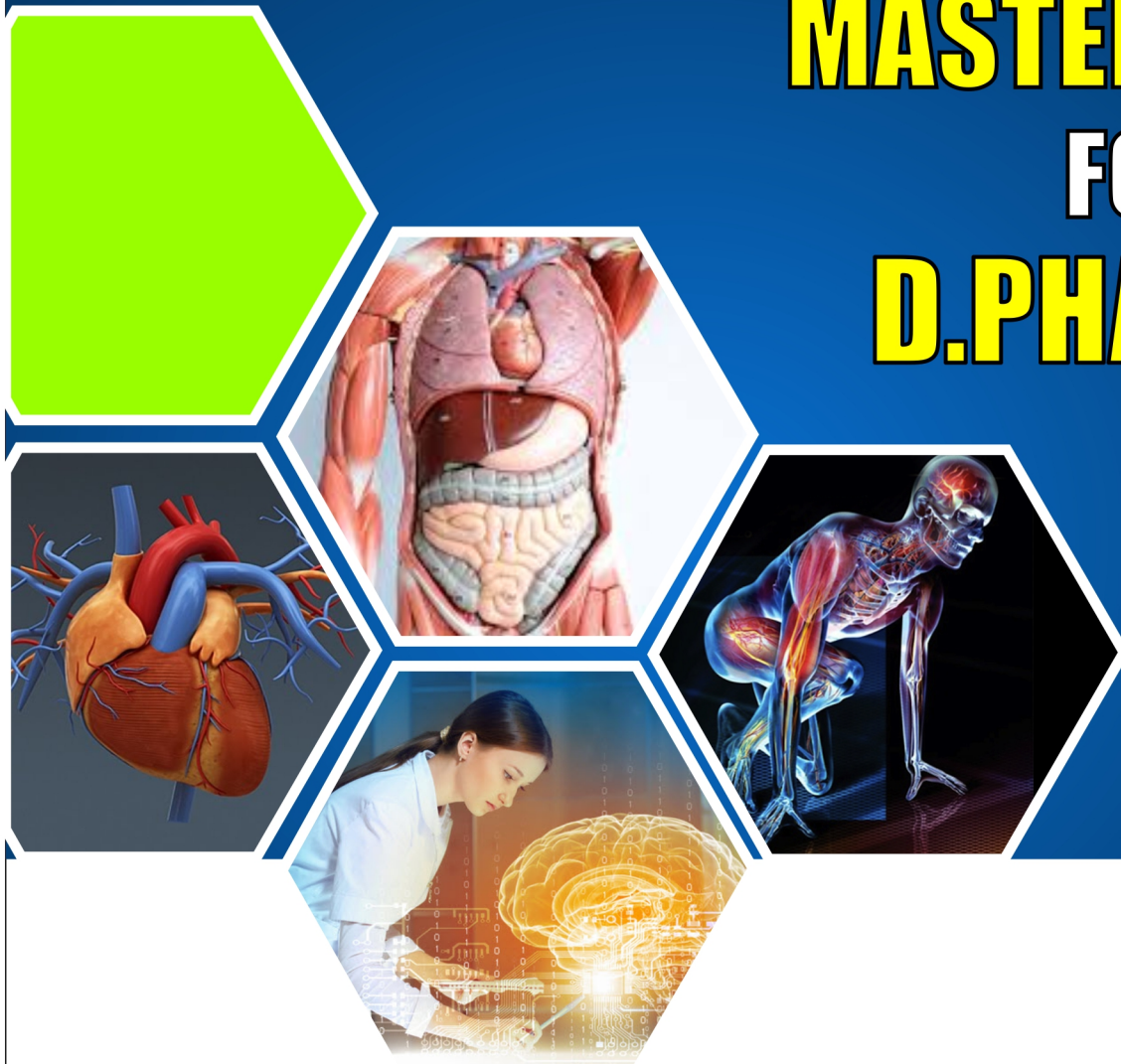




HUMAN ANATOMY AND PHYSIOLOGY

MASTER NOTES FOR D.PHARMA

1st
YEAR
STUDENTS



**Subject Wise
Notes**



**According To
PCI Syllabus**



**Easy To
Understand**



**Prepared By
Experts**



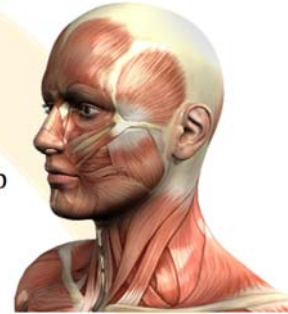
**Learn With
Flow Charts**

Scope of Anatomy and Physiology

- **Scope of Anatomy and Physiology**
- **Definition of various terminologies**

Anatomy

- Anatomy is the study of the structure of the body and of the relationship of its constituent parts to each other.
- Anatomy is science that deals with the structures of the body and the relationship of various parts to each other.



