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# Textbook of **Applied Anatomy** *for BSc Nursing Students* **Semester I**

**4<sup>th</sup>**  
Edition

*As per the Revised INC Syllabus*



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# Contents



## 1. Introduction to Anatomical Terms and Organization of the Human Body ..... 2

- Medical and Anatomical Terminology 2
- Terms 4
- Approaches in Studying Anatomy 7

### Organ Systems of Body 8

- Integumentary System 8
- Skeletal System 8
- Muscular System 9
- Nervous System 9
- Endocrine System 10
- Urinary System 10
- Cardiovascular System 11
- Lymphatic System 11
- Respiratory System 12
- Digestive System 12
- Female Reproductive System 13
- Male Reproductive System 13
- The Cell 14
- Cell Division 21



## 2. Organization of Human Body: Tissue Level .... 26

### Primary Tissues 26

- Definition 26
- Classification 26
- Epithelium (Plural—Epithelia) 26
- The Connective Tissue 30
- Special Connective Tissue 33

### Levels of Organization and Organ Systems of Body 35

- Level of Organization 35

### Skeletal System 36

- Structure of Bone 36

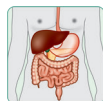
### Muscle Tissue 40

- Skeletal Muscle 40
- Cardiac Muscle 42
- Smooth Muscle 42



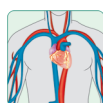
## 3. Respiratory System .....46

- Exchange of Gases 46
- The Nose and Nasal Cavity 46
- Pharynx 51
- The Larynx 51
- The Mediastinum (L. Middle Septum) 55
- The Trachea 56
- The Bronchi 57
- The Lungs 58
- The Pleura 64
- Development of Respiratory System 65



## 4. Digestive System.....68

- Process of Digestion 68
- Parts of Digestive System 68
- Pharynx 73
- The Esophagus 78
- Stomach 80
- The Small Intestine 84
- The Duodenum 84
- The Large Intestine 87
- The Perineal Body 93
- The Peritoneum 94
- The Accessory Organs of Digestion 95
- Development of Digestive System 101
- Development of Pancreas 102



## 5. Circulatory and Lymphatic System ..... 106

- Blood-Microscopic Structure 106
- Composition of Blood 107
- Cellular Components of Blood 108
- Erythrocytes (Red Blood Cells) 108
- Leukocytes (WBCs) 111
- Thrombocytes (Platelets) 113
- Blood Vessels 114
- The Heart 117
- Course of Blood Through the Heart 118
- External and Internal Features of Chambers of the Heart 119
- Valves of the Heart 122
- Blood Supply of Heart 124
- The Aorta 126
- Arteries of Lower Limb 140
- The Effects of Arterial Occlusion 143
- Veins 144
- The Veins of Head and Neck 144
- Veins of the Upper Limb 148
- Veins of the Thorax 149
- Veins of the Abdomen 150
- Veins of Lower Limb 152
- Venous Thrombosis 153
- Development of Heart 154
- Development of Atria 155
- Development of Ventricle 155

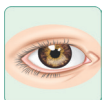
### Lymphatic System 156

- Lymph 156
- Lymph Vessels 156
- Lymphatic Tissue and Organs 157
- Lymph Nodes 157
- The Spleen (GK: Splen, L: Lien) 160
- The Tonsil (Palatine Tonsil) 162
- The Thymus 164
- The Thoracic Duct 165



## 6. Endocrine System.....170

- Local Hormones and General Hormones 170
- The Hypophysis Cerebri or Pituitary Gland 171
- The Thyroid Gland (Thyroid = Shield-Like) 175
- The Parathyroids 178
- The Suprarenal or Adrenal Glands 179
- Pineal Gland (Epiphysis Cerebri) 181
- The Thymus 181
- Hypothalamus 182
- Interstitial Cells of Testes 183
- Pancreas 182
- Glossary 183



## 7. Sensory Organs .....186

- Classification of Sensations 186

### Skin 186

- Types of Skin 186
- Epidermis 186
- The Dermis 188
- Functions of Skin 188
- Appendages of Skin 188
- Blood Supply of Skin 190

### Special Senses 191

- Sense of Smell or Olfaction 191
- Sense of Taste 191
- Sense of Hearing 192
- Sense of Vision (Sight) 199
- Muscles of Eyeball 201
- Visual Pathway 206



## 8. Musculoskeletal System .....210

### Osteology 210

- Functions of Bones 210
- Number of Bones 210
- Classification 210

### Appendicular Skeleton 211

- Upper Limb 211
- The Skeleton of Lower Limb 222

### Axial Skeleton 230

- Skull 230
- The Skeleton of the Thorax (Thoracic Cage) 242
- Vertebral Column 246
- The Bony Pelvis 252

### Joints 253

- Classification of Joints 253
- Fibrous Joints 253
- Cartilaginous Joints 253
- Synovial Joints 254
- Joints of the Upper Limb 256
- Joints of the Lower Limb 262
- Retinacula Related to Joints 270

### Muscular System 272

- Skeletal Muscle 272
- Cardiac Muscle 274



## 9. Renal System (Urinary System) .....316

- Functions of Urinary System 316
- The Kidneys (Renes; Nephros) 317
- The Ureters 320
- Urinary Bladder 321
- Urethra 323
- Radiological Anatomy of Urinary System 324



## 10. Reproductive System.....330

### Male Reproductive System 330

- Penis (L-Tail) 330
- Scrotum 332
- Testes (Singular-Testis) 332
- Epididymis 335
- Spermatic Cord 335
- The Vas Deferens or Ductus Deferens 336
- Seminal Vesicles and Ejaculatory Ducts 337
- Prostate 337
- The Male Urethra 339
- Development of Uterus and fallopian Tubes 339

### Female Organs of Reproduction 339

- Uterus (Womb, Hysteria) 342
- Uterine Tubes or Fallopian Tubes 346
- Ovaries 348
- Vagina (Kolpos) 351
- Mammary Gland or Breast 352
- Breast Cancer 354
- Microscopic Structure of Breast 354



## 11. Nervous System ..... 358

### Divisions of Nervous System 358

#### Nervous Tissue 359

- Neurons 359
- Neuroglia 362
- Ganglia (Singular—Ganglion) 363

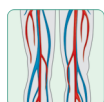
#### Nervous System 364

- Ventricles of the Brain 366
- The Brain 368
- Blood Supply of Cerebrum 371
- Diencephalon 373
- White Matter of Cerebrum 374
- The Spinal Cord 379
- Cranial Nerves 382
- Nervi Terminalis—CN XIII 390
- Summary of Cranial Nerves 390
- Nerve Plexuses 391
- Autonomic Nervous System 398



