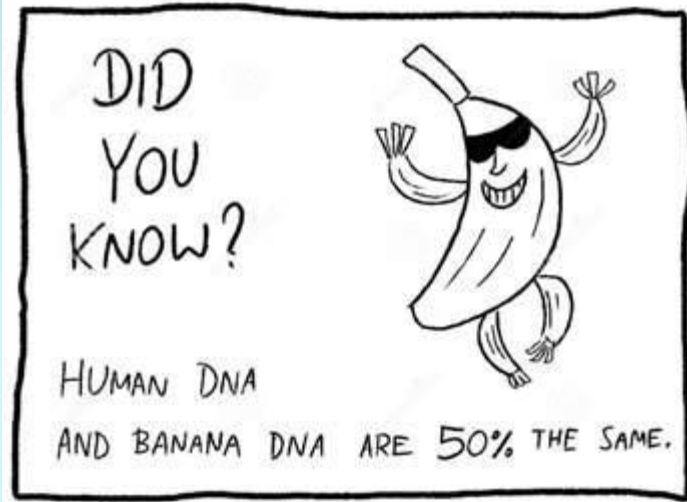
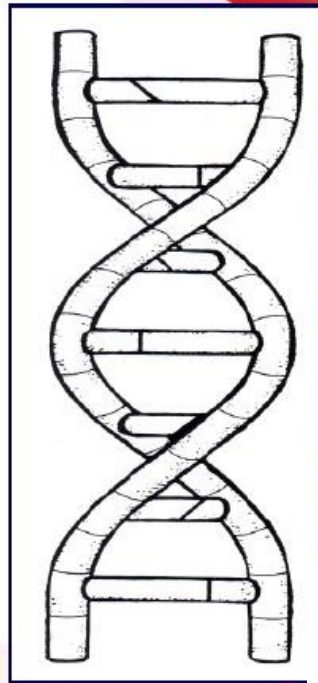


Chapter 12 DNA

DNA Facts

- Each cell contains **9 feet of DNA**
- In an average meal, you **EAT approximately 55,000,000 cells**
- This is equal to approximately **93,205 miles of DNA**



We share 70% of our DNA with slugs.



DNA facts

IF YOU UNWRAP ALL OF THE DNA YOU HAVE IN ALL YOUR CELLS, YOU COULD REACH THE MOON **6000 TIMES.**



99.9% OF OUR DNA SEQUENCE IS THE SAME AS OTHER HUMANS'.



This **0.1% DNA DIFFERENCE** between us may have to do with the number of nucleotides in a person's DNA.



Turn of 20th century

- Scientists began to wonder about what makes up genes



Griffith

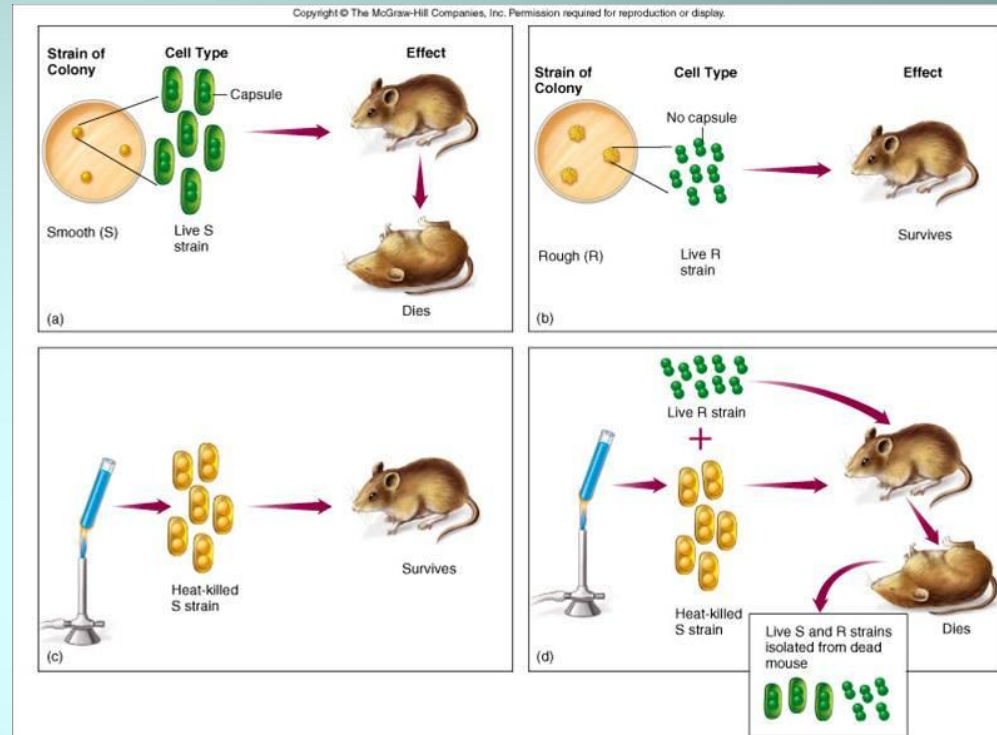
- One of first scientists to investigate genes
- His goal was to figure out how bacteria made people sick

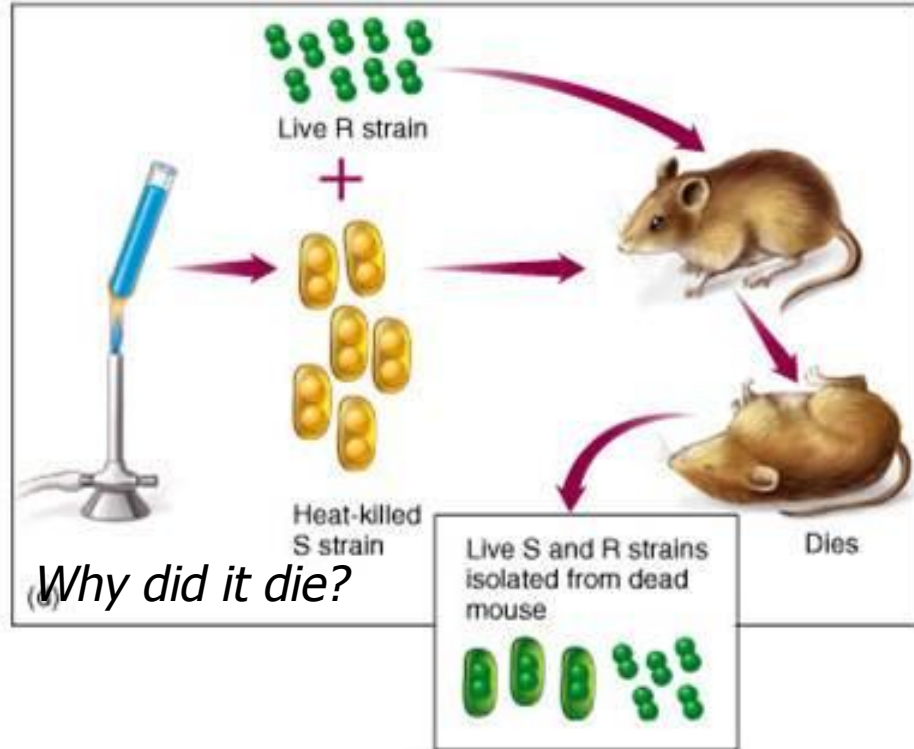
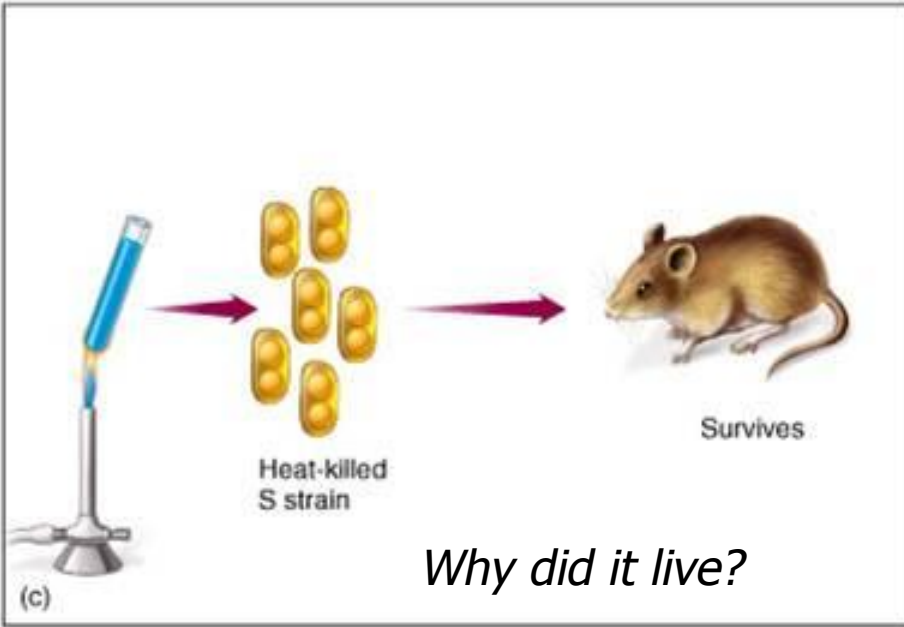
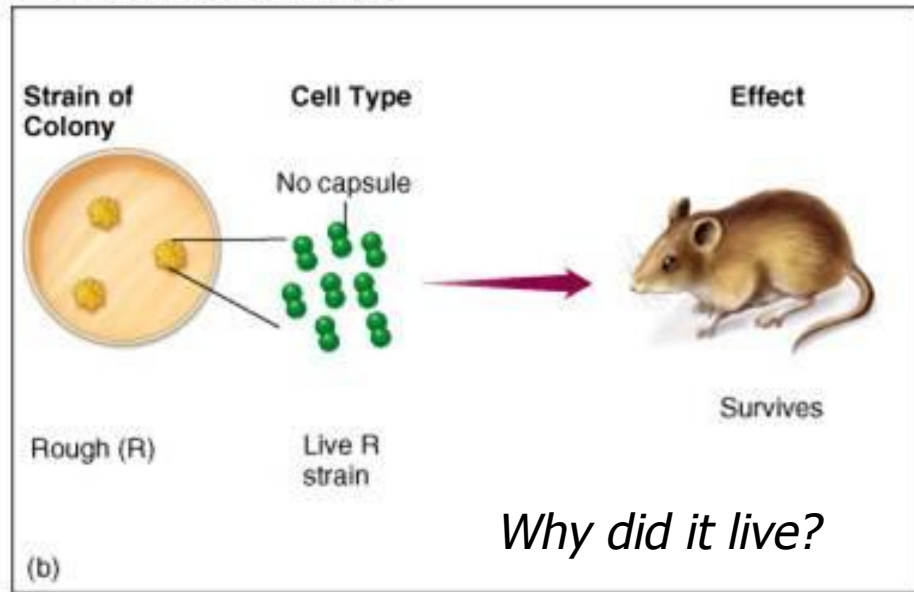
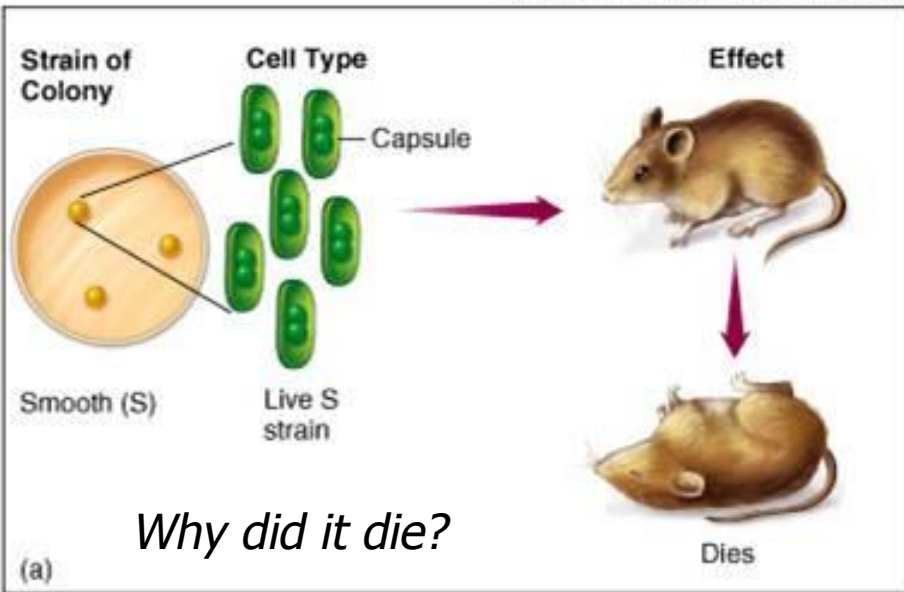


