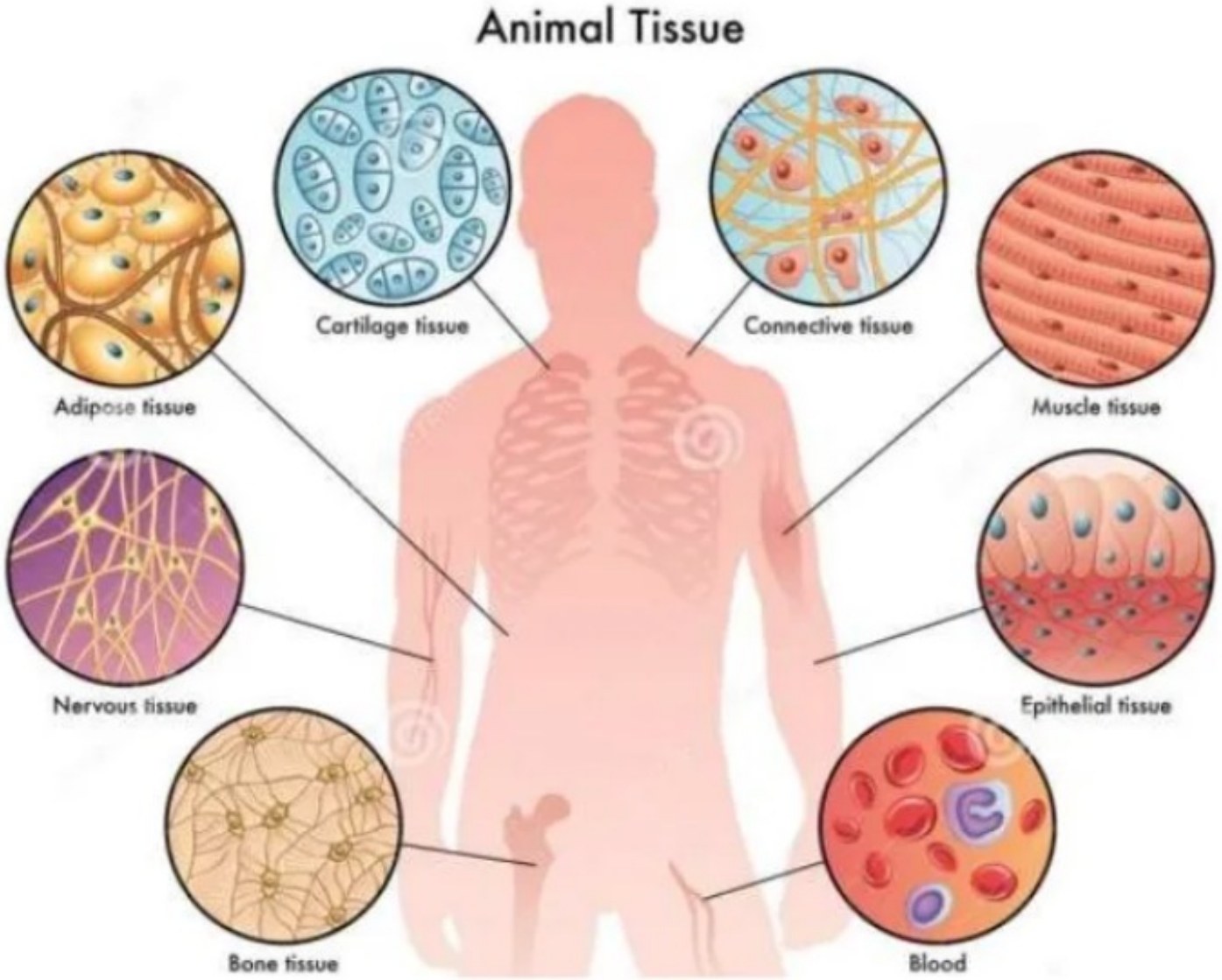
Lesson 2:
Anatomy & Physiology- Tissues

How many types of tissue make the human body?

8 tissues


Animal Tissue
Adipose tissue
Cartilage tissue
Connective tissue
Muscle tissue
Nervous tissue
Epithelial tissue
Bone tissue
Blood

What is a tissue?

A

A group of similar cells with the same structure

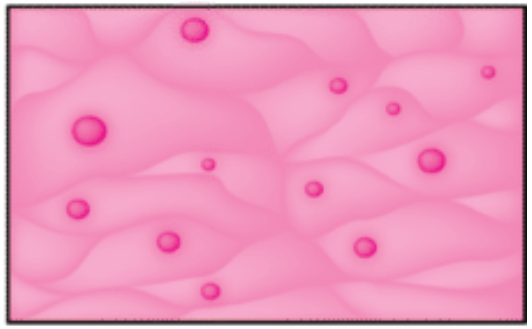
B

A group of cells with similar structure and functions

What is a tissue?

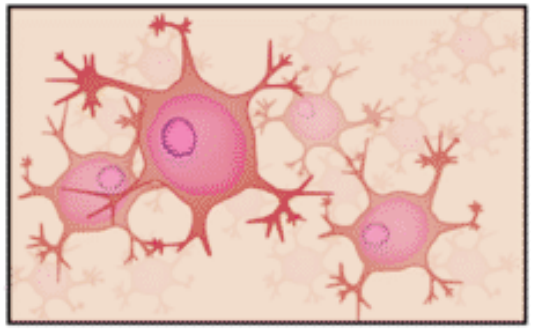
B *"Groups of cells with similar structure and function"*

Connective tissue



Epithelial tissue

Muscle tissue

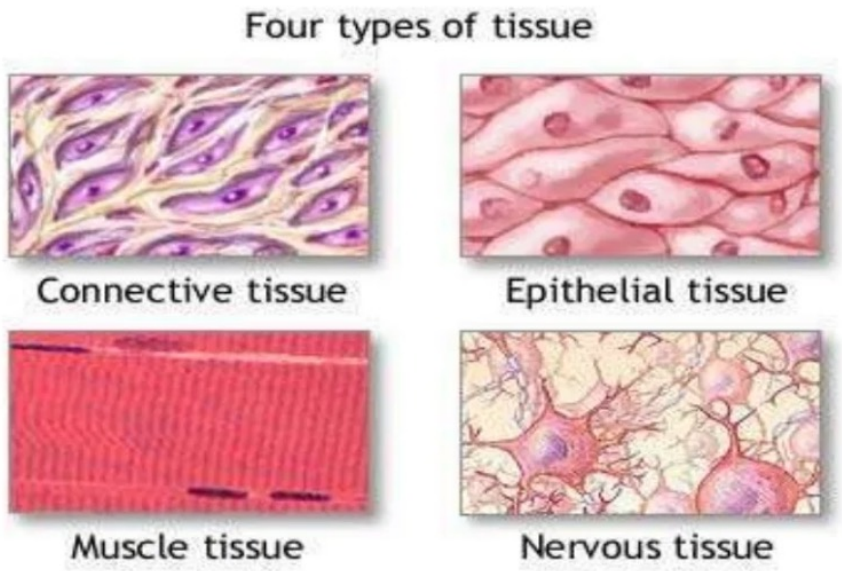


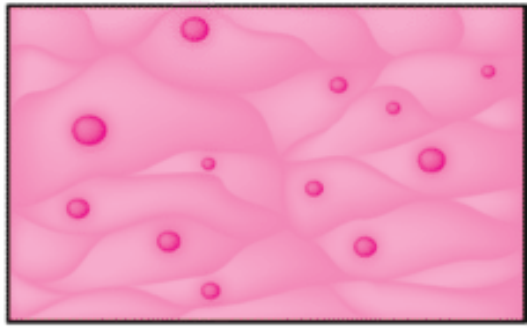
Nervous tissue

Body tissues

"Groups of cells with similar structure and function"

- ***Study of tissue is known as histology***
- **The tissues combined together to form various organs Eg: Kidney, Stmach**
- **Four primary types:**
  1. **Epithelial tissue (epithelium)**
  2. **Connective tissue**
  3. **Muscle tissue**
  4. **Nervous tissue**

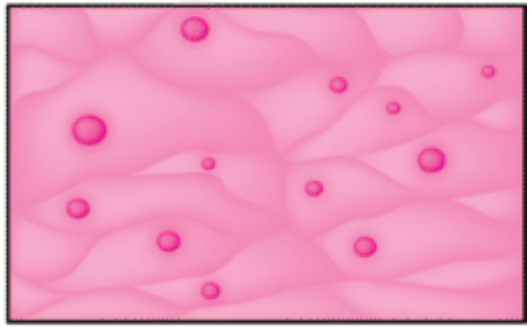




Epithelial tissue

EPITHELIAL tissue:

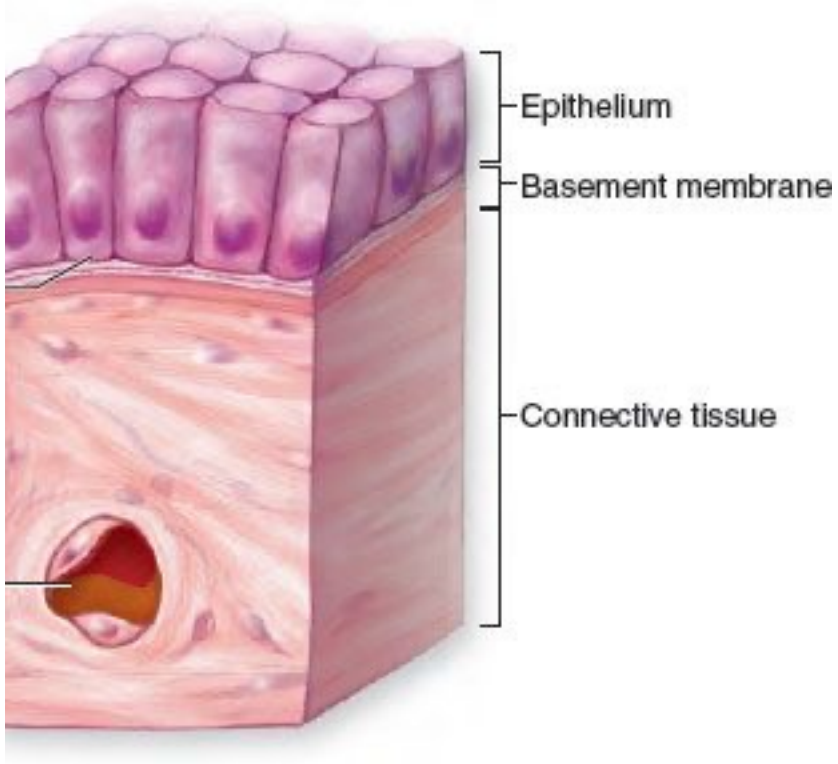
- The epithelium covers the external body surface and lines the internal organs, tubules, vessels & body cavities.
- Cells are closely packed and are arranged in one or more layers
- Epithelial layers contain no blood vessels,
- They must receive nourishment from the underlying connective tissue, through the basement membrane