## 12. Major Surface and Bony Landmarks in Each Body Region ..... 404

- Surface Anatomy 404
- Important Bony Landmarks in the Head and Neck 404
- Surface Marking 405
- Surface Anatomy of the Upper Limb 407
- Surface Anatomy of the Thorax 410
- Surface Anatomy of the Lungs 411
- Surface Anatomy of the Abdomen 413
- Back of the Abdomen 413
- Surface Anatomy of Liver 413
- Spleen 414
- Kidney 414
- Pelvic Organs 414



## 13. Medical Genetics ..... 418

- Prenatal Diagnosis of Genetic Disorders 330
- Noninvasive Techniques 430
- Invasive Techniques 431
- Human Genome Project 432
- Gene Therapy 433



## 14. Miscellaneous Topics ..... 438

- The Adductor Canal 438
- The Axilla 438

- The Carotid Sheath 439
- The Cubital Fossa 440
- The Femoral Triangle 440
- The Femoral Sheath 441
- The Inguinal Ligament (Poupart's Ligament) 441
- Inguinal Canal 442
- Inguinal Hernia 443
- The Popliteal Fossa 443
- The Scalp 444
- Triangles of Neck 445

## Appendices ..... 451

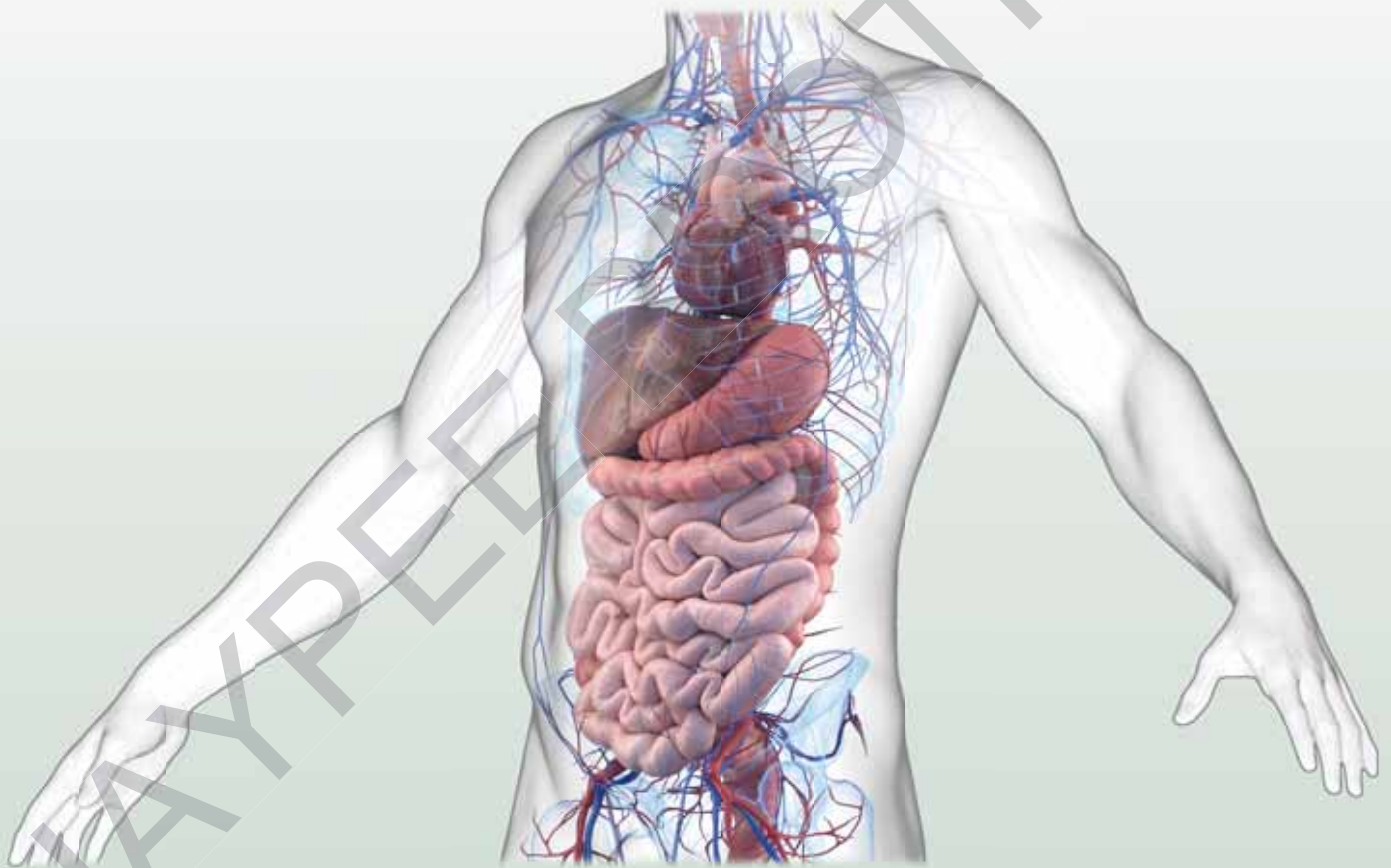
- Appendix 1: Memory Joggers!! 451
- Appendix 2: Common Prefix, Suffix, and Root 453
- Appendix 3: Important Terms Used for Bones 454
- Appendix 4: Largest and Smallest 455
- Appendix 5: Alternative Names of Organs 456
- Appendix 6: Different Types of Cells in Human Body 457
- Appendix 7: Different Plexuses 458
- Appendix 8: Dissection 459
- Photos of Specimens Obtained During Autopsy 464

## Model Question Papers.....467

## Index ..... 479



# THE HUMAN BODY



# CHAPTER 1

## Introduction to Anatomical Terms and Organization of the Human Body



### CHAPTER OUTLINE

- Medical and Anatomical Terminology
- Terms
- Approaches in Studying Anatomy

#### Organ Systems of Body

- Integumentary System
- Skeletal System
- Muscular System
- Nervous System
- Endocrine System

- Urinary System
- Cardiovascular System
- Lymphatic System
- Respiratory System
- Digestive System
- Female Reproductive System
- Male Reproductive System
- The Cell
- Cell Division



### LEARNING OBJECTIVES

- ❖ Describe the anatomical terms, organization of human body
- ❖ Describe the structure of cell, tissues, membranes and glands

## INTRODUCTION

### Anatomy

- Anatomy is the study of structure and function of the body. Aristotle (384–322 BC) was the first person to use the term 'anatomē', a Greek word meaning 'cutting up or taking apart'. The Latin word 'dissecare' has a similar meaning.
- Anatomy is one of the oldest basic medical sciences; it was first studied formally in Egypt. Human Anatomy was taught in Greece by Hippocrates (460–377 BC) who is regarded as the 'Father of Medicine'. He has written several books on anatomy.

