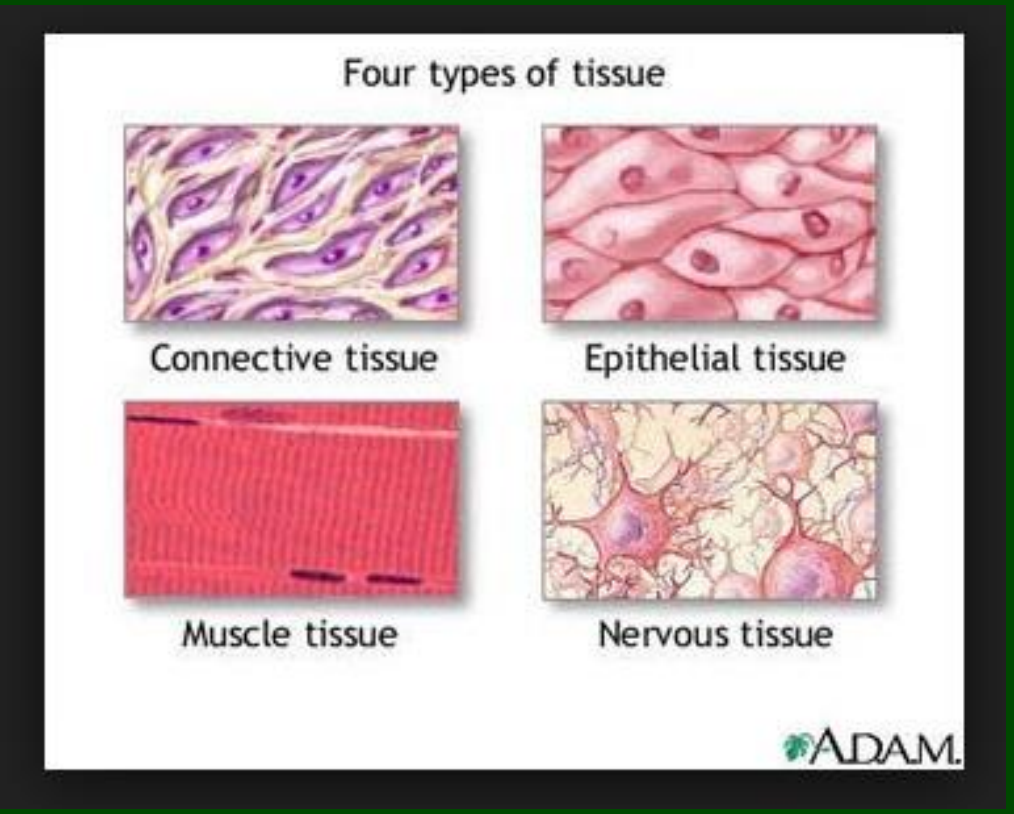
Types of Tissues

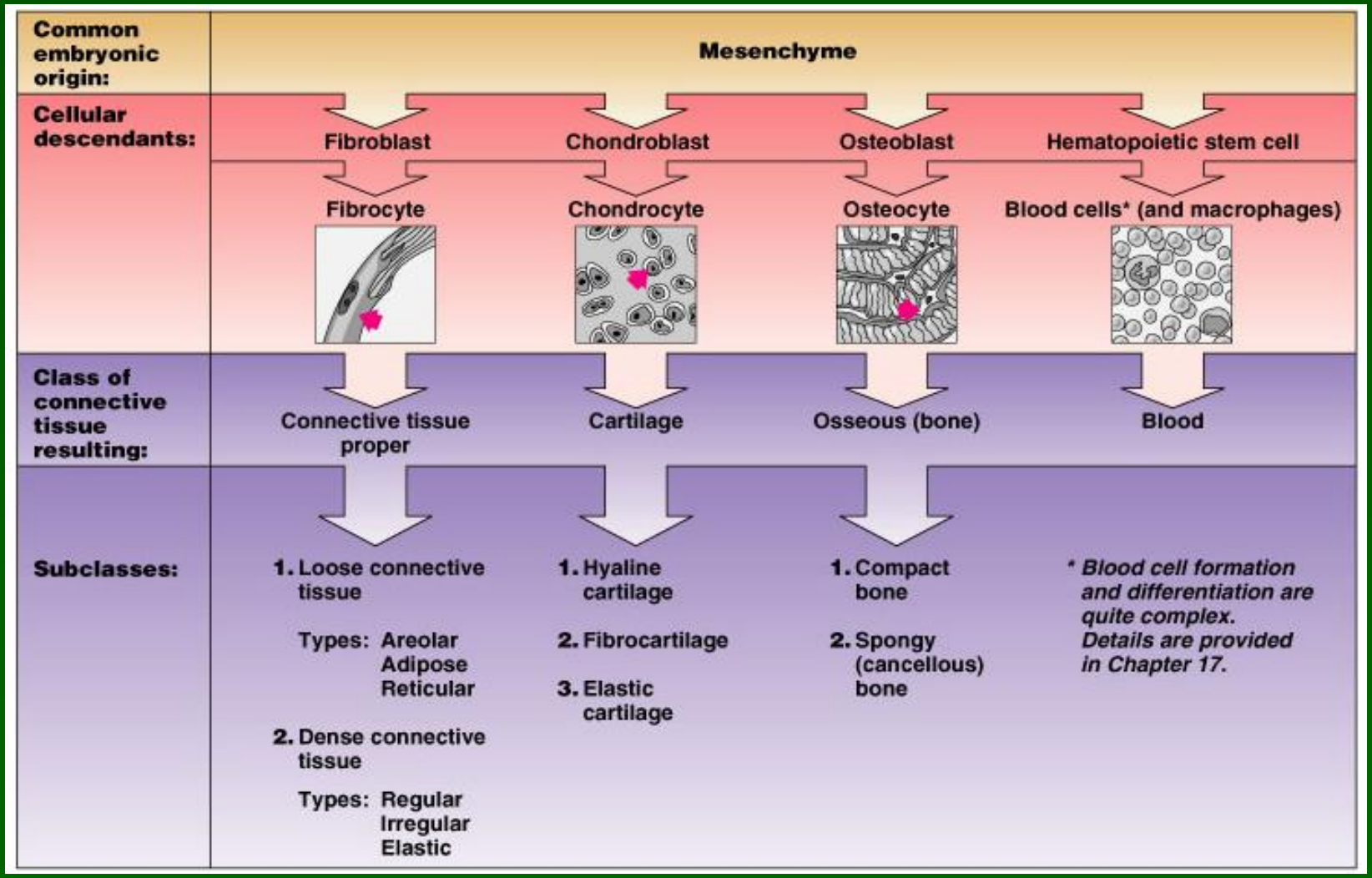


د. نوار غسان

Connective Tissue

- Most diverse and abundant tissue
- Main classes
  - Connective tissue proper
  - Cartilage
  - Bone tissue
  - Blood
- Components of connective tissue:
  - Cells (varies according to tissue)
  - Matrix
    - Fibers (varies according to tissue)
    - Ground substance (varies according to tissue)
      - dermatin sulfate, hyaluronic acid, keratin sulfate, chondroitin sulfate…
- Common embryonic origin – mesenchyme

Classes of Connective Tissue



Connective Tissue Model

- Areolar connective tissue
  - Underlies epithelial tissue
  - Surrounds small nerves and blood vessels
  - Has structures and functions shared by other connective tissues
  - Borders all other tissues in the body
- Structures within areolar connective tissue allow:
  - Support and binding of other tissues
  - Holding body fluids
  - Defending body against infection
  - Storing nutrients as fat

Connective Tissue Proper

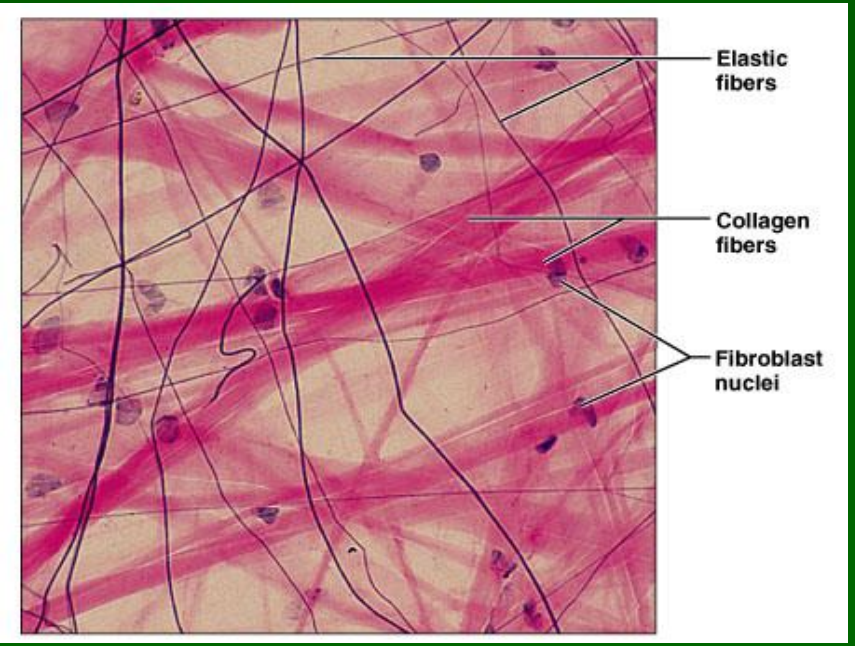
- Loose Connective Tissue
  - Areolar
  - Reticular
  - Adipose
- Dense Connective Tissue
  - Regular
  - Irregular
  - Elastic

Areolar Connective Tissue

- Description
  - Gel-like matrix with:
    - all three fiber types (collagen, reticular, elastic) for support
    - Ground substance is made up by glycoproteins also made and screted by the fibroblasts.
  - Cells – fibroblasts, macrophages, mast cells, white blood cells
- Function
  - Wraps and cushions organs
  - Holds and conveys tissue fluid
  - Important role in inflammation Main battlefield in fight against infection
- Defenders gather at infection sites
  - Macrophages
  - Plasma cells
  - Mast cells
  - Neutrophils, lymphocytes, and eosinophils

