

Essentials of Medical Physiology

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Salient Features

- Thoroughly revised with recent findings in the field of Physiology.
- Fully updated with pathophysiological facts in accordance with the current curriculum of medical education.
- Updated Applied Physiology facts presented in boxes.
- Additional tables and visually appealing flowcharts incorporated.
- Richly illustrated chapters with beautiful descriptive color diagrams.
- Chapter outline given at the beginning of each chapter prepares the mind of the reader what to expect from that chapter and how to approach the chapter for better understanding.
- A real state-of-the-art book with approximately 600+ color diagrams.
- A textbook useful not only for the medical students but also for the dental, paramedical and allied health sciences students.

SAMPLE PAGES

Chapter 3

Transport Through Cell Membrane

CHAPTER OUTLINE

- **IMPORTANCE OF TRANSPORT MECHANISM**
 - TYPES OF TRANSPORT MECHANISMS
- **PASSIVE TRANSPORT: DIFFUSION**
 - SIMPLE DIFFUSION THROUGH LIPID LAYER
 - SIMPLE DIFFUSION THROUGH PROTEIN LAYER
 - FACILITATED OR CARRIER-MEDIATED DIFFUSION
 - FACTORS AFFECTING DIFFUSION
- **SPECIAL TYPES OF PASSIVE TRANSPORT**
- **ACTIVE TRANSPORT**
 - MECHANISM OF ACTIVE TRANSPORT
 - SUBSTANCES TRANSPORTED BY ACTIVE TRANSPORT
- **TYPES OF ACTIVE TRANSPORT**
 - PRIMARY ACTIVE TRANSPORT
 - SECONDARY ACTIVE TRANSPORT
- **SPECIAL TYPES OF ACTIVE TRANSPORT**
 - ENDOCYTOSIS
 - EXOCYTOSIS
 - TRANSCYTOSIS
- **MOLECULAR MOTORS**
 - FUNCTIONS OF MOLECULAR MOTORS
 - TYPES OF MOLECULAR MOTORS
- **APPLIED PHYSIOLOGY**
 - ABNORMALITIES OF SODIUM-POTASSIUM PUMP
 - IRON CHANNEL DISEASES: CHANNELOPATHIES

Chapter outlines are given at the beginning of each chapter.

Complex physiology topics are featured in red boxes.

BOX 114.1: Examples of aerobic and anaerobic exercises.

Examples of aerobic exercise

- | | |
|--------------------|------------------|
| 1. Walking | 7. Rowing |
| 2. Jogging | 8. Skiing |
| 3. Cycling | 9. Elliptical |
| 4. Stationary bike | 10. Running |
| 5. Swimming | 11. Dancing |
| 6. Water aerobics | 12. Jumping rope |

Examples of anaerobic exercise

- | | |
|------------------|-------------------------------------|
| 1. Weightlifting | 4. Push-ups |
| 2. Sprinting | 5. Sit-ups |
| 3. Jumping | 6. High intensity interval training |

BOX 1.3: Some of the integral proteins.

- | | |
|---------------------------------|----------------------|
| 1. Cell adhesion proteins | 4. Channel proteins |
| 2. Cell junction proteins | 5. Hormone receptors |
| 3. Carrier (transport) proteins | 6. Antigens |
| | 7. Enzymes |

BOX 113.1: Types of syncope.

1. Vasovagal or emotional syncope

Also called neurocardiogenic syncope
Fainting is caused by extreme activation of parasympathetic division. Refer **Figure 113.5** for details

2. Postural syncope

Loss of consciousness due to prolonged standing
Occurs due to pooling of blood in lower limbs resulting in decreased blood supply to brain

3. Micturition syncope

Fainting during micturition
Common in patients suffering from orthostatic hypotension (Chapter 100)

4. Effort syncope

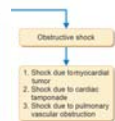
Fainting during exercise or any other strain
Common symptom in patients with stenosis of semilunar valves
Occurs due to failure of heart to increase cardiac reserve (Chapter 95), when the tissues need more blood flow

5. Cough syncope

Fainting while coughing
Severe cough increases intrathoracic pressure, which reduces venous return and cardiac output leading to fainting

