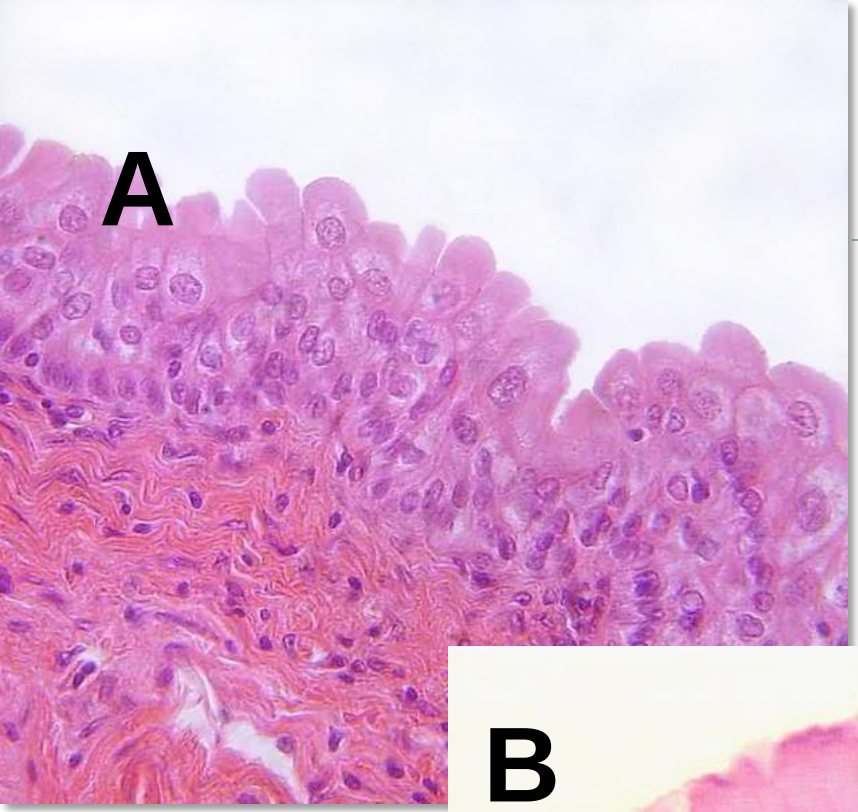
Anatomy and Physiology
Chapter 3: Cells and Tissues

Connective Tissue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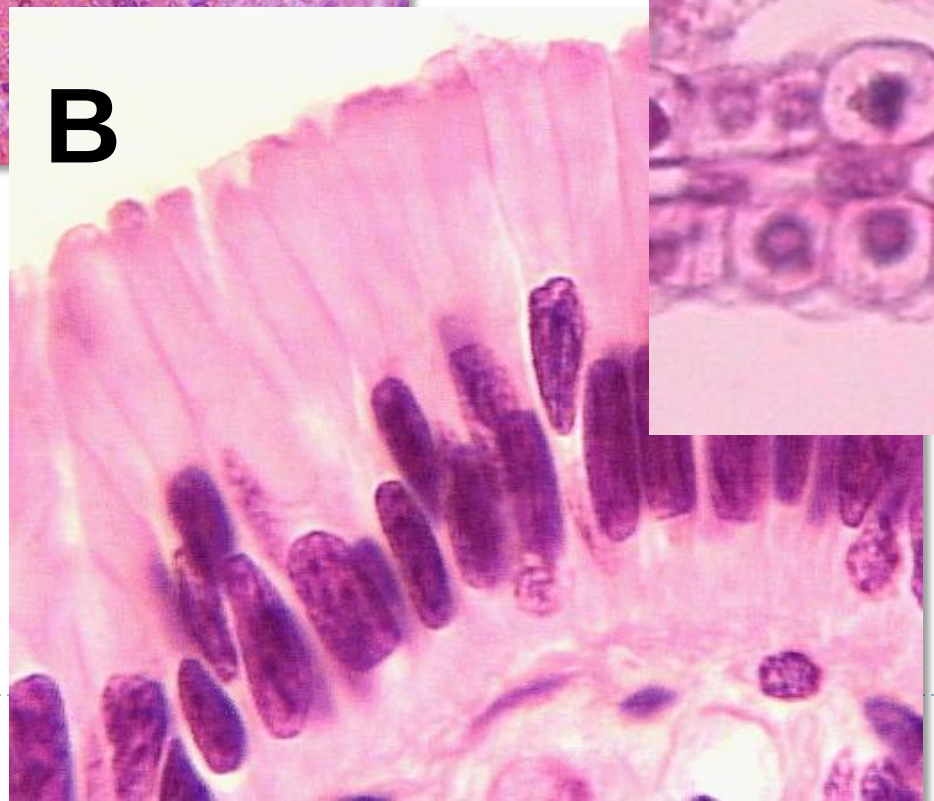
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2. Connective Tissue

(2nd primary tissue type)

- Found everywhere in the body; but the amount varies greatly
- Includes the most abundant and widely distributed tissues

Connective Tissue cont.

- Main subgroups/types
  1. Bone
  2. Hyaline Cartilage
  3. Dense Fibrous
  4. Areolar
  5. Adipose
  6. Blood

2 Connective Tissue Characteristics

1. Vascular (varies with type)
   - Cartilage is avascular
   - Dense connective tissue is poorly vascularized
   - Other types—rich blood supply

2 Connective Tissue Characteristics

2. Extracellular Matrix

- What is matrix?
  - Nonliving ground substance: (fluid to hard) & fibers (collagen, elastic, or reticular)
- Why is matrix important?
  - Matrix is what enables connective tissue to bear weight, withstand great tension, & endure abuses such as physical trauma or abrasion

Connective Tissue cont.

- Major functions are
  1. Protection—bone, cartilage, & fat
  2. Support—bone & cartilage
  3. Binding—connective tissue
  4. Transportation—blood
  5. Insulation—fat

3 Structural Elements of Connective Tissue

- 3 main components of connective tissue

matrix
- 1. Ground substance
- 2. Fibers

3. Cells

3 Structural Elements of Connective Tissue

1. Ground Substance *(found in matrix)*

- Amorphous (unstructured) material that fills the space
- Made of interstitial fluid
- Functions as molecular "sieve" or medium thru which nutrients & other substances can diffuse b/w blood & cells

3 Structural Elements of Connective Tissue

2. **Fibers**: 3 types of fibers

A. **Collagen (glistens white)**
   - Extremely tough & provides tensile strength

B. **Elastin (yellow)**
   - Coiled structure can stretch & recoil like a rubber band
   - Provides elasticity (skin, lungs, & blood vessel walls)

C. **Reticular**
   - Fine collagen fibers, netlike
   - Constructs fine mesh around small blood vessels, support soft tissue of organs.

3 Structural Elements of Connective Tissue

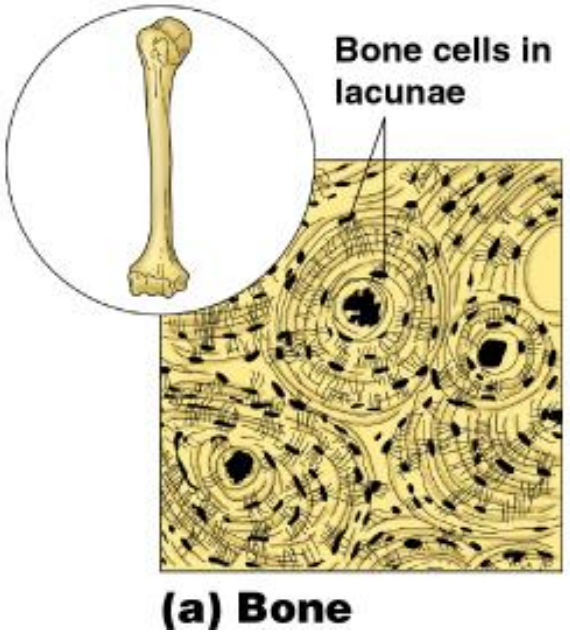
3. Cells

- Primary cell types are:
  1. Bone → osteoblast
  2. Cartilage → chondroblast
  3. Connective tissue proper → fibroblast
  4. Blood → hemocytoblast (always actively mitotic)
- Each cell type exists in immature & mature forms
  - These cells are actively mitotic when immature & less active when mature

"—blast" = immature cell "—cyte" = mature cell

Connective Tissue Types

1. Bone (osseous)

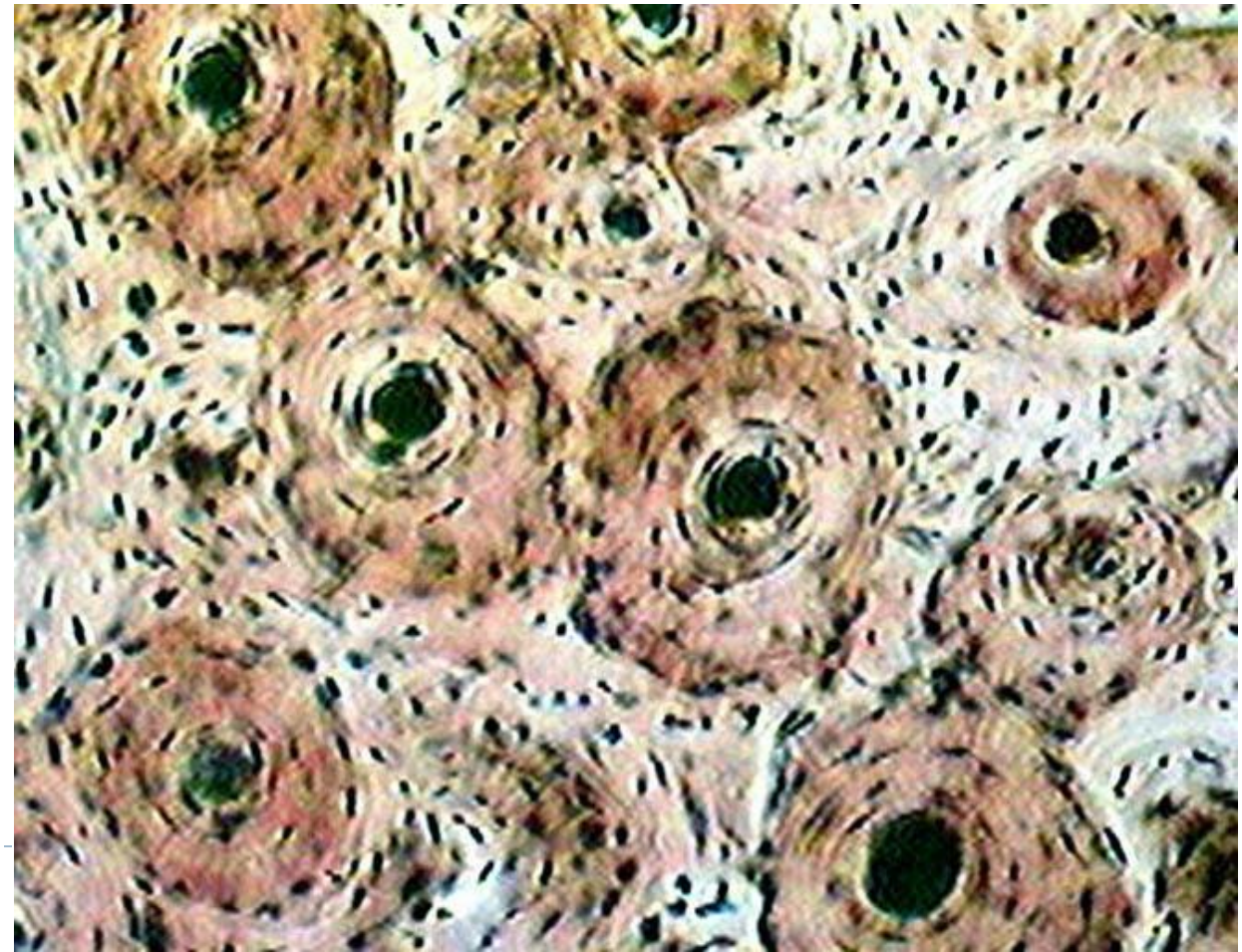


- Protect and supports the body
- Fat storage
- Synthesis of blood cells
- *Composed of:*
  - **Osteoblast** cells in lacunae (cavities)
  - Hard matrix of calcium salts (bone salts)
  - Large numbers of collagen fibers