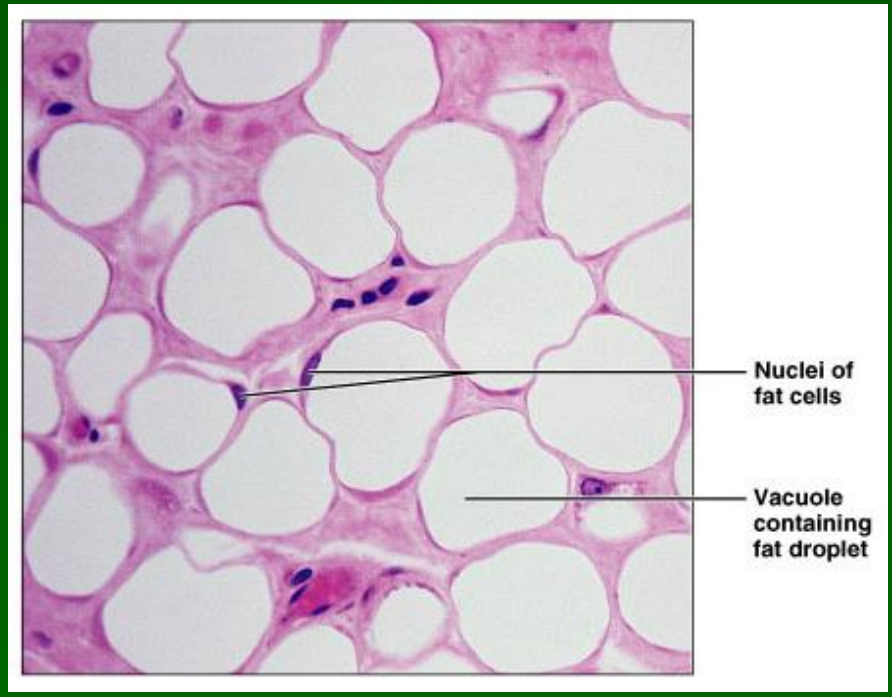
Areolar Connective Tissue

- Location
  - Widely distributed under epithelia
  - Packages organs
  - Surrounds capillaries



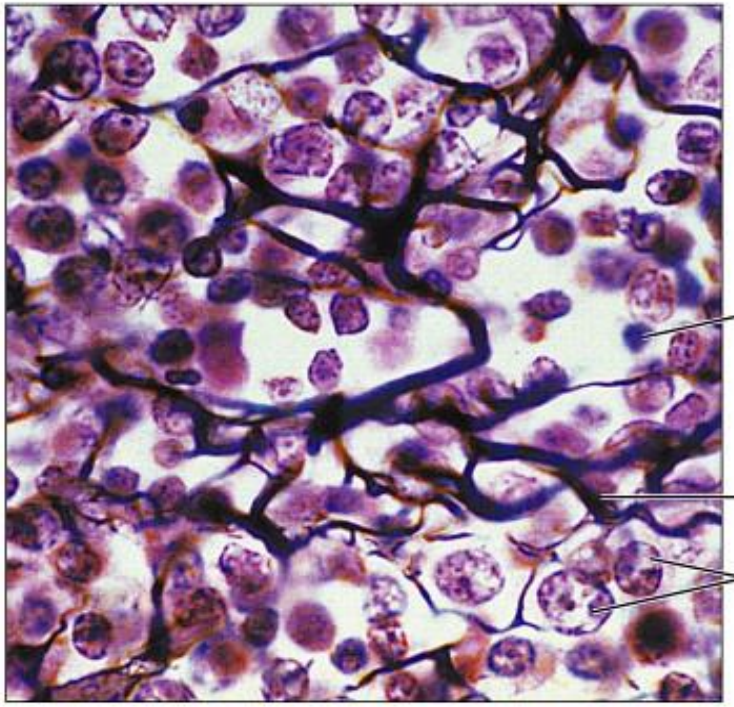
Adipose Tissue

- Description
  - Closely packed adipocytes
  - Have nucleus pushed to one side by fat droplet Function
  - Provides reserve food fuel
  - Insulates against heat loss
  - Supports and protects organs
- Location
  - Under skin
  - Around kidneys
  - Behind eyeballs, within abdomen and in breasts



Reticular Connective Tissue

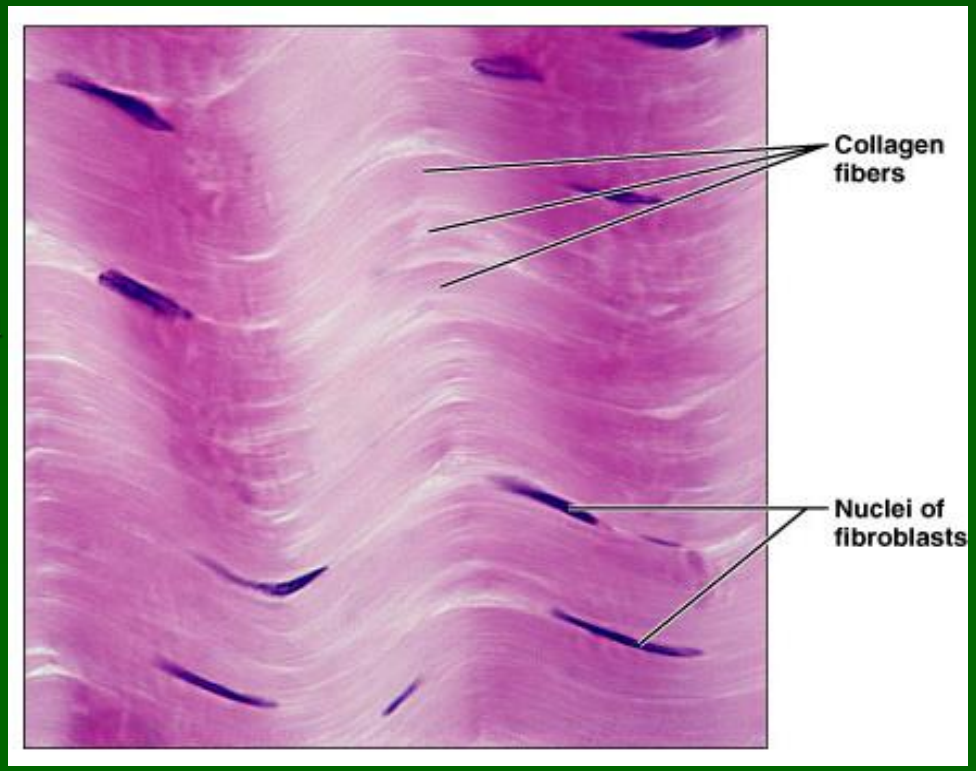
- Description – network of reticular fibers in loose ground substance
- Function – form a soft, internal skeleton (stroma) – supports other cell types
- Location – lymphoid organs
  - Lymph nodes, bone marrow, and spleen



Photomicrograph: Dark-staining network of reticular connective tissue fibers forming the internal skeleton of the spleen (350×).