Clear communication is fundamental in clinical medicine. To describe the body clearly and to indicate the position of its parts and organs relative to each other, anatomists and clinicians use the same descriptive terms of position and direction.

### The Anatomical Position (Fig. 1.1)

All descriptions in Human Anatomy and Clinical Medicine are expressed in relation to 'anatomical position'.

### Anatomical Position

A person in the anatomical position is standing erect (or lying supine) with the head, eyes and toes directed forward, the upper limbs by the sides with the palms facing anteriorly.

## MEDICAL AND ANATOMICAL TERMINOLOGY

Although students entering the new world of medicine are familiar with the common terms for many parts and regions of the body (e.g., heart, brain, liver, lung), they should learn to use the internationally adopted nomenclature, the *Nomina Anatomica*.

Anatomical terminology is important because it introduces the student to a large part of medical terminology. Since most terms are derived from Latin and Greek, medical language can be difficult at first, but as the student learns the origin of medical terms, the words make sense.

**Example:** Levator palpebrae superioris muscle (the muscle which elevates the upper eyelid).

- Levator = one which elevates
- Palpebrae = eyelid
- Superioris = superior or upper.



Fig. 1.1: Anatomical position.

The student must always visualize the anatomical position in his 'mind's eye' when describing patients lying on their backs, sides or fronts. Always describe the body as if it were in the anatomical position.

### APPLICATION AND IMPLICATION IN NURSING

An appropriate knowledge about the body positioning aids in performing a specific diagnostic, therapeutic procedure.

- Supine position—ECG recording, general physical examination
- Lithotomy position—examination of pelvic viscera of female and delivery of a baby, urinary catheter insertion
- Trendelenburg position—patients in shock
- Side lying position—insertion of rectal suppositories/enema

## The Anatomical Planes

Anatomical descriptions are also based on four imaginary planes that pass through the body in the anatomical position. They are as follows:

1. Median plane
2. Sagittal plane
3. Coronal plane
4. Horizontal plane

### Median Plane (Fig. 1.2)

This is the imaginary vertical plane passing longitudinally through the body from front to back, dividing it into right and left halves.

### Sagittal Planes

These are parallel to the median plane. They are named after the sagittal suture of the skull (Fig. 1.3). The sagittal plane that passes through the median plane can be called the midsagittal plane; those passing parallel to the midsagittal plane and away from the median plane may be called the parasagittal planes.

### Coronal Planes

These are imaginary vertical planes passing through the body at right angles to the median plane, dividing it into anterior (front) and posterior (back) portions. These planes are named after the coronal suture of the skull, which is in a coronal plane (Fig. 1.3).

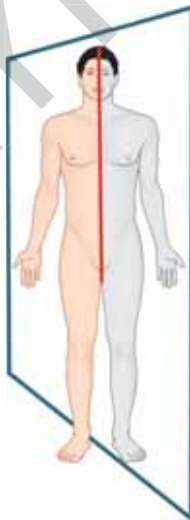


Fig. 1.2: Median plane.

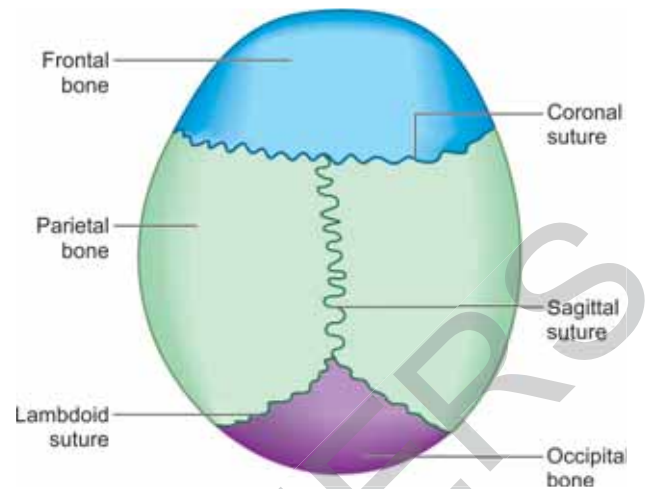


Fig. 1.3: Skull—viewed from above, showing sagittal and coronal sutures.

### Horizontal Planes

These are imaginary planes passing through the body at right angles to both the median and coronal planes (they are parallel to the 'horizon'). A horizontal plane divides the body into superior (upper) and inferior (lower) parts. A horizontal plane is also referred to as the transverse plane (Fig. 1.4).

### Axial Plane

The transverse plane is also known as axial plane.

### Frontal Plane

It is the same as coronal plane.

### Oblique Plane

It is defined as a plane which declines from the zenith or inclines towards the horizon. It runs at an angle to a longitudinal plane or a transverse plane. There are some muscles in our body, with their fibers running obliquely. For example, external and internal oblique muscles of anterior abdominal wall.

To visualize parts of the body in a better way, computed tomography (CT) and magnetic resonance imaging (MRI) are taken in this plane.



Fig. 1.4: Horizontal or transverse plane.



### APPLIED ANATOMY

Knowledge about anatomical planes is important while reading radiographs, CT and MRI as shown in **Figures 1.5A to C**.



**Figs. 1.5A to C:** CT of head: **A.** Coronal; **B.** Horizontal; **C.** Sagittal sections.

Courtesy: Dr VR Rajendran, Professor of Radiodiagnosis and Principal, Government Medical College, Kozhikode, Kerala, India.

### TERMS

#### Terms of Relationship (Table 1.1)

Various terms (adjectives) are used to describe the relationship of parts of the body in the anatomical position.