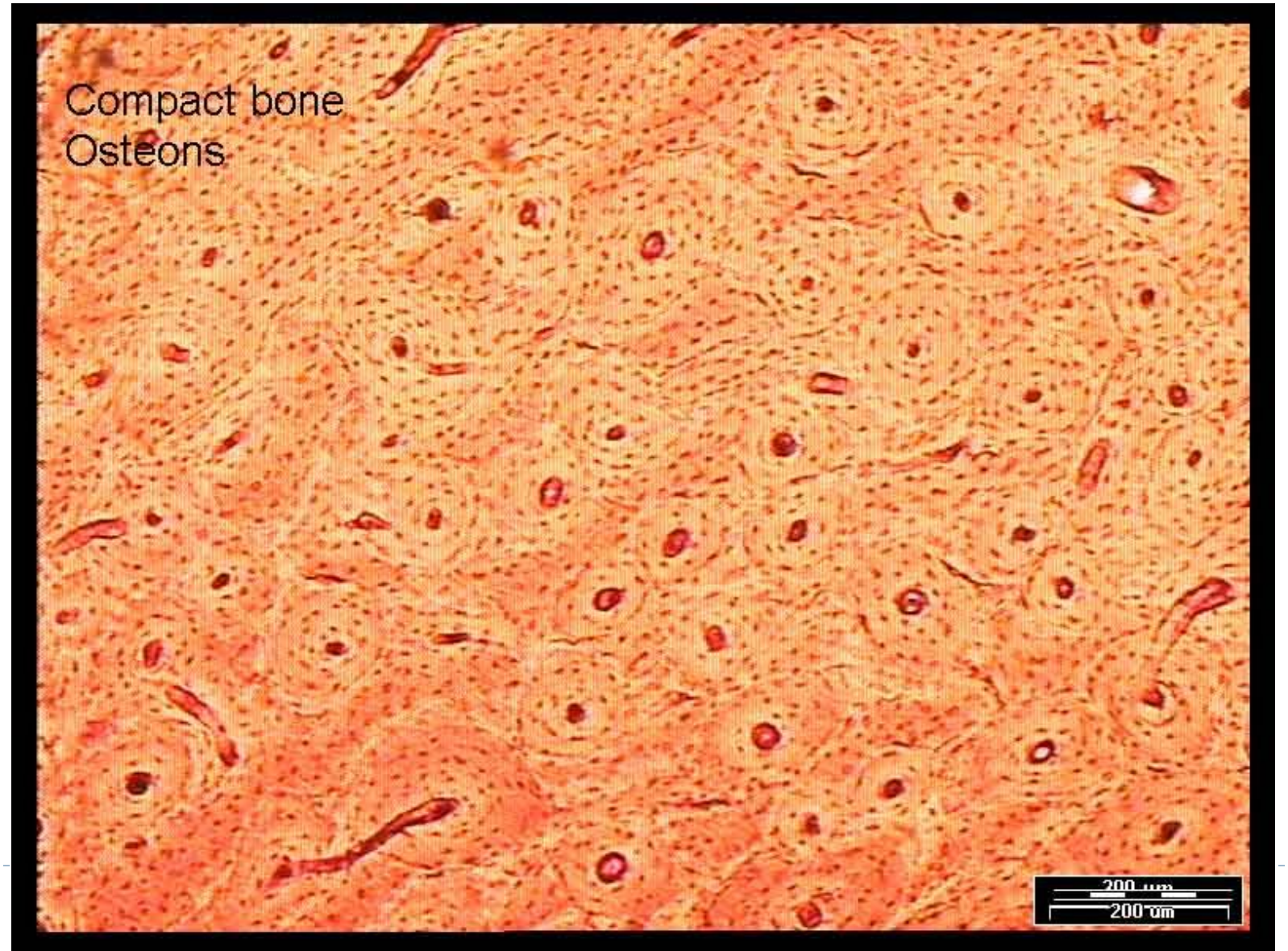
b/c of these 2, bone matrix is harder & more rigid than cartilage matrix

BONE

- Osseous tissue
  - Compact Bone has a hard matrix made of calcium salts

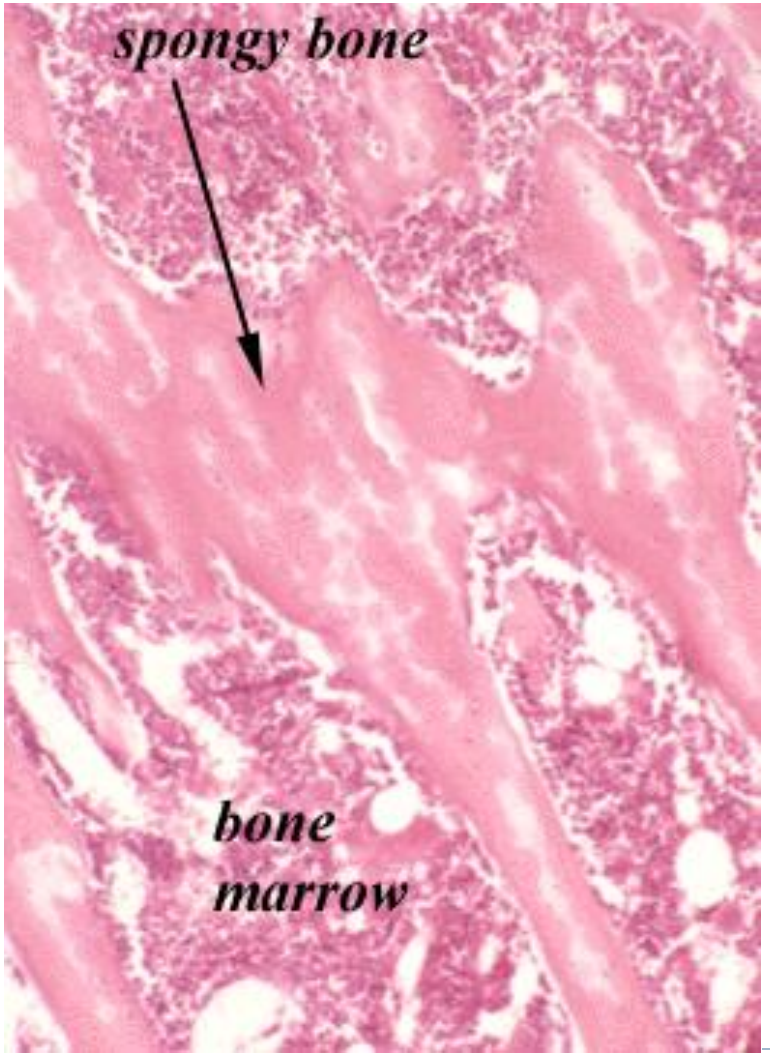


Compact Bone



SPONGY BONE

- Growing Bone
- RBC formation



Check…

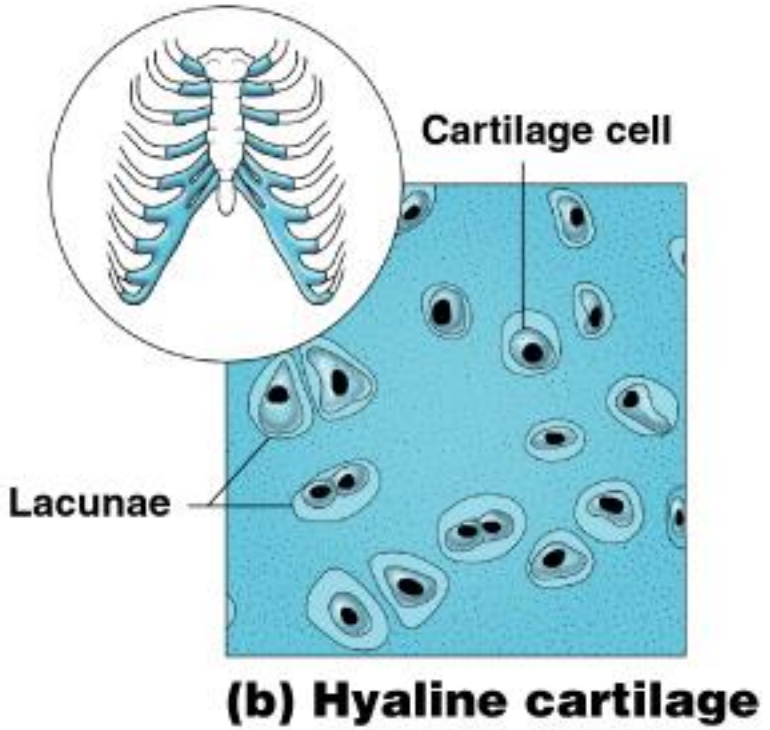
- What are the three components of all connective tissue?
- What is the Matrix made of?
- What are the mature cells of bone and cartilage called?

Connective Tissue

Type 2. Cartilage

Hyaline cartilage

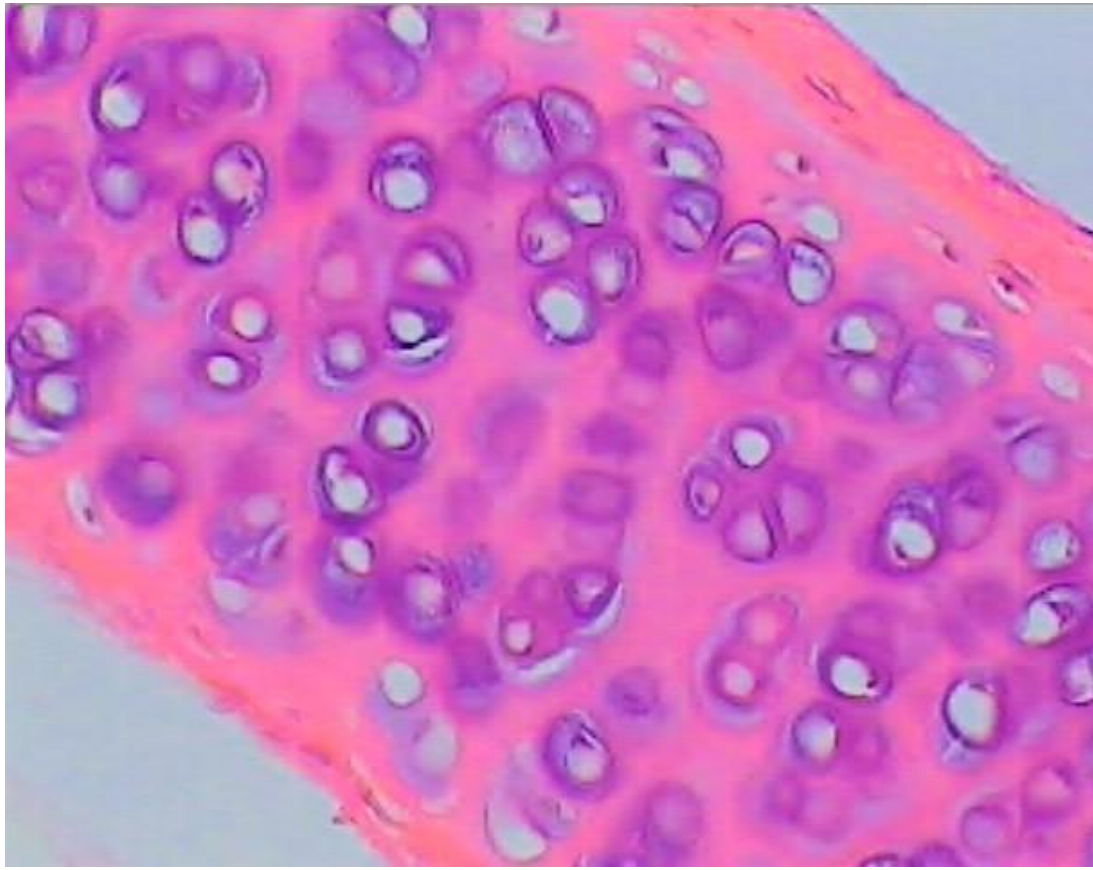
- Supports & reinforces
- Resilient cushioning properties
- Resists compressive stress
- Active growing regions near the end of long bones
- Found in larynx, ribs, end of long bones
- Chondrocytes and collagen



