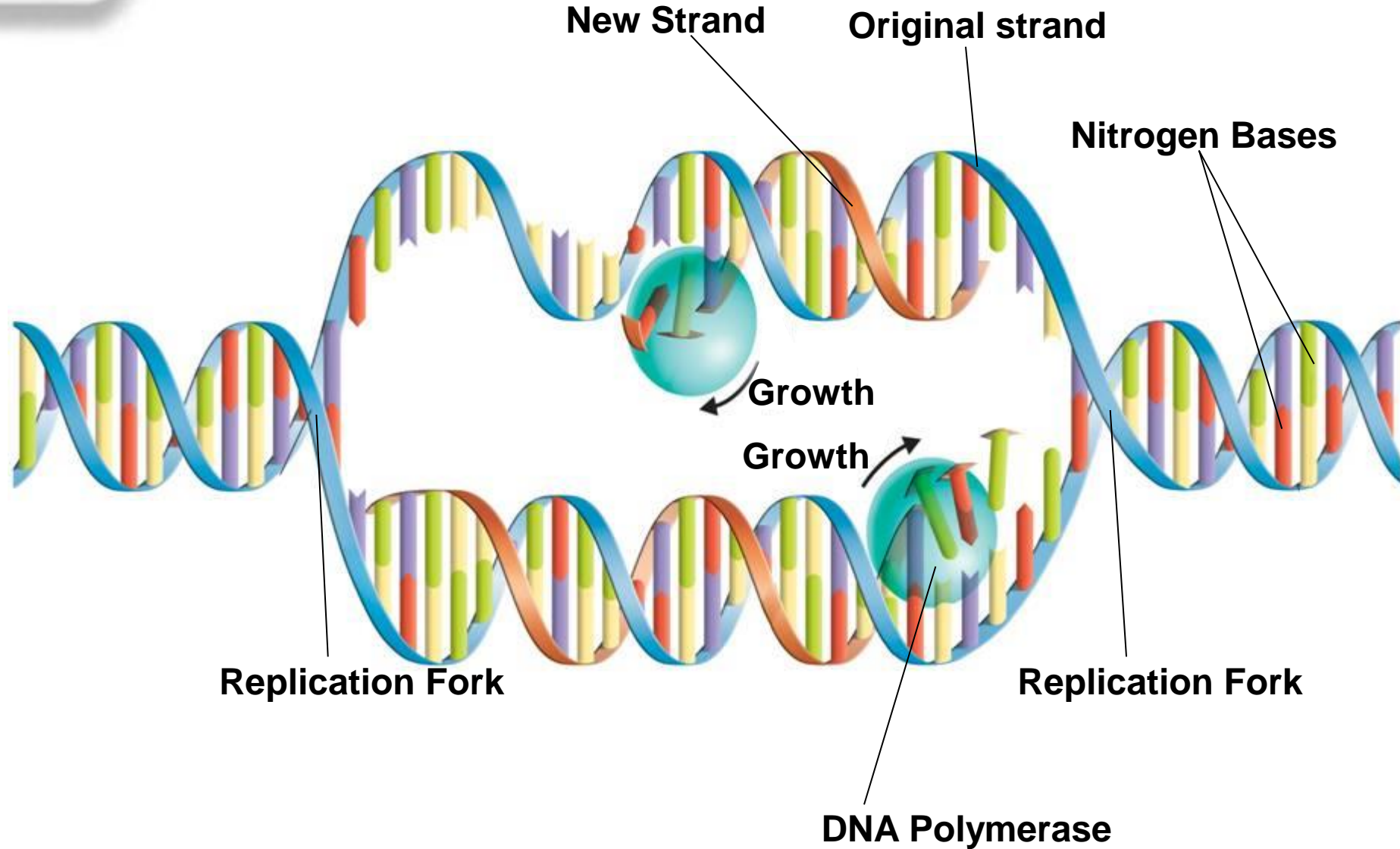


Let's watch

<https://www.youtube.com/watch?v=dKubyIRiN84>

http://www.classzone.com/cz/books/bio_07/resources/htmls/animated_biology/unit3/bio_ch08_0237_ab_dnarep.htm
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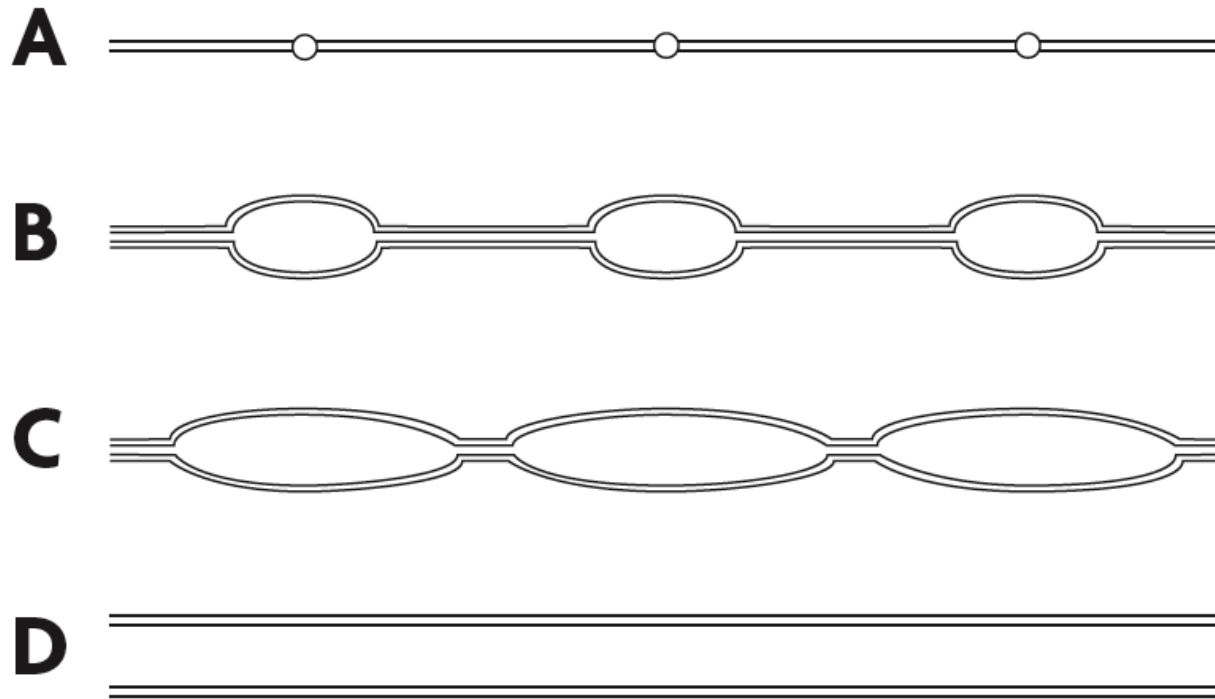




8.3 DNA Replication

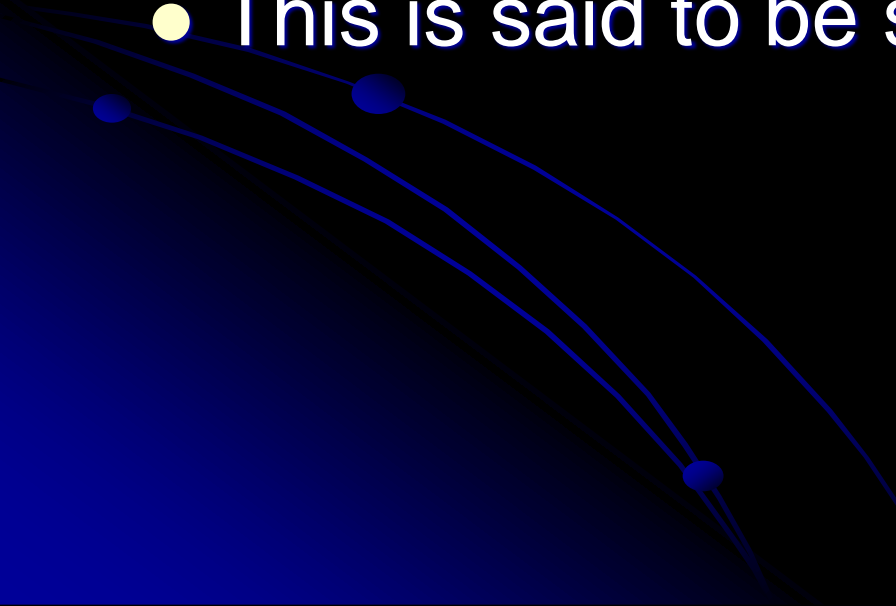
▶ Replication is fast and accurate.

