



JOHNS HOPKINS

WHITING SCHOOL  
of ENGINEERING

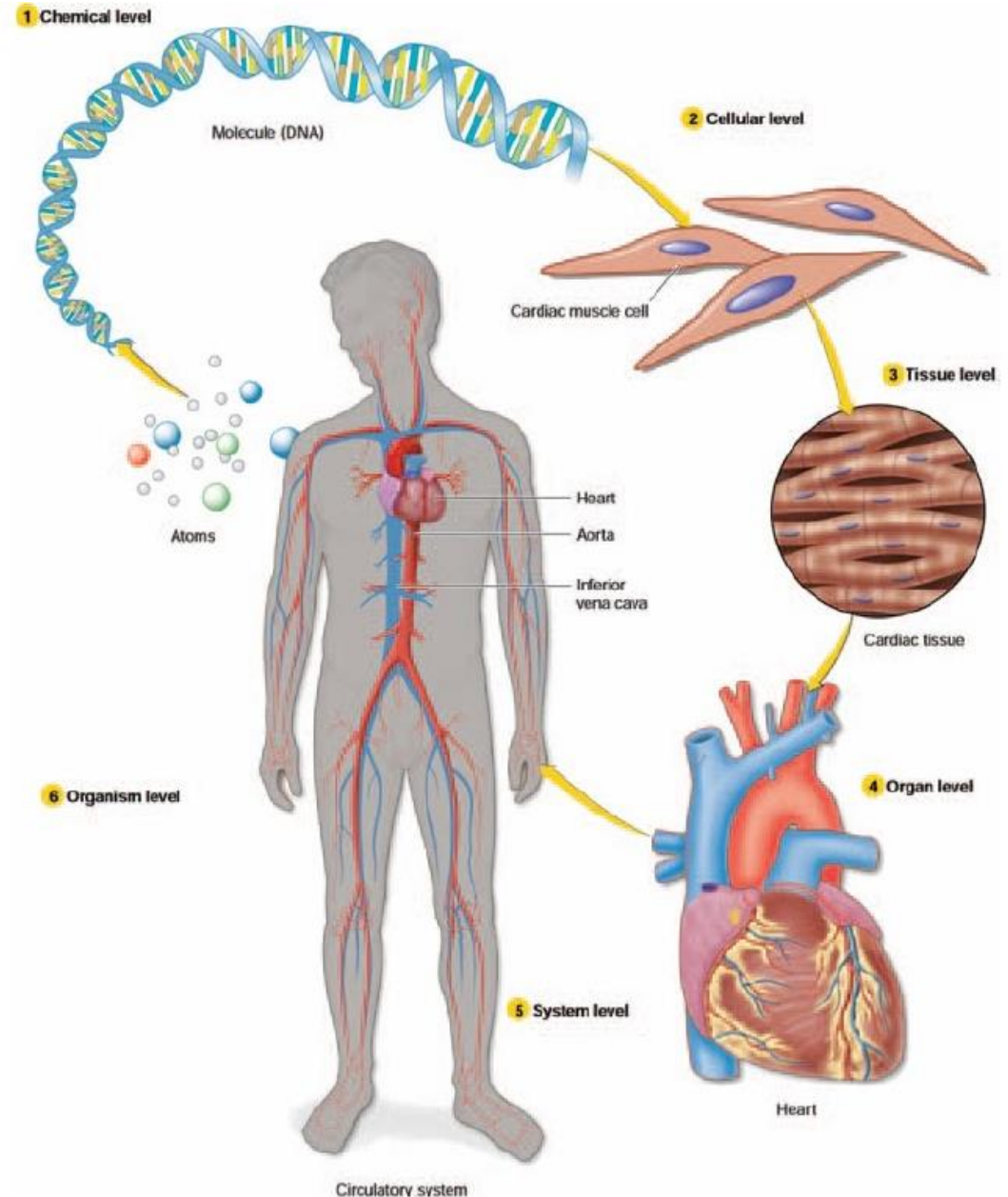
# Cell and Tissue Engineering

Tissue Organization and Dynamics

Part 1 Tissue Organization

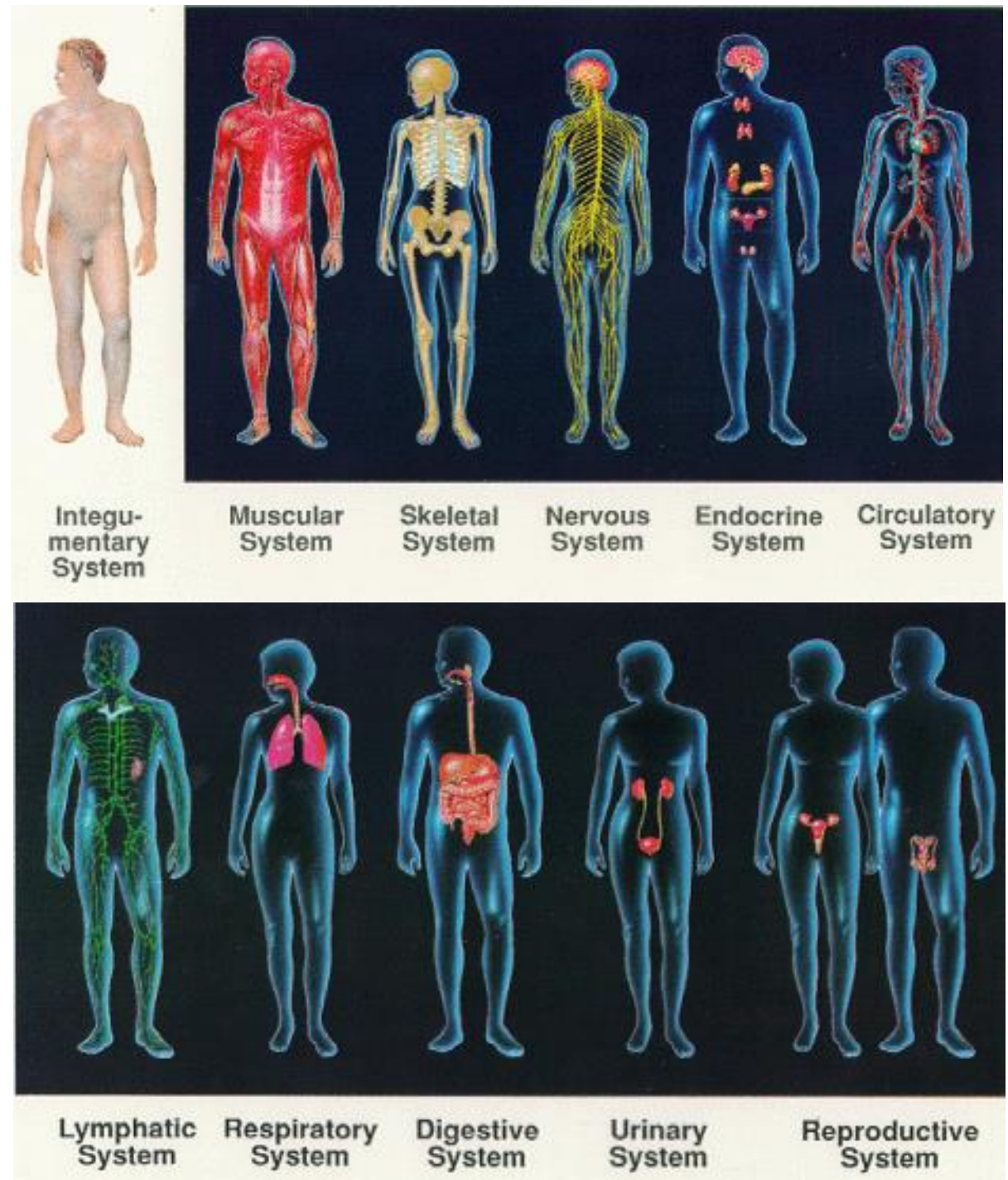
# Levels of organization

- Atom
- Molecule
- Specialized cell
- (Functional Unit)
- Tissue
- Organ
- Organ system
- Organism





# Organ Systems



<http://aarcara.wordpress.com/11th/biology/the-cell-and-systems/>

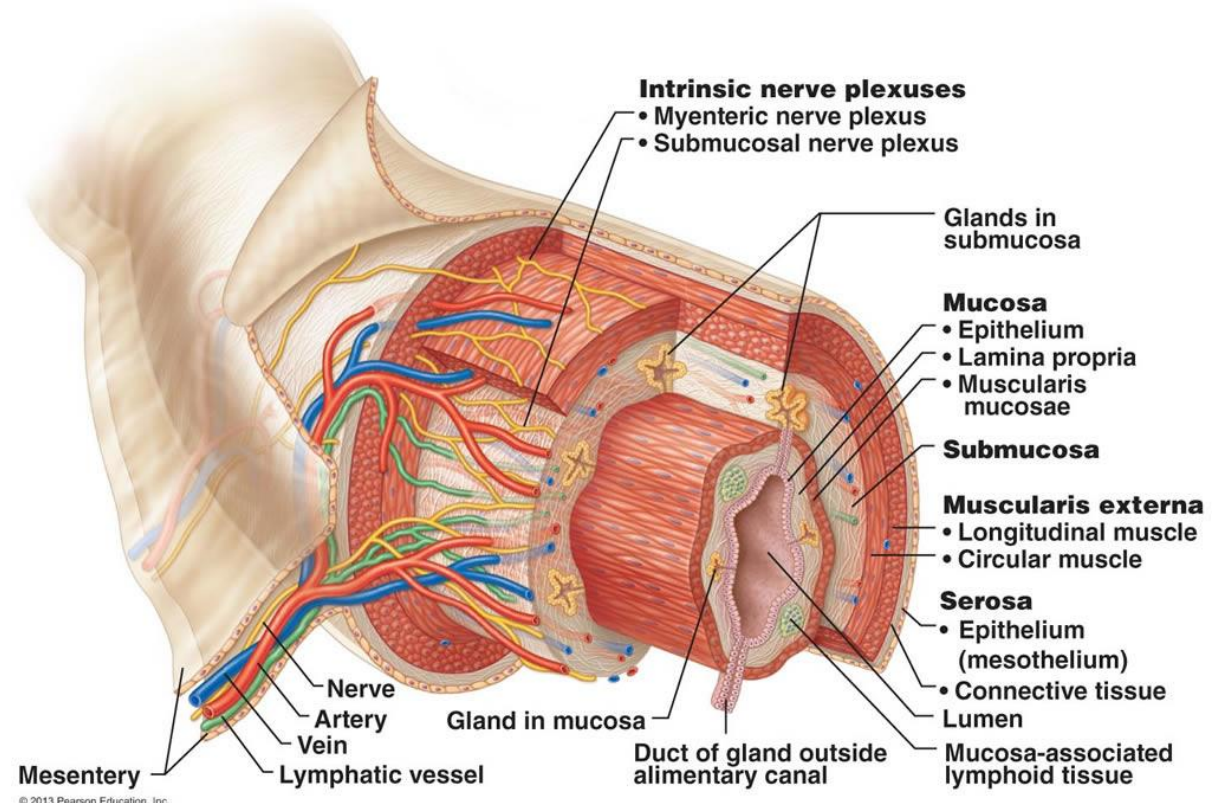
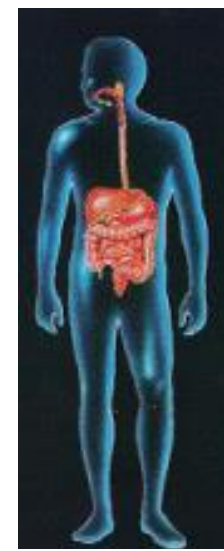
# Organ Systems

## ■ GI system organs

- Esophagus
- Stomach
- Duodenum
- Jejunum/ Ileum
- Colon
- ...

## ■ GI system tissue types

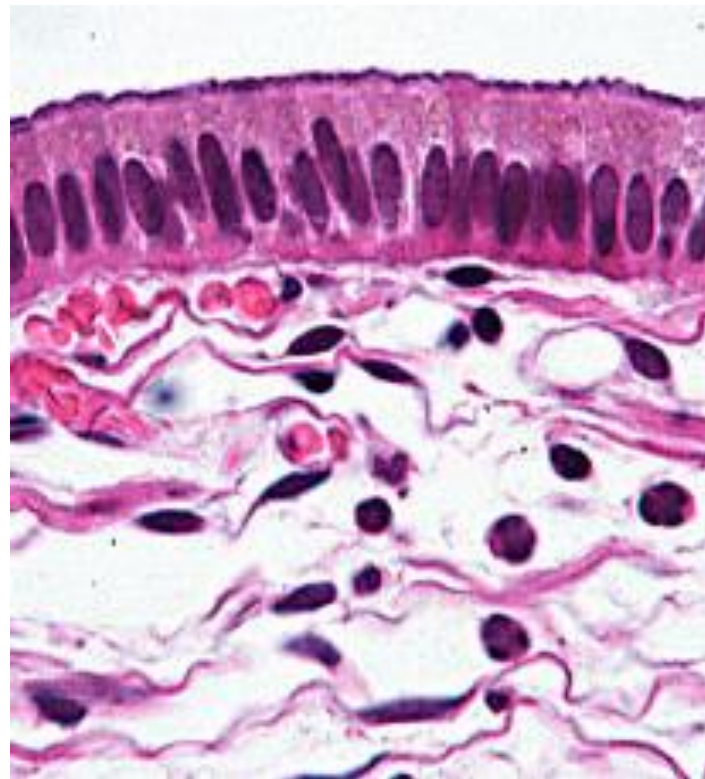
- Epithelia
- Connective
- Muscular
- Nervous