Dense Regular Connective Tissue

- Description
  - Primarily *parallel* collagen fibers
  - Fibroblasts and some elastic fibers
  - Poorly vascularized
- Function
  - Attaches muscle to bone
  - Attaches bone to bone
  - Withstands great stress in one direction
- Location
  - Tendons and ligaments
  - Aponeuroses
  - Fascia around muscles



Cartilage

- Characteristics:
  - Firm, flexible tissue
  - Contains no blood vessels or nerves
  - Matrix contains up to 80% water
  - Cell type – chondrocyte
- Types:
  - Hyaline
  - Elastic
  - Fibrocartilage

Types of Cartilage

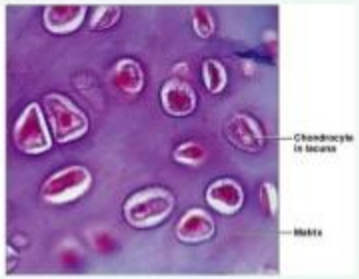
Hyaline cartilage

flexible and resilient

Collagen type II

Chondrocytes: spherical

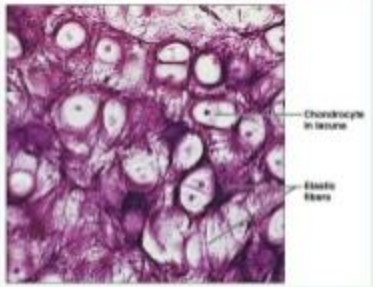
Lacuna (cavity in matrix holding chondrocyte)



Elastic cartilage

highly bendable

elastic + collagen type II

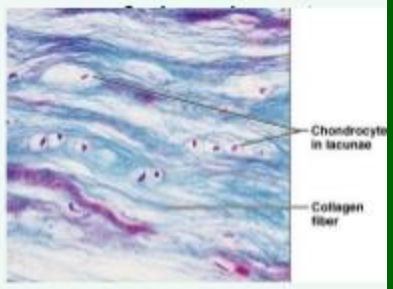


Fibrocartilage

compression and tension

Rows of collagen type I

+

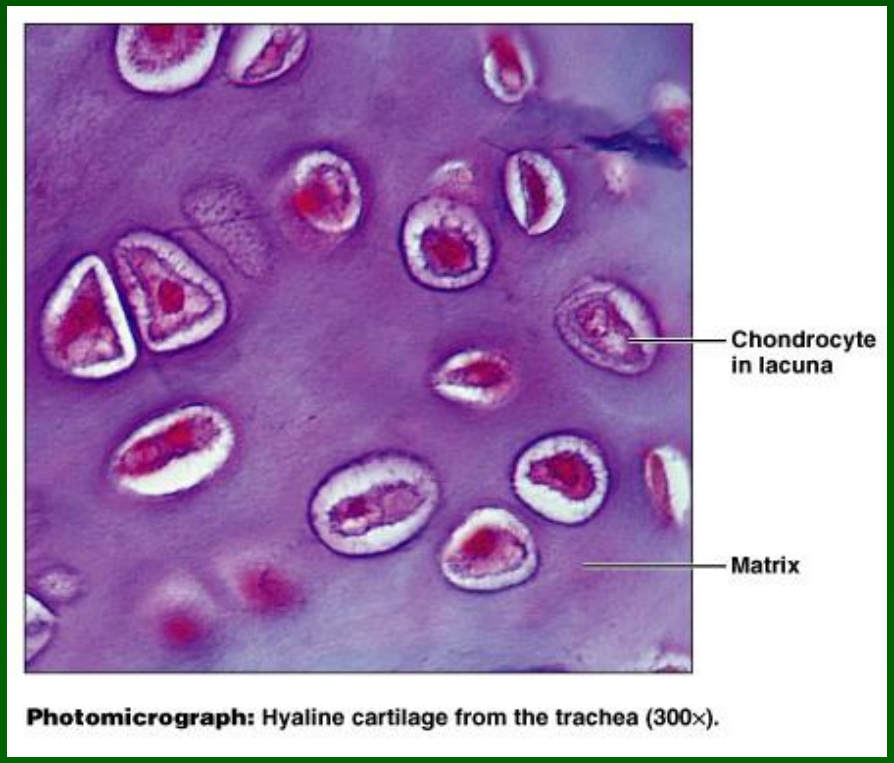


Hyaline Cartilage

- Description
  - Imperceptible collagen fibers (hyaline = glassy)
  - Chodroblasts produce matrix
  - Chondrocytes lie in lacunae
- Function
  - Supports and reinforces
  - Resilient cushion
  - Resists repetitive stress

Hyaline Cartilage

- Location
  - Fetal skeleton
  - Ends of long bones
  - Costal cartilage of ribs
  - Cartilages of nose, trachea, and larynx



