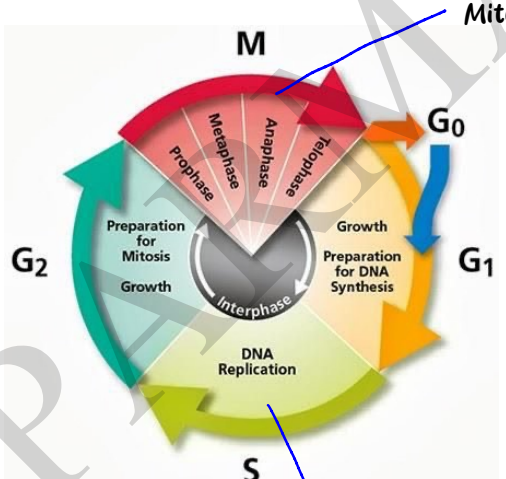
LECTURE - 2 (TISSUES)

- Outermost layer found in cell envelope of bacteria: Glycocalyx
- Bacterial cell wall: Peptidoglycan
- Plasmid DNA function: to confer certain unique phenotypic characters to bacteria
- Role of ribosomes of a polysome is to translate mRNA into proteins
- Peroxisomes: oxidative crystals
- Cell that is amoeboid in shape: White blood cell (has irregular shape)
- Transcription: the process of the flow of genetic information from DNA to RNA
- Nucleus was discovered by Robert Brown

Cell Cycle



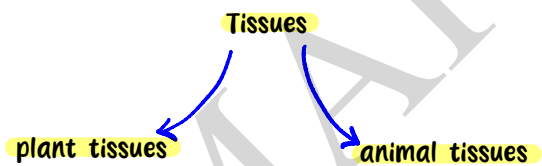
- Major microtubule-organizing centre (MTOC) in eukaryotic cells involved in various cellular process, including sensory reception, locomotion, and embryogenesis: Centrosome

- Cell theory that proved the quasi-fluid nature of lipids to enable lateral movement of proteins within the bilayer: Fluid Mosaic Model

- Protein that protects epithelial cells from damage: Keratin

Tissues

- group of cells that have similar structure combined together to perform a specific function forms a tissue



Importance

- Causes division of labour in multicellular organisms
- Decreases workload on individual cells
- Leads to organisation

Basic Unit of Life → Cell

Group of cells → Tissue

Group of tissues → Organs

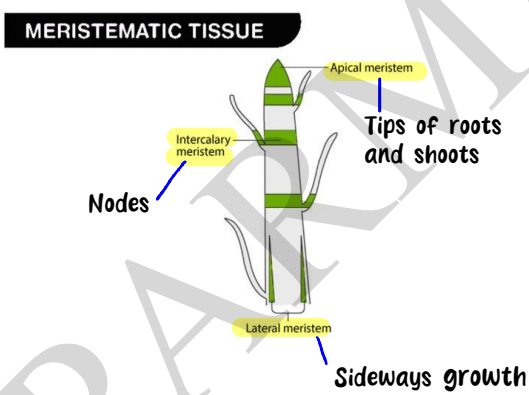
Group of organs → Organ System

Group of Organs → Organism
System

Plant tissue

Meristematic tissue

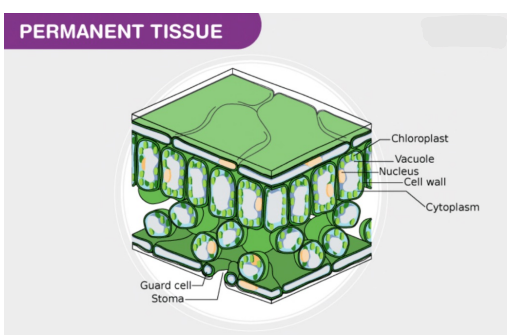
- occurrence: growing regions of plants (root, shoot, etc)
- shape: spherical, oval or rectangular
- Intercellular spaces: absent
- Vacuoles: absent
- Active cells
- Cytoplasm: dense
- Cell wall: cellulose
- Nuclei: prominent
- Cell division



Height growth: Apical and intercalate
Width growth: Lateral

Permanent tissue

- when cell lose the ability to divide, by the process of differentiation, the take a permanent shape, size and function
- Structure: large central vacuoles Cell wall in thin/thick
- Function:
  - protection
  - Support
  - Storage
  - Photosynthesis



