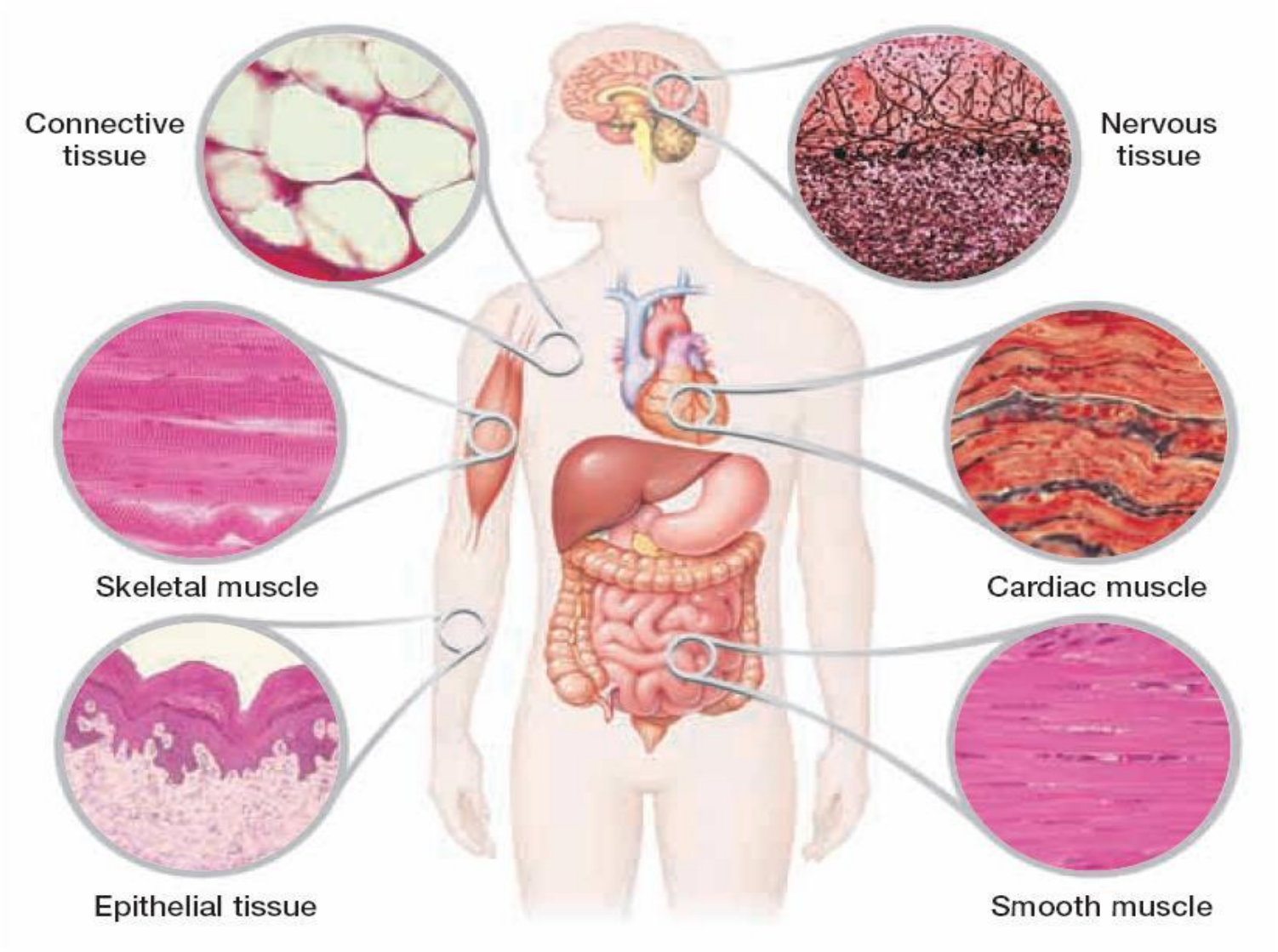
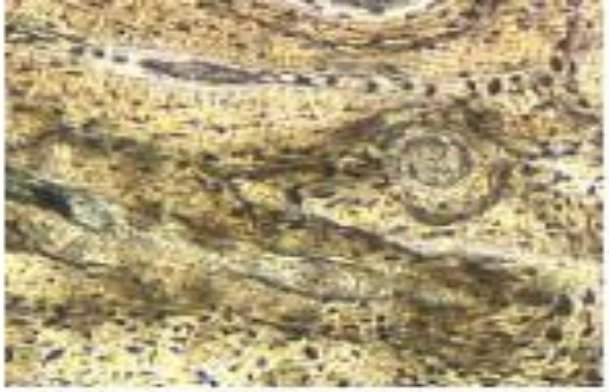
Tissues of the Body

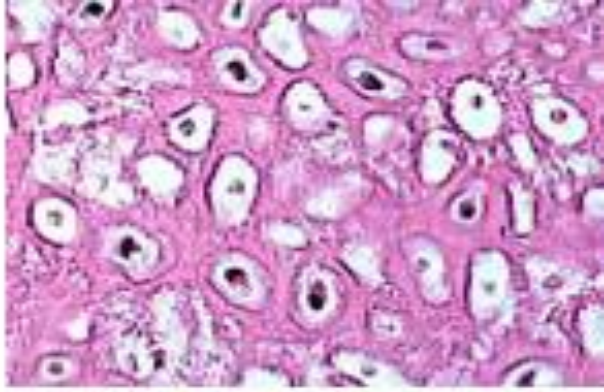
Human Body Tissues



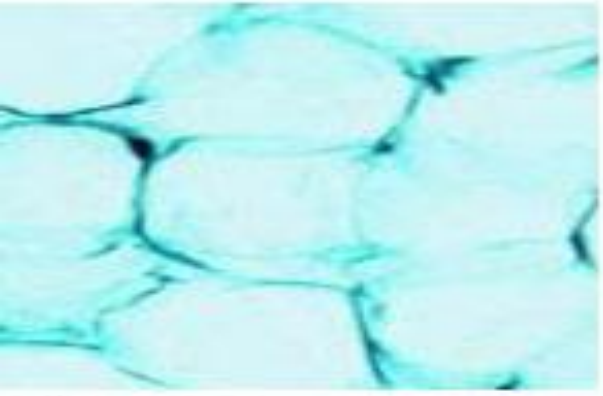
Histological images of various tissues in the body



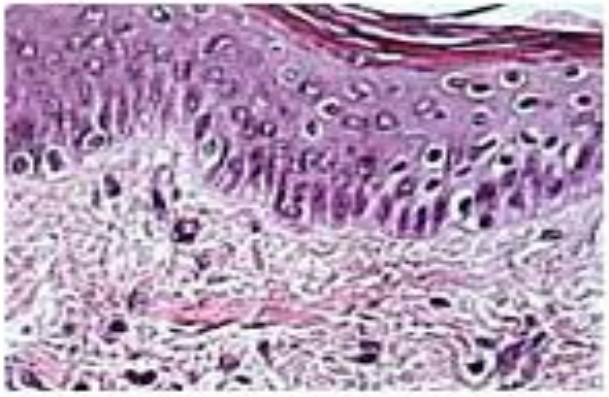
Bone



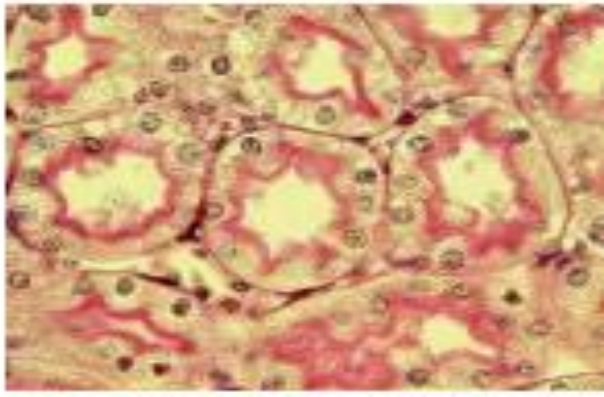
Cartilage



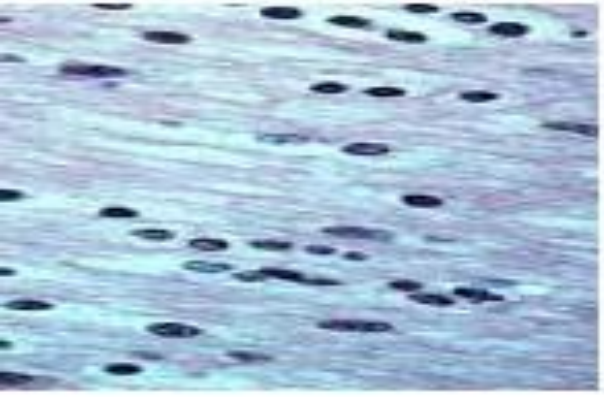
Adipose Tissue



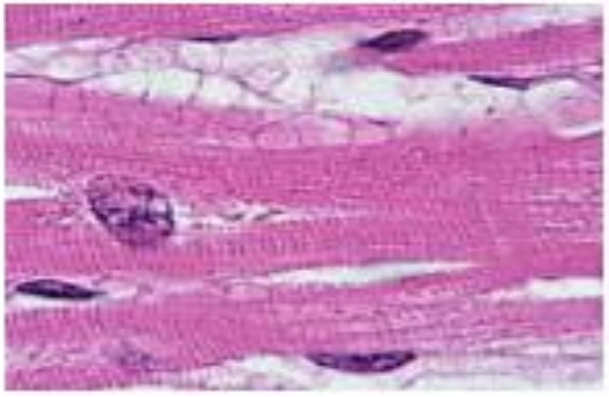
Skin



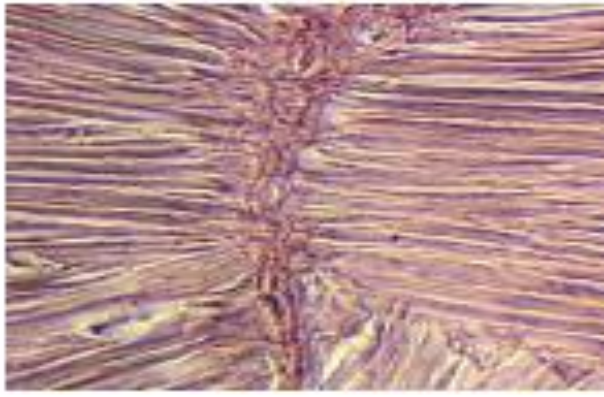
Intestinal Villi



Neural Tissue



Cardiac Muscle

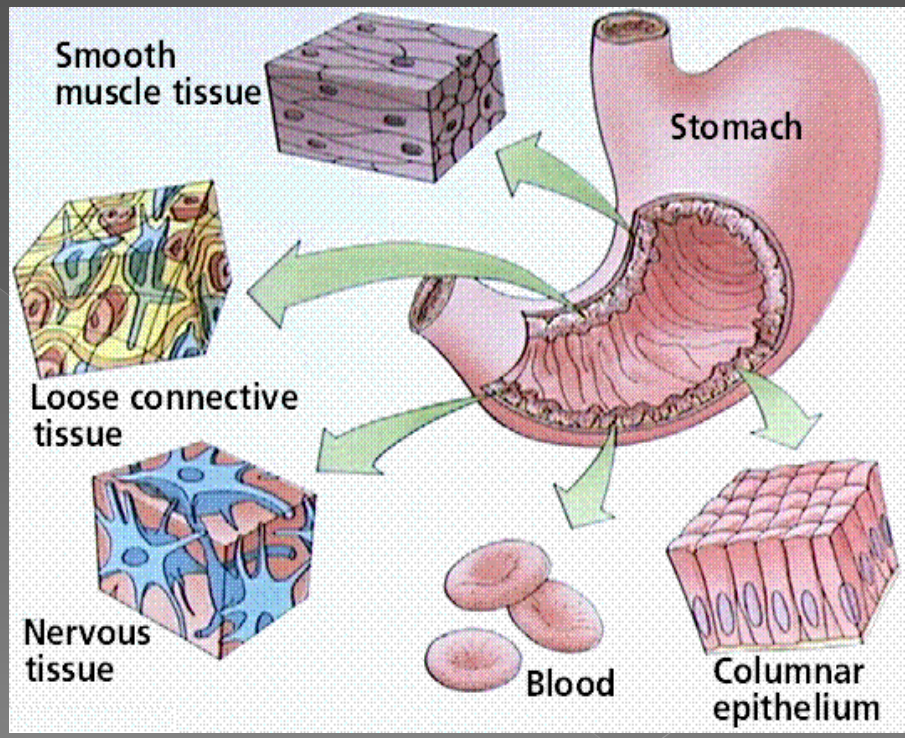


Skeletal Muscle

The Tissue Level of Organisms

- Tissues are groups of similar cells
  - Common Embryonic Origin
  - Common Function

- Histology: the study of tissue



Cells combine to form 4 primary tissues

- Epithelial Tissue
  - Covers surfaces because cells are contact
  - Lines hollow organs, cavities and ducts
  - Forms glands when cells sink under the surface
- Connective Tissue
  - Material found between cells
  - Supports and binds structures together
  - Stores energy
  - Provides immunity to disease

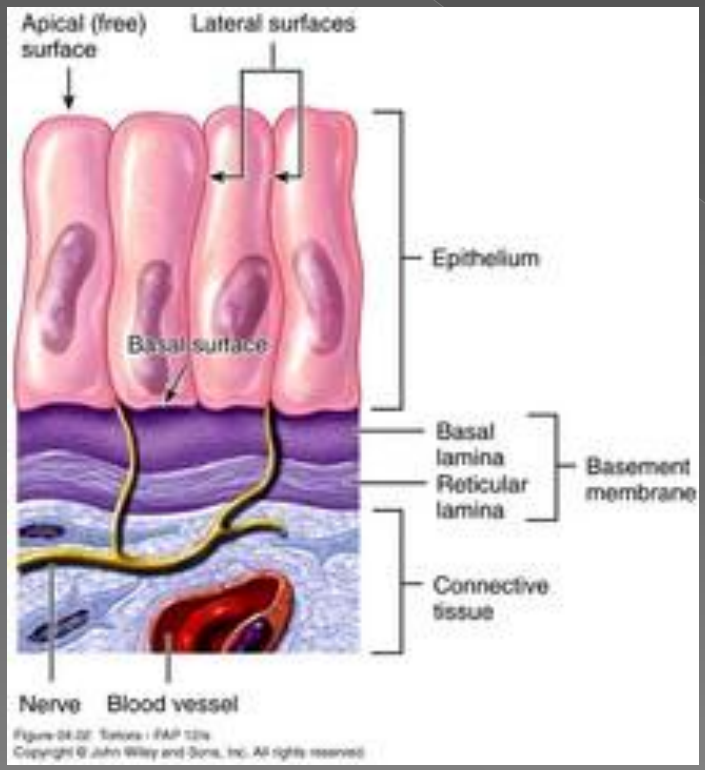
4 Primary Tissue Cont.