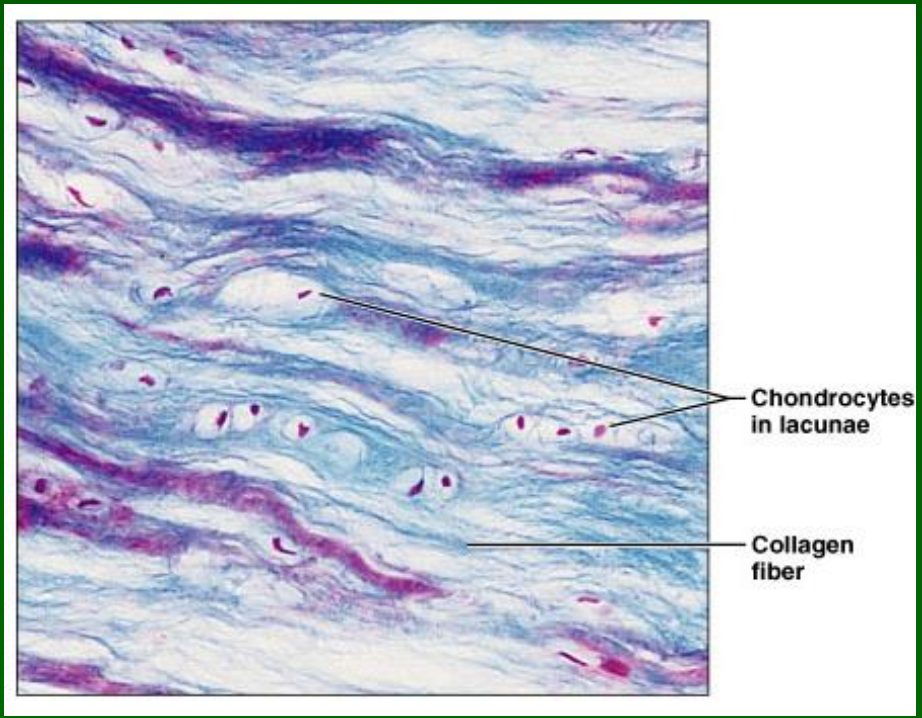
Photomicrograph: Hyaline cartilage from the trachea (300×).

Elastic Cartilage

- Description
  - Similar to hyaline cartilage
  - More elastic fibers in matrix
- Function
  - Maintains shape of structure
  - Allows great flexibility
- Location
  - Supports external ear
  - Epiglottis

Fibrocartilage

- Description
  - Matrix similar, but less firm than hyaline cartilage
  - Thick collagen fibers predominate
- Function
  - Tensile strength and ability to absorb compressive shock
- Location
  - Intervertebral discs
  - Pubic symphysis
  - Discs of knee joint



Summary of the Differences among the three main types of cartilage

	Hyaline Cartilage	Elastic Cartilage	Fibrocartilage
Extracellular matrix	• Type II Collagen • Aggrecan	• Type II Collagen • Aggrecan • Dark elastic fibres	• Dense connective tissue • Type I collagen • Type II collagen
Cells	• Chondrocytes • Chrondroblasts	• Chondrocytes • Chondroblasts	• Fibrochondrocytes
Cell Arrangement	• Isolated, Small • Isogenous groups	• Small isogenous groups	• Axially arranged isogenous groups • Isolated
Perichondrium	• Present	• Present	• Absent
Locations	• Epiphyseal plates of long bones • Fetal skeleton • Articular ends of long bones • Throughout the upper respiratory tract	• External ear • Auditory tube • External acoustic meatus • Epiglottis • Laryngeal cartilage	• Intervertebral discs • Symphysis pubis • Menisci • Tendinous insertions • Glenohumeral/acetabular labra • Tempormandibular joint
Functions	• Joint articulation • Scaffold for osteogenesis	• Structural support	• Weight bearing • Compression/ shear force resistance • Tenacity

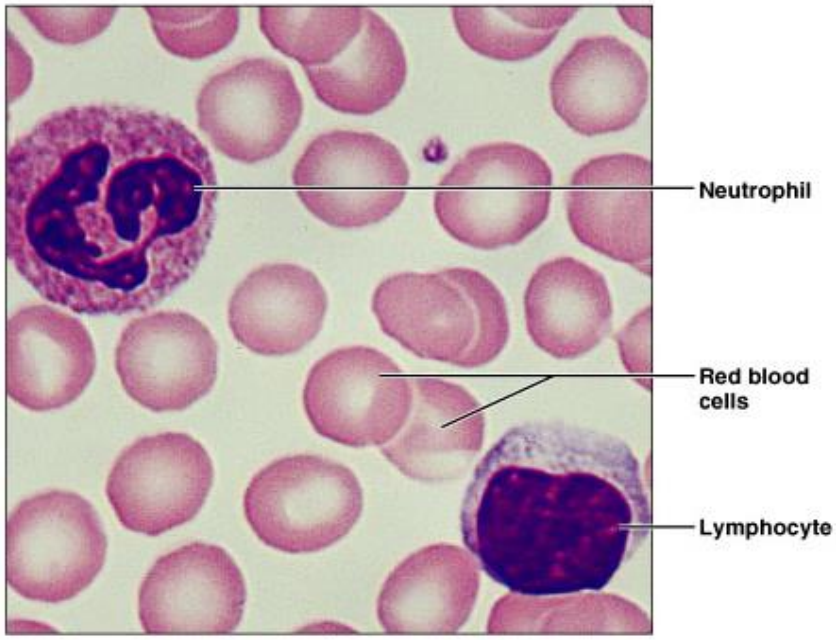
KEN HUB

Bone Tissue

- Function
  - Supports and protects organs
  - Provides levers and attachment site for muscles
  - Stores calcium and other minerals
  - Stores fat
  - Marrow is site for blood cell formation
- Location
  - Bones

