



You'll never look at a tissue the  
same way again!!!!

A tissue is a group of similar cells that usually have a common embryonic origin...

... that function together to carry out specialized activities.

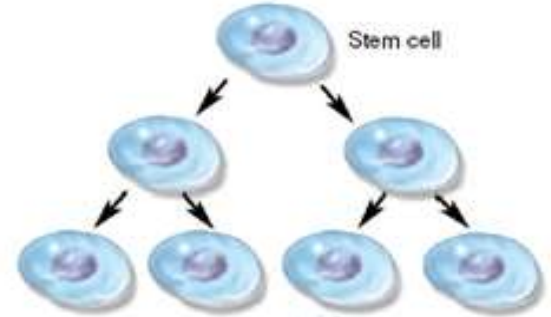
## Characteristics of Embryonic Stem Cells

1. **Origin:**  
Derived from pre-implantation or peri-implantation embryo



Blastocyst

2. **Self-Renewal:**  
The cells can divide to make copies of themselves for a prolonged period of time without differentiating.



Stem cell

3. **Pluripotency:**  
Embryonic stem cells can give rise to cells from all three embryonic germ layers even after being grown in culture for a long time.

The three germ layers and one example of a cell type derived from each layer:



Ectoderm

Neuron

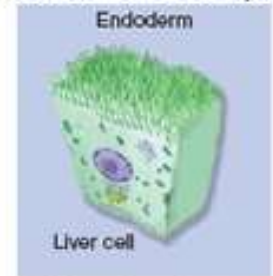
Ectoderm gives rise to: brain, spinal cord, nerve cells, hair, skin, teeth, sensory cells of eyes, ears, nose, and mouth, and pigment cells.



Mesoderm

Blood cells

Mesoderm gives rise to: muscles, blood, blood vessels, connective tissues, and the heart.



Endoderm

Liver cell

Endoderm gives rise to: the gut (pancreas, stomach, liver, etc.), lungs, bladder, and germ cells (eggs or sperm)

- A **pathologist** (path—disease, ology—study of) studies cells and tissues.

- Specifically, a pathologist examines tissues for any changes that may indicate disease

# 4 Classifications of Body



- **Epithelial Tissue**-covers surface that lines the body cavity, lines hollow organs, tubes and form glands.
- **Connective Tissue**-protects and supports the body and helps bind organs together. Also, help to store energy as fat. This is also where immune cells reside.
- **Muscular Tissue**-allows contraction of muscle.
- **Nervous Tissue**-initiates and transmit impulses which coordinates the body's activities to maintain homeostasis

Look at these types of cells in terms of FORM and FUNCTION—what is their job? And can you figure out why they're the shape they are?

### Four types of tissue



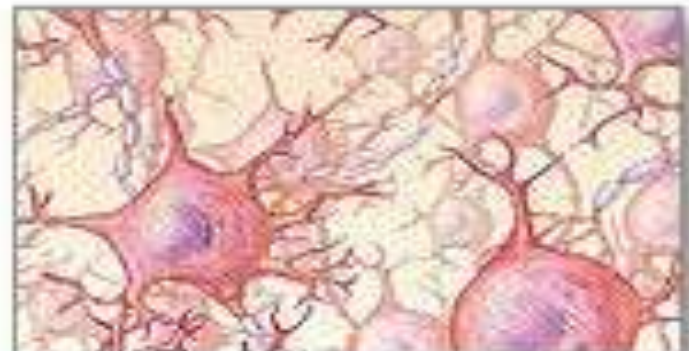
Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue

# EPITHELIUM



There are many different types of epithelia and each have characteristic **STRUCTURE** and **FUNCTION**... in general though...

- Cells are packed closely together with not much extracellular fluid and they are arranged in sheets, layers of columns—(think about their function—now does it make sense why they're packed so closely together!)
- They are **avascular**—there is no blood supply (nutrients are obtained via diffusion). Note the prefix “a” meaning without/not...
- They have a nerve supply
- Because they get so much wear and tear, they have the capacity to renew via cell division

- Shapes of Epithelial tissue:

1. Squamous

3. Columnar

2. Cuboidal

4. Transitional

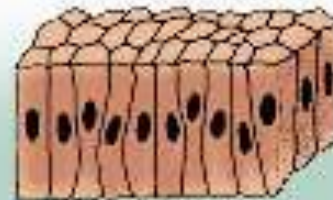
### Types of Epithelium



Simple squamous

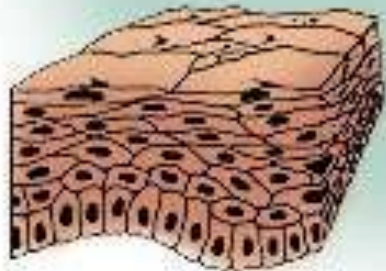


Simple cuboidal

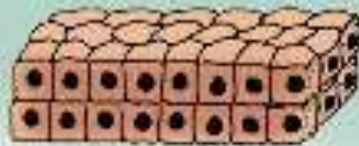


Simple columnar

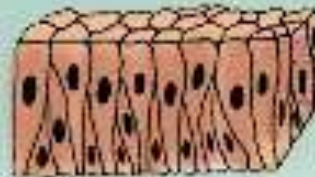
Transitional



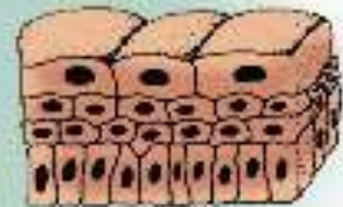
Stratified squamous



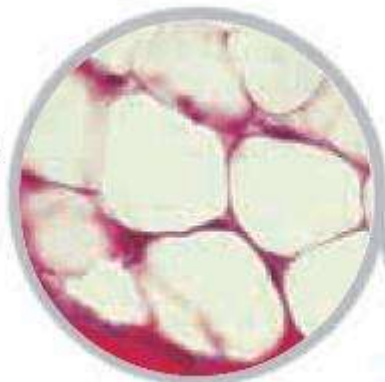
Stratified cuboidal



Pseudostratified columnar



Connective tissue



Nervous tissue



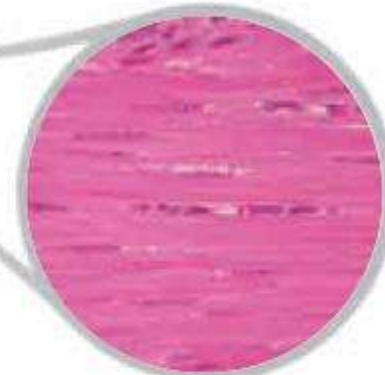
Skeletal muscle



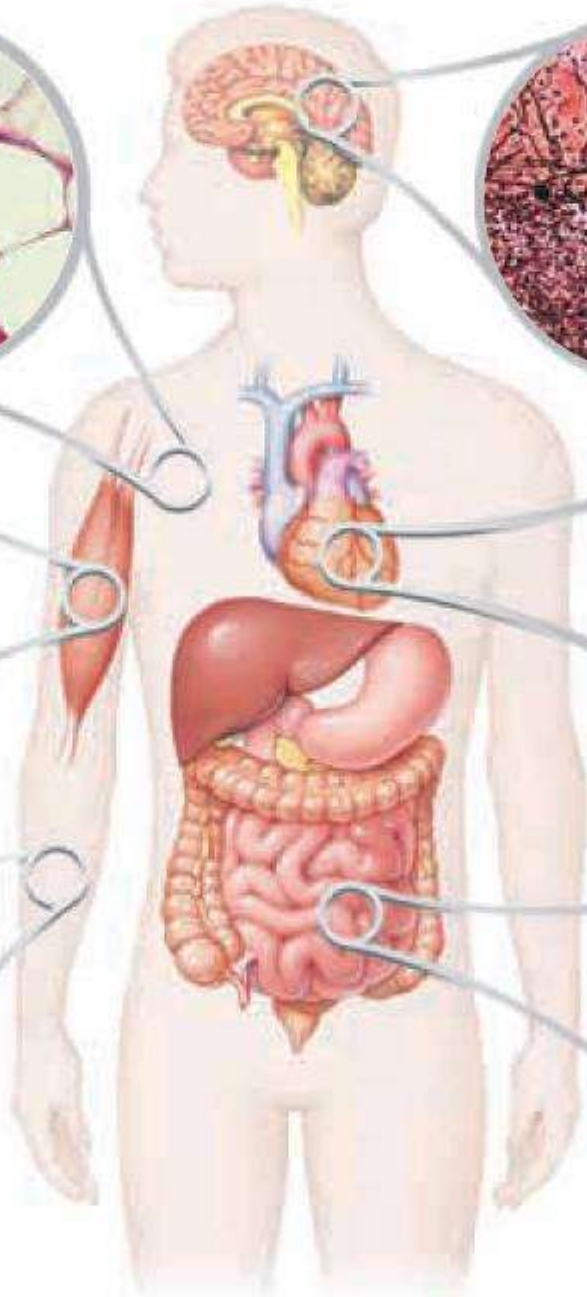
Cardiac muscle



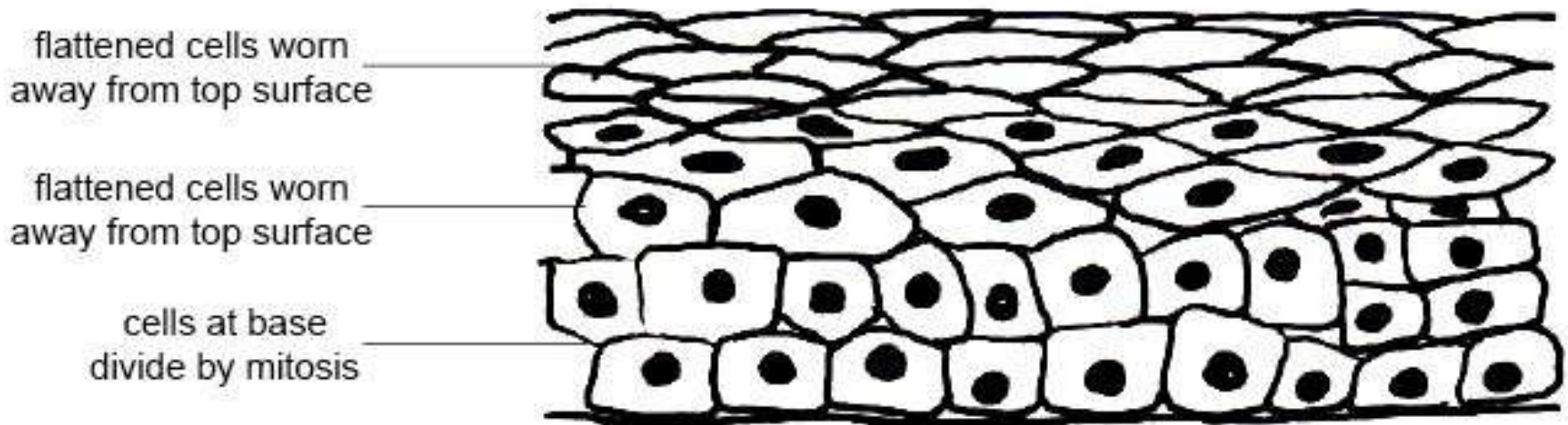
Epithelial tissue

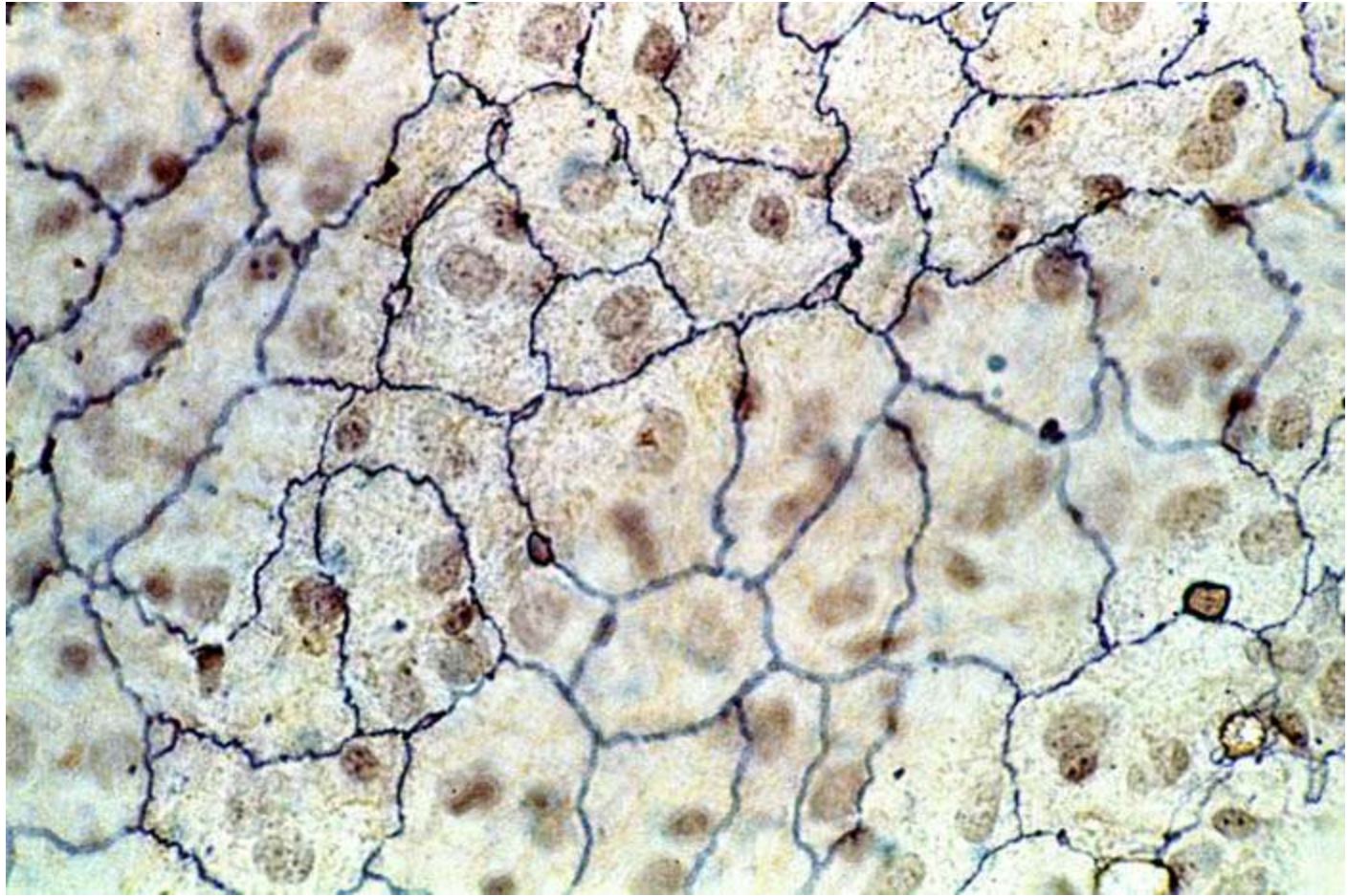


Smooth muscle

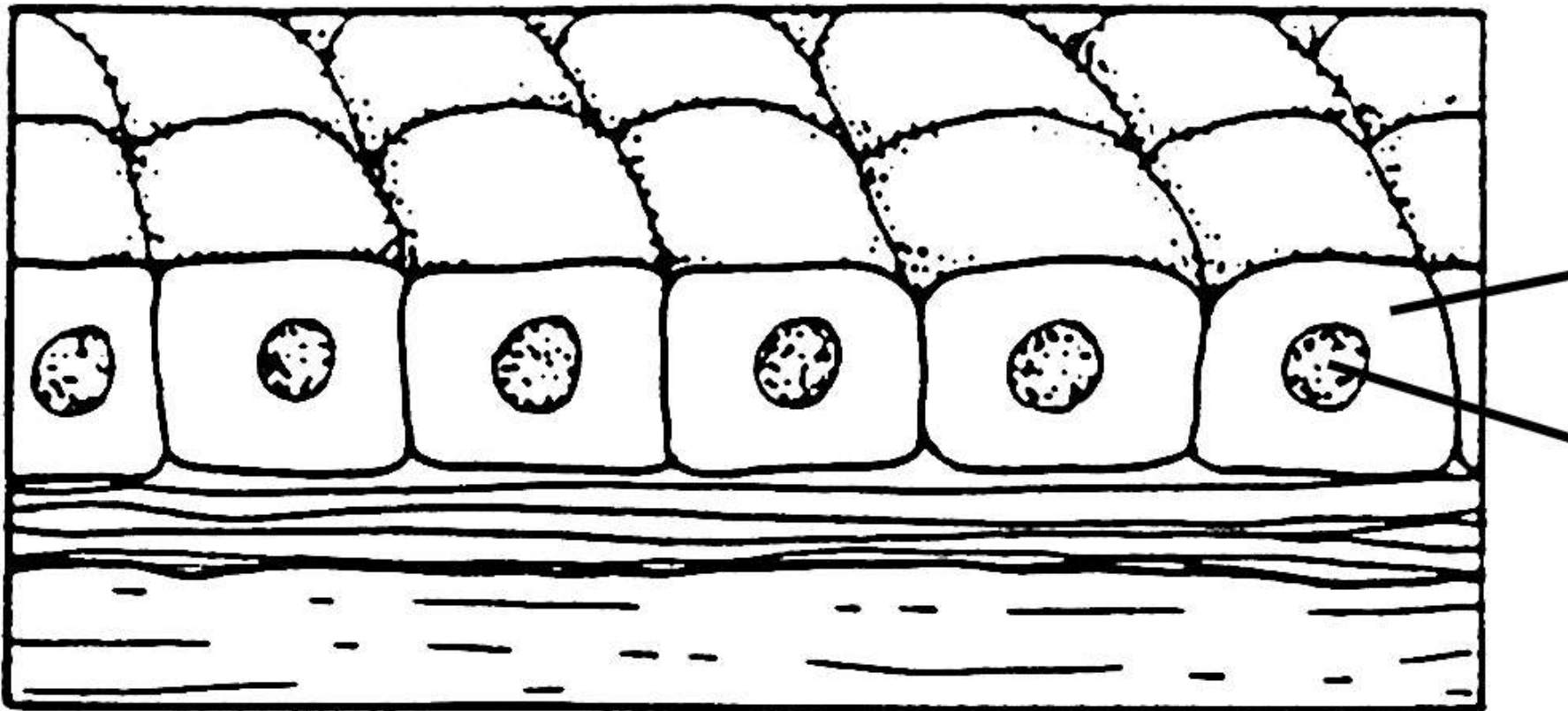


1. Squamous: flat and scale-like... their thinness allows for rapid passage of substances through these cells.  
(Remember diffusion...)





2. **Cuboidal** cells (cube shaped)... they are as tall as they are wide. They function in **secretion** (releasing substances like mucus, sweat and enzymes) as well as **absorption** (the intake of fluids such as digested food in the intestines).