- Muscle Tissue
  - Cells shorten in length producing movement
- Nervous Tissue
  - Cells that conduct electrical impulses
  - Detects changes inside and outside the body
  - Responds with nerve impulses

Epithelial Tissue -- General

- Generally thought of as the protective layer.
- Closely packed cells forming a continuous sheet
- Cells rest on a basement membrane
- Have an upper free (apical) surface
- Avascular- without a blood supply
  - Nutrients diffuse from underlying connective tissue
- Good nerve supply
- Rapid cell division
- 2 types
  - Covering/lining
  - Glandular types

Basement Membrane



- Is like double sided sticky tape b/c it holds epithelium to connective tissues
- Guide for cellular migration during development

Types of Epithelium

- Covering and Lining Epithelium
  - Epidermis of skin
  - Lining of blood vessels and ducts
  - Lining respiratory, reproductive, urinary, & GI tract
- Glandular Epithelium
  - Secreting portion of glands
  - Thyroid, adrenal, and sweat glands

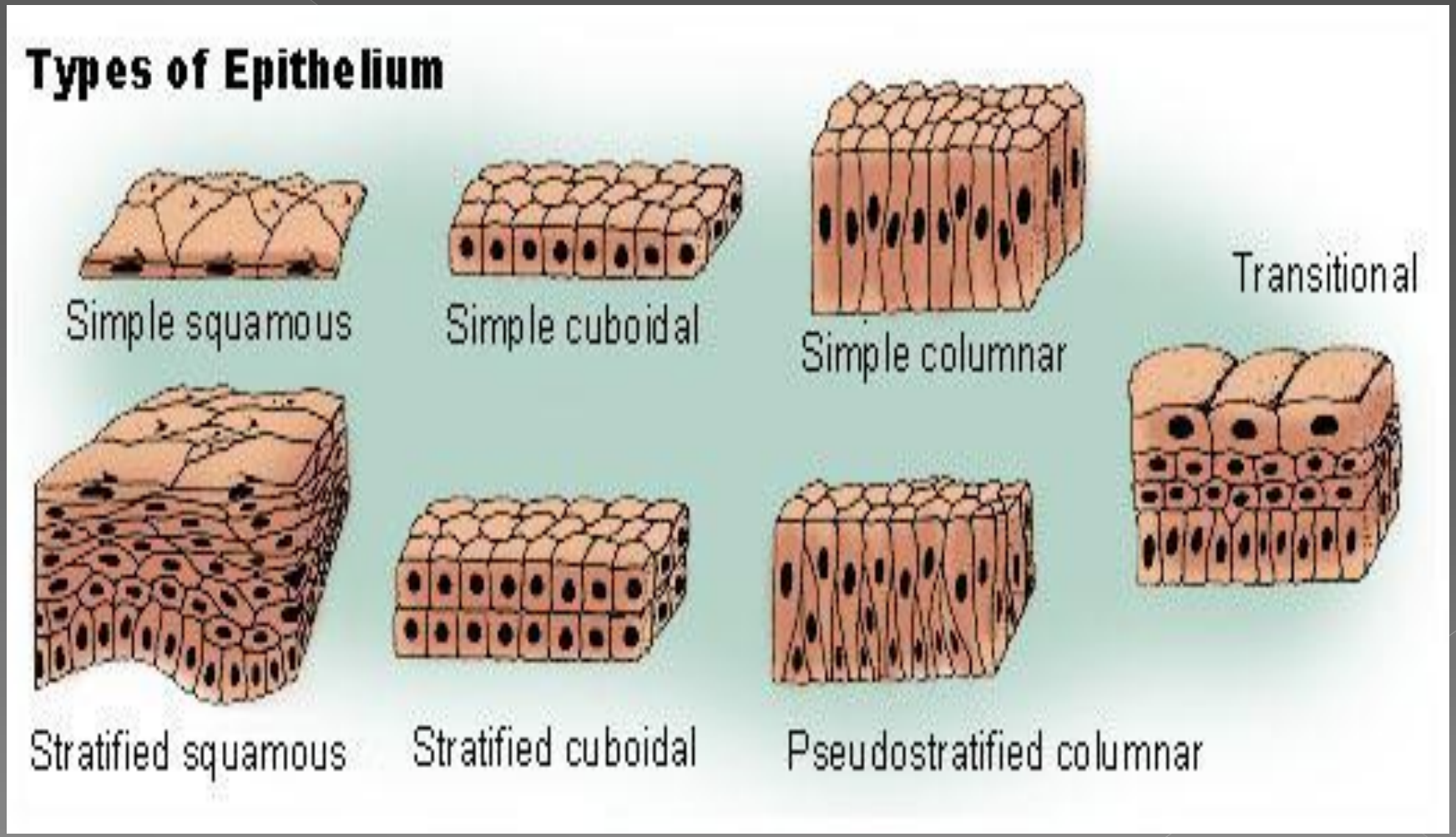
Functions of Epithelial Tissue

- **1. Protect underlying structures**
  - Ex. Oral cavity epithelium protects underlying glands from abrasions.
- **2. Acts as a barrier**
  - Ex. Reduces water loss from body
- **3. Permits the passage of substances**
  - Ex. O_2 & CO_2 exchange through lungs
- **4. Secretes Substances**
  - Ex. Mucous or sweat
- **5. Absorbs substances**
  - Ex. Epithelial of the intestines absorb molecules of digested food.

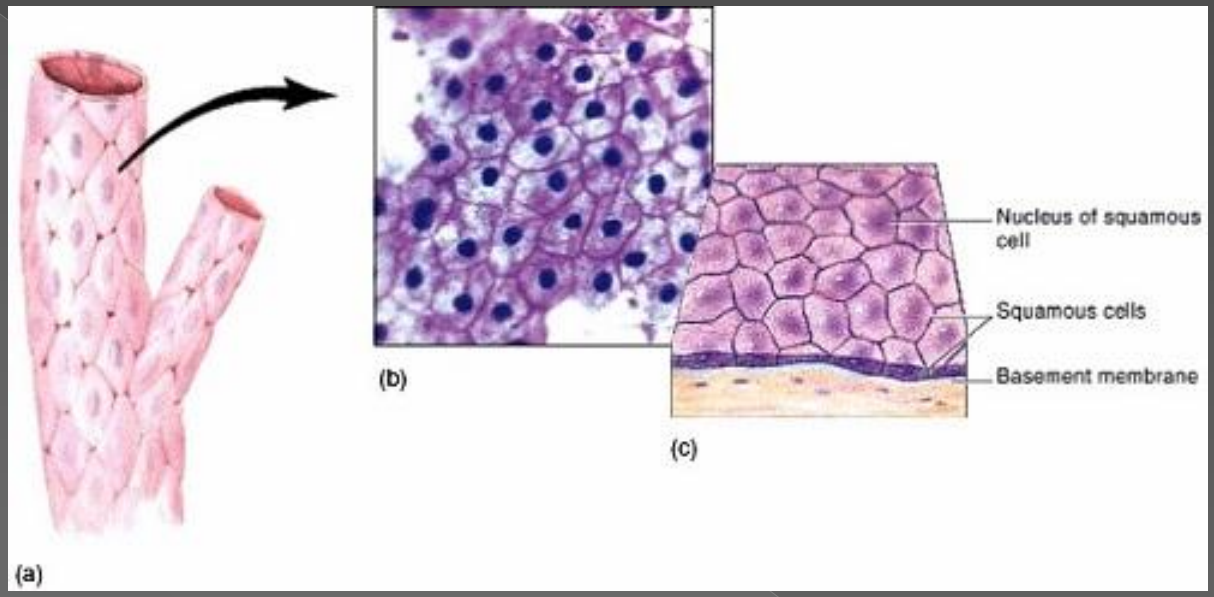
Classification of Epithelium

- *Classified by arrangement of cells into layers*
  - *Simple – one layer thick*
  - *Stratified – many cell layers thick*
  - *Pseudostratified – single layer of cells where all cells don't reach apical surface*
    - *Nuclei are found at different layers so it looks stratified*
- *Classified by shape of surface cells*
  - *Squamous – flat*
  - *Cuboidal – cube shaped*
  - *Columnar – tall column*
  - *Transitional – shape varies with tissue stretching*

Epithelial Tissue

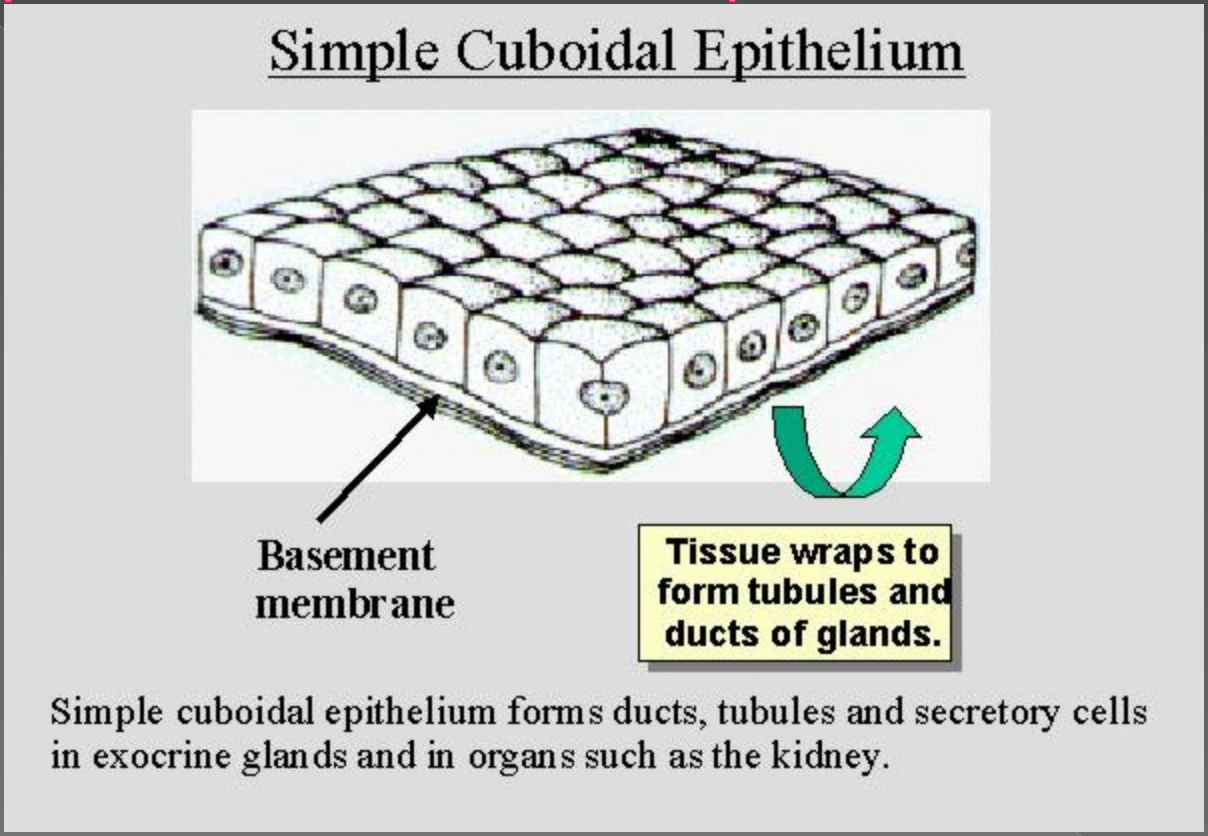


Simple Squamous Epithelium



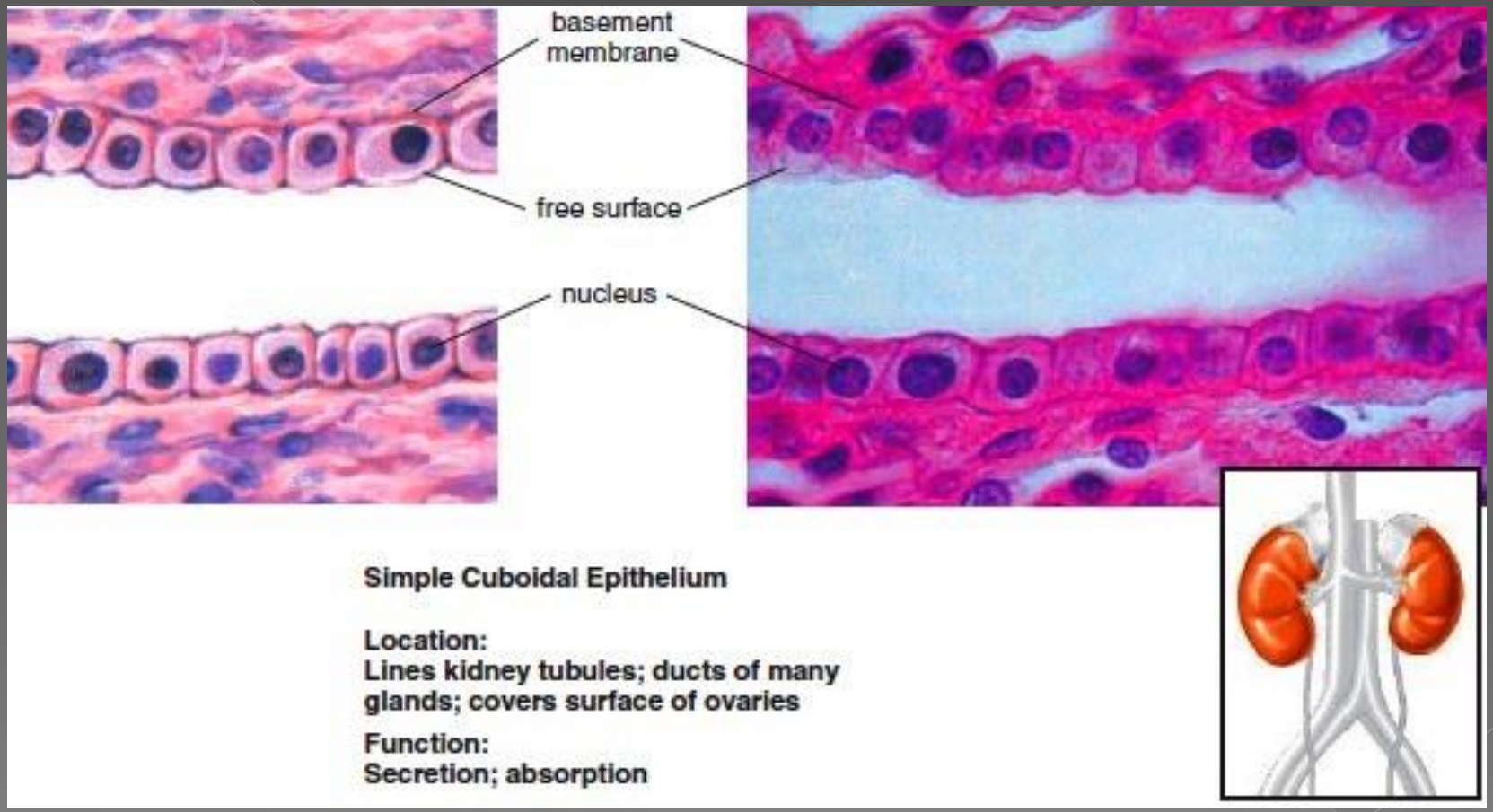
- Single layer of flat cells
  - Lines blood vessels (endothelium), body cavities (mesothelium)
  - Very thin- controls diffusion, osmosis, & filtration
  - Nuclei centrally located
- Cells in direct contact with each other