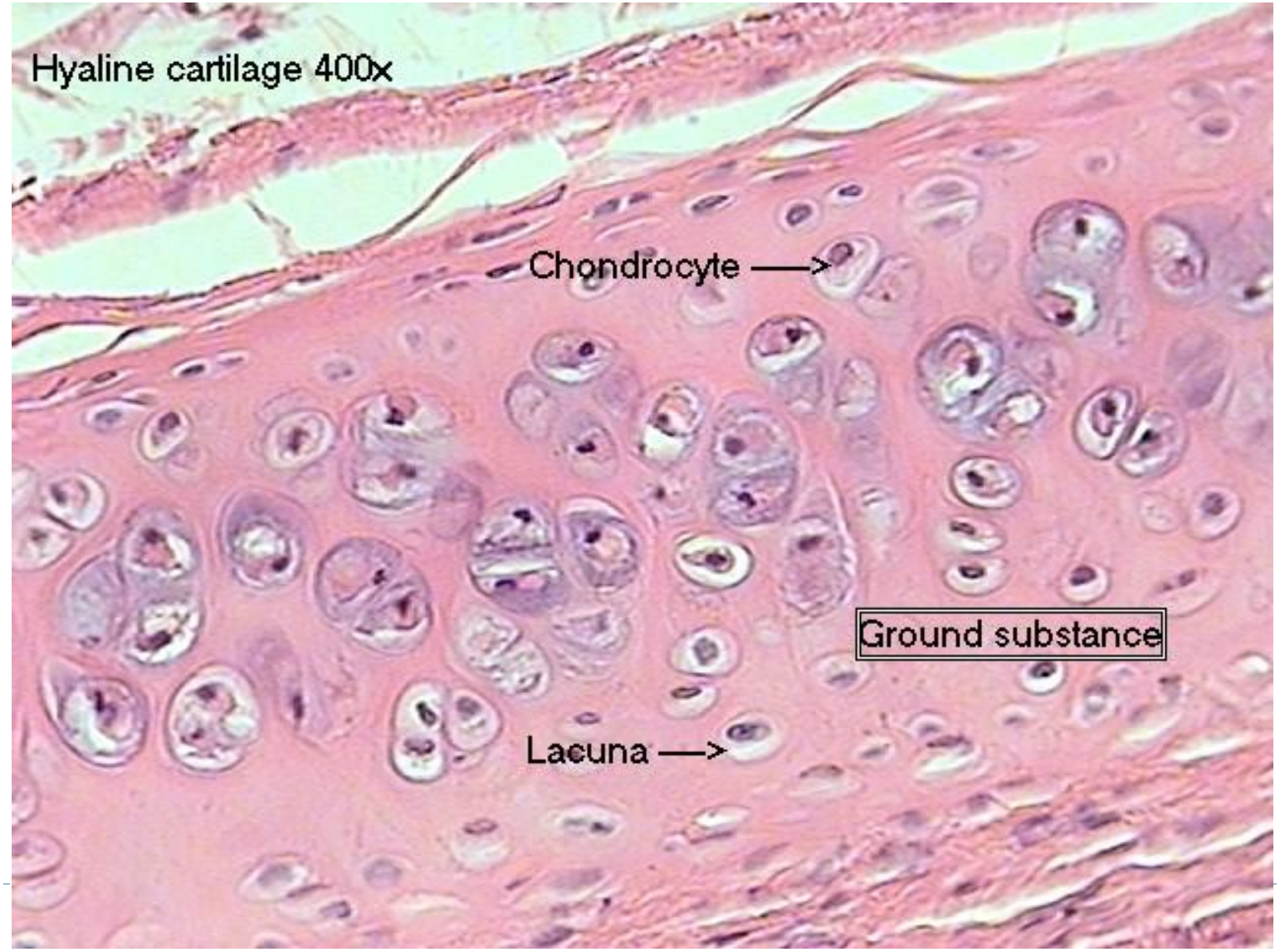
(b) Hyaline cartilage

Hyaline Cartilage

- Found in larynx, attached ribs to breastbone, ends of bones (joints)
- Hard and Durable

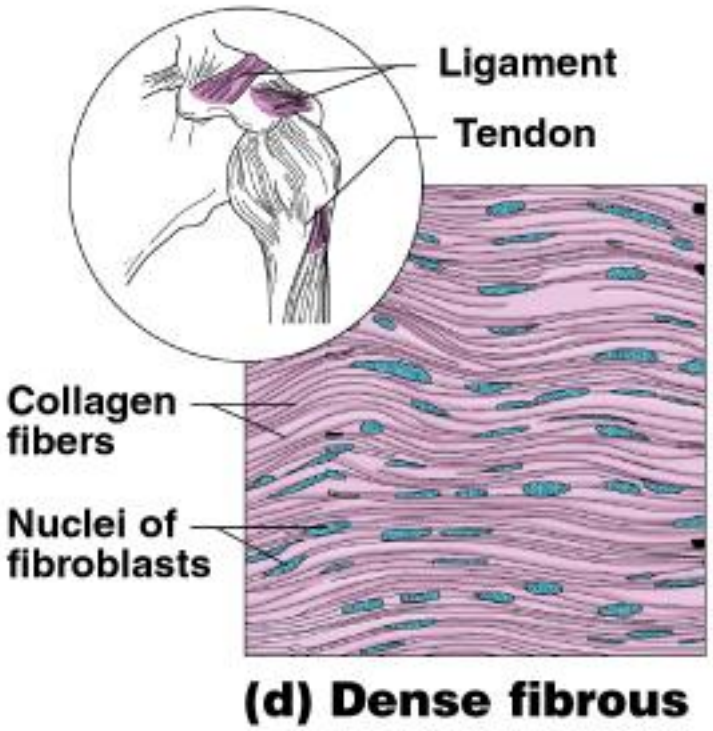


Hyaline Cartilage



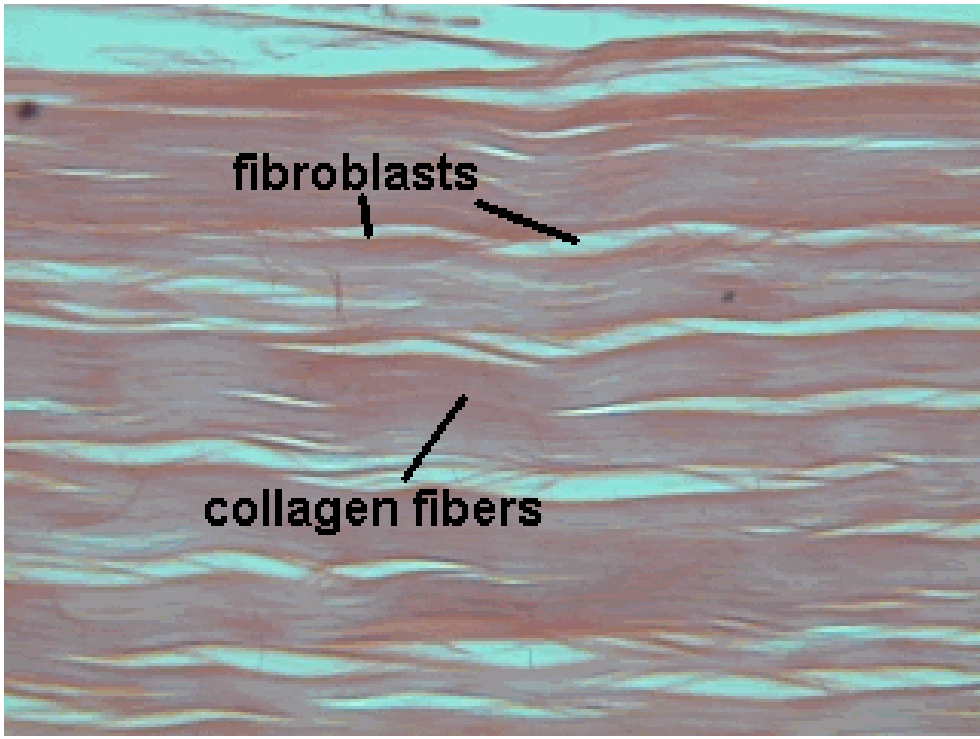
Connective Tissue Types
Type: 3. Dense Fibrous

- Main matrix element is **collagen** fibers
- Cells are **fibroblasts**
- Examples:
  - Tendon – attach muscle to bone
  - Ligaments – attach bone to bone

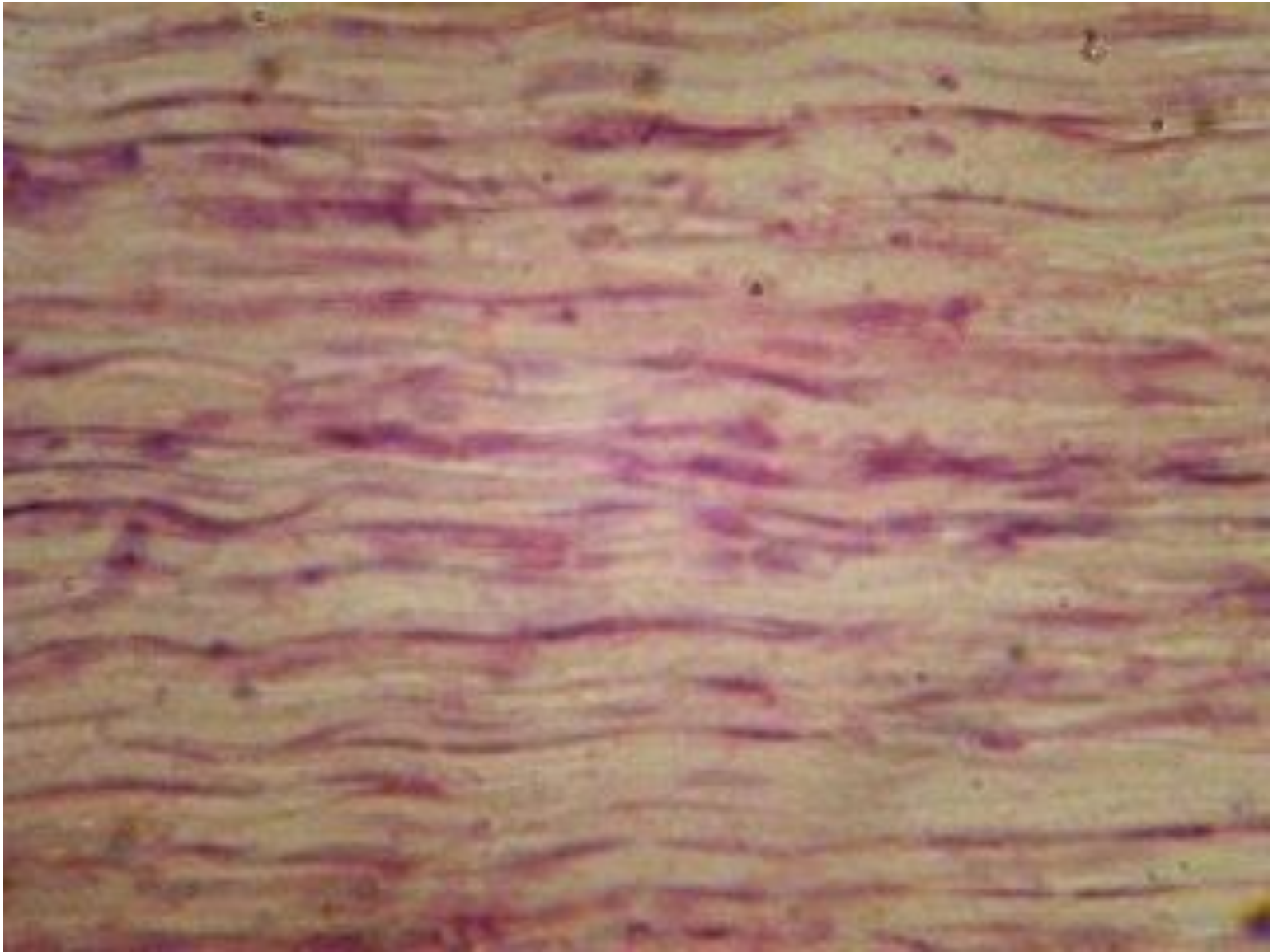


Dense Fibrous Tissue

- Tendons
  - Attach muscles to skeletal bones
- Ligaments
  - Attach bones to bones



