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**Concept based notes**

# **Anatomy and Physiology**

[GNM]

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*Published by :*

**Think Tanks**

**Biyani Group of Colleges**

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**First Edition : 2009**

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**Biyani College Printing Department**

## **Preface**

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the “Teach Yourself” style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

This book covers basic concepts related to the microbial understandings about diversity, structure, economic aspects, bacterial and viral reproduction etc.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director (Acad.)* Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this Endeavour. They played an active role in coordinating the various stages of this Endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

**Author**

# Syllabus

## GNM

### Anatomy and Physiology

#### Course Description

This course is designed to help students gain knowledge of the structure and function of the human body and recognize any deviation from normal health in order to render effective nursing services.

#### General Objectives

Upon completion of this course, the students will be able to :

- Describe in general the structure and functions of the human body.
- Describe in detail the structure and functions of the different organs and systems in the human body.
- Apply the anatomical and physiological principles in the practice of nursing.

#### Course Contents

**Unit-I Introduction to anatomical terms**

**Unit-II Organisation of body cells, tissues, organs, systems, membranes and glands**

**Unit-III Skeletal System**

- Bones : Types, Structure, Function
- Axial Skeleton
- Appendicular Skeleton
- Joints : Classification, Structure and Function.

**Unit-IV Muscular System**

- Type, structure and functions.
- Position and action of chief muscles of the body.

**Unit-V Cardio-Vascular System**

- Blood : Composition, clotting and blood group, matching, Blood products and their use.
- Heart : Position, Structure, Conduction system, Fun and cardiac cycle.
- Blood Vessels : Structure differences and position of vessels
- Circulation of Blood : Systemic, Pulmonary and P Circulation

- Blood Pressure and pulse
- Lymphatic system : Lymph vessels, glands, ducts and lymph circulation, lymph tissues in the body, spleen.

**Unit-VI Respiratory System**

- Structure and functions of respiratory organs
- Physiology of respiration
- Characteristics of normal respiration and its deviation

**Unit-VII Digestive System**

- Structure and function of organs of digestion and access organs
- Process of digestion and absorption
- Metabolism : Meaning and Metabolism of food constitution

**Unit-VIII Excretory System**

- Structure and functions of organs of urinary system
- Structure and functions of the skin
- Regulation of body temperature.
- Fluid and electrolyte balance.

**Unit-IX Nervous System**

- Type, Structure and functions of neuron.
- Central Nervous System :Structure and functions.
- Autonomic Nervous System : Structure and functions

**Unit-X Endocrine System**

- Structure and functions of pituitary, pancreas,thyroid parathyroid, thymus and supra renal glands.

**Unit-XI Sense Organs**

- Structure and functions of eye, ear, nose and tongue.
- Physiology of vision,hearing and equilibrium.

**Unit-XII Reproductive system**

- Structure and functions of reproductive and accessory organs
- Process of reproduction,menstrual cycle and menopause
- Reproductive health
- Structure and functions of male reproductive system.

**Note :** Wherever possible related clinical application should be included in each unit.

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## Chapter-1

# Organization of Body Cells, Tissues

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### Q.1 Define Cell?

**Ans.:** The **cell** is the structural and functional unit of all known living organisms. It is the smallest unit of an organism that is classified as living, and is sometimes called the building block of life. Humans, are multicellular. (Humans have an estimated **100 trillion or  $10^{14}$  cells**, a typical cell size is **10  $\mu\text{m}$** , a typical cell mass is **1 nanogram**).

### Q.2. What are the functions of the Cell?

- Ans.:**
- 1. Cell Growth and Metabolism :** Cell metabolism is the process by which individual cells process nutrient molecules. Metabolism has two distinct divisions: catabolism, in which the cell breaks down complex molecules to produce energy and reducing power, and anabolism, in which the cell uses energy and reducing power to construct complex molecules and perform other biological functions.
  - 2. Creation of New Cells :** Cell division involves a single cell (called a mother cell) dividing into two daughter cells. This leads to growth in multicellular organisms (the growth of tissue) and to procreation (vegetative reproduction) in unicellular organisms.
  - 3. Protein Synthesis :** Cells are capable of synthesizing new proteins, which are essential for the modulation and maintenance of cellular activities. This process involves the formation of new protein molecules from amino acid building blocks based on information

encoded in DNA/RNA. Protein synthesis generally consists of two major steps: transcription and translation.

### Q.3 Define Tissue and what are the types of Tissues?

**Ans.:** **Tissue** is a collection of interconnected cells that perform a similar function within an organism.

- **Epithelium** : Tissues composed of layers of cells that cover organ surfaces such as surface of the skin and inner lining of digestive tract: the tissues that serve for protection, secretion, and absorption.
- **Connective Tissue** : As the name suggests, connective tissue holds everything together. Connective tissue is characterized by the separation of the cells by non-living material, which is called extracellular matrix. Bone and blood are connective tissues.
- **Muscle Tissue** : Muscle cells are the contractile tissue of the body. Its function is to produce force and cause motion, either locomotion or movement within internal organs. Muscle tissue is separated into three distinct categories: visceral or smooth muscle, which is found in the inner linings of organs; skeletal muscle, which is found attached to bone in order for mobility to take place; and cardiac muscle which is found in the heart.
- **Nervous Tissue** : Cells forming the brain, spinal cord and peripheral nervous system.

### Q.4 Explain the function of the Biological Membrane?

**Ans.:** A **biological membrane** or **biomembrane** is an enclosing or separating amphipathic layer that acts as a barrier within or around a cell. It is, almost invariably, a lipid bilayer, composed of a double layer of lipid-class molecules, specifically phospholipids, with occasional proteins intertwined, some of which function as channels.



