


Chapter 12 DNA and RNA

Section 12-1 DNA (pages 287-294)

 **Key Concepts**

- What did scientists discover about the relationship between genes and DNA?
- What is the overall structure of the DNA molecule?

Griffith and Transformation (pages 287-289)

1. What did Frederick Griffith want to learn about bacteria? _____

2. The strain of bacteria that caused pneumonia grew into _____ colonies on culture plates; harmless bacteria produced colonies with _____ edges.
3. Circle the letter of each sentence that is true about Griffith's experiment.
 - a. Mice injected with bacteria from smooth colonies died.
 - b. Mice injected with bacteria from rough colonies died.
 - c. Mice injected with heat-killed bacteria from smooth colonies died.
 - d. Mice injected with a mixture of bacteria from heat-killed smooth colonies and live rough colonies died.
4. What result from Griffith's experiment suggested that the cause of pneumonia was not a chemical poison released by the disease-causing bacteria? _____

5. What is transformation? _____

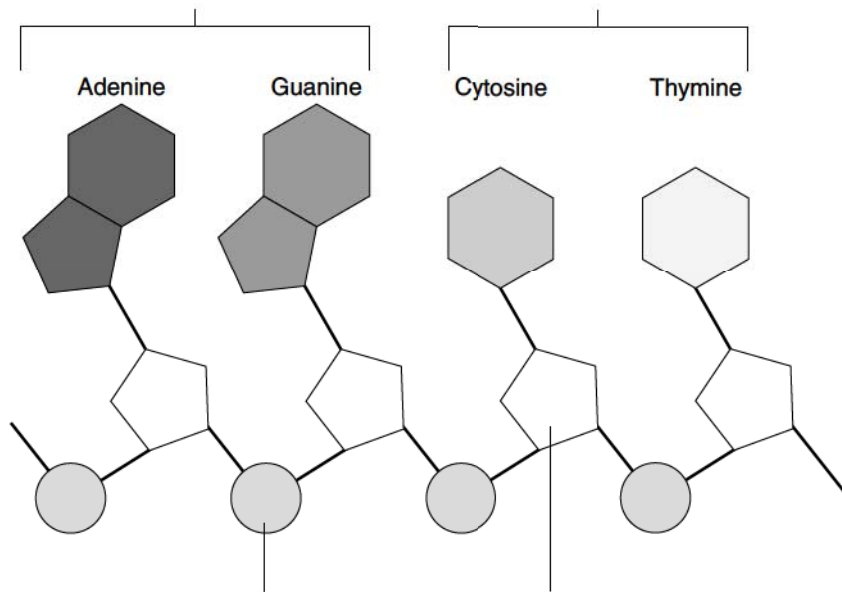
6. What hypothesis did Griffith form from the results of his experiments? _____

Avery and DNA (page 289)

7. Is the following sentence true or false? Avery and his colleagues thought that the molecule required in transformation might also be the molecule of the gene.

8. Briefly describe how Avery and his group determined which molecule was most important for transformation. _____

20. Identify the components of a nucleotide in the diagram below. Label the bases as purines or pyrimidines.



21. Is the following sentence true or false? Adenine and guanine are larger molecules than cytosine and thymine because they have two rings in their structure. _____
22. What forms the backbone of a DNA chain? _____

23. Is the following sentence true or false? The nucleotides must be joined together in a specific order. _____
24. According to Chargaff's rules, the percentages of _____ are equal to those of thymine and the percentages of _____ are equal to those of guanine in the DNA molecule.
25. Rosalind Franklin's work with X-ray diffraction showed that the DNA molecule is shaped like a(an) _____ and contains _____ strands.
26. How did Francis Crick and James Watson try to understand the structure of DNA?

27. How did Watson and Crick describe the structure of DNA? _____

28. Is the following sentence true or false? According to the principle of base pairing, hydrogen bonds could form only between adenine and cytosine. _____

Section 12–2 Chromosomes and DNA Replication (pages 295–299)

This section describes how DNA is packaged to form chromosomes. It also tells how the cell duplicates its DNA before cell division.

DNA and Chromosomes (pages 295–296)

1. Circle the letter of the location of DNA in prokaryotic cells.
a. nucleus b. mitochondria c. cytoplasm d. vacuole
2. Is the following sentence true or false? Most prokaryotes contain a single, circular DNA molecule. _____
3. Eukaryotic DNA is generally located in the cell _____ in the form of a number of chromosomes.
4. Is the following sentence true or false? All organisms have the same number of chromosomes. _____
5. Is the following sentence true or false? The *E. coli* chromosome is longer than the diameter of an individual *E. coli* bacterium. _____
6. Circle the letter of each sentence that is true about chromosome structure.
 - a. The DNA in eukaryotic cells is very loosely packed.
 - b. Prokaryotic cells contain more DNA than eukaryotic cells.
 - c. A human cell contains more than 1 meter of DNA.
 - d. The DNA of the smallest human chromosome is nearly 10 times as long as many bacterial chromosomes.
7. Eukaryotic chromosomes contain both DNA and protein, packed together to form _____.
8. What are histones? _____