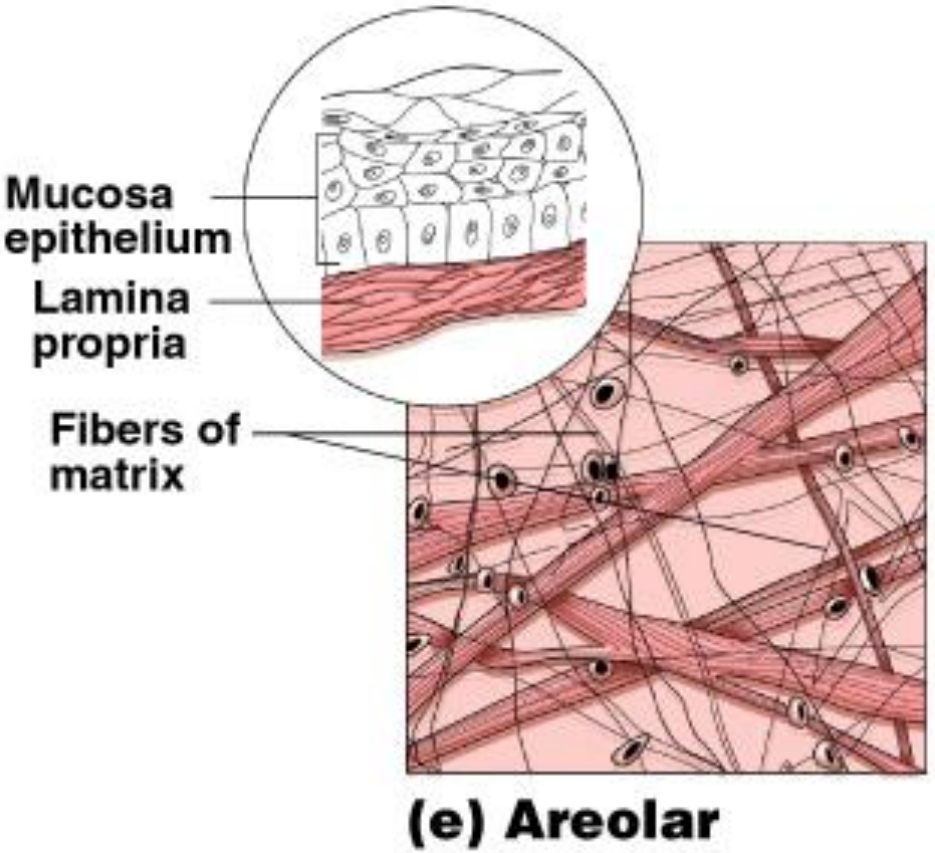
Dense Fibrous Tissue



Connective Tissue Types

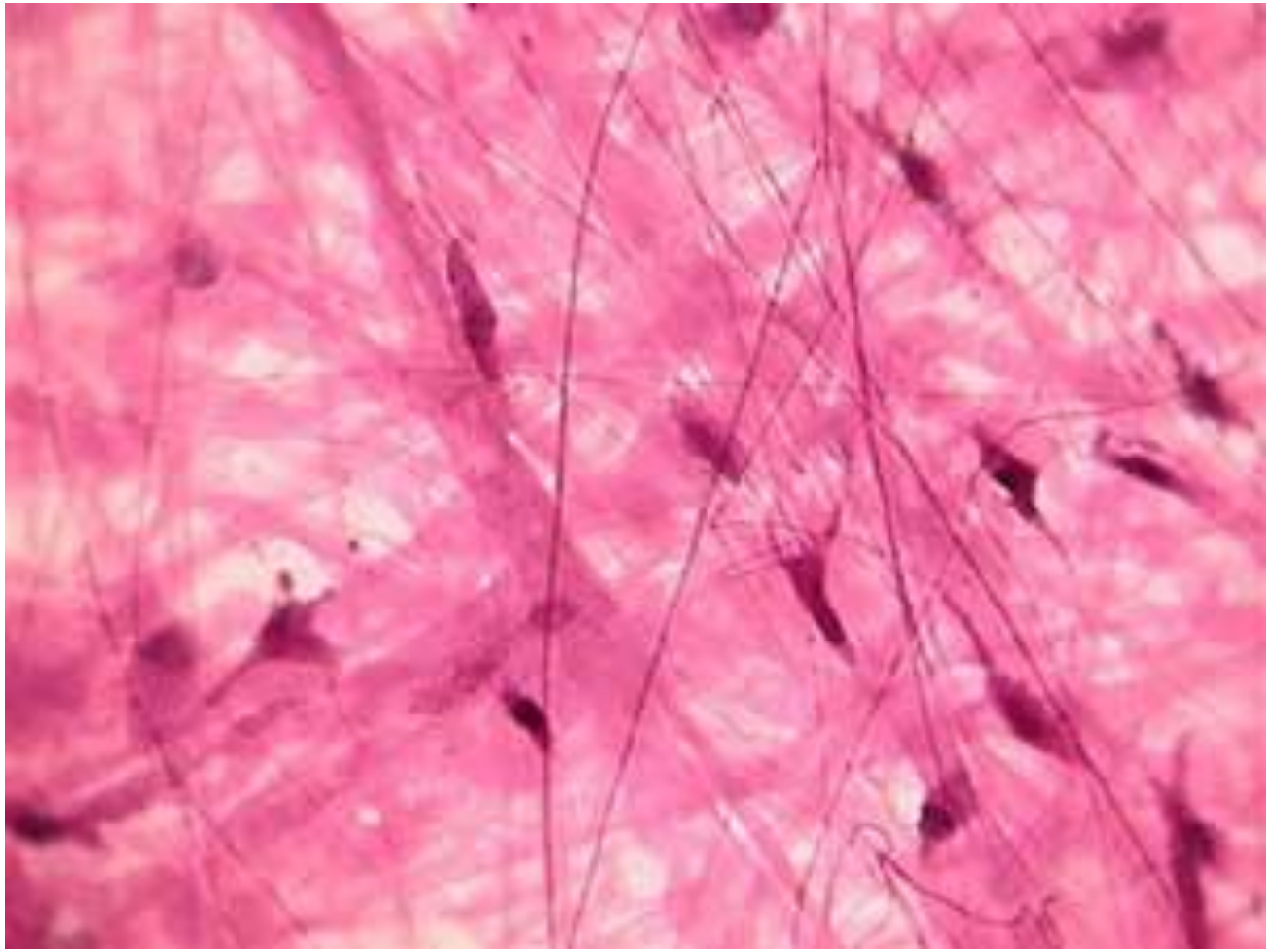
Type 4. Areolar

- Most widely distributed connective tissue
- Soft, pliable tissue
- Contains all fiber types
- Can soak up excess fluid
- Wraps organs & holds them in position

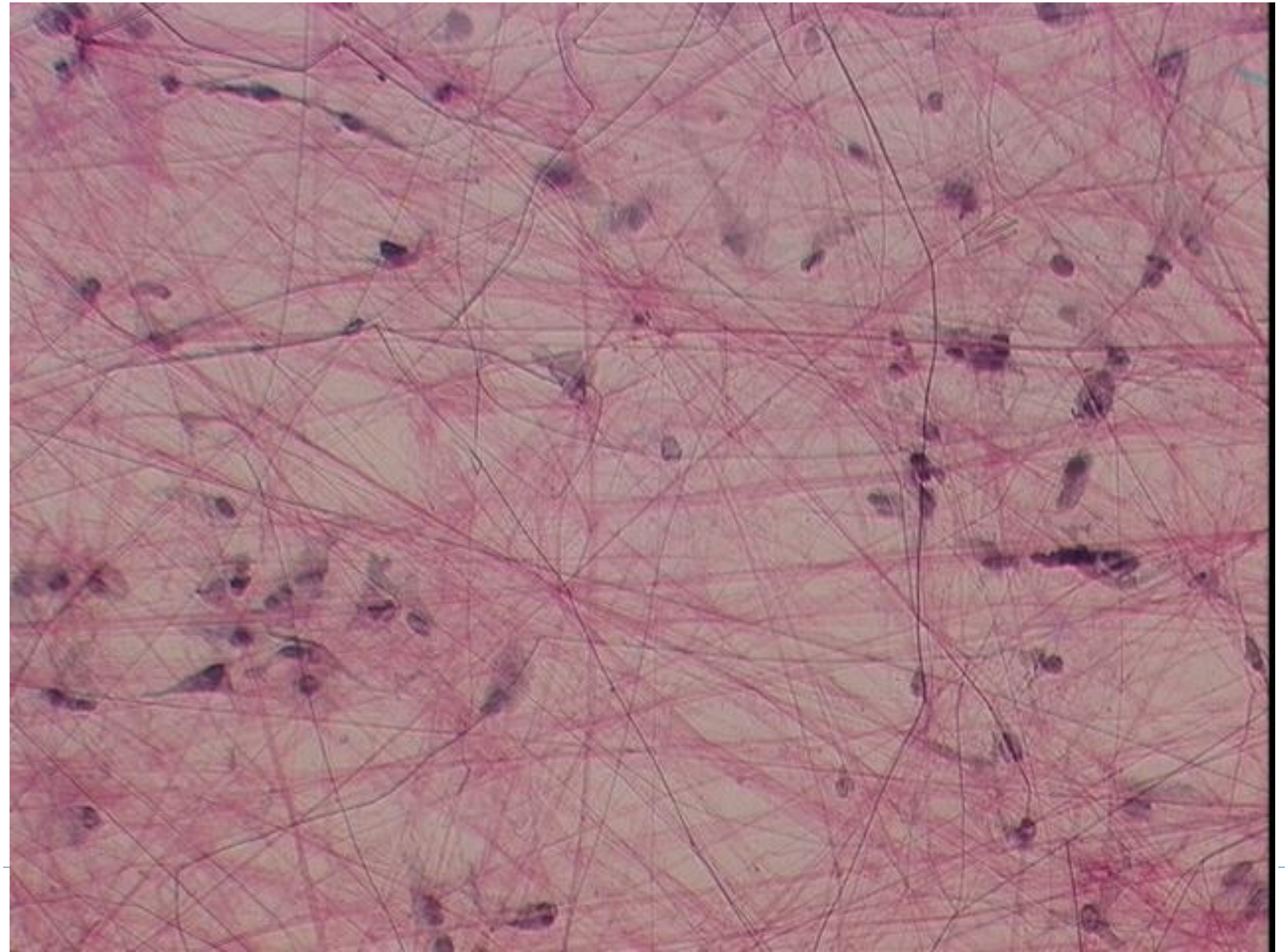


Areolar Tissue

- Connective Tissue Glue

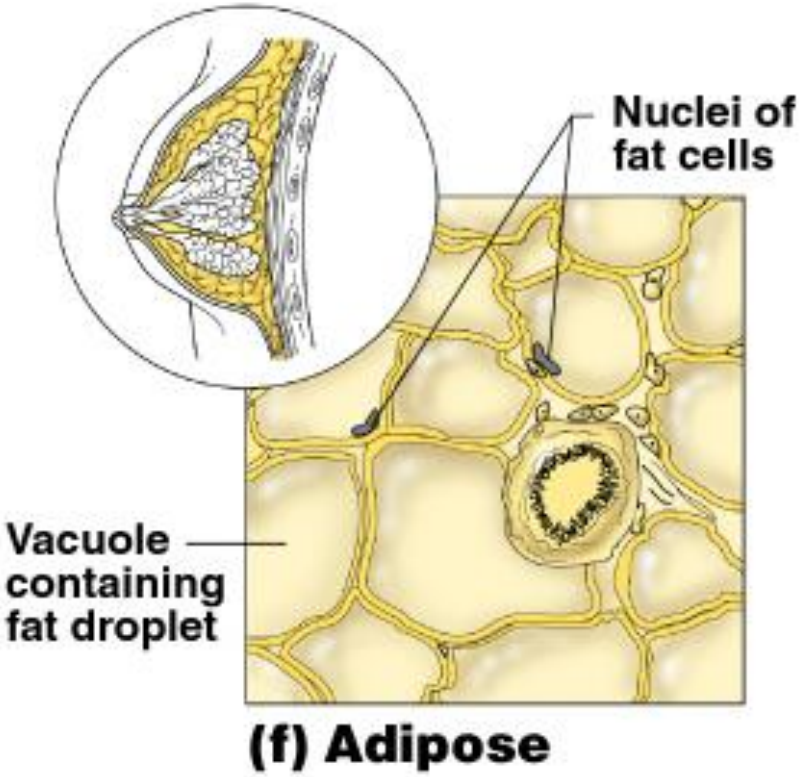


Areolar Tissue



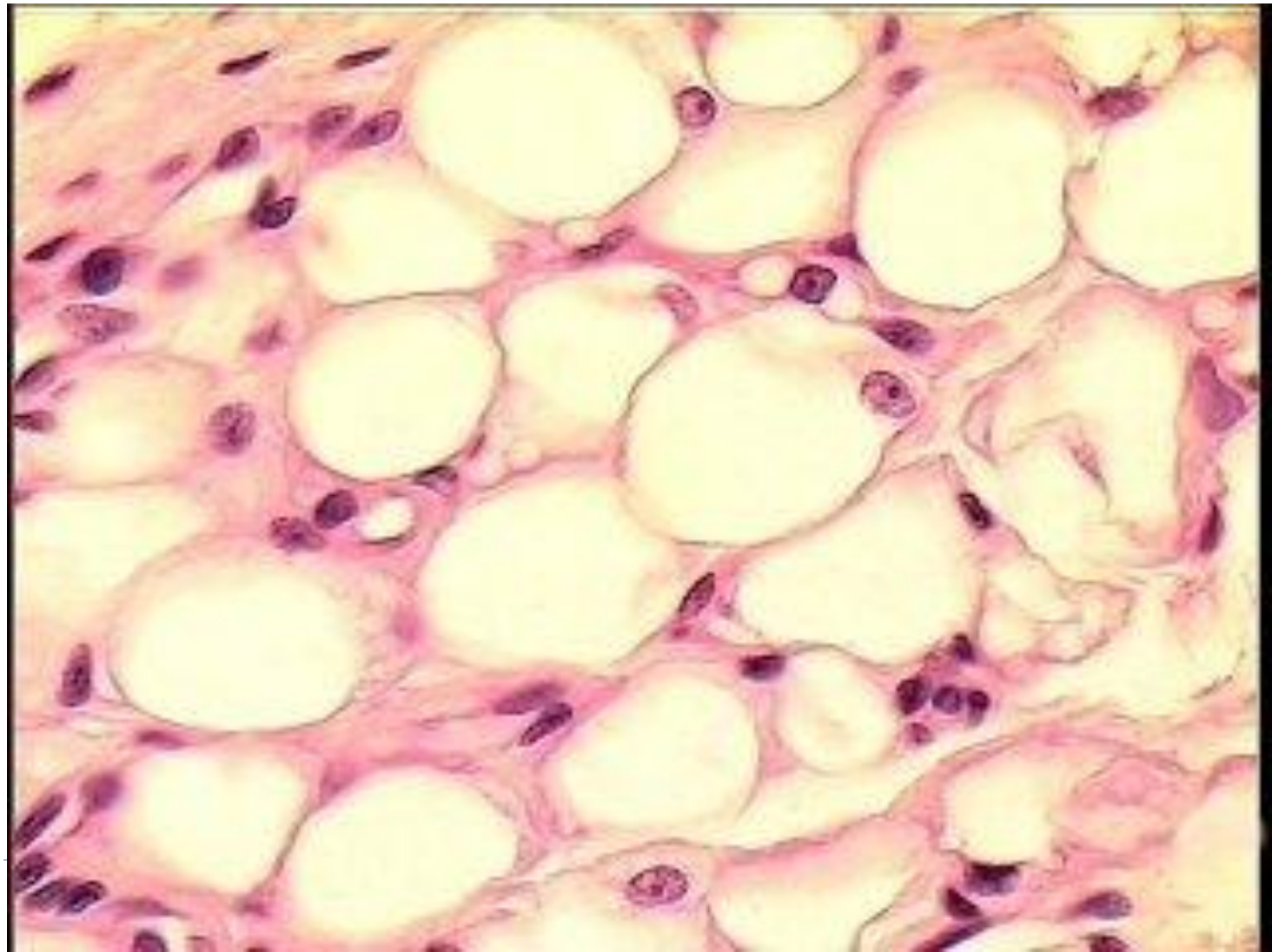
Loose Connective Tissue
Type 5. Adipose

- an areolar tissue in which fat cells predominate
- Functions:
  - Insulates the body
  - Protects some organs
  - Serves as a site of fuel storage—ex. hips and breasts serve as fat "depots"

