

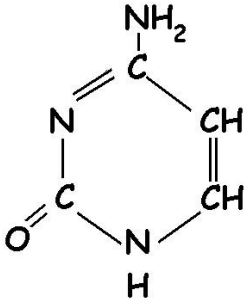
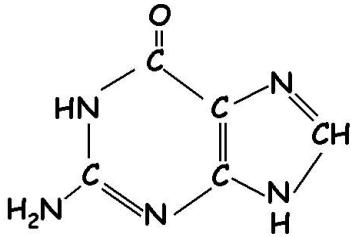
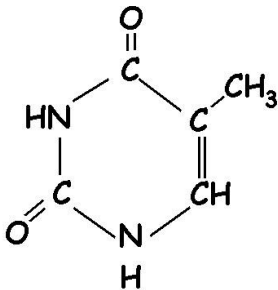
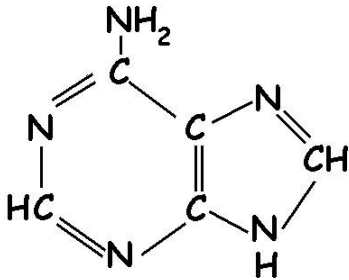
DNA STRUCTURE AND REPLICATION

BUILDING BLOCKS OF DNA:

Nucleotides:

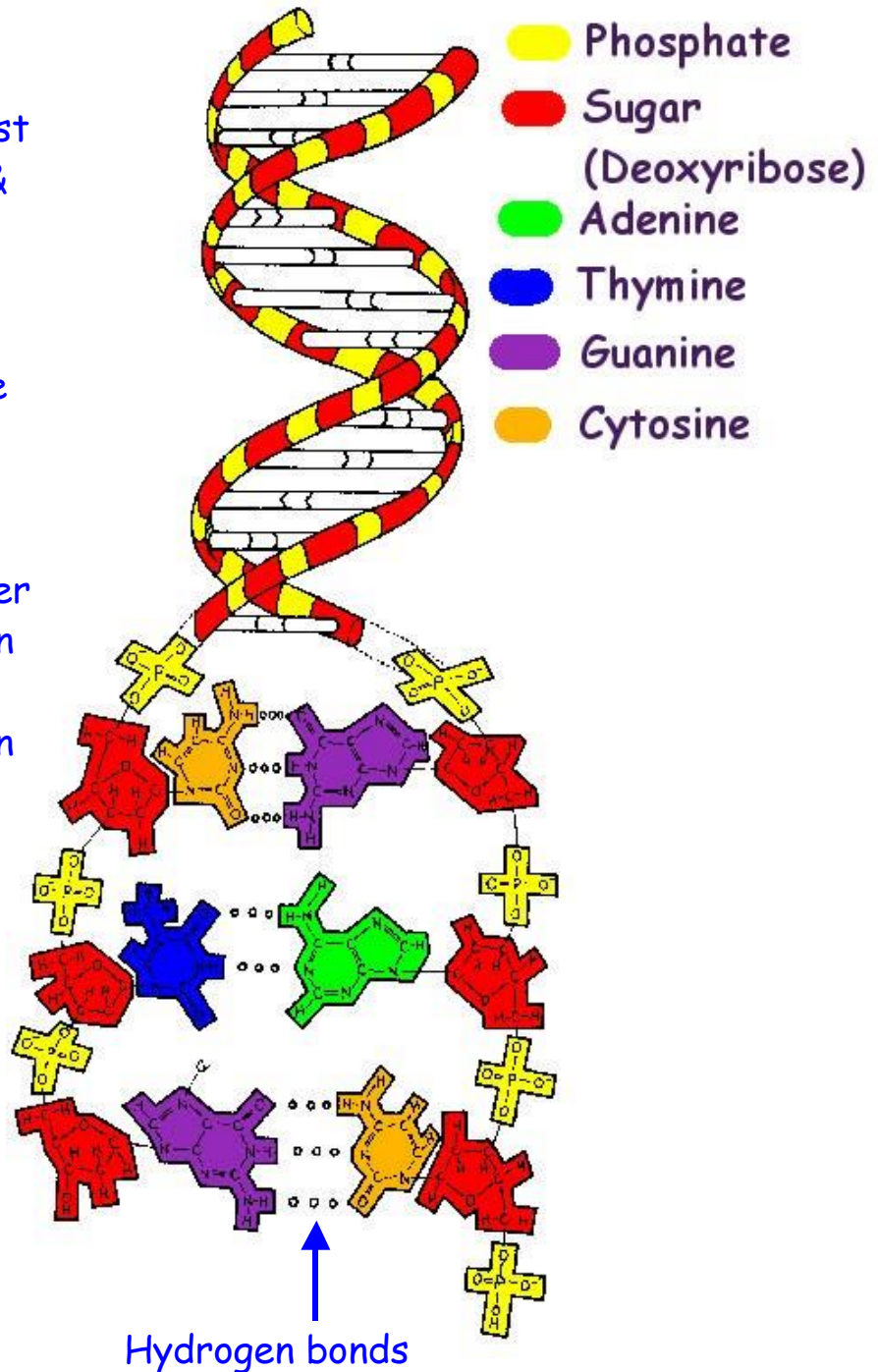
1. 5 carbon sugar (deoxyribose)
2. Nitrogenous base (A, T, C, or G)
3. Phosphate group