Subdivisions of anatomy

1. **Gross Anatomy:** It is concerned with the study of the structures of body that are visible to the naked eye.
2. **Microscopic Anatomy:** It deals with the study and examination of the different structures of the human body using a microscope.



gross anatomy

microscopic anatomy

Physiology

- Physio means nature and ology means study.
- Physiology is the branch of science that deals with the normal functions of living organisms and their body parts.

Scope of Anatomy and physiology

1. Helpful in the study of human evolution and development.
2. Helpful in the structure and function of the human body.
3. Helpful in mass therapy and athletics health-related field training.
4. May be used as a foundation for advanced scientific studies.
5. Helpful to understand the pathology of disease and pathological changes.
6. Helpful to determine the techniques of surgeries.
7. Helpful to know the parameters of normal health.
8. Helpful in overall effective maintenance of individual and community.

Definitions of different terminologies

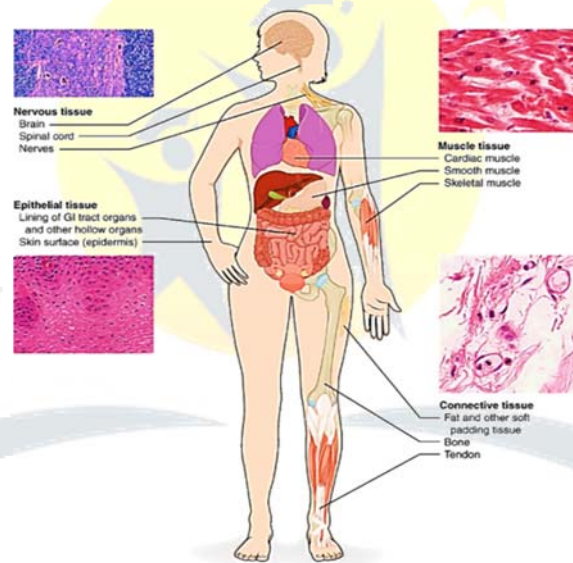
TERMS	DESCRIPTION
Median line	The central plane or the midline of the body which divides it into two halves, that is, right and left.

Tissues of the human body

- Epithelial Tissue – their sub-types and characteristics.
- Connective Tissue – their sub-types and characteristics.
- Muscular Tissue – their sub-types and characteristics.
- Nervous Tissues – their sub-types and characteristics.

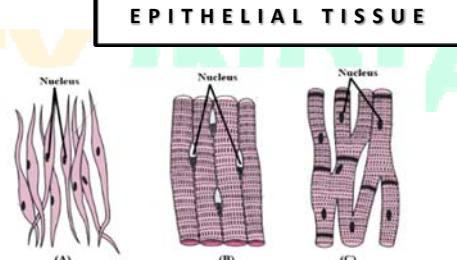
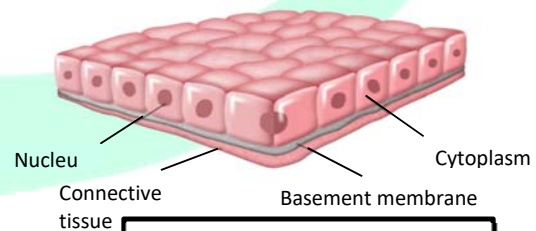
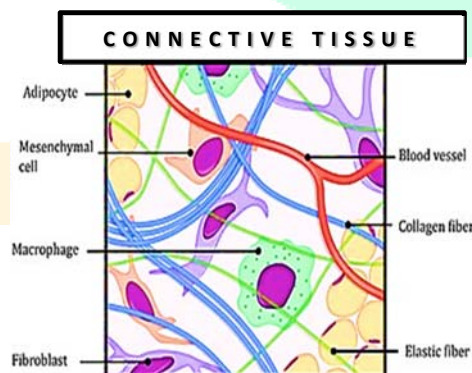
Introduction

- A group of cells having the same origin, similar shape, and specific (or) common generalized function is known as a tissue.
- Tissues may be hard (bone), semisolid (fat), or liquid (blood in their consistency).
- The study of the microscopic anatomy of cells and tissues of plants and animals is called Histology.