#### Terms of Movement (Figs. 1.7 to 1.18, Table 1.2)

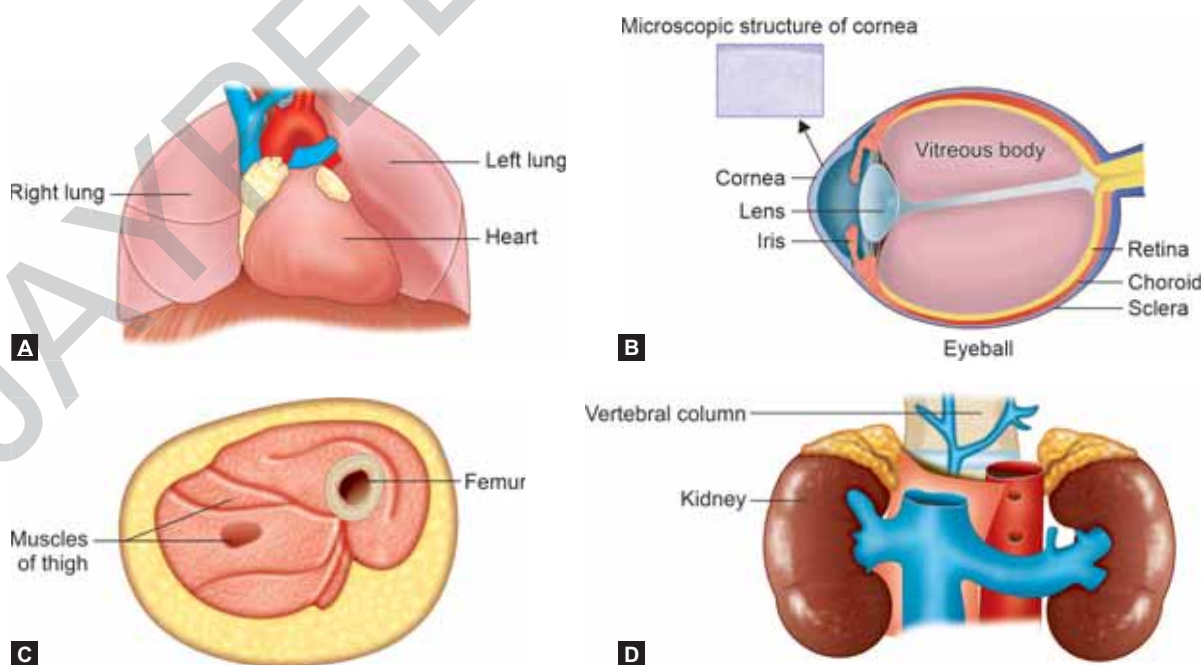
Various terms are used to describe the different movements of the limbs and other parts of the body. Movements take place at joints where two or more bones meet or articulate with one another.

#### The Meaning of Terms

Most of the anatomical terms are derived from Greek and Latin. Some of them are translated to English (e.g., musculus

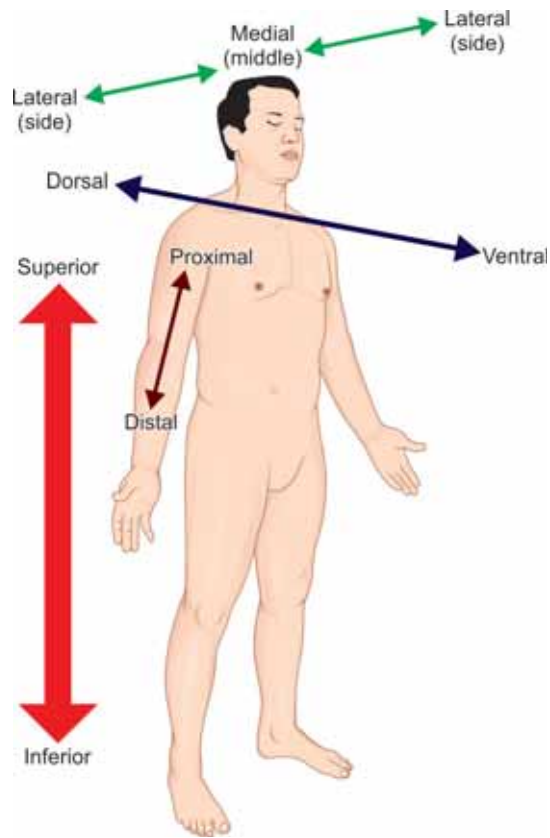
**Table 1.1:** Commonly used terms of relationship and comparison (**Figs. 1.6A to D**).

Sl. No.	Terms	Meaning	Example
1.	Superior (cranial)	Nearer to the head	The lung is superior to the diaphragm
2.	Inferior (caudal)	Nearer to the feet (tail)	The stomach is inferior to the heart
3.	Anterior (ventral)	Nearer to the front	Cornea is anterior to the lens
4.	Posterior (dorsal)	Nearer to the back	Lens is posterior to the cornea
5.	Medial	Nearer to the median plane	Heart is medial to the lung
6.	Lateral	Away from the median plane	Kidney is lateral to the vertebral column
7.	Proximal	Nearer to the trunk or point of origin	The knee is proximal to the ankle
8.	Distal	Farther from the trunk or away from the origin	The wrist is distal to the elbow
9.	Superficial	Nearer to the surface	Muscles of the thigh are superficial to the bone femur
10.	Deep	Farther from the surface	The femur is deep to the muscles of thigh
11.	External (outer)	Towards the exterior	The sclera is the external coat of the eyeball
12.	Internal (inner)	Towards or in the interior	Retina is internal to the sclera and choroid
13.	Central	Nearer or toward the center	Brain is a part of the central nervous system
14.	Peripheral	Farther or away from the center	The spinal nerves are part of the peripheral nervous system
15.	Parietal	Pertaining to the external wall of body cavity	Parietal peritoneum lines the abdominal wall
16.	Visceral	Pertaining to the covering of an organ	Visceral pleura covers the external surface of lung

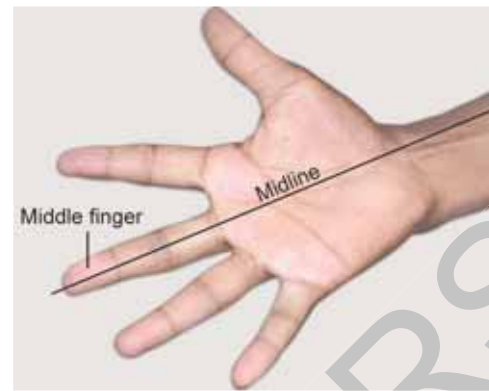


**Figs. 1.6A to D:** Relations of organs: **A.** Heart and lungs; **B.** Gross anatomy of eye and histology of cornea; **C.** Transverse section of thigh, showing femur and muscles; **D.** Kidneys and vertebral column.