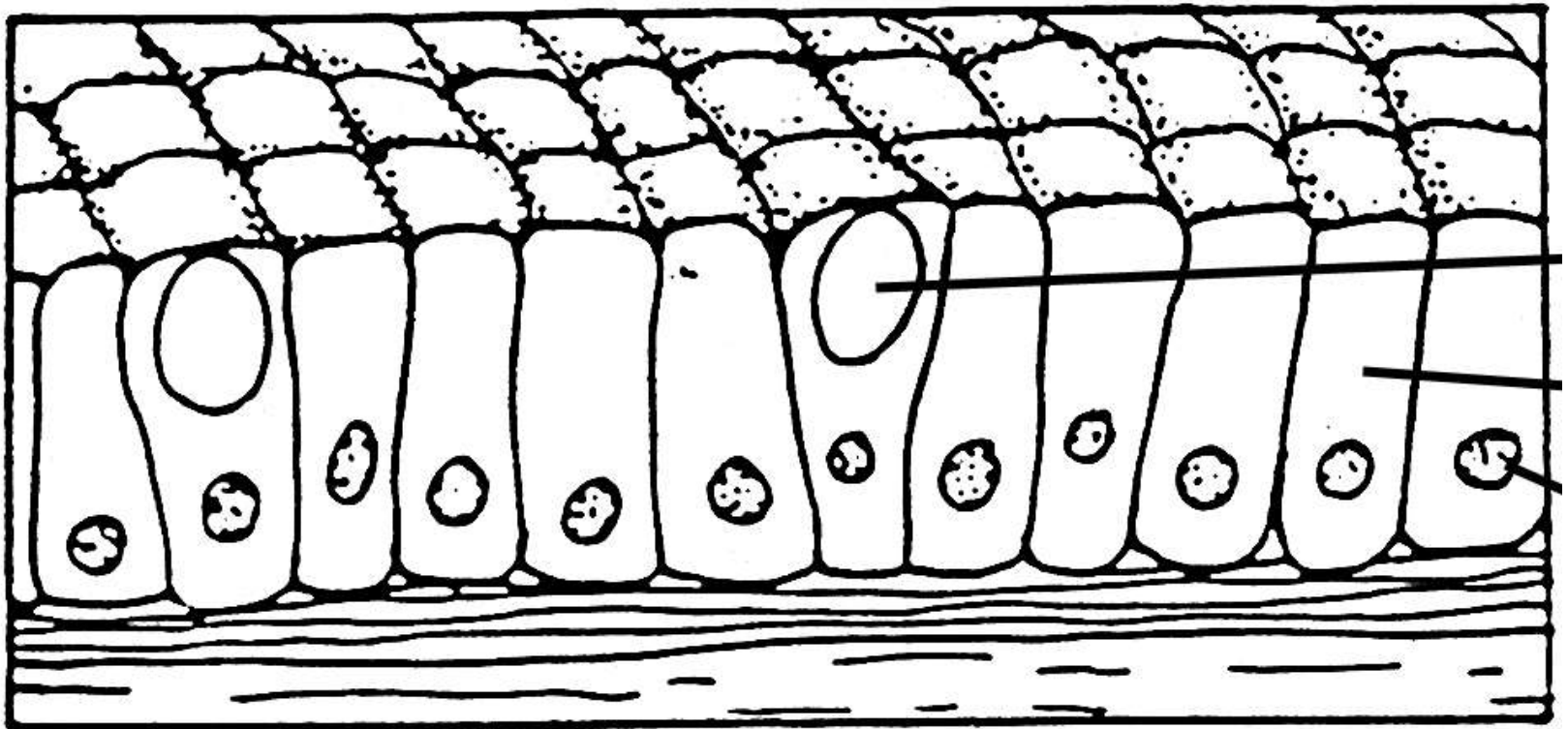


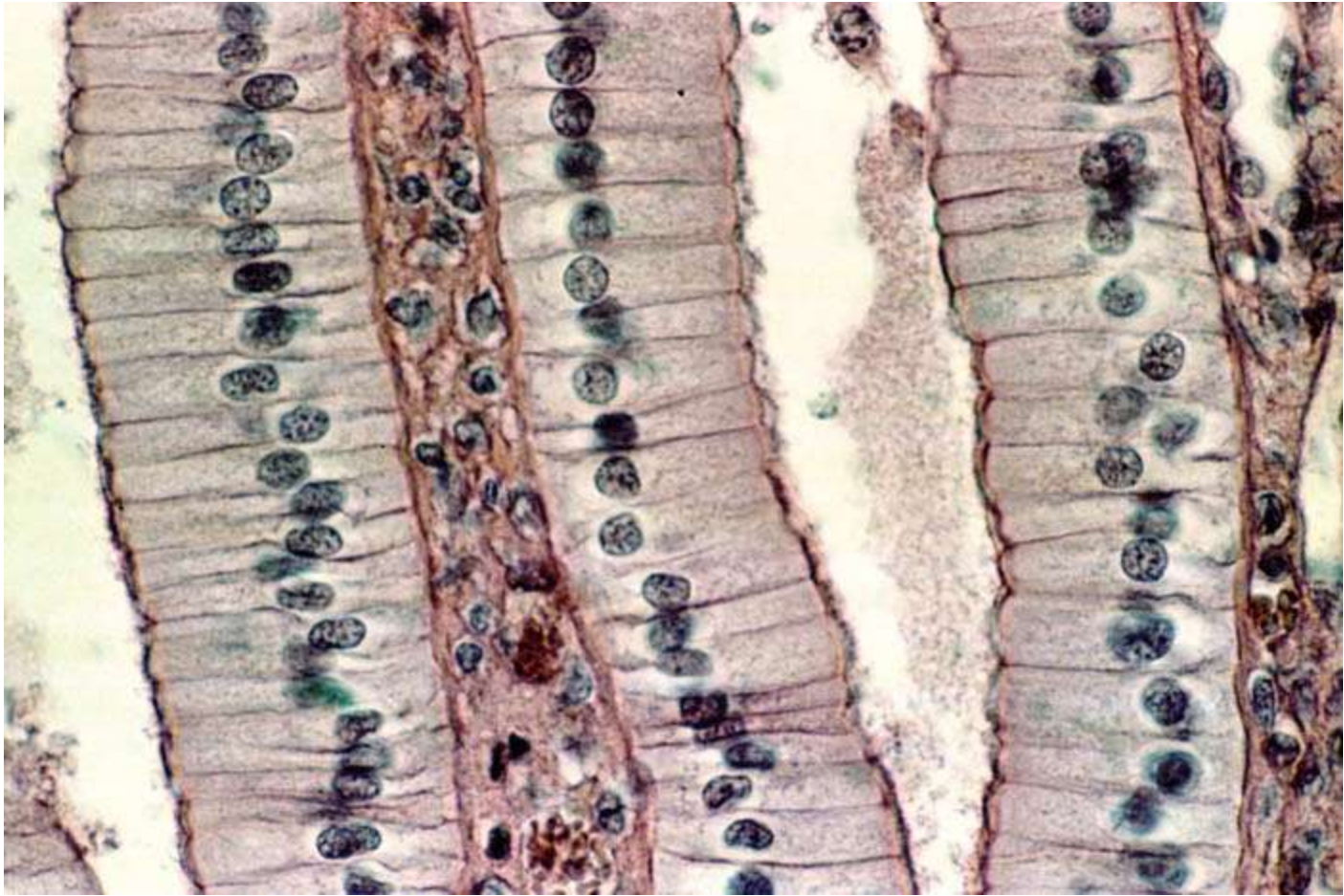


Simple Cuboidal Epithelium  
Kidney, urinary tubules

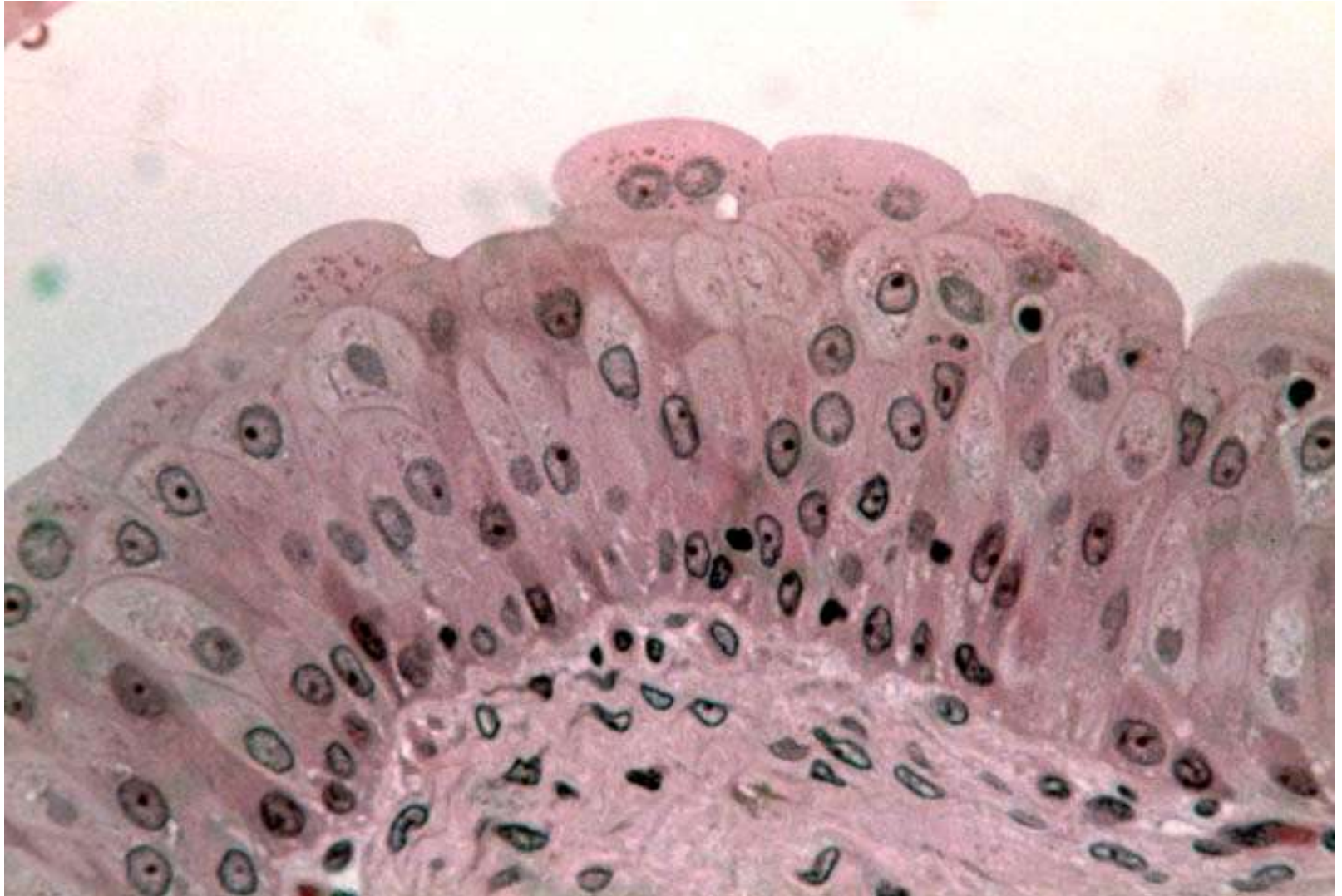


**3. Columnar** epithelium cells are taller than they are wide and protect underlying tissues. They have microvilli at their surface what are specialized for secretion and absorption. They can be found in the inner surface of the stomach, intestines and some areas of the respiratory and reproductive tracts.

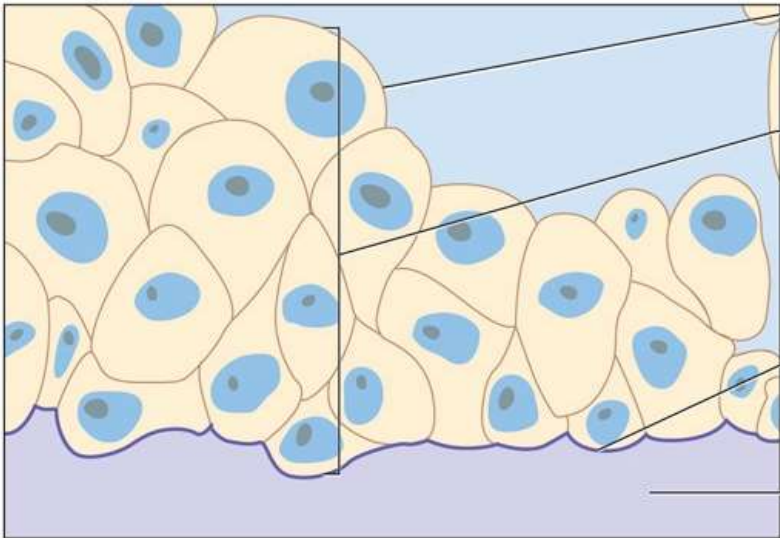




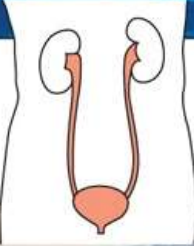
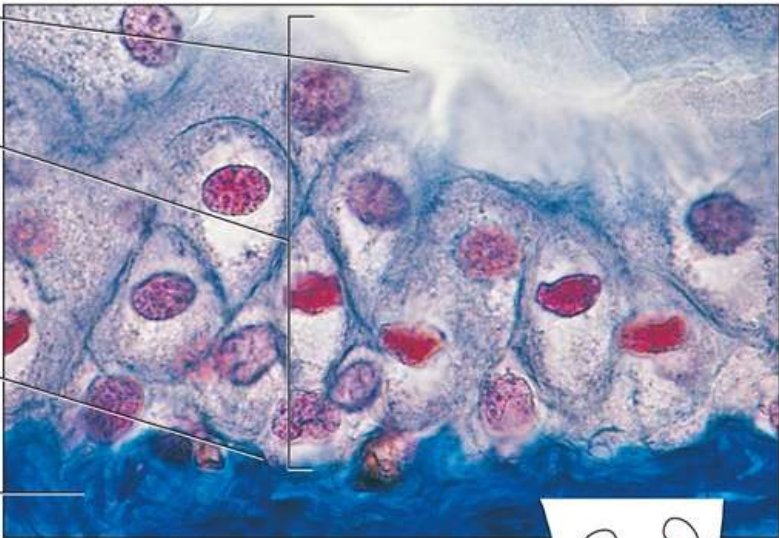