**Q.5 What is Osmosis?**

**Ans.:** **Osmosis** is the diffusion of water through a semi-permeable membrane, from a solution of low solute concentration (high water potential) to a solution with high solute concentration (low water potential), up a solute concentration gradient.

It is a physical process in which a solvent moves, without input of energy, across a semi-permeable membrane separating two solutions of different concentrations.

Osmosis releases energy, and can be made to do work, as when a growing tree-root splits a stone.

**Q.6 Mention the types of Biological Membranes?**

**Ans.:**

- **Cell Membrane :** The cell membrane (also called the plasma membrane, or "phospholipid bilayer") is a selectively permeable lipid bilayer found in all cells. It contains a wide variety of biological molecules, primarily proteins and lipids, which are involved in a vast array of cellular processes such as cell adhesion, ion channel conductance and cell signaling.
- **Mucous Membrane :** The mucous membranes are linings of mostly endodermal origin, covered in epithelium, which are involved in absorption and secretion. They line various body cavities that are exposed to the external environment and internal organs. It is at several places continuous with skin: at the nostrils, the lips, the ears, the genital area, and the anus.
- **S-Layer :** An S-layer (surface layer) is a part of the cell envelope commonly found in bacteria, as well as among archaea (a group of single-celled microorganisms). It consists of a monomolecular layer composed of identical proteins or glycoproteins. This two

dimensional structure is built via self-assembly and encloses the whole cell surface.

**Q.7 What are the Cell components?**

**Ans.:** Human subcellular components :

Organelles :

- (1) Nucleolus
- (2) Nucleus
- (3) Ribosome
- (4) Vesicle
- (5) Rough Endoplasmic Reticulum
- (6) Golgi Apparatus
- (7) Cytoskeleton
- (8) Smooth Endoplasmic Reticulum
- (9) Mitochondria
- (10) Vacuole
- (11) Cytoplasm
- (12) Lysosome
- (13) Centrioles within Centrosome.

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## Chapter-2

# Skeletal System

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**Q.1 How many Bones in the Human Skeleton System?**

**Ans.:** There are **206 bones** in the adult body and about **300 bones** in the infant body.

**Q.2. What is a Joint & which is the strongest Joint in the Human Body?**

**Ans.:** A **joint** is the location at which two or more bones make contact. They are constructed to allow movement and provide mechanical support, and are classified structurally and functionally. The **sacroiliac joint** is the strongest joint between the sacrum, at the base of the spine, and the ilium of the pelvis, which are joined by ligaments. It is a strong, weightbearing synovial joint with irregular elevations and depressions that produce interlocking of the bones.

**Q.3 How many Joints in the Human body?**

**Ans.:** The joints may be classified anatomically into **11** following groups :

- |                              |                             |
|------------------------------|-----------------------------|
| (1) Articulations of Hand    | (2) Wrists                  |
| (3) Elbows                   | (4) Axillary Articulations  |
| (5) Sternoclavicular Joints  | (6) Vertebral Articulations |
| (7) Temporomandibular Joints | (8) Sacroiliac Joints       |
| (9) Hip Joints               | (10) Knee                   |
| (11) Articulations of Foot   |                             |

**Q.4. Which is the Smallest Bone in the Human Body? And what is its functions?**

**Ans.:** The **stapes or stirrup** is the stirrup-shaped small bone or ossicle in the middle ear. It is the smallest and lightest bone in the human body. The stapes transmits the sound vibrations from the incus to the membrane of the inner ear inside the fenestra ovalis. The stapes is also stabilized by the stapedius muscle, which is innervated by the facial nerve.

**Q.5 How Many Bones in the Human Skull? Mention its names?**

**Ans.:** In the Skull (22) :

- **Cranial Bones :**
  - Frontal Bone
  - Parietal Bone (2)
  - Temporal Bone (2)
  - Occipital Bone
  - Sphenoid Bone
  - Ethmoid Bone
- **Facial Bones :**
  - Mandible
  - Maxilla (2)
  - Palatine Bone (2)
  - Zygomatic Bone (2)
  - Nasal Bone (2)
  - Lacrimal Bone (2)
  - Vomer Bone
  - Inferior Nasal Conchae (2)

**Q.6 Which is the Longest and strongest Bone in the Human Body?**

**Ans.:** The **femur** is the thigh bone. In humans, it is the longest, strongest bone. The average human femur is 48 centimeters (19 in) in length and 2.34 cm (0.92 in) in diameter and can support up to 30 times the weight of an adult. It forms part of the hip (at the acetabulum) and part of the knee.

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## Chapter-3

# Muscular System

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**Q.1** Mention the names of Facial Bones?

**Ans.:** There are total **14 facial bones** in the human body. They are :

- Mandible
- Maxilla (2)
- Palatine Bone (2)
- Zygomatic Bone (2)
- Nasal Bone (2)
- Lacrimal Bone (2)
- Vomer Bone
- Inferior Nasal Conchae (2)

**Q.2** What is Muscle? Mention the main types of Muscles?

**Ans.:** **Muscle** is contractile tissue of the body and is derived from the mesodermal layer of embryonic germ cells. Muscle cells contain contractile filaments that move past each other and change the size of the cell. They are classified as skeletal, cardiac, or smooth muscles. Their function is to produce force and cause motion.

**Types of muscles** are :

- Skeletal muscle or "voluntary muscle" is anchored by tendons to bone and is used to affect skeletal movement such as locomotion and in maintaining posture.

- Smooth muscle or "involuntary muscle" is found within the walls of organs and structures such as the esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, blood vessels, and even the skin (in which it controls erection of body hair). Unlike skeletal muscle, smooth muscle is not under conscious control.
- Cardiac muscle is also an "involuntary muscle" but is more akin in structure to skeletal muscle, and is found only in the heart.