Simple Cuboidal Epithelium



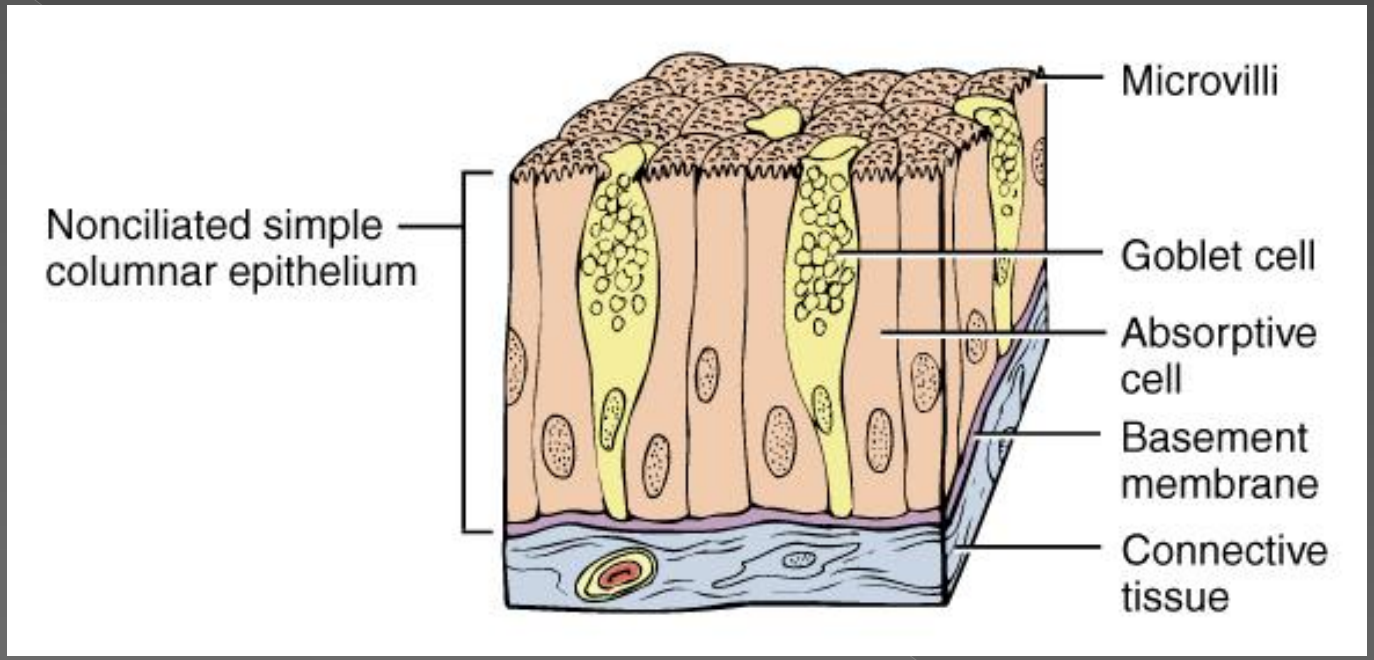
- Single layer of cube shaped cells viewed from the side
- Nuclei round and centrally located
- Absorption or secretion

Examples of simple cuboidal



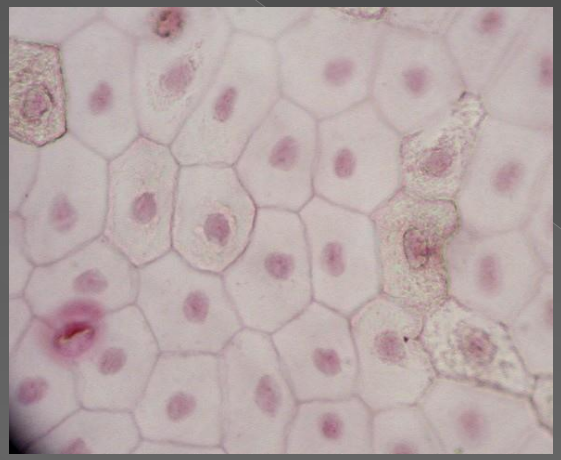
- Sectional view of kidney tubules

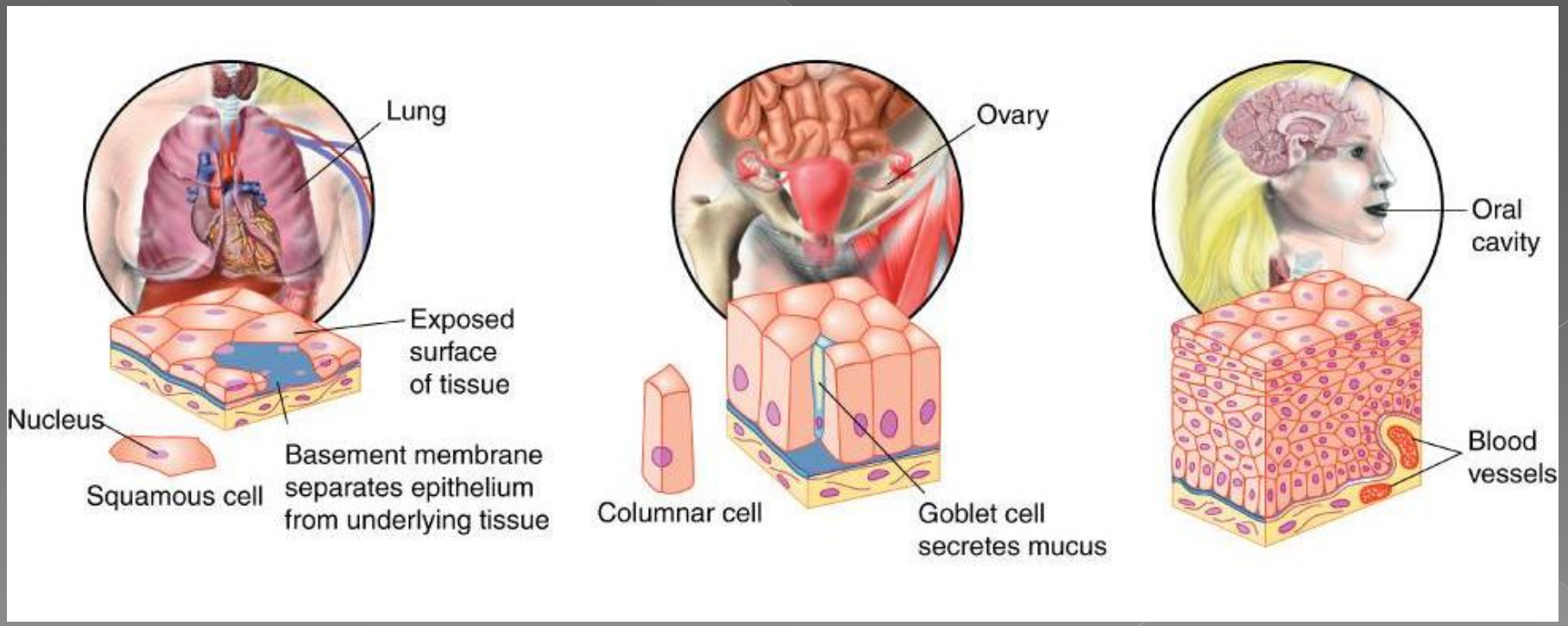
Simple Columnar Epithelium



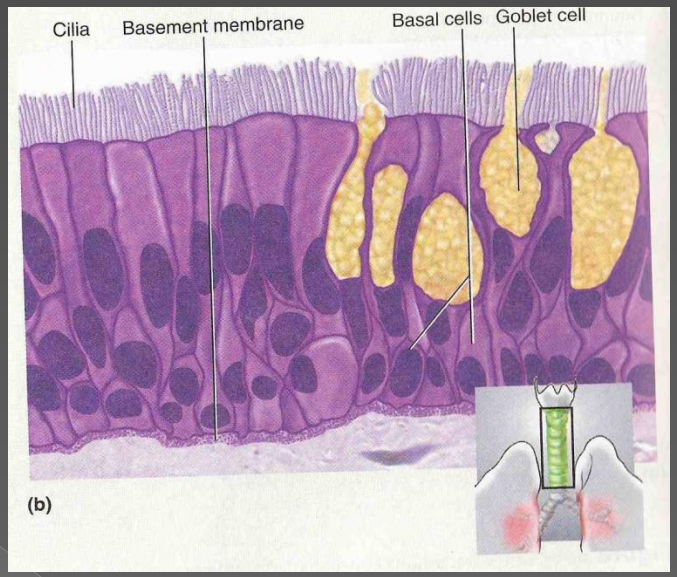
- Single layer rectangular cells
- Unicellular glands – goblet cells secrete mucus
  - Lubricate GI, respiratory, reproductive and urinary systems
- Microvilli – fingerlike projections
  - For absorption in GI tract (stomach – anus)

Function & location determine type!!!



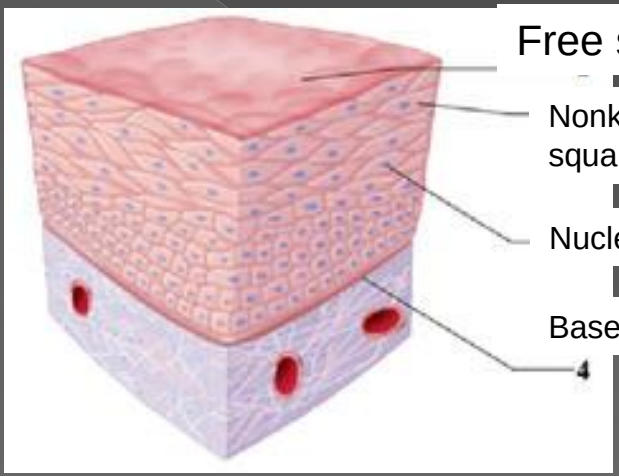


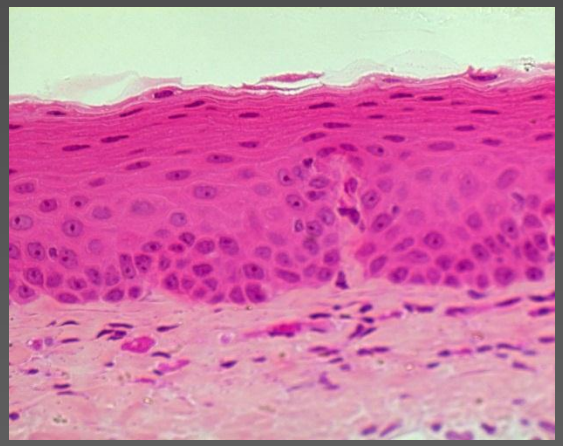
Pseudostratified Columnar Ep.



- Single layer cell
- All cells attached to basement membrane, but not all cells reach apical (free surface)
- Nuclei are at varying depths
- Respiratory system, male urethra, and epididymis

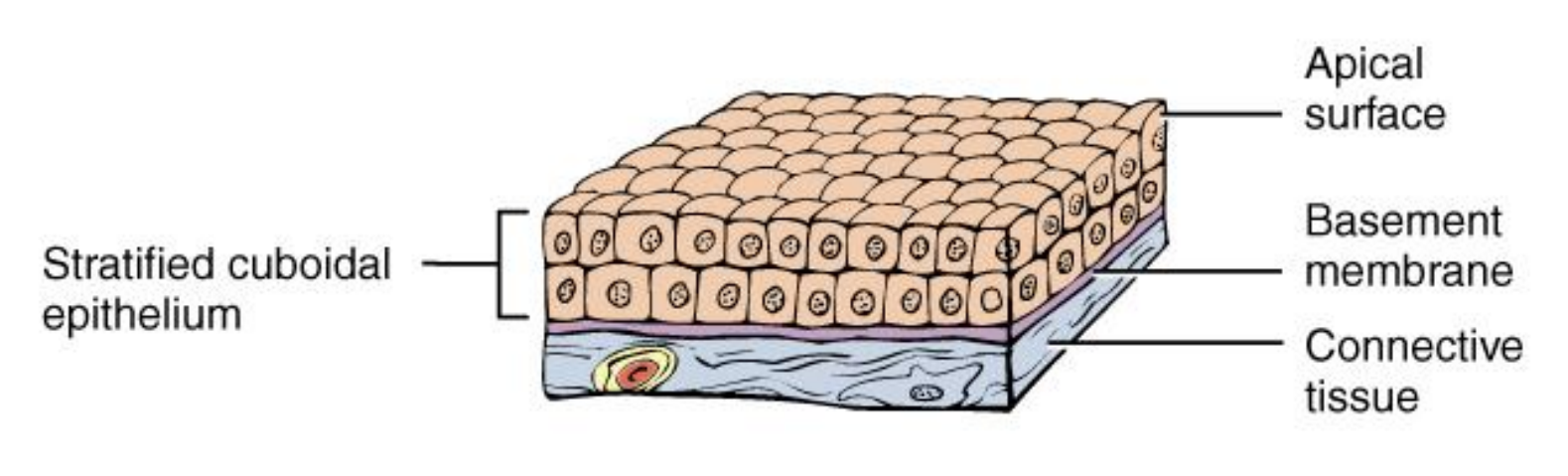
Stratified Squamous Epithelium

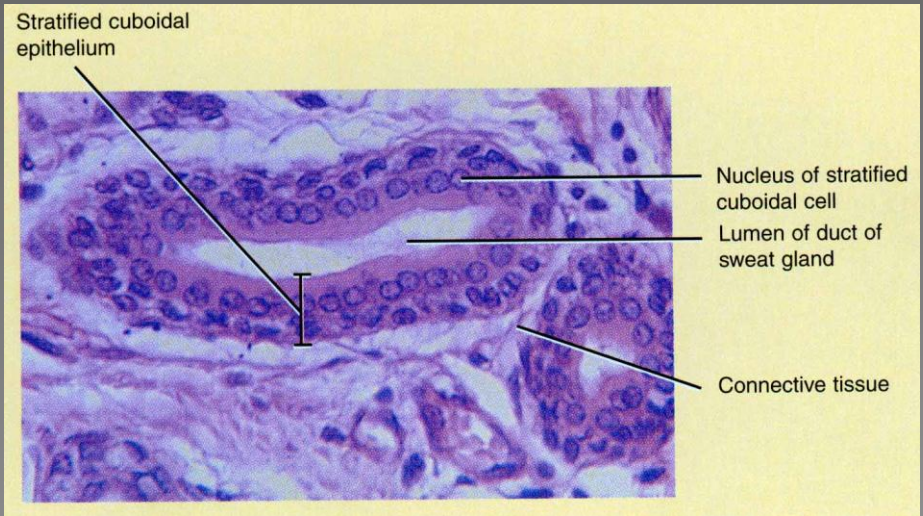




- Several cell layers thick
- Surface cells flat
- Keratinized- surface cells dead and filled with keratin
  - Skin (epidermis)
- Nonkeratinized- no keratin in moist living cells at surface
  - Mouth, vagina

Stratified Cuboidal Epithelium

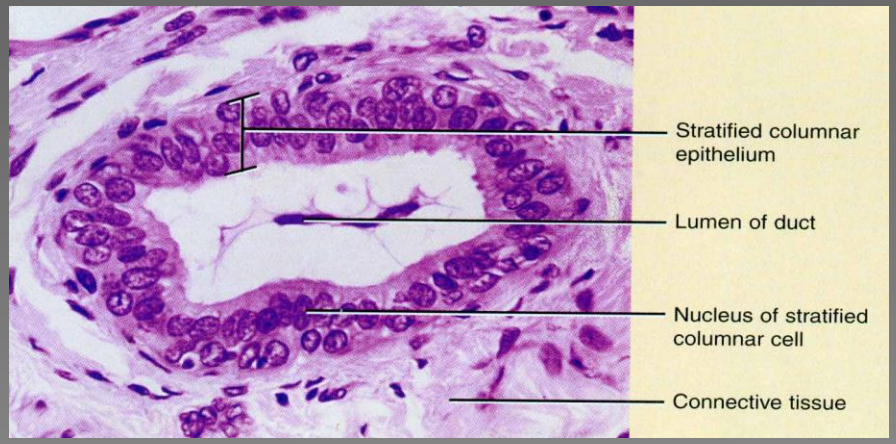


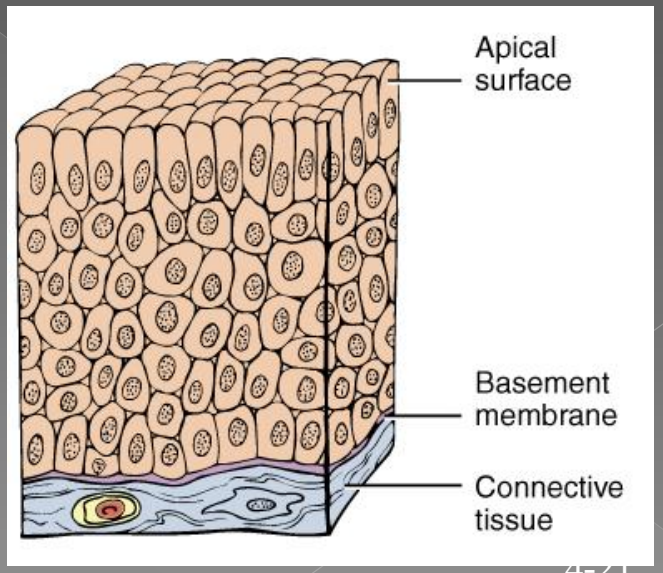


- Multilayered
- Surface cells cuboidal
  - rare (only found in sweat gland ducts & male urethra)
- Absorption, secretion, & protection