Griffith's Experiment

What did he do?

- Mouse #1: S bacteria
 - Dead
- Mouse #2: R bacteria
 - alive
- Mouse #3: Heat-killed S bacteria
 - alive
- Mouse #4: Heat-killed S and R bacteria
 - Dead





Griffith's Experiment

- What did he accomplish/prove?
 - The 2 bacteria must have mixed genetic content
 - This is called **TRANSFORMATION**
 - Since 1 type of bacteria had been changed permanently into another disease causing bacteria

Avery's Experiment

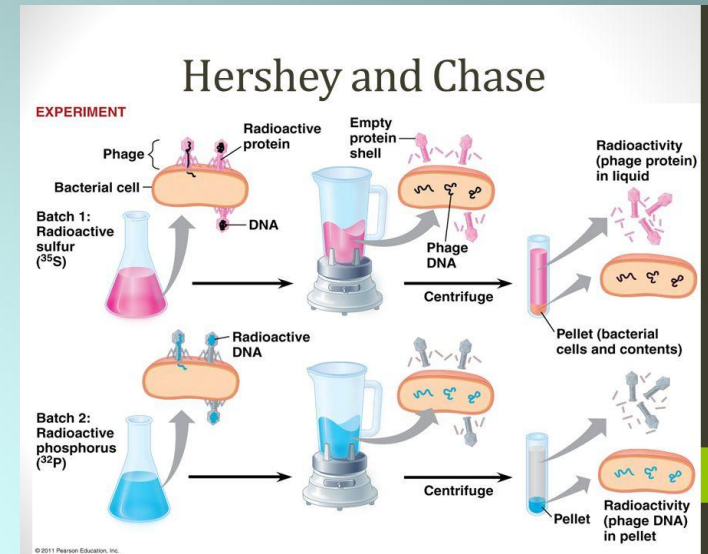
- What did he prove?
 - DNA is the cause of transformation and that it transmits genetic info from 1 generation to the next



Hershey & Chase

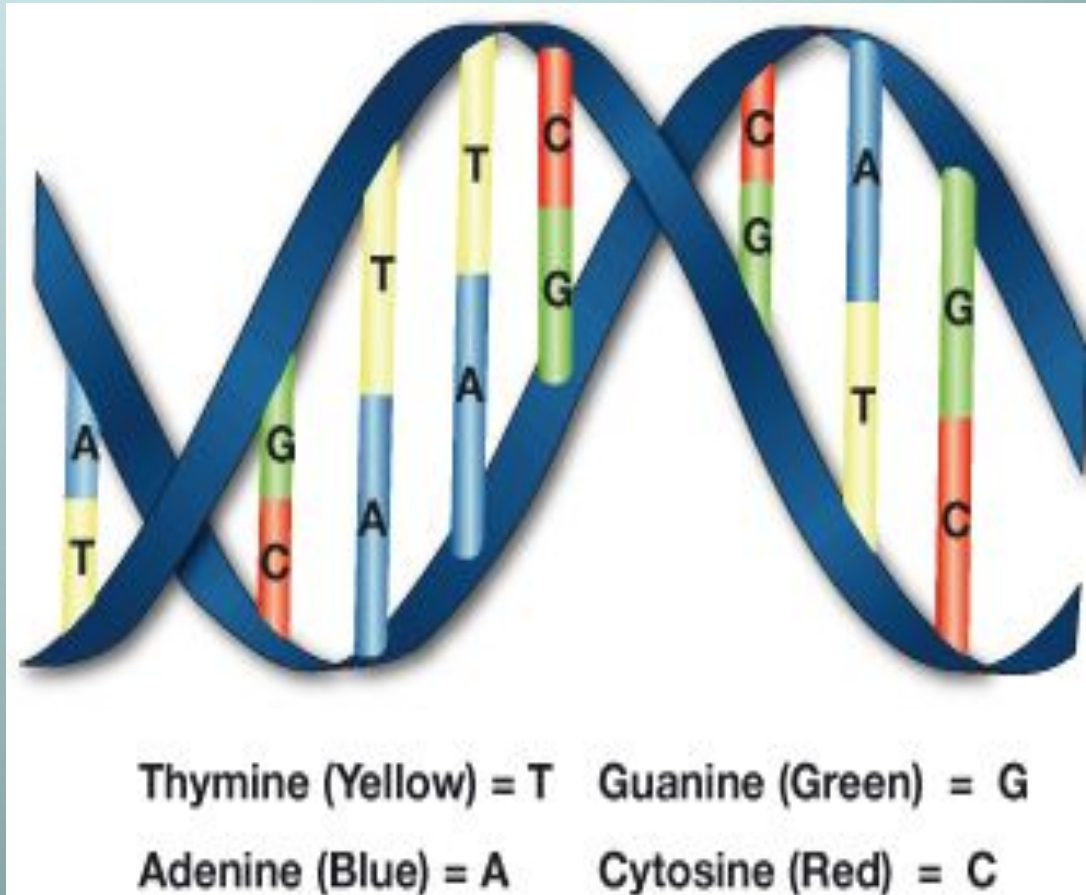
What did they prove?

- Their experiment proved Avery's
- Result that DNA was the genetic material found in genes of ALL living organisms
- **BACTERIOPHAGE**: a virus that affects bacteria



~DNA~

- Full name: **Deoxyribose nucleic acid**
- Shape: ***double helix*** (resembles a spiral staircase)
- Base unit: **nucleotide**



What makes DNA up?