Classification of tissues: The tissues are classified into four major types

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue



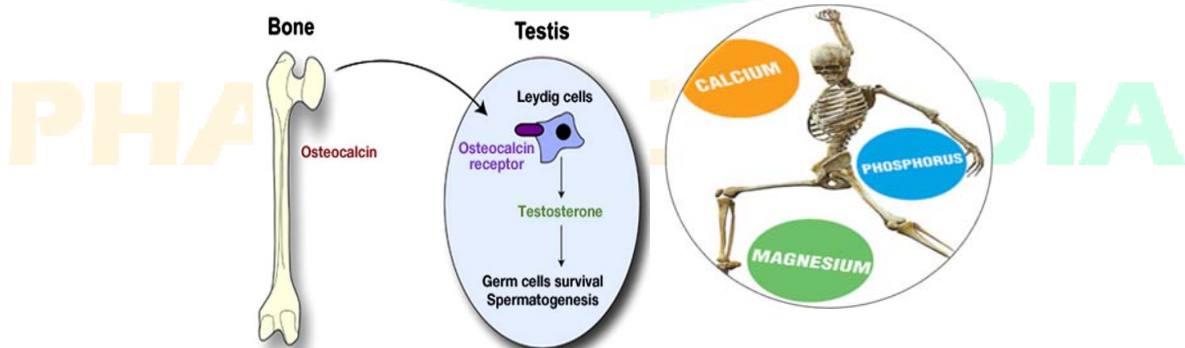
MUSCULAR TISSUE

HUMAN SKELETON - 206 bones			
Axial 80		Appendicular-126	
APPENDICULAR SKELETON - 126 BONES			
LIMB BONES - 120		GIRDLE BONES - 06	
Fore limb Bones – 60	Hind limb Bones - 60	Pectoral Girdle - 4	Pelvic Girdle - 2
Humerus - 1 x 2	Femur - 1 x 2	Scapula - 1 x 2	(is formed by 2 hip bones and each hip bone is formed by fusion of 3 hip bones ilium, ischium and pubis)
Radius - 1 x 2	Patella - 1 x 2	Clavicle - 1 x 2	
Ulna - 1 x 2	Tibia - 1 x 2		
Carpals - 8 x 2	Fibula - 1 x 2		
Metacarpals - 5 x 2	Tarsals - 7 x 2		
Phalanges - 14 x 2	Metatarsals - 5 x 2		
	Phalanges - 14 x 2		

AXIAL SKELETON – 80 BONES				
SKULL SKELETON – 29		STERNUM - 01	RIBS - 24	VERTEBRAL COLUMN - 26
SKULL BONES - 22			True – 14	Cervical – 7
Cranial - 8	Facial - 14		False - 10	Thoracic – 12
Frontal - 1	Maxilla - 2			Lumbar – 5
Parietal - 2	Palatine - 2			Sacral – 5
Temporal - 2	Zygomatic - 2			Coccygeal – 4
Occipital - 1	Nasal - 2			
Ethmoid - 1	Lacrymal - 2			
Sphenoid - 1	Inferior Turbinals - 2			
	Mandible - 1			
	Vomer - 1			
ASSOCIATED SKULL BONES - 07				
Hyoid Bone – 1		Ear ossicles - 2x3 (Malleus. Incus. Stapes)		

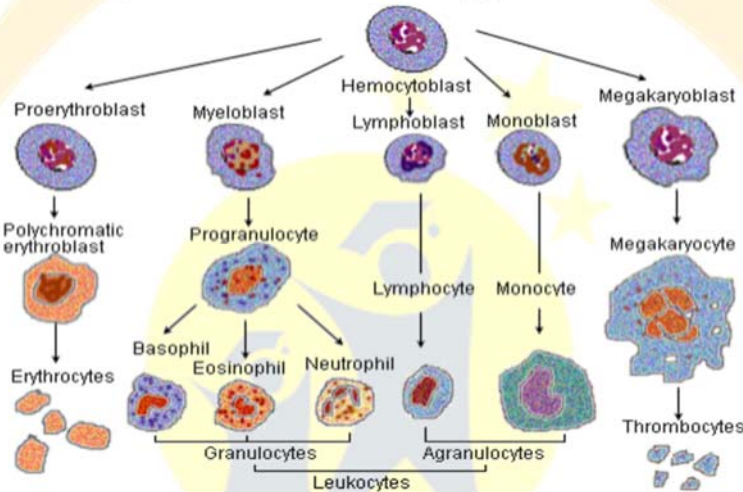
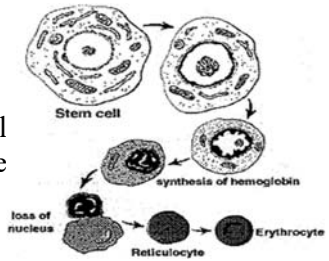
Functions of Osseous System

- 1. Support:** The skeleton provides the framework which supports the body and maintains its shape.
- 2. Movement:** Muscles, bones, and joints provide the principal mechanics for movement.
- 3. Protection:** The skeleton helps to protect our many vital internal organs from being damaged.
- 4. Blood cell production:** The skeleton is the site of haematopoiesis, the development of blood cells that takes place in the bone marrow.
- 5. Storage of minerals:** The bone matrix can store calcium and is involved in calcium metabolism. Bone marrow can store iron in ferritin and is involved in iron metabolism.
- 6. Endocrine regulation:** Bone cells release a hormone called osteocalcin, which contributes to the regulation of blood sugar (glucose) and fat deposition.



