

CHAPTER 12

*Study Guide*

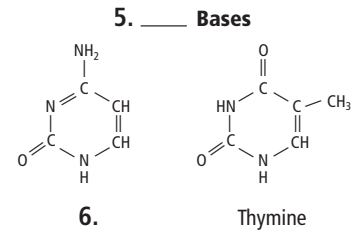
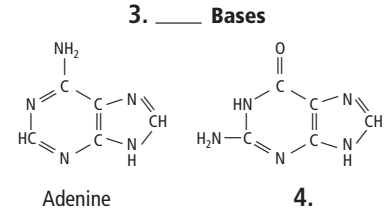
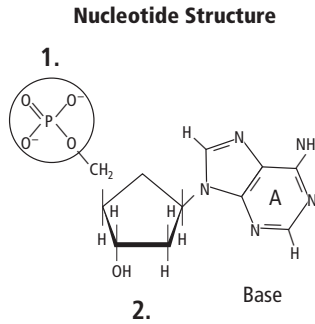
**Section 1: DNA: The Genetic Material**

In your textbook, read about nucleotides.

Label the diagrams of DNA nucleotides and bases. Use these choices:

cytosine      guanine      phosphate      purine      pyrimidine      sugar

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_



In your textbook, read about DNA structure.

Write the term or phrase that best completes each statement. Use these choices:

|             |                  |                   |               |
|-------------|------------------|-------------------|---------------|
| adenine (A) | chromosome       | cytosine          | double helix  |
| double-ring | genetic material | nitrogenous bases | nucleic acids |
| nucleotides | purine           | single-ring       |               |

7. \_\_\_\_\_, guanine (G), cytosine (C), and thymine (T) are the four \_\_\_\_\_ in DNA.
8. In DNA, \_\_\_\_\_ always forms hydrogen bonds with guanine (G).
9. The sequence of \_\_\_\_\_ carries the genetic information of an organism.
10. Chargaff's data states that the number of \_\_\_\_\_ bases equals the number of pyrimidine bases in DNA.
11. The twisted ladder shape of DNA is called a \_\_\_\_\_.
12. DNA is the \_\_\_\_\_ of all organisms.
13. The pyrimidine bases have a \_\_\_\_\_ structure.
14. The purine bases have a \_\_\_\_\_ structure.
15. DNA and RNA are the two \_\_\_\_\_ found in living cells.
16. DNA supercoils to make up the structure known as a \_\_\_\_\_.

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**Section 2: Replication of DNA**

In your textbook, read about semiconservative replication.

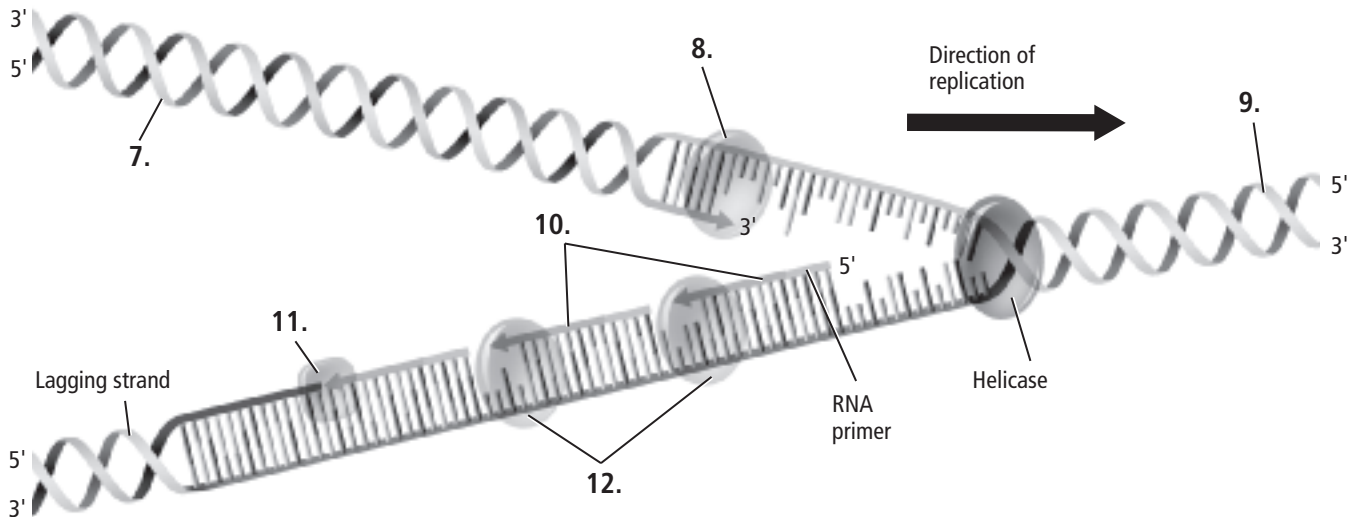
Match the description in Column A with the term in Column B.