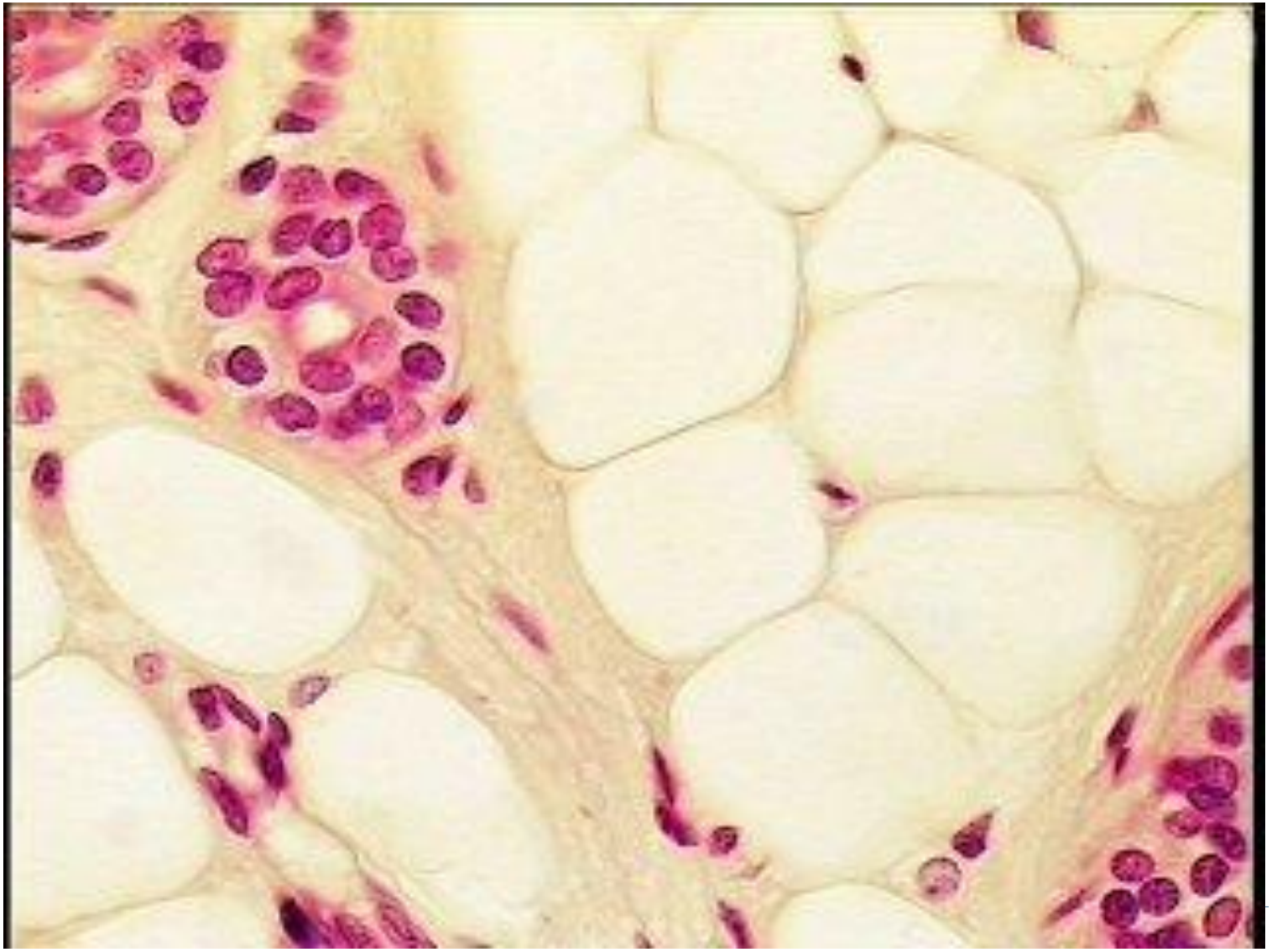


Adipose Tissue

- Fat, areolar tissue where fat cell predominate



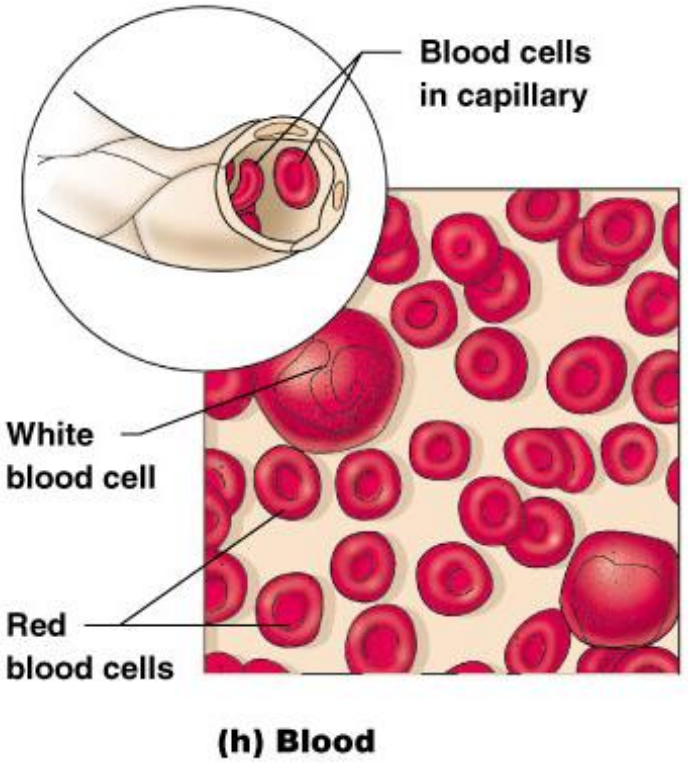
Adipose Tissue



Connective Tissue Types—

5. Blood

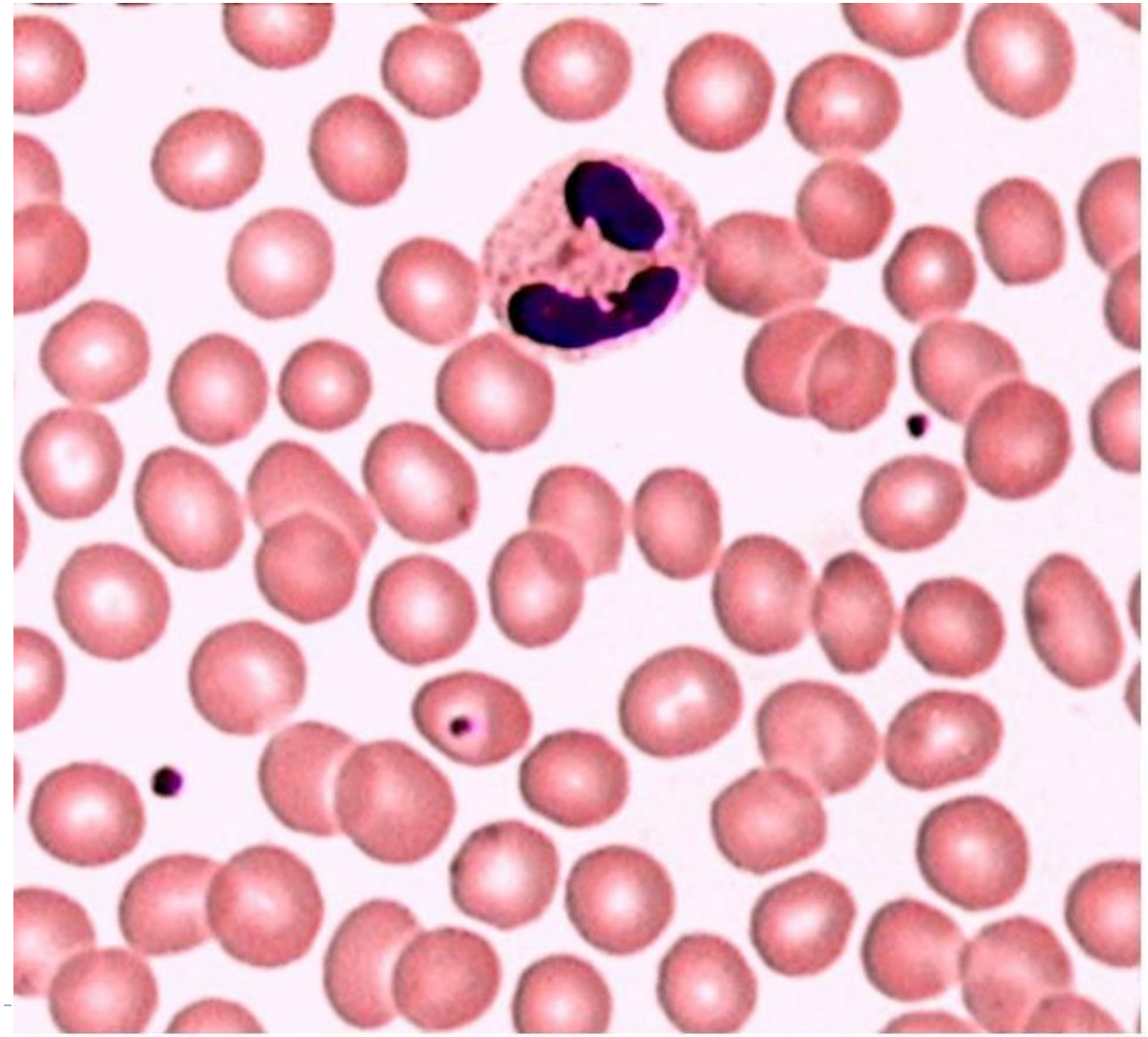
- Most atypical connective tissue
- Consists of blood cells , hemocytoblast, and nonliving fluid matrix and fibers visible when clotting
- Functions --transport vehicle for materials for CV system, carries nutrients, wastes, respiratory gases, & other substances



