# 3 Cell Structure and Function

## Chapter Outline

The Plasma Membrane
The Nucleus
The Cytoplasm
- Ribosomes and Protein Synthesis
- Endomembrane System
- Mitochondria
- Centrioles and Related Organelles

Plasma Membrane Transport
- Passive Transport
- Active Transport
- Endocytosis and Exocytosis

Cell Division
- Mitosis
- Meiosis

## Learning Objectives

1. Describe the structure and function of the plasma membrane.
2. Describe the structure and function of the nucleus.
3. Describe the role of DNA in protein synthesis.
4. Describe the roles of ribosomes and the three types of RNA in protein synthesis.
5. Describe the structures and roles of the endoplasmic reticulum and the Golgi apparatus in packaging and secretion.
6. Describe the structures of lysosomes and peroxisomes and the roles of these organelles in the breakdown of molecules.
7. Describe the structure of mitochondria and their role in producing ATP.
8. Describe the structures of centrioles, cilia, and flagella and their roles in cellular movement.
9. Describe how substances move across the plasma membrane, and distinguish between passive and active transport.
10. Give an overview of mitotic cell division, and explain the mechanism by which the chromosome number stays constant.
11. Contrast mitosis with meiosis in general terms.

## Medical Terminology

| Medical Term | Meaning |
|---|---|
| cyte-, cyto- | cell |
| hem-, hemat- | blood |
| iso- | equal |
| -lysis, -lytic | break down, dissolve |

What do you think *hemolysis* means?

## New Terms

**Basic Key Terms**

| | | | | |
|---|---|---|---|---|
| active transport | diffusion | filtration | mitochondrion | phagocytosis |
| centriole | endocytosis | flagella | nucleolus | pinocytosis |
| chromosome | endoplasmic reticulum | Golgi apparatus | nucleus | plasma membrane |
| cilia | | lysosome | organelle | ribosome |
| cytoplasm | exocytosis | metabolism | osmosis | |

**Clinical Key Terms**

carcinogen
chemotherapy
enetic disease
nemodialysis
hypertonic
hypotonic
isotonic
malignant
metastasis
mutation
apoptosis
tumor

## Study Questions

### *I. The Plasma Membrane/The Nucleus/The Cytoplasm*

A. Match the terms on the left with the description on the right. Place the correct letters in the blanks on the left.

____ 1. plasma membrane
____ 2. centriole
____ 3. flagellum
____ 4. Golgi apparatus
____ 5. lysosome
____ 6. cytoplasm
____ 7. mitochondrion
____ 8. nucleolus
____ 9. nucleus
____ 10. rough ER

a. contains chromatin in the nondividing cell
b. conducts intracellular digestion
c. described by the fluid mosaic model
d. involved in the organization of a spindle during cell division
e. packages products for export
f. overall region outside the nucleus
g. promotes movement of a sperm cell
h. produces ATP molecules
i. site of protein synthesis
j. manufactures ribosomal RNA

B. The underlined words in the following statements make the statements false. In the space provided, rewrite each statement to make it true.