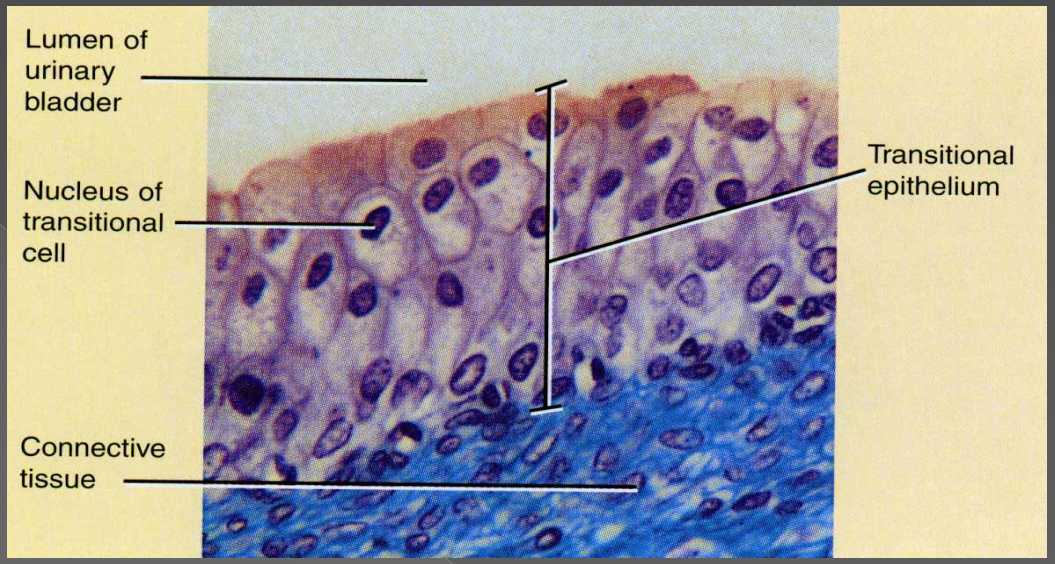
Stratified Columnar Epithelium

- Multilayered
- Surface cells columnar
- Rare (mammary glands, male urethra, & larynx)
- Secretion, protection, & some absorption

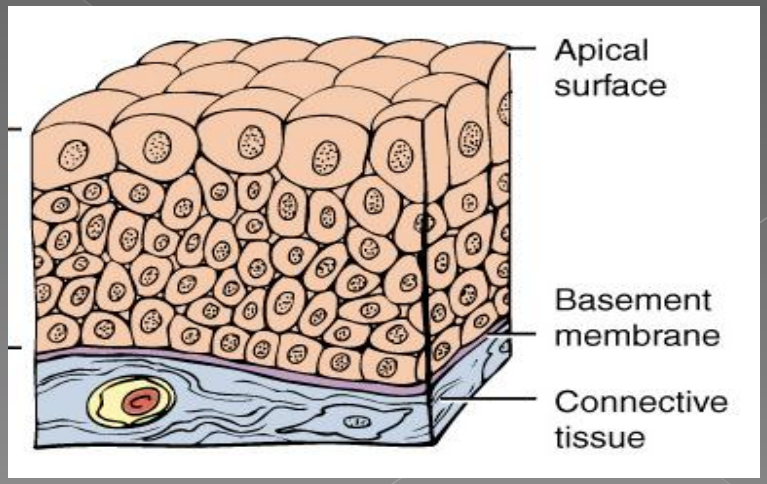




Transitional Epithelium

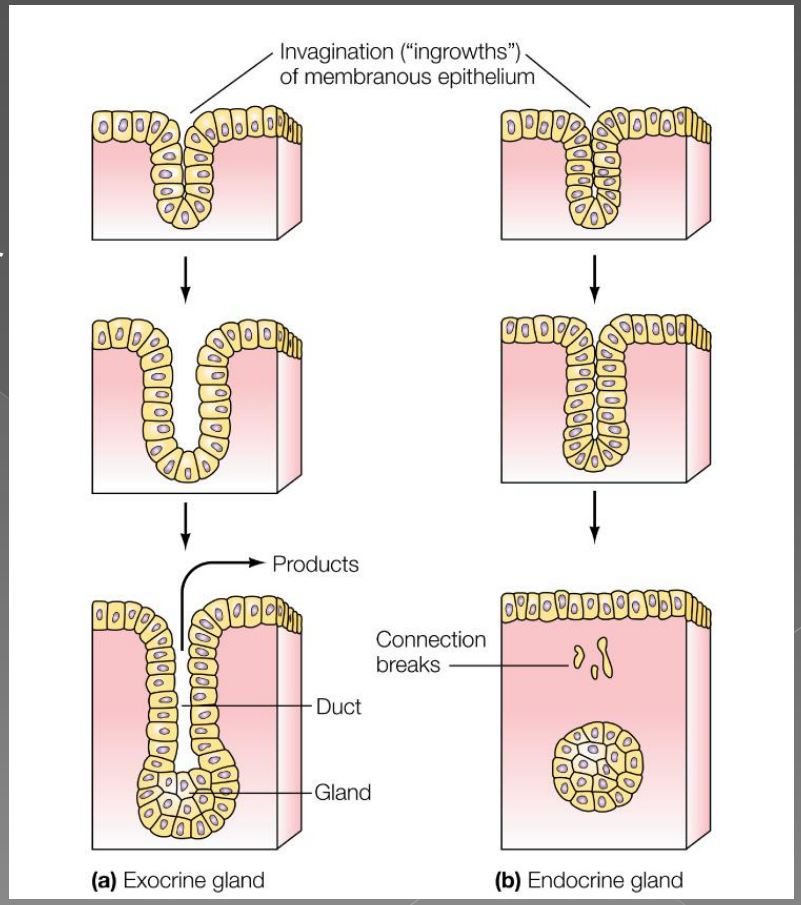


- Multilayered
- Surface cells varying in shape from round to flat if stretched
- Lines hollow organs that expand from within (urinary bladder)



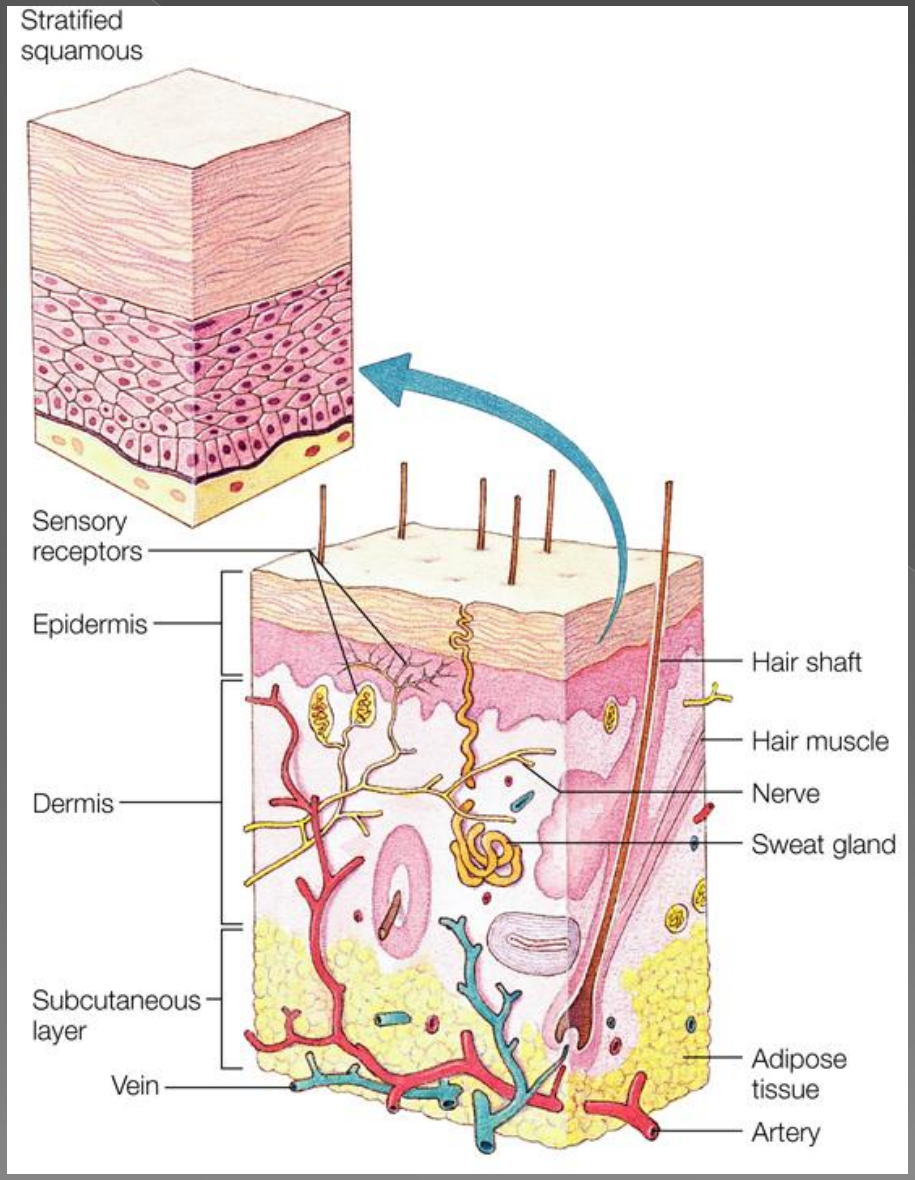
Glandular Epithelia

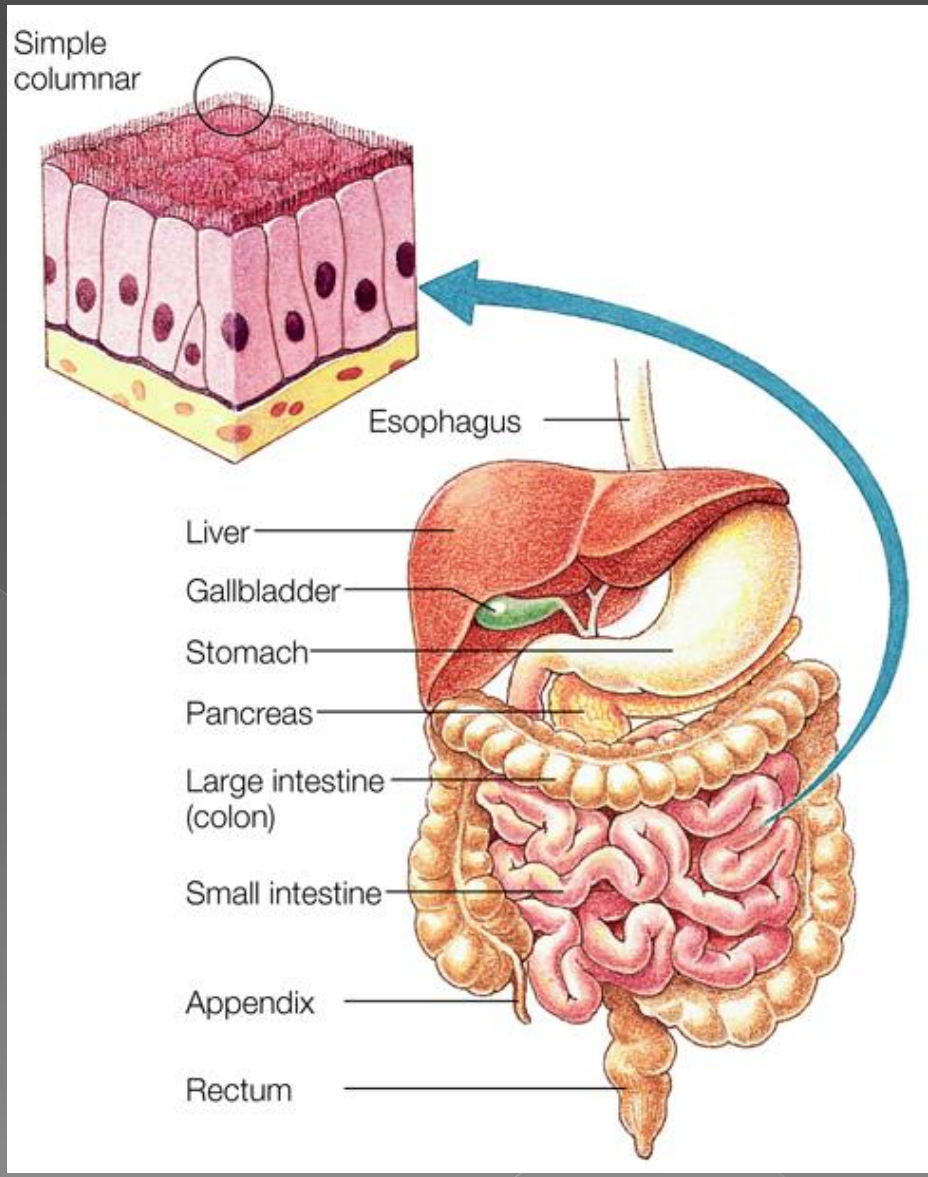
- Derived from epithelial cells that sank below the surface during development
- **Exocrine glands**
  - cells that secrete---sweat, ear wax, saliva, digestive enzymes onto free surface of epithelial layer
  - connected to the surface by tubes (ducts)
  - unicellular glands or multi-cellular glands
- **Endocrine glands**
  - secrete hormones into the bloodstream
  - hormones help maintain homeostasis