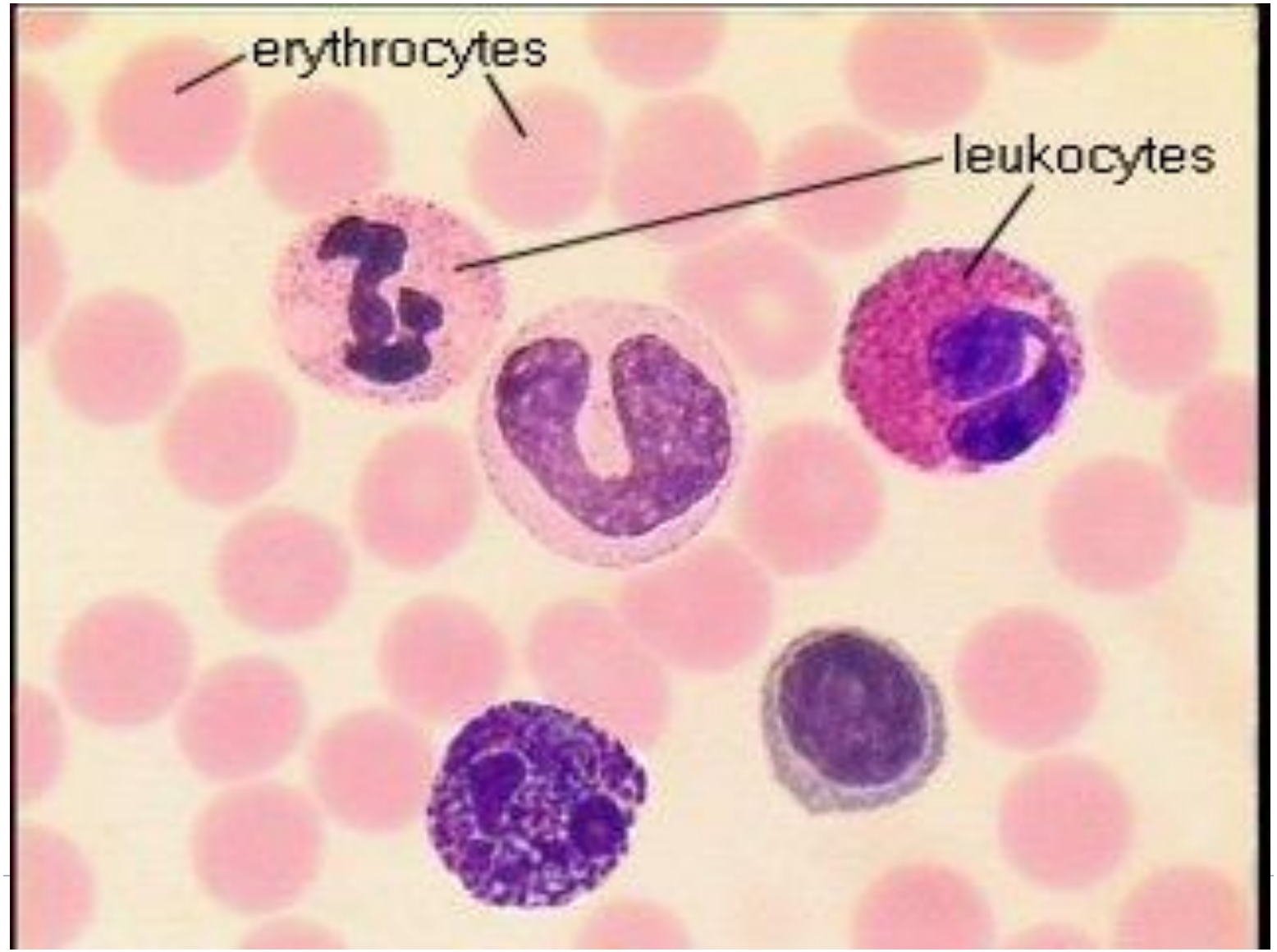
(h) Blood

Blood

- Hemocytoblasts
- Matrix
- Fibers (clotting)



Blood Tissue



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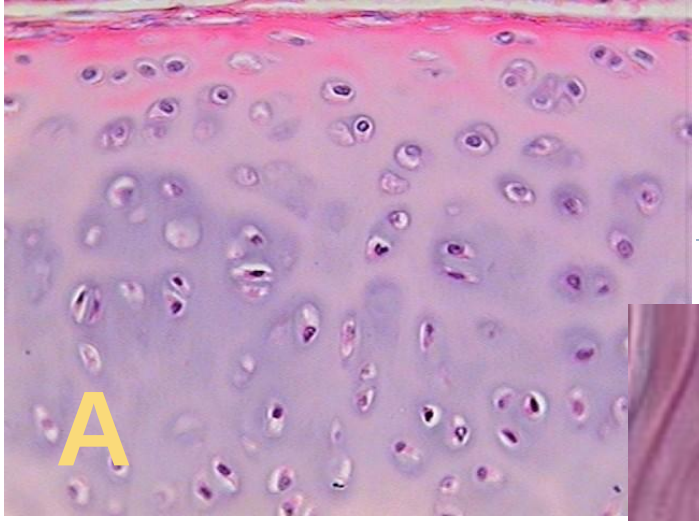
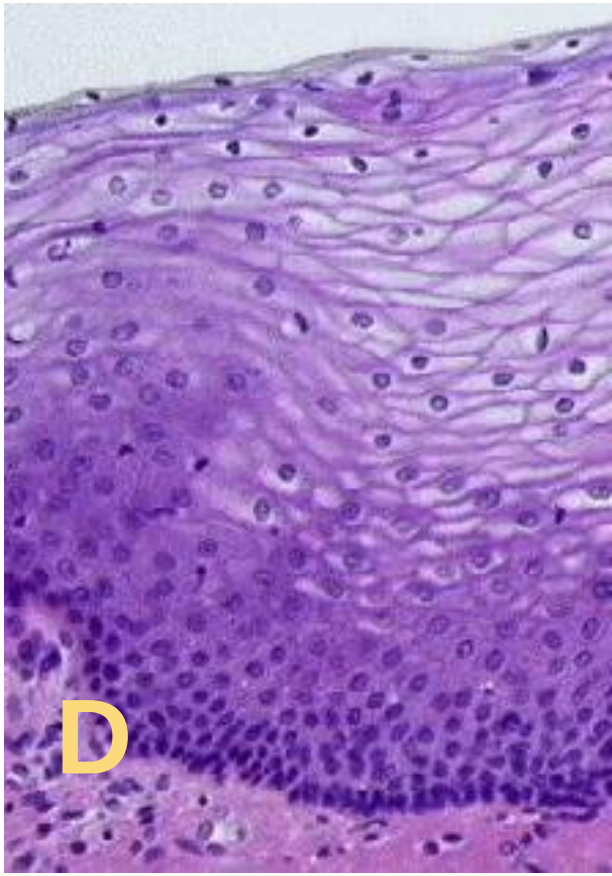
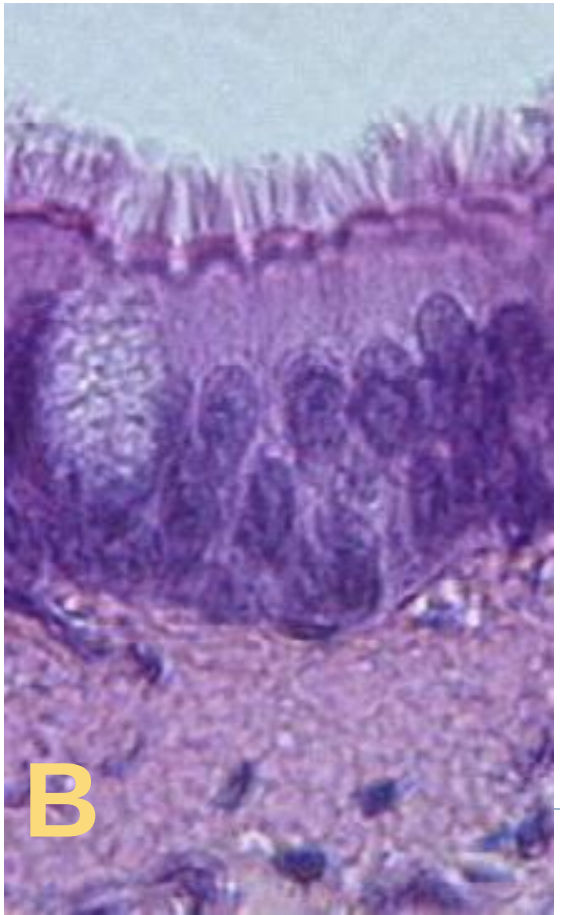
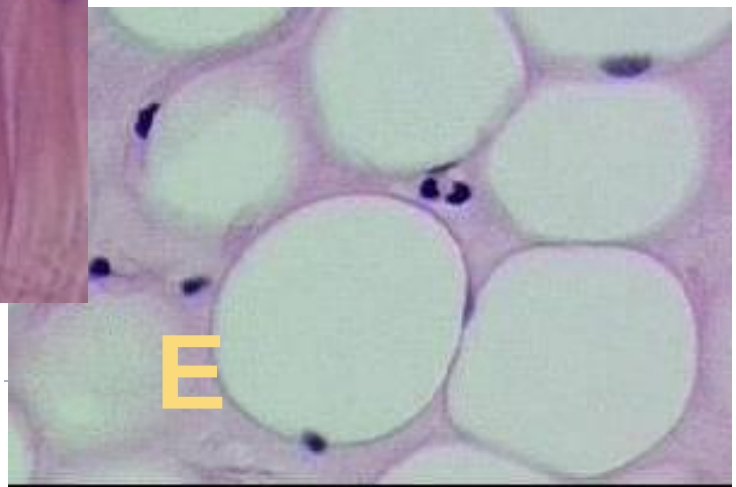




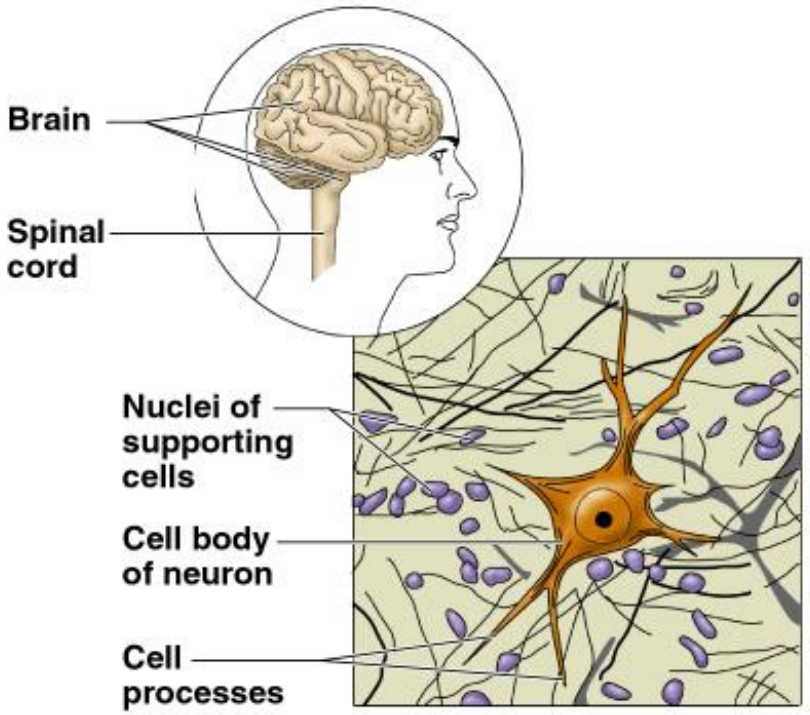




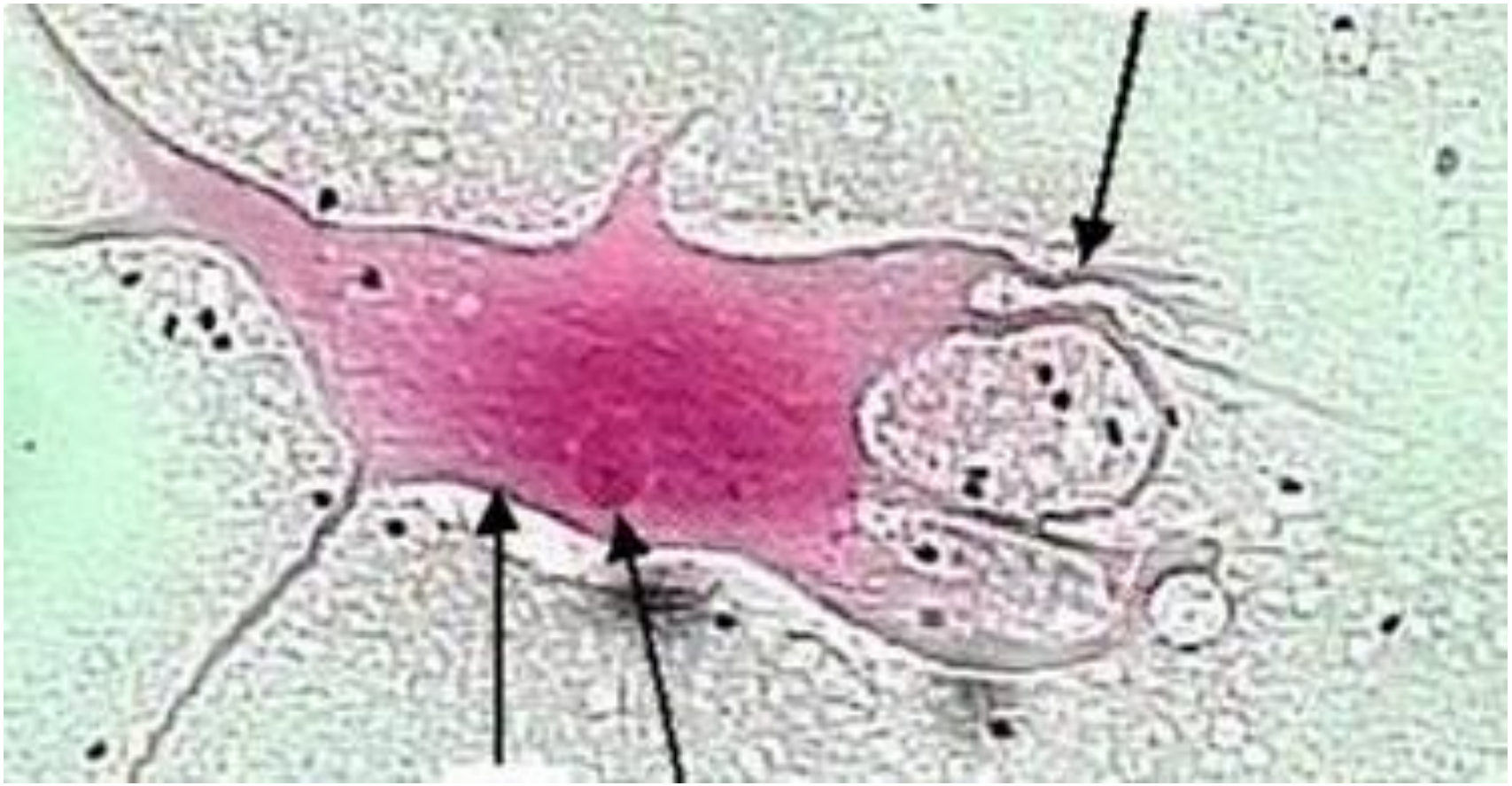
3. Nervous Tissue

(3rd primary tissue type)