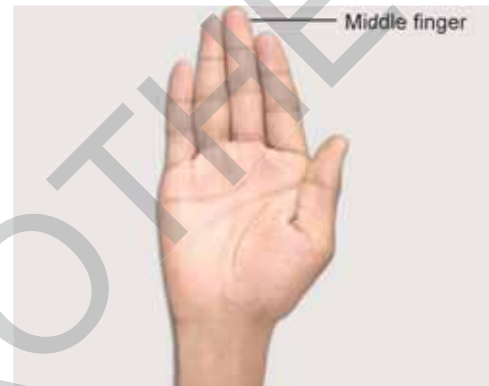




**Fig. 1.7:** Commonly used terms of relationship and comparison (schematic representation).



**Fig. 1.10:** Abduction of digits.



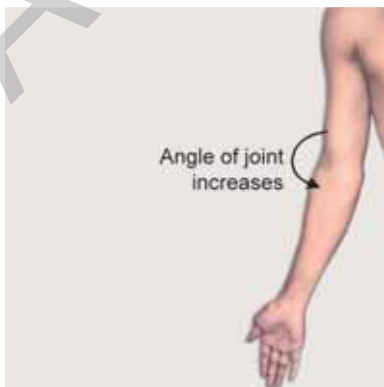
**Fig. 1.11:** Adduction of digits.



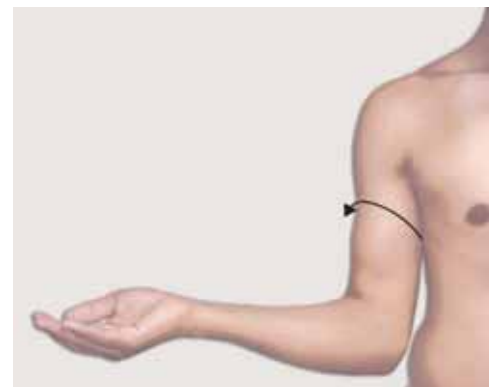
**Fig. 1.8:** Flexion of forearm.



**Fig. 1.12:** Medial rotation of arm.



**Fig. 1.9:** Extension of forearm.



**Fig. 1.13:** Lateral rotation of arm.



**Fig. 1.14:** Pronation of forearm.



**Fig. 1.15:** Supination of forearm.



**Fig. 1.16:** Inversion of foot.



**Fig. 1.17:** Eversion of foot.



**Fig. 1.18:** Opposition of thumb.

**Table 1.2:** Commonly used terms of movement.

Sl. No.	Terms	Meanings	Examples
1.	Flexion	Bending or decreasing the angle between body parts	Flexing the elbow joint
2.	Extension	Straightening or increasing the angle between body parts	Extending the knee joint
3.	Abduction	Moving away from the median plane	Abducting the upper limb
4.	Adduction	Moving toward the median plane	Adducting the lower limb
5.	Rotation	Moving around the long axis	Medial and lateral rotation of UL
6.	Circumduction	Circular movement combining flexion, extension, abduction and adduction	Circumduction of upper limb, e.g., bowling
7.	Eversion	Moving the sole of the foot away from the median plane	
8.	Inversion	Moving the sole of the foot toward the median plane	e.g., as if to remove the thorn
9.	Supination	Rotating the forearm and hand laterally, palm faces anteriorly. Radius lies parallel to ulna	e.g., when a person extends a hand to beg
10.	Pronation	Rotating the forearm and hand medially so that palm faces posteriorly. Radius crosses ulna diagonally	e.g., patting a child on the head
11.	Protrusion	Moving anteriorly	Sticking the chin out
12.	Retrusion or retraction	Moving posteriorly	Tucking the chin
13.	Elevation	To lift	Elevation of eyeball to look upwards
14.	Depression	To lower	Depression of eyeball to look at the feet
15.	Opposition	Occurs in the thumb	Tip of thumb touches the tip of any other finger

= muscle). Many anatomical terms indicate the shape, size, location and function or resemblance of a structure to something.

**Examples:**

1. According to shape

- Deltoid—delta or triangular
- Sphenoid—wedge-shaped
- Styloid—pillar-shaped
- Uvula—grape-like
- Pisiform—pea-shaped

2. According to the number of heads of origin

- Biceps—2 heads
- Triceps—3 heads
- Quadriceps—4 heads

3. According to function

- Depressor anguli oris—muscle which depresses the angle of mouth
- Tensor tympani—muscle which tenses the tympanic membrane

4. According to size
  - Gluteus maximus—largest among the gluteus muscles
  - Gluteus minimus—smallest among the gluteus muscles
5. According to length
  - Abductor pollicis longus—long abductor of thumb
  - Abductor pollicis brevis—short abductor of thumb
6. According to consistency
  - Pancreas—pan = throughout, kreas = flesh, fleshy throughout
  - Dura mater—dura = tough, mater = mother, tough mother
7. According to location
  - Biceps brachii—biceps muscle of arm
  - Biceps femoris—biceps muscle of thigh
  - Triceps brachii—triceps muscle of arm
8. According to sites of attachment
  - Sternocleidomastoid muscle—attached to sternum, clavicle and mastoid
  - Omohyoid—muscle extending from scapula (shoulder blade) to hyoid (omos = shoulder).

Some of the commonly used anatomical and clinical abbreviations are given in **Table 1.3**.

**Table 1.3:** Commonly used anatomical and clinical abbreviations.

a, aa	Artery, arteries
ANS	Autonomic nervous system
A-V	Atrioventricular
C <sub>1</sub> –C <sub>7</sub> (C <sub>8</sub> )	1st to 7th cervical vertebrae or 1st to 8th spinal nerves
Ca	Cancer, carcinoma
CAD	Coronary artery disease
CAT or CT	Computerized axial tomography
CN	Cranial nerve
CNS	Central nervous system
CSF	Cerebrospinal fluid
ECG	Electrocardiogram
EEG	Electroencephalogram/graphy
G; GK	Greek
GI/GIT	Gastrointestinal/gastrointestinal tract
IP	Interphalangeal
IV	Interventricular or intervertebral
IV	Intravenous
IVC	Inferior vena cava
IVF	In vitro fertilization
Jt	Joint
L <sub>1</sub> –L <sub>5</sub>	1st to 5th lumbar nerves/vertebrae
LA	Left atrium
LICS	Left Intercostal space
Lig	Ligament
LP	Lumbar puncture
LV	Left ventricle
m, mm	Muscle, muscles
MCP	Metacarpophalangeal
MI	Myocardial infarction
MRI	Magnetic resonance imaging
MTP	Medical termination of pregnancy

Contd...

Contd...