6. Carotid sinus syncope

Fainting while wearing dress with tight collar
Tight collar dress exerts pressure over region of carotid sinus. This leads to bradycardia, vasodilatation and fainting



Types of syncope

Reflex syncope

Reflex inhibition of parasympathetic for details

Syncope

Stagnant standing
Lower limbs resulting in

Syncope

Orthostatic hypotension

Syncope

Other strain
Stenosis of semilunar
Increase cardiac reserve
as need more blood flow

Syncope

Intrathoracic pressure, which
reduces output leading to

Syncope

Tight collar
over region of carotid sinus
obstruction and fainting

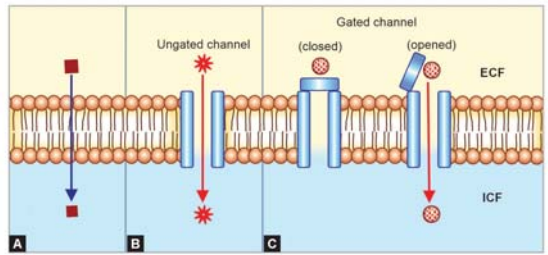


FIGURE 3.1: Hypothetical diagram of simple diffusion through the cell membrane: A. Diffusion through lipid layer. B. Diffusion through ungated channel. C. Diffusion through gated channel.

When membrane composition is asymmetric or anisotropic, it is compressed resulting in deformation of its core fiber. This deformation causes opening of sodium channel and development of receptor potential (Chapter 136). Sound waves cause movement of cilia of hair cells in organ of Corti cause the opening development of it mechanism press also (Chapter 151)

Ion Channel Oils
Refer Applied Ph

3. FACILITATED DIFFUSION
Facilitated or c_d diffusion by which molecules are transported as by single diffusion. Glucose and amino acids cannot diff through lipid bilayer because of their large size and hydrophilic nature. These substances diff through carrier proteins. In this change, if membrane (Fig. 1)

FACTORS AFFECTING RATE OF DIFFUSION
Rate of diffusion is affected by following factors:

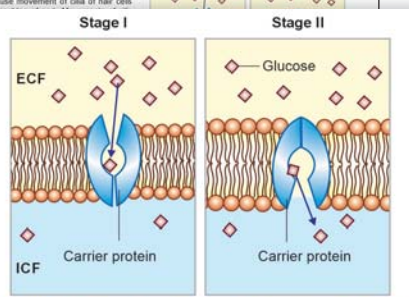


FIGURE 3.2: Hypothetical diagram of facilitated diffusion from higher concentration [extracellular fluid (ECF)] to lower concentration [intracellular fluid (ICF)]. Stage I: Glucose binds with carrier protein. Stage II: Conformational change occurs in the carrier protein and glucose is released into ICF.

600+ Figures & Descriptive Color Diagrams are included to enhance visual learning.

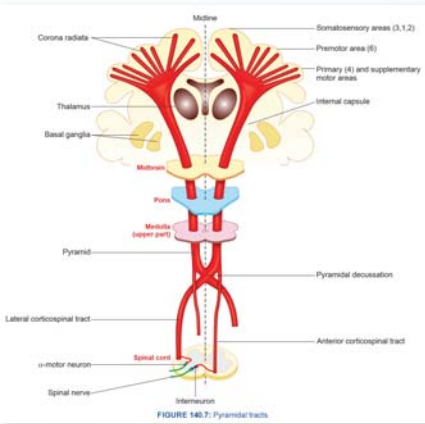


FIGURE 140.7: Pyramidal tracts

Flow Charts are provided to Break Down Broad Concepts.

