

# **ANATOMY**

&

# **PHYSIOLOGY**

**(FOR PARAMEDICAL STUDENTS)**

*Poonam Bachheti*  
Managing Director  
DPMI

*Aruna Singh*  
Principal  
DPMI



(An ISO 9001:2008 Certified Company)

**Vayu Education of India**  
2/25, Ansari Road, Darya Ganj, New Delhi-110 002

## **Anatomy & Physiology**

Copyright © DPMI

**ISBN:** 978-93-83137-78-7

**First Edition:** 2014

**Price:** ₹ 250/-

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the Author and Publisher.

*Printed & bound in India*

*Published by:*

**AN ISO 9001:2008 CERTIFIED COMPANY**

**VAYU EDUCATION OF INDIA**

2/25, Ansari Road, Darya Ganj, New Delhi-110 002

Ph.: 91-11-43526600, 41564445

Fax: 91-11-41564440

E-mail: [vei@veiindia.com](mailto:vei@veiindia.com), [vayueducation1@gmail.com](mailto:vayueducation1@gmail.com)

Website: [www.veiindia.com](http://www.veiindia.com)

# PREFACE

**A**natomy & Physiology are vast subjects, Learning the structure of each and every part of the human body a daunting task is impossible. This book is made especially for paramedical students. It contains anatomy & physiology in combination. This book contains simplified version of all the major systems of the body and it is hoped that this will be beneficial for all paramedical students. The text is simple and the line diagrams are easy to follow. We have tried to present a comprehensive overview of anatomy & physiology required by paramedical students. We have also added a section of question bank to make the book a complete guide for students and hope that this book will be of great help to them. Anatomy is the study of basic anatomical structures assisted with microscopes which includes histology (study of organization of tissues) and cytology (study of cells) physiology (the study of functions) are complementary basic medical sciences when applied to human body. Human body consists of biological systems that consists of organs, tissues cells and connective tissues. Some of the salient features of the book are (a) It is presented in a simple and lucid language, (b) In order to make learning easier, the book has been provided with simple labeled diagrams. Authors of the book are immensely grateful to the Management, HOD Paramedical Sciences and Paramedical Faculty of the Institute for their constant encouragement, relentless efforts, devotion and invaluable guidance and contribution for the initiation and laying ground in the preparation of this book 'Anatomy & Physiology' for Paramedical students. Authors also feel pleasure in acknowledging the valuable contributions of M/s Vayu Education of India, Darya Ganj, New Delhi., for elegant printing and publishing of this book.

The technical help rendered by Ms. Jyotsna Tiwari, Sr. faculty, Dep't of Anatomy & Physiology in preparation of this manuscript is gratefully.

Suggestions if any for the improvement of this book will be highly appreciated.

**Ms. Poonam Bachheti  
Ms. Aruna Singh**



# **SYLLABUS**

## **1. ANATOMY**

- Definition-Anatomy ,Terms used in anatomy

## **2. CELL ORGANIZATION**

- Cell, Tissue introduction, Structure, Functions of cell organelles.

## **3. STUDY OF BODY TISSUES**

- Introduction, Epithelial tissue, Connective tissues, Muscular tissues

## **4. SKELETAL SYSTEM**

- Introduction, Structure & function of individual bones & joints, Skeletal muscles, Cardiac muscles, smooth muscles(Name, Function)

## **5. CIRCULATORY SYSTEM**

- Introduction, Structure , Cardiac cycle, Circulation of Blood, Blood Introduction, Function.

## **6. RESPIRATORY SYSTEM**

- Inroduction, Structure , function of respiratory tract, tidal volume, residual volume, Reserve volume.

## **7. NERVOUS SYSTEM**

- Function, Introduction, Nerves Reflexes,

- Central Nervous system, Peripheral Nervous system, Nervous tissue.

**8. ALIMENTARY CANAL AND DIGESTION OF FOOD**

- Introduction ,function, location, Absorption, Structure

**9. LIVER, GALL BLADDER, PANCREAS**

- Introduction ,functions, location

**10. ENDOCRINE GLANDS**

- Introduction, Human endocrine system, Types of endocrine Glands, functions.