1. Proteins and nucleic acids compose the fluid mosaic model of plasma membrane structure.

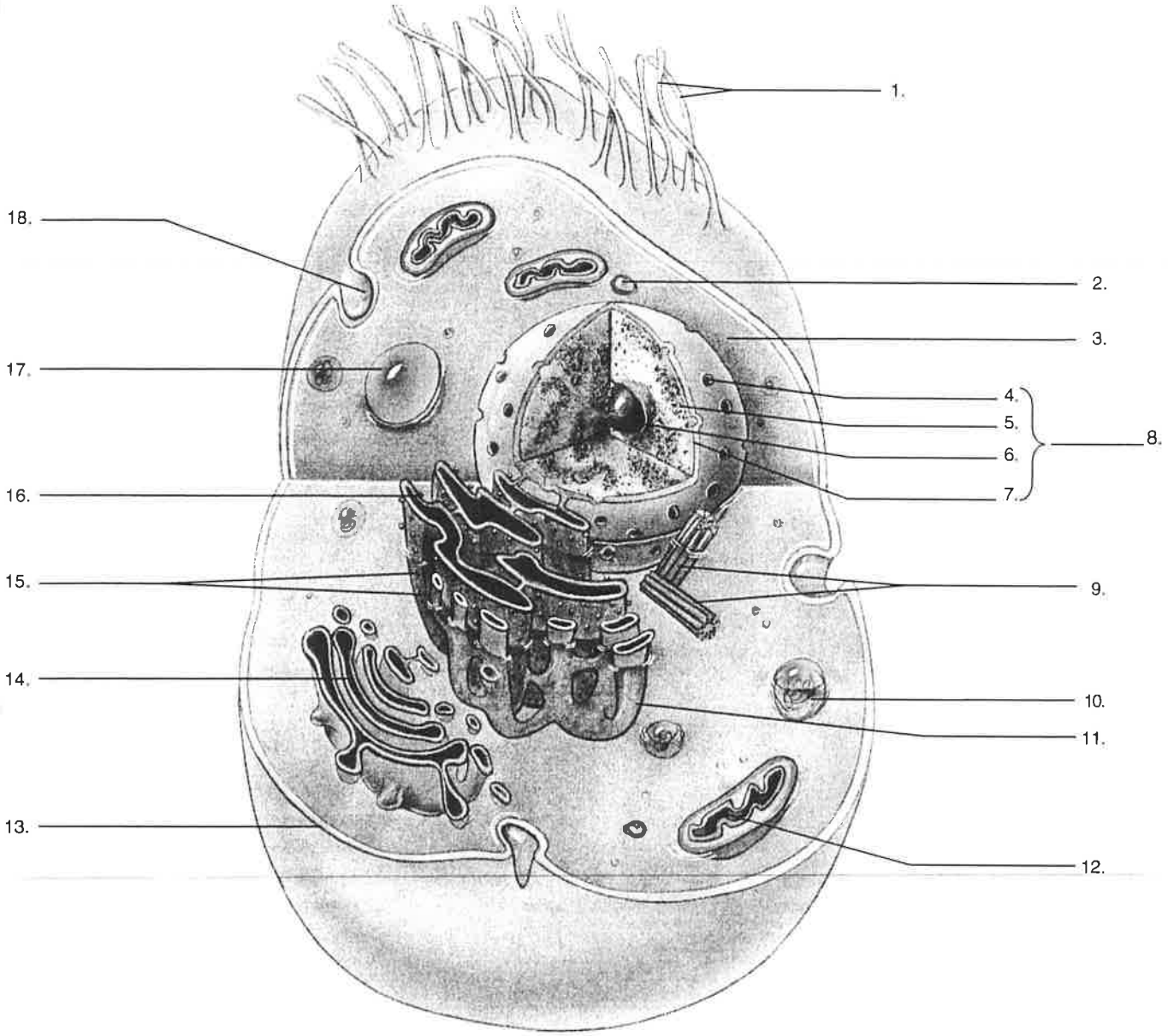
2. *Nucleic acids* serve as receptors for chemical molecules arriving at the plasma membrane.

3. Chromosomes are visible in the cell when it is not dividing.

4. DNA activity is not part of cell metabolism.

5. Smooth ER is the site of carbohydrate synthesis.

C. Use the terms that follow to label the cell structures in the drawing (see text figure 3.1). Write the correct label in the space provided beside each numbered pointer.




centrioles
chromatin
cilia
cytoplasm
Golgi apparatus
lysosome
mitochondrion
nuclear envelope
nuclear pore
nucleolus
nucleus
peroxisome
plasma membrane
ribosomes
rough endoplasmic reticulum
smooth endoplasmic reticulum
vacuole
vesicle formation

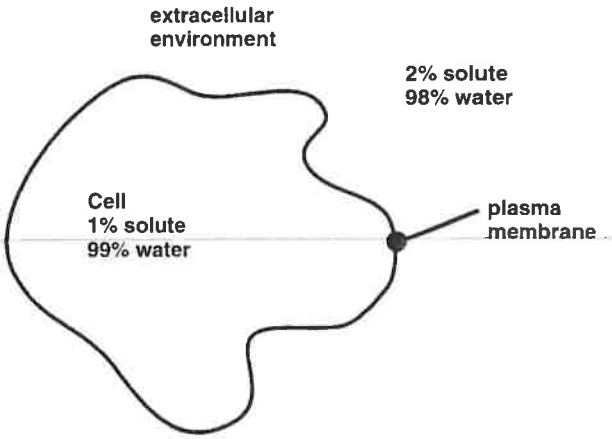
## *II. Plasma Membrane Transport*

A. Match the terms on the left with the description on the right. Place the correct letters in the blanks on the left.

____ 1. active transport
____ 2. diffusion
____ 3. filtration
____ 4. osmosis
____ 5. phagocytosis
____ 6. facilitated diffusion

a. this process requires a large number mitochondria
b. a red blood cell undergoes hemolysis by this process
c. blood pressure pushes molecules out of the capillary by this process
d. movement of substances until they are equally distributed
e. involves vesicle formation to move substances in
f. requires carrier proteins to move substances toward lower concentration

B. Each of the following statements refers to the cell in its environment. The plasma membrane is permeable to water but is not permeable to solute. Refer to the accompanying drawing as you indicate whether each of the following statements is true (T) or false (F).




____ 1. The extracellular environment is hypotonic, compared to the inside of the cell.
____ 2. The intracellular environment is hypertonic, compared to the extracellular environment.
____ 3. The net movement of water will be from the inside of the cell to the outside of the cell.
____ 4. The net movement of solute will be into the cell.
____ 5. The cell will lose volume.
____ 6. The intracellular and extracellular environments will tend toward an isotonic relationship.

## *III. Cell Division*

*Mitosis*

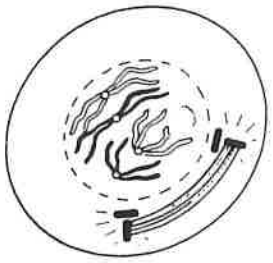
A. Match the terms on the left with the descriptions on the right. Place the correct letters in the blanks on the left.