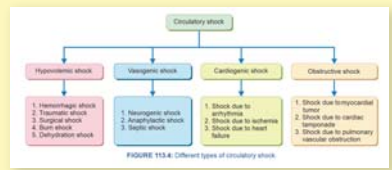


FIGURE 113.4: Different types of circulatory shock

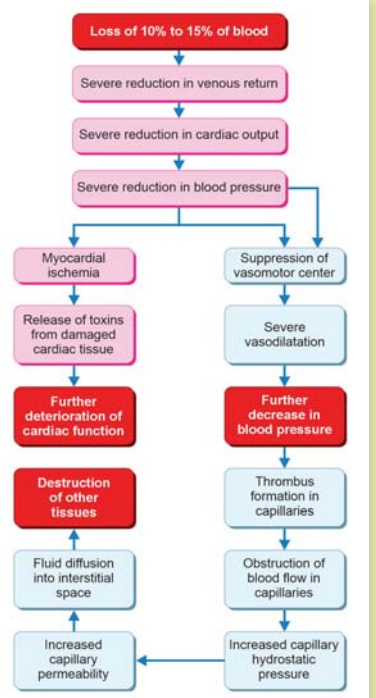


FIGURE 113.2: Progressive stage of circulatory shock.

TABLE 14.7: Actions of substances secreted by basophils.

Substance secreted	Actions
1. Heparin	Prevention of intravascular blood clotting
2. Histamine	Production of acute hypersensitivity reactions by causing vascular and tissue responses
3. Bradykinin	
4. Serotonin	Destruction of microorganisms
5. Proteases	
6. Myeloperoxidases	Destruction of invading organisms by accelerating inflammatory response
7. Cytokine: Interleukin-4	

TABLE 14.8: Substances secreted by monocytes and their actions.

Substance secreted	Actions
1. Interleukin-1	Acceleration of inflammatory response Destruction of invading organisms
2. Macrophage colony-stimulating factor	Formation of macrophage
3. Platelet-activating factor	Aggregation of platelets
4. Chemokines	Chemotaxis

TABLE 14.9: Substances secreted by T lymphocytes and their actions.

Substance secreted	Actions
1. Interleukins-2, 4, 5, 6 and 10	Acceleration of inflammatory response Destruction of invading organisms Activation of T cells and B cells
2. Gamma interferon	Stimulation of phagocytic actions of cytotoxic cells, macrophages and natural killer cells
3. Lysosomal enzymes	Destruction of invading organisms
4. Tumor necrosis factor	Necrosis of tumor Activation of immune system Promotion of inflammation
5. Chemokines	Chemotaxis

Key information is highlighted using Tables.

Mechanism of Action of Basophils
Functions of basophils are executed by the substances released from their granules. Refer Table 14.7

4. FUNCTIONS OF MONOCYTES

Monocytes provide first line of defense of it with neutrophils. Like neutrophils, monocyte and phagocytic in nature. These cells through all tissues of the body. Substance monocytes and their actions are given in Table 14.8

Monocytes are the precursors of tissue macrophages. Matured monocytes stay in the blood for 24 hours. Afterwards, these cells enter the blood and become tissue macrophages. Tissue macrophages are **Kupfer cells** in liver, **macrophages** in lungs and **macrophages** in spleen. Functions of macrophages are discussed in Chapter 14.10.

5. FUNCTIONS OF LYMPHOCYTES

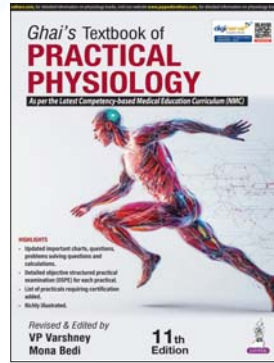
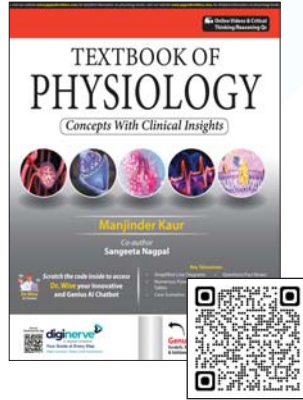
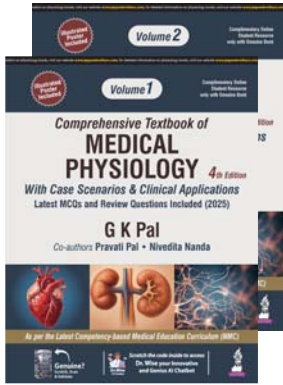
Lymphocytes are responsible for immunity. Lymphocytes are classified into two categories: T lymphocytes and B lymphocytes. T lymphocytes are responsible for development of cellular immunity. B lymphocytes are responsible for the development of humoral immunity. Functions of these lymphocytes are explained in detail in Chapter 14.11

Substances secreted by T lymphocytes are given in Table 14.9 and the substances secreted by B cells are given in Table 14.10.