**Q.3. What is the Muscles Atrophy?**

**Ans.:** There are many diseases and conditions which cause a decrease in muscle mass, known as **muscle atrophy**. Example include cancer and AIDS, which induce a body wasting syndrome called cachexia. Other syndromes or conditions which can induce skeletal muscle atrophy are congestive heart disease and some diseases of the liver.

**Q.4. Which is the Strongest Muscle in Human Body and why?**

**Ans.:** The **tongue** is the strongest muscle in the body. The tongue is the large bundle of skeletal muscles on the floor of the mouth that manipulates food for chewing and swallowing (deglutition). It is the primary organ of taste. Much of the surface of the tongue is covered in taste buds. The tongue, with its wide variety of possible movements, assists in forming the sounds of speech. It is sensitive and kept moist by saliva, and is richly supplied with nerves and blood vessels to help for movement.

**Q.5 What is Myopathy?**

**Ans.:** A **myopathy** is a neuromuscular disease in which the muscle fibers do not function for any one of many reasons, resulting in muscular weakness myopathy implies that the primary defect is within the muscle, as opposed to the nerves or elsewhere (e.g., the brain etc.). Muscle cramps, stiffness, and spasm can also be associated with myopathy.

## Chapter-4

# Cardio Vascular System

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**Q.1. What is the composition of Blood?**

**Ans.:** Blood is composed of blood cells suspended in a liquid called **blood plasma**. Plasma, which comprises 55% of blood fluid, is mostly water (90% by volume), and contains dissolved proteins, glucose, mineral ions, hormones, carbon dioxide (plasma being the main medium for excretory product transportation), platelets and blood cells themselves. The blood cells present in blood are mainly red blood cells (also called **RBCs or erythrocytes**) and white blood cells, including leukocytes and platelets (also called **thrombocytes**).

**Q.2. Write about the Heart. Its position and interior of Heart?**

**Ans.:** The **heart** is a muscular organ in all vertebrates responsible for pumping blood through the blood vessels by repeated, rhythmic contractions, or a similar structure in annelids, mollusks, and arthropods.

In the human body, the heart is usually situated in the middle of the thorax with the largest part of the heart slightly offset to the left (although sometimes it is on the right, called dextrocardia), underneath the breastbone.

Humans have a **four-chambered heart** :

- **Right Atrium** : Receives oxygen-depleted blood from the body via the superior vena cava and the inferior vena cava and pumps it through the tricuspid valve into the right ventricle.



- **Right Ventricle** : Receives oxygen-depleted blood from the right atrium and pumps it through the pulmonary valve into the lungs via the pulmonary artery.
- **Left Atrium** : Receives oxygen-rich blood from the lungs via the pulmonary veins and pumps it through the mitral valve into the left ventricle.
- **Left Ventricle** : Receives oxygen-rich blood from the left atrium and pumps it through the aortic valve to the entire body via the aorta, including to the heart muscle itself through the coronary arteries.

**Q.3. What is the function of Blood?**

**Ans.:** Blood performs many important functions within the body including :

- Supply of oxygen to tissues (bound to hemoglobin which is carried in red cells).
- Supply of nutrients such as glucose, amino acids and fatty acids (dissolved in the blood or bound to plasma proteins).
- Removal of waste such as carbon dioxide, urea and lactic acid.
- Immunological functions, including circulation of white cells, and detection of foreign material by antibodies Coagulation, which is one part of the body's self-repair mechanism.
- Messenger functions, including the transport of hormones and the signaling of tissue damage.
- Regulation of body pH (the normal pH of blood is in the range of 7.35 - 7.45).
- Regulation of body temperature.
- Hydraulic functions.

**Q.4. What is the covering of the Heart wall?**

**Ans.:** The heart is enclosed by a **sac** known as the **pericardium** and is surrounded by the lungs. There are two layers to the pericardial sac: the

fibrous pericardium and the serous pericardium. The serous pericardium, in turn, is divided into two layers, the parietal pericardium, which is fused to and inseparable from the fibrous pericardium, and the visceral pericardium, which is in fact epicardium, or the outer surface of the heart muscle (the myocardium).

In between the parietal and visceral pericardial layers there is a potential space called the **pericardial cavity**. It is normally lubricated by a film of pericardial fluid. Too much fluid in the cavity (such as in a pericardial effusion) can result in pericardial tamponade, compression of the heart within the pericardial sac.

**Q.5 . Explain about the Artery?**

**Ans.:** **Arteries** are blood vessels that carry blood away from the heart (as opposed to veins). All arteries, with the exception of the pulmonary and umbilical arteries, carry oxygenated blood.

**Q.6. Explain about the Vein and which is the Longest Vein of Human Body?**

**Ans.** A **vein** is a blood vessel that carries blood back toward the heart (as opposed to artery). The majority of veins in the body carry low-oxygen blood from the tissues back to the heart; the exceptions being the pulmonary and umbilical veins which both carry oxygenated blood. The **great saphenous vein (GSV)**, is the greater saphenous vein, is the large (subcutaneous) superficial vein of the leg and thigh. It travels mostly in its own fascial compartment in the thigh.

**Q.7 Define the High Blood Pressure and what are the causes of High Blood Pressure?**

**Ans.:** **High blood pressure** is a disease where your blood pressure is always above average. Generally, if a person's blood pressure stays at **140/90 MM Hg** (a unit of pressure) or above in both arms, that person has high blood pressure.

A number of factors increase the risk of developing hypertension :

- High salt use.
- Being overweight.
- Occupation.
- Drinking alcohol.
- Family size.
- Excessive noise and crowding.
- High salt use has received the greatest attention. Approximately 60% of the hypertension patients are affected by salt use.
- Although few women of childbearing age have high blood pressure, up to 10% develop hypertension of pregnancy.