Stages of Development of RBCs

- **Proerythroblast**- It is the earliest stage in the maturation of RBCs. The unipotential cell becomes what is known as a proerythroblast. The cell is large with prominent nucleus. At this stage it does not have haemoglobin.
 - **Normoblast**- It is the second stage. At this stage cell is smaller in size with degenerated nucleus. Haemoglobin is fully present.
 - **Reticulocyte**- In the reticulocyte stage the red blood cell has no nucleus but hemoglobin is present.
 - **Erythrocyte**- In this stage the RBC is fully developed which has no nucleus and no reticulum.
- Note: - Vitamin B12 and folic acid both are necessary for the development of RBCs.*



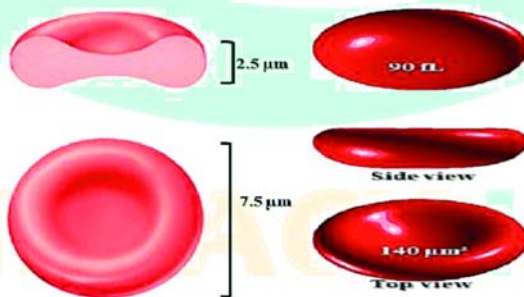
Characteristics and Function of RBCs

1. Red Blood Cells

- Red blood cells (RBCs) are the non-nucleated formed elements in the blood.
- Red blood cells are also known as erythrocytes.

Characteristics

- Red color of the red blood cell is due to the presence of the coloring pigment called hemoglobin.
- RBC count ranges between 4 and 5.5 million/cu mm of blood.
- In adult males, it is 5 million/cu mm and in adult females, it is 4.5 million/cu mm.
- Average lifespan of RBC is about 120 days. After the lifetime the senile (old) RBCs are destroyed in reticuloendothelial system.
- Spleen is called 'Graveyard of RBCs'.



Functions of RBCs

1. Transport of Oxygen from the Lungs to the Tissues

- Hemoglobin in RBC combines with oxygen to form oxyhemoglobin.
- About 97% of oxygen is transported in blood in the form of oxyhemoglobin.

Stages of Blood Clotting

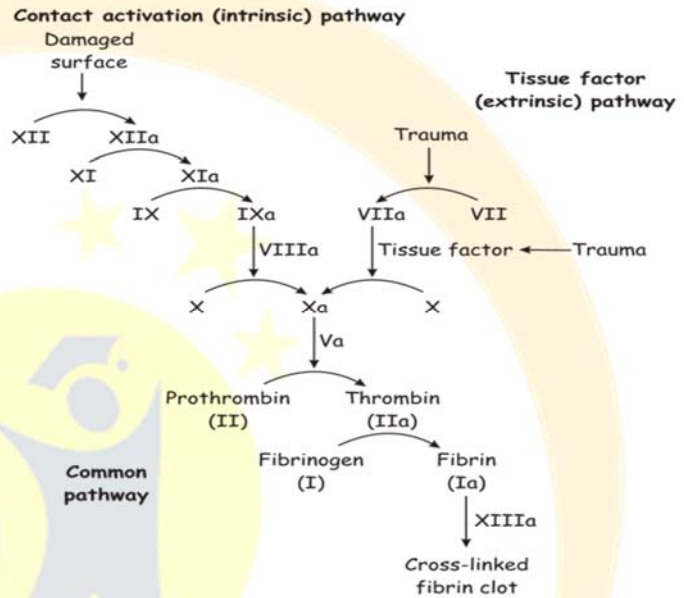
Stage1: formation of Prothrombin Activator

- Blood clotting commences with the formation of a substance called prothrombin activator, which converts prothrombin into thrombin.
- Its formation is initiated by substances produced either within the blood or outside the blood.
- Thus, formation of prothrombin activator occurs through two pathways:
 - i. Intrinsic pathway
 - ii. Extrinsic pathway

i. **Intrinsic System:** This is initiated by liquid blood making contact with a foreign surface, i.e., something that is not part of the body.

ii. **Extrinsic System:** This is initiated by liquid blood making contact with damage tissue.