Blood Tissue

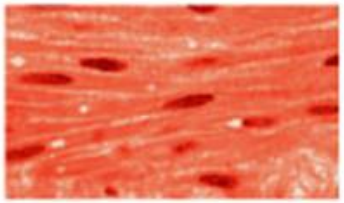
- Description
  - red and white blood cells in a fluid matrix
- Function
  - transport of respiratory gases, nutrients, and wastes
- Location
  - within blood vessels
- Characteristics
  - An atypical connective tissue
  - Develops from mesenchyme
  - Consists of cells surrounded by nonliving matrix

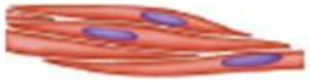


Photomicrograph: Smear of human blood (1500×); two white blood cells (neutrophil in upper left and lymphocyte in lower right) are seen surrounded by red blood cells.

Muscle Tissue

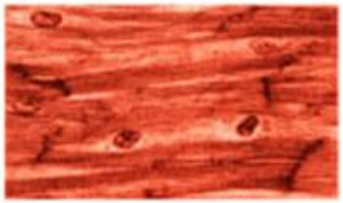
- Types
  - Skeletal muscle tissue
  - Cardiac muscle tissue
  - Smooth muscle tissue





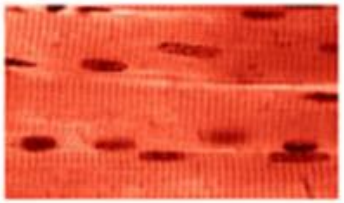
Smooth muscle

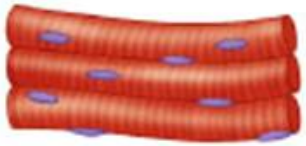
- has spindle-shaped, nonstriated uninucleated fibers.
- occurs in walls of internal organs.
- is involuntary.



Cardiac muscle

- has striated, branched, uninucleated fibers.
- occurs in walls of heart.
- is involuntary.



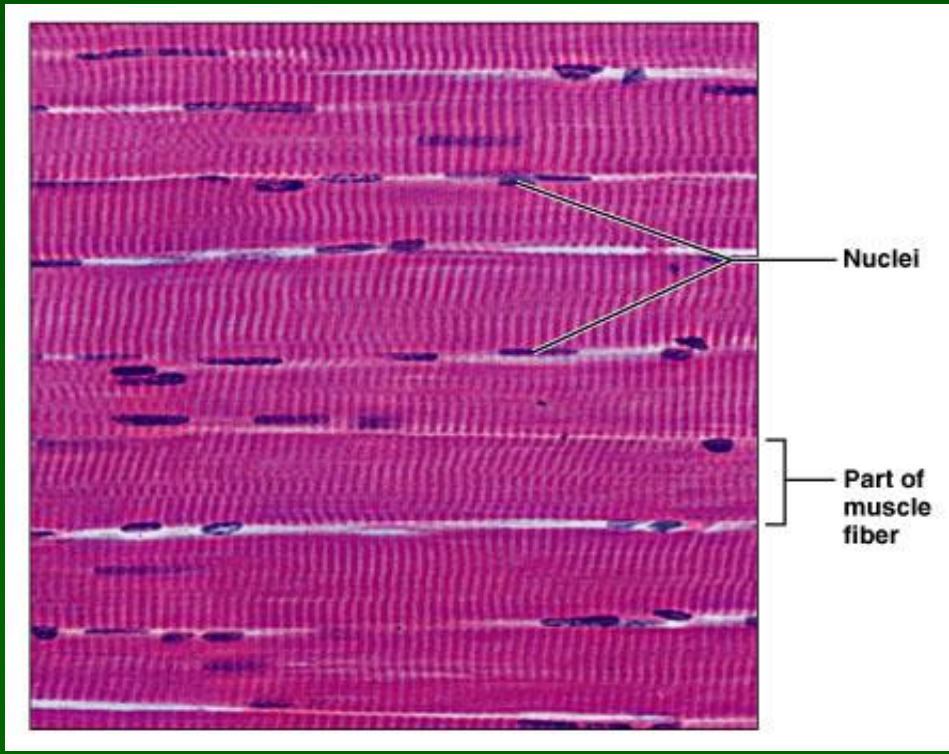


Skeletal muscle

- has striated, tubular, multinucleated fibers.
- is usually attached to skeleton.
- is voluntary.