- DNA replication starts at many points in eukaryotic chromosomes.



- DNA polymerases can find and correct errors.

Semi-conservative DNA Replication

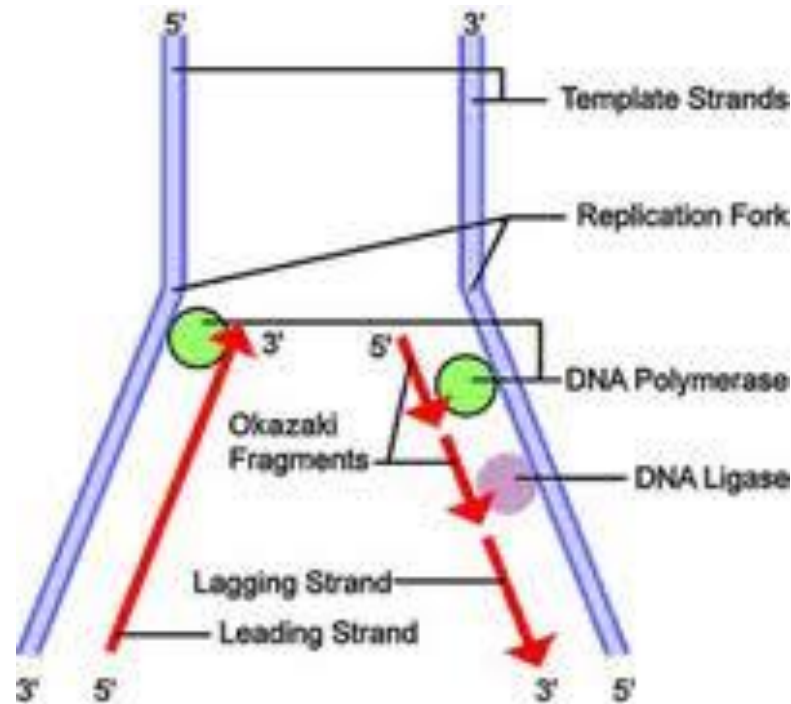
- One side of the DNA molecule is used as a template to create the new molecule of DNA.
 - This is true on BOTH sides.....you end up with 1 NEW and 1 OLD strand.
 - This is said to be semi-conserved
- 