**11. LYMPHATIC SYSTEM,SPLEEN, RETICULO ENDOTHELIAL SYSTEM**

Introduction ,functions, location, Structure

**12. Urinary System**

Introduction, function , structure

**13. Reproductive System**

Introduction ,functions, location, Structure

**14. Integumentary System****15. Special Senses**

# CONTENTS

---

1.	Anatomy .....	1-5
2.	Cell Organization .....	6-15
3.	Study of Body Tissues .....	16-27
4.	Skeletal System .....	28-43
5.	Circulatory System .....	44-60
6.	Respiratory System .....	61-76
7.	Nervous System .....	77-90
8.	Alimentary Canal And Digestion Of Food .....	91-103
9.	Liver, Gall Bladder, Pancreas .....	104-109
10.	Endocrine System .....	110-120
11.	Lymphatic System, Spleen & Re System .....	121-131
12.	Urinary System .....	132-138
13.	Reproductive System .....	139-147
14.	Integumentary System .....	148-153
15.	Special Senses .....	154-166
	<i>Color Figures .....</i>	<i>167-190</i>
	<i>Index .....</i>	<i>191-194</i>

C  
H  
A  
P  
T  
E  
R

1

# Anatomy

---

**Anatomy is the identification and description of the structures of living things. Anatomy is a branch of biology and medicine which can be divided into three broad areas: human anatomy, zootomy (animal anatomy), and phytotomy (plant anatomy).**

The word **anatomy** comes from the Greek *ana-* meaning “up”, and *tome-* meaning “a cutting”. Anatomy, especially in the past, has depended heavily on dissection. In Greek and Latin the words “anatomy” and “dissection” have virtually the same meanings. Although both words have similar origins, anatomy has evolved to become a broad discipline of its own, while dissection remains a technique of anatomical science.

Anatomy can be divided into **Gross Anatomy (macroscopic anatomy)** and **Microscopic Anatomy**.

In medicine, **gross anatomy**, also known as **topographical anatomy** or **macro anatomy**, refers to the study of the biological structures that may be seen with the naked eye.

Gross anatomy may involve dissection or noninvasive methods; the aim is to acquire data about the larger structures of organs and organ systems.

In dissection, the human or animal cadaver is cut open and its organs are studied. Endoscopy, inserting a tube with a camera at the end, might be used to study structures within living animals. There are non-invasive ways of studying, for example, the blood vessels of living animals or humans; an opaque dye may be inserted into the animal to observe the circulatory system (angiography). Live beings may also be studied using MRI (magnetic resonance imaging) or X-ray.

Medical and dental students, as part of their course, will have to perform some kind of practical work in gross human anatomy, this will involve dissection. In many cases, the students dissect human corpses (cadavers).

**Microscopic anatomy**, also known as **histology**, is the study of cells and tissues of animals, humans and plants that are too small to be seen with the naked eye. Microscopic anatomy commonly

involves studying tissues and cells by sectioning and staining (histological techniques), and then looking at them under an electron or light microscope.

### **Characteristics of Life**

- Movement - self initiated change in position, motion of internal parts
- Responsiveness (irritability) - Ability to sense changes within, or around the organism and react to them
- Growth - increase in body size
- Reproduction - Parents produce offspring / producing new individuals
- Respiration - Obtaining oxygen ( $O_2$ ), using it to release energy from food substances, and getting rid of wastes
- Digestion - Chemically changing (breaking down) food substances, and getting rid of wastes
- Absorption - Passage of Digested products (food substances) through membranes and into body fluids
- Circulation - Movement of substances throughout the body
- Assimilation - Changing absorbed substances into chemically different substances
- Excretion - Removal of wastes

METABOLISM:: All physical and chemical changes occurring in an organism

Needs: Water, food, oxygen, heat, pressure - all must be regulated

HOMEOSTASIS: Tendency of the body to maintain a stable, balanced internal environment.

Accomplished through self regulating adjustments

### **LEVELS OF ORGANIZATION (FROM SIMPLEST TO MOST COMPLEX)**

Atoms → Molecules → Macromolecules → Organelles → Cells → Tissues → Organs  
→ Organ Systems → Organism

- A group (mass) of cells working together to carry out certain common functions form a tissue
- A group of tissues working together to carry out certain common functions form an organ

### **General Organization of the Body**

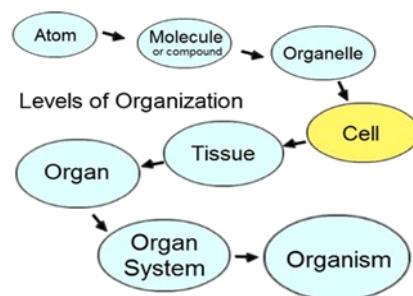
Axial Portion - head, neck, trunk

Appendicular Portion - arms & legs

1. Several body cavities
2. Layers of membranes within cavities
3. Variety of organs and organ systems within cavities  
(VISCERA = internal organs. "Visceral organs")