Nucleotides

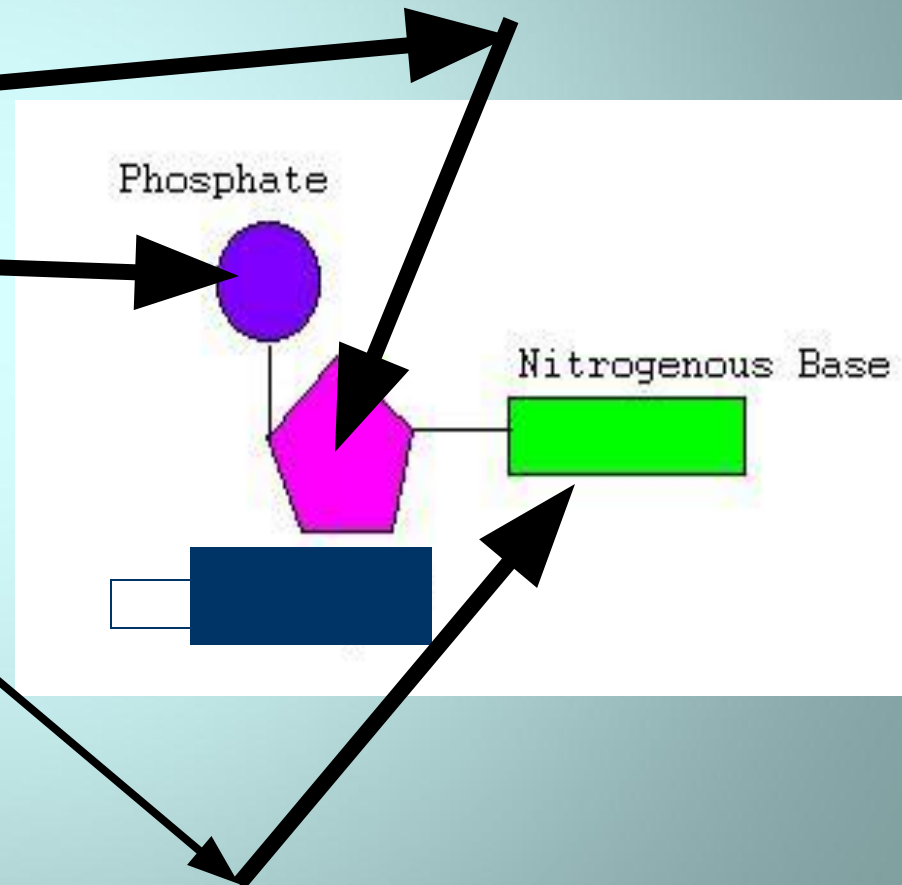
Sugar

- Deoxyribose sugar

Phosphate group

Nitrogenous bases

- Adenine (A)
- Thymine (T)
- Guanine (G)
- Cytosine (C)