NITROGENOUS BASES

PYRIMIDINES	PURINES
<p>Single ring structure C and T</p>	<p>Double ring structure G and A</p>
<p>Cytosine</p> 	<p>Guanine</p> 
<p>Thymine</p> 	<p>Adenine</p> 

DNA STRUCTURE

- Double helix
- Double stranded
- Twisted ladder
- Sides of ladder consist of alternating sugar & phosphate groups
- Rungs of ladder
 - 2 bases
 - Purine - pyrimidine
 - A - T
 - C - G
 - Hydrogen bonds hold bases together
 - 2 H bonds between A and T
 - 3 H bonds between C and G



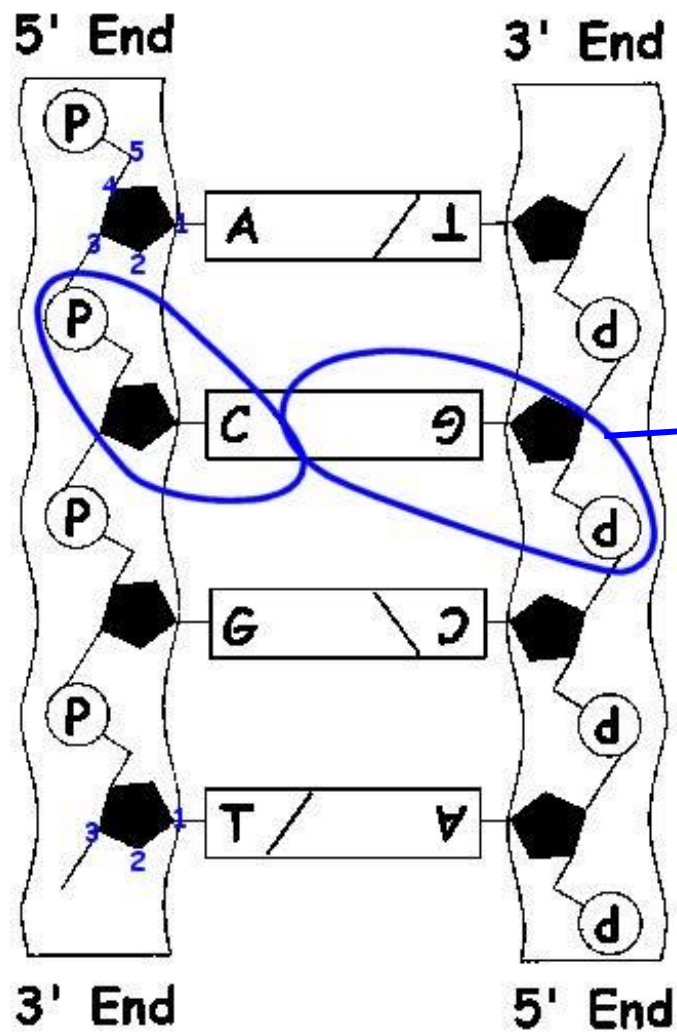
ANTIPARALLEL STRANDS

One strand 5' at top & 3' at bottom
Other strand: 5' at bottom & 3' at top

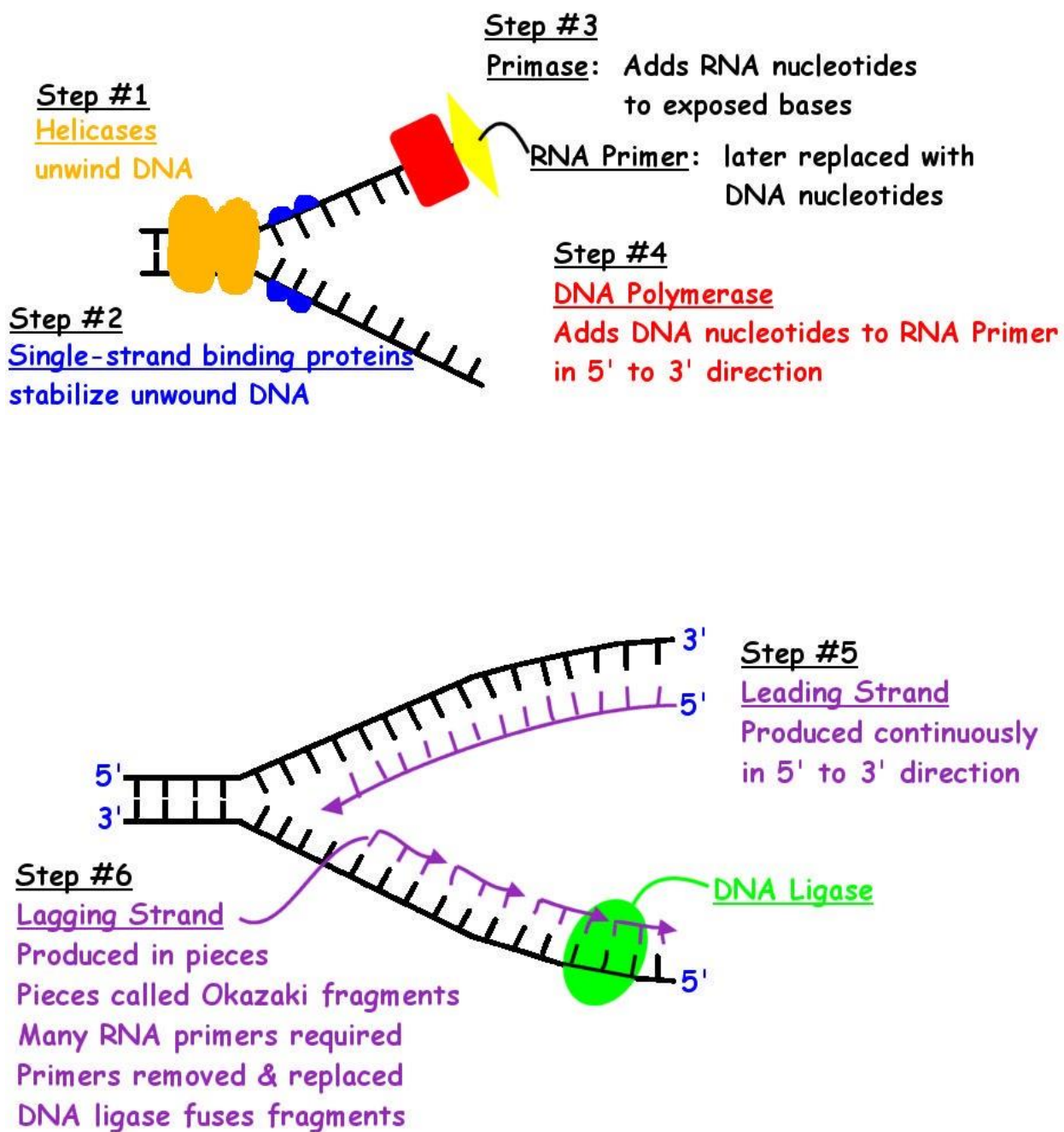
5' end
5th carbon in
deoxyribose



3' end
3rd carbon in
deoxyribose



DNA REPLICATION



QUESTIONS

16.1

1. The following questions refer to the experiments performed by Griffith.

- a. What organism(s) did he use in his experimentation? _____
- b. What are the two strains of pneumococcus and the distinguishing characteristics of each strain?

STRAIN	Distinguishing Characteristics

- c. How did Griffith determine that the S strain and not the R strain was pathogenic?

- d. In one experiment, Griffith injected heat-killed S strain bacteria into mice.
What was he trying to determine by conducting this experiment?

What were the results of this experiment?

What conclusion did he reach based on these results?

- e. In another experiment, he mixed heat-killed S strain with live R strain bacteria and injected the mixture into mice.

What were the results of this experiment?

