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About Dr. Jahangir Moini

- Professor of Science and Health at Eastern Florida State College, Palm Bay Campus
- Former Assistant Professor at Tehran University School of Medicine for 9 years teaching medical and allied health students
- Former Professor and Director of Allied Health programs at Everest University for 15 years
- Worked as a health educator consultant for 18 years at Brevard County Health Department
Overview

• Provides an accessible overview of human anatomy and physiology for all health professionals

• Focus on enhanced student understanding and learning

• Offers assessments and interactive learning resources to increase student comprehension and retention

• Provides students with an easily navigable format
New to the Second Edition

• Four additional chapters, including:
  – New chapter on joints, providing an overview of classifications, types, and injuries
  – Expanded presentation of the nervous system, with additional chapters
  – Enhanced discussion of the cardiovascular system
• New *Focus on Pathology* feature connects anatomy and physiology to human disease
• Essay Questions appear at the end of each chapter
Layout of the Material

Overview of the human anatomy and physiology

Effects of aging on various body systems

Connects anatomy and physiology to human disease
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Transport

Chapter 15:
Blood
Chapter 16:
The Heart
Chapter 17:
The Vascular System
Chapter 18:
The Lymphatic System and Immunity

Environmental Exchange

Chapter 19:
The Respiratory System
Chapter 20:
The Urinary System
Chapter 21:
Fluid, Electrolyte, & Acid-Base Balance
Chapter 22:
Digestive System

Continuity of Life

Chapter 23:
The Reproductive System
Chapter 24:
Pregnancy and Development
Chapter Features

PEDOGOGY
- Chapter Objectives
- Learning Goals
- Assess Your Learning Questions
- Test Your Knowledge Questions
- Critical Thinking Questions
- Essay Questions

BOXED FEATURES
- Focus on Pathology
- Effects of Aging on Body Systems
- Diagnostic Imaging Tables
- Diagnostic Images: MRI, X-Ray, CT Scans
Benefits for Students

• **Facilitates Student Learning**
  – Provides a comprehensive overview of human anatomy and physiology
  – Presents content in an accessible manner targeted to health professions students
  – Includes clinical images such as X-rays, CT Scans and MRIs
  – Offers access to helpful animations and interactive learning tools

• **Provides Self Assessments**
  – Incorporates robust end of chapter assessments for learners
  – Navigate 2 Advantage Access provides additional activities and questions
Next, let’s take a look at some of the features and examples from the text...
Chapter 3

Chapter Objectives

Chapter Outline

Cells

OBJECTIVES

After studying this chapter, readers should be able to:

1. Explain the parts of a cell’s structure.
2. Describe the structure and function of the cell membrane.
3. Describe the structure and function of cytoplasm and cytosol.
4. Describe the parts of the cell nucleus and their functions.
5. Describe the "powerhouses" of the cell.
6. Describe the processes that transport substances across the plasma membrane.
7. Compare and define cilia and flagella.
8. Compare passive and active cell mechanisms.
9. Describe the parts of the cell cycle.
10. Explain cell division and cancer.

OUTLINE

- Overview
- Structure of the Cell
  - Cell Membrane
  - Cytoplasm
  - Nucleus
- Movements Through Cell Membranes
  - Passive Cell Mechanisms
  - Active Cell Mechanisms
- Cell Life Cycle
  - Interphase
  - Cell Division and Cytoplasmic Division
  - Differentiation
  - Cell Division and Cancer
- Summary
- Key Terms
- Learning Goals
- Critical Thinking Questions
- Review Questions
- Essay Questions

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Full-color Images

Figure 3-1: The cell (Lewin, B., et al. 2007). Cells. Sudbury, MA: Jones & Bartlett Learning.)
TEST YOUR UNDERSTANDING QUESTION

1. Name the three major parts of a cell and the function of the cell membrane.
2. Explain how a semipermeable cell membrane functions.

Membrane Lipids

The basic fabric of the cell membrane is formed by the lipid bilayer. It is most made up of phospholipids but also contains glycolipids, cholesterol, and lipid rafts. Phospholipids are amphiphilic molecules that have both hydrophobic and hydrophilic regions. In a cell membrane, they are arranged so that their hydrophobic tails are inside the cell and their hydrophilic heads are outside. This arrangement helps to maintain the integrity of the cell membrane and allows for the transport of substances in and out of the cell.

Membrane Proteins

Membrane proteins are the dynamic elements that determine the function of the cell membrane. They facilitate the transport of molecules across the membrane and are involved in a variety of cellular processes, including cell-cell communication, signal transduction, and enzymatic reactions. Some membrane proteins are transmembrane proteins, which span the membrane and allow the transport of molecules. Others are integral membrane proteins, which are embedded in the membrane and do not span it. Still others are peripheral membrane proteins, which are loosely attached to the membrane and can be easily removed.