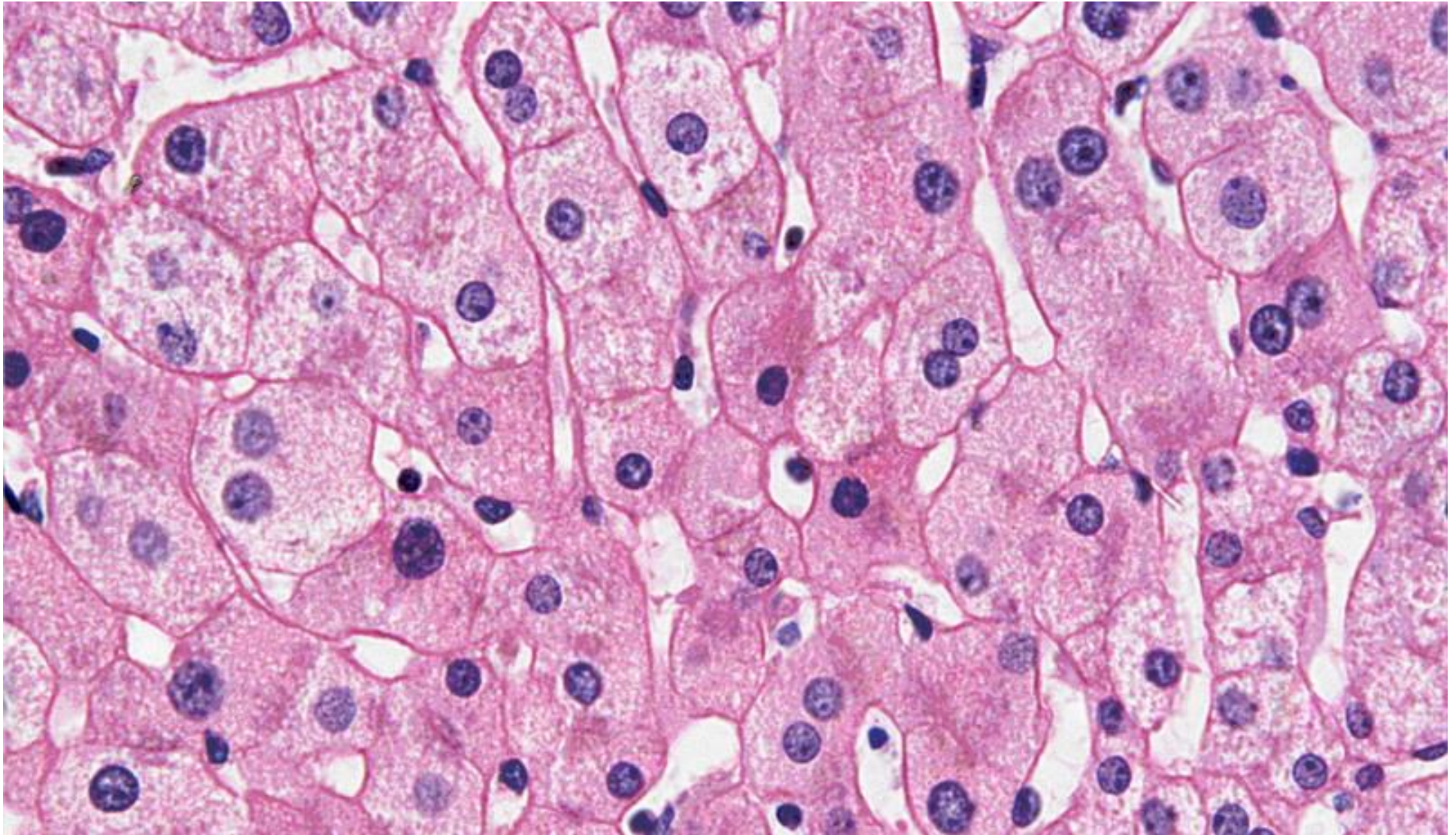
# Tissue Structure

<b>Tissue</b>	<b>A collection of specialized cells and cell products organized to perform a limited number of functions</b>
<b>Histology</b>	<b>The study of tissues</b>

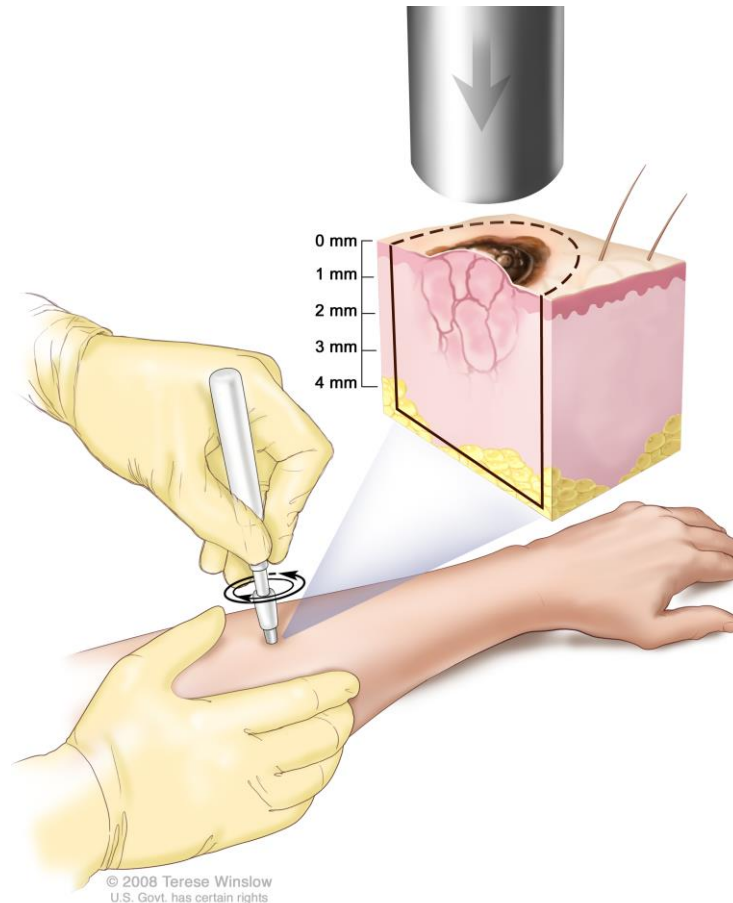




# Histology – H&E Stain: H&E – Hematoxylin and Eosin

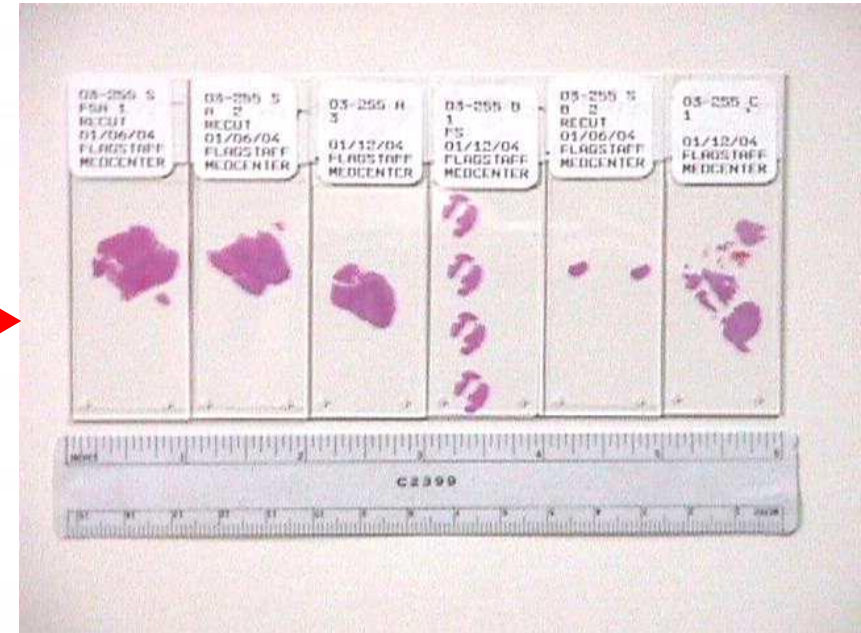
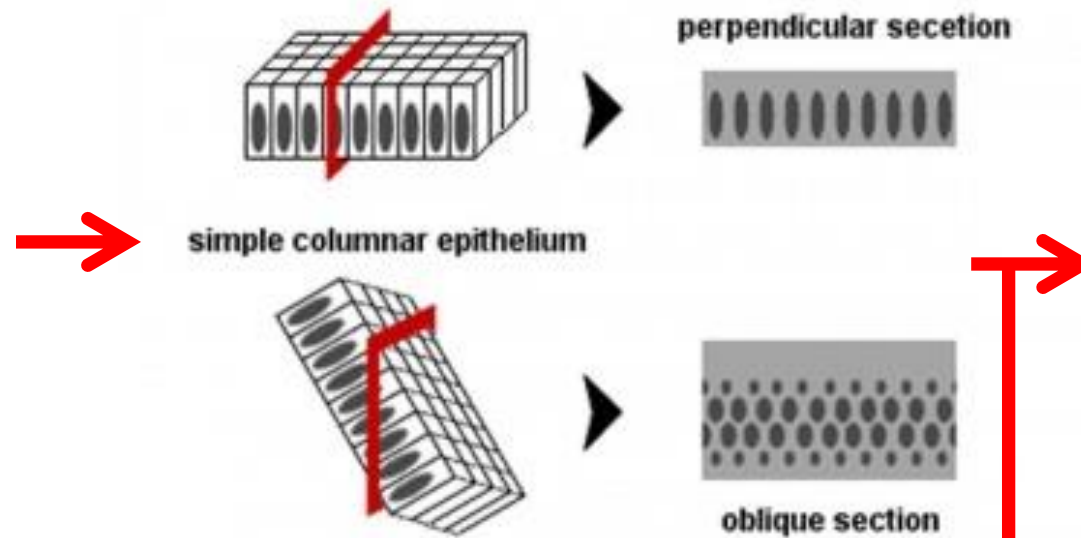


# Histology – H&E Stain: Tissue Sections





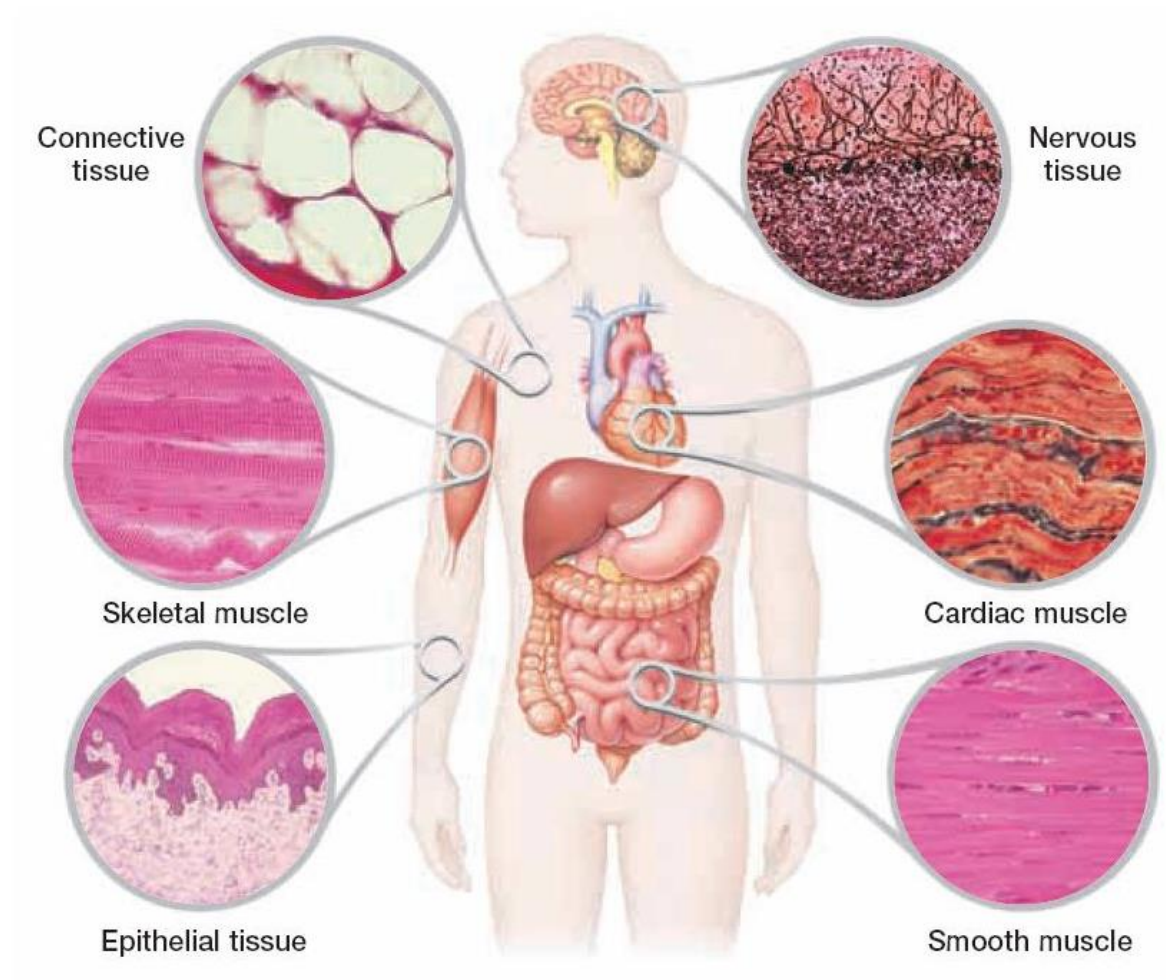
# Histology – H&E Stain: Tissue Sections (cont)





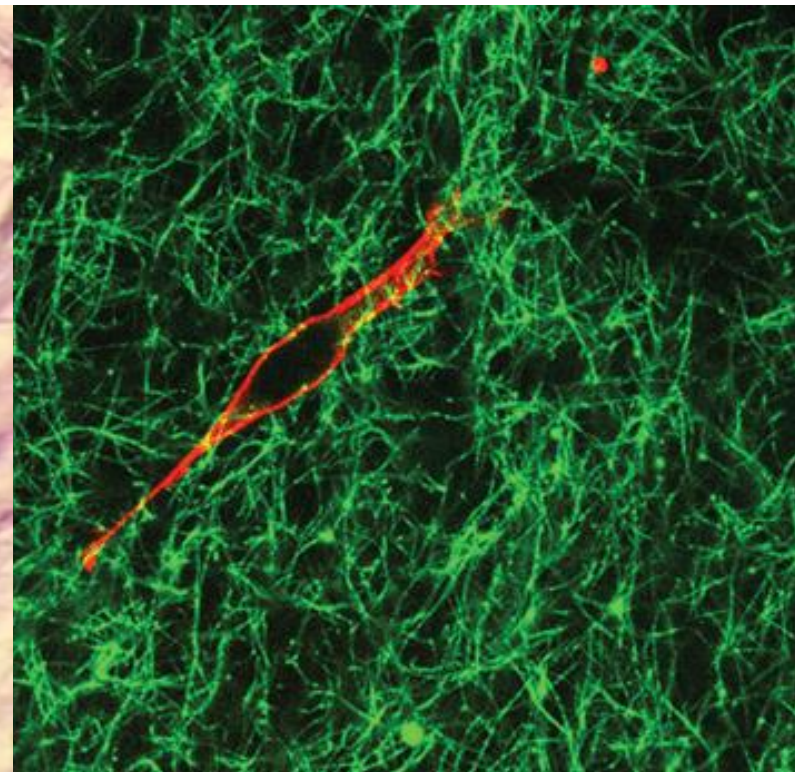
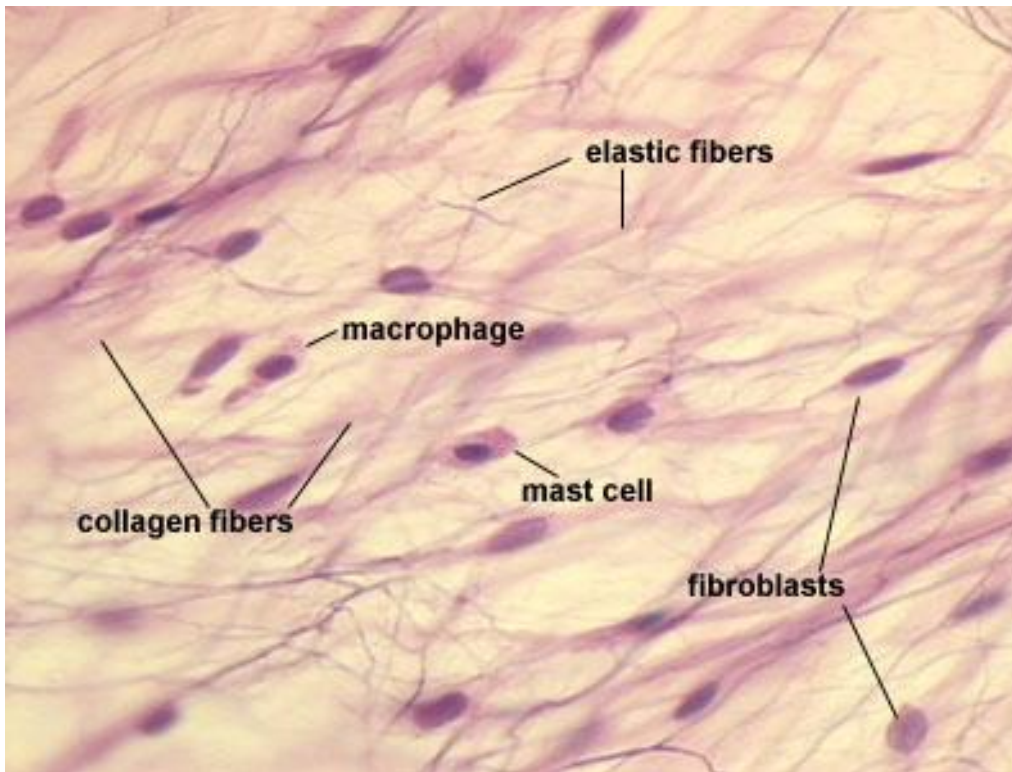
# The Four Tissue Types