- Both the intrinsic and the extrinsic systems involve interactions between coagulation factors.
- These coagulation factors have individual names but are often referred to by a standardized set of Roman Numerals, e.g. Factor VIII (anti-hemophilic factor), Factor IX (Christmas factor).



Clotting factors	
Factors	Name of clotting factor
Factor I	Fibrinogen
Factor II	Prothrombin
Factor III	Tissue Thromboplastin
Factor IV	Ca ⁺ ion
Factor V	Labile factor
Factor VII	Stable factor
Factor VIII	Antihemophilic Factor
Factor IX	Plasma thromboplastin component (PTC)
Factor X	Stuart-Power factor
Factor XI	Plasma Thromboplastin antecedent (PTA)
Factor XII	Hageman factor
Factor XIII	Fibrin stabilizing factor (Fibrinase)

Stage2: conversion of Prothrombin into Thrombin

- Blood clotting is all about thrombin formation.
- Once thrombin is formed, it definitely leads to clot formation.
- Prothrombinase (formed in stage 1) converts prothrombin, which is a plasma protein that is formed in the liver, into the enzyme thrombin.

Positive feedback effect of thrombin enzyme:

- They also take waste and carbon dioxide away from the tissues.
- Blood vessels are needed to sustain life, because all of the body's tissues rely on their functionality.
- They form a closed loop, like a circuit, that begins and ends at your heart.

Blood vessels are three types

1. Arteries
2. Veins
3. Capillaries

1. Arteries

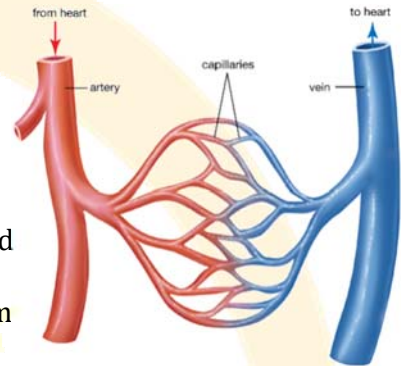
- Blood vessels that carry blood away from the heart are called arteries.
- They are the thickest blood vessels and they carry blood high in oxygen known as oxygenated blood (oxygen rich blood).

2. Veins

- Blood vessels that carry blood back to the heart are called veins.
- They have one-way valves which prevent blood from flowing backwards.
- They carry blood that is high in carbon dioxide known as deoxygenated blood (oxygen poor blood).

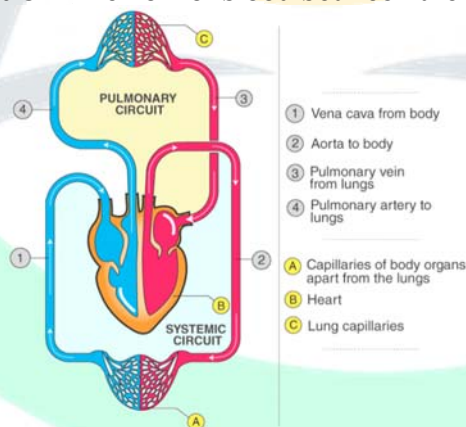
3. Capillaries

- The smallest blood vessels are capillaries and they connect the arteries and veins.
- This is where the exchange of nutrients and gases occurs.



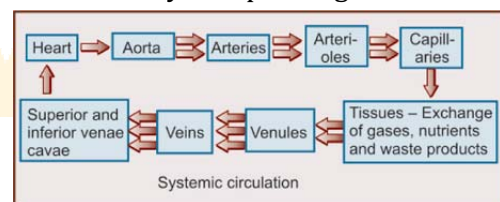
Types of Blood Circulations

- Coronary circulation:** The circulation of blood within the heart.
- Pulmonary circulation:** The flow of blood between the heart and lungs.
- Systemic circulation:** The flow of blood between the heart and the cells of the body.



1. Systemic Circulation

- It is the circulation involving blood supply to all parts of the body excepts lungs.
- It sends oxygenated blood out to cells and returns deoxygenated blood and waste products to the heart.
- This circulation starts from aorta.
- Systemic circulation carries oxygenated blood from the left ventricle, through the arteries, to the capillaries in the tissues of the body.



2. Pulmonary Circulation

- It is also called as primary or pressure wave.
- It is a positive wave and the first wave in ECG.
- The duration of the P wave should not exceed three small squares (0.12 s).
- It indicate the atrial depolarization.
- It spreads from SA node to all parts of atrial musculature.

2. QRS complex

- It is a also called the initial ventricular complex.
- Q wave is small negative wave.
- Its indicate the ventricular depolarization.
- Q wave is due to the depolarization of basal portion of interventricular septum.
- R wave is due to the depolarization of apical portion of interventricular septum and apical portion of ventricular muscle.
- S wave is due to the depolarization of basal portion of ventricular muscle near the atrioventricular ring.

