Structural Organisation in Animals: Animal Tissues

1 TISSUE

- A group of similar cells along with intercellular substances which perform a specific function.
- **Organs** such as stomach, lungs, heart and kidney comprise specific proportion and pattern of **all basic types of tissues**.
- **Division of labour** contributes to survival of multicellular organisms e.g., *Hydra*.

2 TYPES OF TISSUES

Based on
- Structure of cells
- Function performed by cells

→ Epithelial tissue
→ Connective tissue
→ Muscular tissue
→ Neural tissue

4 CELL JUNCTIONS

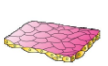
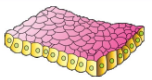
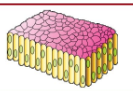
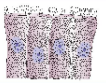
Tight junctions
- **Prevent leakage** across a tissue

Adhering junctions
- Perform **cementing** to keep neighbouring cells together

Gap junctions
- Facilitate the cells to **communicate** with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

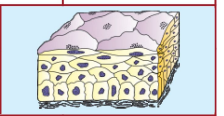
3 EPITHELIAL TISSUE

Simple epithelium (single-layered)

Characteristics	Squamous	Cuboidal	Columnar	Ciliated	Glandular
Figure					
Cells	Flattened, irregular boundaries	Cube-like	Tall and slender	Cuboidal or columnar	Cuboidal or columnar
Nucleus	Central	Central	At base	Central or at base	Central or at base
Function	Diffusion boundary	Secretion and absorption	Secretion and absorption	Move particles or mucus in a specific direction	Specialised for secretion
Location	Air sacs of lungs, walls of blood vessels	Tubular parts of nephron (PCT), ducts of glands	Stomach and intestine	Bronchioles and fallopian tubes	Salivary glands

Compound epithelium (multi-layered)

Layers	2 or more cell layers
Function	○ Protection against mechanical and chemical stresses ○ Limited role in secretion and absorption
Location	Dry surface of skin, buccal cavity, pharynx, inner lining of ducts of salivary glands and pancreas

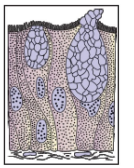


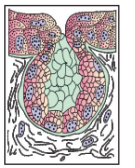
- **Microvilli** present in PCT and small intestine increase surface area for absorption.
- Epithelial tissue provides a covering or a lining for some part of the body.
- Free surface of this tissue faces body fluid or outside environment.
- Its cells are compactly packed with little intercellular matrix.

Types of glands:

I. Based on the number of cells

- **Number of cells**: Single → Unicellular; Many → Multi-cellular
- **Example**: Goblet cells (Secrete mucus); Salivary glands (Secrete saliva)





II. Based on the mode of pouring their secretions

	Exocrine glands	Endocrine glands
Ducts	Present	Absent
Secretions	Mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products	Hormones

- Endocrine glands directly release their secretions into the fluid bathing the gland

5 CONNECTIVE TISSUE

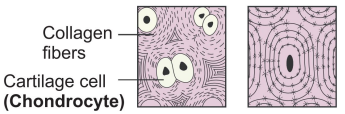
- Most abundant and widely distributed tissue
- Links and supports other tissues and organs
- **Components of Connective tissue:**
  - **Matrix/ground substance :** Modified polysaccharides **or Intercellular material**
  - **Cells:** Fibroblasts, macrophages, adipocytes etc.
  - **Fibres:** Fibroblasts secrete collagen or elastin fibres

Fibres provide strength, elasticity and flexibility to the tissue

III. SPECIALISED CONNECTIVE TISSUE

1. Skeletal Connective Tissues

	Cartilage	Bones
Matrix	Solid, pliable	Hard and non-pliable
Cells in lacuna	Chondrocytes	Osteocytes
Location/ Functions	Tip of nose, outer ear joints, between vertebrae, limbs and hands in adults Most of the cartilages in vertebrate embryos are replaced by bones in adults	Constitutes main structural framework; Interact with skeletal muscles to bring movements; **Bone marrow** in some bones is the site of production of blood cells.



2. Fluid Connective Tissue

- Blood – main circulating fluid that helps in the transport of various substances
- Composed of plasma, RBC, WBC, platelets
- Fibroblasts and fibres are absent in blood.

- Cartilage resists compression.
- Calcium salts and collagen fibres in ground substance provide strength to the bones.
- Lacunae are small cavities enclosing cells with in matrix secreted by them.

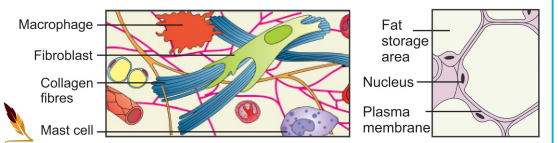
6 THREE TYPES OF CONNECTIVE TISSUE

I. LOOSE CONNECTIVE TISSUE

- Cells and fibres are loosely packed in semi solid matrix

Types

	Areolar tissue	Adipose tissue
Major cells	Fibroblasts, macrophages, mast cells	Adipocytes
Function(s)	Serve as support framework for epithelium	Reservoir of stored fats
Location	Beneath skin	Mainly beneath skin



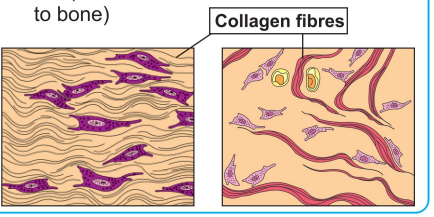
- Excess of nutrients not meant for immediate use are converted to fats and are stored in adipose tissue

II. DENSE CONNECTIVE TISSUE

- Fibroblasts and fibres are compactly packed in matrix

Types

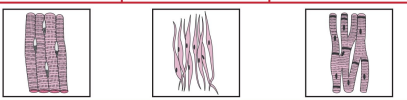
	Dense regular	Dense irregular
Cells and fibres	Parallel bundles of collagen fibres	Fibroblasts and fibres are oriented differently
Location	**Tendons** (attach skeletal muscles to bone) **Ligaments** (attach bone to bone)	Skin
Arrangement of fibres and cells		



7 MUSCULAR TISSUE

- $(\text{Myofibrils})_n \rightarrow (\text{Muscle fibres})_n \rightarrow$ Muscle
- Show **contractility** and return to their uncontracted state in a coordinated fashion
- Play an active role in all movements

Parameters	Skeletal muscle fibres	Smooth/Visceral muscle fibres	Cardiac muscle fibres
Shape	Cylindrical	Spindle/fusiform	Cylindrical
No. of nuclei	Multi-nucleated	Uninucleated	Uninucleated
Location of nuclei	Peripheral nuclei	Central	Central
Striations	Striated	Non striated	Faint striations
Branching	Unbranched	Unbranched	Branched
Under control of will	Yes (Voluntary)	No (Involuntary)	No (Involuntary)
Junctions	Absent	Present	Present
Location	Attached to bones *e.g.* Biceps	Blood vessels, stomach, intestine	Heart wall



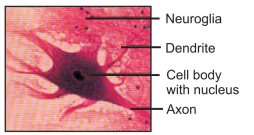
- **Communication junctions (intercalated discs)** at some fusion points allow the cells of cardiac muscles to contract as a unit.

8 NEURAL TISSUE

- Tissue with greatest control over the body's responsiveness to changing conditions.

Tissue Components

	Neurons	Neuroglial cells
	Unit of neural system	More than one half the volume of neural tissue
Excitability	✓	✗
Function	Respond to changing conditions through various stimuli	Protect and support neurons



- Upon suitable stimulation, the electrical disturbance generated travels swiftly along the plasma membrane of neuron.