MV	Mitral valve
n, nn	Nerve, nerves
PA	Posteroanterior
PNS	Peripheral nervous system, paranasal sinuses
RA	Right atrium
RV	Right ventricle
S <sub>1</sub> –S <sub>5</sub>	First to fifth sacral vertebrae/nerves
SA	Sinuatric/sinoatrial
SVC	Superior vena cava
T <sub>1</sub> –T <sub>12</sub>	1st to 12th thoracic vertebrae/nerves
TIA	Transient ischemic attack
TMJ	Temporomandibular joint
V, VV	Vein/veins

## APPROACHES IN STUDYING ANATOMY

The three main approaches are as follows:

1. Regional anatomy
2. Systemic anatomy
3. Clinical anatomy

### Regional Anatomy or Topographical Anatomy

It is the study of the body by regions such as head, neck, thorax, abdomen and limbs.

### Systemic Anatomy (Table 1.4)

It is the study of the body systems, e.g., digestive system, cardiovascular system, nervous system.

**Table 1.4:** Systems and their branches of study.

Sl. No.	System	Organ/organs studied	Branch of study
1.	Integumentary system	Skin	Dermatology
2.	The skeletal system	Bones and cartilages	Osteology
3.	The articular system	Joints and ligaments	Arthrology
4.	The muscular system	Muscles	Myology
5.	The nervous system	Central and peripheral nervous system	Neurology
6.	The circulatory system/ cardiovascular system	Heart, blood vessels and lymphatics	Angiology/ cardiology
7.	The digestive system	Digestive tract and glands assisting digestion	Gastroenterology
8.	The respiratory system	Air passages and lungs	Pulmonology
9.	The urinary system	Kidneys, ureters, bladder and urethra	Urology
10.	The reproductive or genital system	Genital organs—male or female	Female—gynecology Male—andrology
11.	The endocrine system	Ductless glands, e.g., thyroid, pituitary	Endocrinology

### Clinical Anatomy

Correlation of anatomy with clinical signs and symptoms to arrive at a diagnosis.

### Gross Anatomy and Histology

#### Gross Anatomy

It is the examination of body structures that can be seen without a microscope.

### Histology

Microscopic study of a tissue.

### Anatomical Variations

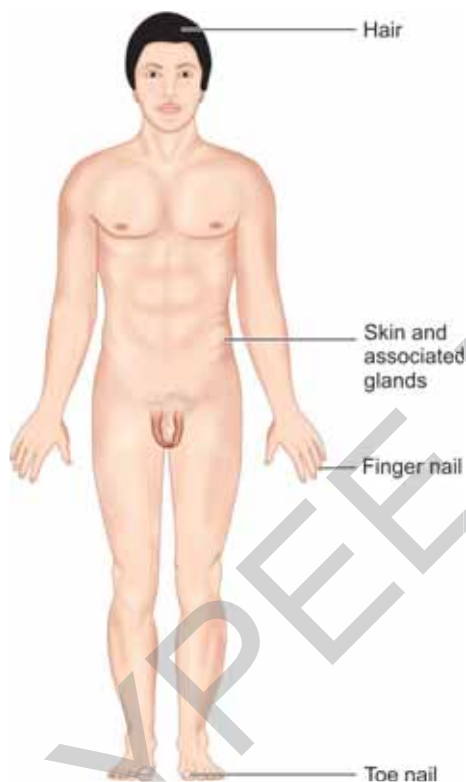
Individuals differ in physical appearance. Similarly variations can be seen in the size, shape, weight of organs; origin, course and termination of arteries, nerves and veins. So, individual variation must be considered while examining a patient and in the diagnosis and treatment of that patient.

## ORGAN SYSTEMS OF BODY

The human body has several organ systems that work interdependently and carry out specific functions. These systems influence each other and work together to maintain health, provide protection from disease, and allow for

reproduction of the human species. The various structures constituting these body systems and their functions are discussed in **Figures 1.19 to 1.35**.

### INTEGUMENTARY SYSTEM (FIG. 1.19)



**Fig. 1.19:** Integumentary system (schematic representation).

### Constituents

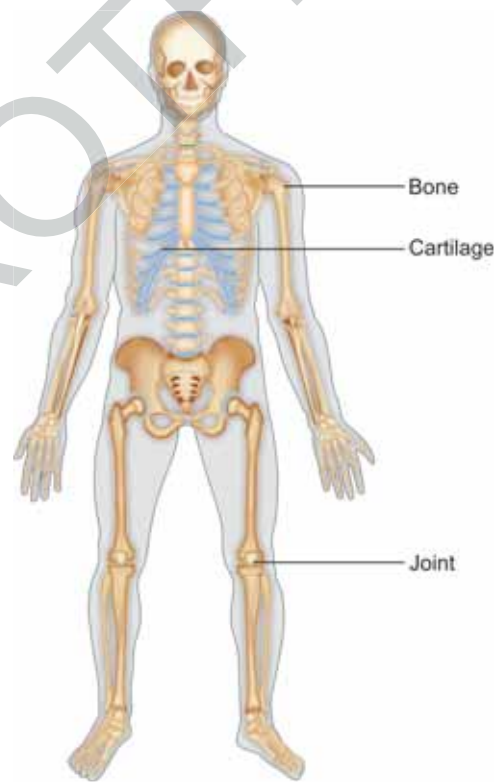
- Skin
- Hair
- Nails

### FUNCTIONS

Skin is a major sensory organ responsible for:

- Protection of body
- Regulation of body temperature
- Elimination of wastes

### SKELETAL SYSTEM (FIG. 1.20)



**Fig. 1.20:** Skeletal system (schematic representation).

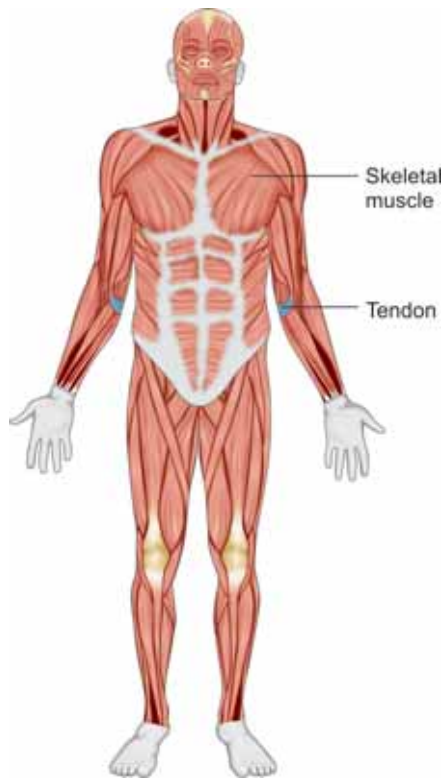
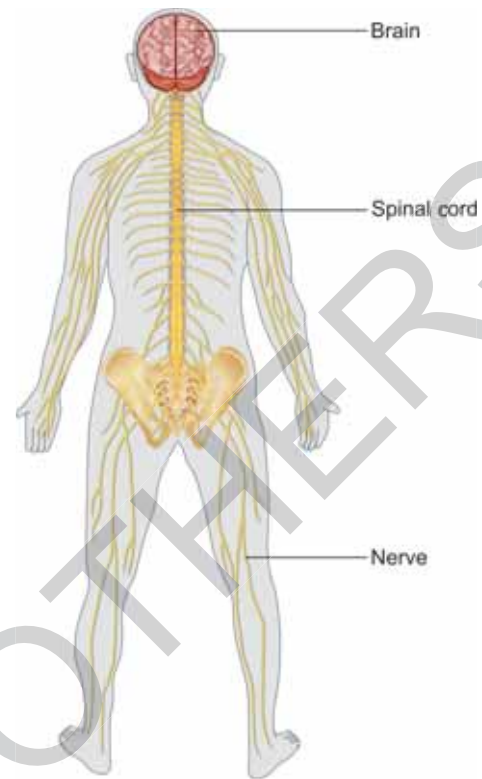
### Constituents