**Q.8 Define Pulse and what is the Normal Pulse Rate?**

**Ans.:** **Pulse** is the throbbing of their arteries as an effect of the heart beat. It can be felt in any place that allows for an artery to be compressed against a bone. A normal pulse rate for a healthy adult, while resting, can range from **60 to 80 beats per minute (BPM)**.

**Q.9 What are common sites to check the Pulse Rate?**

**Ans.:** **The Common Site of Pulse :**

- **Apical Pulse :** Located in the 4th or 5th left intercostal space, just to the left of the sternum.
- **Brachial Pulse :** Located between the biceps and triceps, on the medial side of the elbow cavity.
- **Carotid Pulse :** Located in the neck (carotid artery).
- **Dorsalis Pedis Pulse :** Located on top of the foot (dorsalis pedis artery).
- **Facial Pulse :** Located on the mandible (lower jawbone) on a line with the corners of the mouth (facial artery).

- **Femoral Pulse** : Located in the thigh, halfway between the pubic symphysis and anterior superior iliac spine (femoral artery).
- **Popliteal Pulse** : Located behind the knee in the popliteal fossa, found by holding the bent knee.
- **Radial Pulse** : Located on the thumb side of the wrist (radial artery).
- **Temporal Pulse** : Located on the temple directly in front of the ear (superficial temporal artery).
- **Tibialis Posterior Pulse** : Located on the medial side of the ankle (facing inwards) behind the medial malleolus (posterior tibial artery).
- **Ulnar Pulse** : located on the little finger side of the wrist(ulnar artery).

**Q.10 Write about the Aorta?**

**Ans.:** The **aorta** is the largest artery in the human body, originating from the left ventricle of the heart and bringing oxygenated blood to all parts of the body in the systemic circulation. The aorta is a hard artery, and as such is quite distensible. When the left ventricle contracts to force blood into the aorta, the aorta expands. This stretching gives the potential energy that will help maintain blood pressure during diastole, as during this time the aorta contracts passively.

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## Chapter-5

# Respiratory System

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### Q.1 What is Respiration?

**Ans.:** **Respiration** is the transport of oxygen from the clean air to the tissue cells and the transport of carbon dioxide in the opposite direction. This is in contrast to the biochemical definition of respiration, which refers to cellular respiration: the metabolic process by which an organism obtains energy by reacting oxygen with glucose to give water, carbon dioxide (energy).

### Q.2. What are the Respiratory Organs?

**Ans.:** The **respiratory system** consist of :

- Nasal Cavity (Nose)
- Pharynx (Naso-, Oro-, Laryngo-)
- Larynx (Voice Box)
- Trachea (Wind Pipe)
- Thoracic Cavity (Chest)
- Bronchi (Right and Left)
- Alveoli (Site of Gas Exchange)

**Q.3 Explain about the Lungs?**

**Ans.:** The **lung** is the essential respiration organ. The two lungs are located in the chest on either side of the heart. Their principal function is to transport oxygen from the atmosphere into the bloodstream, and to release carbon dioxide from the bloodstream into the atmosphere.

**Q.4. Which is the Smallest Unit of the Lungs? Explain.**

**Ans.:** The **alveoli** is the smallest unit of the lungs. An alveoli is an anatomical structure that has the form of a hollow cavity. Mainly found in the lung, the pulmonary alveoli are spherical outcroppings of the respiratory bronchioles and are the primary sites of gas exchange with the blood. Alveoli are particular to mammalian lungs.

The lungs contain about **300 million** alveoli, representing a total surface area of approx. 70-90 square meters (m<sup>2</sup>). Each alveolus is wrapped in a fine mesh of capillaries covering about 70% of its area. The alveoli have radii of about 0.05 mm but increase to around 0.1 mm during inhalation. The alveoli consist of an epithelial layer and extracellular matrix surrounded by capillaries. In some alveolar walls there are pores between alveoli.

**Q.5. Write about Trachea and what is the length of Treacha?**

**Ans.:** The **trachea**, or **windpipe**, is a tube that has an inner diameter of about **20-25 mm** and a length of about **10-16cm**. It commences at the larynx (at the level vertebral level of C6 in humans) and bifurcates into the primary (main) bronchi. In humans there are about 15 - 20 incomplete C-shaped cartilaginous rings which reinforces the anterior and lateral sides of the trachea to protect and maintain the airway open. There is a piece of smooth muscle connecting the ends off the incomplete cartilaginous rings called the Trachealis muscle.

**Q.6 Explain about Larynx and its functions?**

**Ans.:** The **larynx**, known as the **voicebox** also, is an organ in the neck of mammals involved in protection of the trachea and sound production.

The larynx houses the vocal folds, and is situated just below where the tract of the pharynx splits into the trachea and the esophagus.

Fine manipulation of the larynx is used in a great way to generate a source sound with a particular fundamental frequency, or pitch. This source sound is altered as it travels through the vocal tract, configured differently based on the position of the tongue, lips, mouth, and pharynx. The process of altering a source sound as it passes through the filter of the vocal tract creates the many different vowel and consonant sounds of the world's languages.

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## Chapter-6

# Digestive System

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### Q.1 Define Digestion?

**Ans.** **Digestion** is the breaking down of food in the body, into a form that can be absorbed and used or excreted. It is also the process by which the body breaks down food into smaller components that can be absorbed by the blood stream.