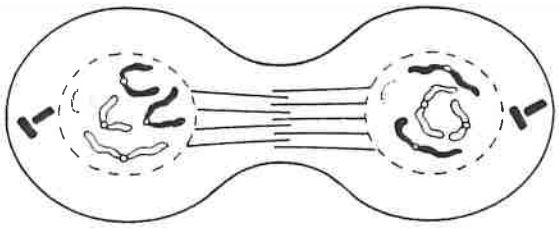
____ 1. anaphase
____ 2. interphase
____ 3. metaphase
____ 4. prophase
____ 5. telophase

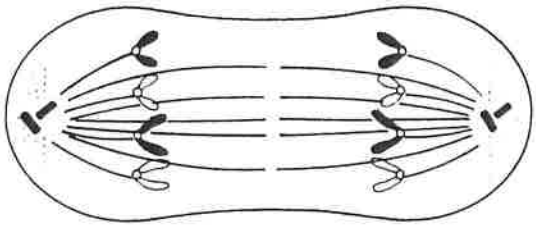
a. chromosomes are lined up on the equator of the spindle apparatus
b. chromosomes are not visible
c. chromosomes are first visible
d. chromosomes first move toward poles
e. furrowing of plasma membrane divides cytoplasm

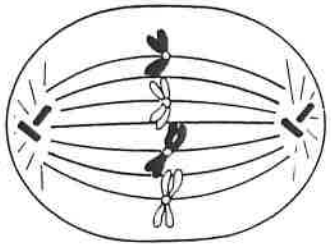
B. Indicate which stage of mitosis each of the accompanying drawings represents.

1. 

2. 

3. 

4. 

5. 

1. Drawing 1 shows _____.
2. Drawing 2 shows _____.
3. Drawing 3 shows _____.
4. Drawing 4 shows _____.
5. Drawing 5 shows _____.

C. Match the terms on the left with the descriptions on the right. Place the correct letters in the blanks on the left.

| | | |
|---|---|---|
| _____ | 1. G1 phase | a. replication of DNA |
| _____ | 2. Mitosis | b. doubling of organelles |
| _____ | 3. G2 phase | c. division of the cytoplasm |
| _____ | 4. S phase | d. condensation of chromatin |
| _____ | 5. Cytokinesis | e. division of nucleus |

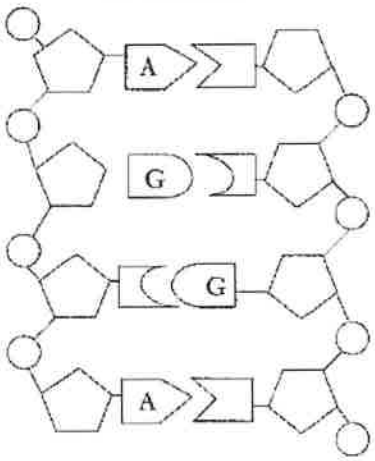
D. Match the terms on the left with the descriptions of the right. Place the correct letters in the blanks on the left.

_____ 1. Chromosomes duplicate
_____ 2. Cell divides only once
_____ 3. Results in identical cells
_____ 4. Involves protein synthesis
_____ 5. Halves the number of chromosomes
_____ 6. Cell divides twice
_____ 7. Results in 4 cells
_____ 8. Involves production of body cells
_____ 9. Important to the growth and repair of organisms
_____ 10. Involves production of gametes

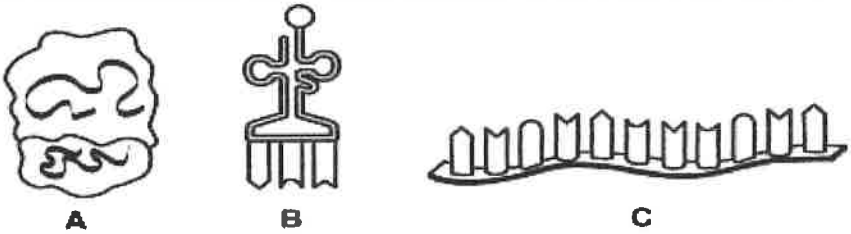
a. mitosis only
b. meiosis only
c. mitosis and meiosis

E. Label the sugar molecules (S), the phosphate molecules (P), and the bases in the above diagram (A, C, T, or G). Circle and label one nucleotide.

DNA Strand




F. Match illustrations of RNA molecules with its name. Place the correct letters in the blanks on the left.




_____ 1. tRNA
_____ 2. mRNA
_____ 3. rRNA

G. Match the terms on the left with the descriptions of the right. Place the correct letters in the blanks on the left.

_____ 1. mRNA specifies the order of amino acids in a particular protein
_____ 2. joins with proteins to form ribosome
_____ 3. Contains a code and serves as a template for RNA production
_____ 4. Brings amino acids to the ribosome
_____ 5. Process that is used to produce mRNA
_____ 6. Process that occurs in the cytoplasm at the ribosome
_____ 7. Process that makes an exact copy of DNA

a. tRNA
b. mRNA
c. rRNA
d. DNA
e. replication
f. transcription
g. translation