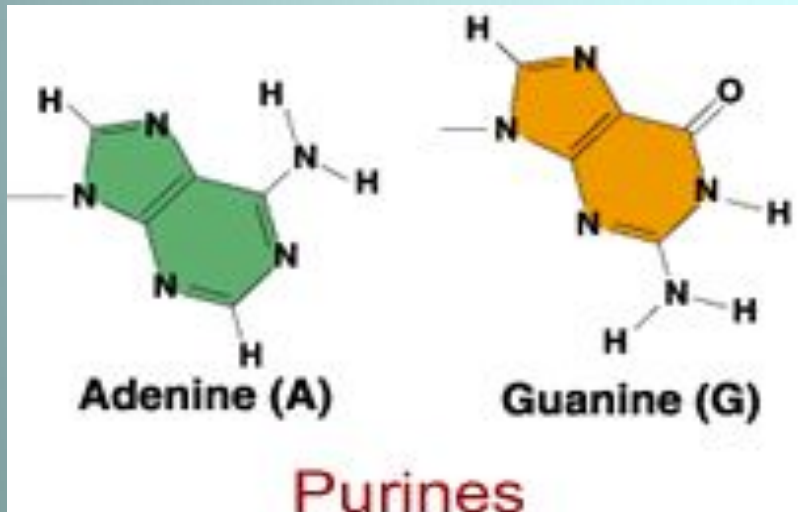


Types of bases

add to
notes

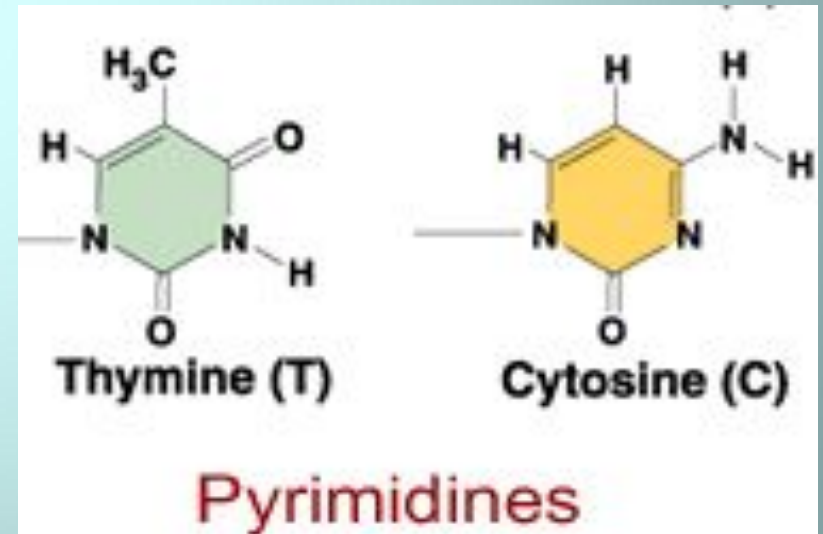
PURINES

- Made up of *Adenine and Guanine*
- Made up of a double ring

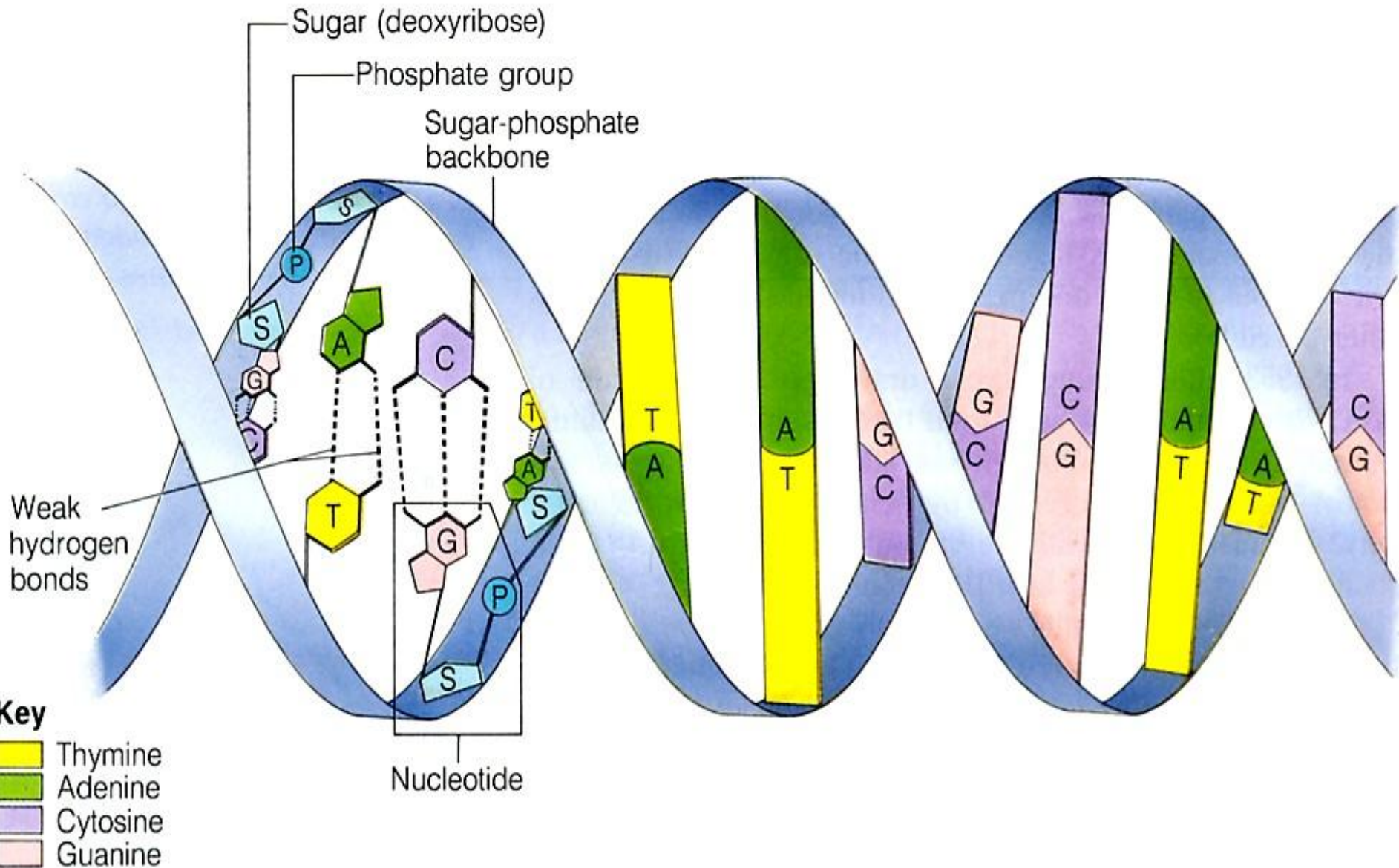


PYRIMIDINES

- Made up of *Thymine and Cytosine*
- Made of only 1 ring

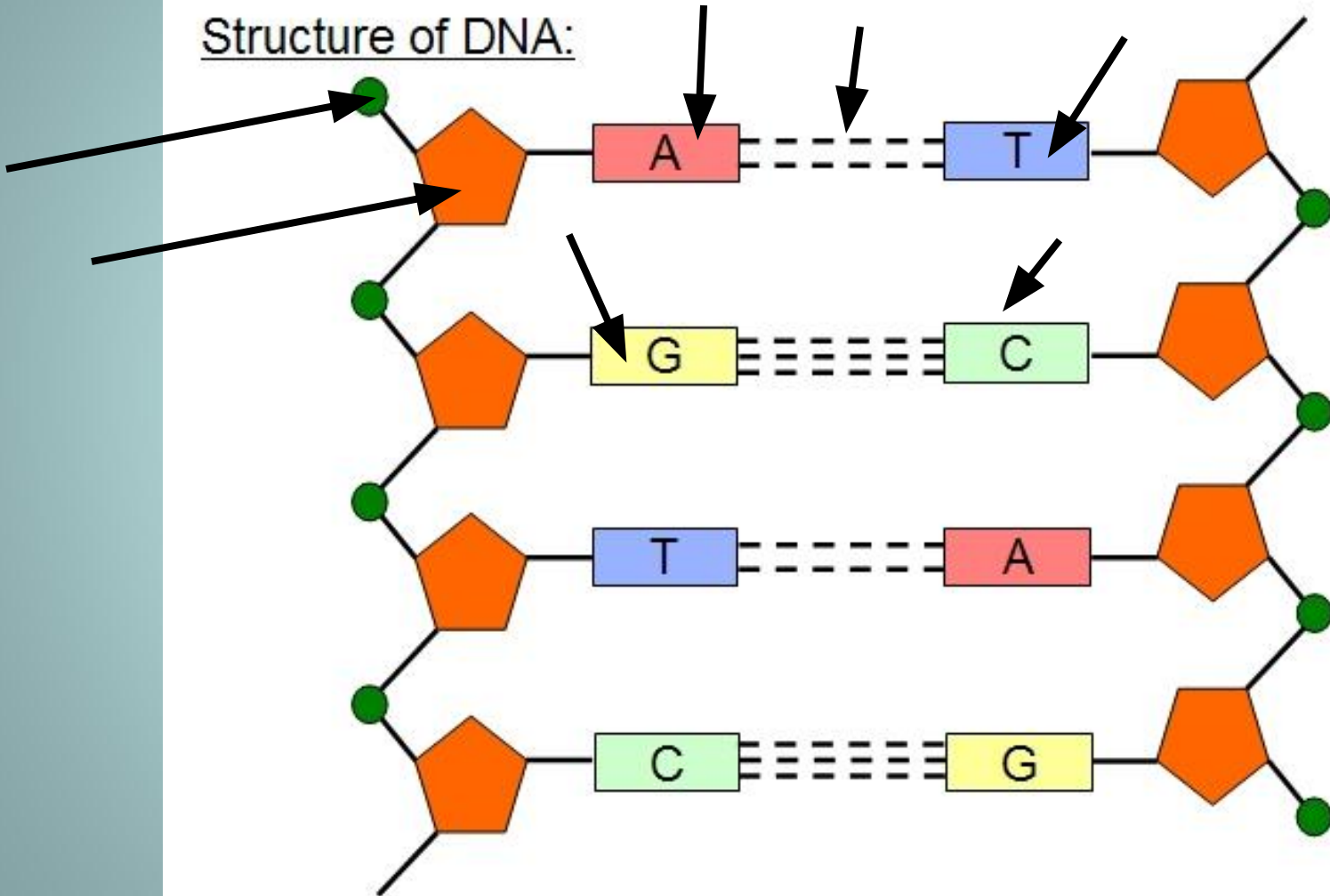


DNA



What are the Parts?

Structure of DNA:



Chargaff's Observations

- He analyzed amounts of bases in various species:
 - He discovered:
 - Adenine always equaled Thymine
 - Cytosine always equaled Guanine
 - The amount of A, T, G, C differ among **each** type of organism
 - This became known as Chargaff's Rule
 - Bases when bonded are always complementary to each other
 - This is often called Base-Pairing rules

X-ray Diffraction

Rosalind Franklin

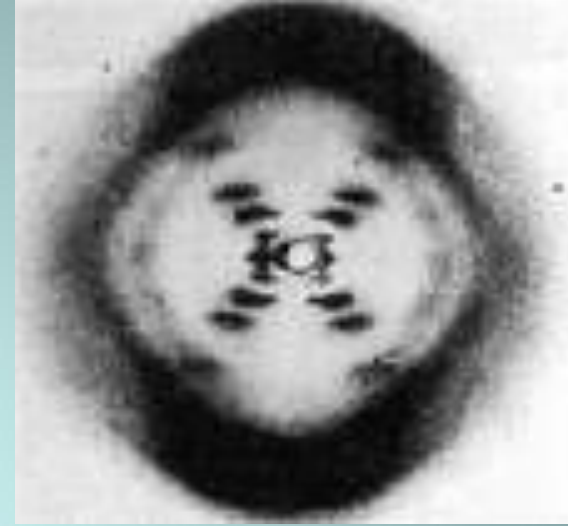
- Used to this technique to discover the shape of DNA

- Photo 51 (final pic)

- This proves that DNA is a double helix like a twisted ladder

- Formed by 2 strands of nucleotides twisted together

DNA is the Genetic material of ALL organism



WATSON & CRICK

What did they find?

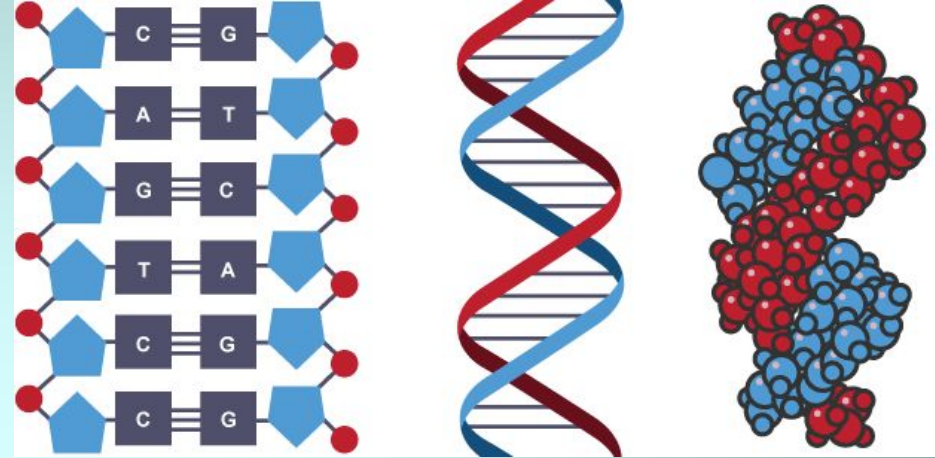
- Found the structure of DNA
 - Credited in history for it

Outside strands=

- Alternating sugars and phosphate groups

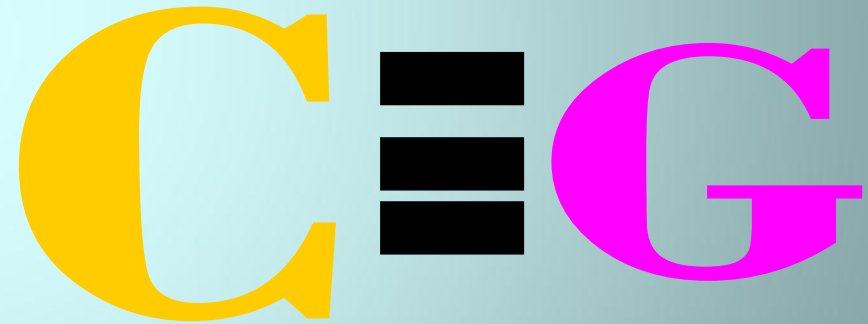
Inside=

- Adenine bonds to Thymine by using 2 hydrogen bonds
- Guanine bonds to Cytosine by using 3 hydrogen bonds



Thus the Base Pairing rules

- Chargaff's Rule





PRACTICE

- ATGCTTAAGCGTTACGTACGG
- GGCCTAATTTCCCCATCGATT
- TTTAAACCCGGGTGACTAGCT

Prokaryotes

- DNA is held in the cytoplasm
- Made in a ring shape

Bacterial chromosomes have a single point of origin.