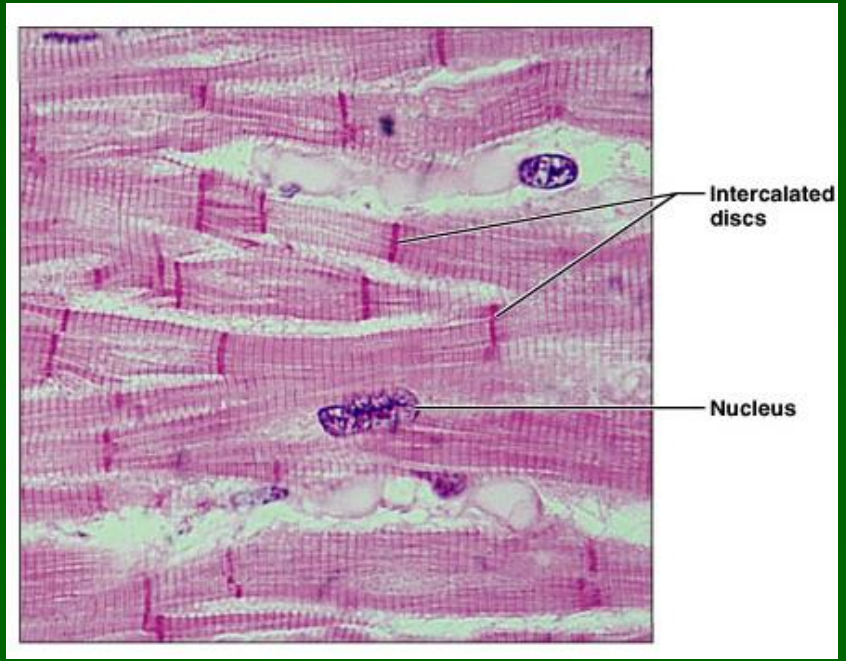
Skeletal Muscle Tissue

- Characteristics
  - Long, cylindrical cells
  - Multinucleate
  - Obvious striations
- Function
  - Voluntary movement
  - Manipulation of environment
  - Facial expression
- Location
  - Skeletal muscles attached to bones (occasionally to skin)



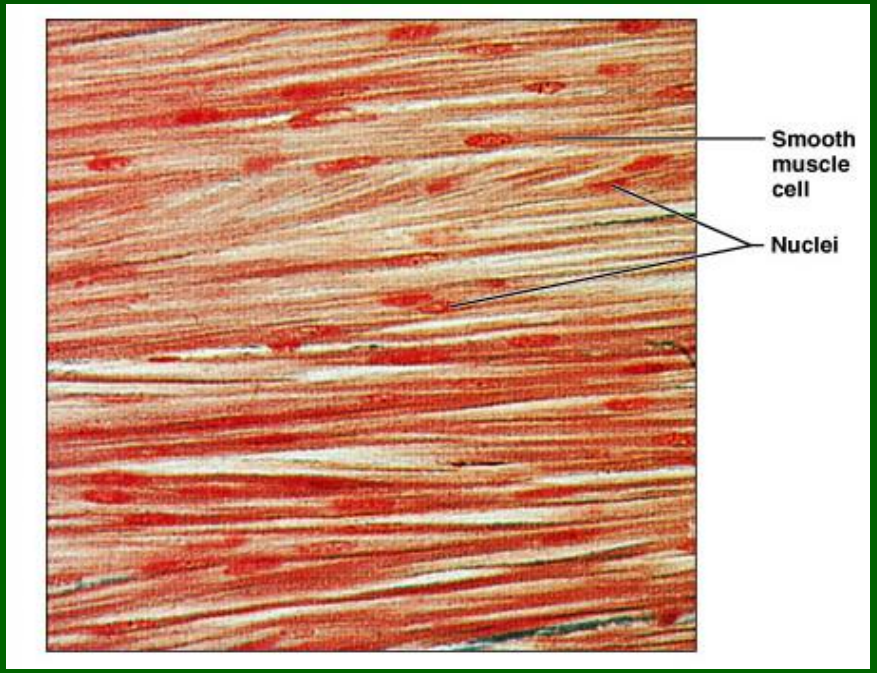
Cardiac Muscle Tissue

- Function
  - Contracts to propel blood into circulatory system
- Characteristics
  - Branching cells
  - Uninucleate
  - Striations
  - Intercalated discs
- Location
  - Occurs in walls of heart



Smooth Muscle Tissue

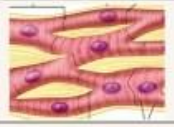
- Characteristics
  - Spindle-shaped cells with central nuclei
  - Arranged closely to form sheets
  - No striations
- Function
  - Propels substances along internal passageways
  - Involuntary control
- Location
  - Mostly walls of hollow organs



Gross features

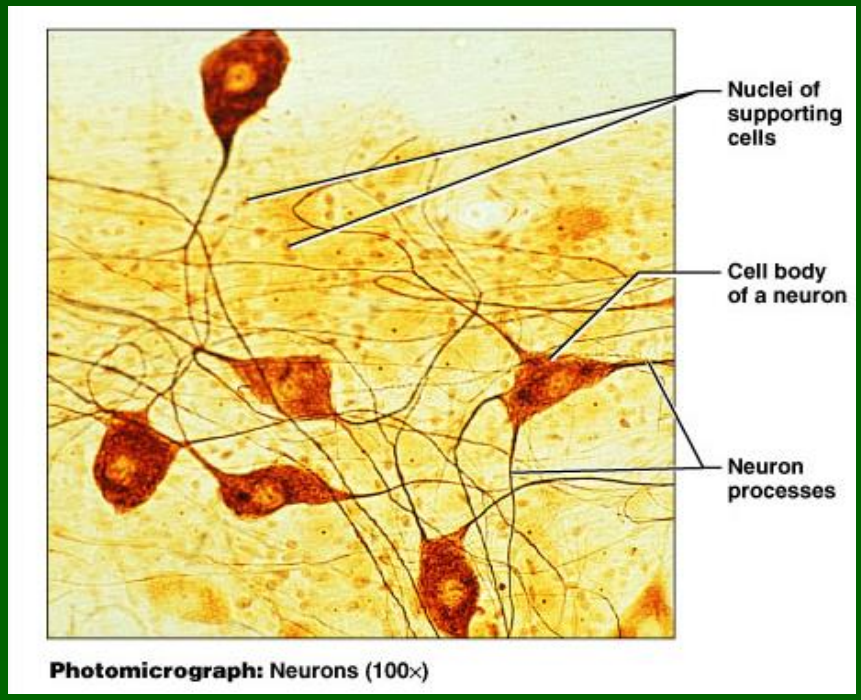
Property	Skeletal Muscle 	Cardiac Muscle 	Smooth Muscle 
Location	Attached to skeleton	Heart	Walls of blood vessels and hollow viscera
Function	Locomotion and movement of parts of body	Pump blood into arteries	Constriction of BVs, bronchi and peristalsis
Speed of Contraction	Fast	Intermediate	Slow
Nerve supply	Somatic NS	Autonomic NS	Autonomic NS
Control	Voluntary	Involuntary	Involuntary