Types of Permanent Tissue

- Simple Tissue
- Complex Tissue

Lateral

- Present beneath the bark
- Increase girth of root or stem

Intercalary

- Present at the base of leaves/internodes
- Increase length of leaves and internodes

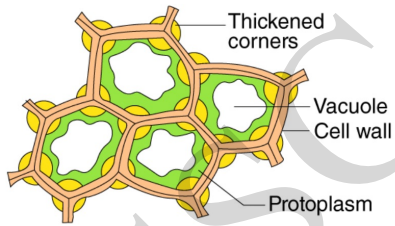
Apical

- Present at shoot and root apex
- Increase in length of root and stem

Simple Tissue

→ Types — mechanical tissue

a) Collenchyma Tissue



Occurrence: in leaf stalks and stem of dicots

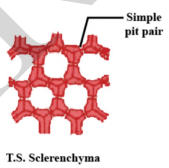
Cell Structure
- Living
- Elongated
- Irregularly thickened at corners
- Very little intercellular space

Functions
- Provides mechanical strength and flexibility
- Allows bending of parts

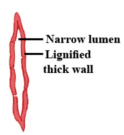
ex: tendrils and stems of climbers

b) Parenchyma Tissue

Aerenchyma
Chlorenchyma



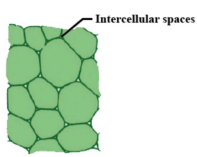
T.S. Sclerenchyma



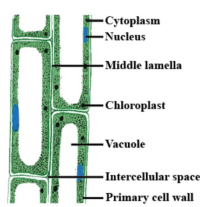
L.S. Sclerenchyma

Functions
- Food storage tissue
- In some cases contains chlorophyll, called Chlorenchyma
- When loosely packed, intercellular airy spaces are present called Aerenchyma

→ Provides buoyancy to parts, helps them float

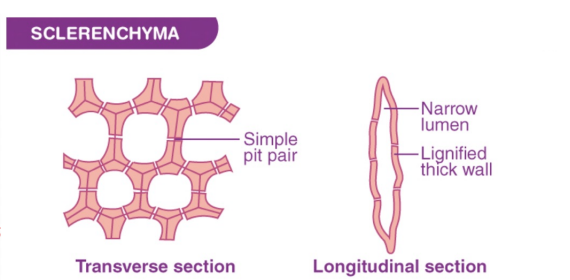


T.S. Parenchyma



L.S. Parenchyma

c) Sclerenchyma Tissue → Dead cells



- Provides toughness to the tissue

Occurrence: Outer parts

eg: bark, husk of coconut, veins of leaves

- Walls are thick → Lignin

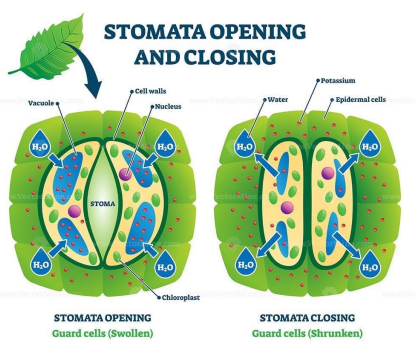
Protective Tissue (part of simple tissues)

Types:
- Epidermis
- Cork

a) Epidermis → Cuticle

- Occurrence: Outermost layer of plant parts
  eg: leaves, flowers, stem and roots

Functions:
- Protects all parts of plants
- Prevents water loss
- Plants of dry habitats have thicker epidermis (cactus plant)
- Epidermal cells on the aerial parts of plant secrete waxy secretions which prevents from:
  - Water loss
  - Injury
  - Fungi infection



- Plants growing in desert have cuticle
- Layer of cutin is called cuticle
- Cutin is waxy materials and water resistant
- Cuticle aids in protection against water loss, injury and invasion of fungi
- Epidermal cells of the roots form hair like structures
- Long hair like parts increase absorption surface area of roots
- In leaves, epidermal cells form stomata
- Stomata are guarded by guard cells which are kidney shaped and regulate gaseous exchange

b) Cork

- External protective tissue
- Dead
- Compactly arranged cells
- Intercellular spaces absent
- Walls have suberin