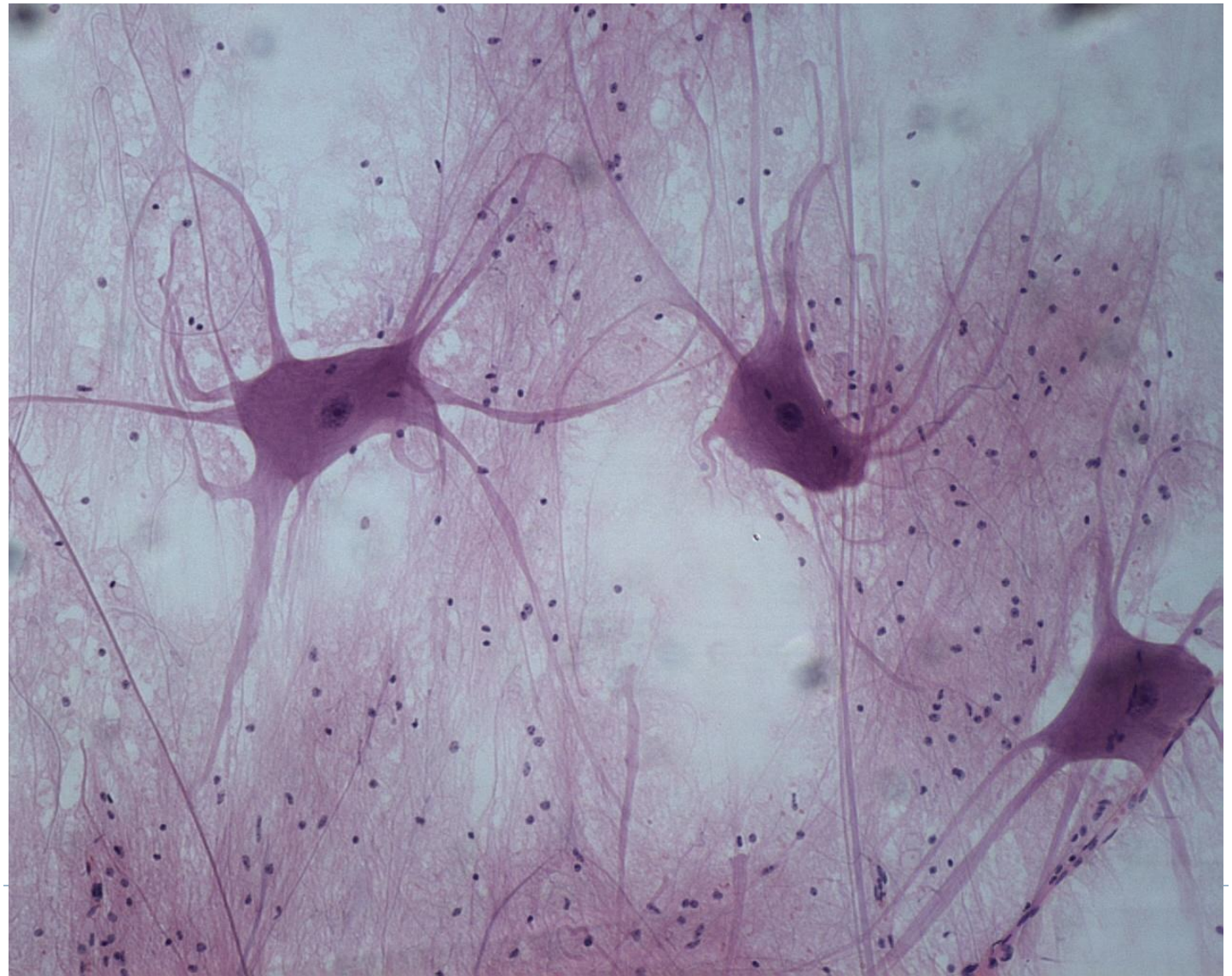
- Found in brain, spinal cord, & nerves
- Regulates & controls body functions
- Highly specialized branching Neuron cells generate & conduct nerve impulse
- Cytoplasmic extensions allow electrical impulses to transmit over large w/n the body



Nervous Tissue



Nervous Tissue



4. Muscle Tissue

(4th primary tissue type)

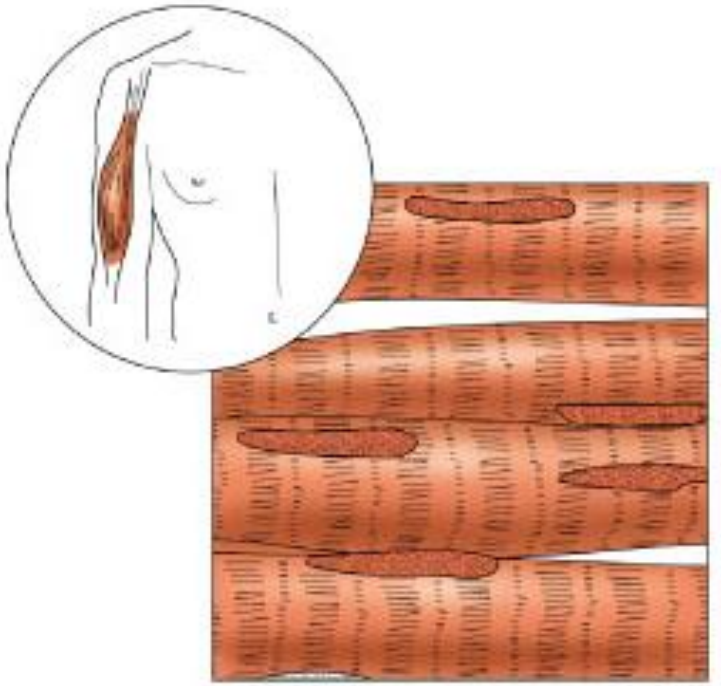
- Function is to produce body movements
- Highly cellular, well-vascularized tissues
- Muscle cells are composed of myofilaments
  - 2 types of myofilaments:
    1. Actin
    2. Myosin

Work together to bring about contraction of muscles

3 Types Muscle Tissue

1. Skeletal Muscle

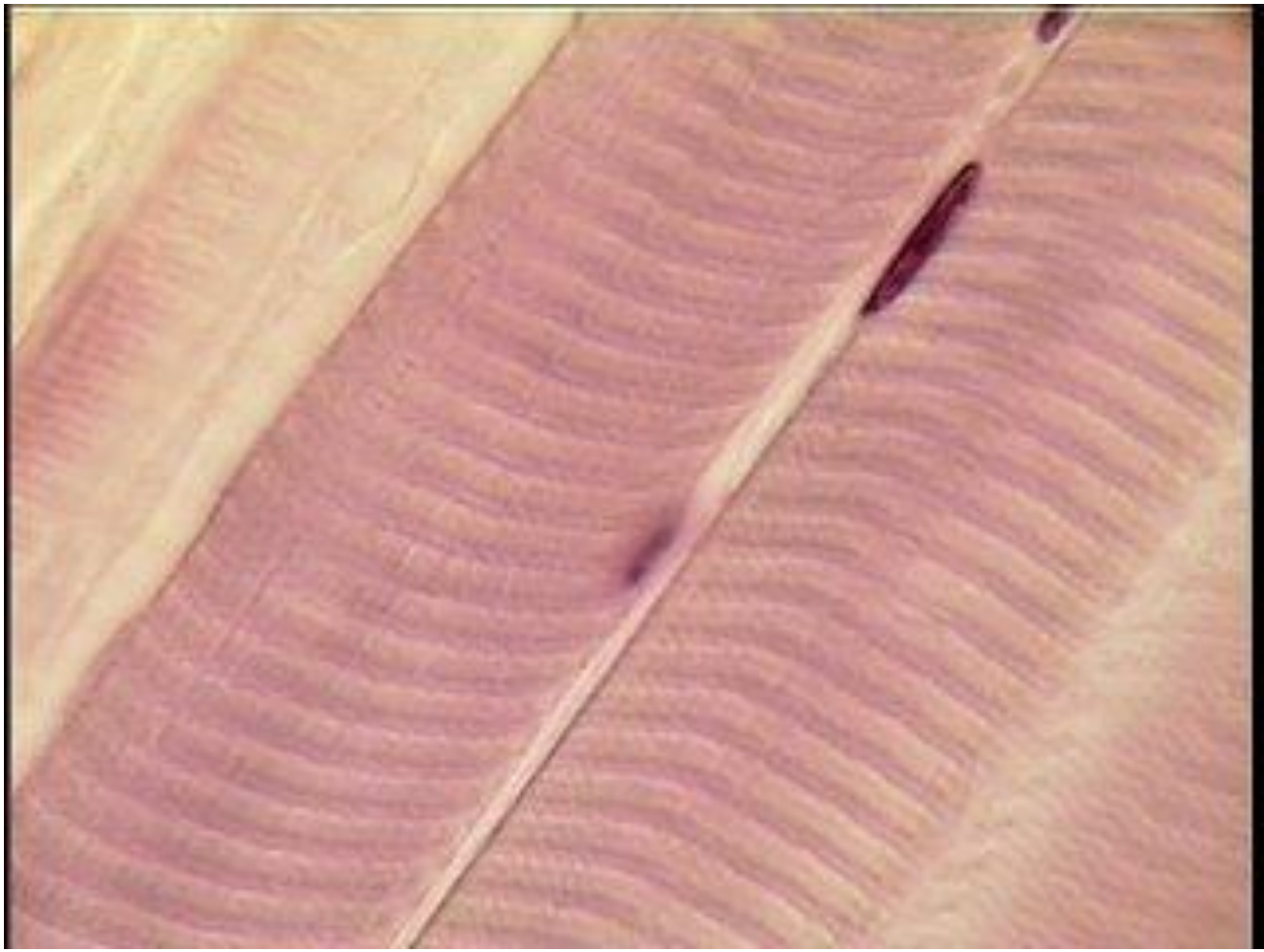
- Form the flesh of the body
- Pull (contract) on bones or causing body movements
- Controlled voluntarily
- Cells- long, cylindrical, and **striated or banded**
- Cells have many nuclei (**multinucleated**)