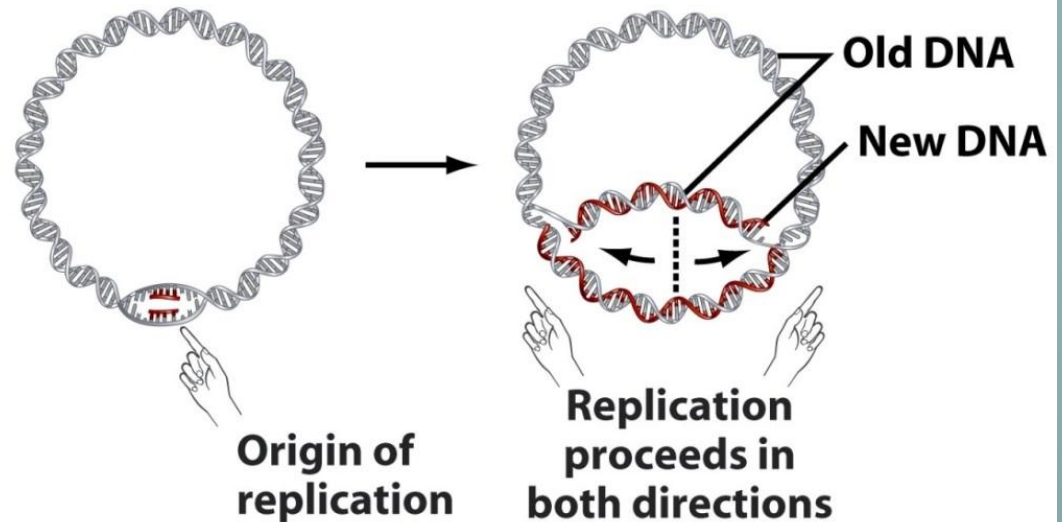
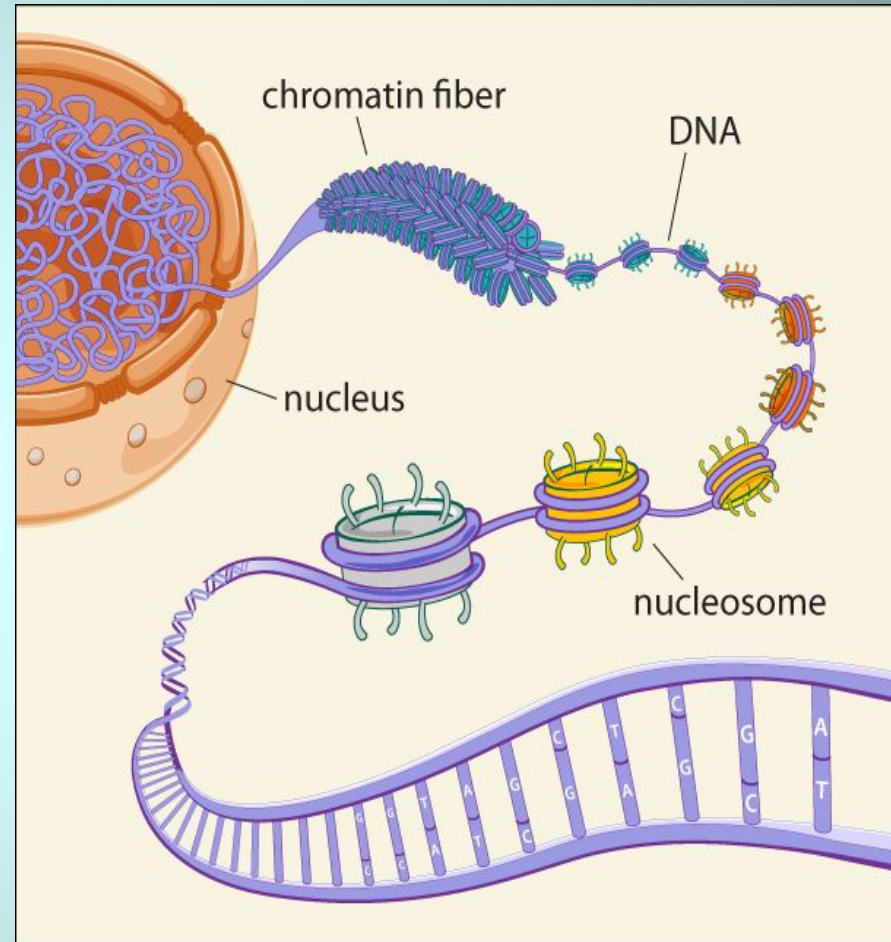


Figure 14-11b Biological Science, 2/e

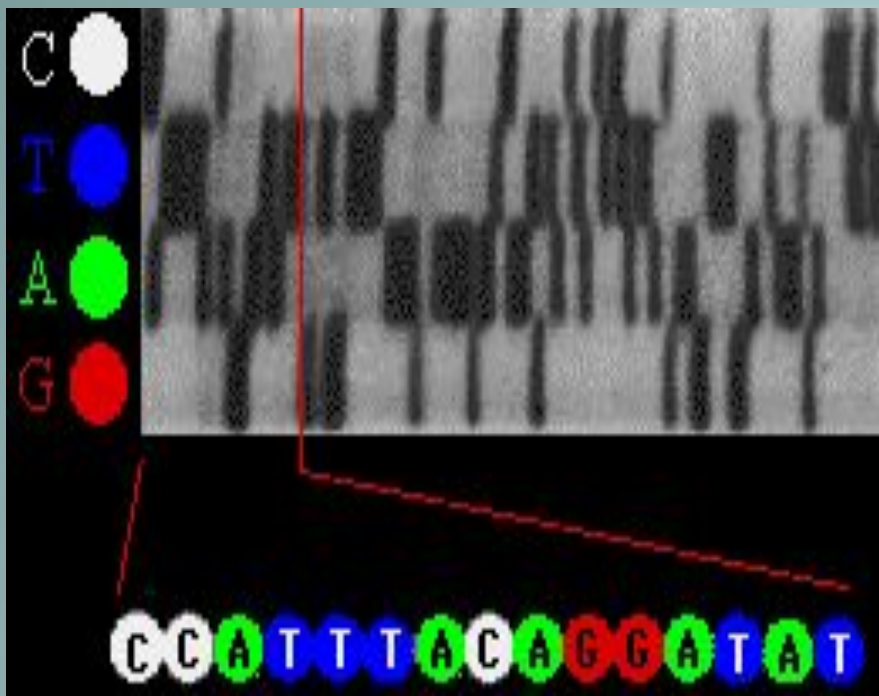
EUKARYOTES

- DNA is held in the nucleus
- Organized in chromosomes
- Wrapped around histones and coils into nucleosomes

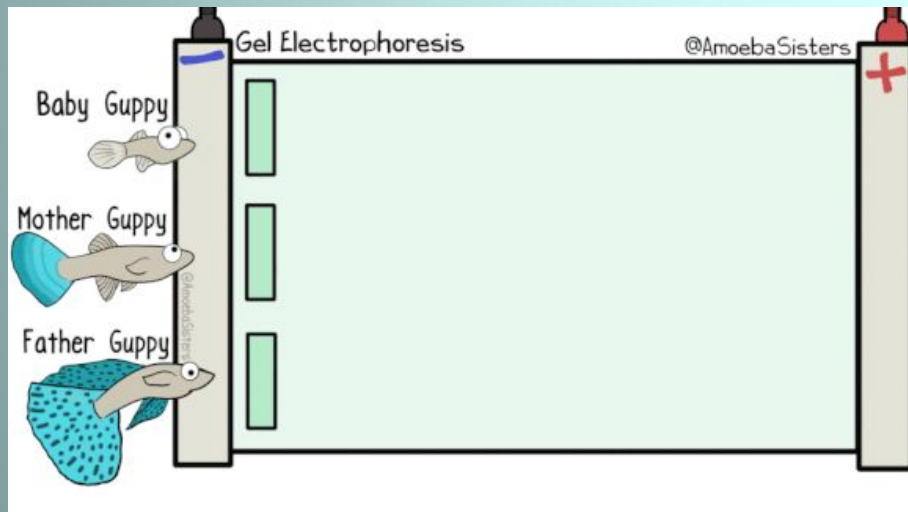


DNA

sequencing



- Scientists figure out the order of bases in a piece of DNA from an X-ray film like this.
- This is called sequencing.
- Each dark band on the X-ray ladder matches a colored base.
- Each row of bands corresponds to one of the four bases.