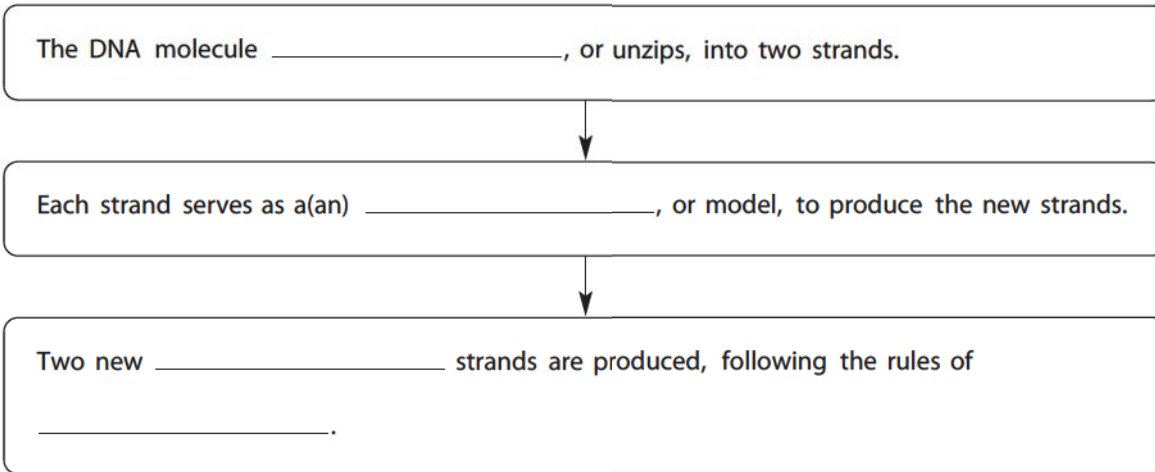
9. Why are individual chromosomes visible only during mitosis? _____

10. Is the following sentence true or false? Changes in chromatin structure and histone-DNA binding are associated with changes in gene activity. _____
11. What do nucleosomes do? _____

DNA Replication (pages 297–299)

12. What occurs during the process of replication? _____

13. Complete the flowchart to describe the process of DNA replication.



14. Is the following sentence true or false? In eukaryotic chromosomes, DNA replication begins at a single point in the chromosome and proceeds in two directions.

15. The sites where DNA replication and separation occur are called _____.

16. What occurs when a molecule of DNA is “unzipped”? _____

17. What is the complementary strand of bases for a strand with the bases TACGTT?

18. Is the following sentence true or false? Each DNA molecule resulting from replication has one original strand and one new strand. _____

19. List two major roles of DNA polymerase in the process of DNA replication.

a. _____

b. _____

Reading Skill Practice

The illustrations in textbooks can help you better understand a difficult concept. Look at Figure 12–10 on page 297. List in order, beginning with DNA, the levels of organization of eukaryotic DNA to form chromosomes. Do your work on a separate sheet of paper.

Section 12–3 RNA and Protein Synthesis

(pages 300–306)



Key Concepts

- What are the three main types of RNA?
- What is transcription?
- What is translation?

The Structure of RNA (page 300)

1. List the three main differences between RNA and DNA.

- _____
- _____
- _____

2. What is the importance of the cell's ability to copy a single DNA sequence into RNA?

Types of RNA (pages 300–301)

3. What is the one job in which most RNA molecules are involved? _____

4. Complete the table about the types of RNA.

TYPES OF RNA

Type	Function
	Carries copies of the instructions for assembling amino acids from DNA to the rest of the cell
Ribosomal RNA	
	Transfers each amino acid to the ribosome to help assemble proteins

Transcription (page 301)

5. Circle the letter of each sentence that is true about transcription.

- During transcription, DNA polymerase binds to RNA and separates the DNA strands.
- RNA polymerase uses one strand of DNA as a template to assemble nucleotides into a strand of RNA.
- RNA polymerase binds only to DNA promoters, which have specific base sequences.
- Promoters are signals in RNA that indicate to RNA polymerase when to begin transcription.

RNA Editing (page 302)

- 6. Many RNA molecules from eukaryotic genes have sections, called _____, edited out of them before they become functional. The remaining pieces, called _____, are spliced together.
- 7. Is the following sentence true or false? RNA editing occurs in the cytoplasm of the cell.

- 8. What are two explanations for why some RNA molecules are cut and spliced?
 - a. _____

 - b. _____

The Genetic Code (pages 302–303)

- 9. Proteins are made by joining _____ into long chains called polypeptides.
- 10. How can only four bases in RNA carry instructions for 20 different amino acids?

- 11. What is a codon? _____

- 12. Circle the letter of the number of possible three-base codons.
 - a. 4 b. 12 c. 64 d. 128
- 13. Is the following sentence true or false? All amino acids are specified by only one codon. _____
- 14. Circle the letter of the codon that serves as the “start” codon for protein synthesis.
 - a. UGA b. UAA c. UAG d. AUG

Translation (pages 303–305)

- 15. What occurs during the process of translation? _____

- 16. Where does translation take place? _____

17. Circle the letter of each sentence that is true about translation.
- a. Before translation occurs, messenger RNA is transcribed from DNA in the nucleus.
 - b. Translation occurs in the nucleus.
 - c. It is the job of transfer RNA to bring the proper amino acid into the ribosome to be attached to the growing peptide chain.
 - d. When the ribosome reaches a stop codon, it releases the newly formed polypeptide and the mRNA molecule.

18. What is an anticodon? _____

The Roles of RNA and DNA (page 306)

Match the roles with the molecules. Molecules may be used more than once.

Roles	Molecules
_____ 19. Master plan	a. DNA
_____ 20. Goes to the ribosomes in the cytoplasm	b. RNA
_____ 21. Blueprint	
_____ 22. Remains in the nucleus	

Genes and Proteins (page 306)

23. Many proteins are _____, which catalyze and regulate chemical reactions.
24. Is the following sentence true or false? Genes are the keys to almost everything that living cells do. _____

Reading Skill Practice

A flowchart is useful for organizing the steps in a process. Make a flowchart that shows the steps in the process of translation. Look at Figure 12–18 on pages 304–305 for help. For more information about flowcharts, see Appendix A. Do your work on a separate sheet of paper.