The Principal enzyme is DNA Polymerase!!

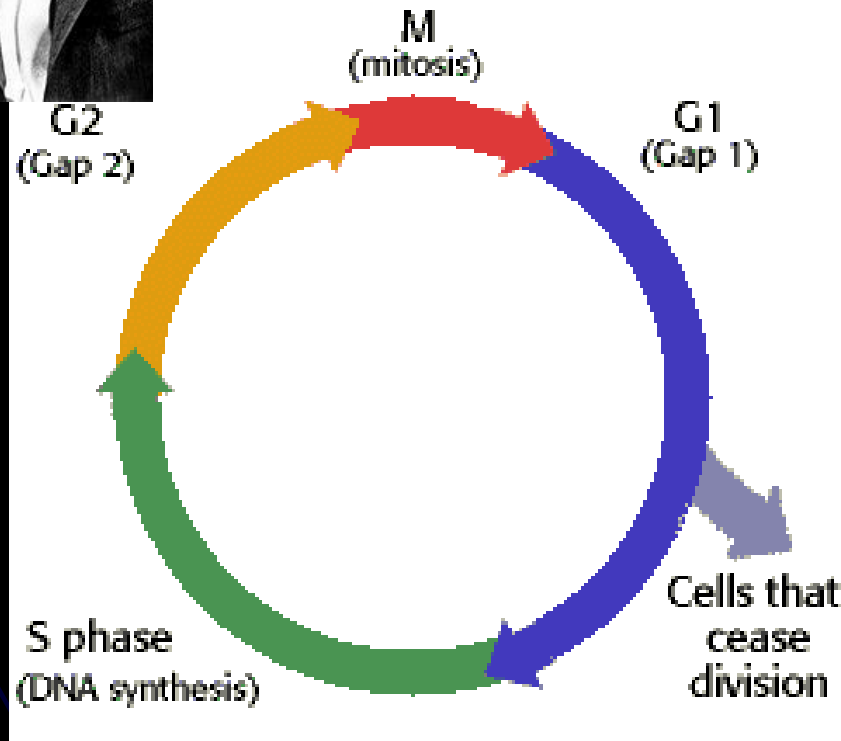
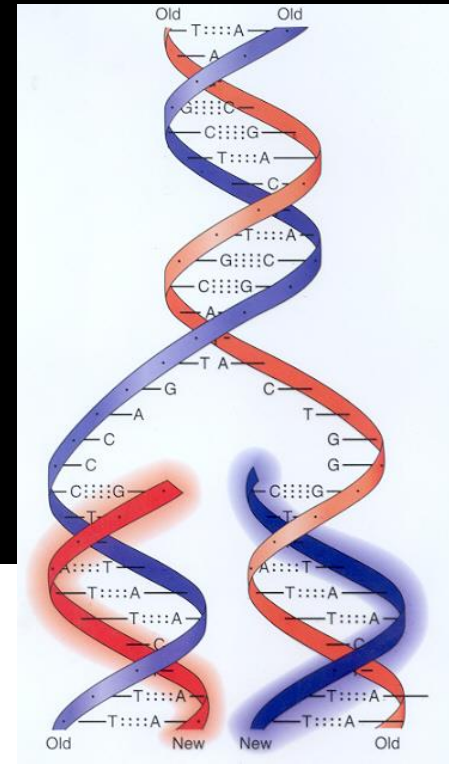
- DNA polymerase joins individual nucleotides to produce a new DNA molecule and then “proofreads” each new DNA strand for accuracy.
- **DNA is “READ” in the 3’-5’ direction by polymerase** And the **NEW** strand of
- **DNA is “BUILT” in the 5’-3’ direction**

- One new strand of DNA is made continuously.

The other new strand of DNA is made dis-continuously, creating **Okazaki** fragments that are linked together to make a long strand.



Once more time.....



Vocabulary for 8.2

- Replication
- Interphase
- Sphase
- Messelson and Stahl
- Semi-conservative
- Anti-parallel
- Helicase
- DNA Polymerase
- Ligase
- Continuously
- Dis-continuously
- Okazaki fragments