| Column A   | Column B                            |
|--|-------------------------------------|
| _____ 1. unwinds in multiple areas as DNA is replicated                          | A. semiconservative replication     |
| _____ 2. parental strands separate and serve as templates for new strands of DNA | B. DNA helicase                     |
| _____ 3. the DNA of prokaryotes  | C. single-stranded binding proteins |
| _____ 4. keep the strands of DNA separate during replication                     | D. leading strand                   |
| _____ 5. elongates as DNA unwinds and is replicated continuously                 | E. eukaryotic DNA                   |
| _____ 6. unwinds the double helix  | F. circular DNA                     |

In your textbook, read about base pairing.

Label the diagram showing DNA replication. Use these choices:

| DNA ligase | DNA polymerase | leading strand | Okazaki fragments | parental DNA |
|------------|----------------|----------------|-------------------|--------------|
| 7. _____   |                |                | 10. _____         |              |
| 8. _____   |                |                | 11. _____         |              |
| 9. _____   |                |                | 12. _____         |              |



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### Section 3: DNA, RNA, and Protein

In your textbook, read about the central dogma of biology.

For each statement below, write true or false.

- \_\_\_\_\_ 1. The central dogma of biology, or the mechanism of reading and expressing genes in all living things, can be expressed as follows:  
DNA → RNA → proteins.
- \_\_\_\_\_ 2. The process of the synthesis of mRNA from DNA is called translation.

In your textbook, read about the code.

Refer to the figure. Respond to each statement.

3. Express the following sequence of DNA nucleotides as complementary mRNA codons.

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

\_\_\_\_\_

4. Write the specific amino acid or code that each mRNA codon from statement 3 above represents.

\_\_\_\_\_

5. Identify the start and stop mRNA codons.

\_\_\_\_\_

| First Base | Second Base               |                  |                   |                   | Third Base |
|------------|---------------------------|------------------|-------------------|-------------------|------------|
|            | U                         | C                | A                 | G                 |            |
| U          | UUU<br>phenylalanine      | UCU<br>serine    | UAU<br>tyrosine   | UGU<br>cysteine   | U          |
|            | UUC<br>phenylalanine      | UCC<br>serine    | UAC<br>tyrosine   | UGC<br>cysteine   | C          |
|            | UUA<br>leucine            | UCA<br>serine    | UAA<br>stop       | UGA<br>stop       | A          |
|            | UUG<br>leucine            | UCG<br>serine    | UAG<br>stop       | UGG<br>tryptophan | G          |
| C          | CUU<br>leucine            | CCU<br>proline   | CAU<br>histidine  | CGU<br>arginine   | U          |
|            | CUC<br>leucine            | CCC<br>proline   | CAC<br>histidine  | CGC<br>arginine   | C          |
|            | CUA<br>leucine            | CCA<br>proline   | CAA<br>glutamine  | CGA<br>arginine   | A          |
|            | CUG<br>leucine            | CCG<br>proline   | CAG<br>glutamine  | CGG<br>arginine   | G          |
| A          | AUU<br>isoleucine         | ACU<br>threonine | AAU<br>asparagine | AGU<br>serine     | U          |
|            | AUC<br>isoleucine         | ACC<br>threonine | AAC<br>asparagine | AGC<br>serine     | C          |
|            | AUA<br>isoleucine         | ACA<br>threonine | AAA<br>lysine     | AGA<br>arginine   | A          |
|            | AUG (start)<br>methionine | ACG<br>threonine | AAG<br>lysine     | AGG<br>arginine   | G          |
| G          | GUU<br>valine             | GCU<br>alanine   | GAU<br>aspartate  | GGU<br>glycine    | U          |
|            | GUC<br>valine             | GCC<br>alanine   | GAC<br>aspartate  | GGC<br>glycine    | C          |
|            | GUA<br>valine             | GCA<br>alanine   | GAA<br>glutamate  | GGA<br>glycine    | A          |
|            | GUG<br>valine             | GCG<br>alanine   | GAG<br>glutamate  | GGG<br>glycine    | G          |