### **Body Cavities**

- A. Dorsal Cavity —Cranial Cavity - Brain, Spinal Cavity -  
Spinal Cord
- B. Ventral Cavity
  1. Thoracic Cavity - right and left compartment separated by mediastinum. Heart , lungs, esophagus, trachea



**Fig. Levels of Organization**

## 2. Abdominopelvic Cavity

- Abdominal cavity - stomach, spleen, liver, gall bladder, small intestine
- Pelvic cavity - part of the large intestine, urinary bladder, reproductive organs
- Thoracic and abdominopelvic cavity separated by DIAPHRAGM
- The organs within the cavities are surrounded by a type of two layered membrane called the SEROUS MEMBRANE
- The outer layer of each membrane is called the PARIETAL layer and forms a “lining” against the inner wall of each cavity
- The inner layer of each membrane covers the surface of each organ and is called the VISCERAL layer

**Various terms used for describing body structures are as follows:**

**Dorsal** and **ventral**. Dorsal refers to the back of an organism and ventral to the belly.

**Cranial** and **caudal**. Cranial refers to the head end and caudal to the tail end.

**Anterior** and **posterior**. In a quadruped the terms are synonymous with cranial and caudal. In a biped (*Homo*) anterior is used to indicate the ventral surface and posterior to indicate the dorsal surface. You must be careful to use these terms properly for each organism. (Compare pig and human).

**Superior** and **inferior**. These terms are the equivalents of cranial and caudal in *Homo*. Superior means toward the head and inferior toward the feet. These terms are not used for quadrupeds.

**Right** and **left**. Although these may seem obvious, remember that these terms always refer to the specimen's right or left.

**Proximal** and **distal**. Proximal refers to the end of a structure nearest a major point of reference and distal to the end furthest from a point of reference. The point of reference is usually the origin of a structure (such as a limb) or the ventral midline of the body. Proximal and distal are relative terms. These terms are correctly used to describe relative positions of structures in the limbs.

**Medial** and **lateral**. Medial means nearer the midline of the body and lateral means further from the midline; these are relative terms. They may also refer to the midline and “sides” of a major organ. The “outer” surface of a limb is the lateral surface and the “inner” the medial.

**Superficial** and **deep**. Superficial refers to structures nearer the skin, and deep to structures further away from the skin; these are relative terms. They should be used instead of the colloquial “on top of” (superficial to) or “underneath” (deep to).

### Planes

A **plane** is a flat surface along which a body can be divided (or sectioned) to show internal structures. By studying a number of sections of a region, a three-dimensional perspective of structures can be obtained. The standard planes used to divide the vertebrate body are defined below. Note the differences between bipeds and quadrupeds.

A **sagittal plane** divides the body into right and left parts. A **median sagittal plane** divides the body into equal right and left halves.

A **frontal** (or **coronal**) plane passes from right to left and divides the body into dorsal and ventral parts.

A **transverse plane** (or **cross section**) passes perpendicular to the long axis of the body (or of a limb)

## **Body Cavities**

These spaces are very important, providing housing and protection for vital organs. The following list identifies the cavities and subcavities of the human body:

- **Dorsal cavity:** Bones of the cranial portion of the skull and vertebral column, toward the dorsal (posterior) side of the body.
- **Cranial cavity:** Contains the brain
- **Spinal portion:** Contains the spinal cord, which is an extension of the brain

**Ventral cavity:** Anterior surface of torso; divided by diaphragm muscle into upper thoracic cavity and abdominopelvic cavity.

**Thoracic cavity:** The chest; contains trachea, bronchi, lungs, esophagus, heart and great blood vessels, thymus gland, lymph nodes, and nerves. Contains smaller cavities, too:

- **Pleural cavities** surround each lung
- **Pericardial cavity** contains the heart. The pleural cavity surrounds both the pleural and pericardial cavities.
- **Abdominopelvic cavity:** Imaginary line that runs across hipbones divides the body into the abdominal and pelvic cavities.
- **Abdominal cavity:** Contains stomach, liver, gallbladder, pancreas, spleen, kidneys, and intestines (small and large), ovaries (in female); the **peritoneal cavity** (peritoneum) surrounds the abdominal organs
- **Pelvic cavity:** Contains colon, rectum, urinary bladder, uterus (in females)

## **Membranes:**

1. Pleura (or pleural membrane) - surrounds the lungs
  - outer layer = parietal pleura
  - inner layer = visceral pleura
2. Pericardium (or pericardial membrane) - surrounds the heart
  - outer layer = parietal pericardium
  - inner layer = visceral pericardium
3. Peritoneum (or peritoneal membrane) - surrounds all the organs within the abdominopelvic cavity
  - outer layer = parietal peritoneum
  - inner layer = visceral peritoneum
  - Between the layers of each membrane is a lubricating fluid which is called SEROUS FLUID