Exocrine- sebacious glands of skin

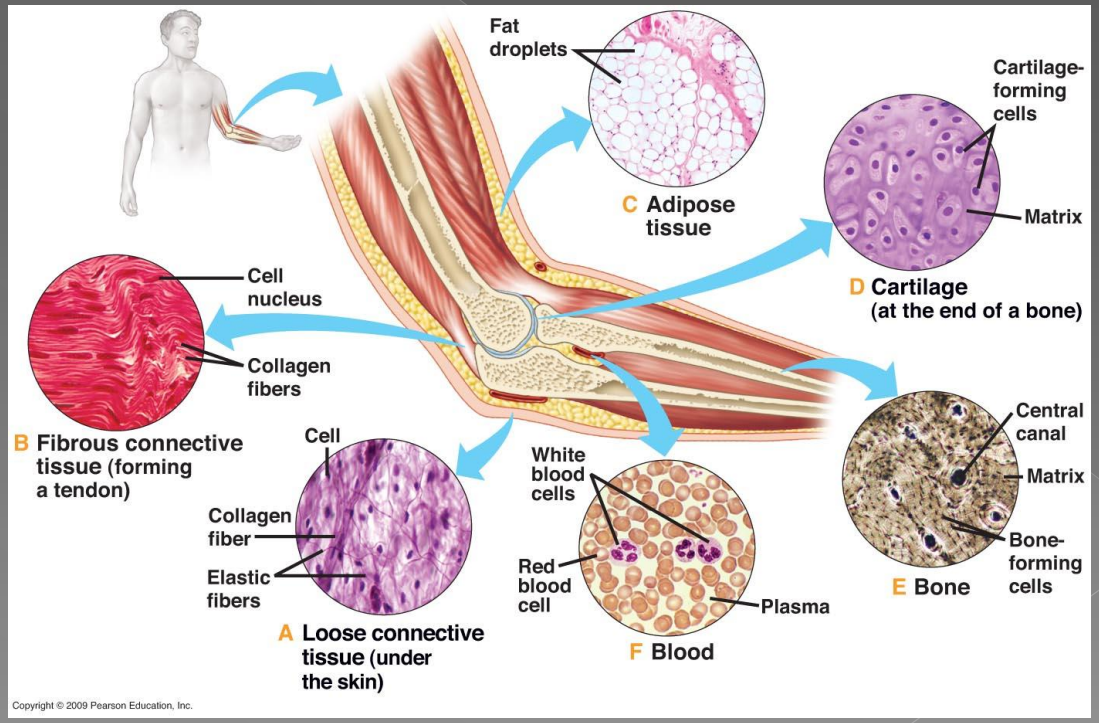
Endocrine- no ducts sm intestines





Connective Tissues

- Cells rarely touch due to extracellular matrix
- Matrix(fibers & ground substance secreted by cells
- Consistency varies from liquid, gel to solid
- Does not occur on free surface
- Good nerve & blood supply except cartilage & tendons



Types of Connective Tissue Fibers

- Collagen (25% of protein in your body)
  - tough, resistant to pull, yet pliable
  - formed from the protein collagen
- Elastin (lungs, blood vessels, ear cartilage)
  - smaller diameter fibers formed from protein elastin surrounded by glycoprotein (fibrillin)
  - can stretch up to 150% of relaxed length and return to original shape
- Reticular (spleen and lymph nodes)
  - thin, branched fibers that form framework of organs
  - formed from protein collagen

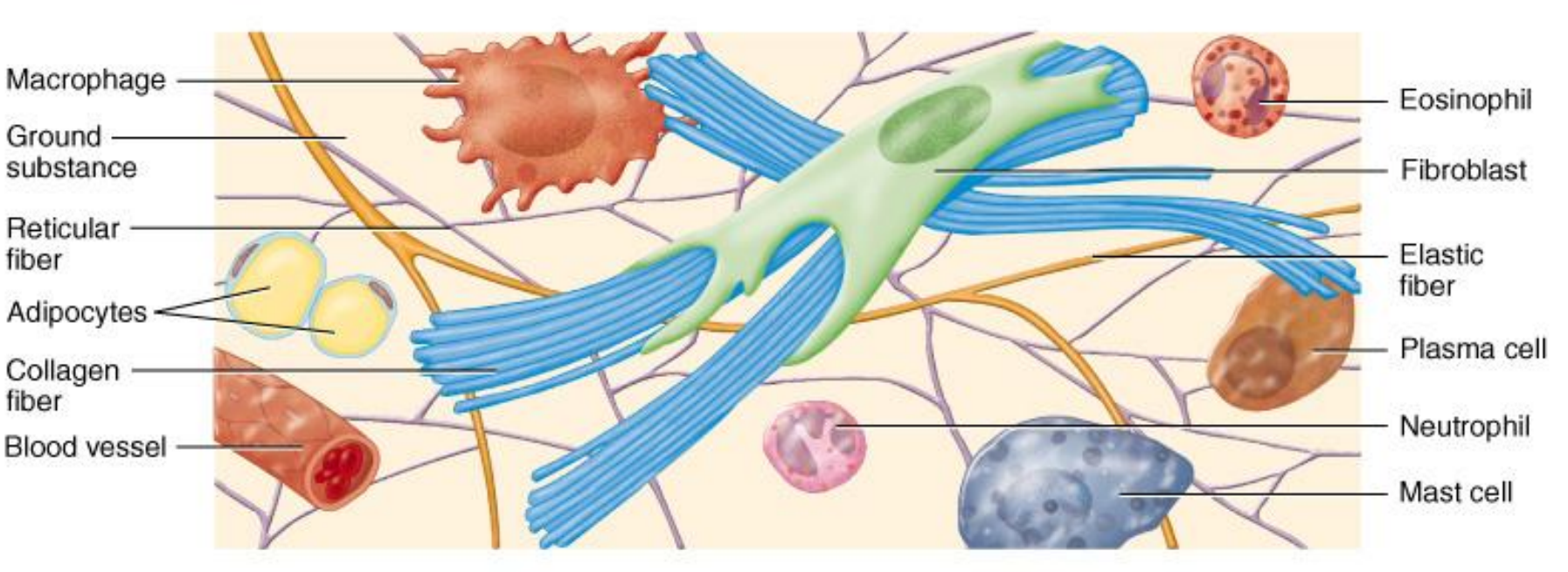
Mature Connective Tissue

- Loose connective tissue
- Dense connective tissue
- Cartilage
- Bone
- Blood
- Lymph (not in this lecture)

Loose Connective Tissues

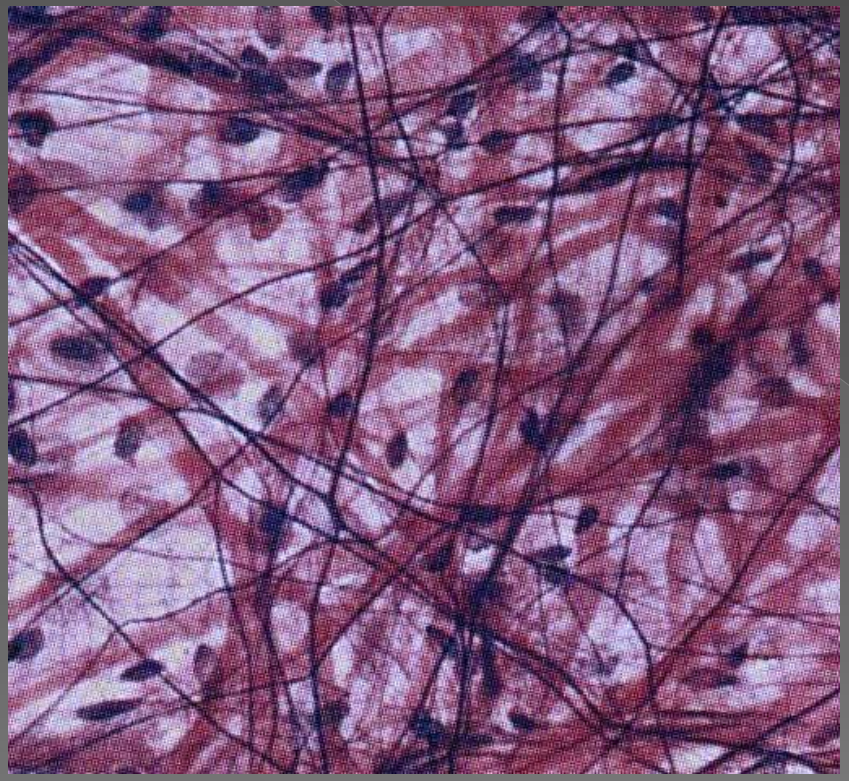
- Loosely woven fibers throughout tissues
- Types of loose connective tissue
  - areolar tissue
  - adipose tissue
  - reticular tissue

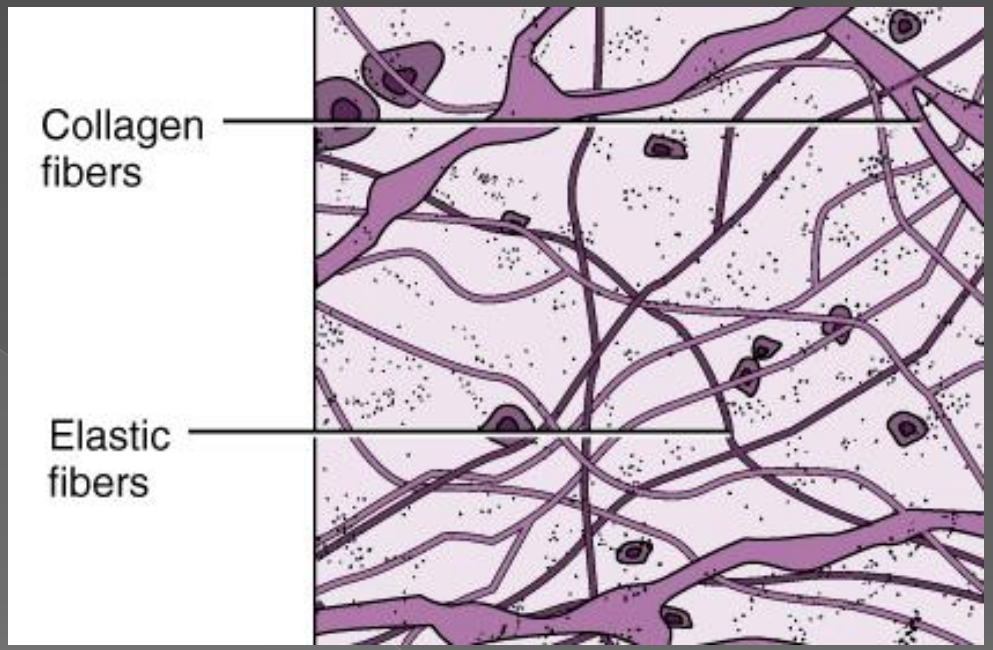
Areolar Connective Tissue



- Cell types = fibroblasts, plasma cells, macrophages, mast cells and a few white blood cells
- All 3 types of fibers present
- Gelatinous ground substance

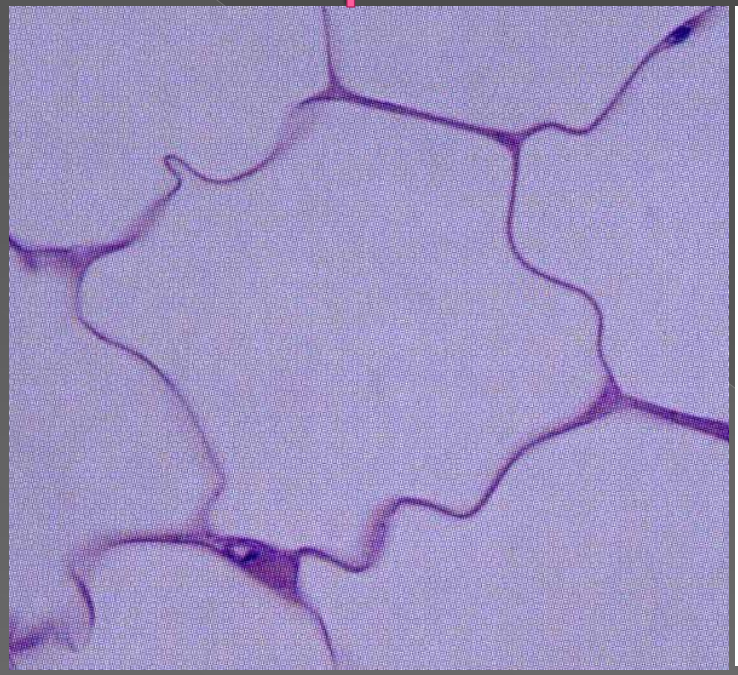
Areolar Connective Tissue

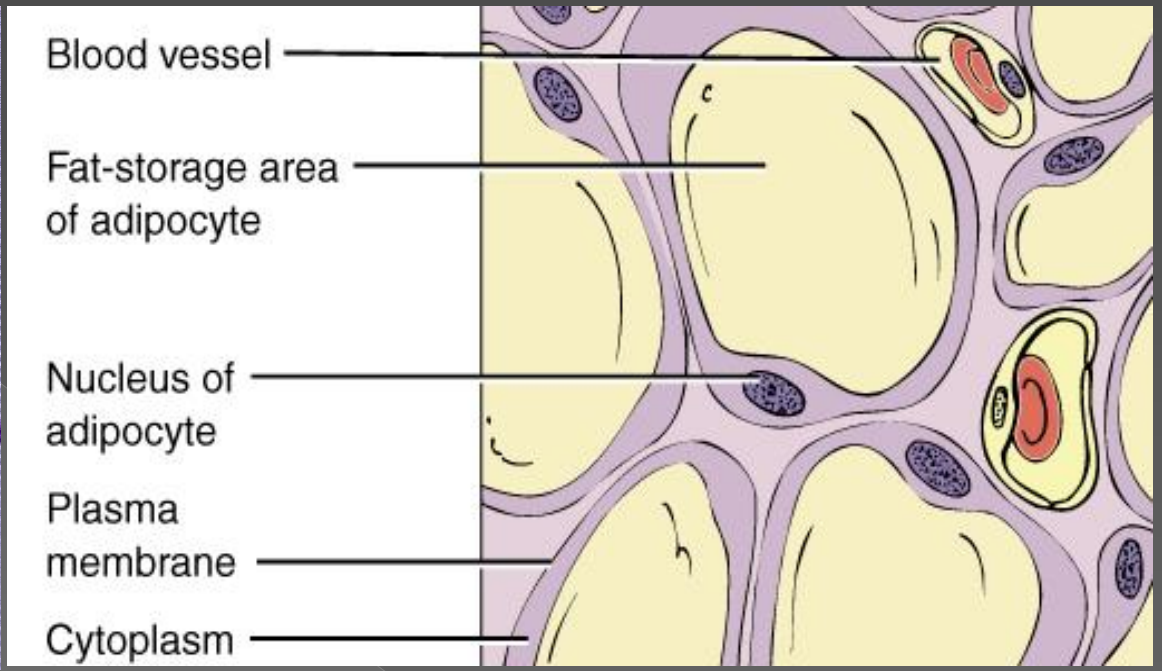




- Black = elastic fibers,
- Pink = collagen fibers
- Nuclei are mostly fibroblasts

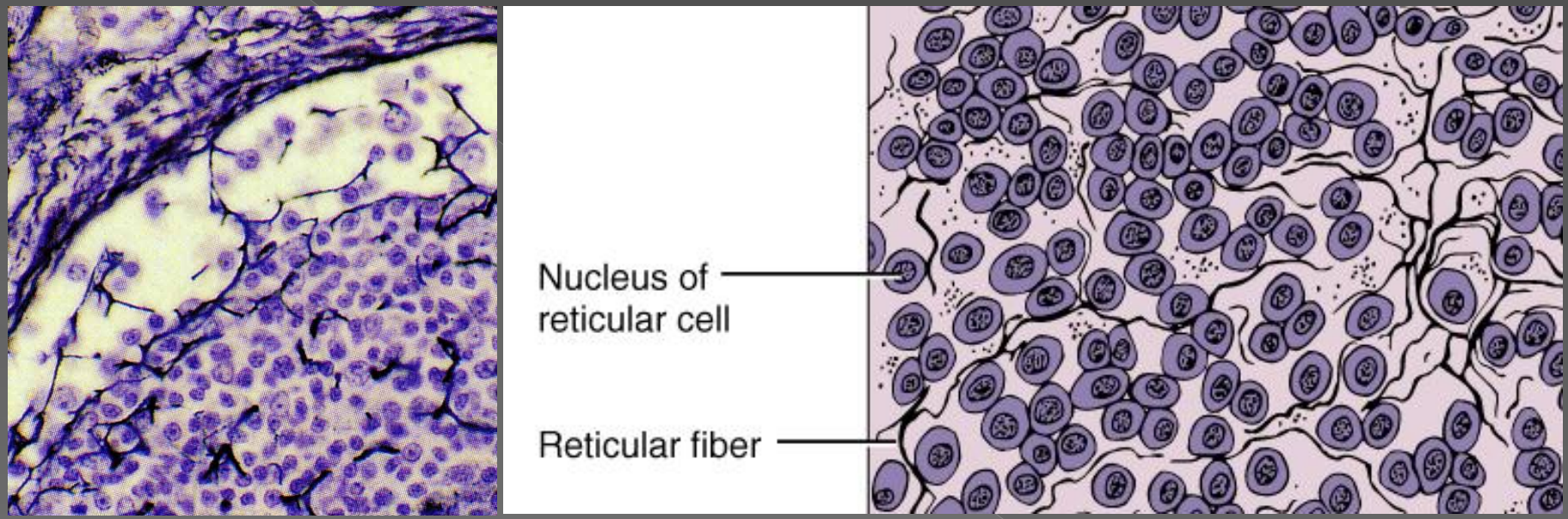
Adipose Tissue





- Peripheral nuclei due to large fat storage droplet
- Deeper layer of skin, organ padding, yellow marrow
- Reduces heat loss, energy storage, protection
- Brown fat found in infants has more blood vessels and mitochondria and responsible for heat generation