In your textbook, read about translation and the role of the ribosome.

Use each of the terms below only once to complete the passage.

anticodon                      cytoplasm                      mRNA                      protein  
ribosome                      start codon                      translation                      tRNA

Once the (6) \_\_\_\_\_ is synthesized, it leaves the nucleus and enters the (7) \_\_\_\_\_. The 5' end of the mRNA connects to the (8) \_\_\_\_\_, where the code is read and translated to make a(n) (9) \_\_\_\_\_ in a process called (10) \_\_\_\_\_. In translation, (11) \_\_\_\_\_ interprets the mRNA codon sequence. Once the mRNA is associated with the ribosome, a tRNA with the (12) \_\_\_\_\_ CAU will bind to the mRNA (13) \_\_\_\_\_ AUG.

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**Section 4: Gene Regulation and Mutations**

In your textbook, read about prokaryote and eukaryote gene regulation.

If the statement is true, write true. If the statement is false, replace the italicized term or phrase to make it true.

1. *Gene regulation* is the ability of an organism to control which genes are transcribed.

\_\_\_\_\_

2. A *chromosome* contains the genes for the proteins needed for a specific metabolic pathway.

\_\_\_\_\_

3. An operator is a segment of DNA that acts as an on/off switch for *translation*.

\_\_\_\_\_

4. *Eukaryotes* can control gene expression using transcription factors.

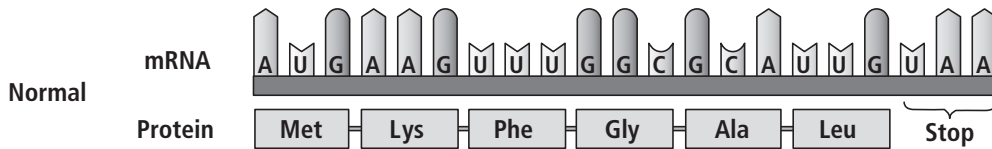
\_\_\_\_\_

5. Hox genes play an important role in determining the *gender* of an organism.

\_\_\_\_\_

In your textbook, read about mutations.

Refer to the figure below. Respond to the following statement.



6. **Record** the mRNA codon sequence that would result from a substitution mutation of A instead of G in the amino acid alanine (Ala) in the above protein.

\_\_\_\_\_

Complete the table by filling in the missing information. Use these choices:

|                    | frameshift        | substitution     |
|--------------------|-------------------|------------------|
| mRNA Sequence      | Mutation Sequence | Type of Mutation |
| 7. UGU-CCG-GAA-CGA | UGC-CGG-GAA-CGA   |                  |
| 8. GAA-CGU-AGC-GGU | GAU-CGU-AGC-GGU   |                  |
| 9. UGU-UUC-CCU-UAA | UGU-UCC-CUU-AA*   |                  |