- Occurrence: in mature roots and shoots

- Guttation: the process of planting axis liquid from its leaves or blades
- Hydathode: a plant organ responsible for gat vascular plants
- The process happens at night

Functions:

- Protection to mature roots and shoots
- Suberin regulate gaseous exchange and water passage

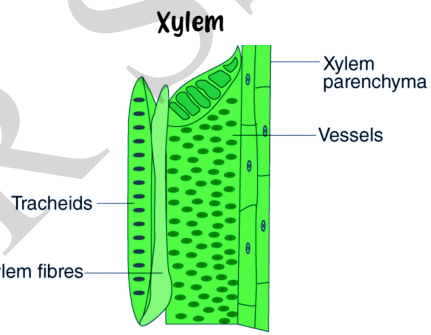
Complex Permanent Tissue

- Made up of more than one type of cells

Function
- Transport water, minerals and food materials

Types
- Xylem
- Phloem

vascular tissues



Xylem

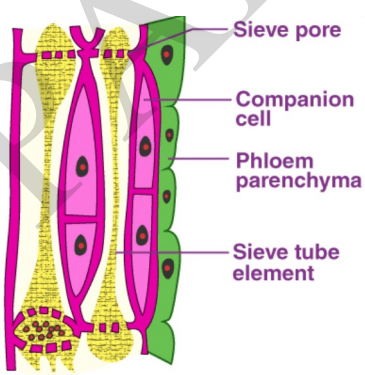
- Conducting tissue (one-way conduction)
- Conducts water and minerals from roots to shoots

Xylem Types:

Living
- Xylem parenchyma: food storage
- Tracheids
- Vessels
- Xylem fibres/sclerenchyma — dead

Phloem

- Conducts food (two-way conduction)



Phloem Tissue

Phloem Types:

- Sieve tubes
- Companion cells
- Phloem parenchyma: food storage
- Phloem fibers: rigidity and support → or Phloem Sclerenchyma

- Animal Tissue
  - Epithelial
    - Squamous
    - Cuboidal
    - Columnar
    - Ciliated
  - Muscular
    - Striated
    - Smooth
    - Cardiac
  - Connective
    - Areolar
    - Adipose
    - Skeletal
    - Fluid
  - Nervous

a) Epithelial → Tightly packed

Characteristics
- Covering/protective tissues of animal body; cells form continous sheet

Function
- Protection to body from injury, infection and damage
- Absorption of water and nutrients
- Forms lining of mouth and alimentary canal
- Eliminates waste

Types

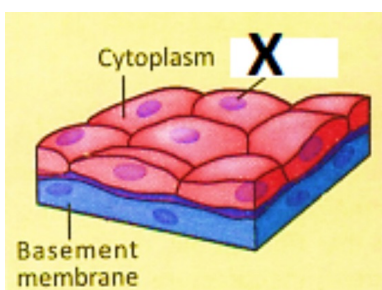
i) Squamous Epithelial Tissue

Types
- Cells are extremely thin
- Cells are flat
- Irregularly shaped

a) Simple Squamous Tissue
- Single layer of cells
- Forms delicate lining

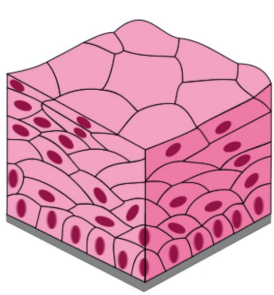
eg: mouth and oesophagus

food pipe

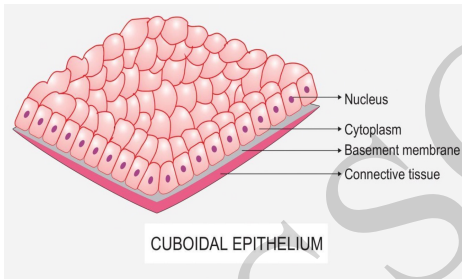


b) Stratified Squamous Tissue
- Cells are arranged in layers
- Prevent wear and tear

eg: Skin



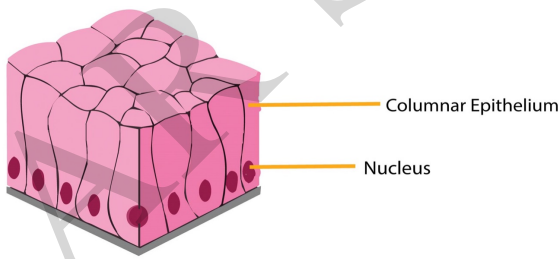
ii) Cuboidal Epithelial Tissue



Structure
- Cube like
- Tall = wide

Occurrence
- Sweat glands
- Salivary glands
- Thyroid glands
- Lining of Kidney tubules