- Epithelial
- Connective
- Muscular
- Nervous



# Tissue Structure

<b>Tissue</b>	<b>A collection of specialized cells and cell products organized to perform a limited number of functions</b>
<b>Histology</b>	<b>The study of tissues</b>

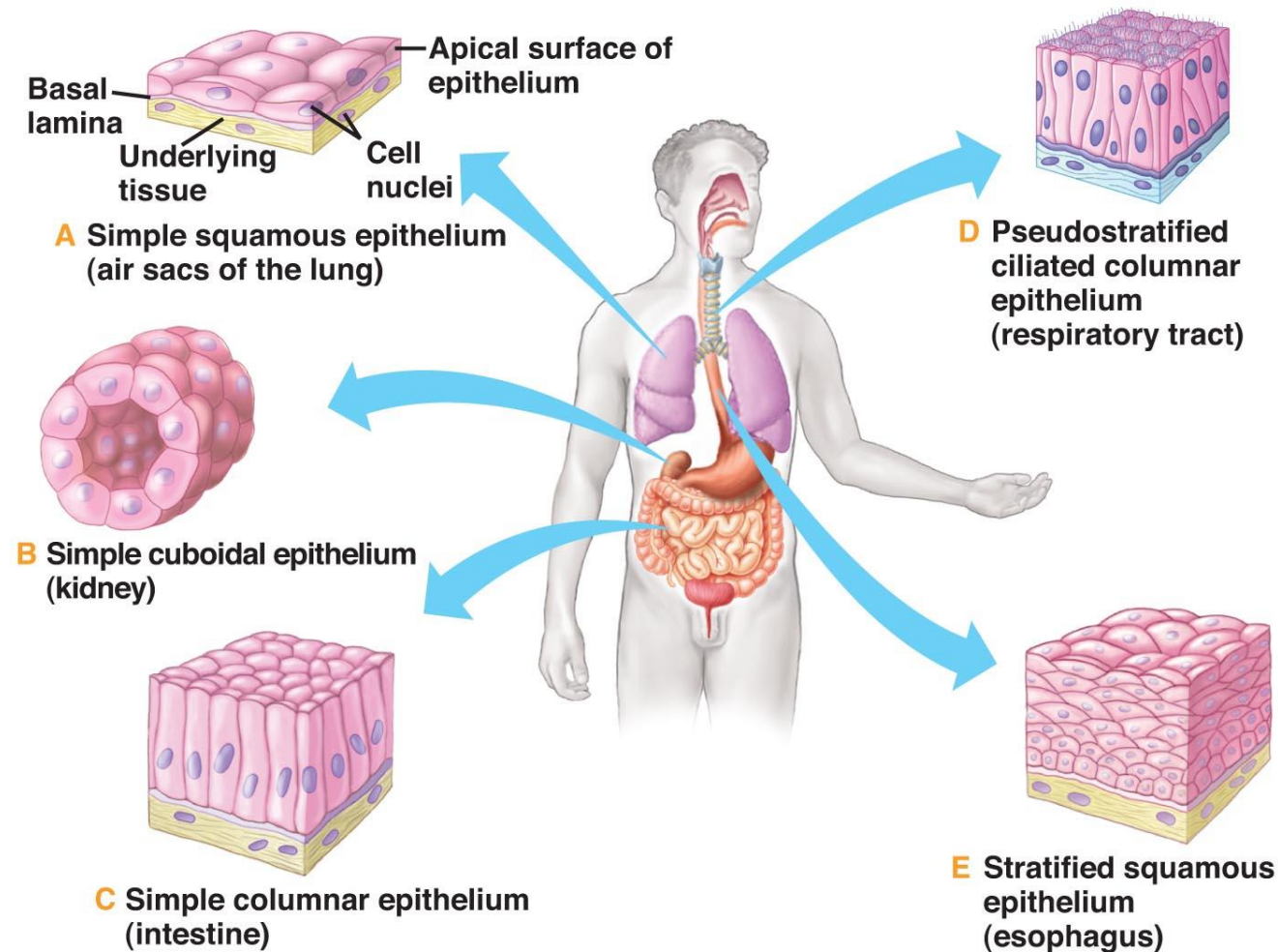




# Epithelial

## Key Functions

- Protective barrier
- Interface with the environment

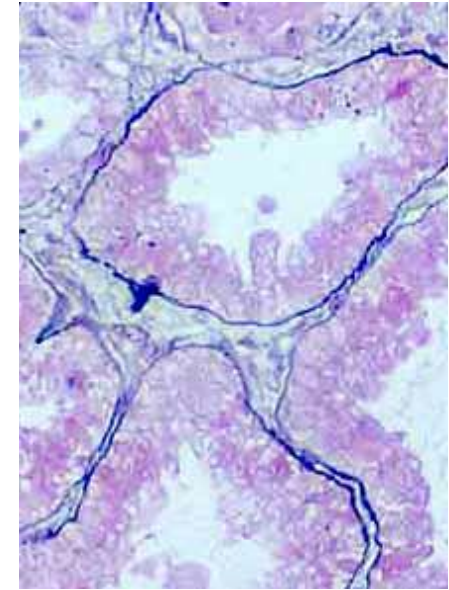
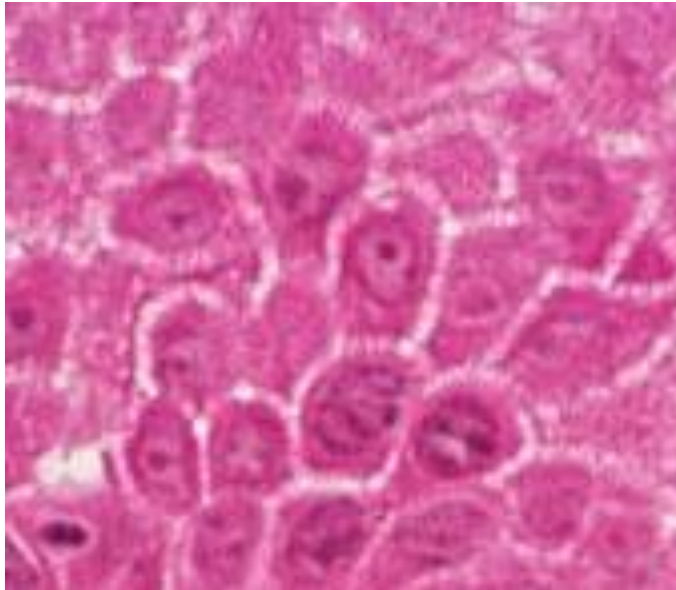


## Epithelial locations

# Epithelial

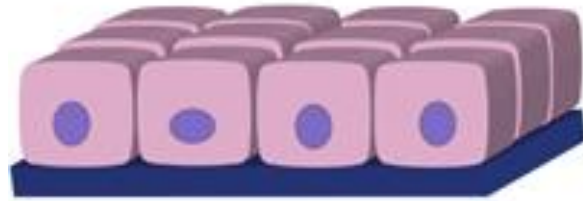
## Key Features

- Uninterrupted layer of cells
- Cells are attached to one another
- Intercellular spaces are small
- Cells are polarized
- Cells are separated from the rest of the tissue by a basement membrane

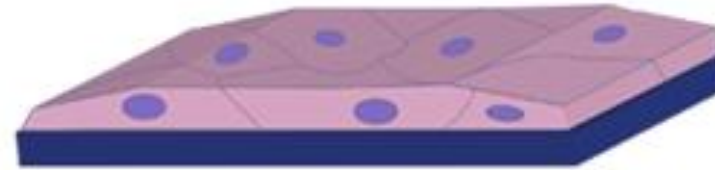




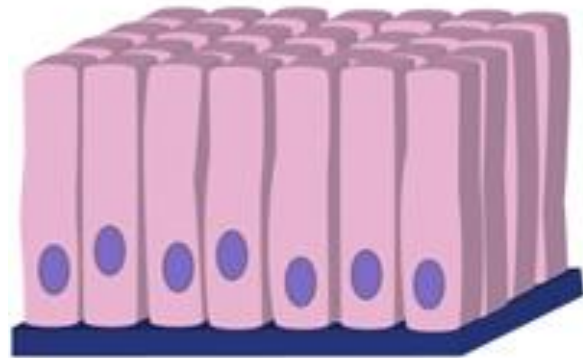
# Epithelial



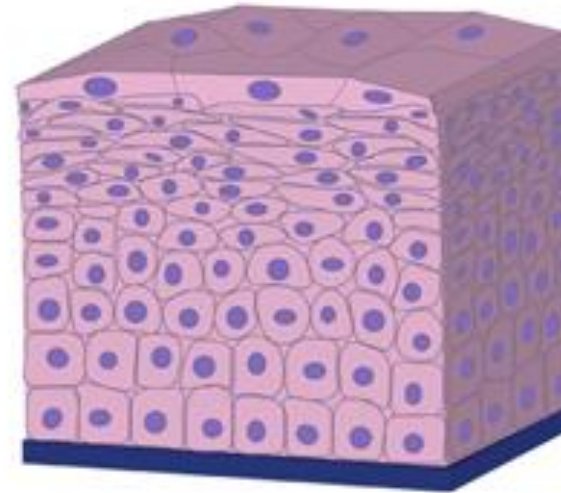
**Simple Cuboidal**



**Simple Squamous**



**Simple Columnar**



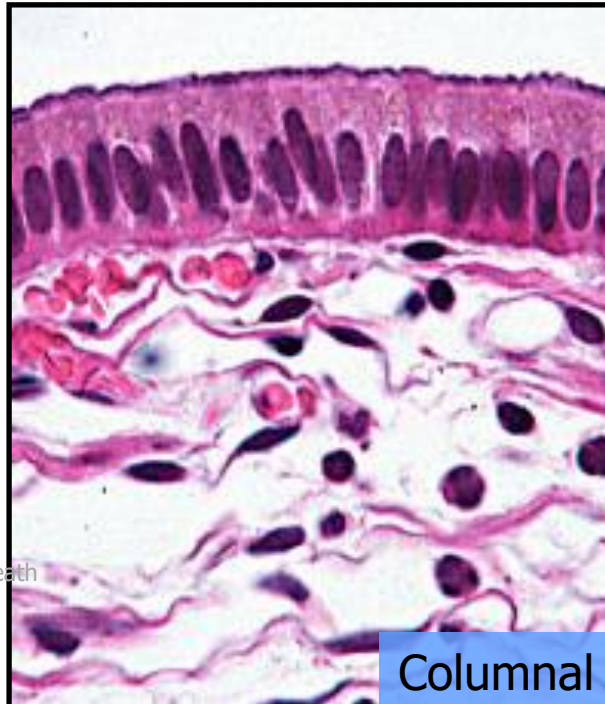
**Stratified Squamous**

# Epithelial

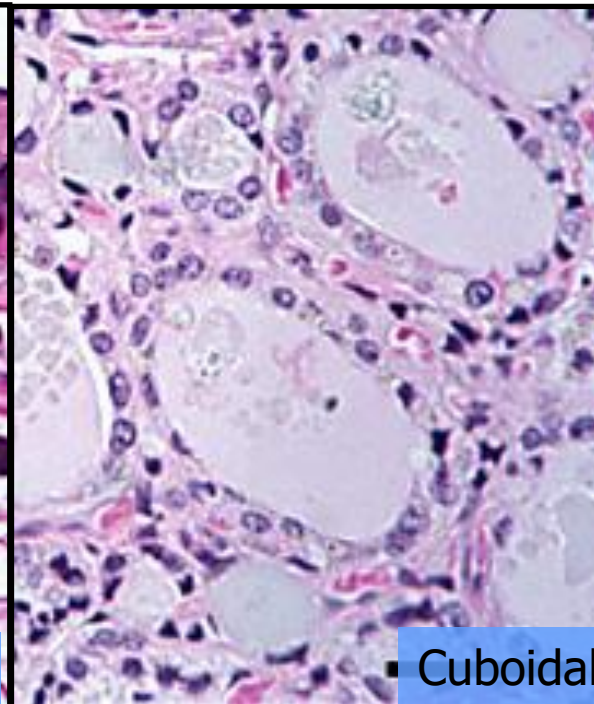
- Columnar
- Cuboidal
- Simple squamous
- Stratified squamous