### Q.2. What are the Digestive Organs?

**Ans.:** The organs of **digestive system** are :

- Oral cavity
- Esophagus
- Stomach
- Small Intestine
- Large Intestine

### Q.3 Write about Small Intestine. What is its length?

**Ans.:** The **small intestine** is the part of the gastrointestinal tract (gut) between the stomach and the large intestine and comprises the duodenum, jejunum, and ileum. It is where the vast majority of digestion takes place. Nutrients diffuse through the villi, projections sticking out of the walls of the small intestine, into the blood. It is approximately **7 m (22.97 ft)** long and can vary from **4-7 m**.



**Q.4. Mention the function of Stomach?**

**Ans.:** The **functions of stomach** are :

- The human stomach can produce and secrete about 2.2 to 3 liters of gastric acid per day with basal secretion levels being typically highest in the evening.
- The stomach can expand to hold between 2-4 liters of food.
- It is a temporary food storage area, and in the process of digestion, the food goes into the stomach first.
- Other functions include absorbing some ions, water, and some lipid soluble compounds such as alcohol, aspirin, and caffeine.

**Q.5 Write the function of Small Intestine?**

**Ans.:** Absorption of the majority of nutrients takes place in the small intestine with the following notable exceptions :

- Iron is absorbed in the duodenum
- Vitamin B12 and bile salts are absorbed in the terminal ileum.
- Water and lipids are absorbed by passive diffusion throughout
- Sodium is absorbed by active transport and glucose and amino acid co-transport.
- Fructose is absorbed by facilitated diffusion.
- The digestion of proteins into peptides and amino acids principally occurs in the stomach but some also occurs in the small intestine.
- The small intestine is where the most chemical digestion takes place.

**Q.6 Explain about the Large Intestine?**

**Ans.:** The **large intestine** is the last part of the digestive system. The final stage of the alimentary canal in vertebrate animals. Its function is to absorb the remaining water from indigestible food matter, as well as store the useless nutrients and wastes and flush them from the body. The large intestine

starts in the right iliac region of the pelvis, just at or below the right waist. Joined to the bottom end of the small intestine, it consists of the cecum and colon. The large intestine is about **1.5 meters long**, which is about one-fifth of the whole length of the intestinal canal.

**Q.7. What is the function of Large Intestine?**

**Ans.:** The functions of **large intestine** are :

- The large intestine takes 12-25 hours to finish up the remaining processes of the digestive system. Food is not broken down any further in this stage of digestion.
- The large intestine simply absorbs vitamins that are created by the bacteria inhabiting the colon.
- It is also very important in absorbing water and compacting the feces.
- It also stores fecal matter in the rectum until eliminated through the anus.
- It is also responsible for passing along solid waste.

**Q.8. Write about the Oesophagus and its functions?**

**Ans.:** The **oesophagus**, sometimes known as the **gullet**, is an organ in vertebrates which consists of a muscular tube through which food passes from the pharynx to the stomach. In humans the esophagus is continuous with the laryngeal part of the pharynx at the level of the C6 vertebra. It is usually **25-30 cm long** which connects the mouth to the stomach. It is divided into **cervical**, **thoracic**, and **abdominal** parts.

- Food is passed through the esophagus by using the process of peristalsis.
- The esophagus is lined with mucous membrane, and is more deeply lined with muscle that acts with peristaltic action to move swallowed food down to the stomach.

- It connects the pharynx, which is the body cavity that is common to the digestive factory and respiratory system with the stomach, where the second stage of digestion is initiated.

**Q.9. Explain the process of Digestion?**

**Ans.: Oral Cavity :** In humans, digestion begins in the oral cavity where food is chewed. Saliva is secreted in large amounts (1-1.5 litre/day) by three pairs of exocrine salivary glands (parotid, submandibular, and sublingual) in the oral cavity, and is mixed with the chewed food by the tongue.

**Esophagus :** The esophagus, a narrow, muscular tube about 30 centimeters (12 inches) long, starts at the pharynx, passes through the larynx and diaphragm, and ends at the cardiac orifice of the stomach. The chewed food is pushed down the esophagus to the stomach through peristaltic contraction of these muscles. It takes only seconds for food to pass through the esophagus, and little digestion actually takes place.

**Stomach :** The food enters the stomach after passing through the cardiac orifice. In the stomach, food is further broken apart, and thoroughly mixed with a gastric acid and digestive enzymes that break down proteins.

**Small Intestine :** After being processed in the stomach, food is passed to the small intestine via the Pyloric sphincter. The majority of digestion and absorption occur here as chyme enters the duodenum. Here it is further mixed with three different liquids: bile, pancreatic juice, intestinal enzymes. Most nutrient absorption takes place in the small intestine.

**Large Intestine :** After the food has been passed through the small intestine, the food enters the large intestine. The large intestine absorbs water from the bolus and stores feces until it can be egested(Defecation).

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## Chapter-7

# Excretory System

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**Q.1 Define Urinary System? What are the organs of Urinary System?**

**Ans.:** The **urinary system** (also called **excretory system** or the **genitourinary system (GUS)**) is the organ system that produces, stores, and eliminates urine. two kidneys, two ureters, the bladder, and the urethra.

**Q.2. What is the functions of Kidneys?**

**Ans.:** The main **functions of the kidneys** are :

- Excretion of waste products.
- Homeostasis.
- Acid-base balance.
- Blood pressure.
- Plasma volume.
- Hormone secretion.

**Q.3. Describe the importance of Urinary Bladder?**

**Ans.:** The **urinary bladder** is a hollow, muscular, and distensible (or elastic) organ that sits on the pelvic floor in mammals. It is the organ that collects urine excreted by the kidneys prior to disposal by urination. Urine enters the bladder via the ureters and exits via the urethra.

In **males**, the bladder is superior to the prostate, and separated from the rectum by the rectovesical excavation.

In **females**, the bladder is separated from the rectum by the rectouterine excavation, and it is separated from the uterus by the vesico uterine excavation.