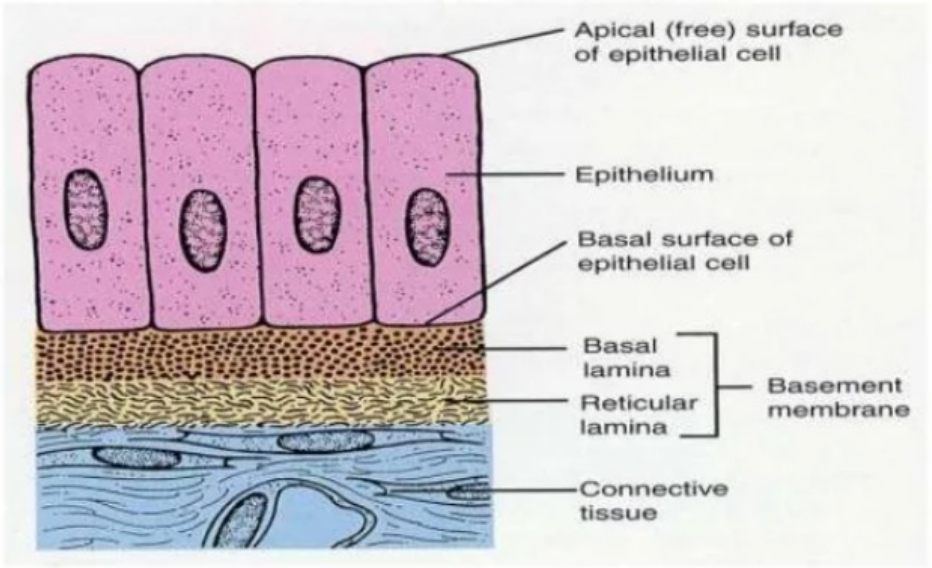
Epithelial tissue

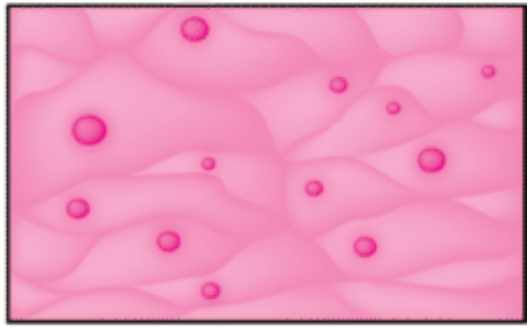
EPITHELIAL tissue:

- The basement membrane separates the epithelial tissue from the underlying connective tissue
- The lower surface of the epithelium rests on a basement membrane



Epithelial Tissues and Their Basement Membrane





Epithelial tissue

EPITHELIAL tissue:

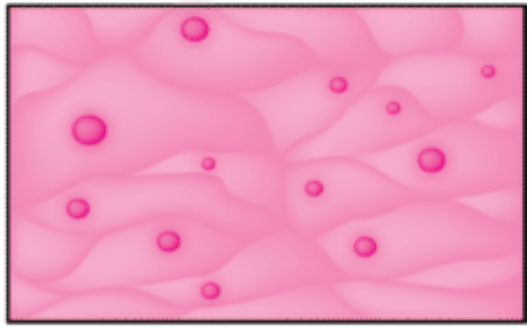
CLASSIFICATION OF EPITHELIUM

Number of cell layers

- Simple—one layer
- Stratified—more than one layer

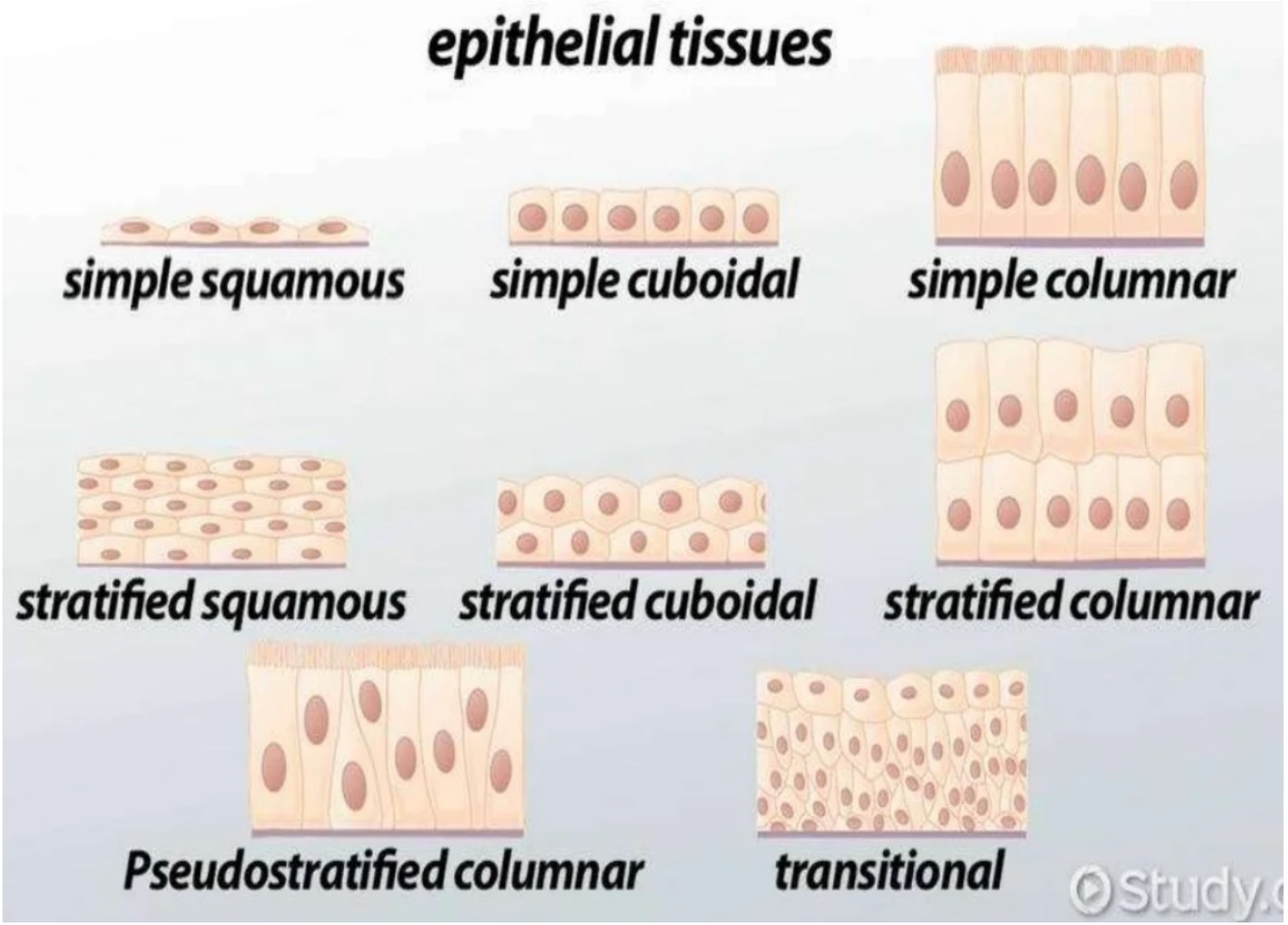
Shape of cells

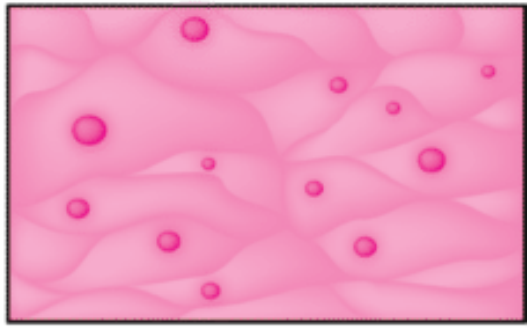
- Squamous :Flattened
- Cuboidal : Cube-shaped
- Columnar : Column-like



Epithelial tissue

EPITHELIAL tissue:





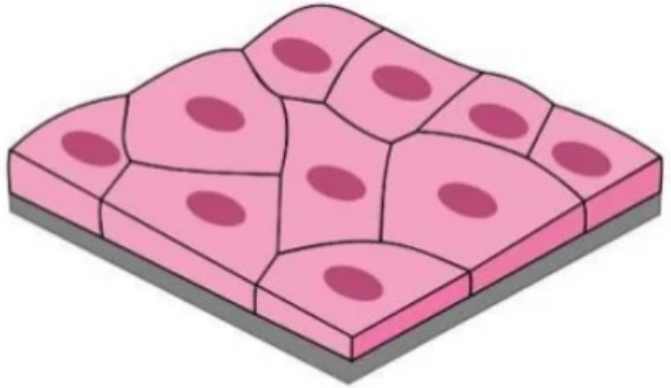
Epithelial tissue

EPITHELIAL tissue:

SIMPLE EPITHELIUM

Cells arranged in single layer

SIMPLE SQUAMOUS EPITHELIUM·



Structure:

Single layer of flat cells

Location

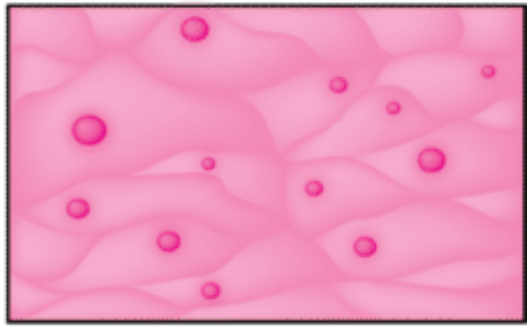
usually forms membranes

- Alveoli of the lungs
- Linings of blood vessel and lymphatic vessels
- line and cover organs in ventral cavity

Functions:

Diffusion,

Filtration, or Secretion in membranes



Epithelial tissue

EPITHELIAL tissue:

SIMPLE CUBOIDAL EPITHELIUM:

Structure: Single layer of cube-like cells

Location:

Common in glands and their ducts

- Forms walls of kidney tubules
- Covers the surface of ovaries

Functions:

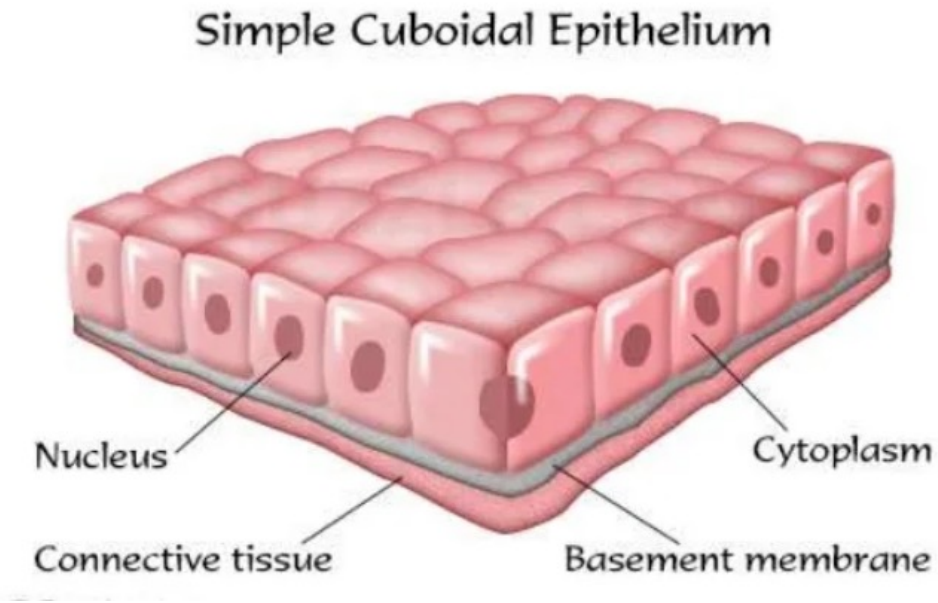
secretion

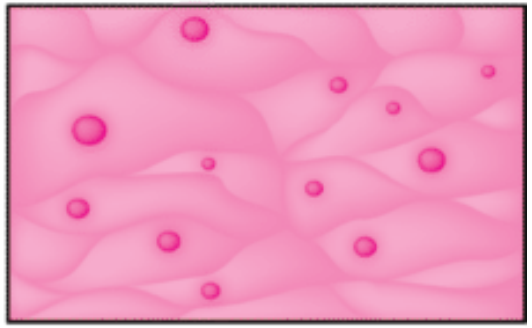
Absorption

ciliated types

propel mucus

reproductive cells





Epithelial tissue

EPITHELIAL tissue:

SIMPLE COLUMNAR EPITHELIUM:

Structure:

Single layer of tall cells,

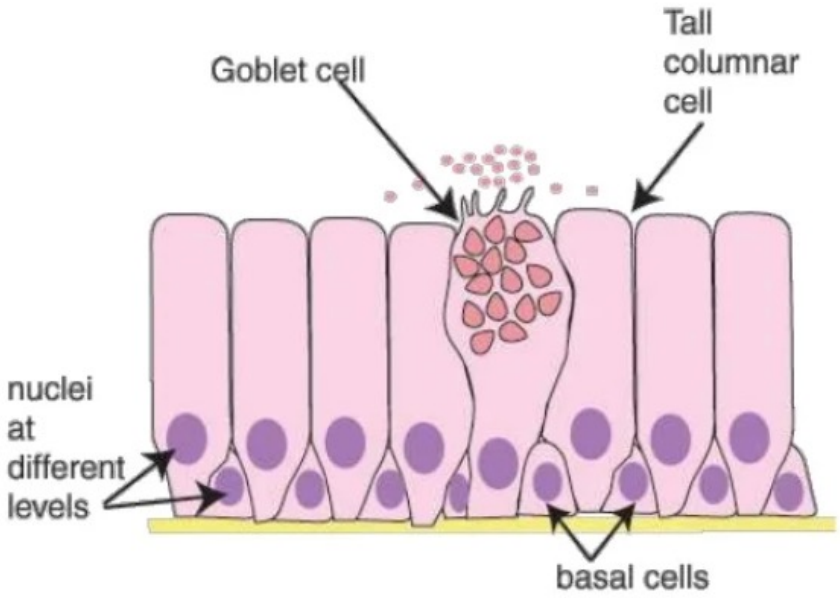
- Contains Goblet cells - secrete mucus

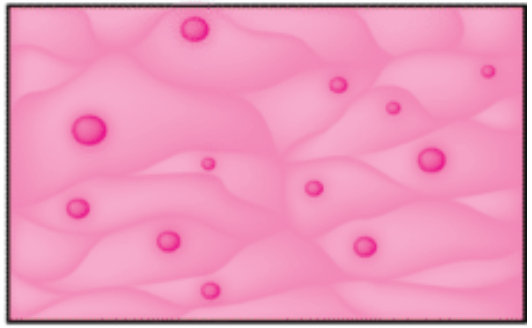
Location:

- Lines the mucus membrane of stomach, intestine, uterus

Functions:

- Secretion
- absorption
- ciliated types
- propel mucus
- reproductive cells





Epithelial tissue

EPITHELIAL tissue:

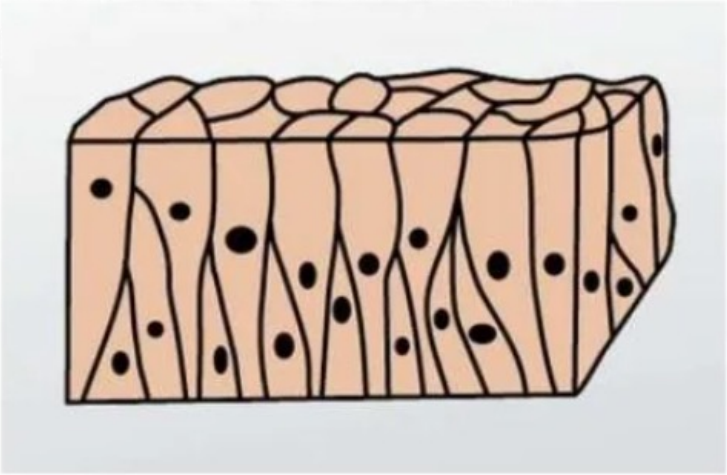
PSEUDOSTRATIFIED COLUMNAR EPITHELIUM

Structure:

- All cells rest on a basement membrane
- Single layer, but some cells are shorter than others giving a false (pseudo) impression of stratification

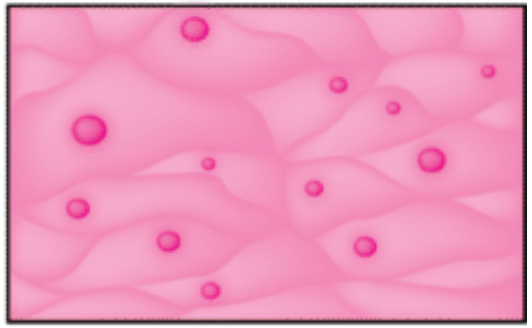
Location:

- Respiratory tract, where it is ciliated and known as pseudostratified ciliated col



Functions:

- Absorption
- secretion



Epithelial tissue

EPITHELIAL tissue:

STRATIFIED EPITHELIUM

"arrangement of cells over one another"

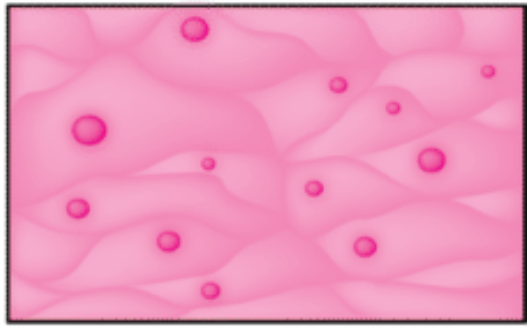
STRATIFIED SQUAMOUS EPITHELIUM:

Structure:

It comprises of multiple layers of flattened squamous cells

2types

- Keratinized stratified squamous epithelium
- Non – Keratinized stratified squamous epithelium



Epithelial tissue

EPITHELIAL tissue:

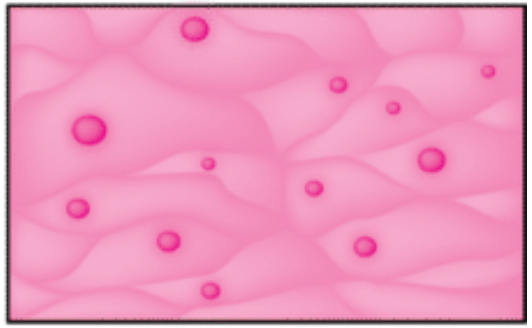
- Two types:

Keratinized stratified squamous epithelium:

- **Contains tough keratin fibres**
- **Which gives protective qualities to the skin**
- **Eg: skin**

Non – Keratinized stratified squamous epithelium

- **These cell does not contain keratin**
- **The cell surface remains moist**
- **Eg epithelium lines vagina, mouth, esophagus**



Epithelial tissue

EPITHELIAL tissue:

STRATIFIED CUBOIDAL EPITHELIUM:

Structure:

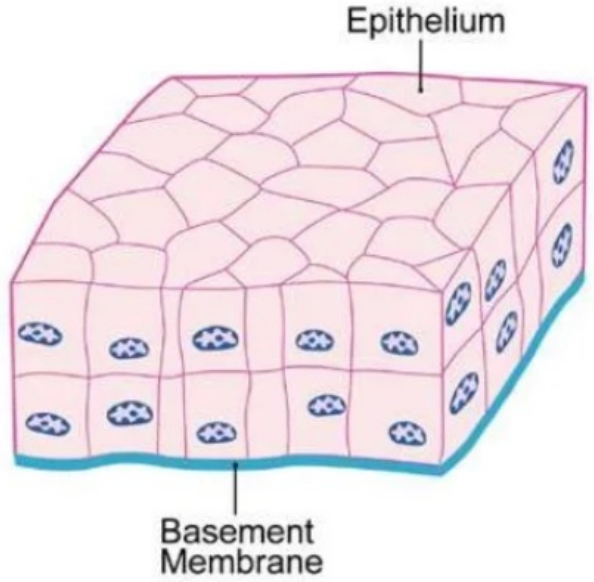
- Two or more layers of cuboidal cells

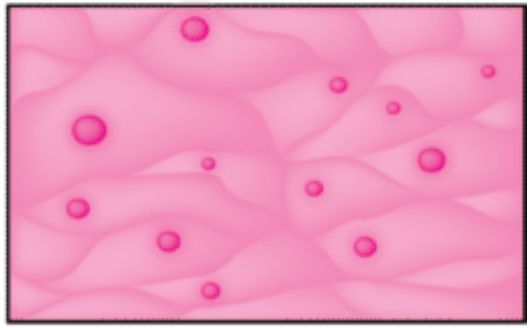
Eg:

- it is found in the pharynx
- Duct of sweat gland

Function:

- Protection





Epithelial tissue

EPITHELIAL tissue:

STRATIFIED COLUMNAR EPITHELIUM:

Structure:

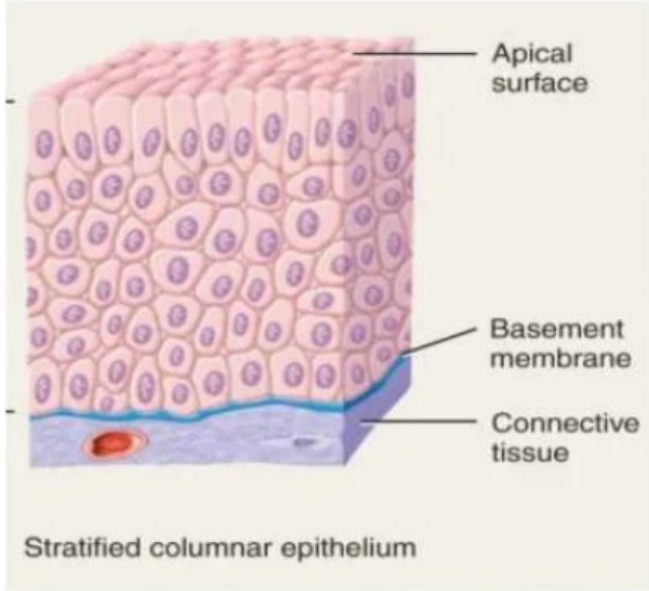
- Comprises of multiple layer of columnar cells
- surface cells are columnar,
- cells underneath vary in size and shape

Eg:

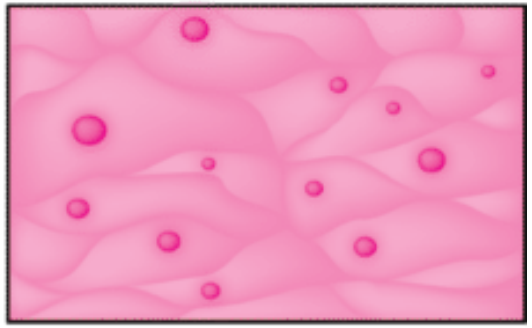
- Mucus layer of anus
- Few parts of male urethra

Functions

- protection



Stratified columnar epithelium



Epithelial tissue

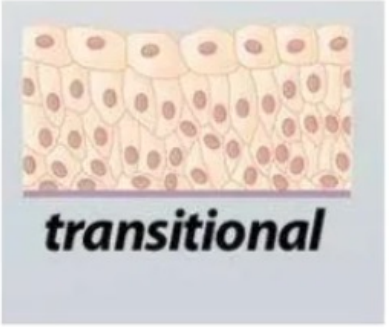
EPITHELIAL tissue:

TRANSITIONAL EPITHELIUM:

- Transitional – variable appearance
- It present in the area which are subject to changes in stress and tension

STRUCTURE:

- They are multiple layer of cells & elastic in nature
- Its ideal for lining urinary bladder

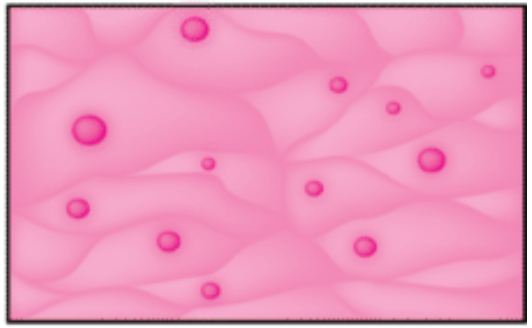


LOCATION:

- Urinary bladder

FUNCTION:

- Allow bladder to stretch while accumulation of urine



Epithelial tissue

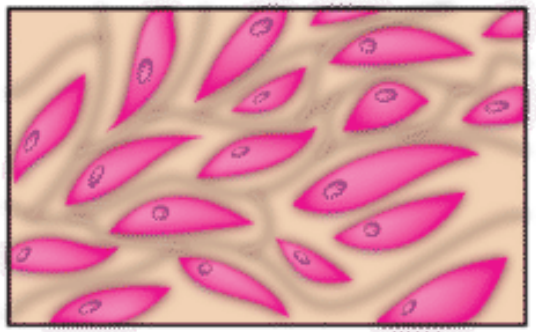
EPITHELIAL tissue:

GLANDULAR EPITHELIUM

- It is specialized for performing secretary activity
- One or more glandular cells responsible for secretion

Two major gland types

- Endocrine gland
  - Ductless; secretions diffuse into blood vessels
  - eg: thyroid, adrenals, and pituitary
- Exocrine gland
  - Secretions empty through ducts to the epithelial surface
  - Eg: sweat and oil glands, liver, and pancreas

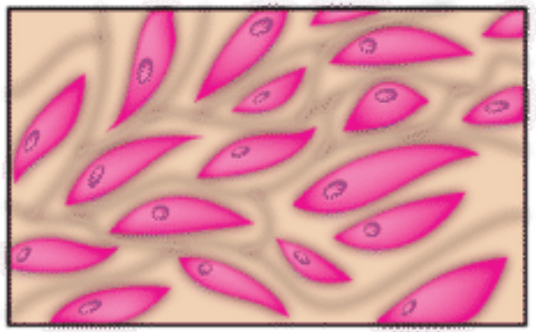


Connective tissue

CONNECTIVE tissue:

CONNECTIVE TISSUE

- Found everywhere in the body
- Includes the most abundant and widely distributed
- Found in every organ of the body

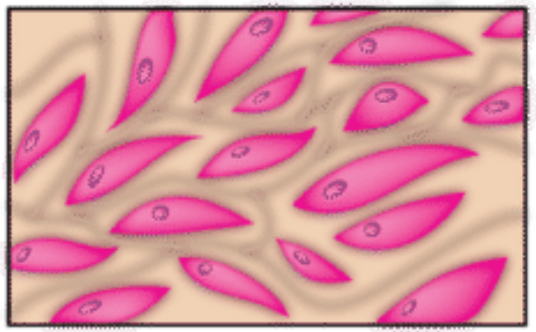


Connective tissue

CONNECTIVE tissue:

Connective Tissue Characteristics

- **Variations in blood supply**
  - Some tissue types are well vascularized
  - Some have a poor blood supply or are avascular
- **Extracellular matrix**
  - Nonliving material that surrounds living cells



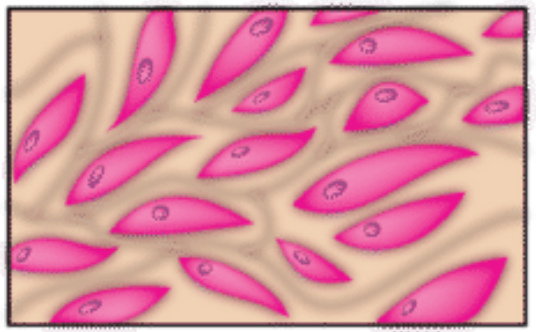
Connective tissue

CONNECTIVE tissue:

Extracellular Matrix

Two main elements

1. **Ground substance**—mostly water along with adhesion proteins and polysaccharide molecules
2. **Fibers**
   - **Produced by the cells**
   - **Three types:**
     1. **Collagen (white) fibers**
     2. **Elastic (yellow) fibers**
     3. **Reticular fibers (a type of collagen)**

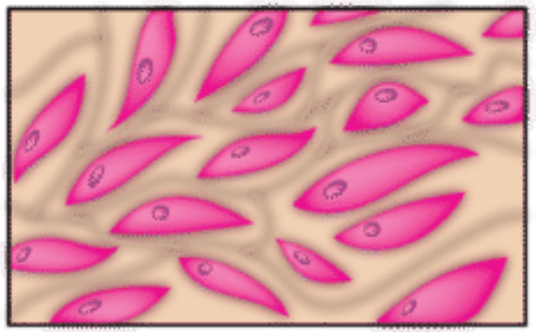


Connective tissue

CONNECTIVE tissue:

Connective Tissue Types

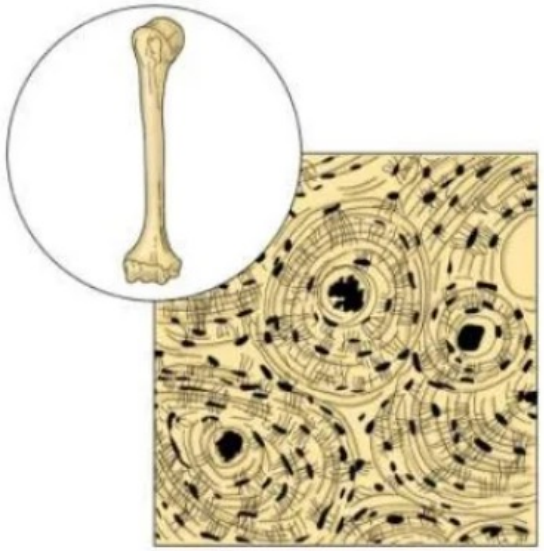
- From most rigid to softest, or most fluid:
  - **BONE**
  - **CARTILAGE**
  - **DENSE CONNECTIVE TISSUE**
  - **LOOSE CONNECTIVE TISSUE**
  - **BLOOD**

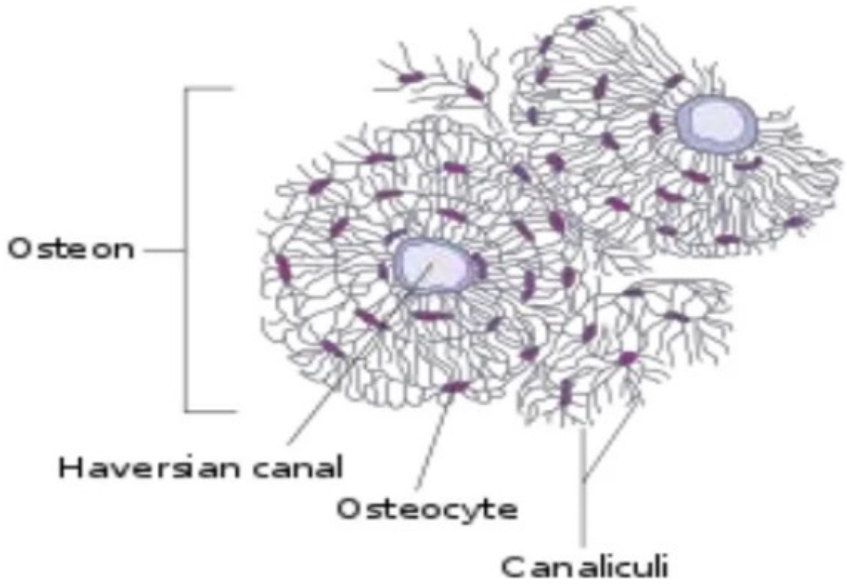


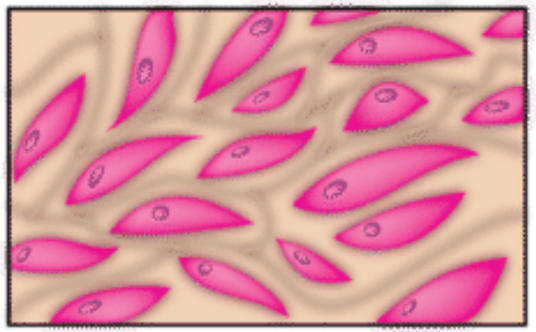
Connective tissue

CONNECTIVE tissue:

- **Bone (osseous tissue)**
  - Composed of:
    - **Osteocytes (bone cells) sitting in lacunae (cavities)**
    - **Hard matrix of calcium salts**
    - **Large numbers of collagen fibers**
  - Functions to protect and support the body







Connective tissue

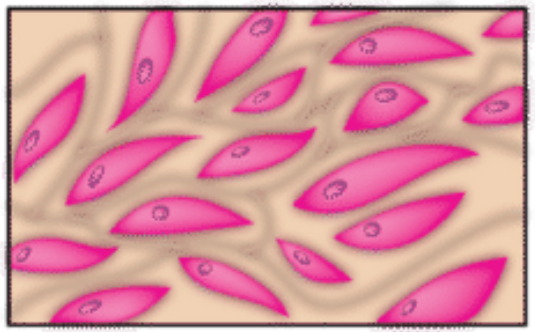
CONNECTIVE tissue:

CARTILAGE:

- Less hard and more flexible than bone
- Found in only a few places in the body
- Chondrocyte (cartilage cell) is the major cell type

Types

- HYALINE CARTILAGE
- ELASTIC CARTILAGE
- FIBROCARTILAGE



Connective tissue

CONNECTIVE tissue:

HYALINE CARTILAGE

- The word hyaline derived from greek
- Hyaline – glass
- hyaline cartilage is the most widespread type of cartilage
- It forms covering of ends of bone at joints
- It forms the support ring of respiratory tubes

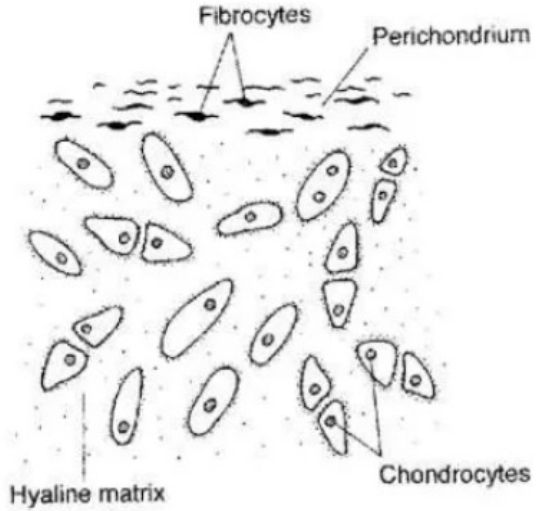
LOCATIONS:

- Larynx
- Entire fetal skeleton prior to birth
- Epiphyseal plates

  (end portion of long bone)