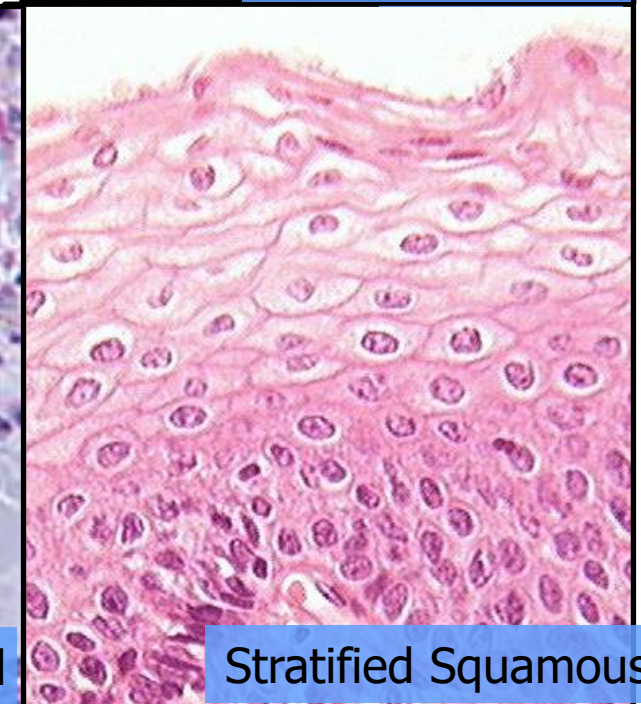
Simple Squamous



Columnal



■ Cuboidal

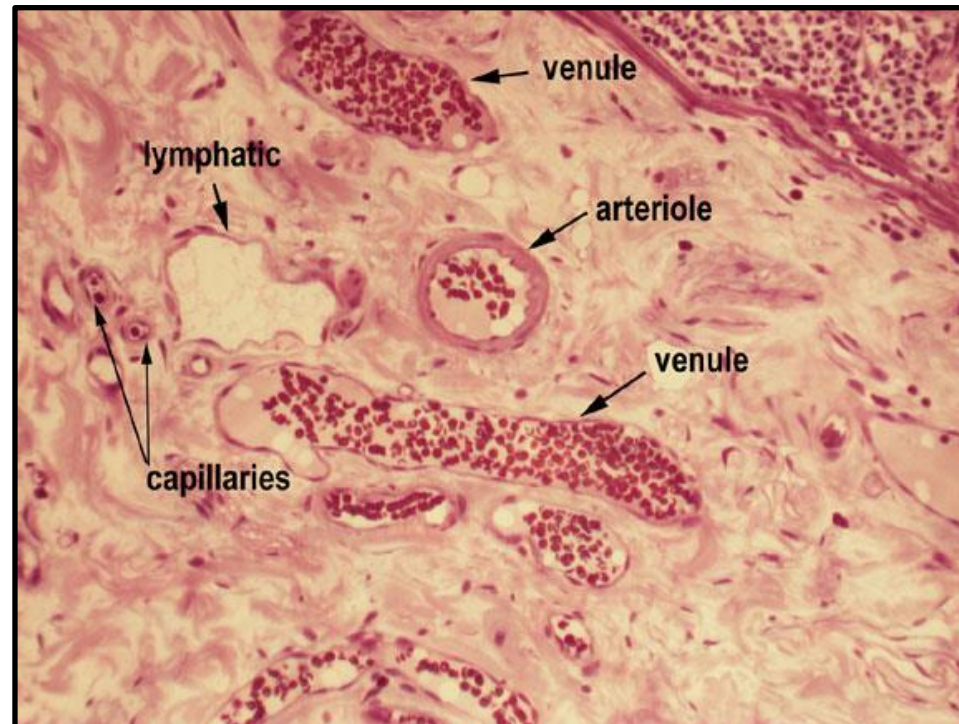


Stratified Squamous 14



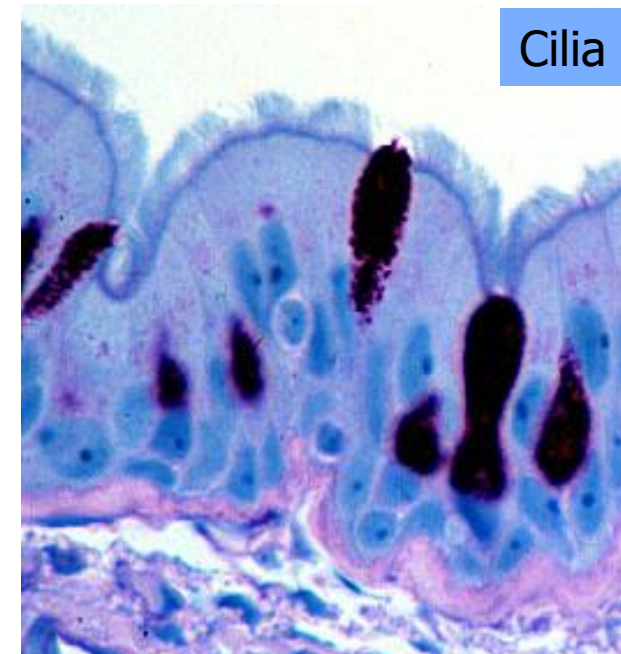
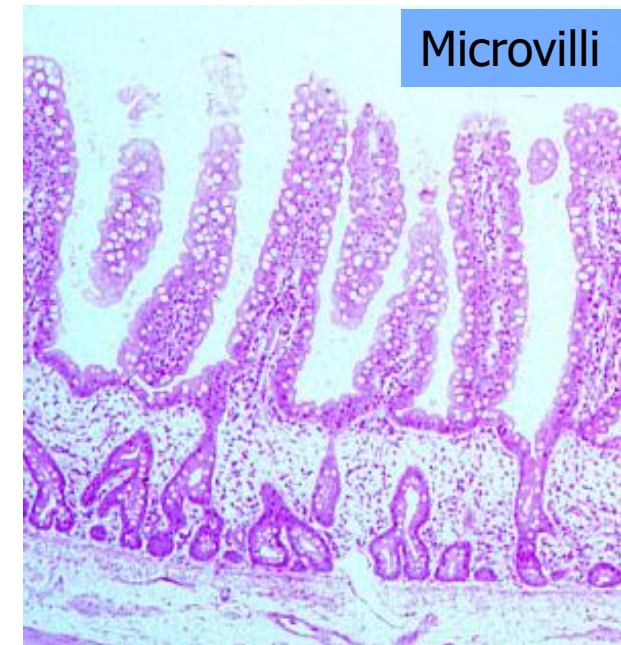
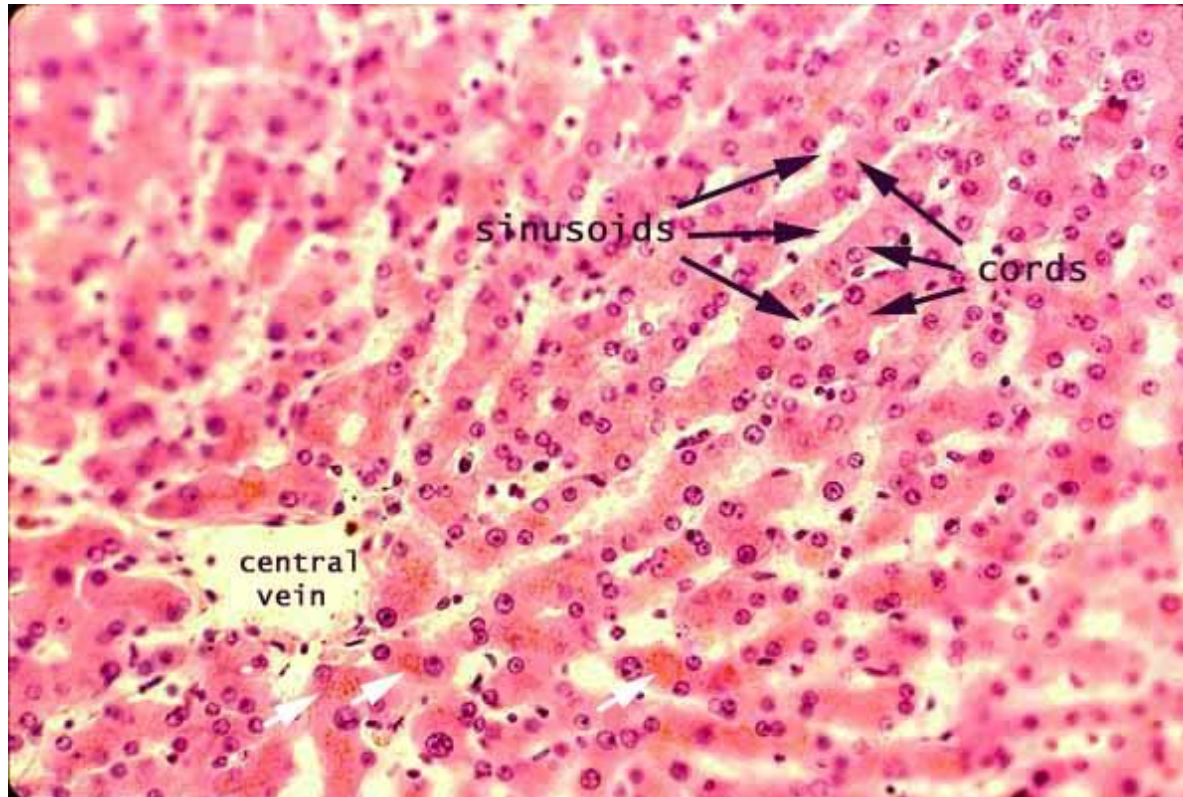
# Epithelial

- Columnar
- Cuboidal
- Simple squamous
- Stratified squamous



# Epithelial

- Ciliated cells (e.g. trachea)
- Absorptive cells (e.g. intestine)
- Secretory cells (e.g. hepatocyte)

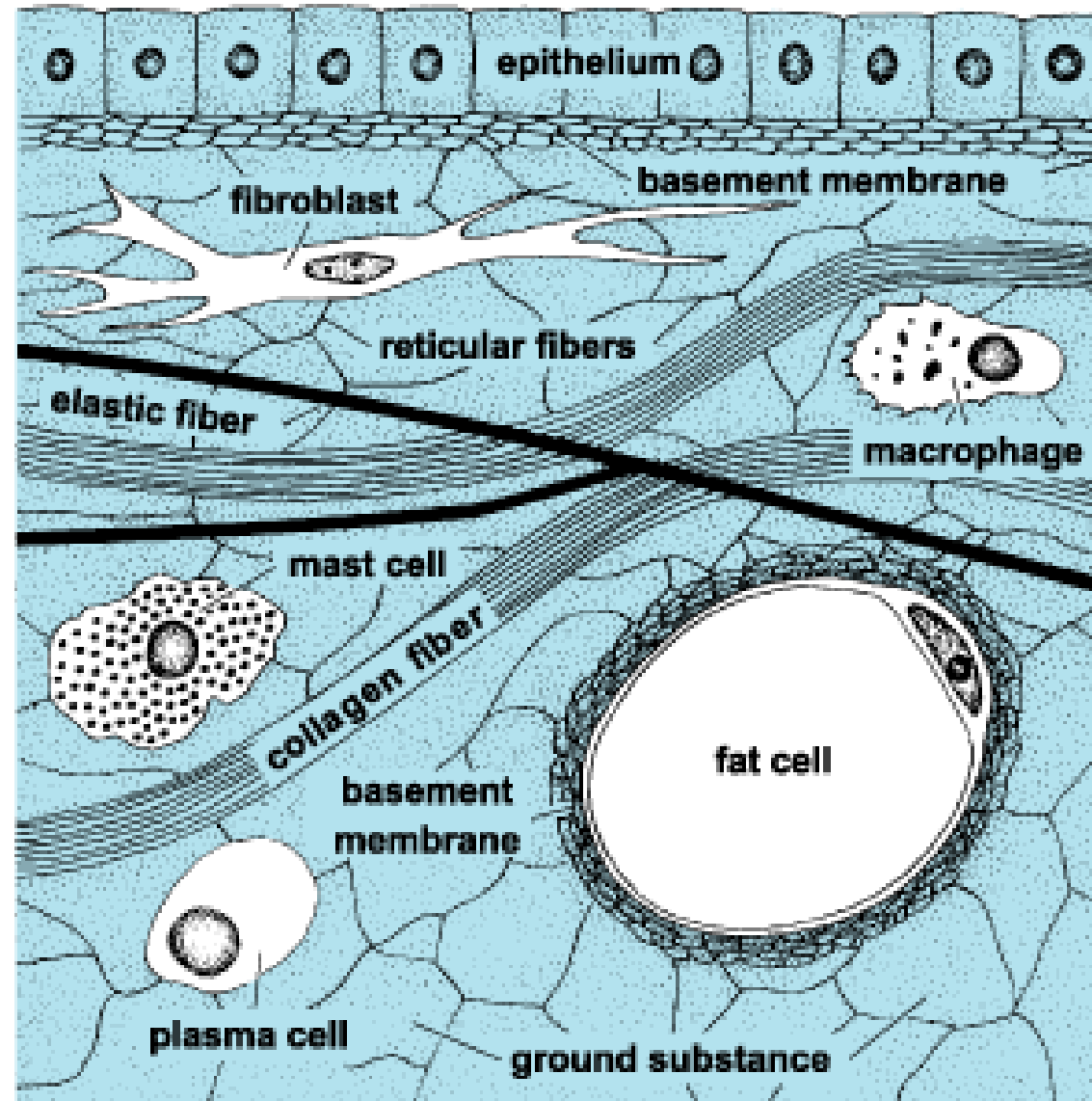




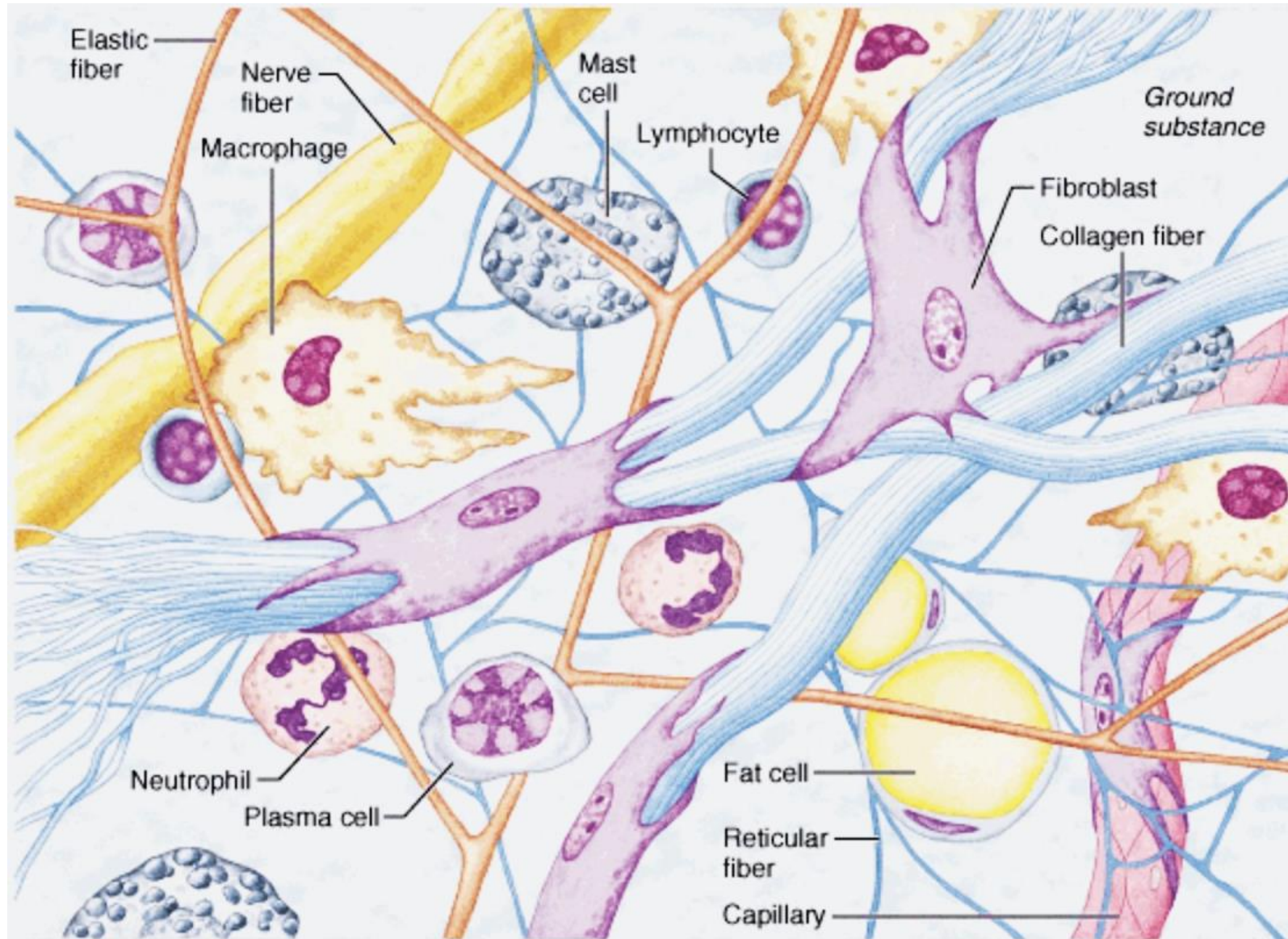
# Connective

## Cell types

- Fibroblast
- Macrophages & mast cells
- Adipose cells  
*fat storage*
- Osteoblast  
*bone*
- Chondrocytes  
*cartilage*