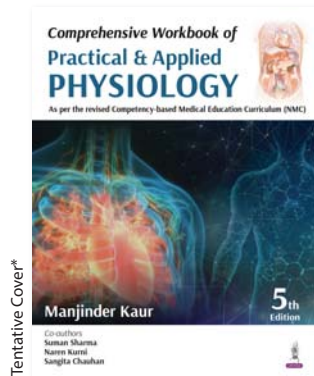
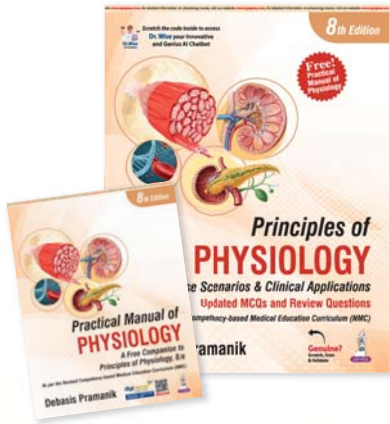
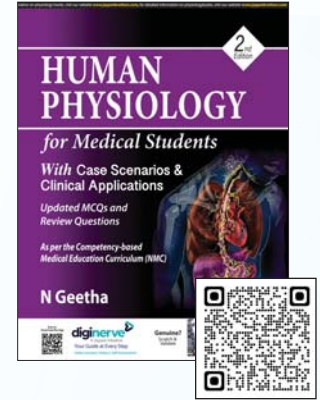
MAST CELLS

Mast cell is a large tissue cell resembling granulocyte. Generally, mast cells are found along the blood vessels and are prominently seen in areas such as skin.

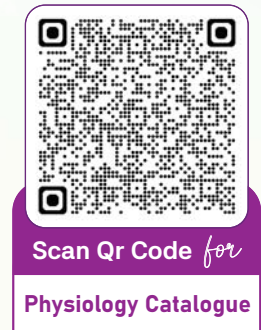
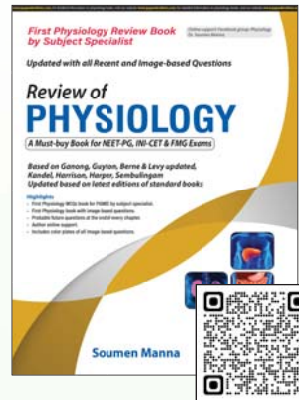
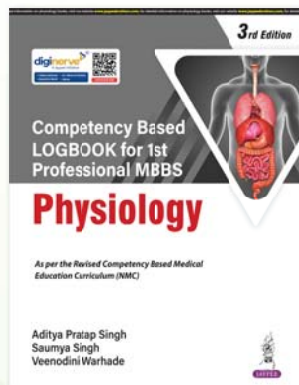
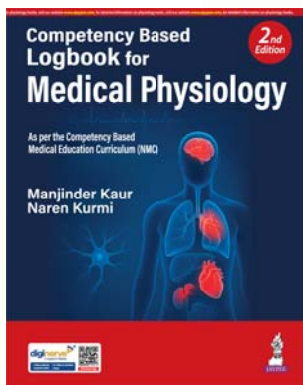
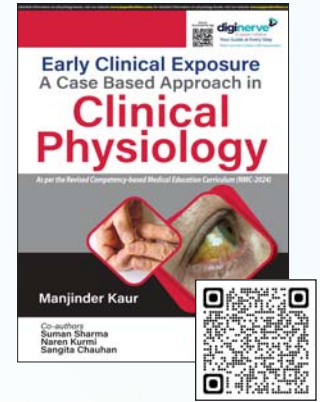
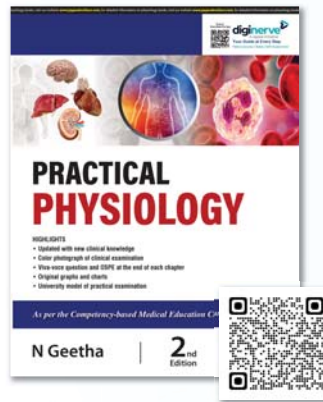
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