What strain of the bacteria was found in blood samples from the experiment mice?

What conclusion did he reach based on the results of this experiment?

2. Define *transformation*

3. The following questions refer to the experiments performed by Avery, McCarty, and MacLeod.

- a. Avery, McCarty, & MacLeod continued the experimentation begun by Griffith. Their experimentation tried to identify what substance in the heat killed S strain transformed the R strain into S strain bacteria. They isolated protein, carbohydrates, RNA, and DNA from samples of heat killed S strain bacteria. They then mixed each of the isolates with R strain bacteria and looked for transformation.

Only one isolate, when mixed with the live R strain bacteria, resulted in transformation. What was that isolate?

- b. What conclusion did they reach based on the results of their experiments?

4. The following questions refer to the experiments of Hershey & Chase (Blender Experiment).

- a. What are bacteriophages? _____

b. Describe the composition of the T2 bacteriophage.

c. Sketch a T2 bacteriophage and label the parts listed in b

d. What effect does the T2 phage have on E. coli?

e. In one experiment, they grew T2 phages and E. coli in media with radioactive sulfur (^{35}S).

Into what phage component was the ^{35}S incorporated? _____

The phages with the ^{35}S were then allowed to infect E. coli free of ^{35}S . After a period of time, the culture was blended, centrifuged, and analyzed to determine where the location of the ^{35}S in the mixture.

Where was the ^{35}S located in the centrifuged mixture? _____

What conclusion did they reach based on these results?

f. In another experiment, they grew T2 phages and E. coli in media with radioactive phosphorus (^{32}P). After a period of time, the culture was blended, centrifuged, and analyzed to determine where the location of the ^{32}P in the mixture.

Where was the ^{32}P located in the centrifuged mixture? _____

What conclusion did they reach based on these results?

g. Hershey's & Chase's experimentation provided evidence that:

5. State Chargaff's rule.

6. What two scientists worked out the structure of the DNA molecule?

7. The building blocks of DNA are called: _____

What are the three components of these building blocks?

8. What was the role of Rosalind Franklin in the discovery of the double helix?

9. The nitrogenous bases found in DNA are classified in to two groups. Identify each of the following examples and/or characteristics as true of **purines** or **pyrimidines**.

_____ 6-membered ring of carbon and nitrogen atoms	_____ adenine
_____ 5-membered ring fused with a 6-membered ring	_____ cytosine
_____ guanine	_____ thymine

10. How many hydrogen bonds are formed between:

a. cytosine and guanine when they base pair? _____
b. thymine and adenine when they base pair? _____

11. Why does adenine pair with thymine and not cytosine?

12. Given that the DNA of a certain fly species consists of 27.3% adenine and 22.5% guanine use Chargaff's rules to deduce the percentages of thymine and cytosine.

13. Name the five nitrogenous bases, and put a checkmark in the correct column for each base. Also indicate if the base is found in DNA (D), RNA (R), or both (B).

Nitrogenous Base	Purine	Pyrimidine	D, R or B

14. Explain what is meant by 5' and 3' ends of the nucleotide

15. What do we mean when we say the two strands of DNA are *antiparallel*?

16.2

16. DNA replication is semiconservative. What does this mean?

17. Listed below are the steps in DNA replication. Put the steps in the correct order.

- _____ DNA polymerase adds nucleotides to the exposed bases
- _____ DNA ligase joins the Okazaki fragments on the lagging strand
- _____ Primase synthesizes the RNA primer
- _____ Helicases unwind the DNA double helix
- _____ Single-stranded proteins stabilize the unwound DNA

18. Distinguish between the *leading* and the *lagging strands* during DNA replication.

19. What is the direction of synthesis of the new strand?

20. What are *Okazaki fragments*? How are they welded together?

21. Match the role/function with the correct molecule.

A. DNA ligase

B. DNA polymerase

C. Helicases

D. Okazaki fragments

E. Primase

F. RNA primer

G. Single-strand binding proteins

_____ Unwind and unzip DNA

_____ Keep DNA strands separated

_____ Adds DNA nucleotides to exposed bases

_____ Produces the RNA primer

_____ Short RNA segment needed to start DNA replication

_____ Fuses the Okazaki fragments

_____ Replication fragments of the lagging strand

22. Which enzyme . . . ?

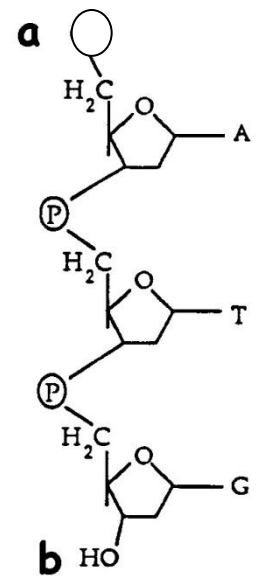
a. untwists and separates strands	
b. holds DNA strands apart	
c. synthesizes RNA primer	
d. adds DNA nucleotides to new strand	
e. relieves strain caused by unwinding	
f. joins DNA fragments together	
g. removes RNA primer and replaces with DNA	