Essential Questions

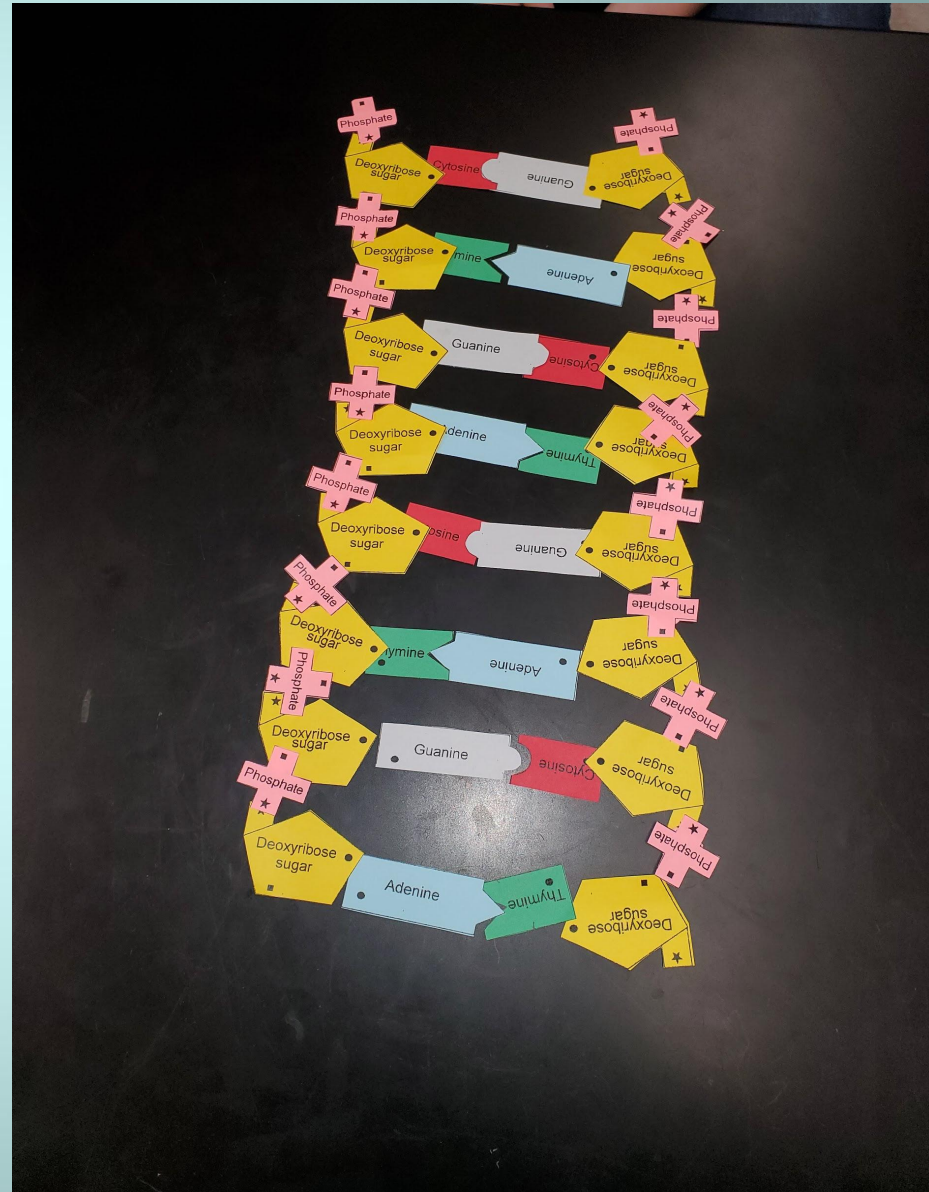
- What is the basic building block of DNA?
- What bases are in DNA?
- What are the 2 categories of bases? Which is in each?
- What is the difference between eukaryotic DNA and prokaryotic DNA?
- *Vocabulary: double helix, nucleosome, histone, adenine, guanine, thymine, cytosine, purine, pyrimidine*

Build your DNA

What did you notice about the 2 sides?

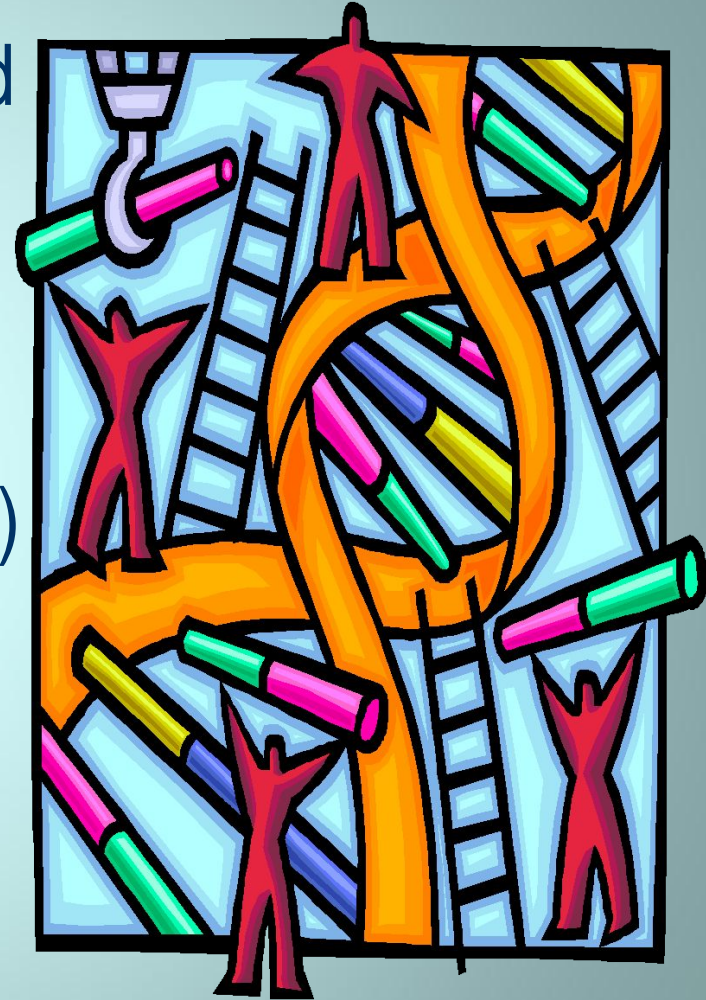
What did you notice about the middle?

antiparallel



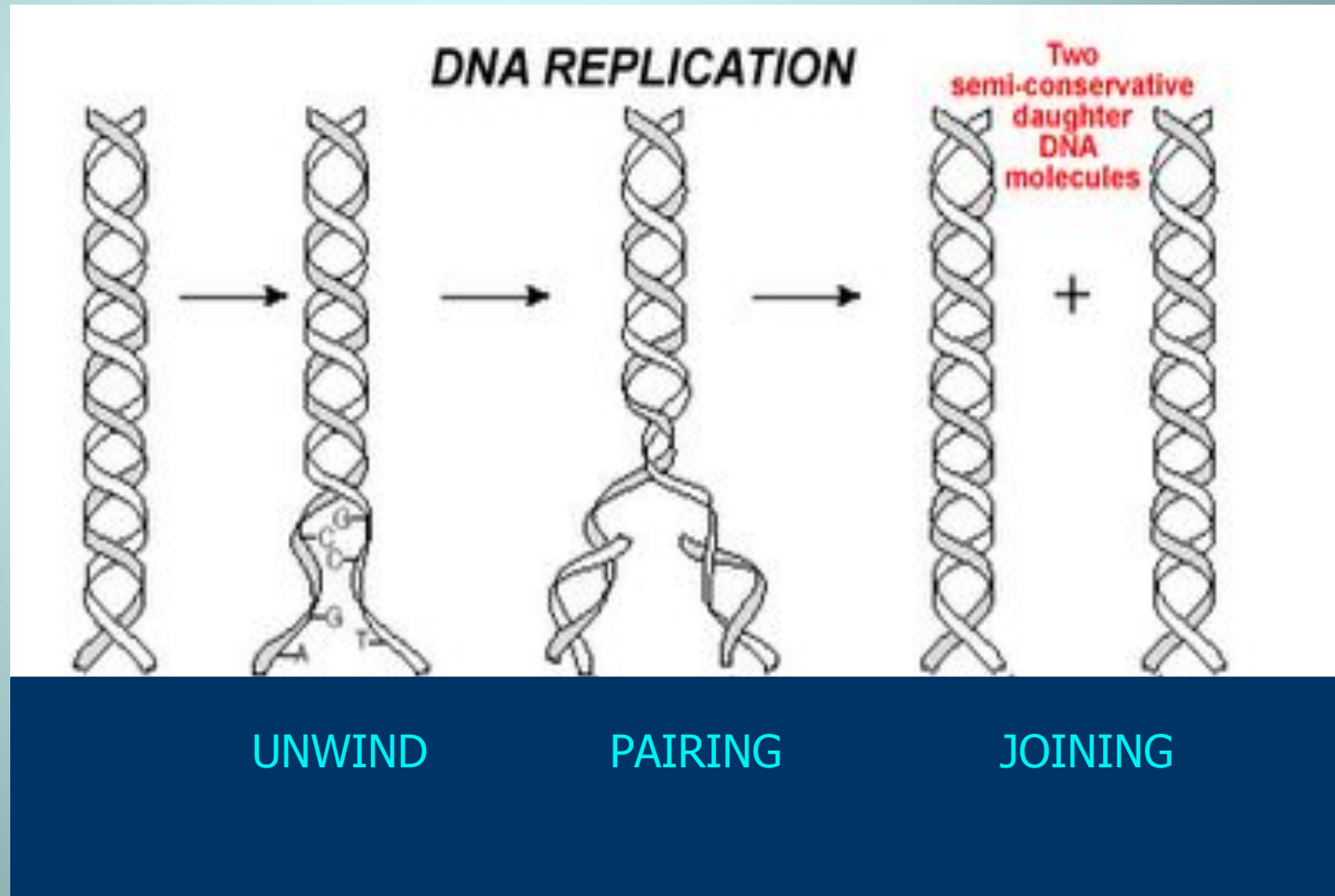
Sec 2 Replication of DNA

- DNA replicates by making a strand that is complementary to each original strand
- Following all base-pairing rules
- Occurs during Synthesis (S phase) of Interphase