Reticular Connective Tissue

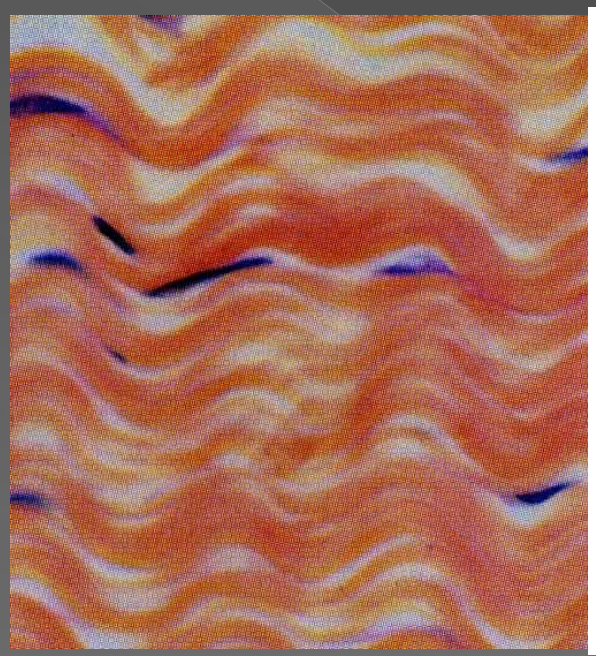


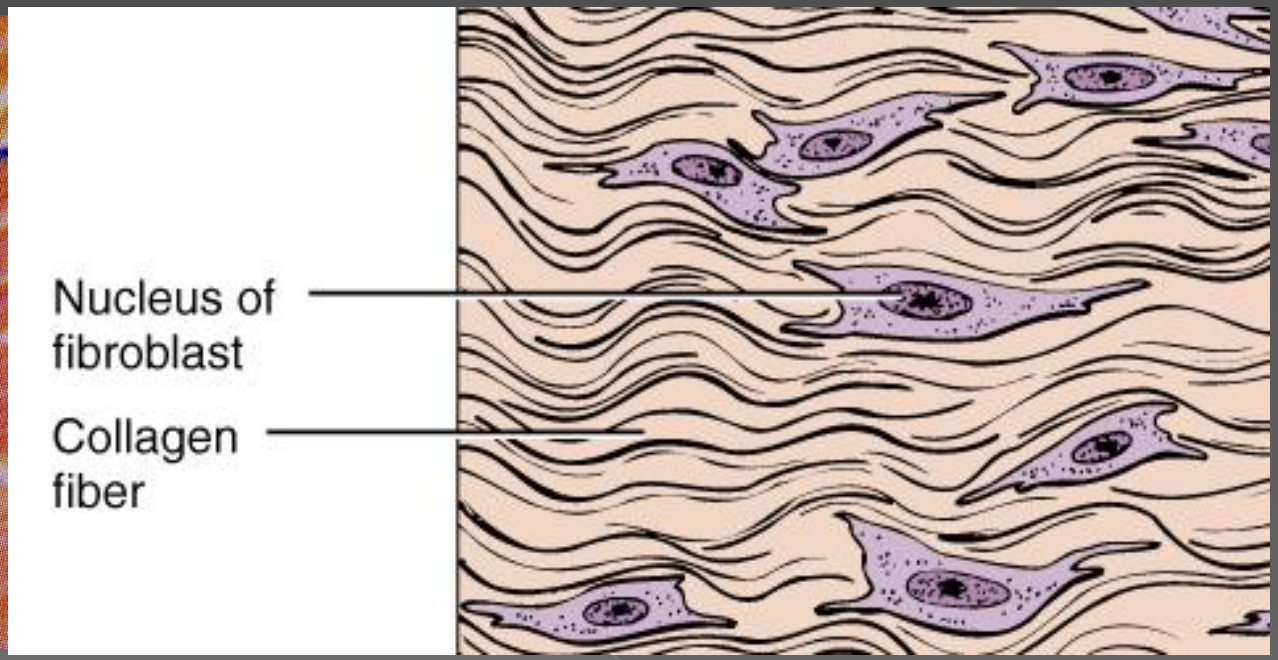
- Network of fibers & cells that produce framework of organ
- Holds organ together (liver, spleen, lymph nodes, bone marrow)

Dense Connective Tissue

- More fibers present but fewer cells
- Types of dense connective tissue
  - dense regular connective tissue
  - dense irregular connective tissue
  - elastic connective tissue

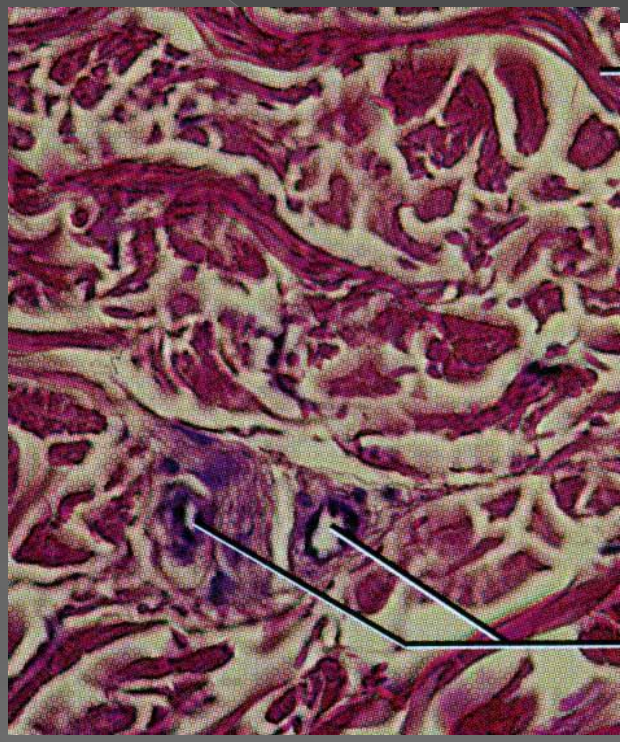
Dense Regular Connective Tissue

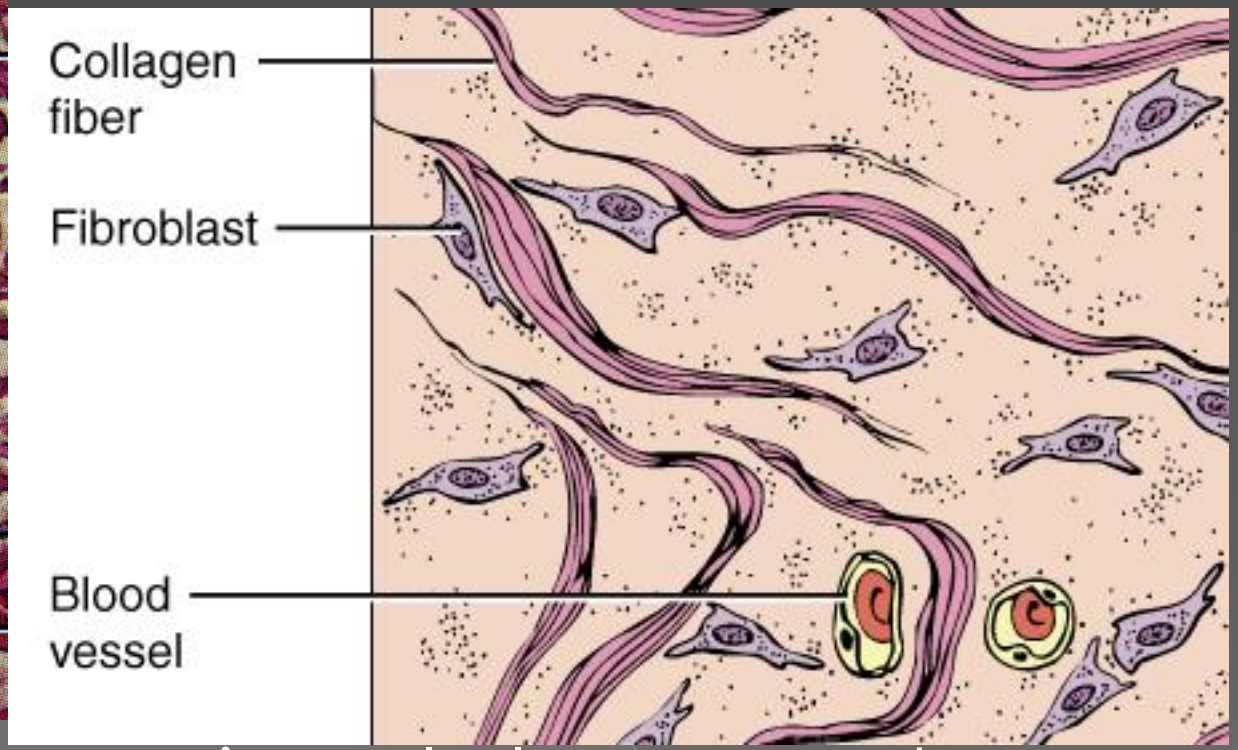




- Collagen fibers in parallel bundles with fibroblasts between bundles of collagen fibers
- White, tough and pliable when unstained (forms tendons)
- Also known as white fibrous connective tissue

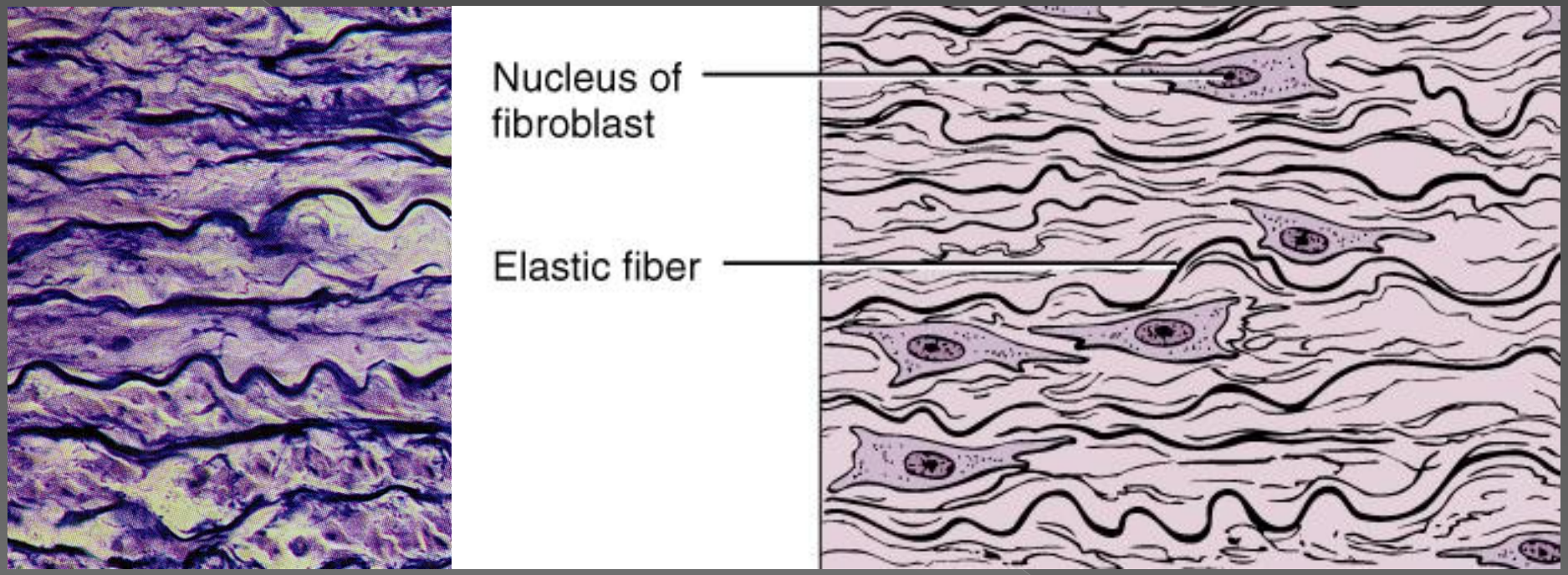
Dense Irregular Connective Tissue





- Collagen fibers are irregularly arranged (interwoven)
- Tissue can resist tension from any direction
- Very tough tissue -- white of eyeball, dermis of skin

Elastic Connective Tissue

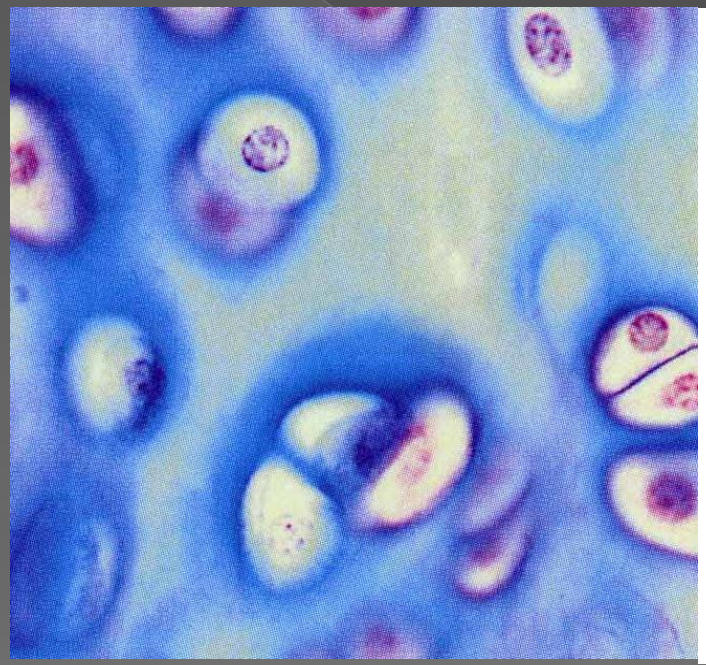


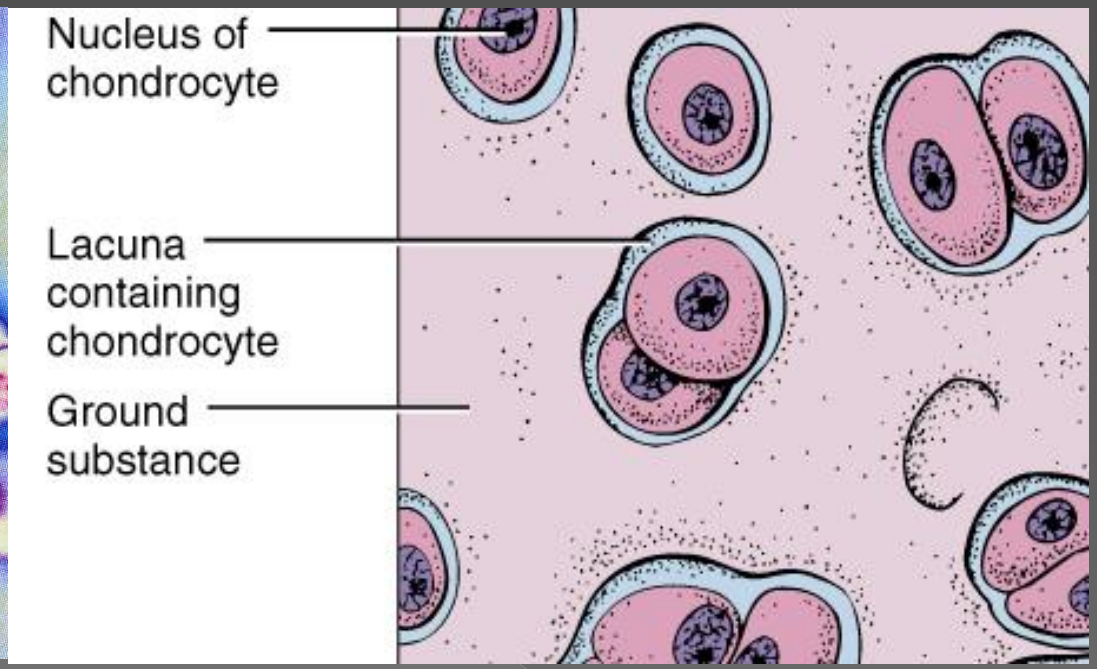
- Branching elastic fibers and fibroblasts
- Can stretch & still return to original shape
- Lung tissue, vocal cords, ligament between vertebrae