3. T-wave

- It indicate the ventricular repolarization.
- T wave is final ventricular complex and is a positive wave.

4. P-R interval

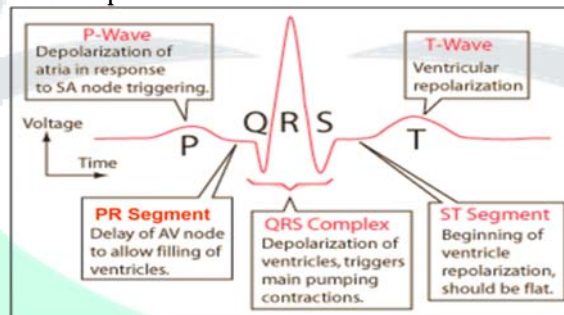
- It indicate the atrial depolarization.
- It is the interval between the onset of P wave and the onset of Q wave.
- P-R interval conduction of impulses through AV node.

5. Q-T interval

- It is the interval between the onset of Q wave and the end of T wave.
- Indicate the ventricular depolarization and ventricular repolarization.

6. S-T segments

- The time interval between the end of S wave and the onset of T wave is called S-T segment.
- It indicate the isoelectric period.



Blood Pressure

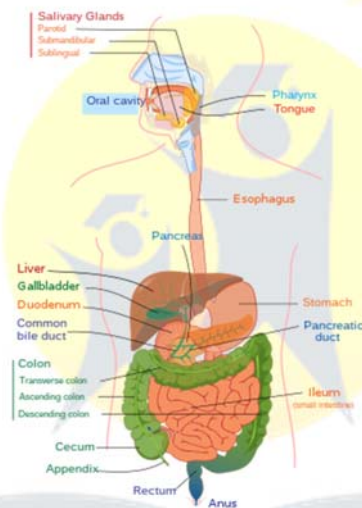
- Blood pressure is the lateral pressure exerted by blood-on-blood vessels.
- The blood pressure which is normally expressed is arterial blood pressure.
- Blood pressure is measured by sphygmomanometer.
- BLOOD PRESSURE = Cardiac output X PR (Peripheral resistance)
- **It has two phases**
 1. **Systolic blood pressure:** It is the maximum blood pressure. This occurs during the systole of the heart. (range 100 to 120 mm Hg.)
 2. **Diastolic blood pressure:** It is the minimum pressure. It occurs during the diastole of the heart (range 60 to 80 mm Hg.) Pulse pressure is the difference between systolic and diastolic blood pressure (It is nearly 40mmHg.).

Regulation of Blood Pressure

- Anatomy and Physiology of the GIT
- Anatomy and functions of accessory glands
- Physiology of digestion and absorption

Anatomy and Physiology of GIT

- The digestive system consists of gastrointestinal tract (alimentary canal) and its glands.
- The functions of gastrointestinal tract are ingestion, digestion and absorption of food and excretion of waste products.

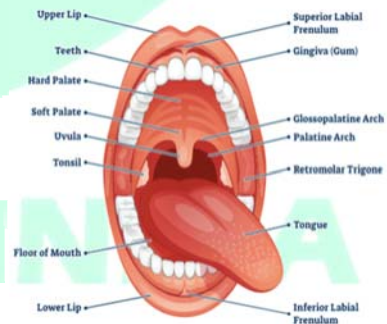


Parts of Digestive System

1. Mouth	2. Pharynx
3. Esophagus	4. Stomach
5. Small intestine	6. Large intestine
7. Rectum	8. Anus

Mouth (Buccal Cavity)

- It is the upper expanded portion which forms the beginning of alimentary canal. It can be divided into two parts –
 1. Vestibule, an outer part. It lies between lips and inner lining of cheeks externally and gums and teeth internally.
 2. Cavity of mouth, an inner part. It is bounded by teeth and mastoid bone at the sides, palate above and tongue below.
- The important structures of mouth are
 1. Tongue
 2. Teeth
 3. Salivary glands



1. Tongue

- It lies in the floor of the mouth and it is attached to hyoid bone.