4. **Transitional cell tissue** change in shape from cuboidal to flat and back as organs stretch! They are typically found in the area of the body that is subjected to stress and must be able to stretch (like the wall of the bladder—these types keep it from tearing under pressures of stretching.)



# Let's look at the bladder

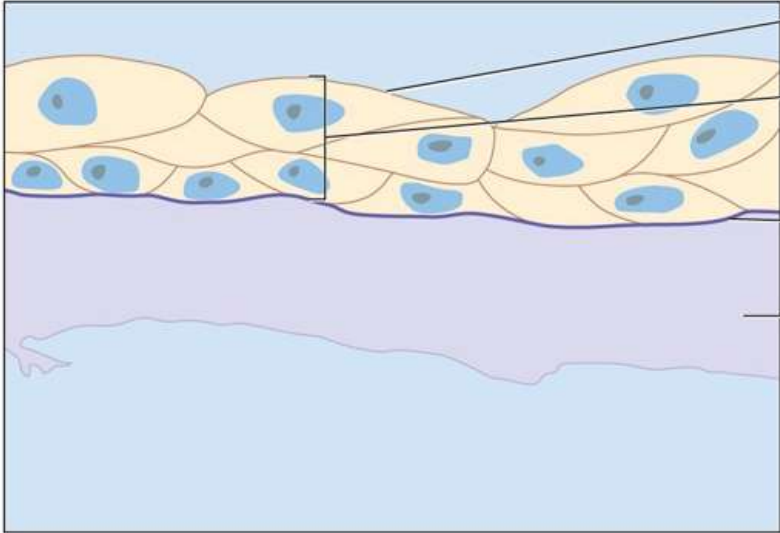


Free surface of tissue  
Unstretched transitional epithelium  
Basement membrane  
Underlying connective tissue

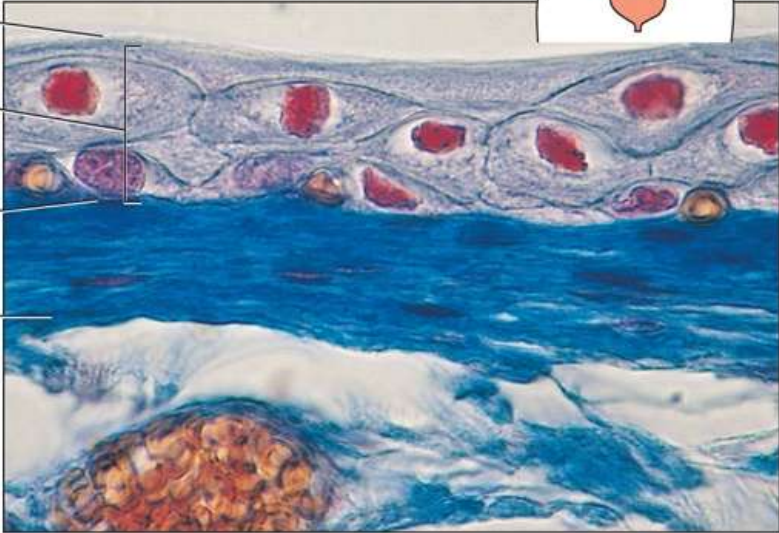


(a)

(b)



Free surface of tissue  
Stretched transitional epithelium  
Basement membrane  
Underlying connective tissue