(b) Skeletal muscle

MUSCLE

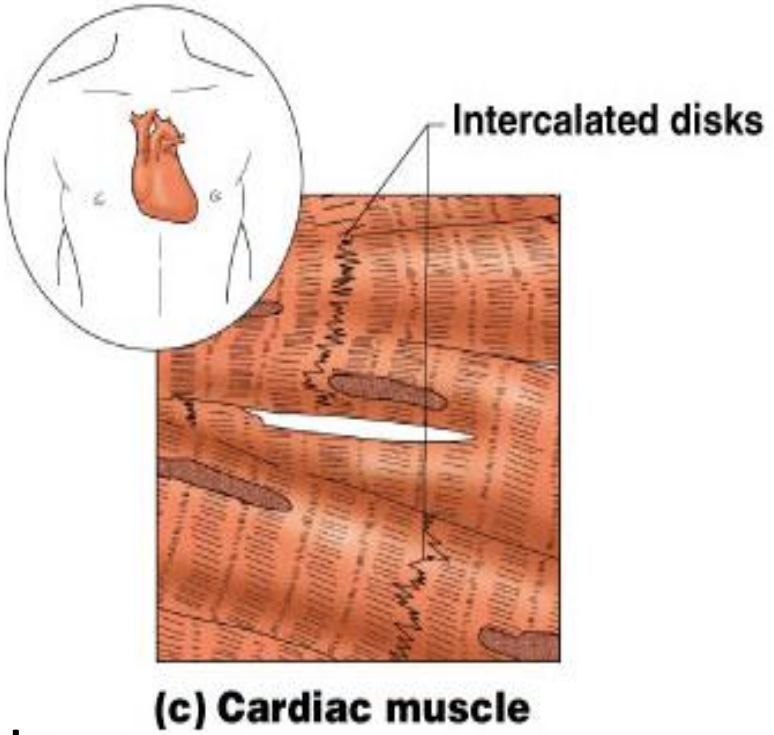
- SKELETAL
  - Voluntary
  - Striations



Skeletal Muscle

3 Types Muscle Tissue

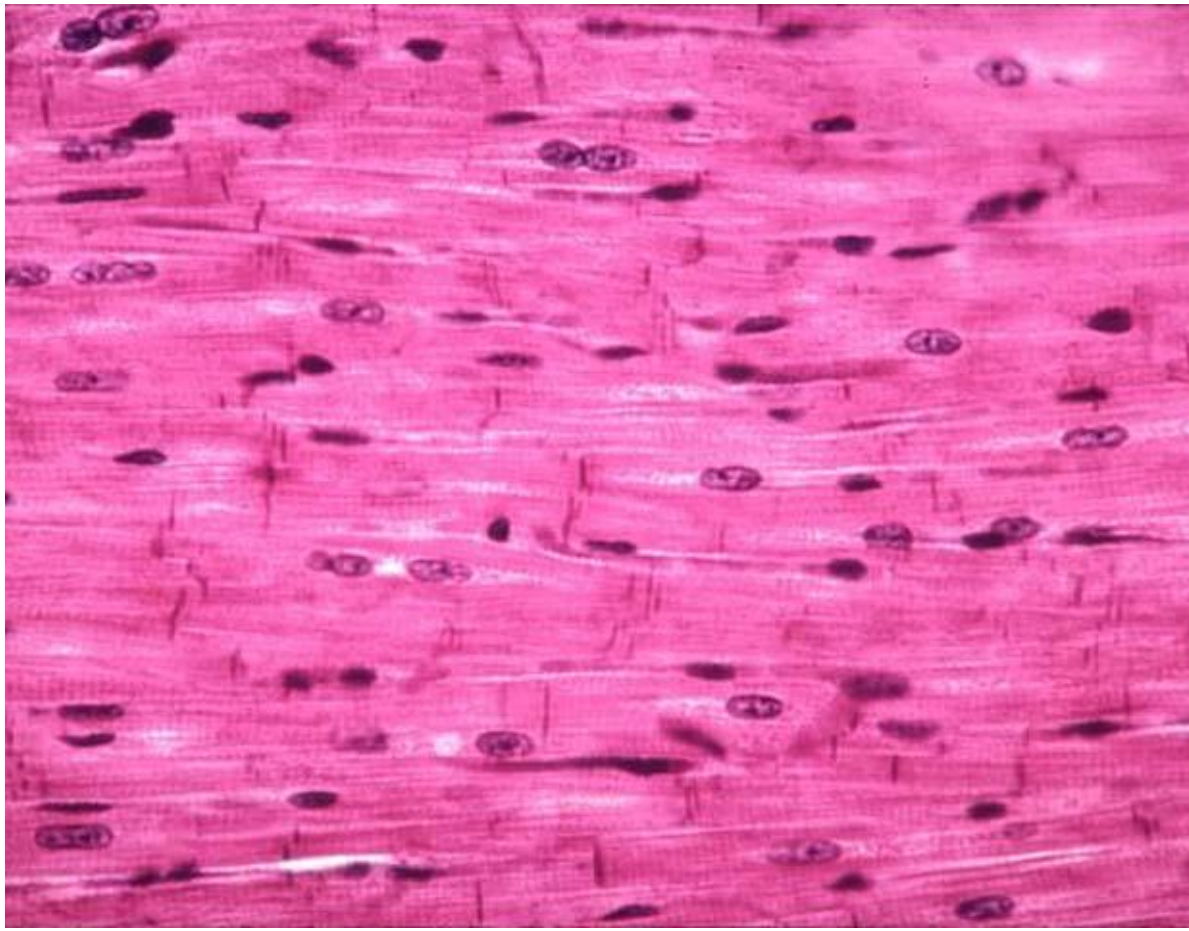
2. Cardiac muscle



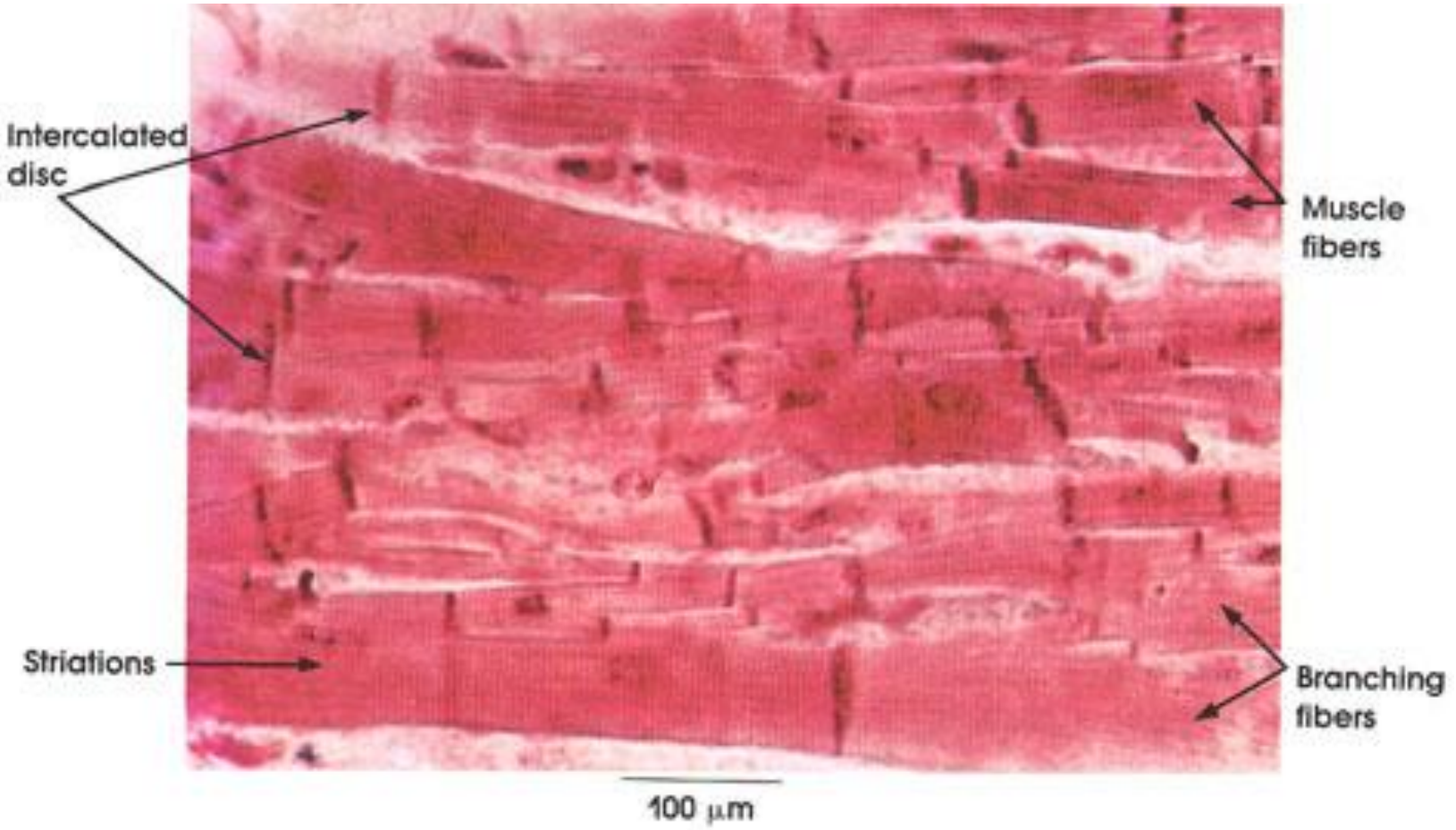
- Function is to pump blood (involuntary) thru vessels to rest of body
- Found only in the heart wall
- Cells are **striated**, like skeletal, but there are structural differences:
  - Branching cells fit together tightly at unique junctions called intercalated disks
  - One nucleus per cell (**uninucleate**)

Cardiac Muscle

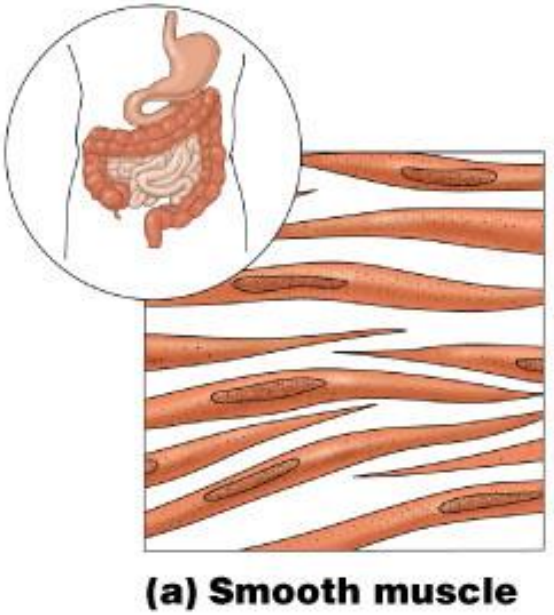
- Involuntary
- Striations
- Intercalated Disks



Cardiac Muscle



3 Types Muscle Tissue

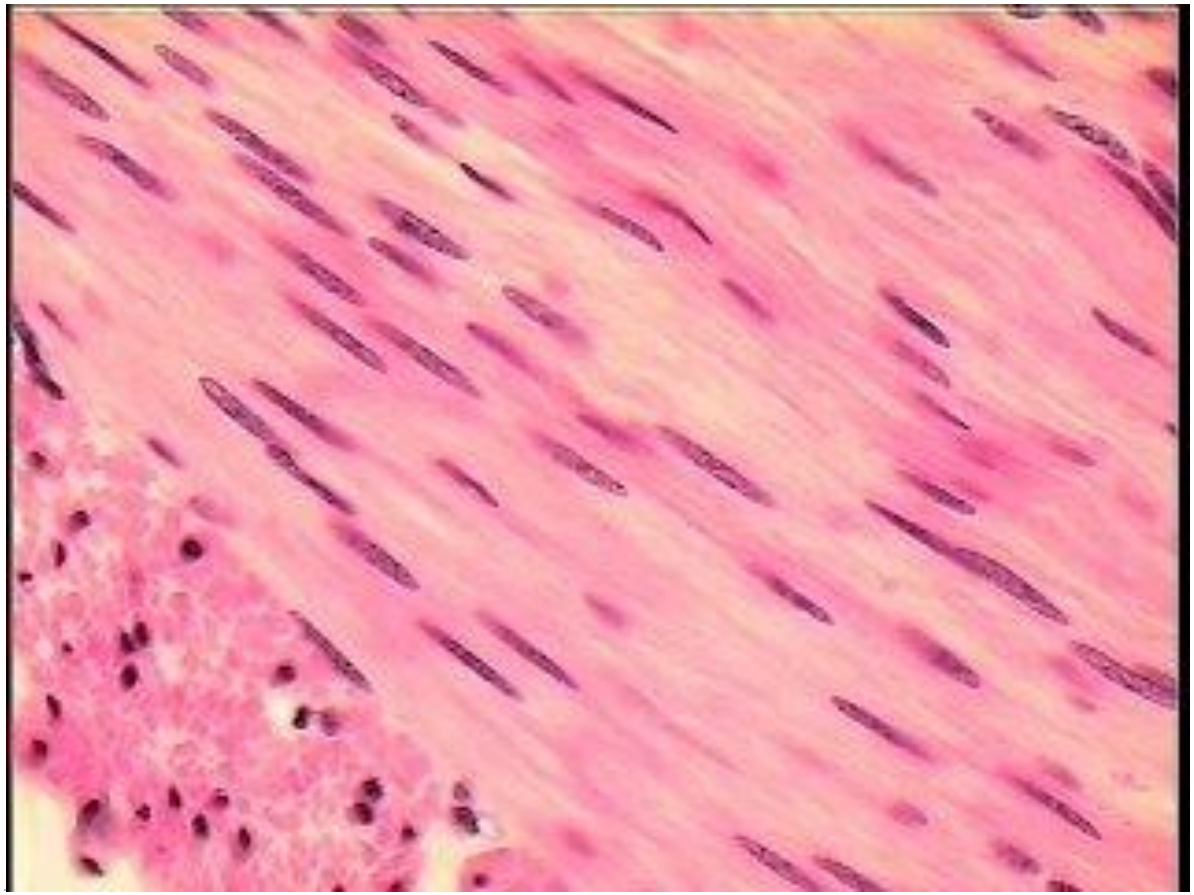

(a) Smooth muscle

3. Smooth muscle

- No visible striations
- Involuntary muscle
- Individual cells are spindle shaped & contain **one** centrally located nucleus
- Found in walls of hollow organs (except heart); digestive & urinary tract organs, uterus, & blood vessels
- Functions to squeeze substances thru organs by alternately contracting & relaxing (peristalsis)

Smooth Muscle

- Involuntary



Smooth Muscle