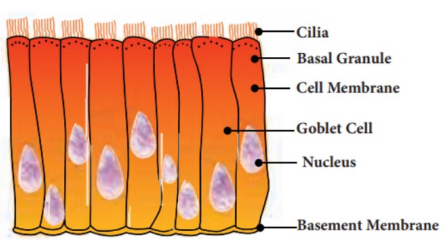
iii) Columnar Epithelial Tissue



Structure
- Pillar like cells
- Tall > Wide

Occurrence
- Lining of intestine
- Lining of stomach, gallbladder

iv) Ciliated Epithelial Tissue



Structure
- Cuboidal/Columnar cells
- Cells have hair like projections on free surface called "cilia", which facilitates movement

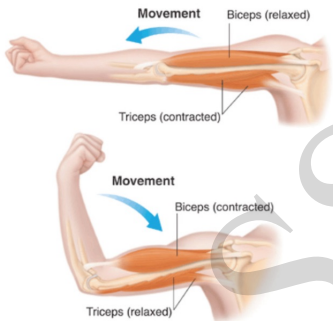
Occurrence
- Respiratory tract
- Urinary tubules or kidney

Function
- Movement of mucus, urine, egg etc through rhythmic beating of cilia

b) Muscular Tissue/ Muscle Tissue

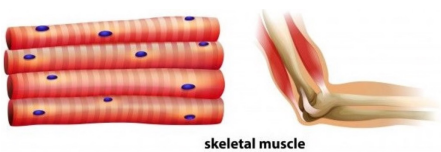
Function

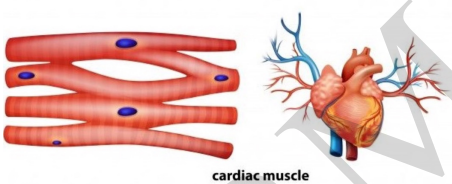
- Movement of body
  - Contractile protein
- Are elongated and large sized
- Contraction and relaxation

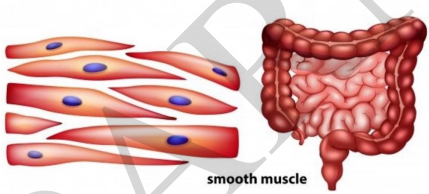


Types

- Cardiac muscle
- Skeletal muscle
- Smooth muscle


skeletal muscle


cardiac muscle


smooth muscle

a) Skeletal Muscle

- Muscle fibres are elongated and cylindrical
- Fast in nature
- Unbranched
- Each cell is multinucleated (many nuclei)
- Striations are present (alternate dark and light bands
- Easily fatigue

Occurrence

- Biceps, bone

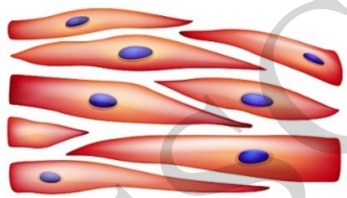
Other names

- Attached to skeletal: Skeleton Muscles
- Striations are present: Striated Muscles
- Are under our control: Voluntary muscles

b) Smooth/Visceral Muscles

Uninucleated

- Nucleus located at the centre of each cell
- Striations are absent
- Unbranched
- Slow
- Do not fatigue



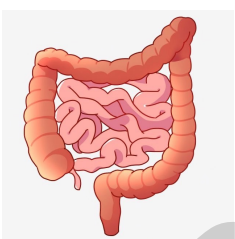
BlueRingMedia/Shutterstock.com

soft interior organs: lung, liver, abdomen, intestines

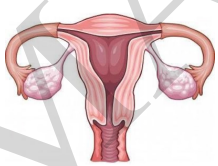
Other names

- Found in visceral organs: Visceral Muscles
- Striations are absent: Unstriated muscles
- Not under our control: Involuntary Muscles