- Bones
- Joints
- Associated cartilages

### FUNCTIONS

- Provides support and protection to body
- Helps in body movements



**MUSCULAR SYSTEM (FIG. 1.21)****Fig. 1.21:** Muscular system (schematic representation).**NERVOUS SYSTEM (FIG. 1.22)****Fig. 1.22:** Nervous system (schematic representation).**Constituents**

- Mainly skeletal muscles
- Smooth muscles
- Cardiac muscles

**Constituents**

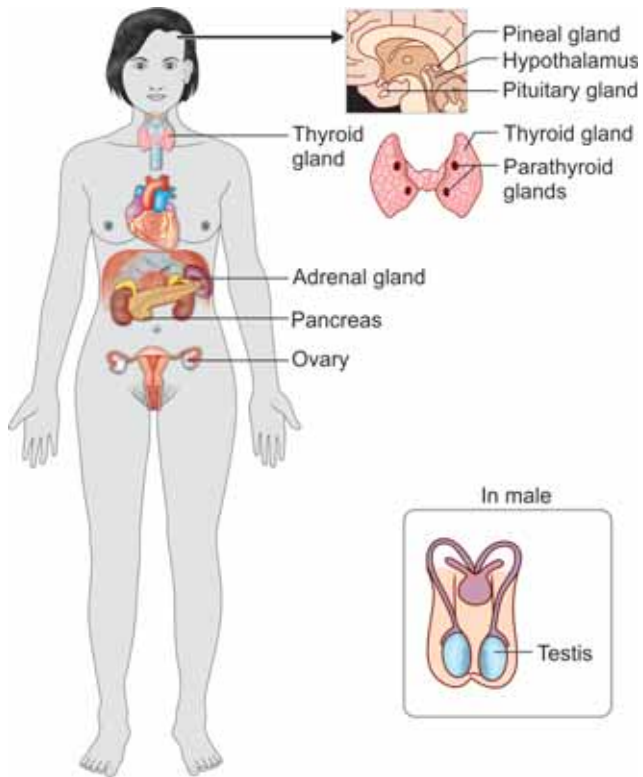
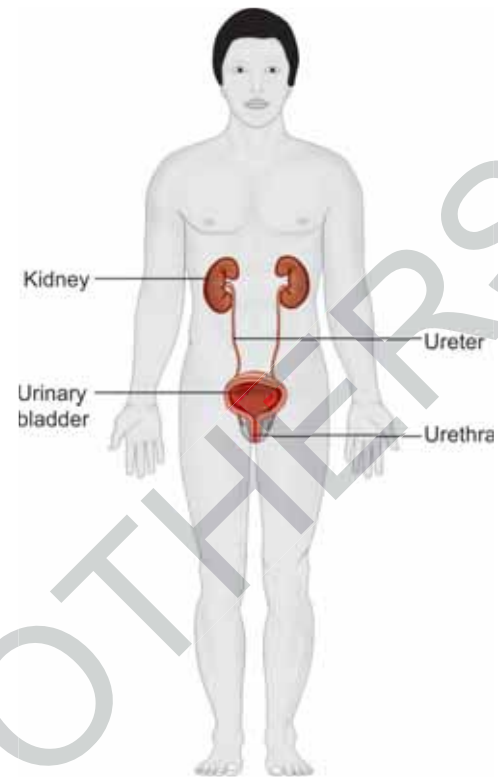
- Brain
- Spinal cord
- Nerves
- Special sense organs like eyes, ears

**FUNCTIONS**

- Skeletal muscle help in body movements
- Maintenance of posture
- Production of heat

**FUNCTION**

- Regulation of body activities and body's internal and external environment by nerve impulses

**ENDOCRINE SYSTEM (FIG. 1.23)****Fig. 1.23:** Endocrine system (schematic representation).**URINARY SYSTEM (FIG. 1.24)****Fig. 1.24:** Urinary system (schematic representation).**Constituents**

- Hypothalamus
- Pituitary gland
- Thyroid gland
- Pineal gland
- Parathyroid gland
- Pancreas
- Ovaries/testes
- Adrenal glands
- Enteroendocrine glands

**Constituents**

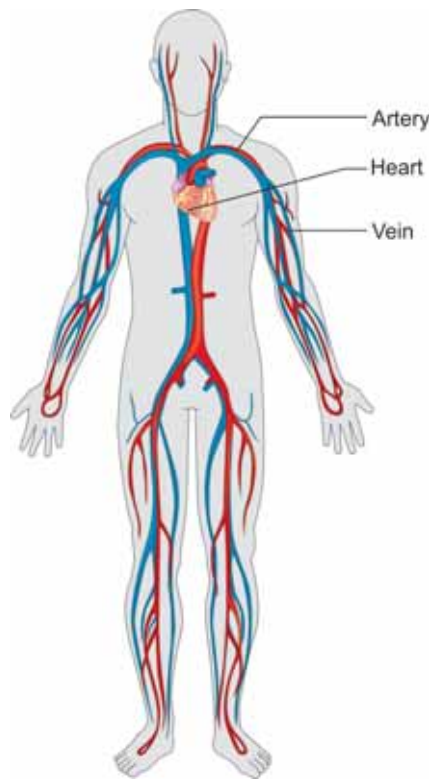
- Kidneys
- Ureters
- Urinary bladder
- Urethra