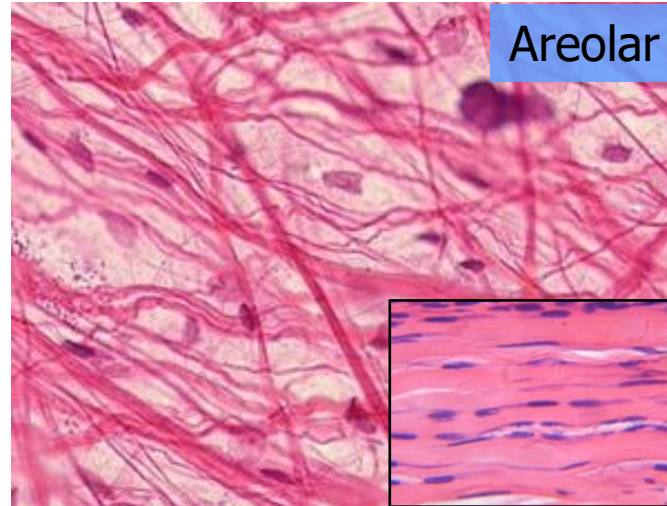
# Connective



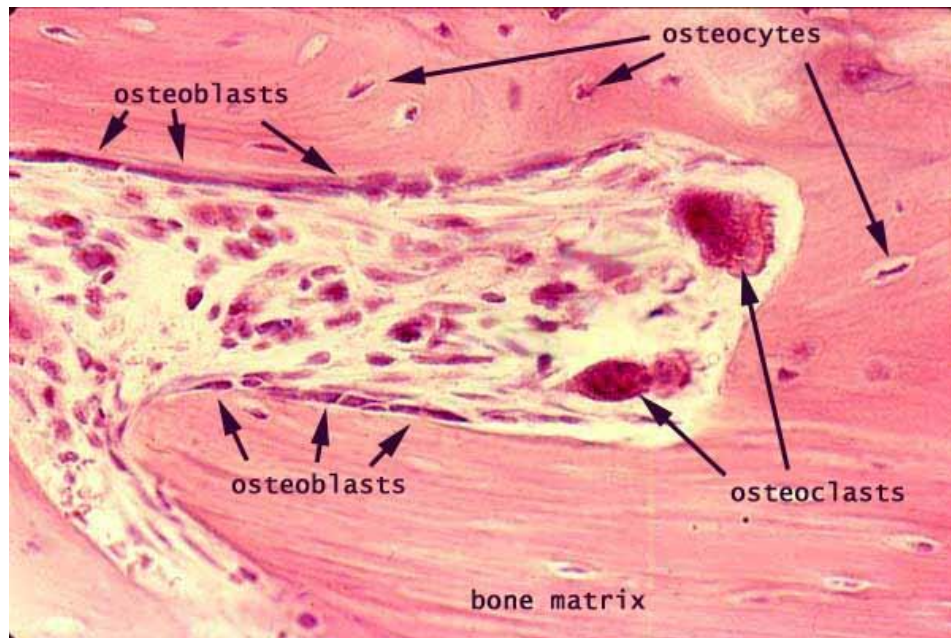
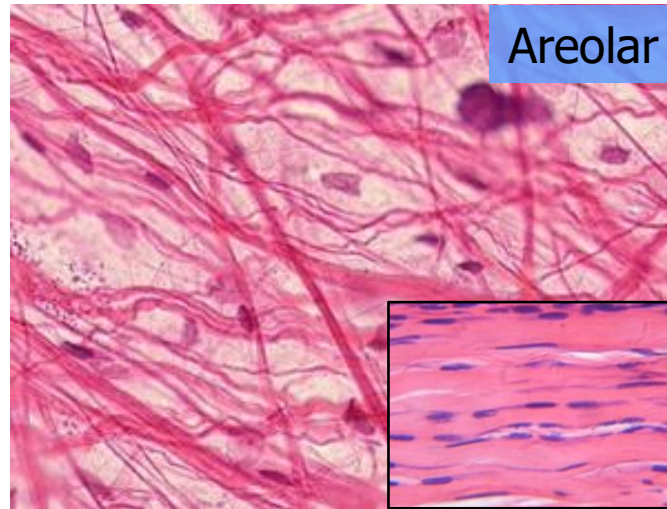


# Connective

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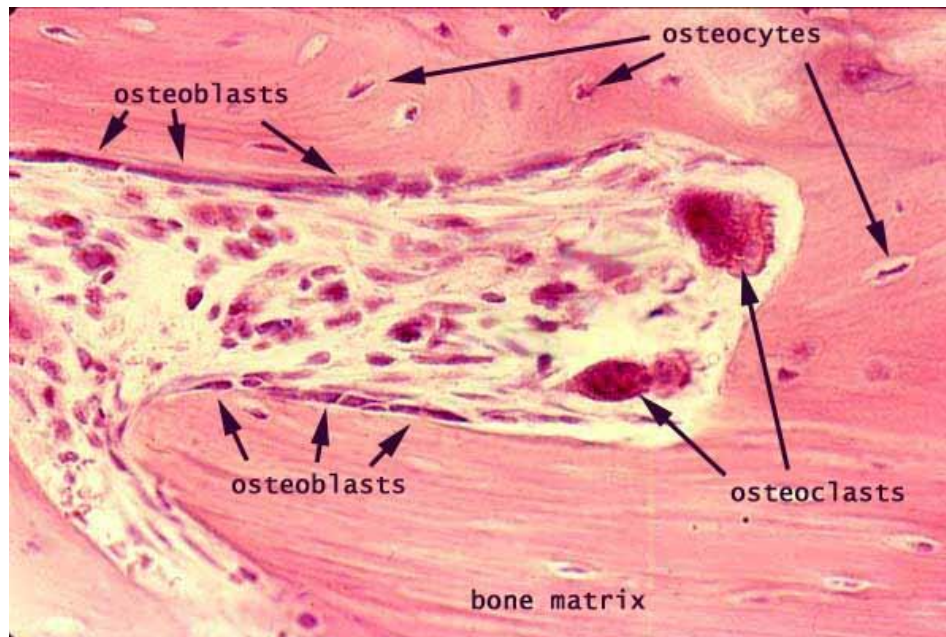
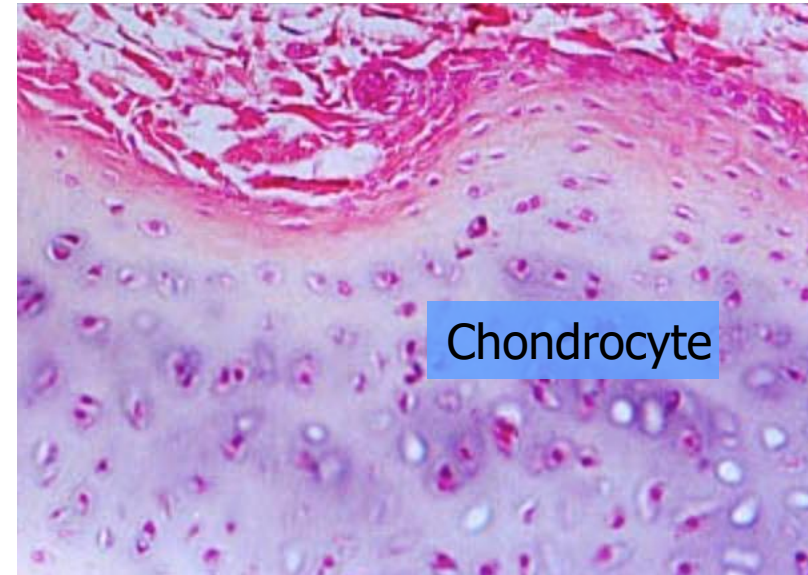
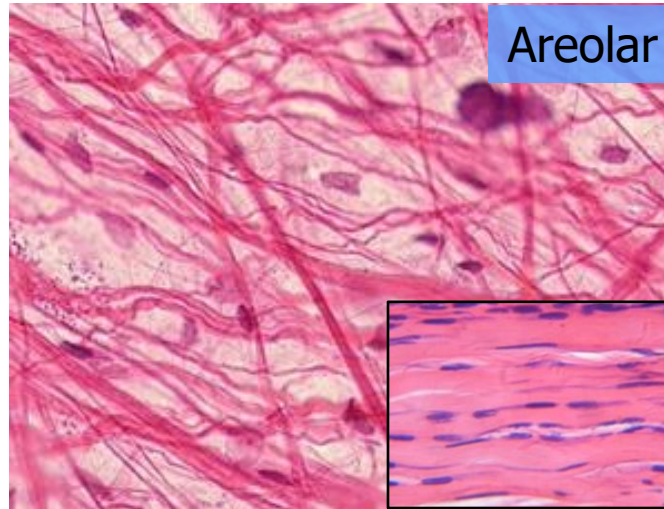


# Connective



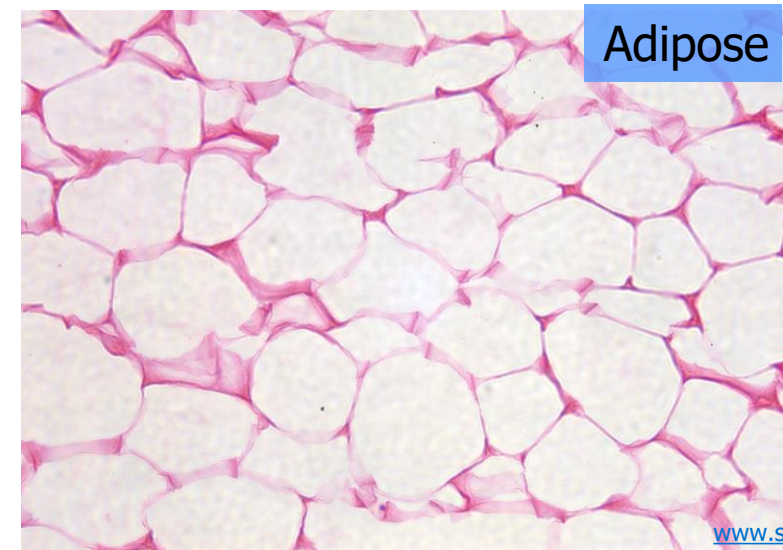
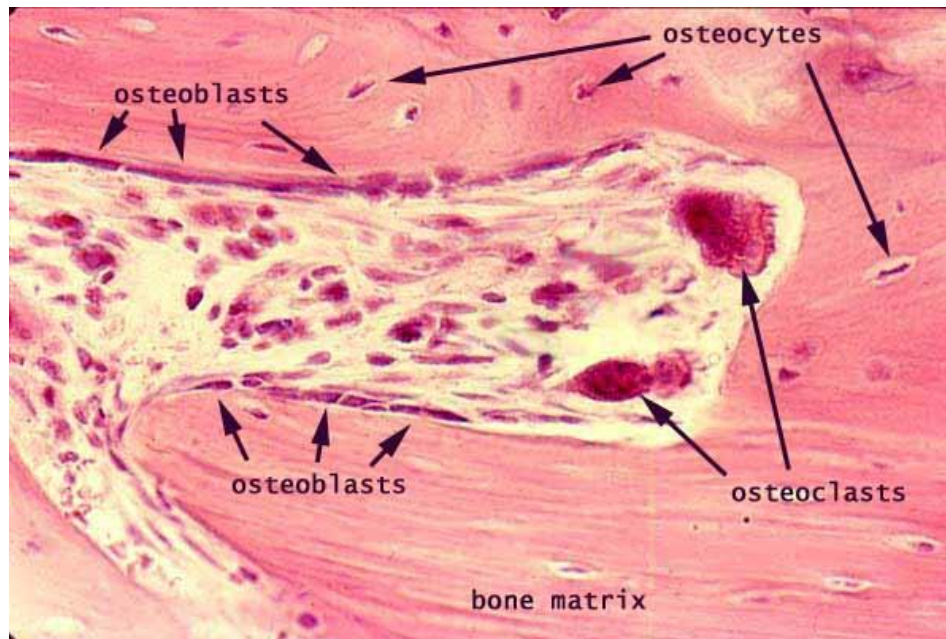
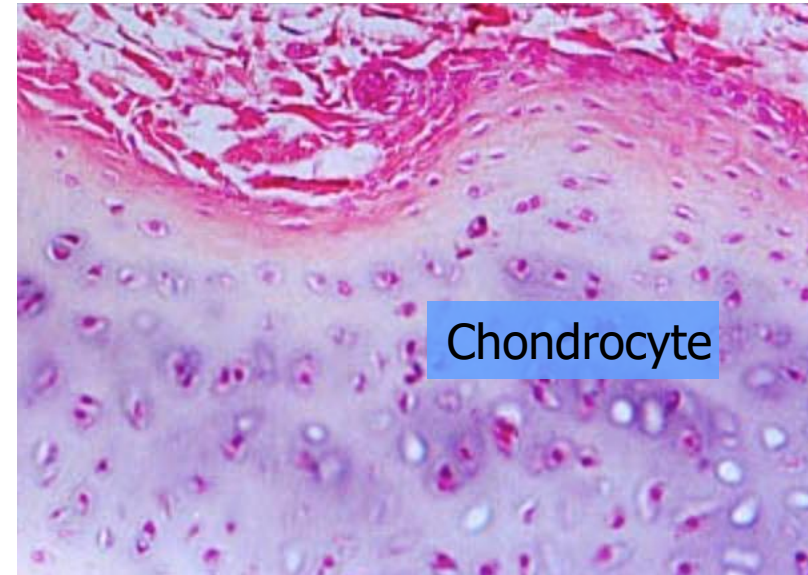
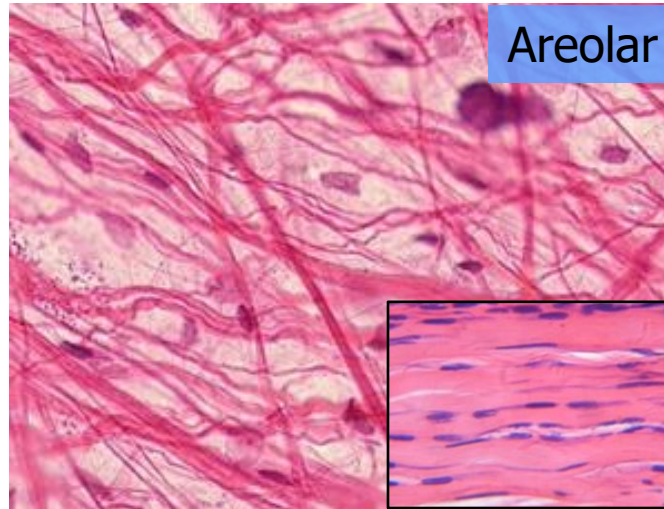


