

Chapter 12 DNA and RNA

Section 12–1 DNA (pages 287–294)

This section tells about the experiments that helped scientists discover the relationship between genes and DNA. It also describes the chemical 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? _____

Name _____ Class _____ Date _____

9. Transformation did not occur when _____ was destroyed.

10. What was the conclusion from Avery's experiments? _____

The Hershey-Chase Experiment (pages 289–290)

11. What is a bacteriophage? _____

12. Circle the letter of each part that makes up a bacteriophage.

- a. lipid coat c. carbohydrate core
b. protein coat d. DNA core

13. What happens when a bacteriophage infects a bacterial cell? _____

14. How would Hershey and Chase learn whether genes were made of protein or DNA?

15. Circle the letter of the molecule for which phosphorus-32 (^{32}P) is used as a radioactive marker.

- a. protein b. lipid c. DNA d. carbohydrate

16. Is the following sentence true or false? If ^{35}S was found in the bacteria, it would mean that the viruses' DNA had been injected into the bacteria. _____

17. What results did Hershey and Chase observe? _____

18. Hershey and Chase concluded that the genetic material of the bacteriophage was _____.

The Components and Structure of DNA (pages 291–294)

19. List the three critical things that genes were known to do.

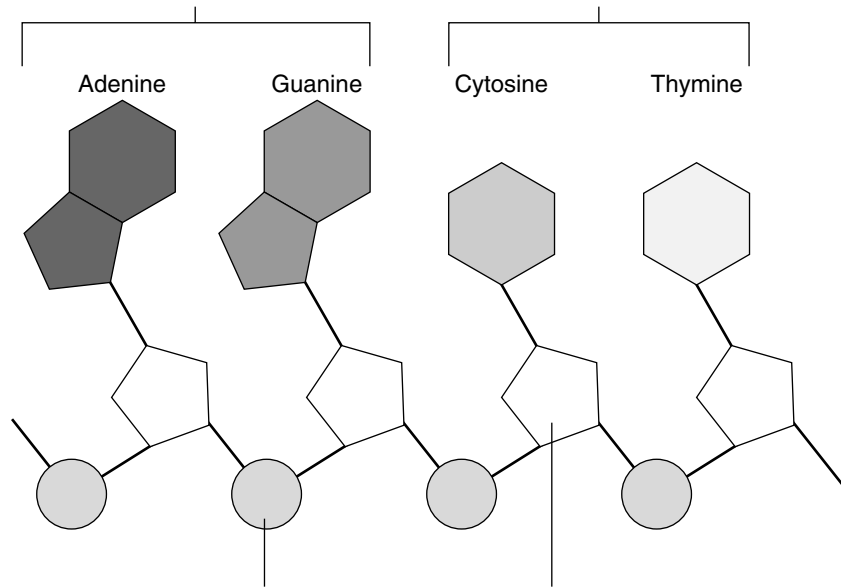
- a. _____

b. _____

c. _____

20. Adenine, guanine, cytosine, and thymine are four kinds of _____ bases in DNA.

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



22. 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. _____

23. What forms the backbone of a DNA chain? _____

24. Is the following sentence true or false? The nucleotides must be joined together in a specific order. _____

25. According to Chargaff's rules, the percentages of _____ are equal to thymine and the percentages of _____ are equal to guanine in the DNA molecule.

26. Rosalind Franklin's work with X-ray diffraction showed that the DNA molecule is shaped like a(an) _____ and contains _____ strands.

27. How did Francis Crick and James Watson try to understand the structure of DNA?

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

29. 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)

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

- Why are individual chromosomes visible only during mitosis? _____

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

Section 12–3 RNA and Protein Synthesis (pages 300–306)

This section describes RNA and its role in transcription and translation.

The Structure of RNA (page 300)

1. List the three main differences between RNA and DNA.
 - a. _____
 - b. _____
 - c. _____
2. Is the following sentence true or false? RNA is like a disposable copy of a DNA segment. _____
3. What is the importance of the cell's ability to copy a single DNA sequence into RNA?

Types of RNA (pages 300–301)

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

5. Complete the compare-and-contrast 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)

6. Circle the letter of each sentence that is true about transcription.
 - a. During transcription, DNA polymerase binds to RNA and separates the DNA strands.
 - b. RNA polymerase uses one strand of DNA as a template to assemble nucleotides into a strand of RNA.
 - c. RNA polymerase binds only to DNA promoters, which have specific base sequences.
 - d. Promoters are signals in RNA that indicate to RNA polymerase when to begin transcription.

RNA Editing (page 302)

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

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

 - b. _____

The Genetic Code (pages 302–303)

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

12. What is a codon? _____

13. Circle the letter of the number of possible three-base codons.
a. 4 b. 12 c. 64 d. 128
14. Is the following sentence true or false? All amino acids are specified by only one codon. _____
15. 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)

16. What occurs during the process of translation? _____

17. Where does translation take place? _____

18. 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.
19. 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
_____	20. Master plan	a. DNA
_____	21. Goes to the ribosomes in the cytoplasm	b. RNA
_____	22. Blueprint	
_____	23. Remains in the nucleus	

Genes and Proteins (page 306)

24. Many proteins are _____, which catalyze and regulate chemical reactions.
25. 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.

Section 12–4 Mutations (pages 307–308)

This section describes and compares gene mutations and chromosomal mutations.

Introduction (page 307)

1. What are mutations? _____

2. Is the following sentence true or false? Chromosomal mutations result from changes in a single gene. _____

Kinds of Mutations (pages 307–308)

3. Mutations that occur at a single point in the DNA sequence are _____ mutations.
4. A mutation involving the insertion or deletion of a nucleotide is a(an) _____ mutation.
5. Complete the compare-and-contrast table of types of chromosomal mutations.

CHROMOSOMAL MUTATIONS

Type	Description	Examples
		ABC•DEF → AC•DEF
Duplication		
	Part of a chromosome becomes oriented in the reverse of its usual direction	
Translocation		

Name _____ Class _____ Date _____

6. Circle the letter of each sentence that is true about gene mutations.
- a. Point mutations affect just one nucleotide.
 - b. The substitution of one nucleotide for another in the gene never affects the function of the protein.
 - c. Point mutations that involve the insertion or deletion of a nucleotide change the reading frame of the genetic message.
 - d. Frameshift mutations affect every amino acid that follows the point of the mutation.

Significance of Mutations (page 308)

7. Mutations that cause dramatic changes in protein structure are often _____.
8. Mutations are a source of _____ in a species.
9. What is polyploidy? _____