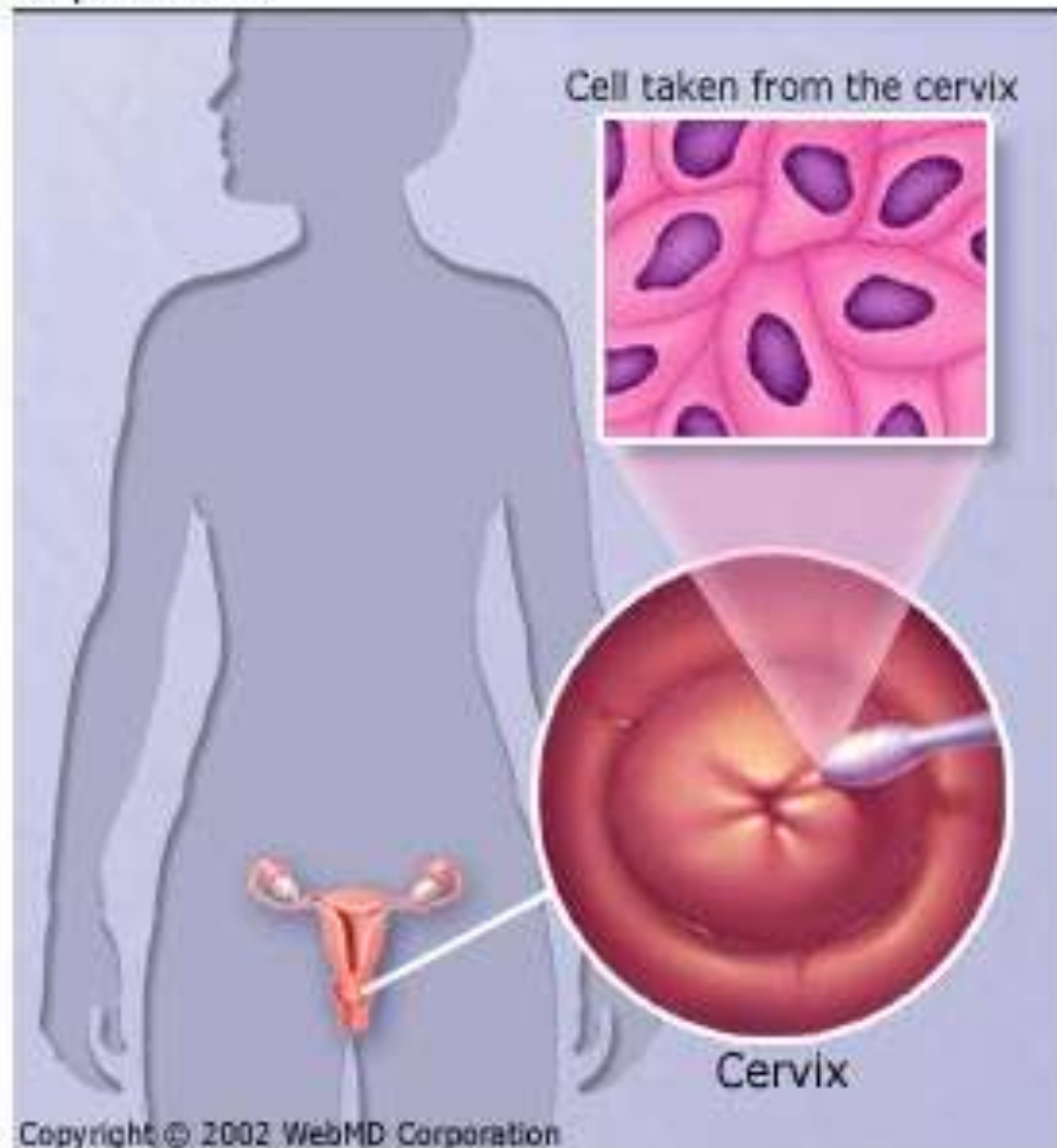
(c)

(d)

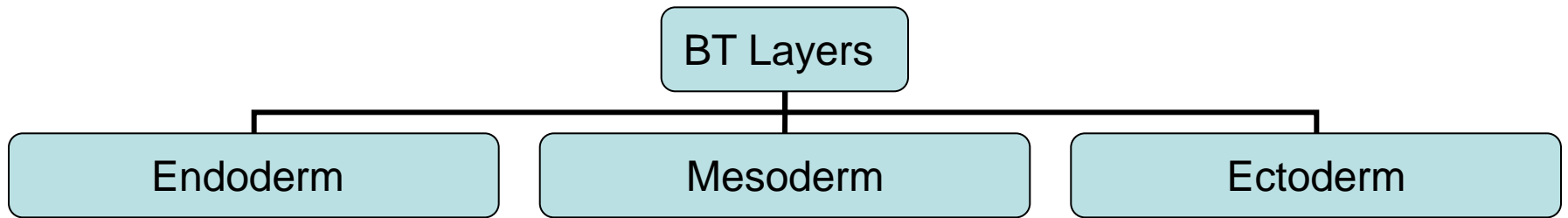
# The Papanicolau Test aka: Pap Smear

Involves collecting and microscopically examining epithelial cells that have sloughed off the apical (surface) layer of tissue. This type of test is done when examining the epithelium of the cervix and vagina to detect any early changes in the cells of the female reproductive system that may be a result of cancer or a precancerous condition. An annual pap test is recommend for all women as part of their routine, yearly pelvic exams

# Pap Smear



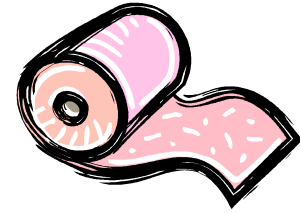
# Body Layers



# Organs in these layers

- **Endoderm-** “inner skin”-locations include GI track, lining of bladder, and respiratory system
- **Mesoderm-** “middle skin”-locations include skeletal, muscle, and blood dermis of skin.
- **Ectoderm-** “outer skin”- locations include nervous, skin, and oral cavity.

# Functions of Epithelial



- Protection
- Secretion
- Absorption
- Excretion
- Sensory
- Reproduction

# Epithelial

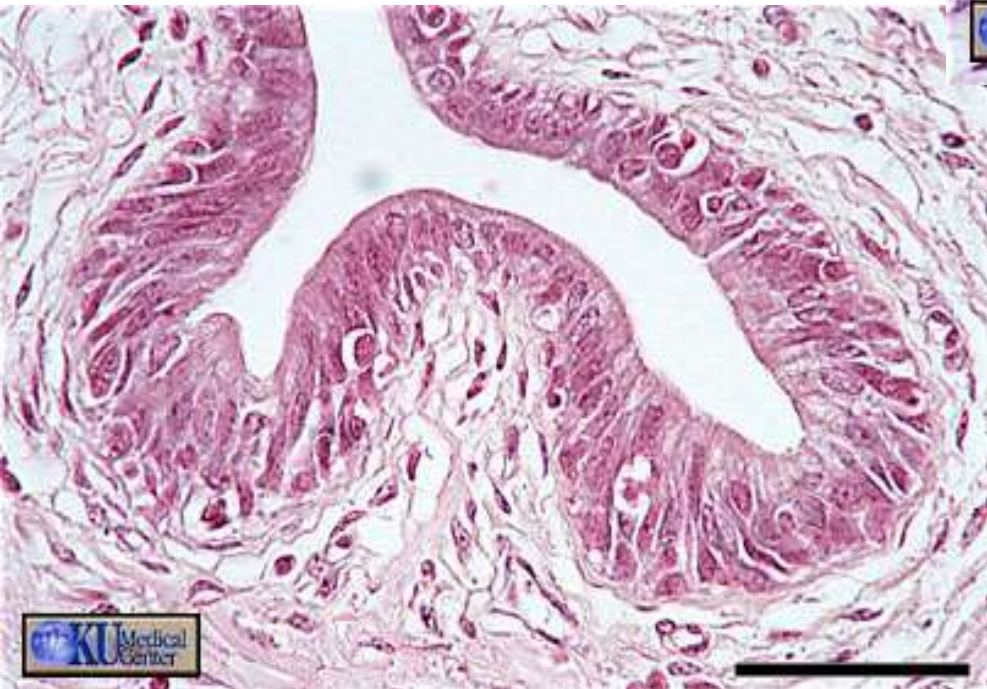
Will act as a:

- lining,
- glandular tissue or
- membrane

# Glandular Tissue

- Specialize epithelial cells.
- Glandular cells secrete chemicals necessary to maintain homeostasis.
- G.cells secretes into:
  - ducts (exocrine gland)-i.e: saliva, sweat and mucus.
  - Directly into EC matrix (endocrine) i.e: hormones.

# Sweat gland duct



# Penile Urethra duct

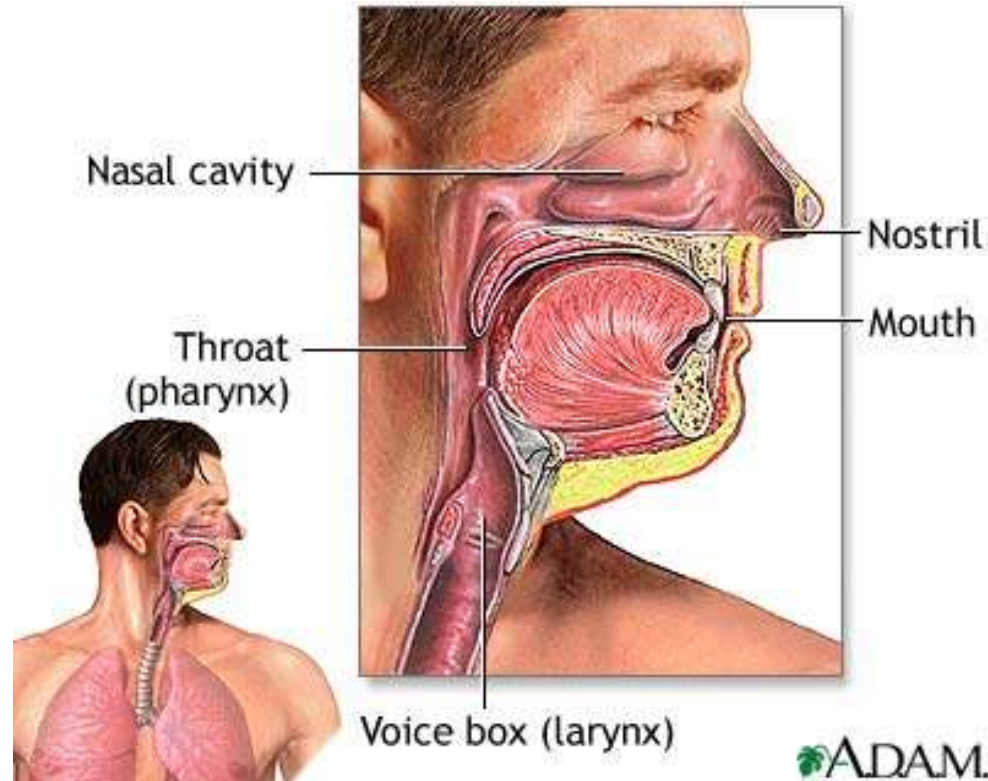
# Ep. Tissue as a Membrane

Remember:

Epithelium tissue directly overlies the connective tissue (which we'll cover next).