# Connective





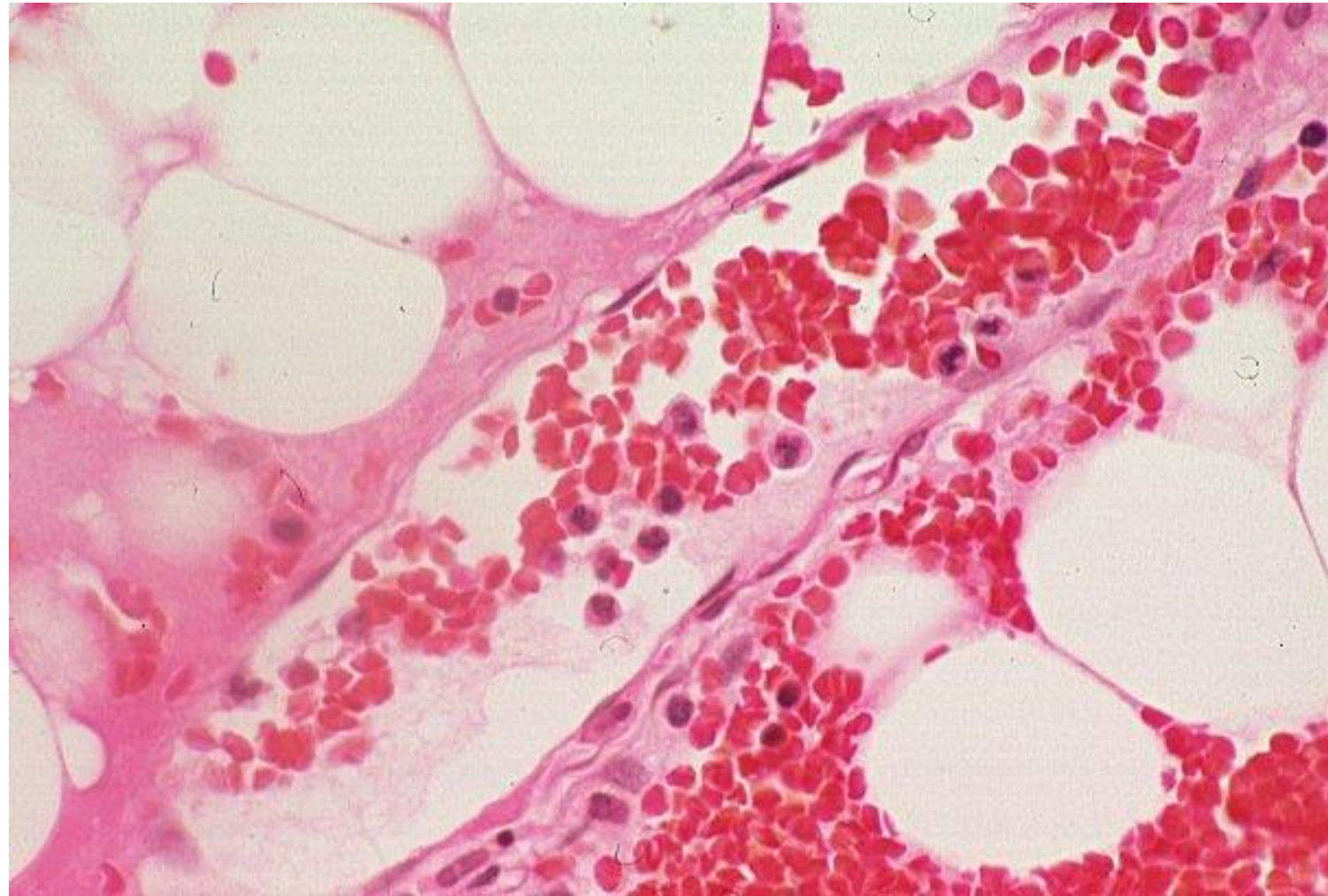
# Connective





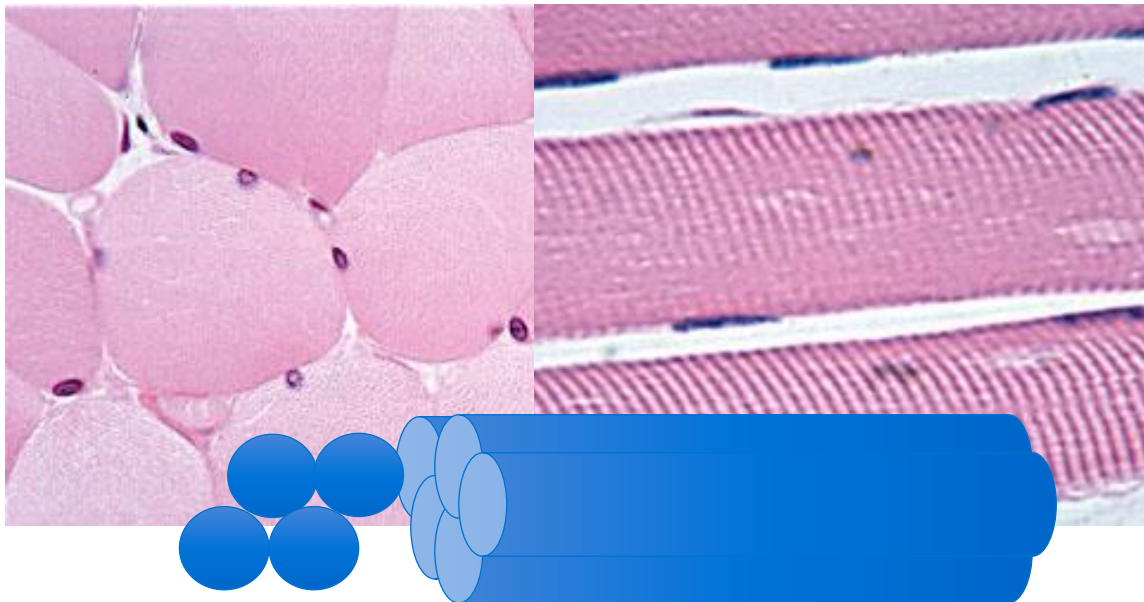
# Connective

Blood



# Muscular

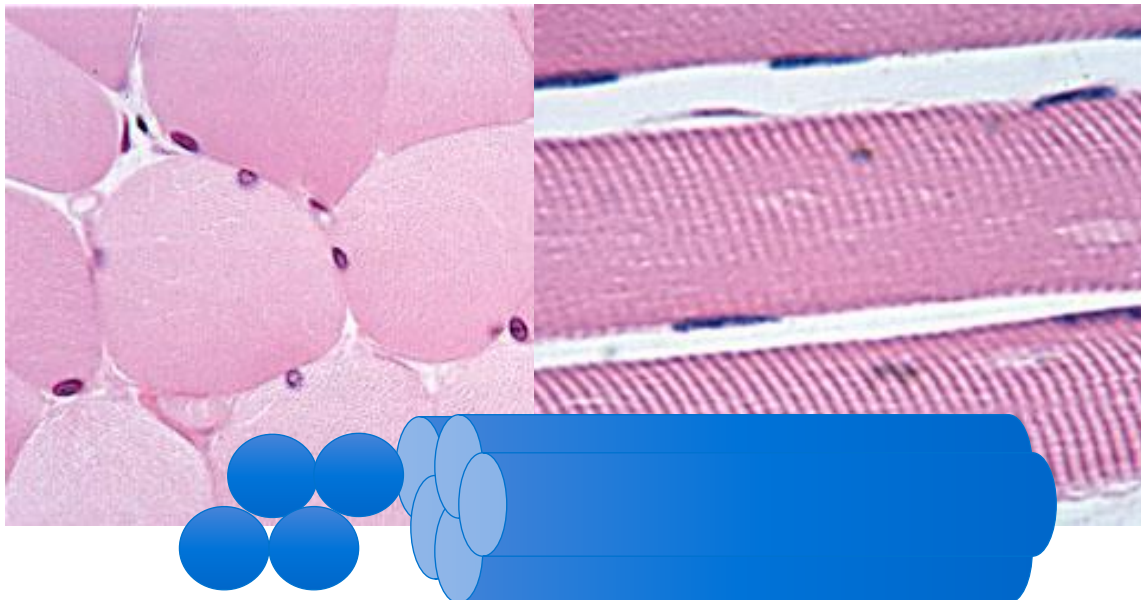
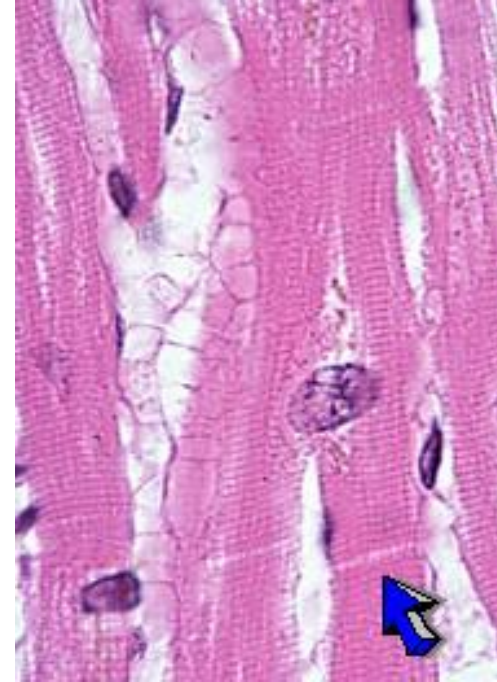
- Skeletal muscle





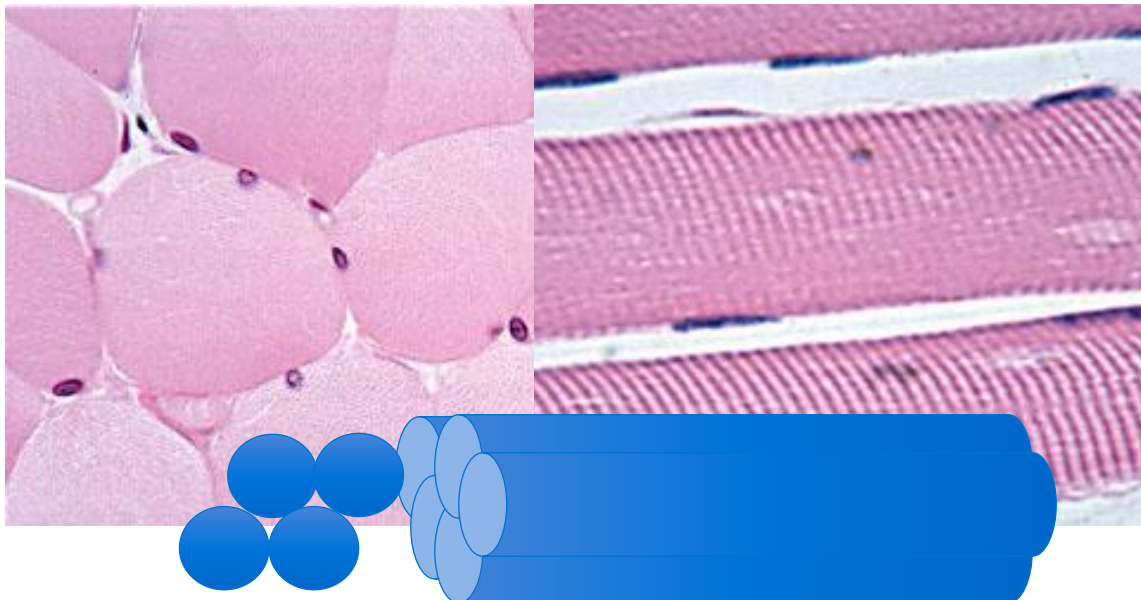
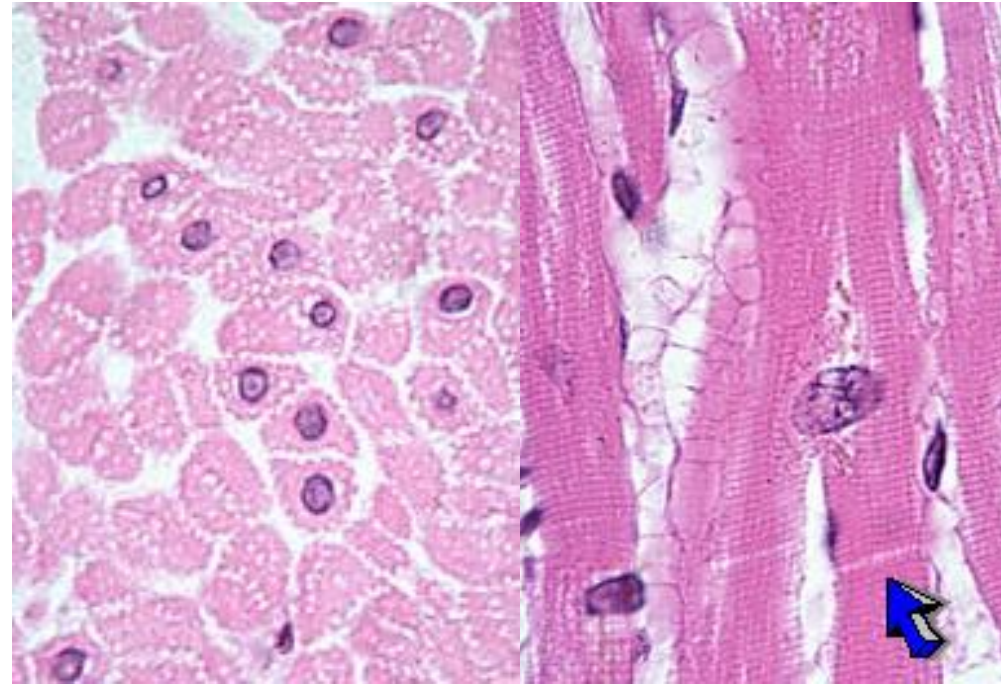
# Muscular