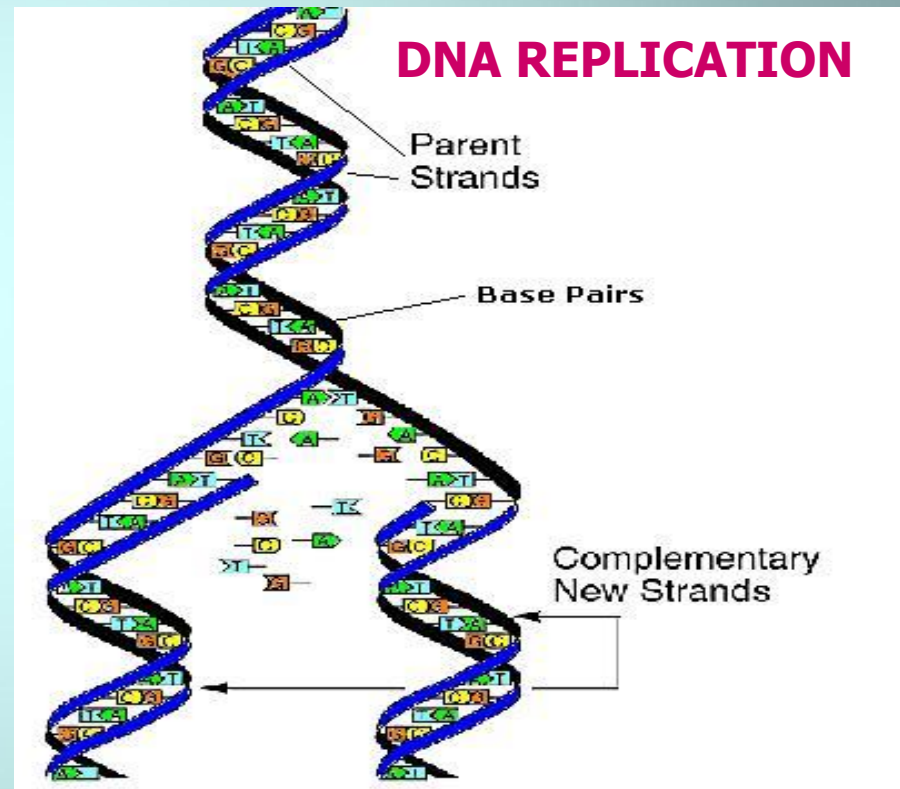
DNA Replication = 3 steps

- 1) unwinding
- 2) base-pairing
- 3) joining



Unwinding Stage

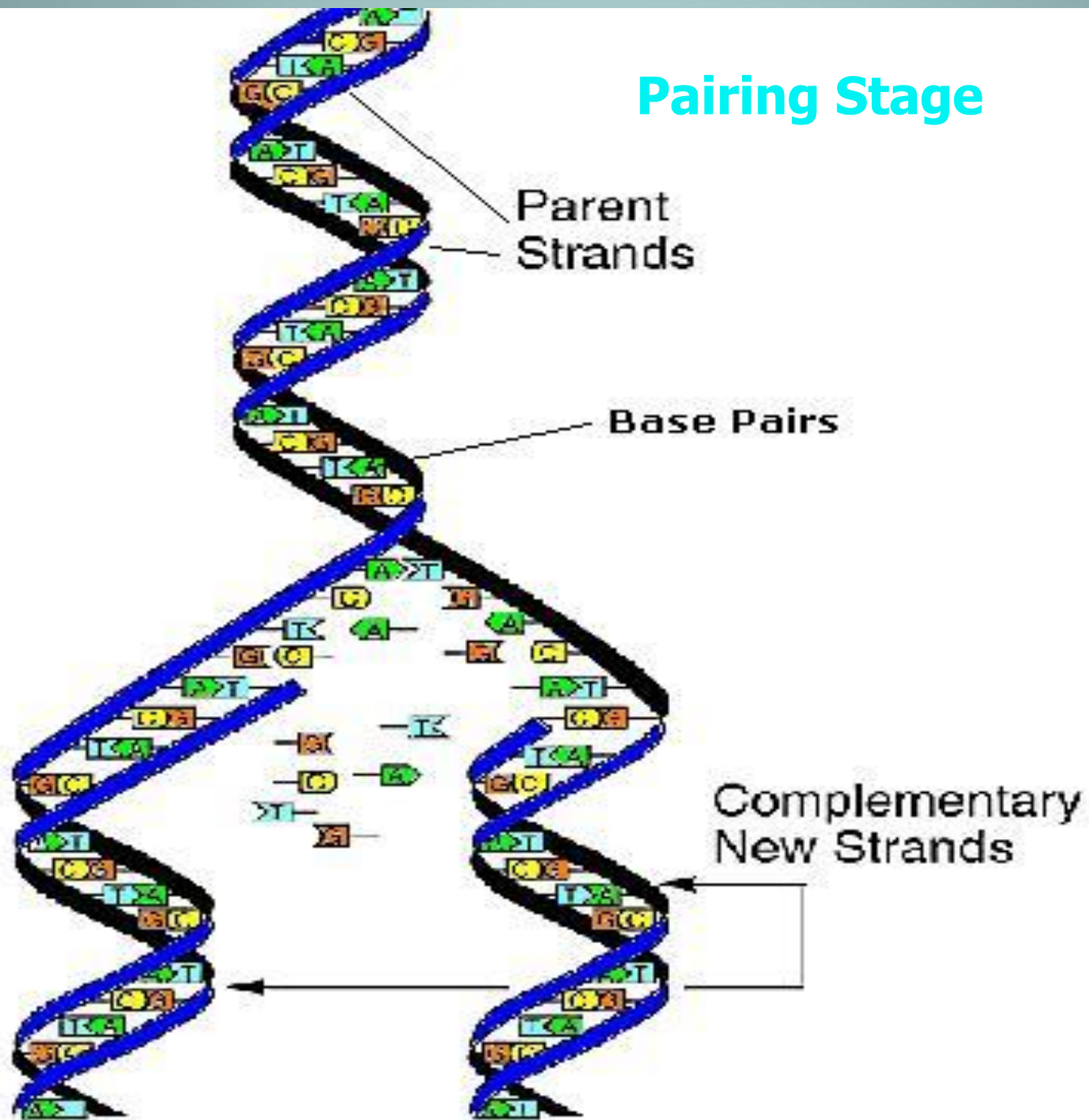
- **DNA helicase** (an enzyme) unwinds and unzips the double helix
- Hydrogen bonds are broken between the bases
- This opens up the DNA to start being copied



Base-Pairing Stage

- DNA polymerase (an enzyme) joins individual nucleotides to its complement on the new strand
- It connects only to its complement
- Adenine bonds to Thymine
- Guanine bonds to Cytosine
- This allows identical copies of the original double strand to be produced

Pairing Stage



Joining stage

- The DNA strand is put back together
- Eukaryotes have many origins of replication on a chromosome
 - Replicate in both directions until entire chromosome copied
- Prokaryotes have 1 origin of replication
 - replicate in both directions until each chromosome is copied
- Telomeres are placed on the ends of chromosomes
 - They are difficult places for replication
 - They are like “caps”

Joining Stage

Bacterial chromosomes have a single point of origin.