**Q.4. What is Skin and what are the functions of the Skin?**

**Ans.:** **Skin** is the largest organ of the integumentary system made up of multiple layers of epithelial tissues that guard underlying muscles and organs.

**Skin performs the following functions :**

- Protection.
- Sensation.
- Heat regulation.
- Control of evaporation.
- Aesthetics and communication.
- Storage and synthesis.
- Excretion.
- Absorption.
- Water resistance.

**Q.5. Mention the composition of the Skin?**

**Ans.:** **Composition of the Skin :**

**Epidermis :** It is the outermost layer of the skin. It forms the waterproof, protective wrap over the body's surface and is made up of stratified squamous epithelium with an underlying basal lamina. The epidermis contains no blood vessels, and cells in the deepest layers are nourished by diffusion from blood capillaries extending to the upper layers of the dermis..

**Components :** The epidermis contains no blood vessels, and is nourished by diffusion from the dermis. The main type of cells which make up the epidermis are keratinocytes, melanocytes, Langerhans cells and Merckel cells.

**Layers :** Epidermis is divided into several layers where cells are formed through mitosis at the innermost layers. They move up the strata changing shape and composition as they differentiate and become filled with keratin.

**Sublayers :** Epidermis is divided into the following 5 sublayers or strata :

- Stratum Corneum
- Stratum Lucidum
- Stratum Granulosum
- Stratum Spinosum
- Stratum Germinativum

**Dermis :** The dermis is the layer of skin beneath the epidermis that consists of connective tissue and cushions the body from stress and strain. The dermis is tightly connected to the epidermis by a basement membrane.

**Papillary Region :** The papillary region is composed of loose areolar connective tissue. It is named for its fingerlike projections called papillae, that extend toward the epidermis. The papillae provide the dermis with a "bumpy" surface that interdigitates with the epidermis, strengthening the connection between the two layers of skin.

**Reticular Region :** The reticular region lies deep in the papillary region and is usually much thicker. It is composed of dense irregular connective tissue, and receives its name from the dense concentration of collagenous, elastic, and reticular fibers that weave throughout it.

#### **Q.6. What is Electrolyte Balance of the Body?**

**Ans.:** **Electrolytes** play a vital role in maintaining homeostasis within the body. They help to regulate myocardial and neurological function, fluid balance, oxygen delivery, acid-base balance and much more. Electrolyte balance is

maintained by oral, or in emergencies, intravenous (IV) intake of electrolyte-containing substances, and is regulated by hormones, generally with the kidneys flushing out excess levels. In humans, electrolyte homeostasis is regulated by hormones such as antidiuretic hormone, aldosterone and parathyroid hormone. Serious electrolyte disturbances, such as dehydration and overhydration, may lead to cardiac and neurological complications and, unless they are rapidly resolved.

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## Chapter-8

# Nervous System

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### Q.1 Define Nervous System?

**Ans.:** The **nervous system** is a highly specialized network whose principal components are nerves called neurons. Neurons are interconnected to each other in complex arrangements and have the property of conducting, using electrochemical signals, and a great variety of stimuli both within the nervous tissue as well as from and towards most of the other tissues.

### Q.2 What is the function of Neurons?

**Ans.:** **Neurons** are electrically excitable cells in the nervous system that process and transmit information. Neurons are highly specialized for the processing and transmission of cellular signals. Given the diversity of functions performed by neurons in different parts of the nervous system, there is, as expected, a wide variety in the shape, size, and electrochemical properties of neurons :

- Convey information from tissues and organs into the central nervous system.
- Transmit signals from the central nervous system to the effector cells.

### Q.3. What is Synapses?

**Ans.:** **Synapses** are specialized junctions through which neurons signal to each other and to non-neuronal cells such as those in muscles or glands.



synapses allow neurons to form interconnected circuits within the central nervous system. They are thus crucial to the biological computations that underlie perception and thought.

**Q.4. Mention the CNS (Central Nervous System)?**

**Ans.:** The **Central Nervous System (CNS)** of the vertebrate nervous system which is enclosed in meninges. It contains the majority of the nervous system, and consists of the brain (in vertebrates which have brains), and the spinal cord. The CNS is contained within the dorsal cavity, with the brain within the cranial cavity, and the spinal cord in the spinal cavity. the central nervous system is conceived as a system devoted to information processing, where an appropriate motor output is computed as a response to a sensory input.

**Q.5 Define the Autonomic Nervous System?**

**Ans.:** The **Autonomic Nervous System (ANS)** (or visceral nervous system) is the part of the peripheral nervous system that acts as a control system, maintaining homeostasis in the body. The ANS affects heart rate, digestion, respiration rate, salivation, perspiration, diameter of the pupils, micturition (urination), and sexual arousal.

**Q.6 Describe the functions of Autonomic Nervous System?**

**Ans.:** There are two main **functions of the Autonomic Nervous System :**

**(A) Sympathetic Nervous System :**

- Diverts blood flow away from the gastro-intestinal (GI) tract and skin via vasoconstriction.
- Blood flow to skeletal muscles,
- Increases heart rate and the contractility of cardiac cells
- Dilates pupils and relaxes the lens, allowing more light to enter the eye.

**Parasympathetic Nervous System :**

- Dilates blood vessels leading to the GI tract, increasing blood flow.

- The parasympathetic nervous system can also constrict the bronchiolar diameter when the need for oxygen has diminished.
- During accommodation, the parasympathetic nervous system causes constriction of the pupil and lens.
- The parasympathetic nervous system stimulates salivary gland secretion, and accelerates peristalsis, so, in keeping with the rest and digest functions.
- Is also involved in erection of genitals, via the pelvic splanchnic nerves 2-4.