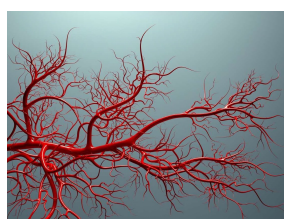
Organs like; that have visceral muscles



Intestine

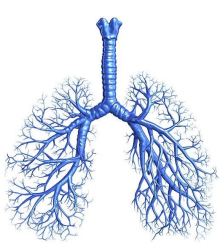


Uterus



Blood vessels

Stomach

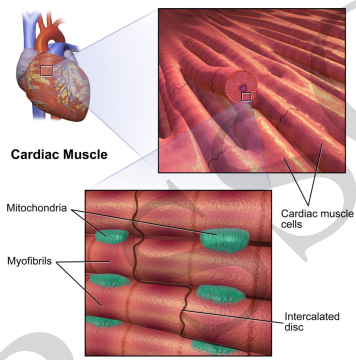


Bronchi

Iris

c) Cardiac Muscles

- Fibres are cylindrical in shape
- Each fibre is uninucleated
- Fibres are branched
- Striations are present
- Do not fatigue



Other names

- Cardiac muscle: only present in heart
- Striated: Striations are present
- Not under our control: Involuntary muscles

Function

- Perform contraction and relaxation in wall of heart
- Help to pump and distribute blood to body

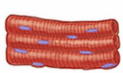
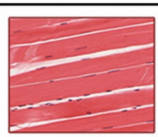
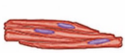
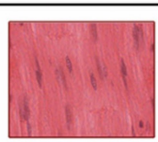
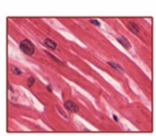
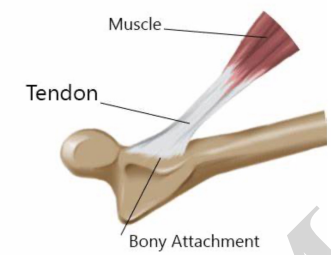
	Main features	Location	Type of cells	Histology
Skeletal muscle	- Fibers : striated, tubular and multi nucleated - Voluntary - Usually attached to skeleton			
Smooth muscle	- Fibers : non-striated, spindle-shaped, and uninucleated. - Involuntary - Usually covering wall of internal organs.			
Cardiac muscle	- Fibers : striated, branched and uninucleated. - Involuntary - Only covering walls of the heart.			

Figure 1. Key features of skeletal, smooth and cardiac muscle.

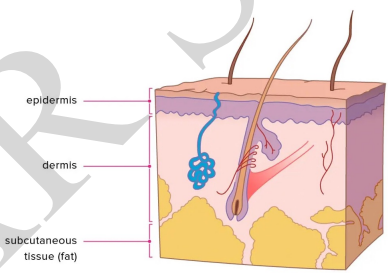
c) Connective Tissue

- Connects various body parts
- Cells are embedded in an intracellular matrix
- Matrix may be jelly, fluid, dense or rigid

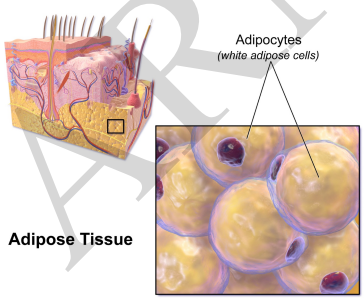
Cartilage Blood Bone



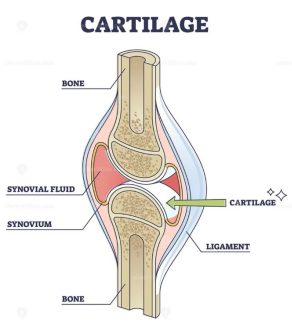
Tendons



Dermis



Adipose



Cartilage

Types of Connective tissue

a) Areolar Connective Tissue

i) Loose Connective Tissue
ii) Dense Connective Tissue
- Ligaments
- Tendons

b) Adipose Connective Tissue

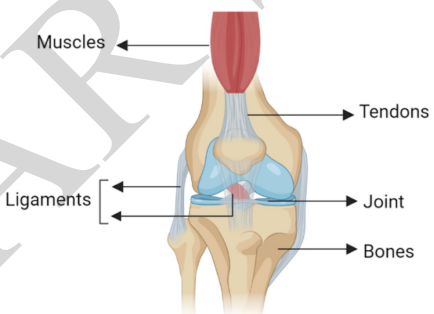
Structure
- Cells + loose gel like matrix