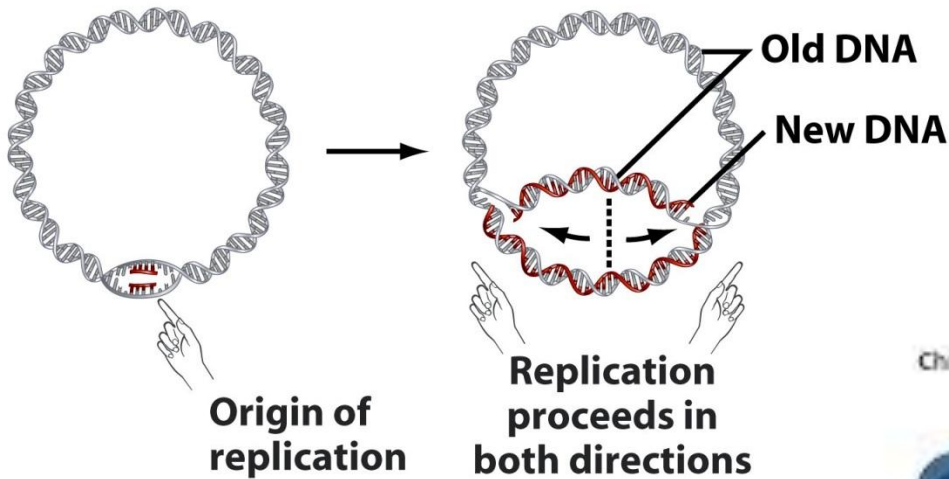
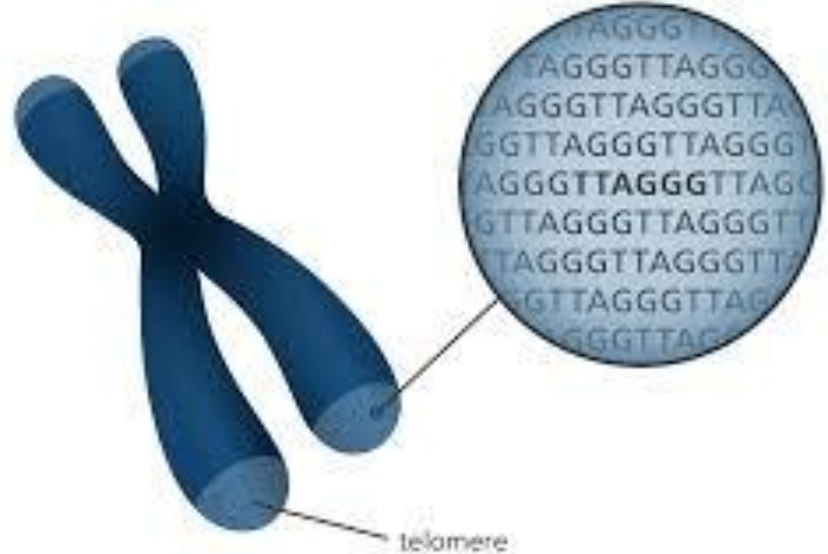


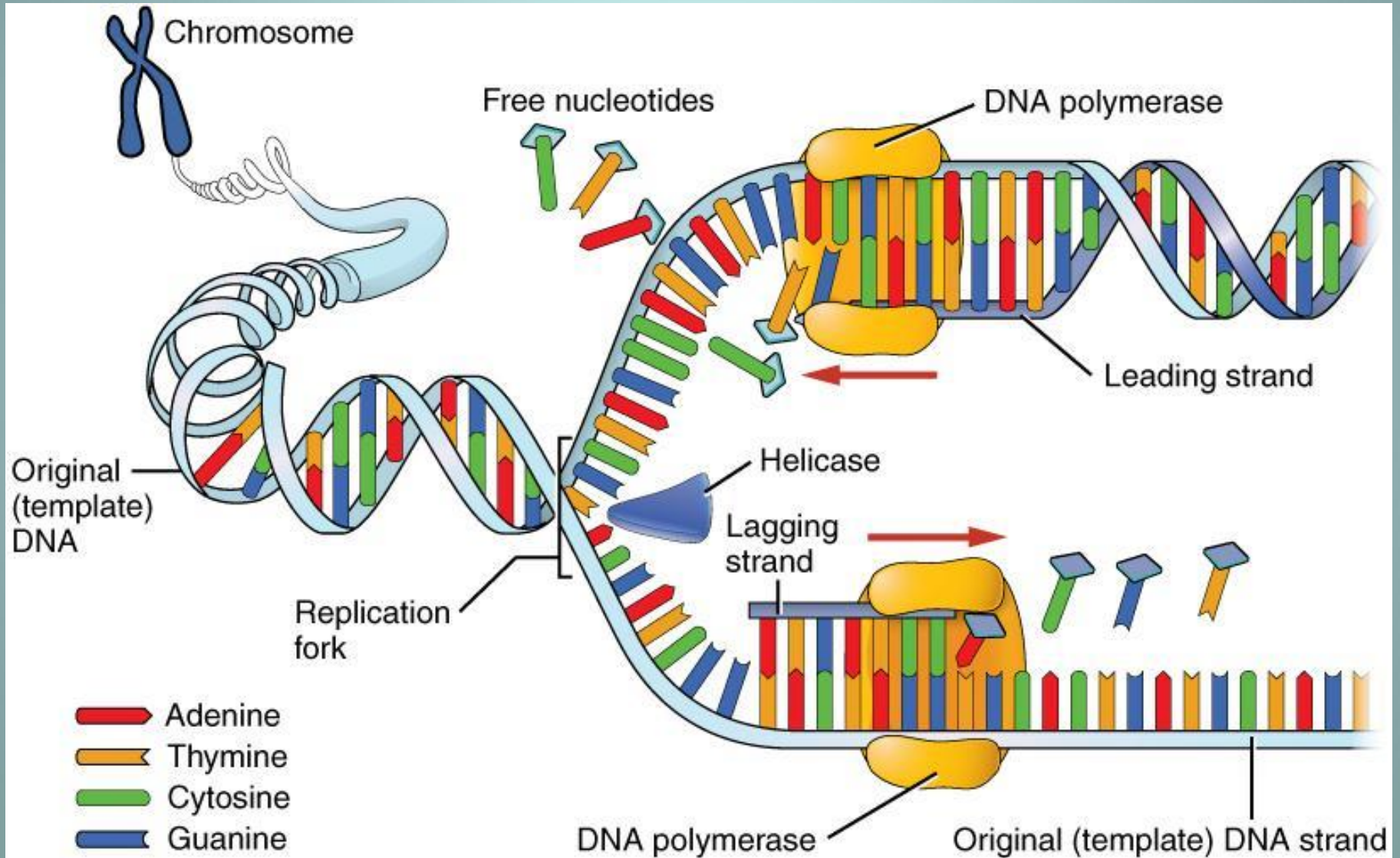
Figure 14-11b Biological Science, 2/e

© 2005 Pearson

Chromosome



DNA Replication



Rate of replication

- 50 nucleotides per second in mammals
- 500 nucleotides per second in prokaryotes

- How long would it take a bacterium to add 4000 nucleotides?
- A human?



Multiple Forks

- Replication DOES NOT take place at one end and the stop at the other end
- Instead there are multiple replication forks
 - 100 sections that consist of 100,000 nucleotides
 - An entire chromosome can be replicated in 8 hours.
 - It would take about 3 full days if we didn't use multiple replication forks!!!!

Essential Questions

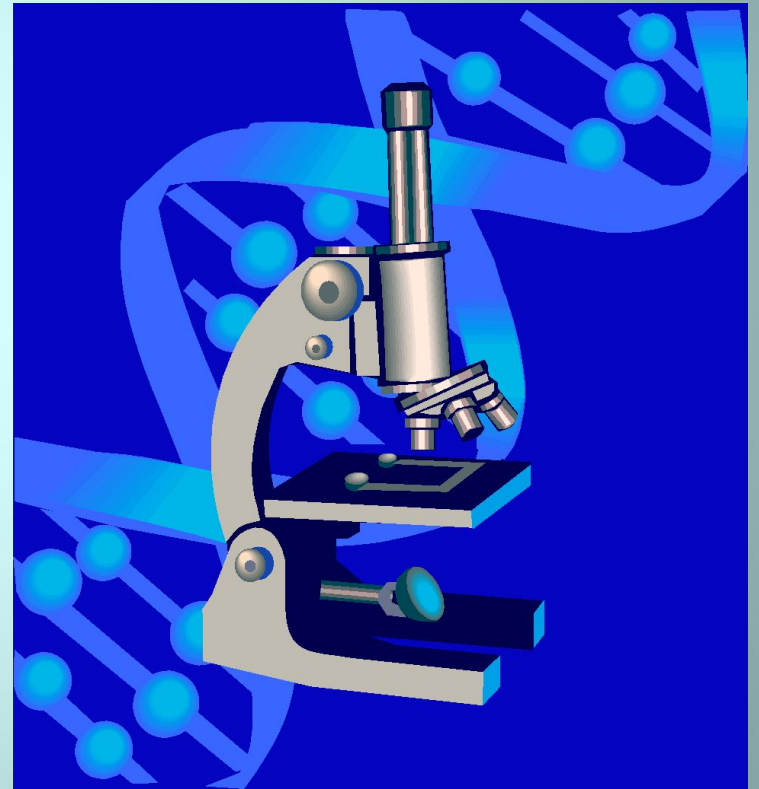
- What are the stages of DNA replication?
- Name and describe the function of the enzymes used during DNA replication.
- What is the difference between a prokaryote and eukaryote method of DNA replication?
- *Vocabulary: DNA polymerase, DNA helicase, Unwinding stage, Pairing Stage, Joining Stage*

DNA “Quiz Check”

- Complete the “Quiz” check
- 6) draw a nucleotide
- 7) describe how Adenine bonds to Thymine
- 8) describe how Guanine bonds to Cytosine
- 9) list the 3 steps of DNA replication
- 10) briefly explain each step of replication

DNA Workshop

- We will complete this together
- All answers go into your journal



DNA Concept Map

- Number 1 to 15
- Fill in the boxes with the correct word to complete the flow chart
- Use the worksheet to help you also