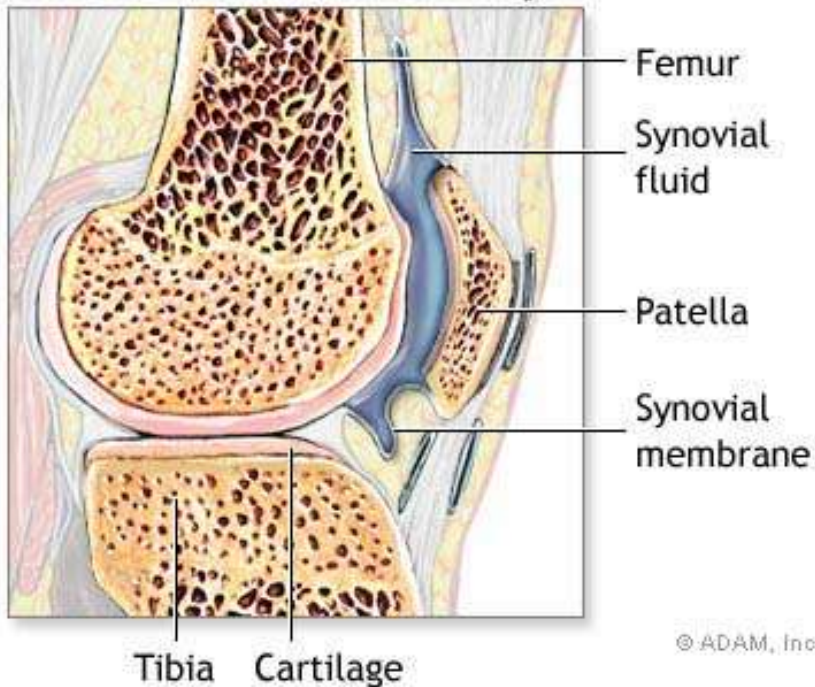
Membrane can be:

- **Mucous membrane:** lines cavities that open to the outside world

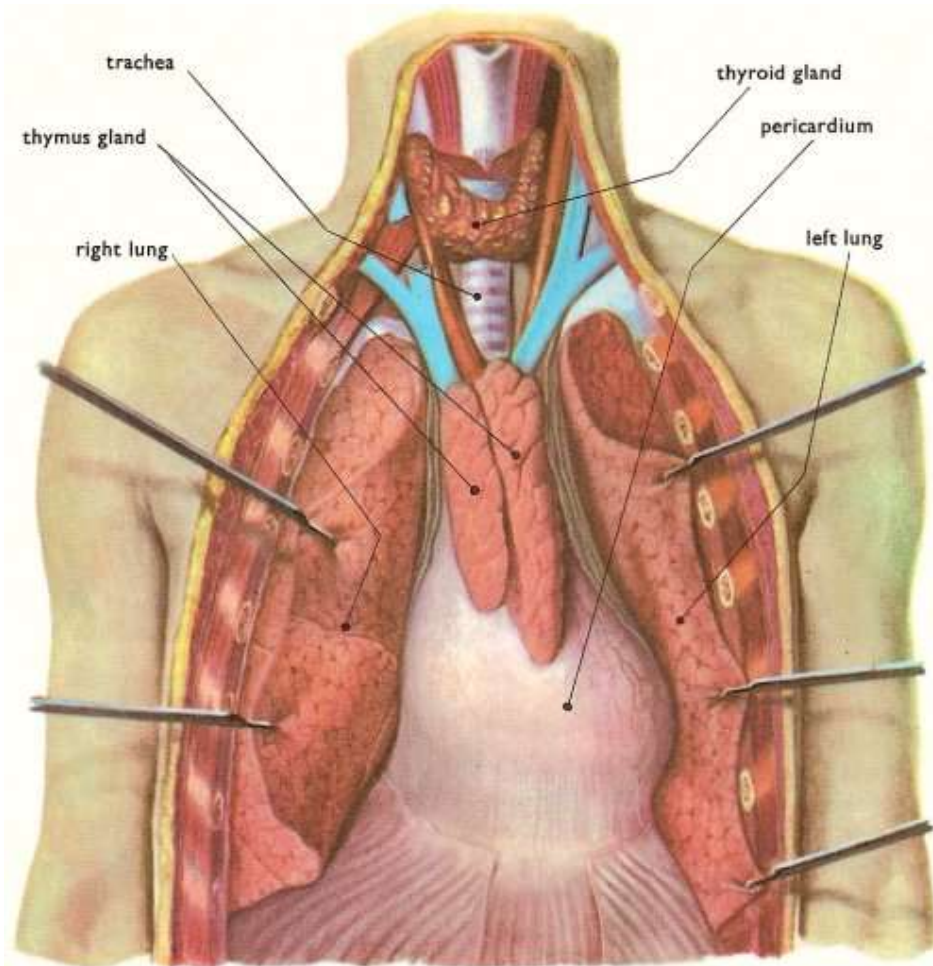


- **Serous membranes:** line closed cavities
- **Synovial membrane:** joint cavities

Cut-section view of normal knee joint



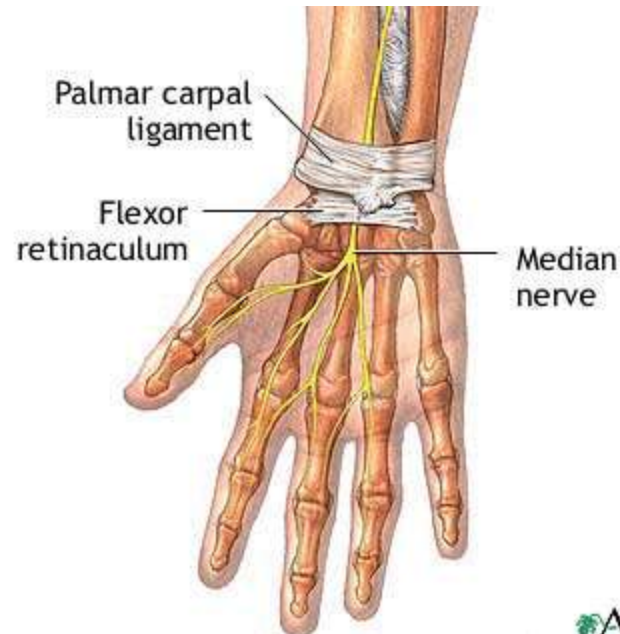
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# What's the connection?

What allows epithelia cells to maintain their structure?

Answer: Connective Tissue!



# Connective Tissue

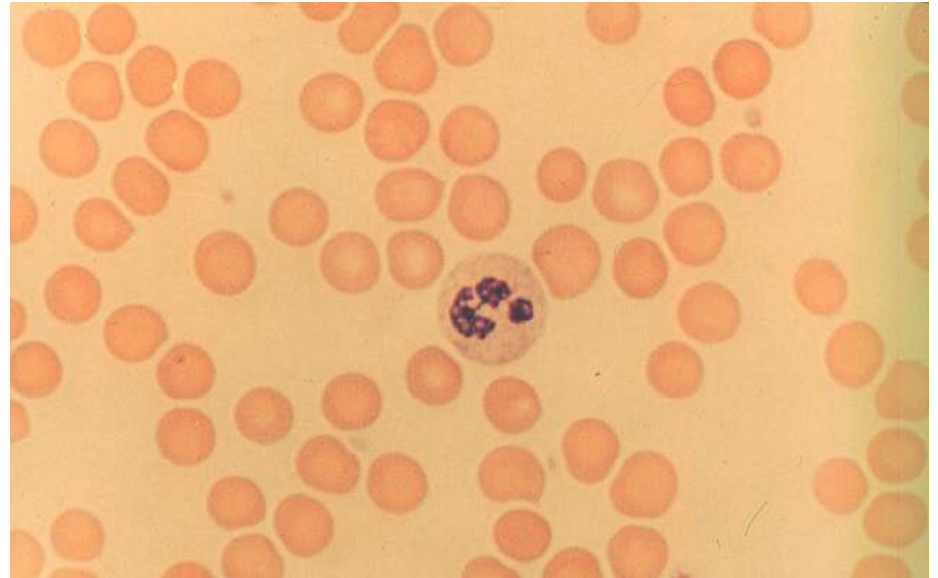
The most abundant tissue in the body.

It's most found in:

- Skin
- Membranes
- Muscles
- Bones
- Nerves
- All internal organs

Sometimes **connective tissue** is delicate and paper thin, especially when it is the webs that holds internal organs together to give them shape.

Sometimes **connective tissue** exists as strong, tough chords, rigid bone, and even in the form of a fluid—blood!



# What is connective tissue's job?

Well, this depends on its FORM (aka structure)

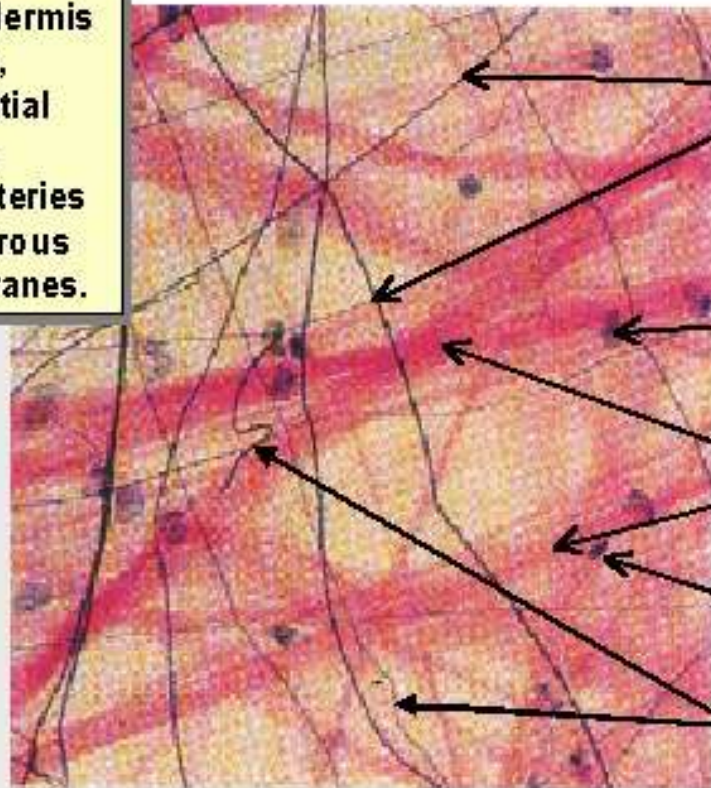
- Sometimes it is to be a supporting framework...
- Sometimes it is to transport substances through out the body... (blood)
- And sometimes it defends us against microbes!