2. Teeth

- Teeth are concerned with mastication. Depending on the age at which they arise, teeth can be classified into two types-

Nervous System

- Classification of nervous system
- Anatomy and physiology of cerebrum, cerebellum, mid brain
- Function of hypothalamus, medulla oblongata and basal ganglia
- Spinal cord-structure and reflexes
- Names and functions of cranial nerves.
- Anatomy and physiology of sympathetic and parasympathetic nervous system (ANS)

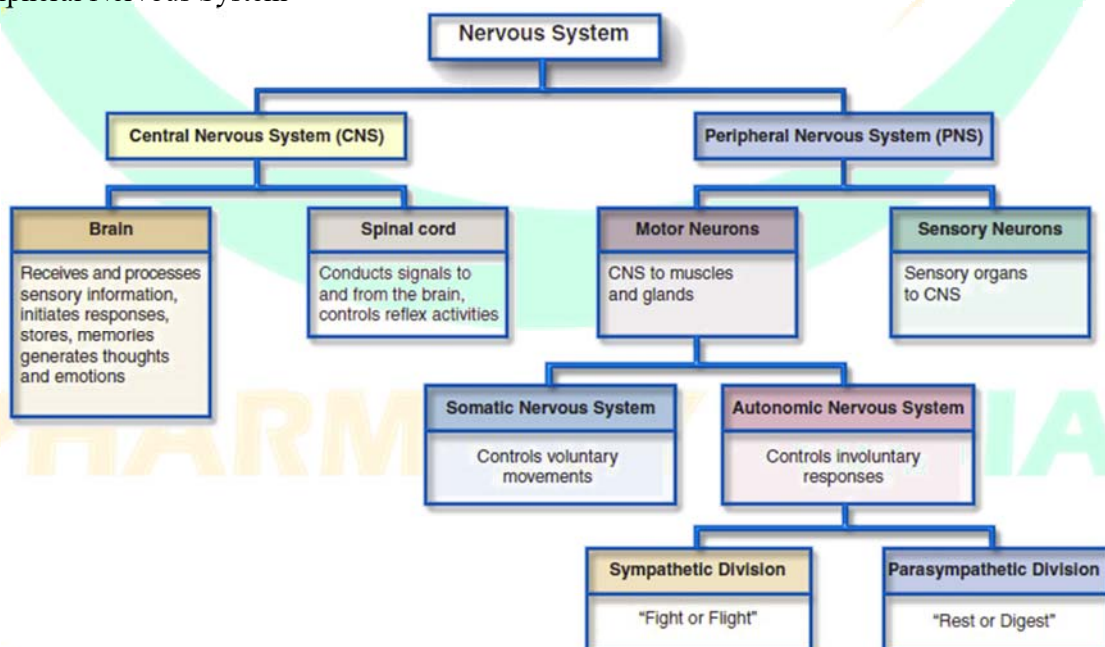
Nervous System

- The nervous system is the major controlling, regulatory, and communicating system in the body.
- It is the center of all mental activity including thought, learning, and memory.
- The nervous system is responsible for regulating and maintaining homeostasis.
- The central nervous system consist of brain present in the cranial cavity and the spinal cord present in the vertebral column.
- The spinal cord has 32 segments and the brain consists of the brain stem, diencephalon, cerebellum, and cerebrum.
- The nervous system is the major controlling, regulatory, and *communicating* system in the body.
- The nervous system is responsible for regulating and maintaining homeostasis.



Classification of Nervous System

- Central Nervous System
- Peripheral Nervous System



Urinary System

- Anatomy and physiology of urinary system.
- Physiology of urine formation.
- Renin - angiotensin system.
- Clearance tests and micturition

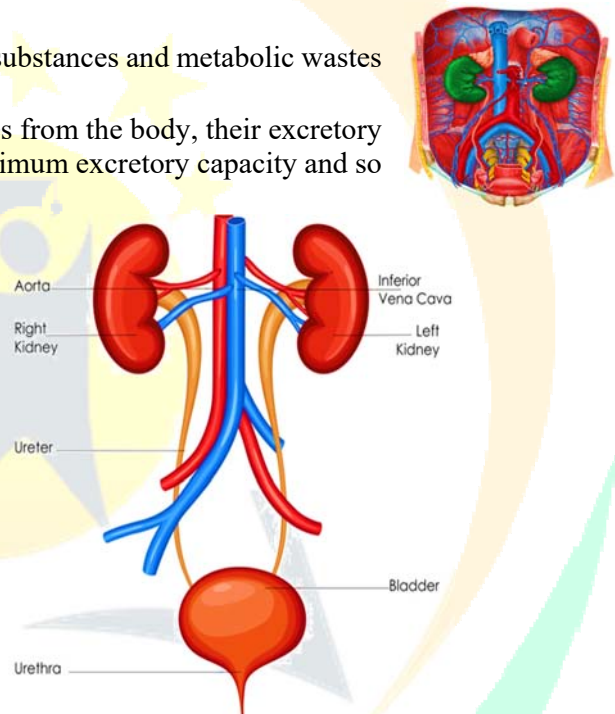
Introduction

- Excretion is the process by which the unwanted substances and metabolic wastes are eliminated from the body.
- Various organs are involved in removal of wastes from the body, their excretory capacity is limited. But, Urinary system has maximum excretory capacity and so it plays a major role in homeostasis.