Microscopic features

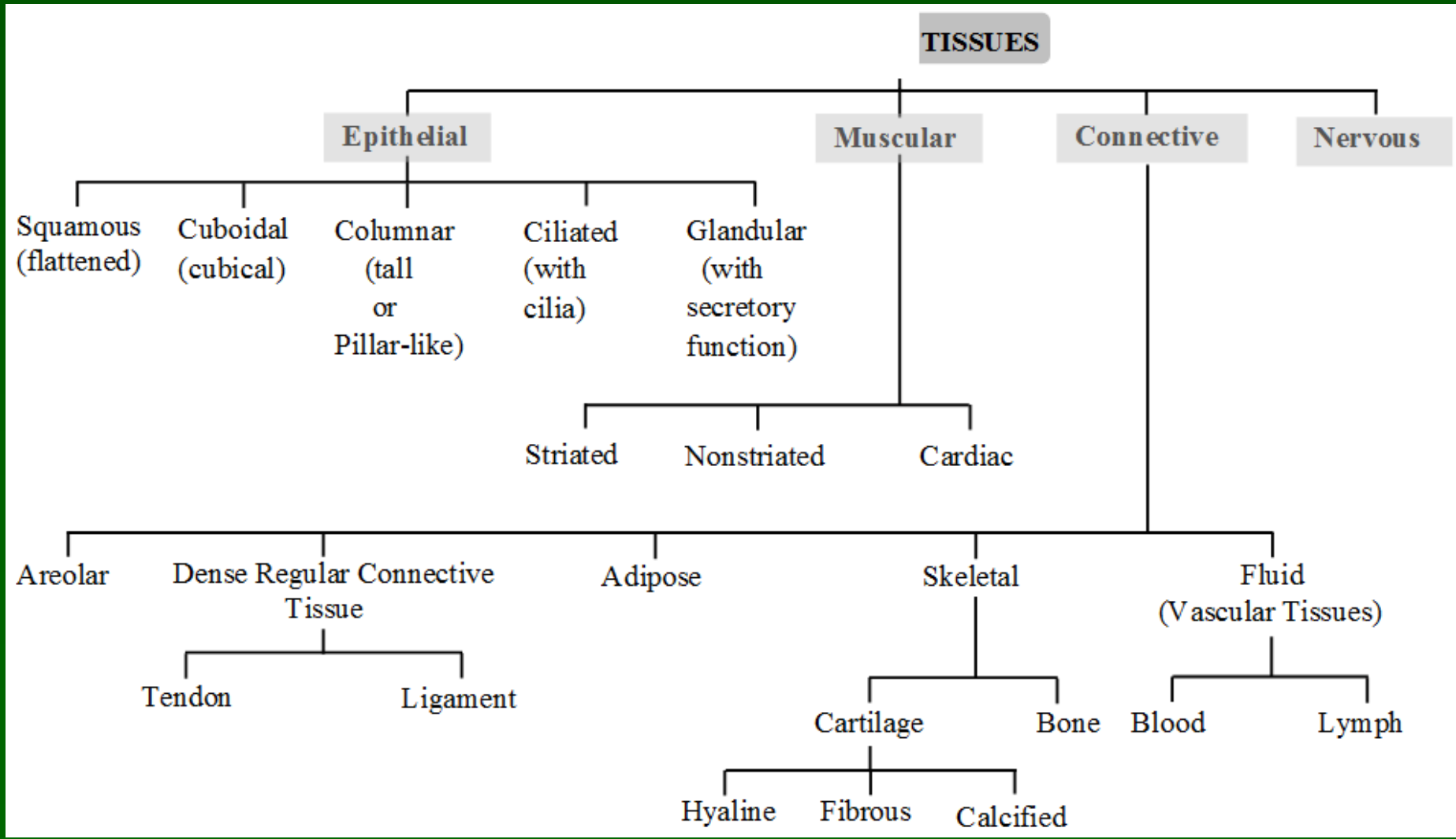
Features	Skeletal Muscle	Cardiac Muscle	Smooth Muscle
			
Shape of muscle fiber	Cylindrical	Cylindrical and branched	Fusiform
Striations	Yes	Yes	No
Nuclei	Many, located peripherally	Single, located centrally	Single, located centrally
Cells Connected by	-	Intercalated Discs	Gap Junctions

Nervous Tissue

- Function
  - Transmit electrical signals from sensory receptors to effectors
- Location
  - Brain, spinal cord, and nerves
- Description
  - Main components are brain, spinal cord, and nerves
  - Contains two types of cells
    - Neurons – excitatory cells
    - Supporting cells (neuroglial cells)



Photomicrograph: Neurons (100×)


TISSUES
Epithelial
Muscular
Connective
Nervous
Squamous (flattened)
Cuboidal (cubical)
Columnar (tall or Pillar-like)
Ciliated (with cilia)
Glandular (with secretory function)
Striated
Nonstriated
Cardiac
Areolar
Dense Regular Connective Tissue
Adipose
Skeletal
Fluid (Vascular Tissues)
Tendon
Ligament
Cartilage
Bone
Blood
Lymph
Hyaline
Fibrous
Calcified


thank you