Cartilage

- Network of fibers in rubbery ground substance
- Resilient and can endure more stress than loose or dense connective tissue
- Types of cartilage
  - hyaline cartilage
  - fibrocartilage
  - elastic cartilage

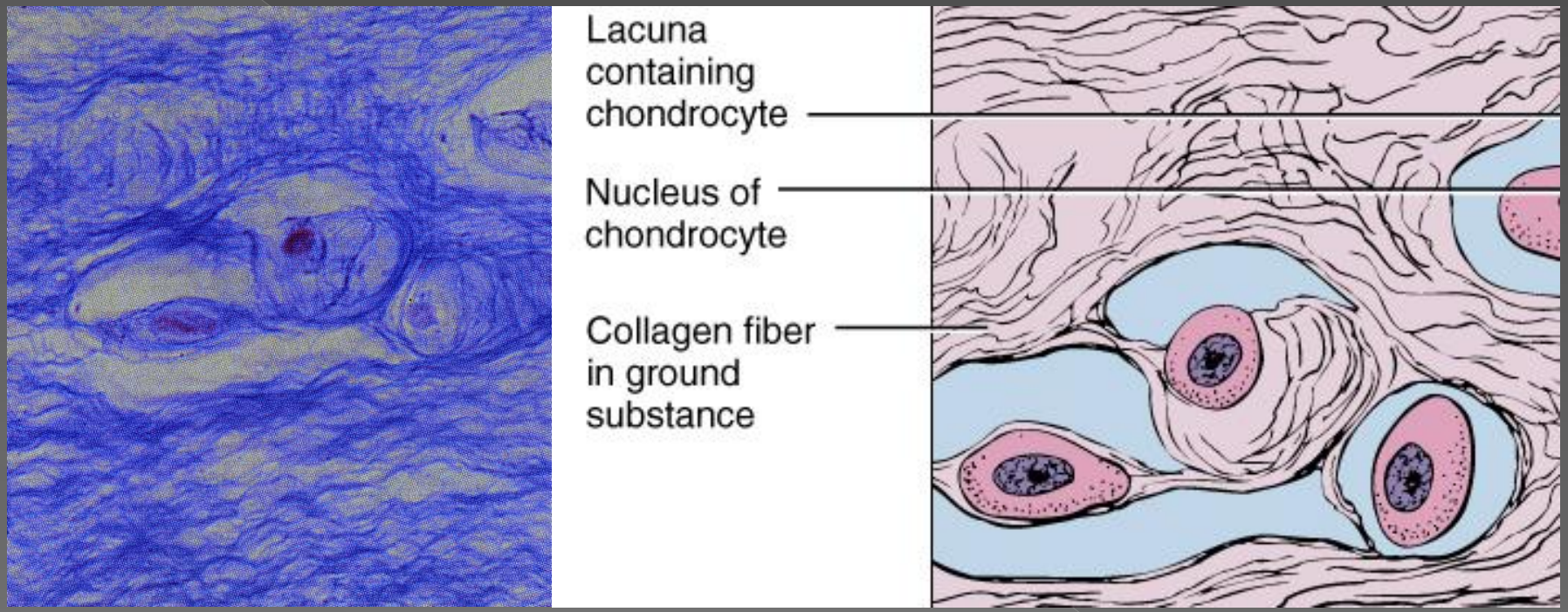
Hyaline Cartilage





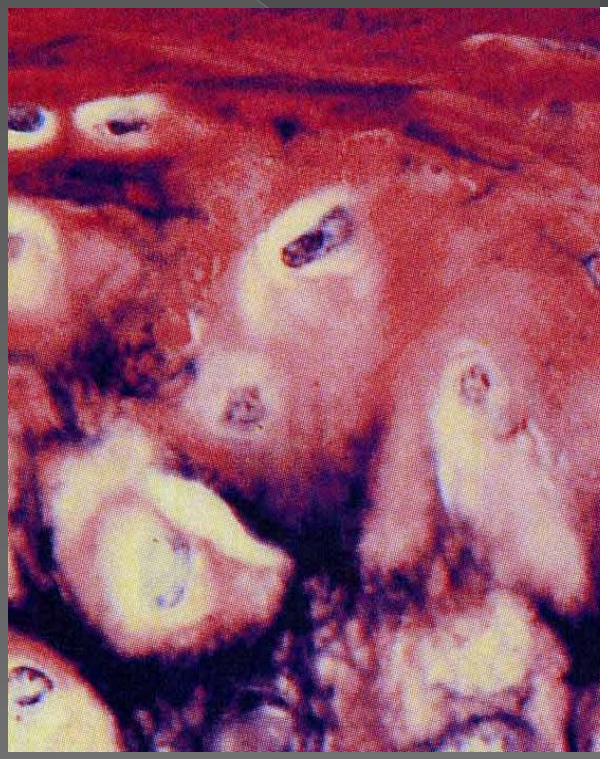
- Bluish-shiny white rubbery substance
- Chondrocytes sit in spaces called lacunae
- No blood vessels or nerves so repair is very slow
- Reduces friction at joints as articular cartilage

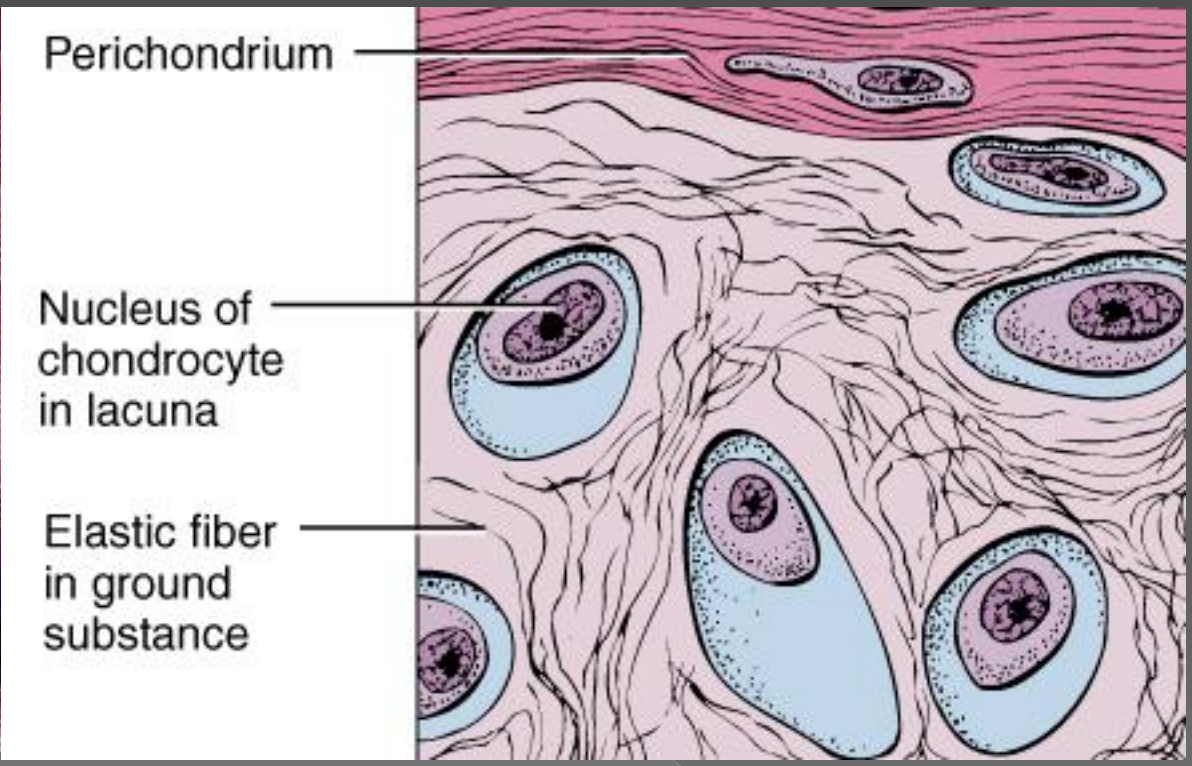
Fibrocartilage



- Many more collagen fibers causes rigidity & stiffness
- Strongest type of cartilage (intervertebral discs)

Elastic Cartilage



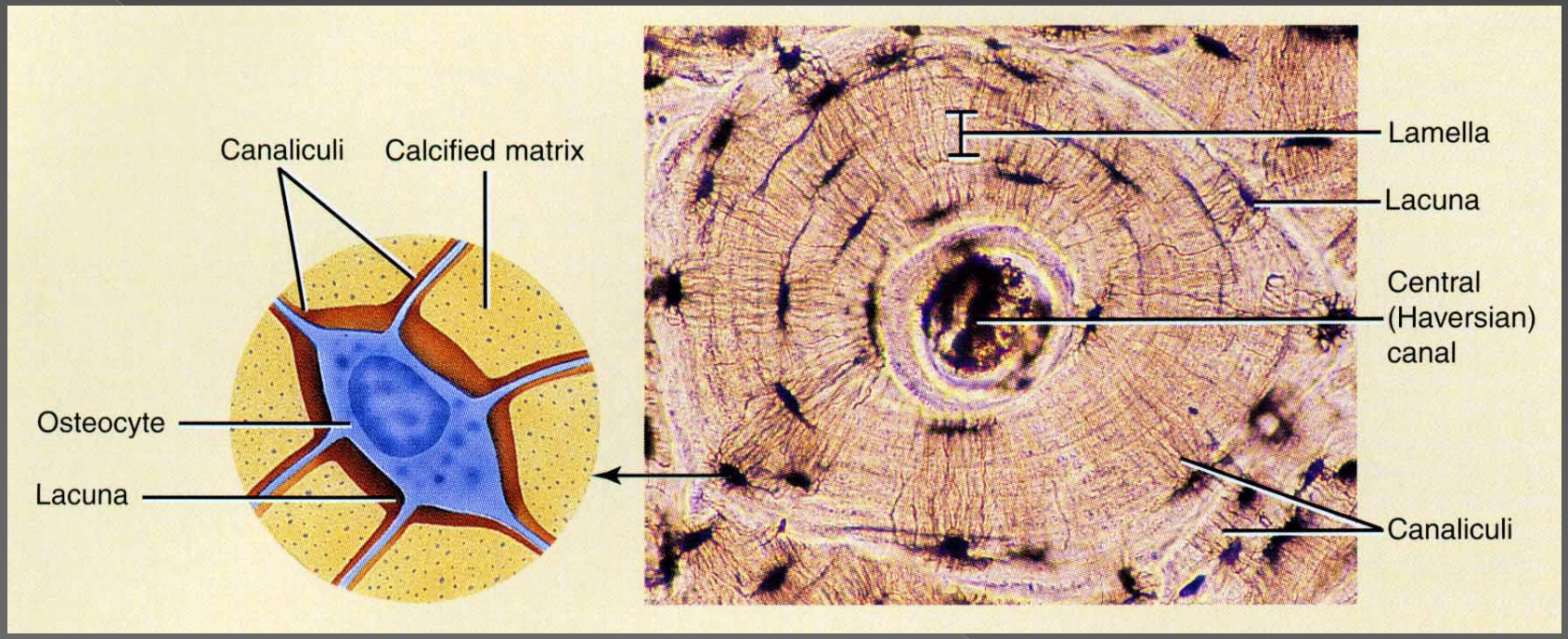


- Elastic fibers help maintain shape after deformations
- Ear, nose, vocal cartilages

Bone (Osseous) Tissue

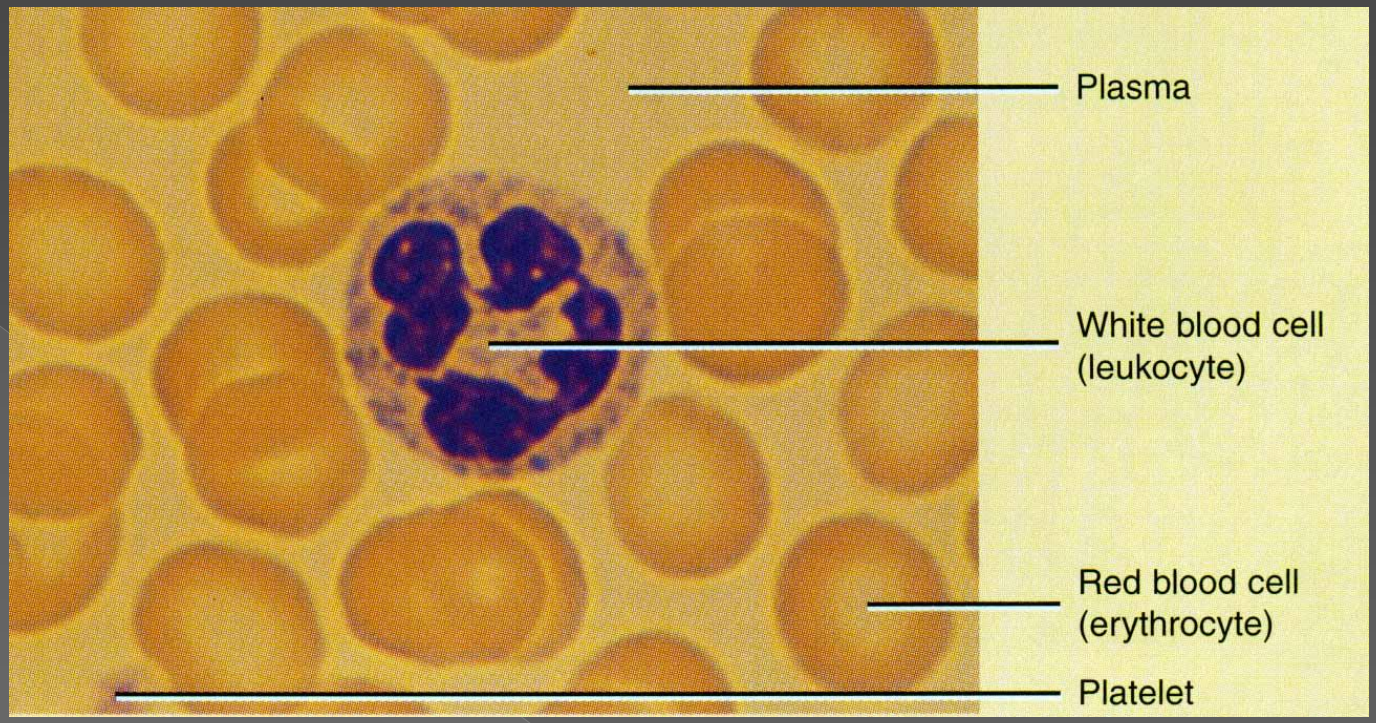
- Spongy bone
  - sponge-like with spaces and trabeculae
  - trabeculae = struts of bone surrounded by red bone marrow
  - no osteons (cellular organization)
- Compact bone
  - solid, dense bone
  - basic unit of structure is osteon (haversian system- canal containing blood supply)
- Protects, provides for movement, stores minerals, site of blood cell formation