**FUNCTION**

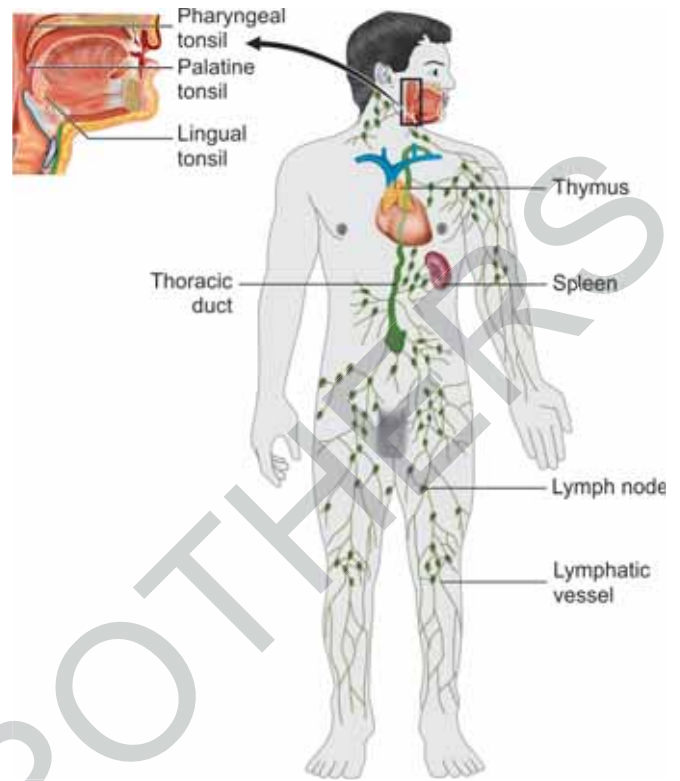
- Regulation of body activities by releasing hormones

**FUNCTIONS**

- Production, storage and elimination of urine
- Regulation of volume and chemical composition of blood
- Maintenance of acid-base balance of the body

**CARDIOVASCULAR SYSTEM (FIG. 1.25)****Fig. 1.25:** Cardiovascular system (schematic representation).**Constituents**

- Heart
- Blood vessels—arteries and veins
- Blood

**LYMPHATIC SYSTEM (FIG. 1.26)****Fig. 1.26:** Lymphatic system (schematic representation).**Constituents**

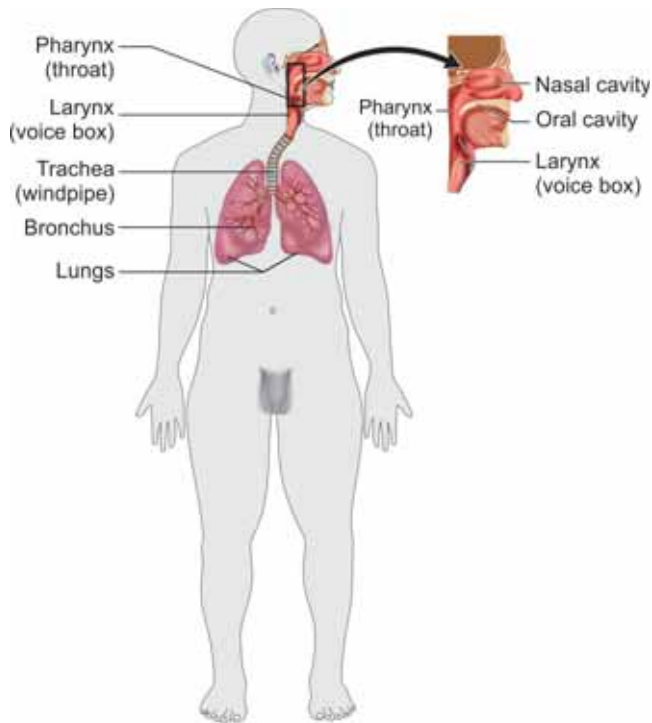
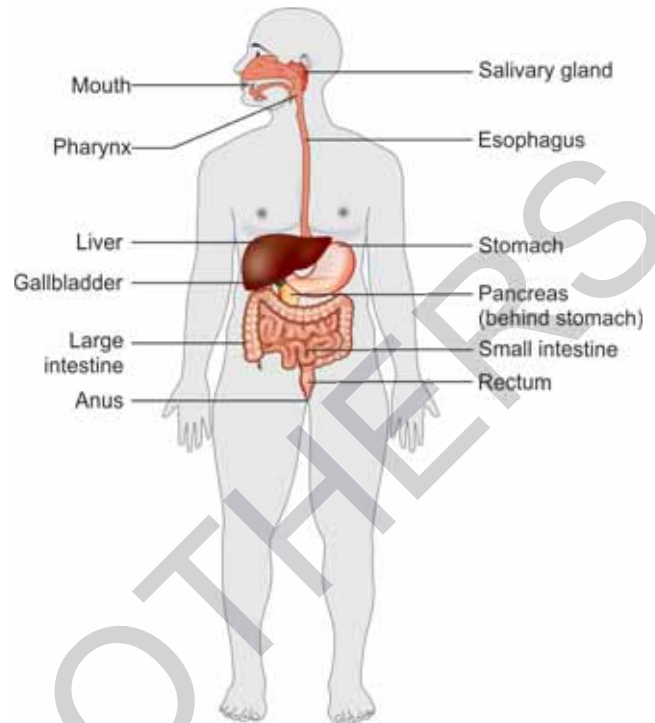
- Spleen
- Thymus
- Tonsils
- Lymph nodes
- Lymphatic vessels

**FUNCTIONS**

- Heart pumps the blood through the blood vessels
- Blood carries oxygen and nutrients to the cells and takes away the wastes and carbon dioxide from the cells

**FUNCTIONS**

- Return proteins and fluids to the blood
- Removes bacteria, toxins and other foreign bodies from tissue
- Lymph serves as an important route for intestinal fat absorption
- Sites of maturation and proliferation of B and T cells

**RESPIRATORY SYSTEM (FIG. 1.27)****Fig. 1.27:** Respiratory system (schematic representation).**DIGESTIVE SYSTEM (FIG. 1.28)****Fig. 1.28:** Digestive system (schematic representation).**Constituents**

- Pharynx
- Larynx
- Trachea
- Bronchial tubes
- Lungs

**Constituents**

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small and large intestines
- Salivary glands
- Liver, gallbladder and associated ducts
- Pancreas

**FUNCTIONS**

- Transfer of oxygen from inhaled air to blood and carbon dioxide from blood to exhaled air
- Regulation of acid-base balance of body fluids

**FUNCTIONS**

- Digestion of food
- Absorption of nutrients
- Elimination of wastes



# Textbook of Applied Anatomy for BSc Nursing Students

## Salient Features

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