# A closer look at Areolar and Adipose Connective Tissue

- Most widely distributed
- The 'glue' that gives form to internal organs

Found in outer dermis of skin, interstitial tissue, mesenteries and serous membranes.

Areolar Tissue  
Photomicrograph



Elastic fibers form an interconnecting network

Mast cell

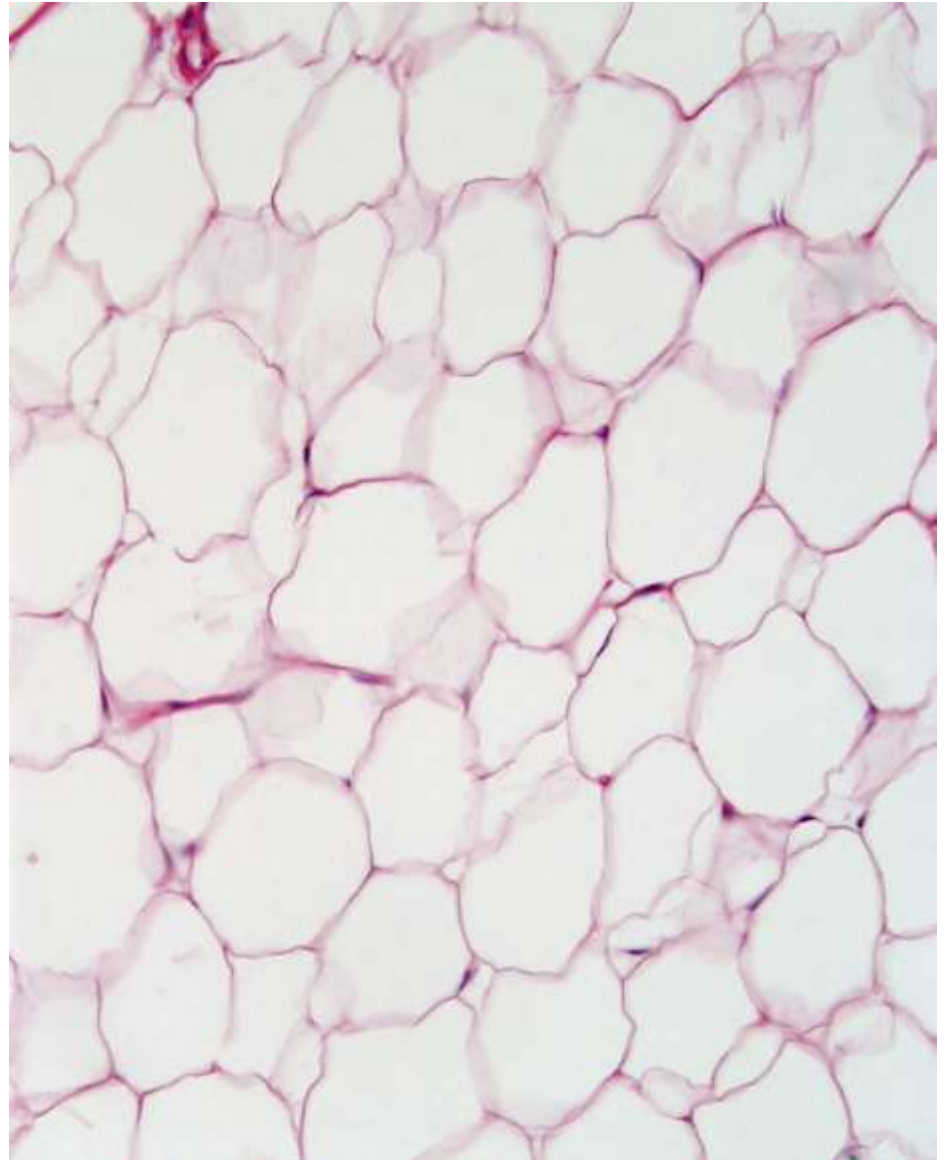
Collagen fibers form dense bundles

Fibroblast

Reticular fibers

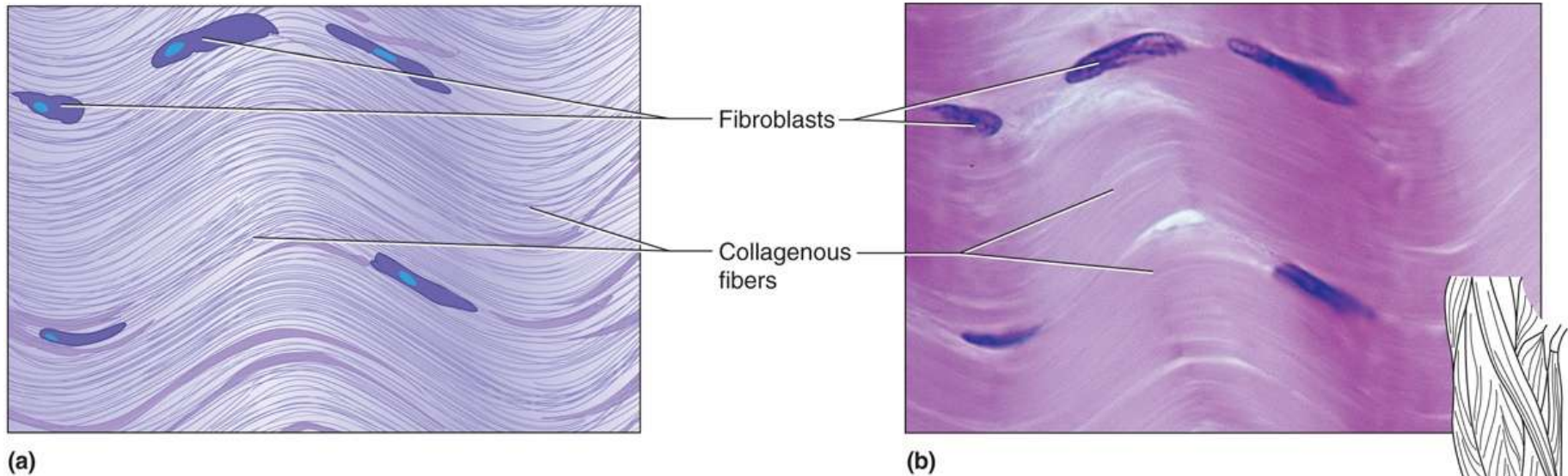
# Adipose or Fat Tissue

- Is specialized to store lipids! It has FORM that has lots of large spaces where fat can accumulate!



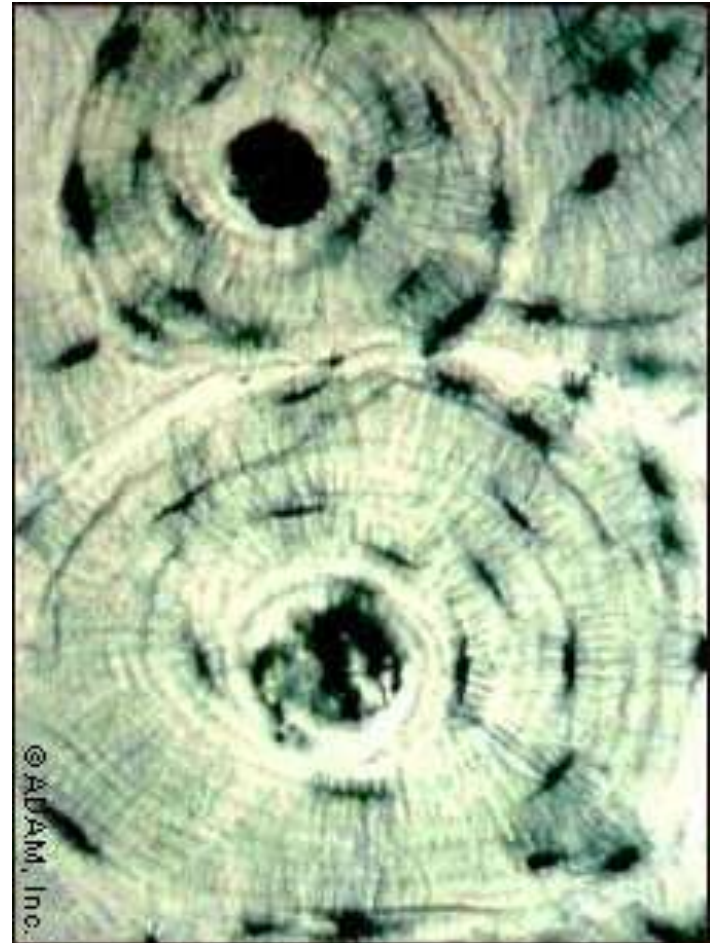
# Fibrous Connective Tissue

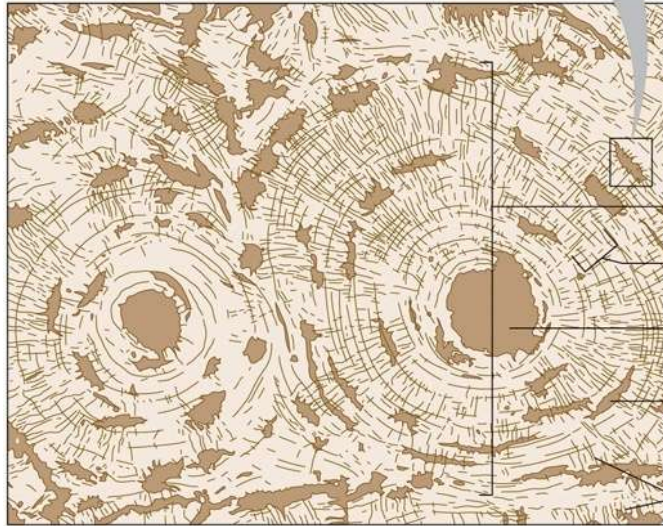
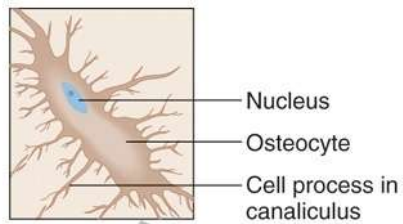
- Made up of strong, white **collagen** fibers in parallel rows.
- This connective tissue makes tendons with strength and flexibility but no stretch!