## **ORGANIC SYSTEMS**

1. Integumentary	Body covering. Skin, hair, nails, sweat glands. Function: protect underlying tissues and regulate body temperature
2. Skeletal Bones, ligaments, cartilage	Function: Support, movement, protection, and production of blood cells
3. Muscular	Muscles of the body Function: Movement, maintenance of posture, production of body heat

4. Nervous	Brain, spinal cord, nerves through the body  Function: Communication throughout body, mental activities, maintaining homeostasis
5. Endocrine	Ductless glands = pituitary, adrenal, thyroid, parathyroid, pancreas, ovaries, testes, thymus, pineal glands  Function: Secretion of hormones, communication between body parts
6. Digestive	Mouth, teeth, pharynx, esophagus, stomach, small intestine, large intestine, liver, gall bladder, and many glands including the pancreas Function: Breakdown of food substances into simpler forms that can be absorbed (digestion).
7. Circulatory	Heart, blood vessels, blood.  Function: Transports materials throughout the body. *Lymphatic system usually included with the circulatory system
8. Urinary	Kidneys, ureters, urinary bladder, urethra  Function: Removes ("filters") wastes from the blood and helps maintain the body's water and electrolyte balance helps maintain the body's water and electrolyte balance
9. Respiratory	Trachea, lungs, Bronchus, alveoli, Function- enables us to breathe
10. Reproductive	Male , female reproductive organs,It is a collection of organs that work together for the purpose of producing a new life.

C  
H  
A  
P  
T  
E  
R

2

# Cell Organization

---

## *Learning Objective*

*After reading this unit, you should be able to Identify the function of the following cell structures:*

- a. Cell membrane
- b. Cytoplasm
- c. Mitochondria
- d. Lysosome
- e. Nucleus
- f. DNA
- g. Chromosomes

*Identify effects of radiation on cell structures.*

*Identify factors which affect the radiosensitivity of cells.*

*Given a list of types of cells, identify which are most or least radiosensitive*

## **STRUCTURE & FUNCTION OF ALL CELL ORGANELLES:**

### **Cell Structure**

Cells are the building blocks of which man and his living environment are composed; they are the fundamental unit of which all living organisms are made. Although there is no such thing as a typical cell, all cells have several features in common.

Most cells are composed of protoplasm: a mixture of carbohydrates, lipids, proteins, nucleic acids, inorganic salts, gases and between 70 and 80% water. The cell may be subdivided into three major parts: (1) the cell membrane; (2) the cytoplasm; and (3) the nucleus

## NUCLEUS

In cell biology, the **nucleus** also sometimes referred to as the “control center”, is a membrane-enclosed organelle found in eukaryotic cells. It contains most of the cell’s genetic material, organized as multiple long linear DNA molecules in complex with a large variety of proteins, such as histones, to form chromosomes. The genes within these chromosomes are the cell’s nuclear genome. The function of the nucleus is to maintain the integrity of these genes and to control the activities of the cell by regulating gene expression—the nucleus is therefore the control center of the cell.

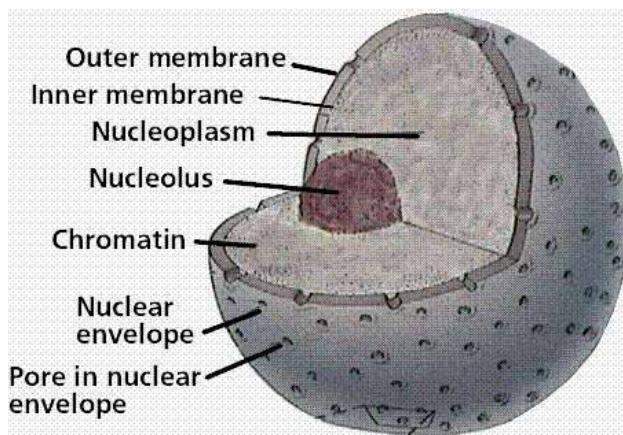


Fig. 2.1: Nucleus

The Eukaryotic cell nucleus, visible in this diagram are nucleolus, Chromatin Nuclear, envelope and nucleoplasm.