Compact Bone



- Osteon = lamellae (rings) of mineralized matrix
  - calcium & phosphate---give it its hardness
  - interwoven collagen fibers provide strength
- Osteocytes in spaces (lacunae) in between lamellae
- Canaliculi (tiny canals) connect cell to cell

Blood

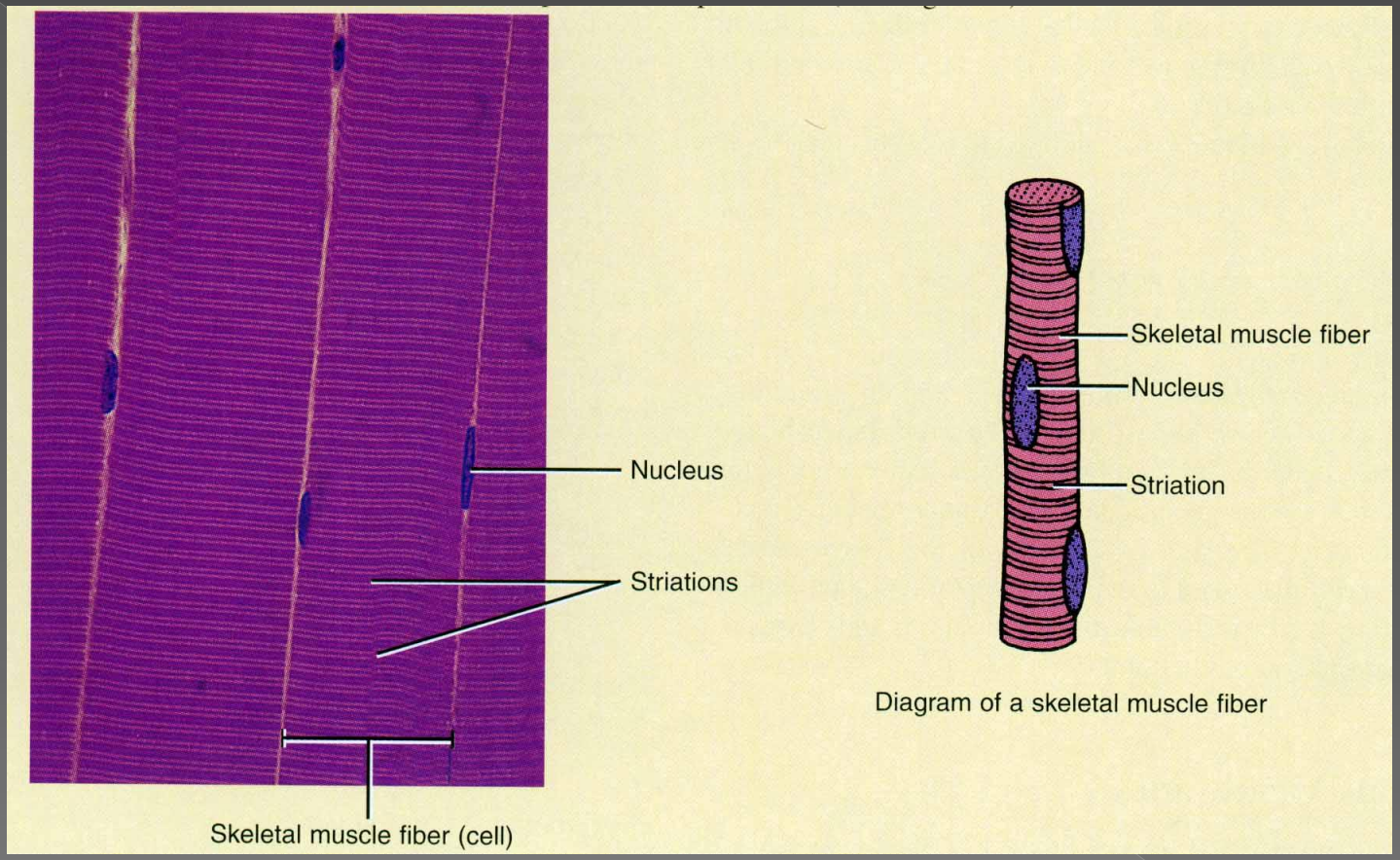


- Connective tissue with a liquid matrix = the plasma
- Cell types = red blood cells (erythrocytes), white blood cells (leukocytes) and cell fragments called platelets
- Provide clotting, immune functions, carry O2 and CO2

Muscle

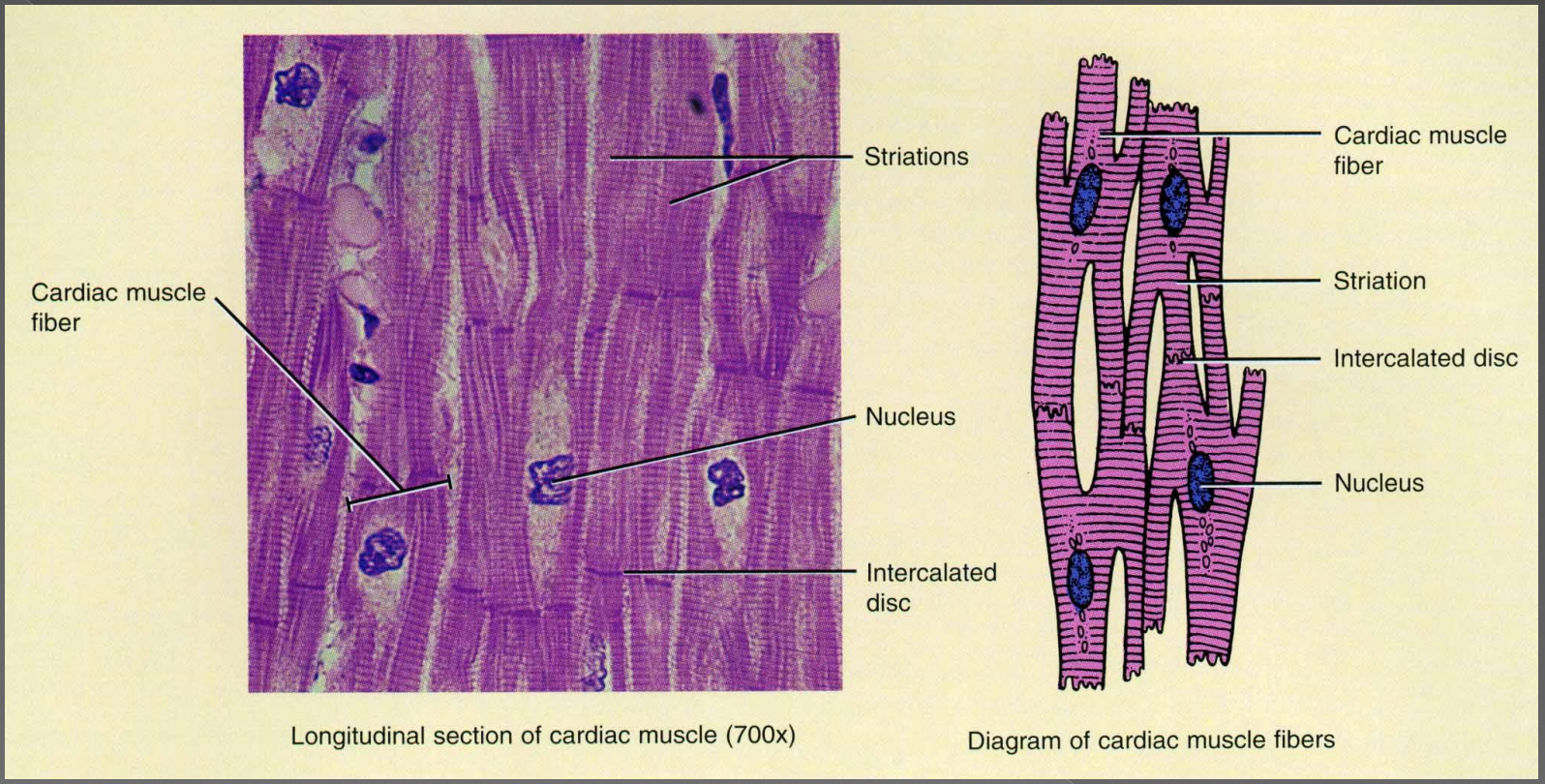
- Cells that shorten
- Provide us with motion, posture and heat
- Types of muscle
  - skeletal muscle
  - cardiac muscle
  - smooth muscle

Skeletal Muscle



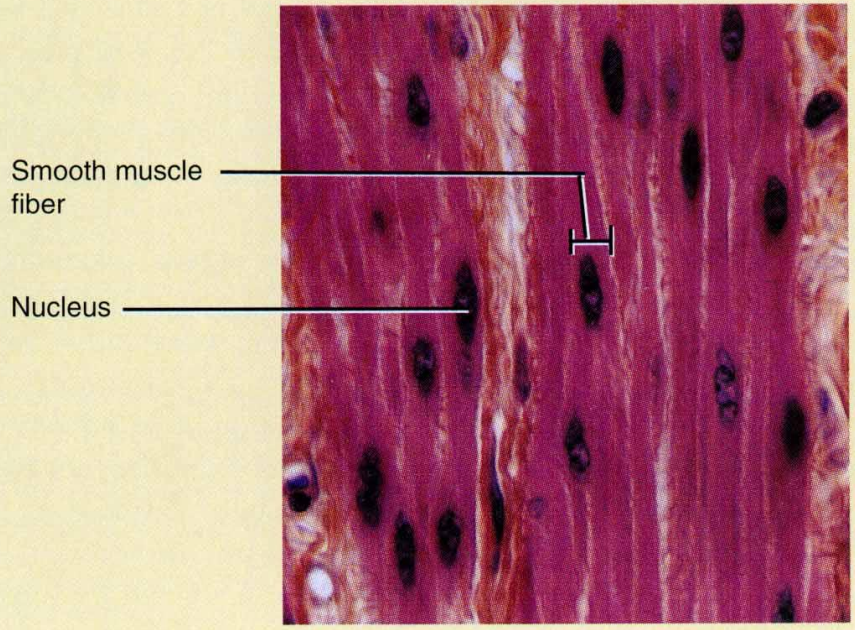
- Cells are long cylinders with many peripheral nuclei
- Visible light and dark banding (looks striated)
- Voluntary or conscious control

Cardiac Muscle



- Cells are branched cylinders with one central nuclei
- Involuntary and striated
- Attached to and communicate with each other by intercalated discs

Smooth Muscle



Longitudinal section of smooth muscle (840x)

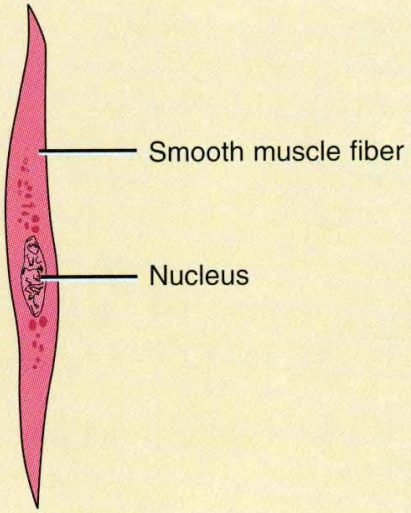
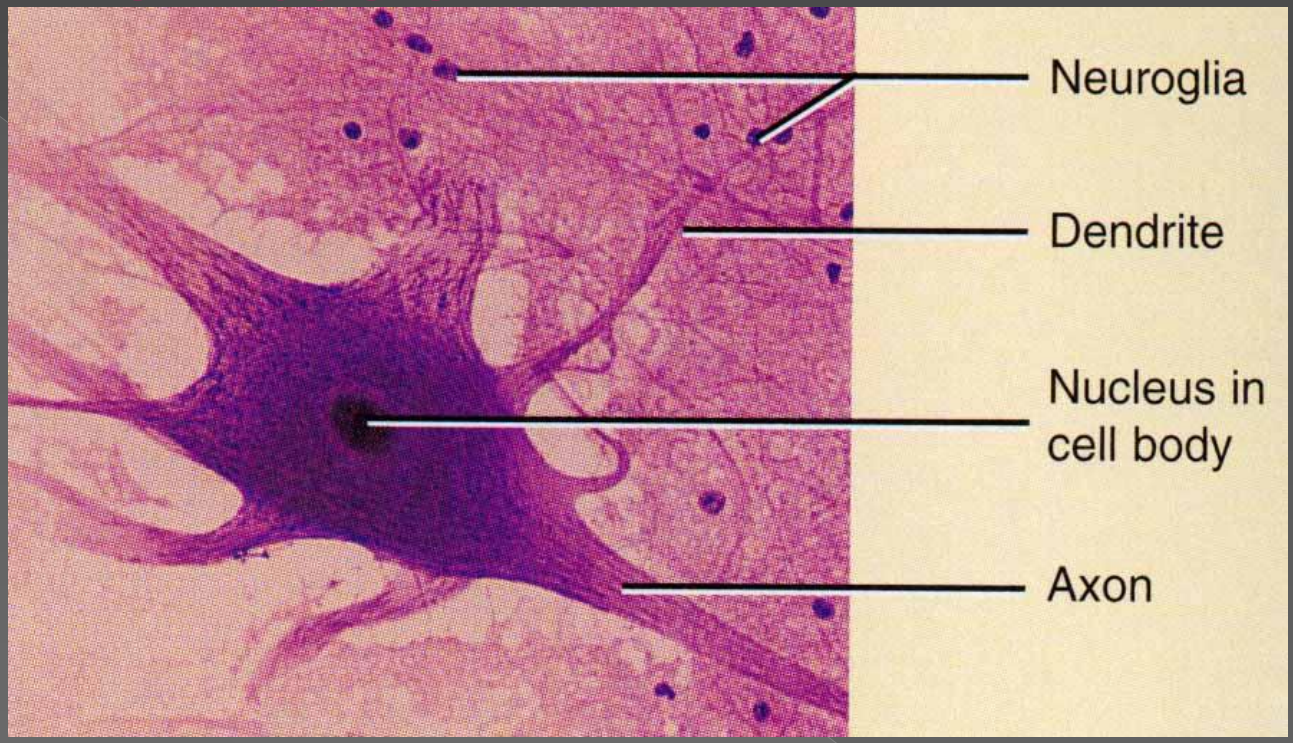


Diagram of a smooth muscle fiber

- Spindle shaped cells with a single central nuclei
- Walls of hollow organs (blood vessels, GI tract, bladder)
- Involuntary and nonstriated

Nerve Tissue



- Cell types -- nerve cells and neuroglial (supporting) cells
- Nerve cell structure
  - nucleus & long cell processes conduct nerve signals
    - dendrite --- signal travels towards the cell body
    - axon ---- signal travels away from cell body