- Skeletal muscle
- Cardiac muscle



# Muscular

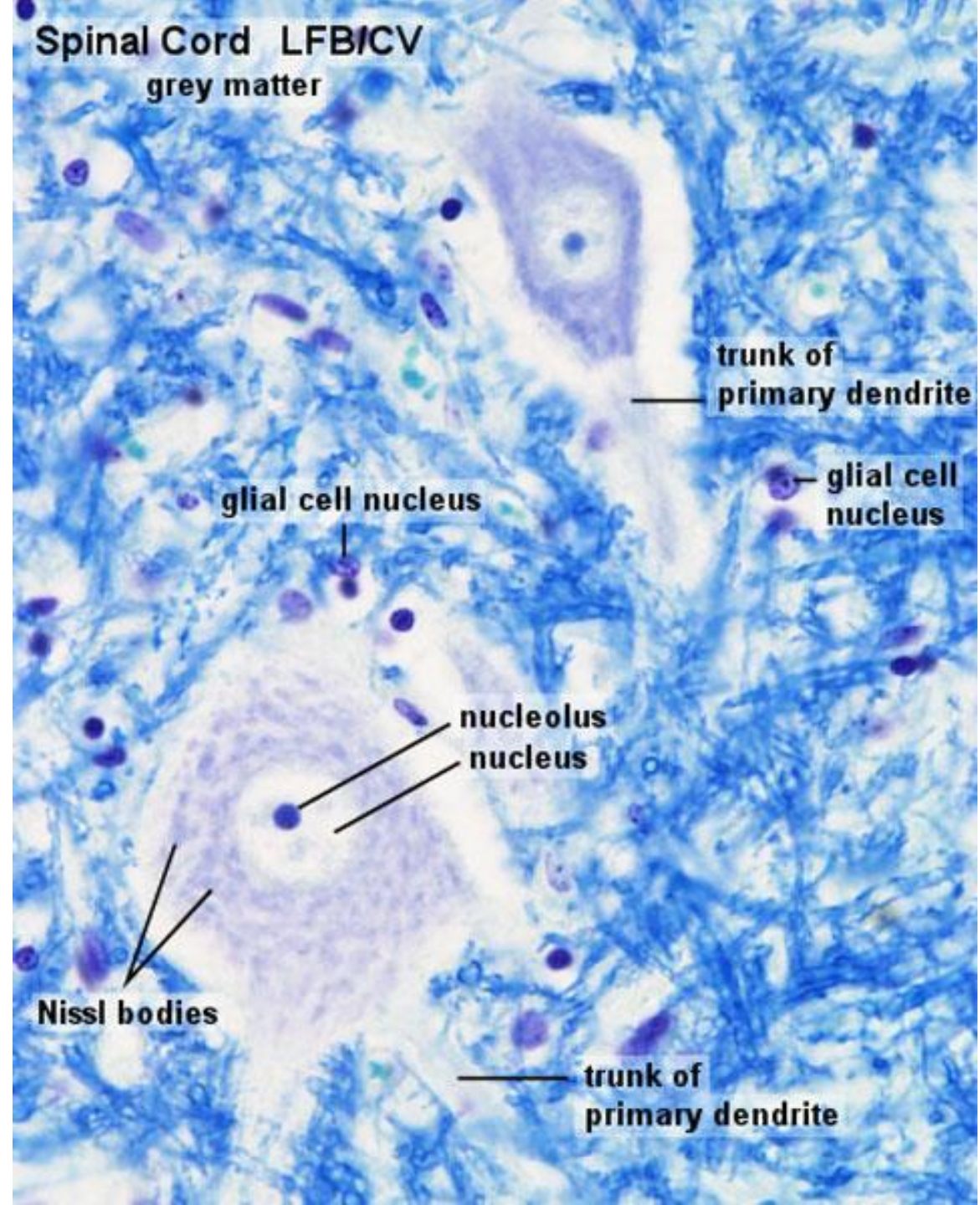
- Skeletal muscle
- Cardiac muscle
- Smooth muscle





# Nervous

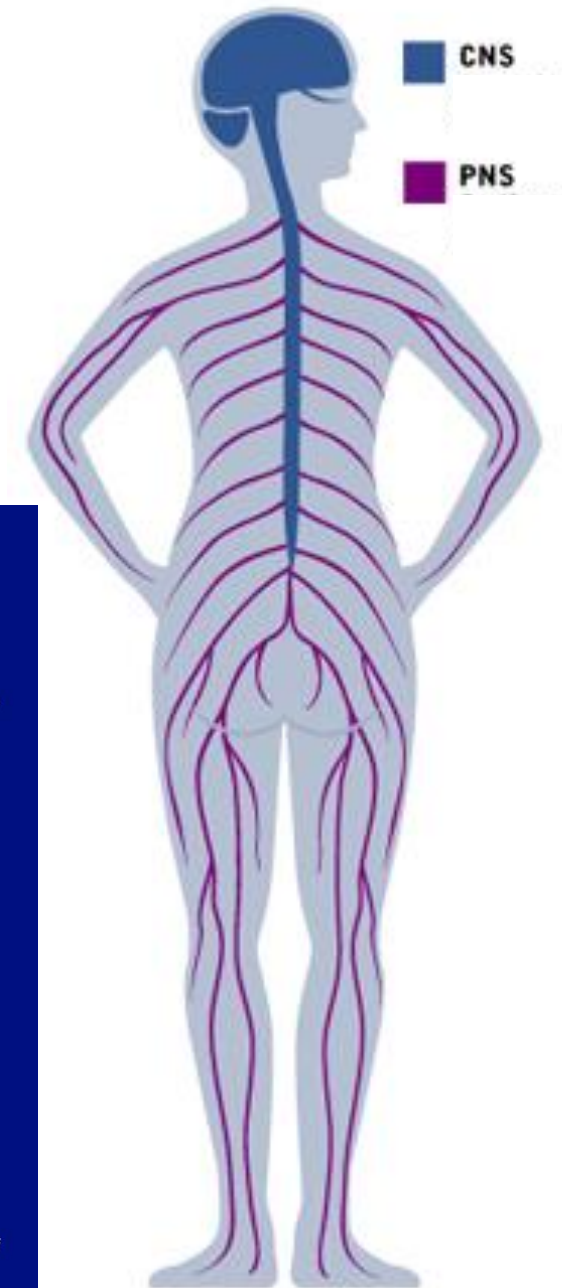
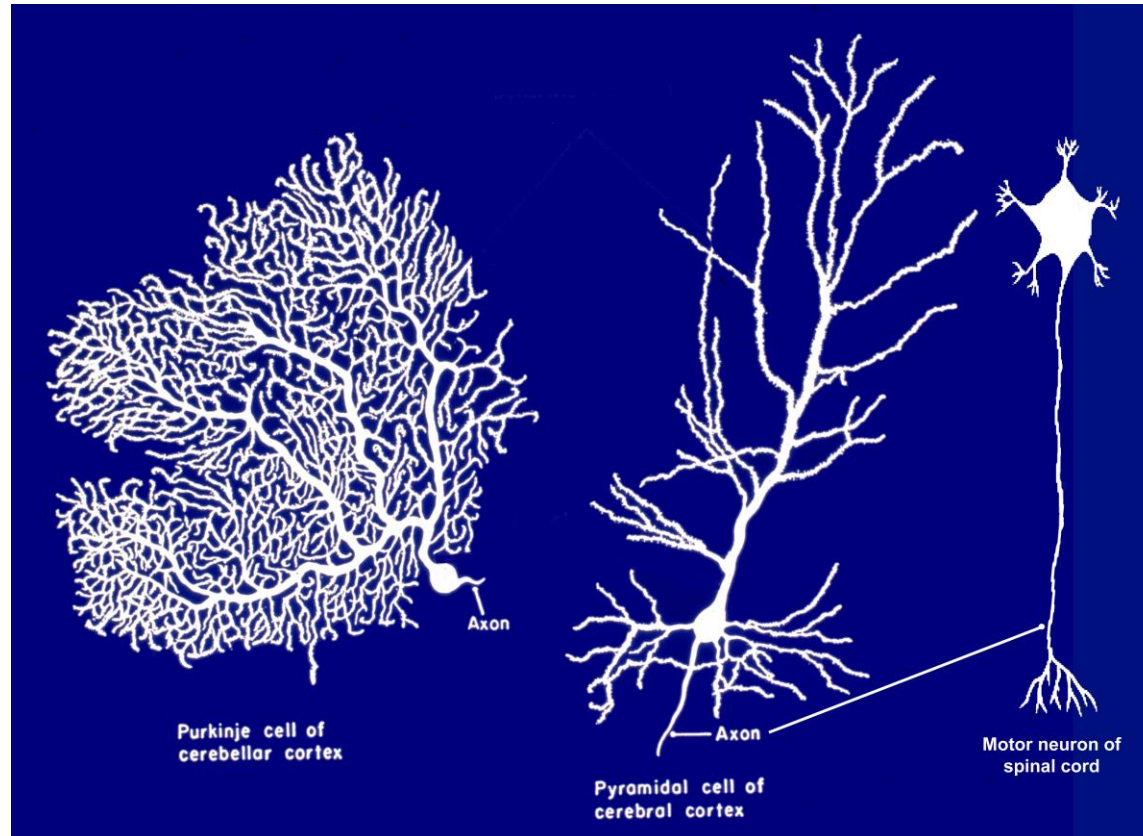
- Neurons
- Glial cells
- Schwann cells
- Oligodendrocytes



[http://php.med.unsw.edu.au/embryology/index.php?title=File:Spinal\\_cord\\_histology\\_03.jpg](http://php.med.unsw.edu.au/embryology/index.php?title=File:Spinal_cord_histology_03.jpg)  
[www.militarydisabilitymadeeasy.com](http://www.militarydisabilitymadeeasy.com)

# Nervous

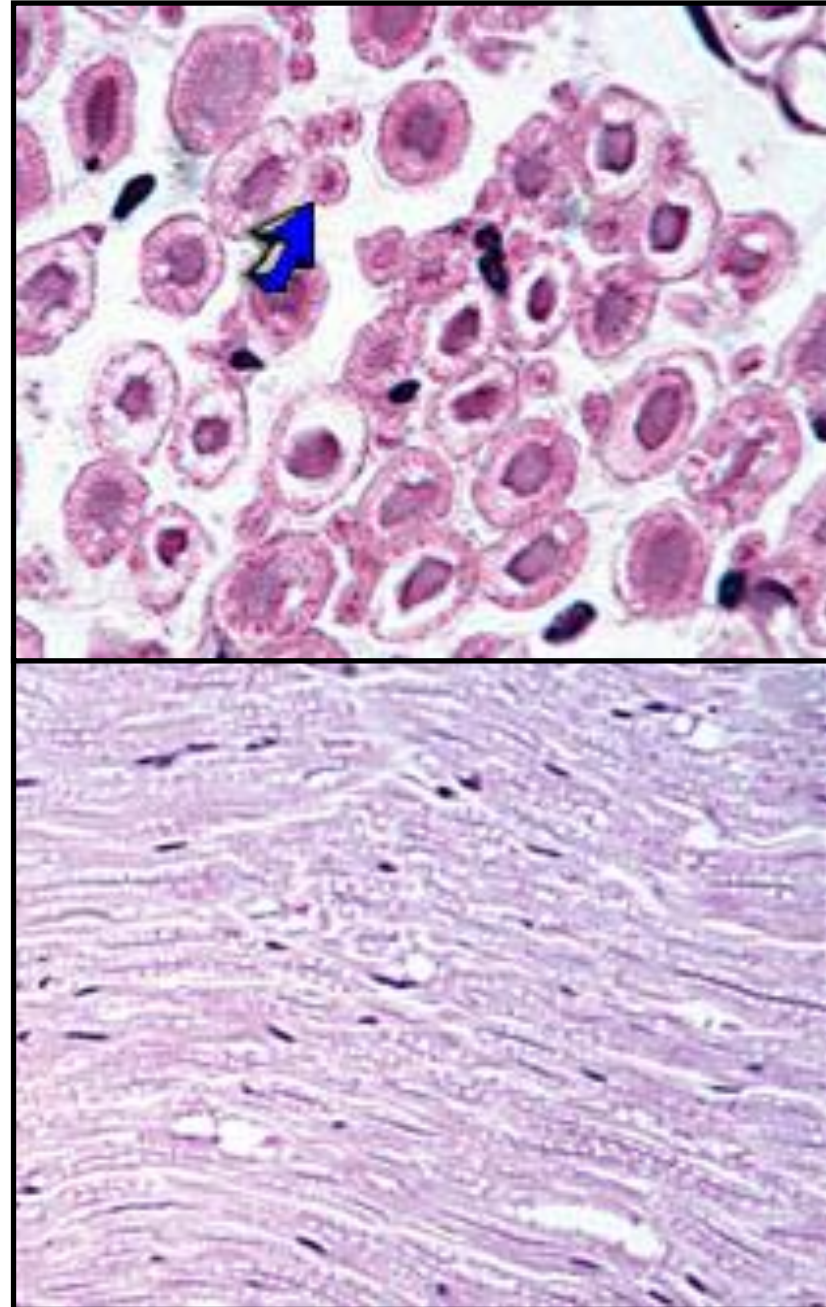
- Neurons
- Glial cells
- Schwann cells
- Oligodendrocytes