**Q.7 Describe the function of the Central Nervous System?**

**Ans.:** The central nervous system is conceived as a system devoted to information processing, where an appropriate motor output is computed as a response to a sensory input. Yet, many threads of research suggest that motor activity exists well before the maturation of the sensory systems and then, that the senses only influence behaviour without dictating it.

**Q.8 What are the function of the Glial Cells?**

**Ans.:** Glial cells are non-neuronal cells that provide support and nutrition, maintain homeostasis, form myelin, and participate in signal transmission in the nervous system.

The four main **functions of glial cells** are :

- (1) To surround neurons and hold them in place,
- (2) To supply nutrients and oxygen to neurons,
- (3) To insulate one neuron from another,
- (4) To destroy pathogens and remove dead neurons.

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## Chapter-9

# Endocrine System

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### Q.1 Define Endocrine System?

**Ans.:** The **endocrine system** is an integrated system of small organs that involve the release of extracellular signaling molecules known as hormones. The endocrine system is instrumental in regulating metabolism, growth, development and puberty, tissue function, and also plays a part in determining mood.

### Q.2 What is the importance of the Endocrine System ?

**Ans.:** The Endocrine system is an information signal system much like the nervous system. However, the nervous system uses nerves to conduct information, whereas the endocrine system mainly uses blood vessels as information channels. Glands located in many regions of the body release into the bloodstream specific chemical messengers called hormones. Hormones regulate the many and varied functions of an organism, e.g., mood, growth and development, tissue function, and metabolism, as well as sending messages and acting on them.

### Q.3 What are the types of Glands in the Human Body?

**Ans.:** Major Endocrine Glands (Male or Female) :

- |                   |                     |
|-------------------|---------------------|
| (1) Pineal Gland  | (2) Pituitary Gland |
| (3) Thyroid Gland | (4) Thymus          |

- |                   |              |
|-------------------|--------------|
| (5) Adrenal Gland | (6) Pancreas |
| (7) Ovary         | (8) Testes   |

**Q.4 Mention the functions of the Pituitary Gland?****Ans.: Pituitary Gland (Hypophysis) :**

- ❖ Anterior Pituitary Lobe (Adenohypophysis)
- ❖ Posterior Pituitary Lobe (Neurohypophysis)

**Anterior Pituitary Gland** secretes the Hormones are :

- (1) Growth Hormone
- (2) Prolactin
- (3) Adrenocorticotrophic Hormone or Corticotropin
- (4) Lipotropin
- (5) Thyroid-Stimulating Hormone or Thyrotropin
- (6) Follicle-Stimulating Hormone
- (7) Luteinizing Hormone

**Posterior Pituitary Gland** secretes the Hormones are :

- (1) Oxytocin
- (2) Vasopressin or Antidiuretic Hormone

**Q.5 Mention the Name of Hormones secreted by Thyroid Gland?****Ans.:** Thyroid Gland secretes the Hormones are :

- (1) Triiodothyronine
- (2) Thyroxine
- (3) Calcitonin.

**Q.6 What are the Hormones secreted by Parathyroid Gland?**

**Ans.:** The **Parathyroid Gland** secretes the parathyroid hormone.  $\text{Ca}^{2+}$  reabsorption in kidney activate vitamin D.

**Q.7 What are the Hormones secreted by Adrenal Gland?**

**Ans.:** Hormones secreted by **Adrenal Gland** are :

- (1) Glucocorticoids (Cortisol)
- (2) Mineralocorticoids (Aldosterone)
- (3) Androgens (including DHEA and Testosterone)
- (4) Adrenaline (Epinephrine)
- (5) Noradrenaline (Norepinephrine)
- (6) Dopamine (increase Heart Rate and Blood Pressure)
- (7) Enkephalin (Regulate Pain)

**Q.8 Mention the importance of Thymus Gland?**

**Ans.:** In the two thymic lobes, lymphocyte precursors from the bone-marrow become thymocytes, and subsequently mature into T cells. Once mature, T cells emigrate from the thymus and constitute the peripheral T cell repertoire responsible for directing many facets of the adaptive immune system.

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## Chapter-10

# Sense Organs

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### Q.1 Define the Sensory System ?

**Ans.:** A **sensory system** is a part of the nervous system responsible for processing sensory information. A sensory system consists of sensory receptors, neural pathways, and parts of the brain involved in sensory perception. Commonly recognized sensory systems are those for vision, hearing, somatic sensation (touch), taste and olfaction (smell).

### Q.2 Describe the Sense Organs in Human Body?

**Ans.:** The **Human Sensory System** consists of the following sub-systems :

- Visual System (Vision)
- Auditory System (Hearing)
- Somatosensory System (Touch)
- Gustatory System (Taste)
- Olfactory System (Smell)

### Q.3 What are the Sensory Receptors in Human Body?

**Ans.:** Sensory receptors are :

- Chemosensor
- Mechanoreceptor

- Nociceptor
- Photoreceptor
- Thermoreceptor

**Q.4. Mention the types of the Taste Buds in Tounge?**

**Ans.:** **Taste buds** are small structures on the upper surface of the tongue, soft palate, and epiglottis that provide information about the taste of food being eaten.

The human tongue has about **10,000 taste buds**. The majority of taste buds on the tongue sit on raised protrusions of the tongue surface called papillae.

There are four types of **papillae** present in the human tongue :

- (1) **Fungiform Papillae** : These are present mostly at the apex (tip) of the tongue, as well as at the sides.
- (2) **Filiform Papillae** : These are thin, long papillae "V"-shaped cones that don't contain taste buds but are the most numerous. These papillae are mechanical and not involved in gustation.
- (3) **Foliate Papillae** : These are ridges and grooves towards the posterior part of the tongue found on lateral margins.
- (4) **Circumvallate Papillae** : There are only about 3-14 of these papillae on most people, and they are present at the back of the oral part of the tongue.