Anatomy of Urinary System

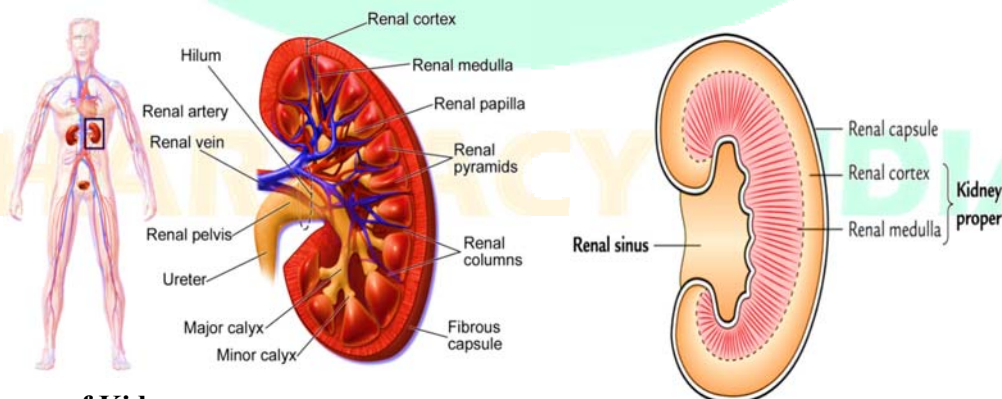
➤ Urinary system includes:

1. A pair of kidneys
2. Ureters
3. Urinary bladder
4. Urethra



1. KIDNEY

- They are the two bean shaped organ lying on the posterior abdominal wall on each side of the vertebral column.
- Kidney is a compound tubular gland covered by a Connective tissue capsule.
- There is a depression on the medial border of kidney called hilum, through which renal artery, renal veins, nerves and ureter pass



Different layers of Kidney

Steps in Pregnancy

➤ Fertilization of the ovum

- It refers to fusion of male and female gametes (sperm and ovum) to form a new offspring.
- Fertilization takes place in the fallopian tubes, Fertilization happens when a sperm cell successfully meets an egg cell in the fallopian tube. Once fertilization takes place, this newly fertilized cell is called a Zygote.

➤ Implantation

- Implantation is the process by which the fertilized ovum called zygote implants (gets attached) in the endometrial lining of uterus.
- Zygote takes 3 to 5 days to reach the uterine cavity from fallopian tube.

➤ Development of Placenta and Embryo

- After implantation, placenta develops between morula and endometrium
- When implantation occurs, there is further increase in the thickness of endometrium because of continuous secretion of progesterone from corpus luteum.
- An embryo is the early stage of development of a multicellular organism

➤ Gestation period

- It refers to the pregnancy period and measured in weeks
- A normal pregnancy can range from 38 to 42 weeks.
- Infants born before 37 weeks are considered premature.

Parturition

- Parturition is the expulsion or delivery of the fetus from the mother's body
- It occurs at the end of pregnancy
- The process by which the delivery of fetus occurs is called labor. It involves various activities such as contraction of uterus, dilatation of cervix and opening of vaginal canal.
- **Stages of parturition:** Three stages

➤ First Stage

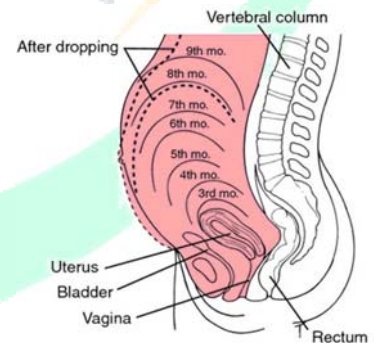
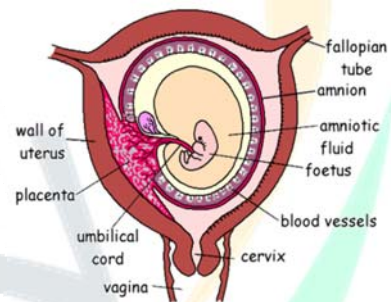
- ✓ The strong uterine contractions called labor contractions begins.
- ✓ Labor contractions arise from fundus of uterus and move downwards which results in dilatation of cervix and opening of vaginal canal.
- ✓ This stage extends for a variable period of time.

➤ Second stage

- ✓ In this stage, the fetus is delivered out from uterus through cervix and vaginal canal.
- ✓ This stage lasts for about 1 hour.

➤ Third stage

- ✓ During this stage, the placenta is detached from the decidua and is expelled out from uterus



It occurs within 10 to 15 minutes after the delivery of the child.