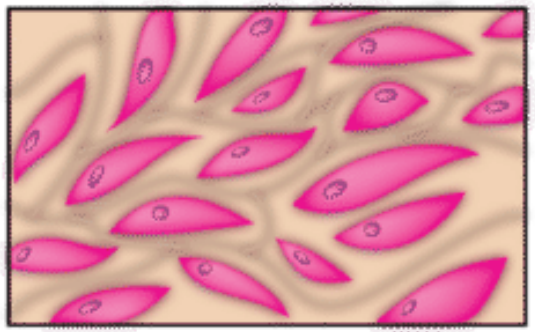
FUNCTIONS

– *more flexible skeletal element than bone*

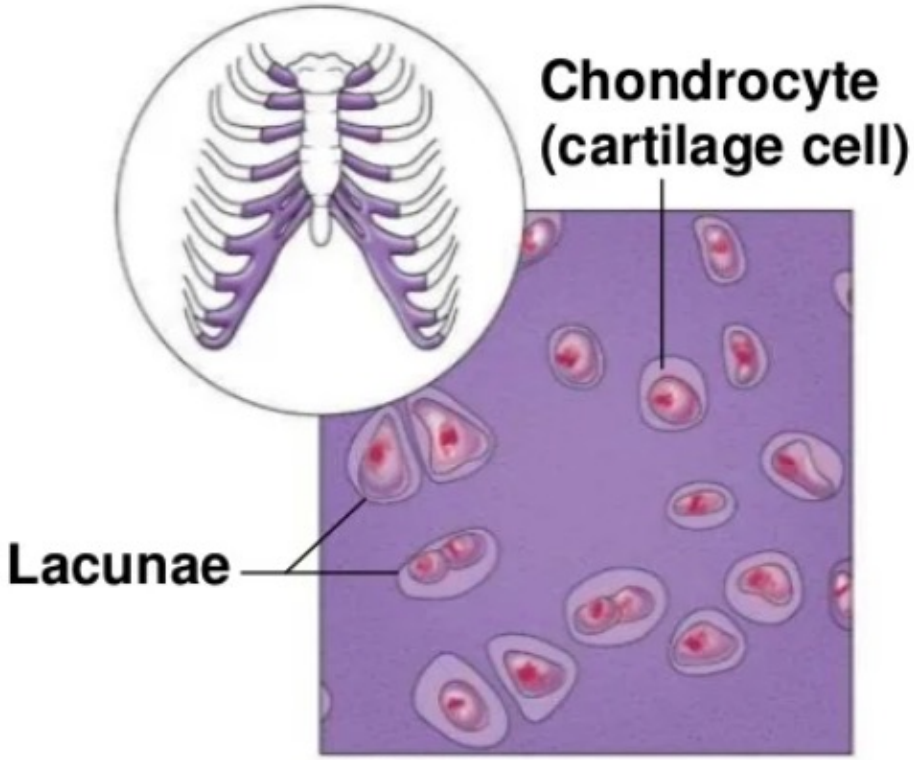


Hyaline cartilage

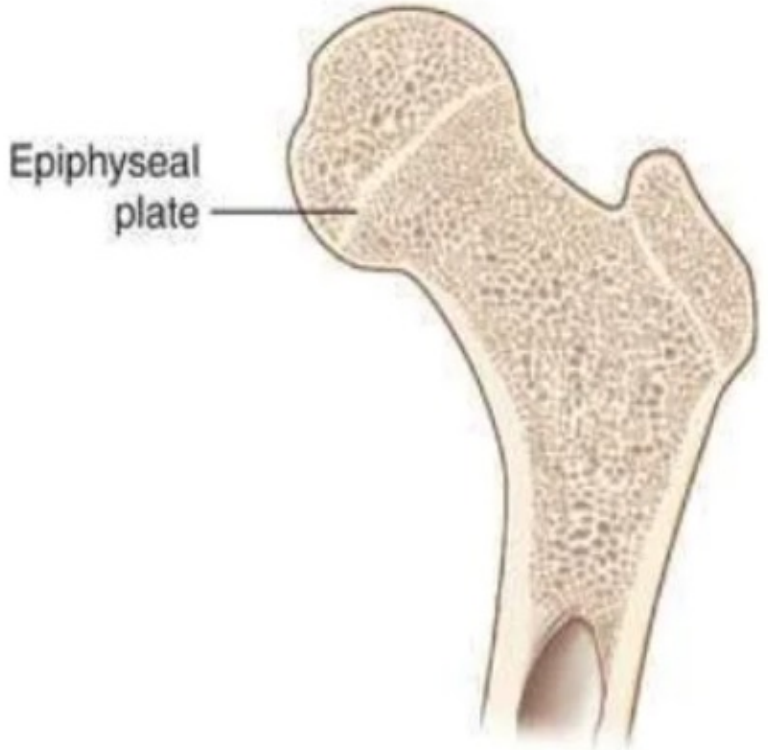
CONNECTIVE tissue:

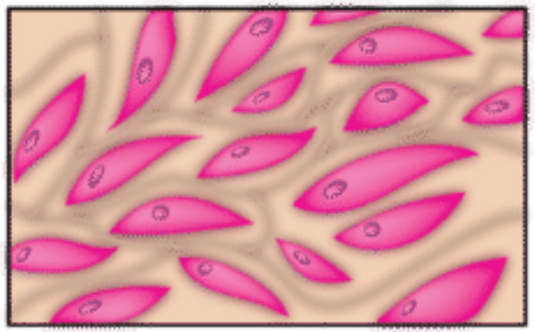


Connective tissue



(b) Diagram: Hyaline cartilage





Connective tissue

CONNECTIVE tissue:

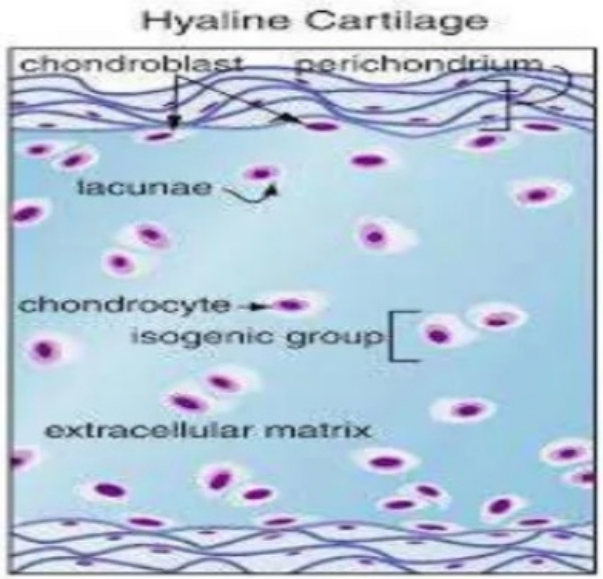
Fibrocartilage

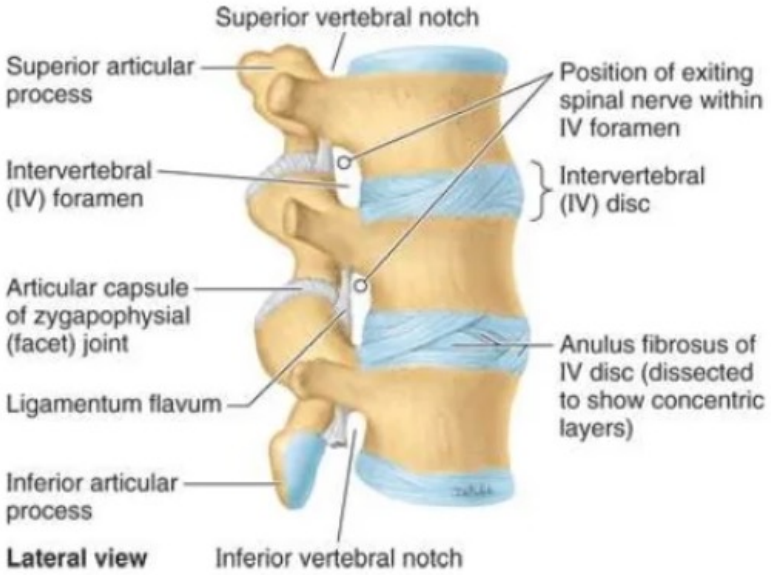
The strongest & most durable cartilage of the body

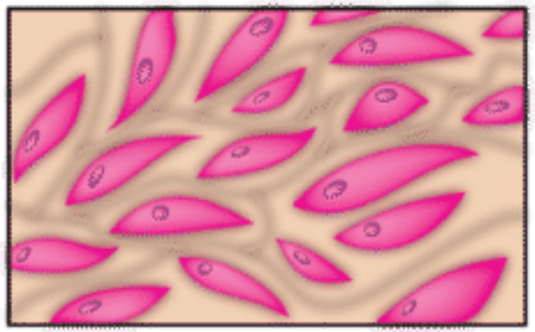
Matrix of the fibrocartilage tissue is densely packed with white collagen fibres

Location:

- **Forms cushion like *intervertebral* discs between vertebrae of the spinal column**







Connective tissue

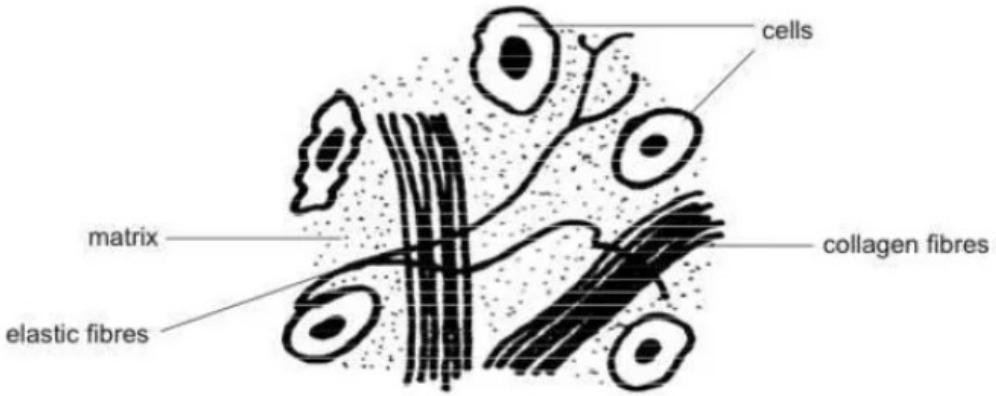
CONNECTIVE tissue:

ELASTIC CARTILAGE

- Highly compressible
- Few collagen fibres present
- Contains large number of very fine elastic fibres – provides flexibility

Location:

- External ear
- larynx



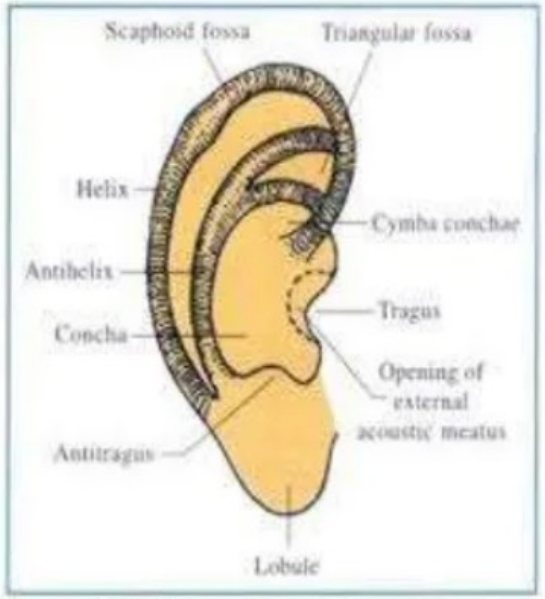
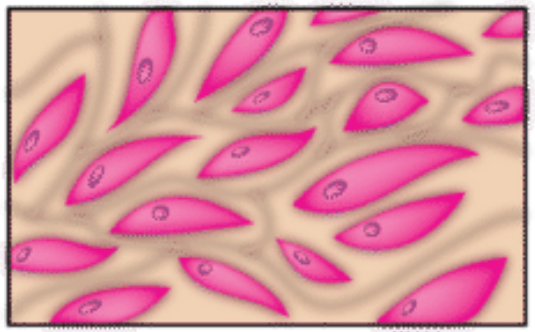
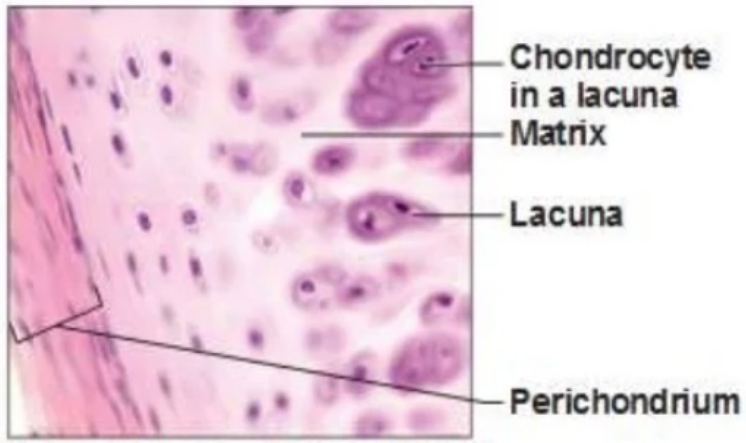


Fig. 14.1. *Lateral view of right auricle.*

CONNECTIVE tissue:

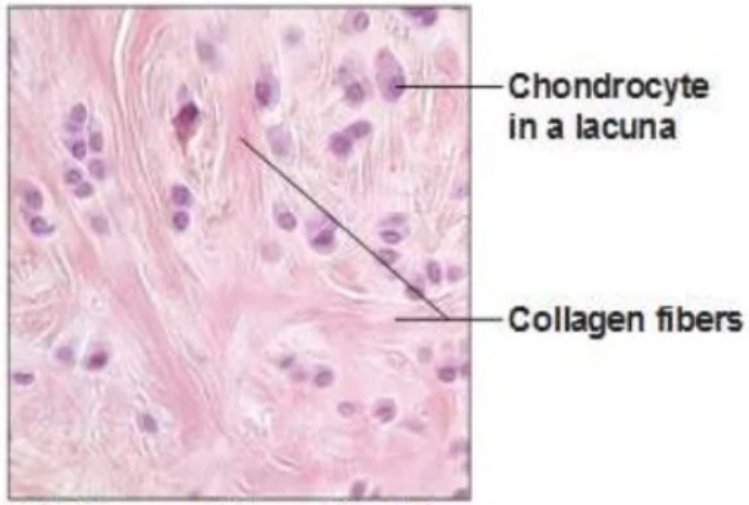


Connective tissue

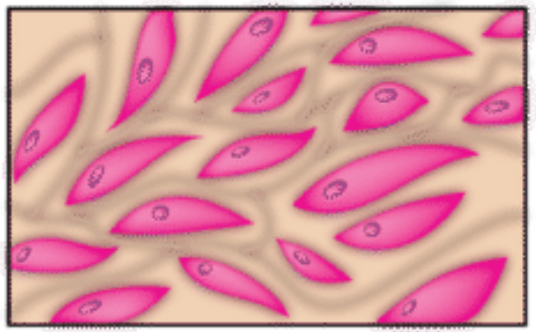


(a) Hyaline cartilage (180×)

(b) Elastic cartilage (470×)



(c) Fibrocartilage (285×)



Connective tissue

CONNECTIVE tissue:

Dense connective tissue (dense fibrous tissue)

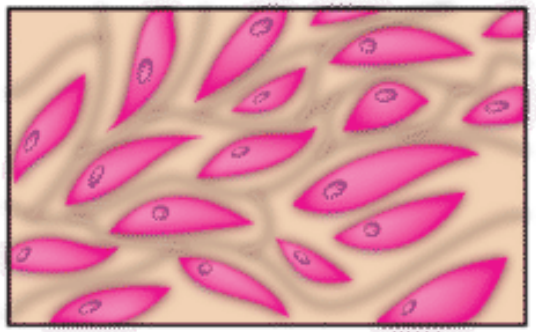
- The fibres are closely packed in the matrix
- Fibroblasts (synthesis ECM & Collagen)are less in number

Types:

- Dense irregular connective tissue
- Dense regular connective tissue
- Elastic dense regular fibrous tissue

Locations:

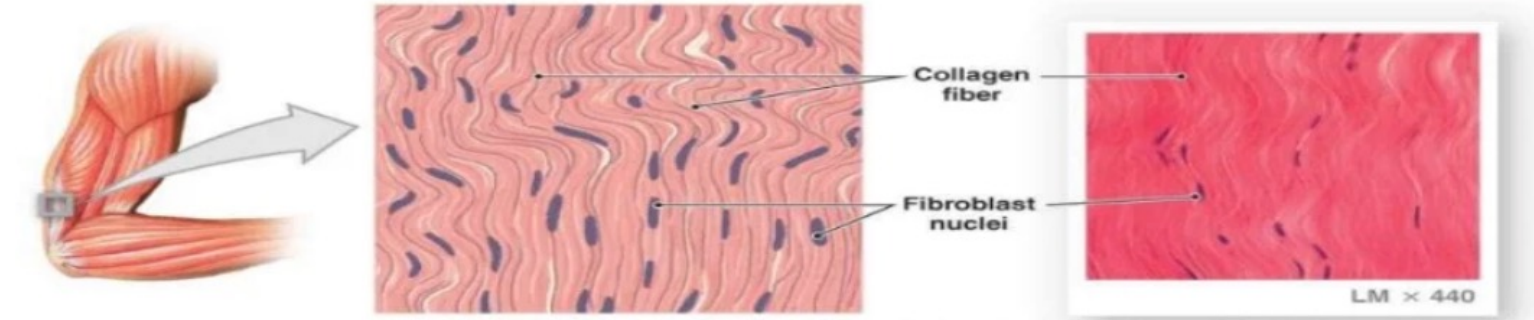
- Tendons—attach skeletal muscle to bone
- Ligaments—attach bone to bone at joints and are more elastic than tendons
- Dermis—lower layers of the skin



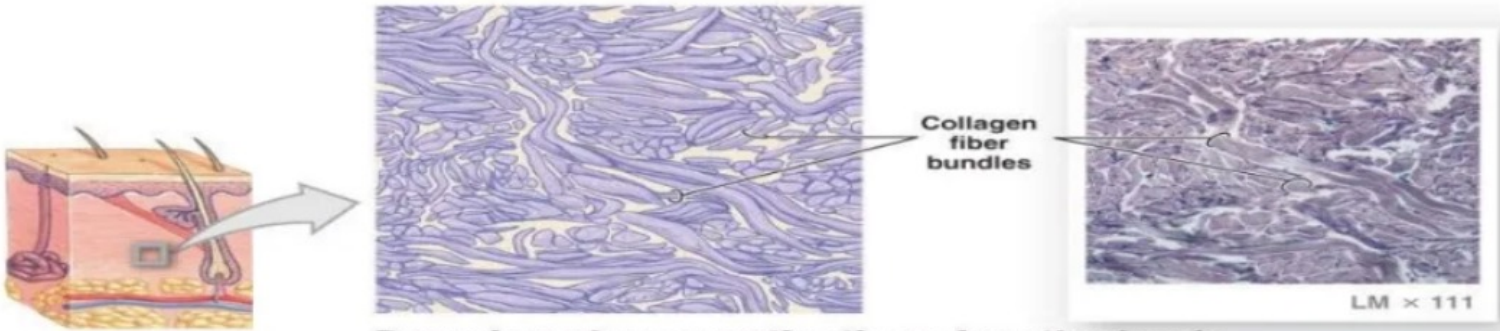
Connective tissue

CONNECTIVE tissue:

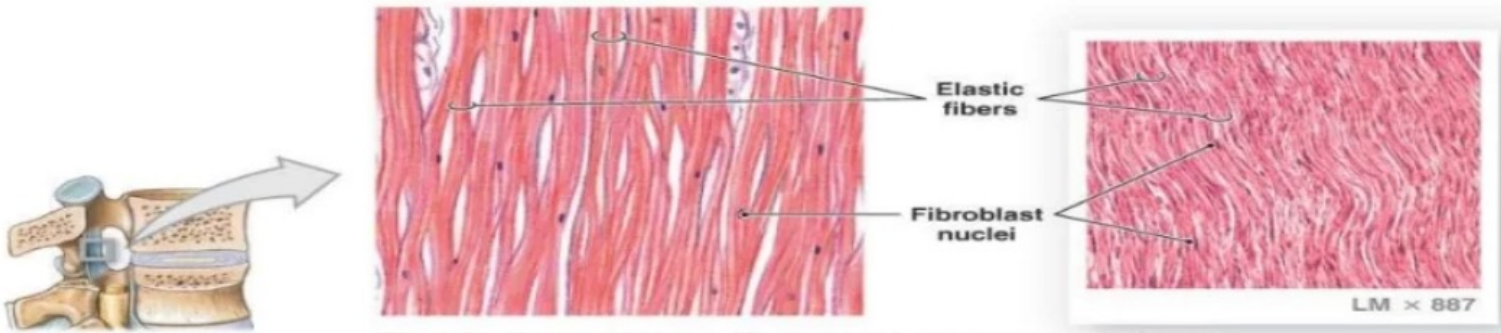
The three types of dense connective tissues



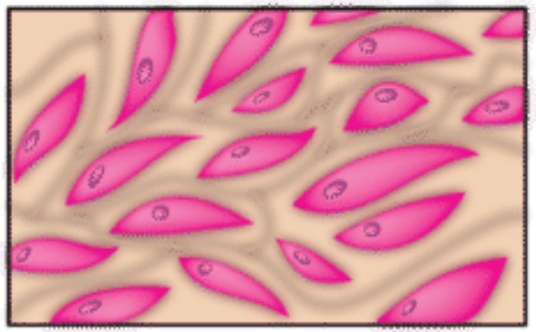
Dense regular connective tissue in a tendon from the triceps muscle



Dense irregular connective tissue from the dermis



Elastic tissue from a ligament between vertebrae



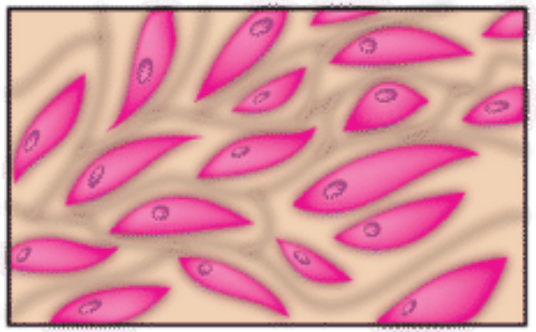
Connective tissue

CONNECTIVE tissue:

LOOSE CONNECTIVE TISSUE TYPES

Two types:

- Areolar connective tissue
- Adipose tissue
- Reticular connective tissue



Connective tissue

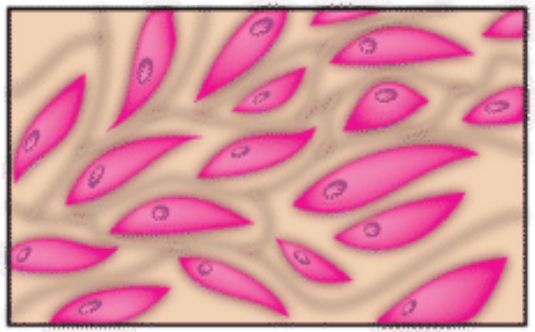
CONNECTIVE tissue:

LOOSE FIBROUS CONNECTIVE TISSUE:

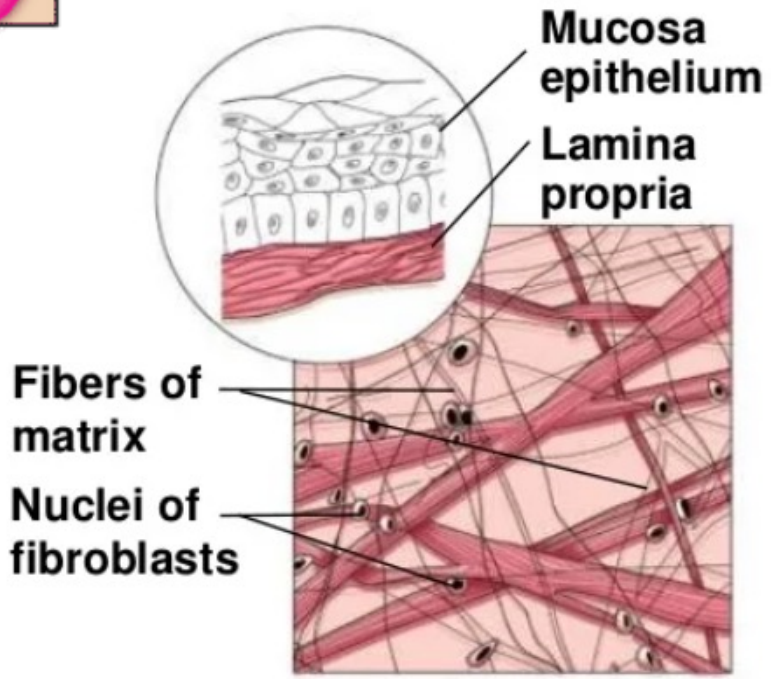
– Also known as - Areolar tissue

- **Most widely distributed connective tissue**
- **The tissues are stretchable – loose connective tissue**
- **Functions as a universal packing tissue and "glue" to hold organs in place**
- **Layer of areolar tissue called *lamina propria* underlies all membranes**
- **All fiber types form a loose network**
- **Can soak up excess fluid (causes edema)**

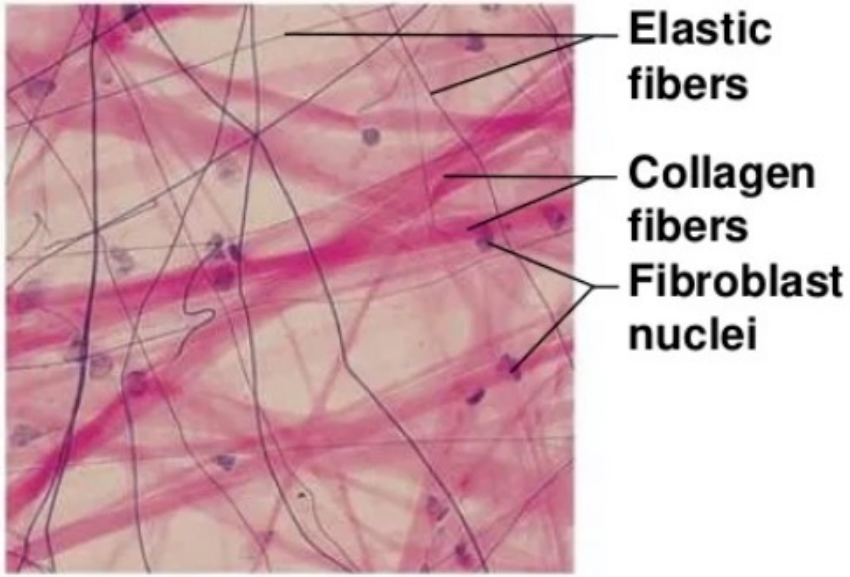
CONNECTIVE tissue:



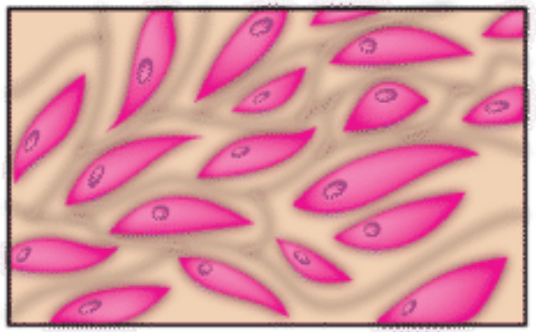
Connective tissue



(e) Diagram: Areolar



Photomicrograph: Areolar connective tissue, a soft packaging tissue of the body (270 ×)



Connective tissue

CONNECTIVE tissue:

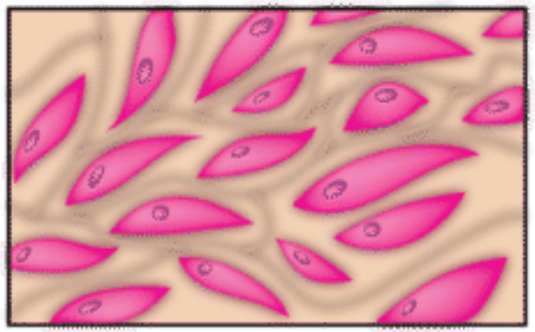
ADIPOSE TISSUE

- Adipose tissue primarily consist of fat cells – adipocytes
- Adipocyte – contains large vesicle filled with triglycerides
- Accumulation of more fat may increase the cell size
- White fat present in high amount – stores energy for body
- It provides support and protection to body organs

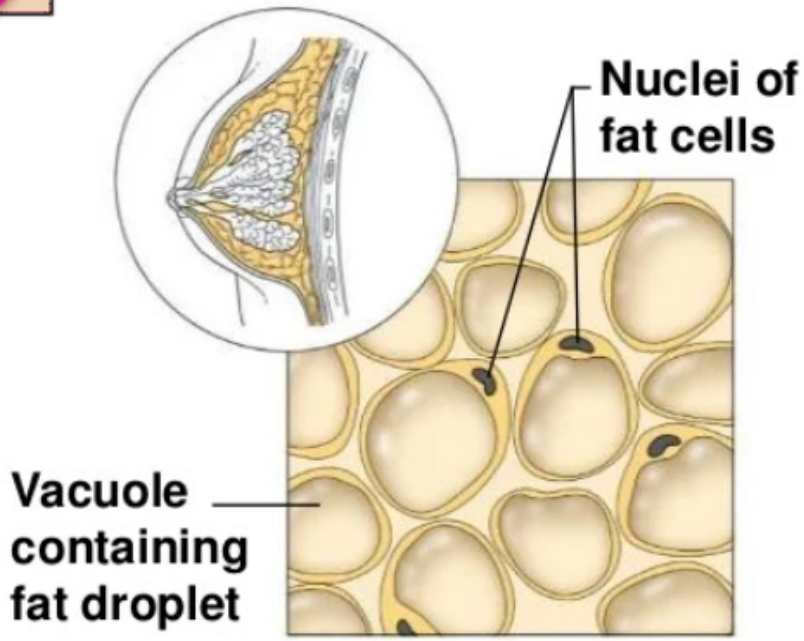
FUNCTIONS

- Insulates the body
- Protects some organs
- Serves as a site of fuel storage

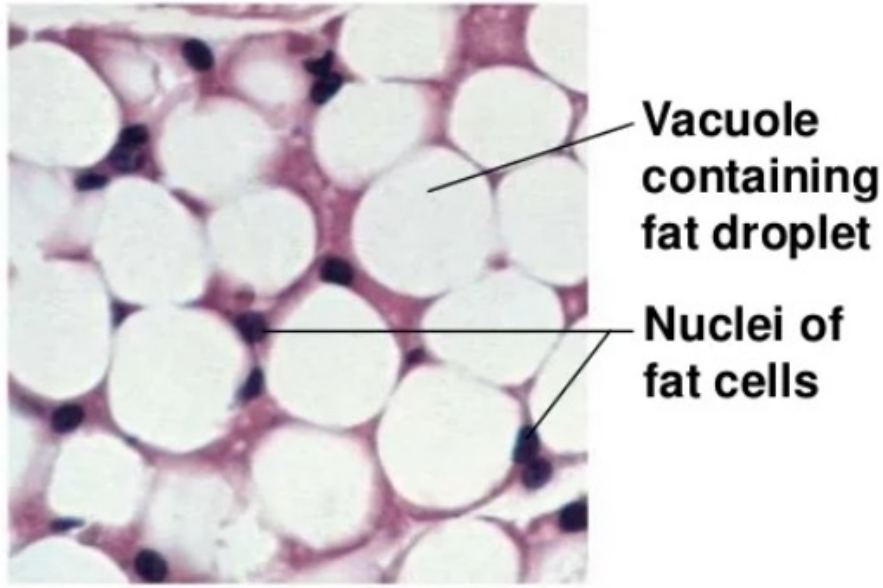
CONNECTIVE tissue:



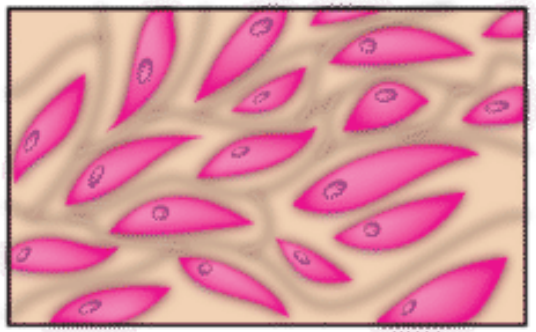
Connective tissue



(f) Diagram: Adipose



Photomicrograph: Adipose tissue from the subcutaneous layer beneath the skin (570×)



Connective tissue

CONNECTIVE tissue:

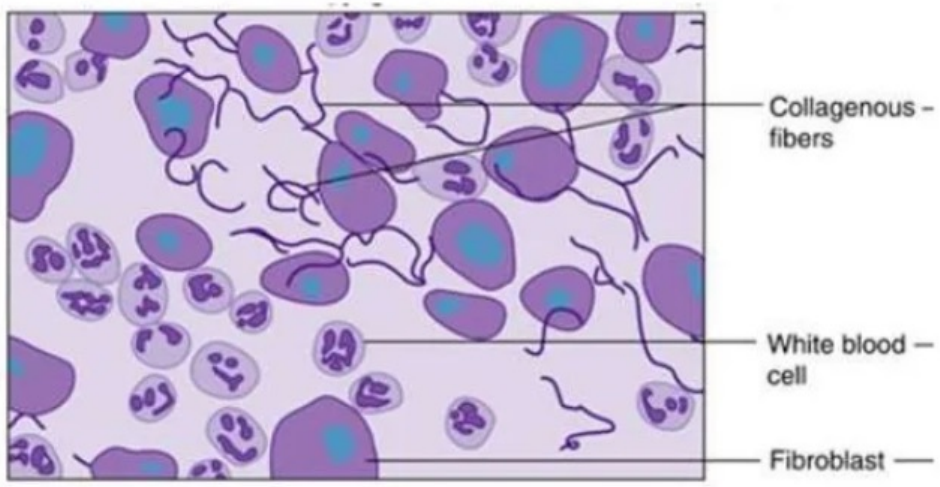
RETICULAR CONNECTIVE TISSUE

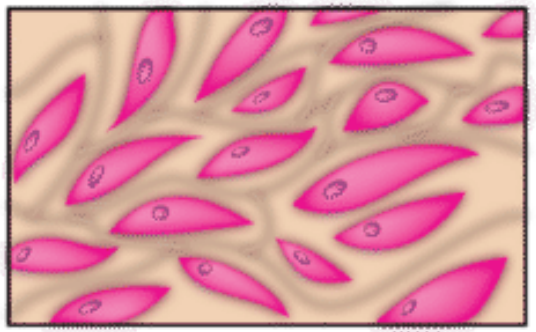
Reticular – like a net

It forms a mesh like network by thin branching reticular fibre

Locations:

- Spleen
- Lymph
- Bone marrow



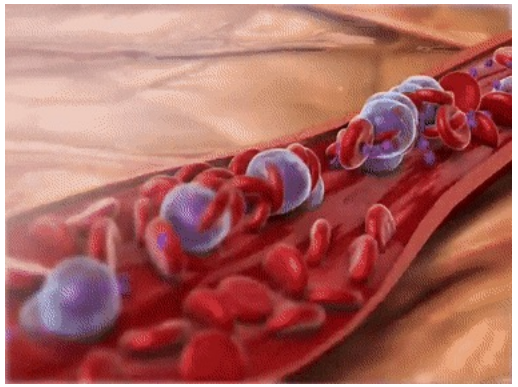


Connective tissue

CONNECTIVE tissue:

BLOOD (VASCULAR TISSUE)

- Blood is a liquid connective tissue
- It does not contain any fibre or ground substances
- It mainly comprises of
- Plasma – liquid portion forms around 55%
- Blood cells – solid portion – forms 45%
- It includes WBCs, RBCs. Platelets



Functions

- Transport of gas (Oxygen & CO2), nutrients, waste
- Regulate body temperature & pH
- WBC gives immunity to body

Extracellular matrix video

Muscle tissue

MUSCLE tissue:

MUSCLE TISSUE

- Muscular tissue present in all parts of body
- This system assist the skeletal system in movement of the body
- Contraction& relaxation are the character of this tissues
- Pumping of blood by heart, movement in the GIT are done by these muscles

Muscle tissue

MUSCLE tissue:

THREE TYPES OF TISSUES:

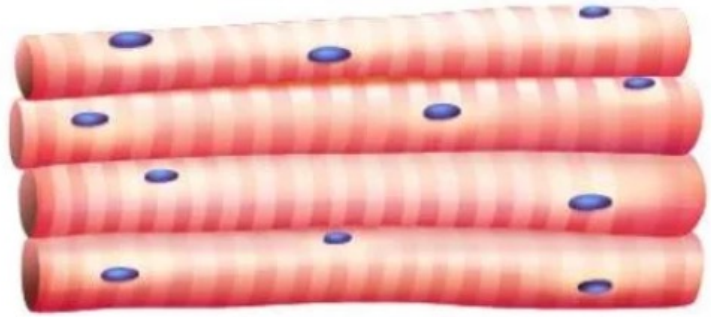
1. Skeletal muscle
2. Cardiac muscle
3. Smooth muscle

Muscle tissue

MUSCLE tissue:

Skeletal muscle

- Voluntarily (consciously) controlled
- The muscle fibres are long and cylindrical shaped
- They are striated (Stripes)
- They are multinucleated cell
- They attached to the skeleton and pull on bones or skin
- Produces gross body movements or facial expressions



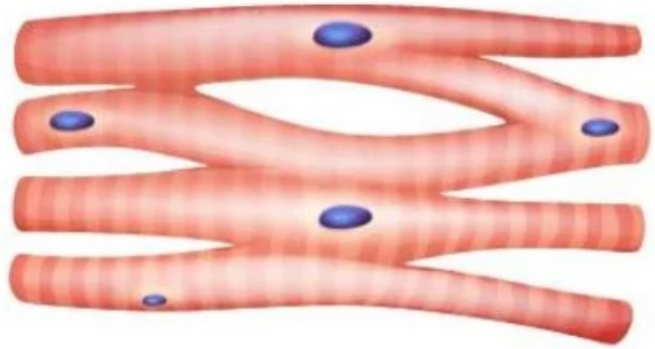
Skeletal muscle

Muscle tissue

MUSCLE tissue:

CARDIAC MUSCLE:

- These are cross striated muscle
- Uninucleate in nature, branching
- Involuntarily controlled
- Found only in the heart
- These muscles helps in generation of contraction
- Pumps blood through blood vessels



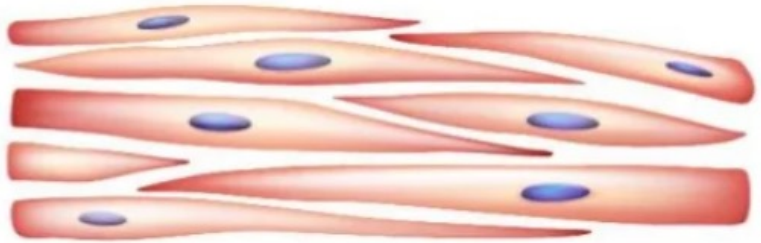
Cardiac muscle

Muscle tissue

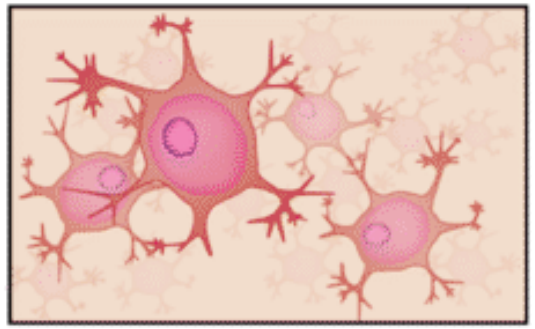
MUSCLE tissue:

Smooth (visceral) muscle

- These cells thin and spindle shaped
- Non striated muscle, Involuntarily controlled
- Uninucleate in nature
- They contain actin (thin) & myosin (thick) filaments – helps in contraction
- Found in walls of hollow organs such as stomach, uterus, and blood vessels
- Peristalsis, a wavelike activity, is a typical activity



Smooth muscle

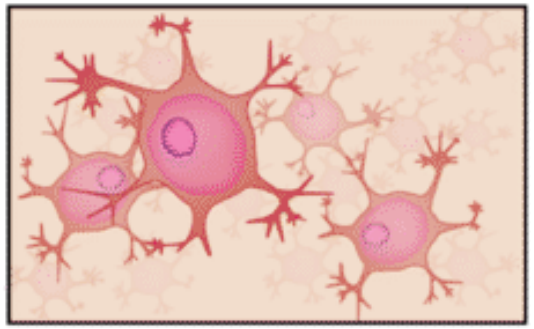


Nervous tissue

NERVOUS tissue:

NERVOUS TISSUE

- These tissues are responsible for rapid communication & coordination between various parts of body
- Neurons are located within the organs of central nervous system
- Eg: brain and spinal cord
- A typical neuron contains following structure
  - Cell body or soma
  - Myelin sheath
  - Node of ranvier



Nervous tissue

NERVOUS tissue:

CELL BODY OR SOMA:

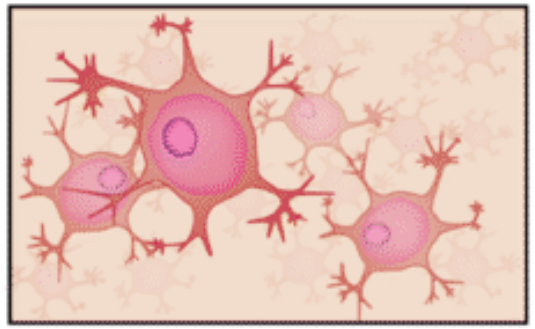
- A plasma membrane encloses the cell body
- It has centrally located nucleus
- Cytoplasm of the cell body consist of the granules – Nissl bodies
- 2 Cytoplasmic extensions emerge from cell body

Axon:

- It terminates nerve impulse away from the cell body or soma

Dendrites:

- They are either one or more in number and carry nerve signals towards the body



Nervous tissue

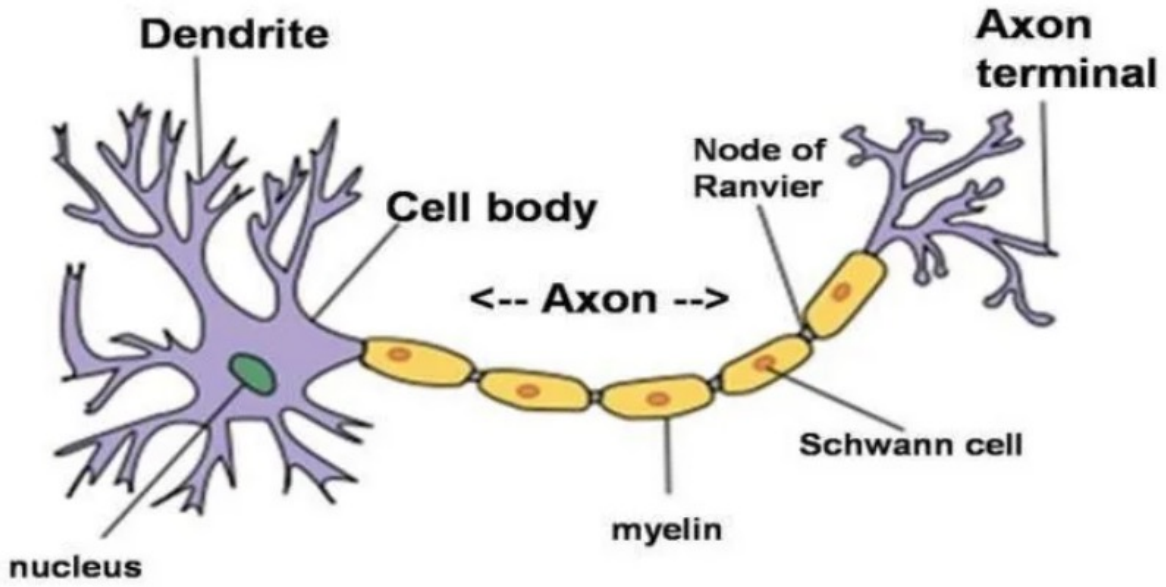
NERVOUS tissue:

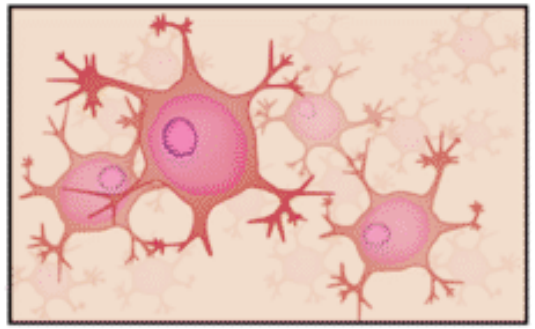
MYELIN SHEATH:

It covers the axon forming a whitish fatty, non cellular layer around the axon

NODE OF RANVIER:

it is the gap between the two adjacent schwann cells





Nervous tissue

NERVOUS tissue:

Functions:

- involved in the transportation of nerve impulse

  Between neuron to neuron &

  Between neuron to effector organ