Occurrence
- Between skin and muscles
- Around blood vessels and nerves
- In bone marrow
- In space inside organs

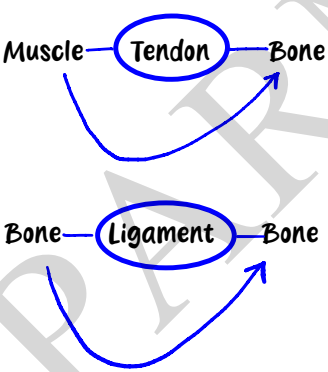
Functions
- Connects skin + muscles
- Fills the space inside the organs
- Supports internal organs
- Helps in repair of tissues

ii) Dense Connective Tissue

a) Tendons
- Fibrous tissue
- Great strength
- Limited flexibility
- Connects muscles to bones



Tendons and Ligaments



b) Ligaments
- Considerable strength
- Little matrix is present
- Connects bones to bones

b) Adipose Connective Tissue

Structure
- Aggregation of fat cells
- Cells are rounded/oval and contain large fat droplets

Occurrence
Below the skin
Betⁿ internal organs

fatty people have more adipose tissue

Function
- Prevents body from mechanical shocks
- Fat reservation
- Act as insulation
- Temperature regulation

c) Skeletal Connective Tissue

Types

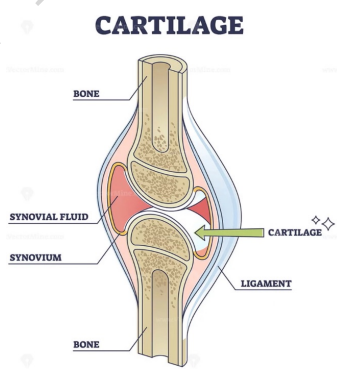
- Cartilage
- Bones
  - 300 bones: child
  - 206 bones: adult

Longest bone: Femur (Thighs)

Shortest bone: Stapes (Ear)

i) Cartilage

- Widely spaced out cells
- Matrix is gel-like
- Matrix is slightly elastic
- Cartilage is flexible



Occurrence
- Ear pinna, nose tip, trachea, larynx
- Smoothens bone surfaces at joints

Function
- Support and flexibility to body parts

ii) Bones

- Very strong
- Non flexible
- Hard and rigid
- Matrix is hard and composed of calcium and phosphorous compounds

Functions

- Forms a framework
- Supports the body
- Provides shape to body
- Protects vital body organs like brain, lungs, etc.

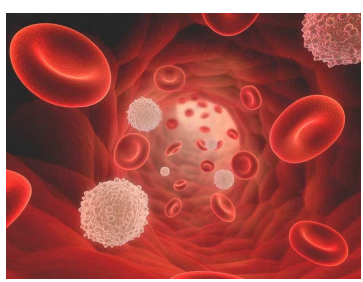
Layer: meningitis

22 bones in brain

- 8: cranial
- 14: facial

d) Fluid Connective Tissue

Connects different part of the body
Maintains a continuity



Types

- Blood
- Lymph

i) Blood

Blood

Function: transports gases, digested food, hormones, waste materials

- Liquid — 55%
  - Plasma: 92% water and 8% hormones, proteins, glucose, fats, vitamins
    - Yellow fluid
- Solid — 45%
  - RBC
  - WBC
  - Platelets

Solid

RBC

- red in colour due to presence of heme (Fe)
- Heme has high affinity towards oxygen
- Heme transports oxygen throughout the body to carry out respiration to produce energy
- Graveyard of RBC: Spleen
- Shape: Biconcave; disc-shaped
- Also known as erythrocytes

- Time period of RBC: 120 days
- End point: Spleen
- No of formation: 4.5–6.5M

WBC

- Also known as leukocytes
- Prevent from infection, provide our body a defence mechanism
- Is formed in bone marrow

Types

- Monocytes
- Lymphocytes → T cells and B cells
- Basophils
- Neutrophils → Granulocytes
- Eosinophils