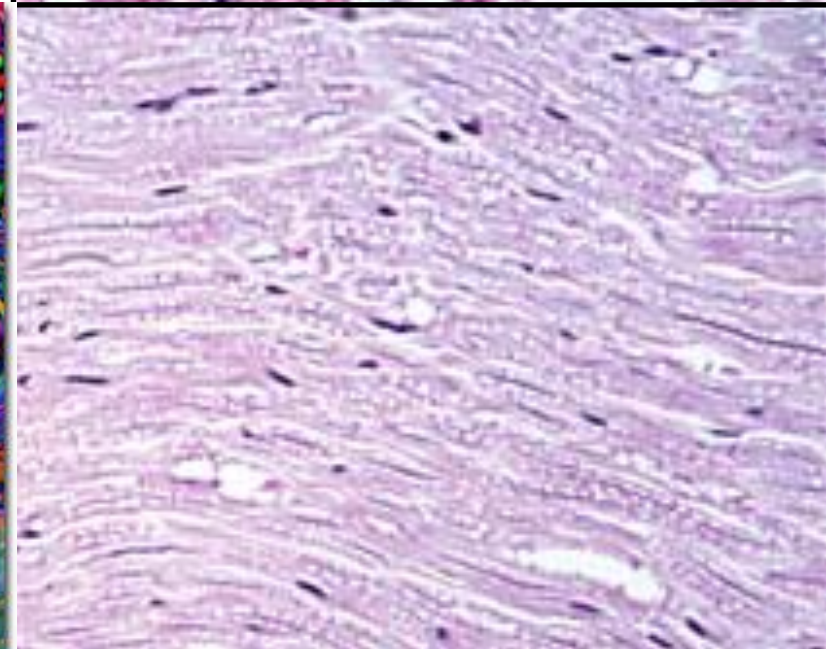
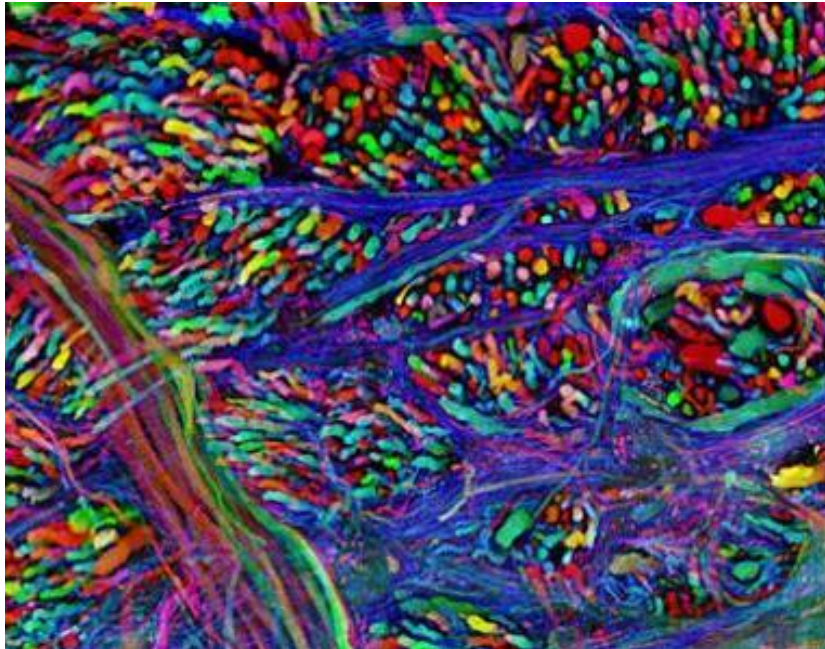
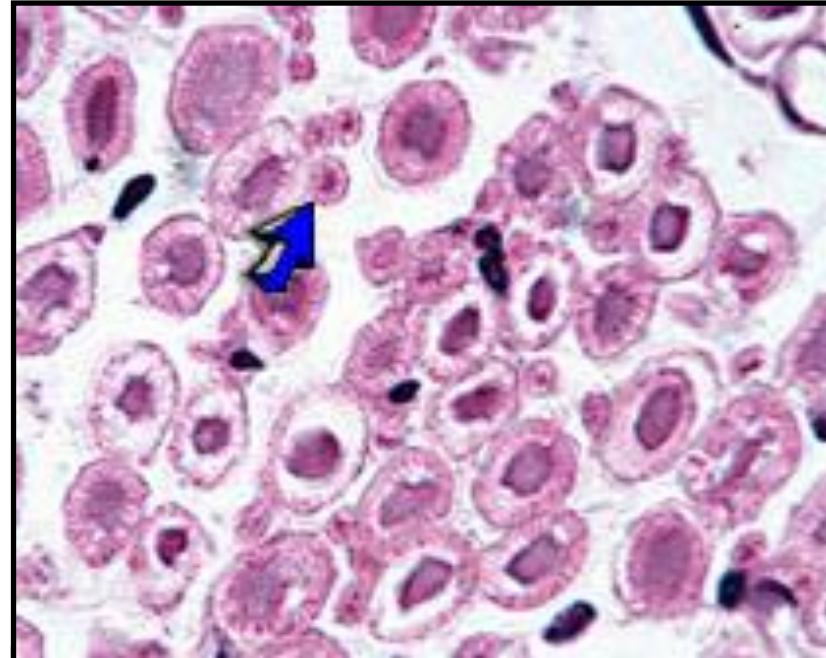
# Nervous

- Neurons
- Glial cells
- Schwann cells
- Oligodendrocytes



# Nervous

- Neurons
- Glial cells
- Schwann cells
- Oligodendrocytes

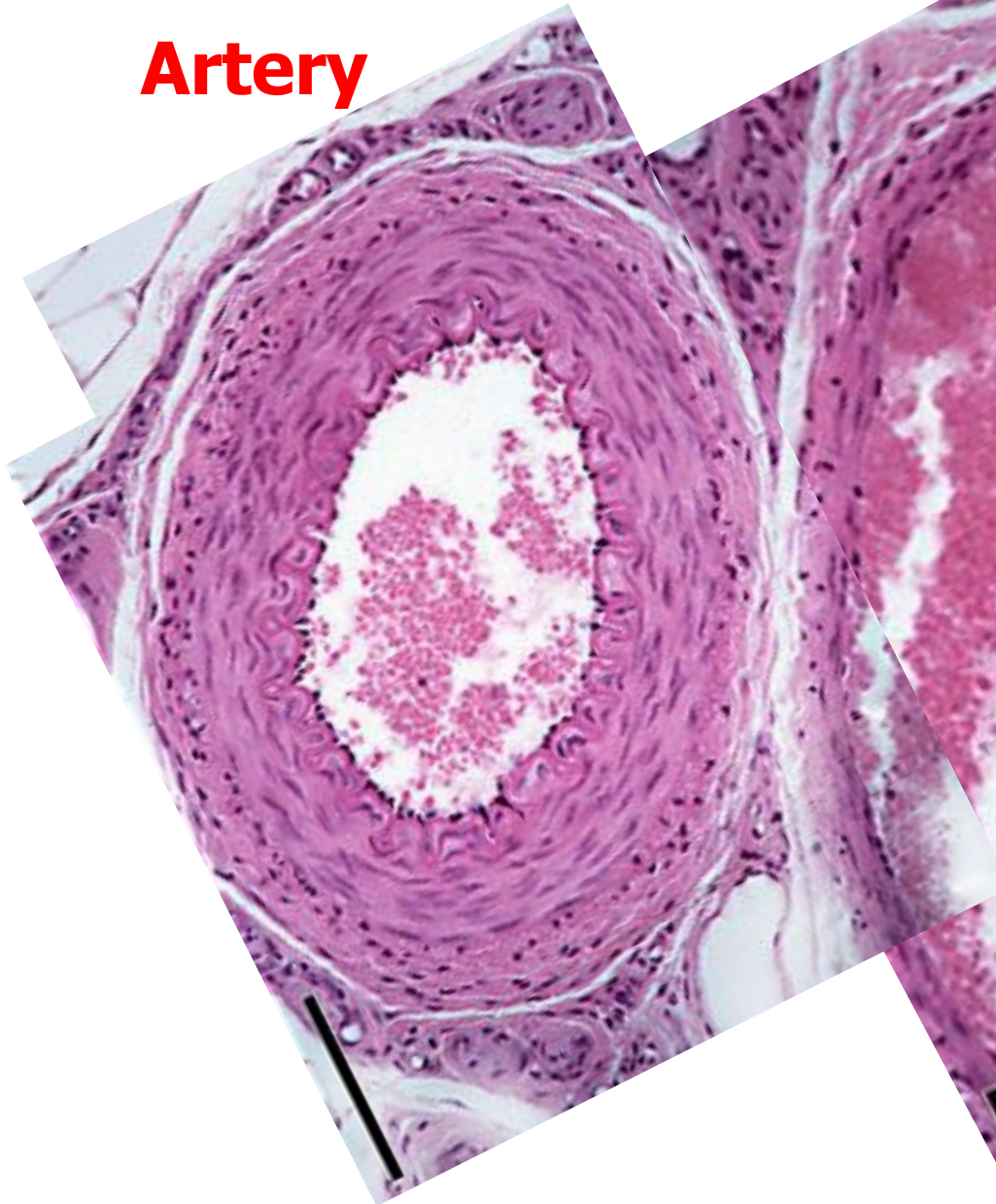




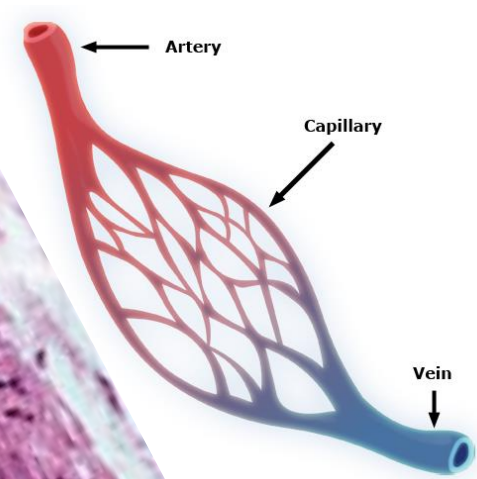
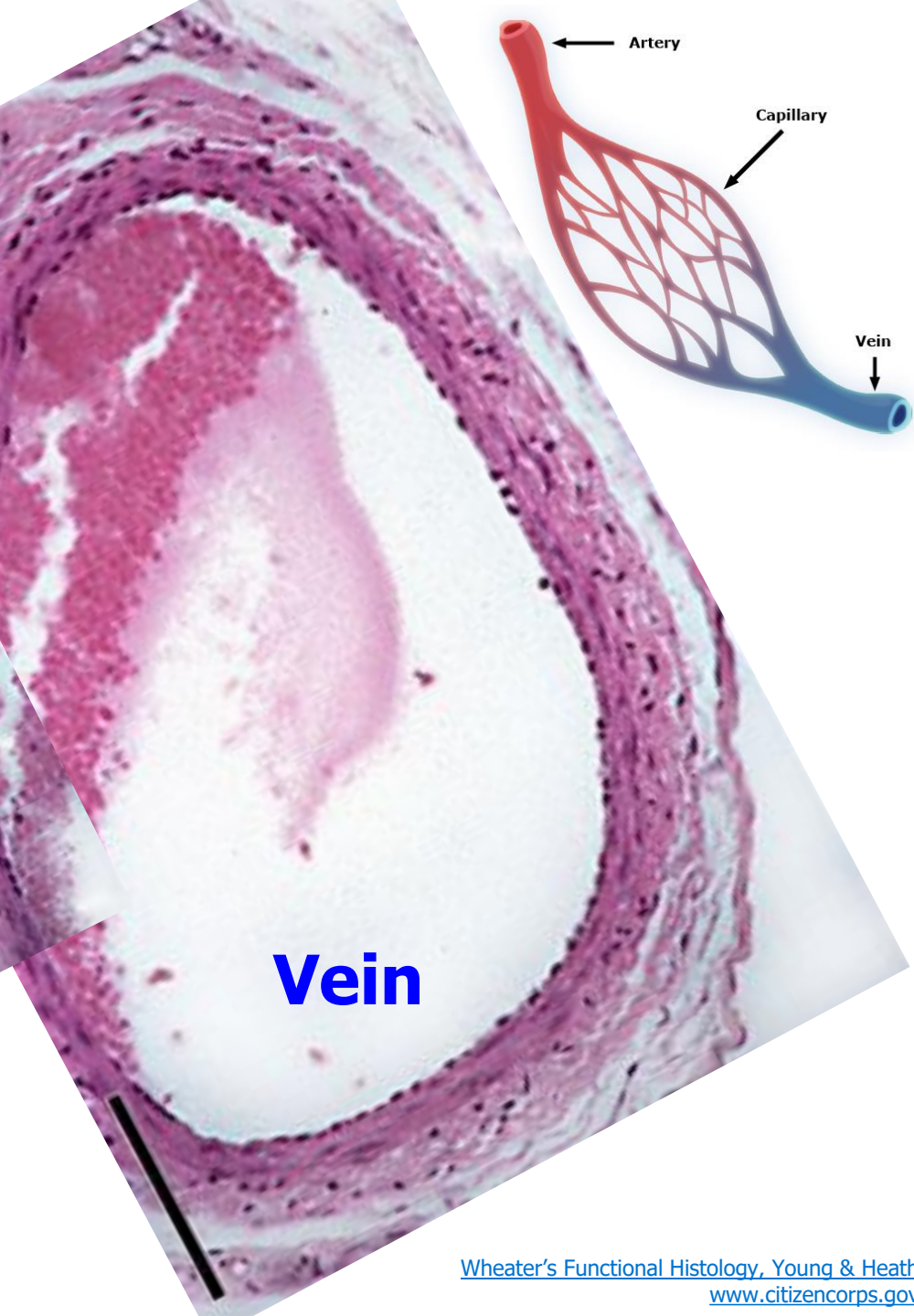




**Artery**



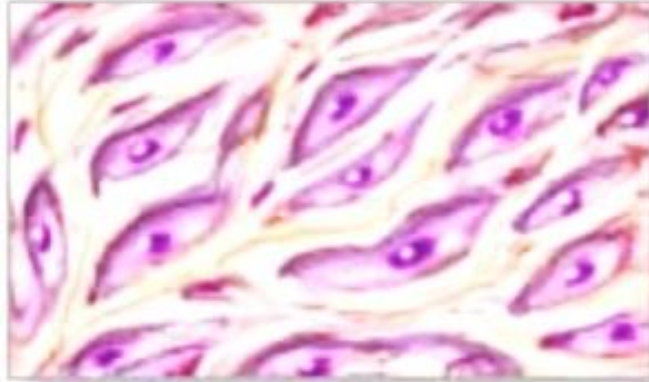
**Vein**



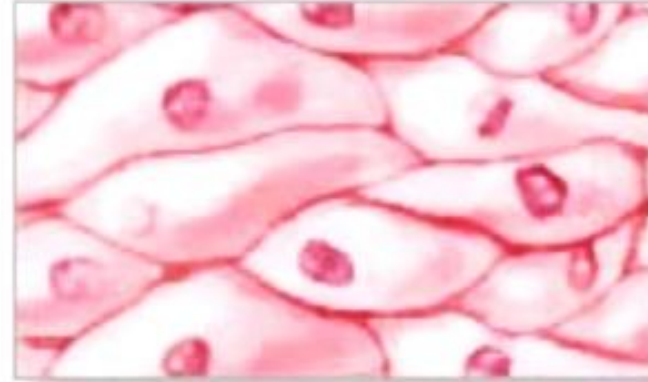


# Tissue Organization Summary

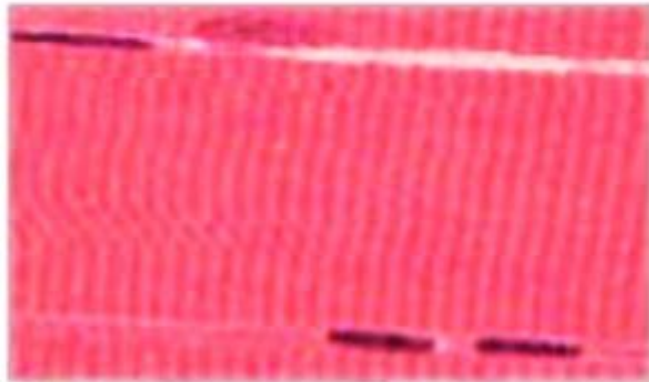
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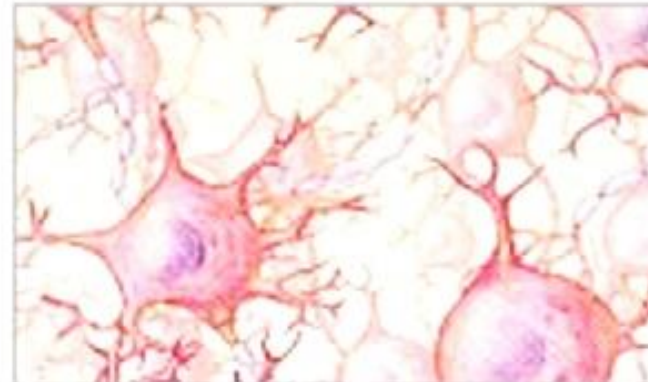
Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue



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