Glycolipids

Glycolipids are lipids that have sugar groups attached, and they are found only in the outer plasma membrane surface. They make up approximately 1% of the cell membrane. The mucous cells of the gut lining (mucosal membrane) are rich in glycolipids, which are secreted as mucus. Glycolipids also serve as a barrier to protect the cell membrane from invasion by viruses and other pathogens. The barrier function of glycolipids is important in the maintenance of the integrity of the cell membrane and the protection of the cell from infection.
FOCUS ON PATHOLOGY
- Boxed Feature

As you have learned, cell membranes are selectively permeable. This is a very important property of cell membranes. When damaged, many substances are able to flow in and out of cells freely. For example, in burn victims, vital fluids, ions, and proteins leak out of damaged cells.
<table>
<thead>
<tr>
<th>TABLE 3-1 Structures and Functions of Organelles</th>
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<tbody>
<tr>
<td><strong>Organelles</strong></td>
</tr>
<tr>
<td>Cytoskeleton</td>
</tr>
<tr>
<td>Rough ER (RER)</td>
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<tr>
<td>Smooth ER (SER)</td>
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<tr>
<td>Golgi apparatus</td>
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<tr>
<td>Lysosomes</td>
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<tr>
<td>Microfilaments</td>
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<td>Intermediate filaments</td>
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<td>Microtubules</td>
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<td>Mitochondria</td>
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<td>Peroxisomes</td>
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<td>Ribosomes</td>
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</table>
Chapter 3 Summary

**SUMMARY**

The cell is the basic unit that performs all the vital physiologic functions in the body. The three parts of the cell are the semipermeable cell membrane, the cytoplasm, and the nucleus. The cell membrane is mostly made up of lipids and proteins, usually in a double layer of phospholipid molecules. The cytoplasm is a gel-like material suspending the cell's organelles. The organelles in the cytoplasm each have specific actions that help to carry out the cell's activities. They are vital to the life of the cell, tissue, and organism.

The cell nucleus is the control center for cellular operations. Inside the nucleus, a fluid called nucleoplasm suspends the nucleolus and chromatin. The nucleus also contains chromosomes. The DNA controls protein synthesis in the nucleus.

The cell membrane uses passive and active mechanisms to allow various substances to enter or leave the cell. Passive cell mechanisms include diffusion, osmosis, and filtration. Active cell mechanisms require energy and specific carrier molecules and include active transport, endocytosis, and exocytosis. A neoplasm is a mass of tissue produced by abnormal cell growth and division. The two types of tumors are benign or malignant. Tumors that are malignant spread into surrounding tissues in a process known as metastasis.
Key Terms

**KEY TERMS**

- Active transport
- Cell membrane
- Centrioles
- Centrosome
- Chromatin
- Chromosomes
- Cilia
- Cisterns
- Clathrin
- Cytology
- Cytoplasm
- Cytoskeleton
- Cytosol
- Endocytosis
- Endoplasmic reticulum (ER)

**KEY TERMS (CONTINUED)**

- Equilibrium
- Exocytosis
- Facilitated diffusion
- Flagella
- Golgi apparatus
- Glycolipids
- Hydrostatic pressure
- Integral proteins
- Isotonic
- Lipid rafts
- Lysosomes
- Microfilaments
- Mitochondria
- Mitosis
- Myosin
- Nucleolus
- Nucleus
- Osmolarity
- Osmotic pressure
- Peripheral proteins
- Peroxisomes
- Phospholipids
- Ribosomes
- Semi-permeable
- Sex cells
- Somatic cells
- Stem cells
- Vesicles

Ch 3
Key Terms
LEARNING GOALS

The following learning goals correspond to the objectives at the beginning of this chapter:

1. There are three major parts to a cell: the cell membrane, the nucleus, and the cytoplasm. The cell membrane encloses the cell, its nucleus, and its cytoplasm. The nucleus contains the cell’s genetic material and controls its activities. The cytoplasm fills out the cell and its shape.

2. The cell (plasma) membrane controls movement of substances both into and out of the cell. It is also where much of the cell’s biologic activities are conducted. Molecules in the cell membrane form pathways that allow the detection of signals from outside the cell to be transmitted inside. Each cell’s membrane is thin, delicate, and able to stretch. There are usually tiny folds on the surface, which help to increase its surface area. Cell membranes can be differentially permeable or semipermeable.

3. Cytoplasm is a substance that contains all the cellular contents between the plasma membrane and the nucleus. It makes up most of cell volume and is a gel-like material suspending the cell’s organelles. Cytoplasm consists of cytosol and a cytoskeleton. Cytosol is the fluid portion of cytoplasm.