- Shape: round/irregular

- Life span: 12 days
- No. of formation: 4000–10,000

Platelets

- Helps in blood clotting
- If suffering from dengue, it reduces
- Also known as thrombocytes

- No. of formation: 150–400K
- Life span: 7–10 days

Order in number:

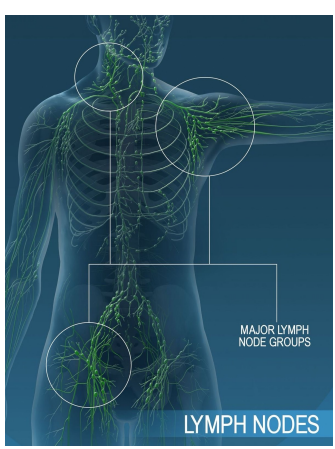
RBC > Platelets > WBCs

- study of blood: hematology

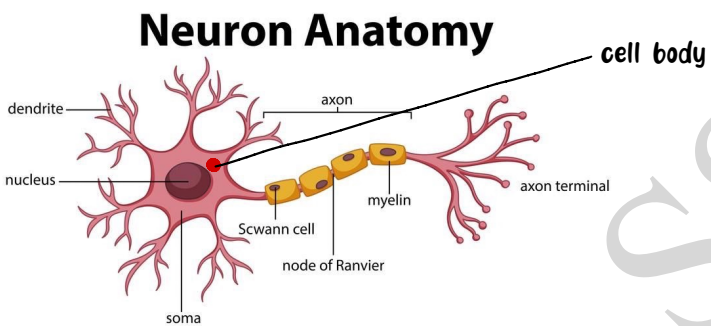
ii) Lymph

Structure

- Colourless fluid
- RBCs and Blood proteins are absent



d) Nervous Tissue



- Found in brain, spinal cord, nerves
- Fundamental unit of nervous system: Neuron

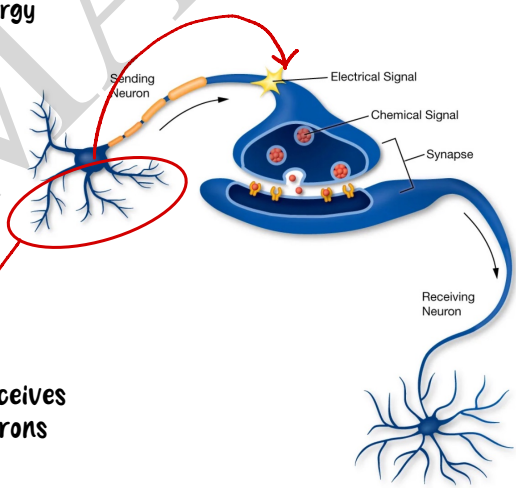
- fundamental unit of kidney: Nephron
- Study of kidney: Nephrology

Function

Sense stimuli:

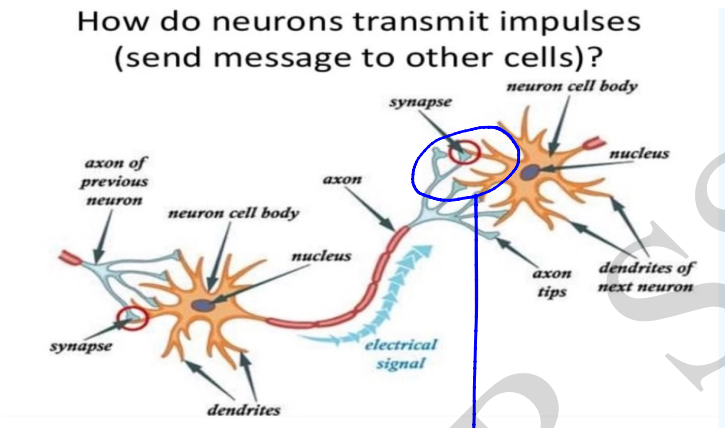
- Touch
- Smell
- Taste
- Hearing
- Sight

Converts Chemical Energy to Electrical Energy



Hair like structures receives signals from other neurons

- Glial cells: far more numerous than neurons and unlike neurons, they are capable of mitosis



- one neuron's dendrite transmit information to other neuron's cell body
- The gap betⁿ these two is called synapse

- Camel hump is made of: Adipose tissue