**Q.5 Describe the physiology of Vision?**

**Ans.:** The **eye** is a complex biological device. focus light from external objects in the visual field onto a light-sensitive medium. Light entering the eye is refracted as it passes through the cornea. It then passes through the pupil (controlled by the iris) and is further refracted by the lens. The cornea and lens act together as a compound lens to project an inverted image onto the retina.

**Q.6 Describe the physiology of Hearing?**

**Ans.:** **Hearing** is one of the traditional five senses. It is the ability to perceive sound by detecting vibrations via an organ such as the **ear**. The inability to hear is called deafness. hearing is performed primarily by the auditory system: vibrations are detected by the ear and transduced into nerve impulses that are perceived by the brain (primarily in the temporal lobe). Like touch, audition requires sensitivity to the movement of molecules in the world outside the organism. Both hearing and touch are types of **mechanosensation**.

**Q.7 What are the function of Olfactory Bulb?**

**Ans.:** The **olfactory bulb** transmits smell information from the **nose** to the brain, and is thus necessary for a proper sense of smell. it is generally assumed that it functions as a filter, as opposed to an associative circuit that has many inputs and many outputs. the olfactory bulb also receives "top-down" information from such brain areas.

- Enhancing discrimination between odors.
- Enhancing sensitivity of odor detection.
- Filtering out many background odors to enhance the transmission of a few select odors.
- Permitting higher brain areas involved in arousal and attention to modify the detection or the discrimination of odors.

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## Chapter-11

# Reproductive System

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### Q.1 Define the Reproductive System?

**Ans.:** The **reproductive system** is a system of organs within an organism which work together for the purpose of reproduction.

Human reproduction takes place as internal fertilization by sexual intercourse. The sperm then travels through the vagina and cervix into the uterus or fallopian tubes for fertilization of the ovum. Upon successful fertilization and implantation, gestation of the foetus then occurs within the female's uterus for approximately nine months, this process is known as **pregnancy in humans**. Gestation ends with birth, the process of birth is known as **labor**. Labor consists of the muscles of the uterus contracting, the cervix dilating, and the baby passing out the vagina. Human's babies and children are nearly helpless and require high levels of parental care for many years. One important type of parental care is the use of the mammary glands in the female breasts to feed the baby.

### Q.2. What are the accessory organs of Female Reproductive System?

**Ans.:** The **organs of female reproductive system** are :

- (1) Vulva.
- (2) Pubic Hair

- (3) Clitoral Hood
- (4) Clitoris
- (5) Labia Majora
- (6) Labia Minora
- (7) Perineum

### Q.3 Explain about the Menstrual Cycle?

**Ans.:** In the female reproductive system, the **menstrual cycle** is a recurring cycle of physiologic changes that occurs in reproductive-age females. Overt menstruation (where there is blood-flow from the vagina) occurs primarily in humans. The menstrual cycle is under the control of the hormone system and is necessary for reproduction. Menstrual cycles are counted from the first day of menstrual flow, because the onset of menstruation corresponds closely with the hormonal cycle. The menstrual cycle may be divided into several phases, and the length of each phase varies from woman to woman and cycle to cycle.

### Q.4 Define the Menopause?

**Ans.:** The cessation of menstrual cycles at the end of a woman's reproductive life is termed **menopause**. The average age of menopause in women is **51 years**, with anywhere between 40 and 58 being common. Menopause is the **complete shutting down of the female reproductive system**. The word menopause literally means the permanent physiological, or natural, cessation of menstrual cycles, from the Greek roots 'meno' (month) and 'pauasis' (cessation). In other words, menopause is the natural and permanent stopping of the monthly female reproductive cycles, and in human females who still have a uterus, this is traditionally indicated by a permanent absence of monthly periods or menstruation.

**Q.5 Mention the organs of the Male Reproductive System?**

**Ans.:** Male genitalia. 1. Testicles, 2. Epididymis, 3. Corpus Caverosa, 4. Foreskin, 5. Frenulum, 6. Urethral Opening , 7. Glans Penis, 8. Corpus Spongiosum, 9. Penis, 10. Scrotum.

**Q.6 What is the function of the Bartholin Gland?**

**Ans.:** The **Bartholin's glands** are two glands located slightly below and to the left and right of the opening of the vagina in women. They secrete mucus to provide vaginal lubrication. Bartholin's glands are homologous to Cowper's glands in males. However, while Bartholin's glands are located in the superficial perineal pouch.

**Q.7 What is the function of Testicles ?**

**Ans.:** The **respective functions of the testicles** are :

- Producing sperm (spermatozoa).
- Producing male sex hormones that of which testosterone is the best-known.

Both functions of the testicle, sperm-forming and endocrine, are under control of gonadotropic hormones produced by the anterior pituitary :

- Luteinizing Hormone (LH)
- Follicle-Stimulating Hormone (FSH)

**Q.8 What are the functions of the Ovaries?**

**Ans.:** **Ovaries** are oval shaped and, in the human, measure approximately **3 cm x 1.5 cm x 1.5 cm**. The ovary is located in the lateral wall of the pelvis in a region called the **ovarian fossa**. Each ovary is then attached to the Fimbriae of the Fallopian Tube. Usually each ovary takes turns releasing eggs every month; however, if there was a case where one ovary was absent or dysfunctional then the other ovary would continue providing eggs to be released.

**Q.9** Define the Menarche?

**Ans.:** Menarche is the first menstrual period, or first menstrual bleeding in the females of human beings. From both social and medical perspectives it is often considered the central event of female puberty, as it signals the possibility of fertility. Timing of menarche is influenced by both genetic and environmental factors, especially nutritional status.

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