23. Use the diagram at the right to answer the following questions.

a. Which letter (a, b) indicates the 5' end of the DNA strand?

b. At which letter (a, b) would the next nucleotide be added?

24. In what direction is DNA synthesized?



25. Explain the roles of each of the following enzymes in DNA proofreading and repair.

Enzyme	Role
DNA polymerase	
Nuclease	
Ligase	
Repair enzymes	

24. What is a *thymine dimer*? How might it occur? How is it repaired?

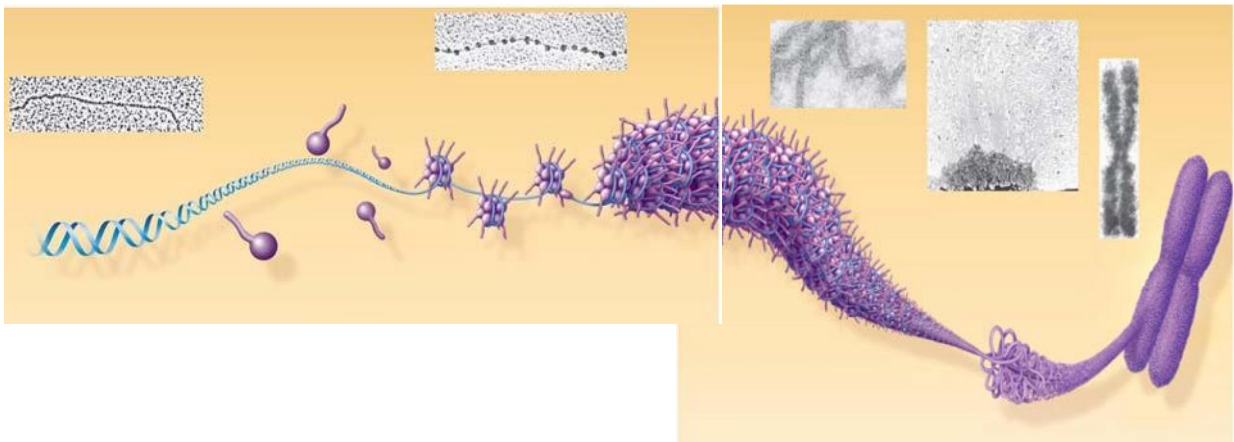
25. Make a sketch of a chromosome and label the *telomeres*.

26. Explain telomere erosion and the role of *telomerase*.

27. Why are cancer cells immortal, but most body cells have a limited life span?

16.3

28. On the diagrams below, identify the following: *30-nm fiber*, *metaphase chromosome*, *double helix*, *histone proteins*, *nucleosomes*, *protein scaffold*, and *looped domains (300-nm fiber)*.



End of Chapter Synthesis and Evaluation Problems

Do problems 1-8, 12, and 13. Check and correct your answers to 1-8 and 12 in back of text.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

12. Draw, color and label your model here!

***Question #13 should be typed out, then answered in no more and no less than 100 to 150 words. Turn in separately to the tray. This is worth **20 points!** Do not plagiarize. Use your own words and thoughts...but, use vocabulary terms and ideas taught in this chapter!

Study Guide/ISN (20 points)

In your study guide book, review pages 119 to 123. In your ISN, do the following: Title the page **Chapter 16 Molecular Genetics Must Know!** In one color, copy down each of the must know items listed on page 119 in study guide leaving space underneath to include in a different color a brief description, diagram, model, or mnemonic device that will help you study for the unit test and more importantly the AP Test in May.

Bozeman Science/ AP Biology/ISN (See Syllabus for format) (20 points each)

1. DNA & RNA part 1 (Big Idea 3)
2. DNA & RNA part 2 (Big Idea 3)
3. Models and Representations (AP Biology Practices)