4. The cell nucleus serves as the control center for cellular operations. Inside the nucleus is a fluid called nucleoplasm that suspends the following structures:
   - Nucleolus: A mini-nucleus made up of mostly DNA and protein, with no surrounding membrane
   - Chromatin: Loosely coiled DNA and protein fibers that condense, forming chromosomes

5. The mitochondria are the “powerhouses” of each cell. They are organelles with double membranes that play a central role in the production of ATP. There may be hundreds or thousands of mitochondria in each cell. Cells that use more ATP have more mitochondria (such as liver, kidney, and muscle cells).

6. Passive cell mechanisms include diffusion, osmosis, and filtration. Active cell mechanisms include active transport, endocytosis, and exocytosis.
   - Diffusion is the process by which substances spontaneously move from regions of higher concentration to regions of lower concentration.
   - Osmosis is a special type of diffusion that occurs when water molecules diffuse from an area of higher water concentration to an area of lower water concentration.
   - Filtration forces molecules through membranes.
   - Active transport is the movement of particles through membranes from regions of lower concentration to regions of higher concentration.
   - Endocytosis involves a secretion from the cell membrane moving particles too large to enter the cell by other processes within a vesicle of the cell.
   - Exocytosis is the opposite process of endocytosis, in which a substance stored in a vesicle is secreted from the cell.

7. Cilia and flagella extend from certain cell surfaces. Cilia are hair-like, moving in a coordinated sweeping motion to move fluids over the surface of tissues. Flagella are longer than cilia and often exist as only a single flagellum, such as the tail of a sperm cell.

8. Passive cell mechanisms do not require energy, whereas active cell mechanisms do.
## Critical Thinking Questions

A 63-year-old woman was diagnosed with carcinoma of the thyroid. Unfortunately, it had metastasized to her vertebral bones.

1. Explain the cell division in relation to cancer.
2. Describe the term metastasis and the most common cause of cancer.

## Review Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
</table>
| 1. Which of the following is the control center for cellular operations? | A. cell membrane  
B. lysosomes  
C. nucleus  
D. mitochondria |
| 2. Which of the following organelles is involved in the digestion of foreign material? | A. ribosomes  
B. lysosomes  
C. mitochondria  
D. Golgi apparatus |
| 3. Where is most of the ATP required to power cellular operations produced? | A. mitochondria  
B. nucleoli  
C. Golgi apparatus  
D. centrioles |
| 4. Where does synthesis of lipids take place?                           | A. lysosomes  
B. nucleoli  
C. rough endoplasmic reticulum  
D. smooth endoplasmic reticulum |
| 5. A solution that contains a higher solute concentration than the cytoplasm of a cell is referred to as | A. hypertonic  
B. isotonic  
C. hypotonic  
D. semitonic |
| 6. Which of the following is true about cell membranes?                 | A. They are impermeable  
B. They are freely permeable  
C. They are differentially permeable or semipermeable  
D. They are actively permeable |
| 7. The movement of oxygen from an area of high concentration to an area of low concentration is an example of | A. filtration  
B. diffusion  
C. osmosis  
D. active transport |
| 8. The fluid-filled cavity within mitochondria is called the            | A. matrix  
B. crista  
C. vesicle  
D. anticondon |
ESSAY QUESTIONS

1. What are the lipid and protein membranes of a cell?
2. Compare hydrophilic and hydrophobic lipids.
3. How many membrane proteins are found in the cell membrane? Describe them.
4. What are lipid rafts? Give two examples.
5. Compare cilia with flagella.
6. Contrast the roles of the ER-bound ribosomes with those that are free in the cytosol.
7. Compare and contrast active and passive cell membranes.
8. Name the cell life cycle and its four phases.
10. Define the structures of DNA and RNA, and identify their locations.
Instructor Resources

• Lecture Outlines in PowerPoint format, featuring more than 100 slides per chapter

• Instructor’s Manual, featuring Sample Syllabus, Teaching Strategies, Lecture Outlines, Discussion Topics, Image Bank and Answer Key

• Test Bank, containing 70-100 questions per chapter; variety of question types (multiple choice, matching, true/false, figure matching, etc.)
Student Resources

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- **eBook**
  - Animations Library
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  - End-of-Chapter Graded Quizzes

- **Study Tools**
  - Learning Objectives
  - Flashcards
  - Practice Activities
  - Chapter Overview Presentation Slides in PowerPoint format

- **Assessments**
  - Lesson Quizzes
  - Midterm
  - Final

**Instructor Tools:**
- Preloaded Assignments
- Automatic Grading
- Student Reporting

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Knowledge Check Questions within eBook
Skills that signal involvement in communication and focus on the patient: examples are maintaining eye contact unless culturally inappropriate to do so, sitting directly in front of and at the same level as the person talking, interjecting encouraging words, maintaining an interested facial expression, and building the conversation from the patient's responses.
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