## MITOCHONDRIA

Mitochondria contain their own DNA (termed mDNA). They function as the sites of energy release (following glycolysis in the cytoplasm) and ATP formation (by chemiosmosis). The mitochondrion has been termed the powerhouse of the cell. Mitochondria are bounded by two membranes. The inner membrane folds into a series of cristae, which are the surfaces on which adenosine triphosphate (ATP) is generated. The matrix is the area of the mitochondrion surrounded by the inner mitochondrial membrane. Ribosomes and mitochondrial DNA are found in the matrix.

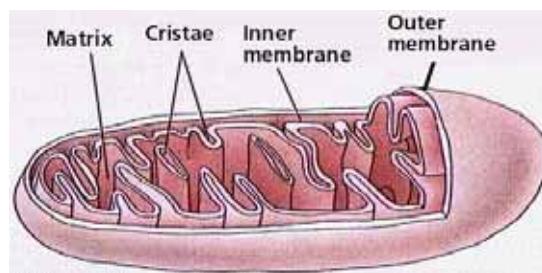


Fig. 2.2: Structure of mitochondria

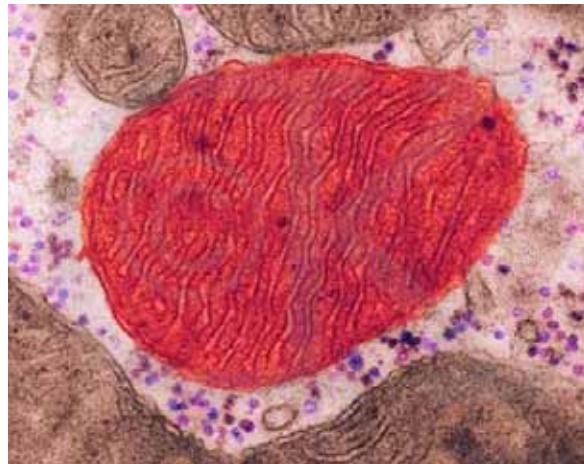


Fig. 2.3: Muscle Cell Mitochondrion

### PLASTIDS

**Plastids** are major organelles found in the cells of plants and algae. Plastids are the site of manufacture and storage of important chemical compounds used by the cell. Plastids often contain pigments used in photosynthesis, and the types of pigments present can change or determine the cell's colour.

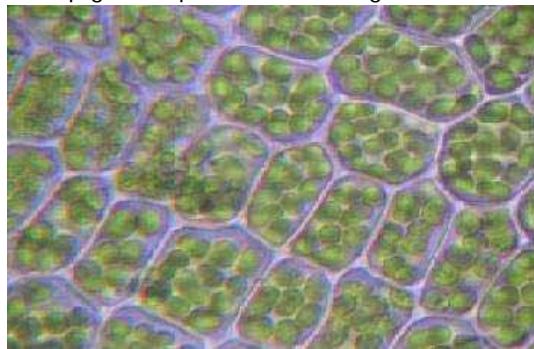
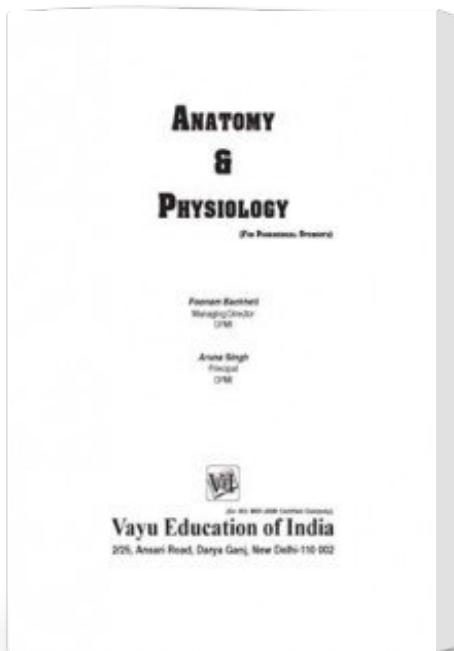


Fig. 2.4: Plant Cells with visible Chloroplast

### ENDOPLASMATIC RETICULUM

Endoplasmic reticulum, is a mesh of interconnected membranes that serve a function involving protein synthesis and transport. Rough endoplasmic reticulum (Rough ER) is so-named because of its rough appearance due to the numerous ribosomes that occur along the ER. Rough ER connects to the nuclear envelope through which the messenger RNA (mRNA) that is the blueprint for proteins travels to the ribosomes. Smooth ER; lacks the ribosomes characteristic of Rough ER and is thought to be involved in transport and a variety of other functions.

# Anatomy and Physiology



Publisher : Vayu Education

ISBN : 9789383137787

Author : Poonam Bachheti,  
Aruna Singh

Type the URL : <http://www.kopykitab.com/product/3192>



Get this eBook