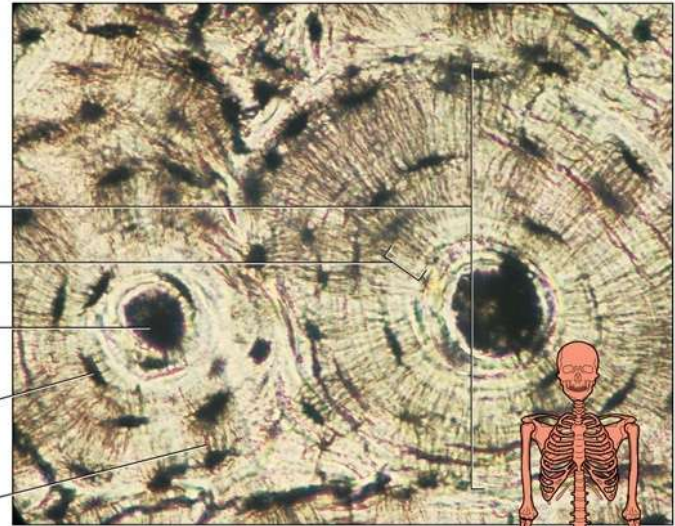
- **Bone** is one of the most highly specialized forms of connective tissue.
- It's hard and calcified in blocks called **osteons** (what's the name of that bone disease? Notice the root word!)

# Bone Tissue

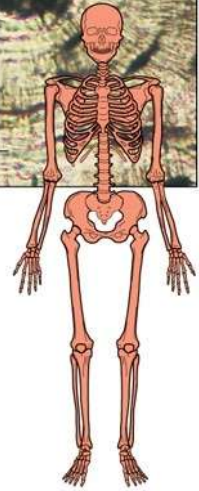
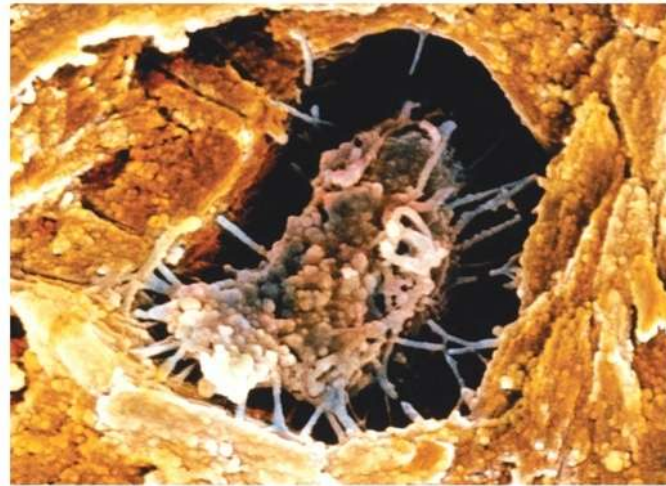




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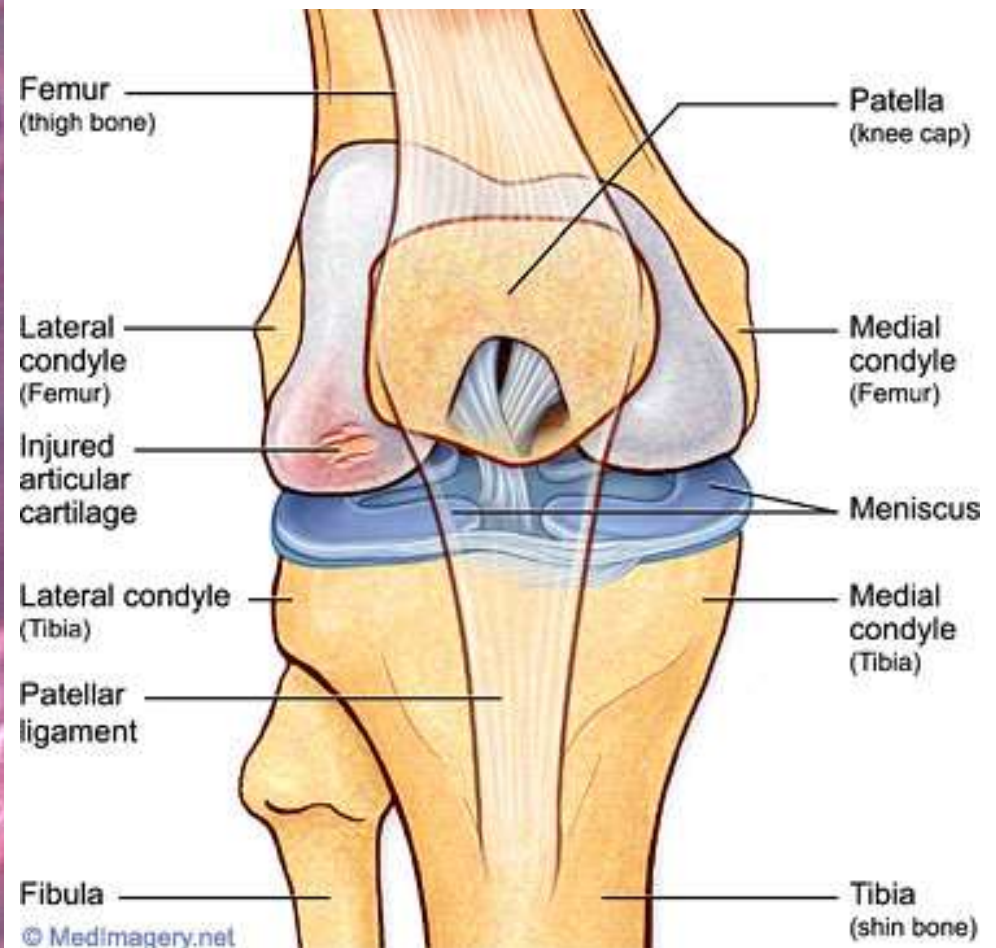
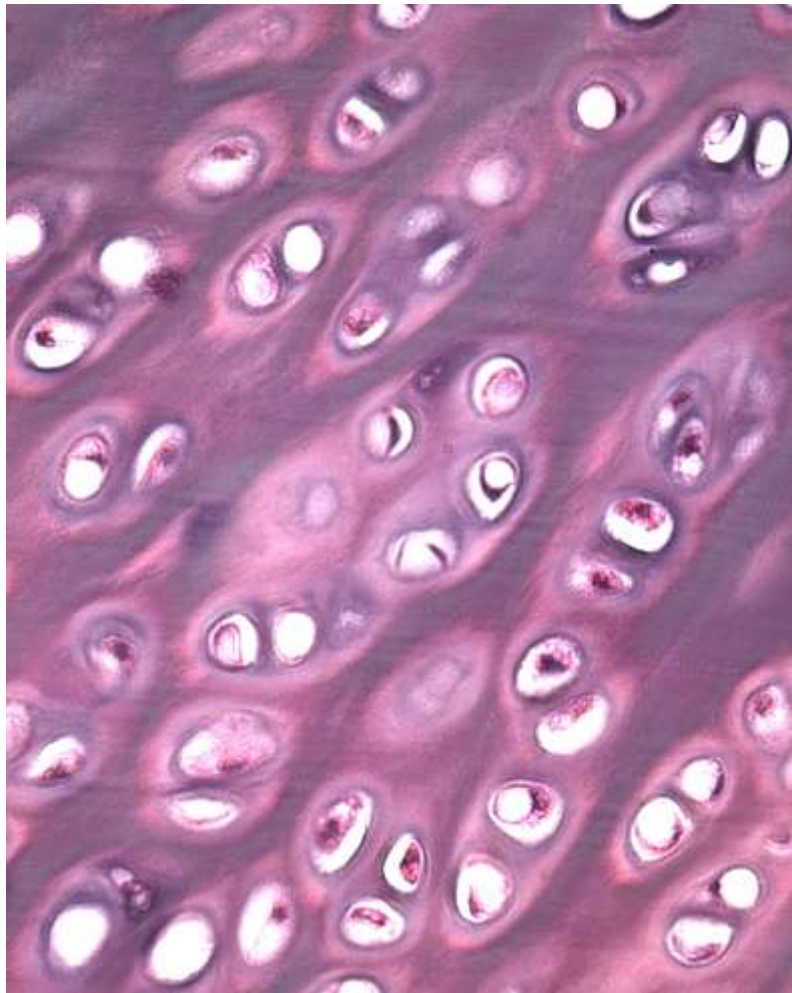


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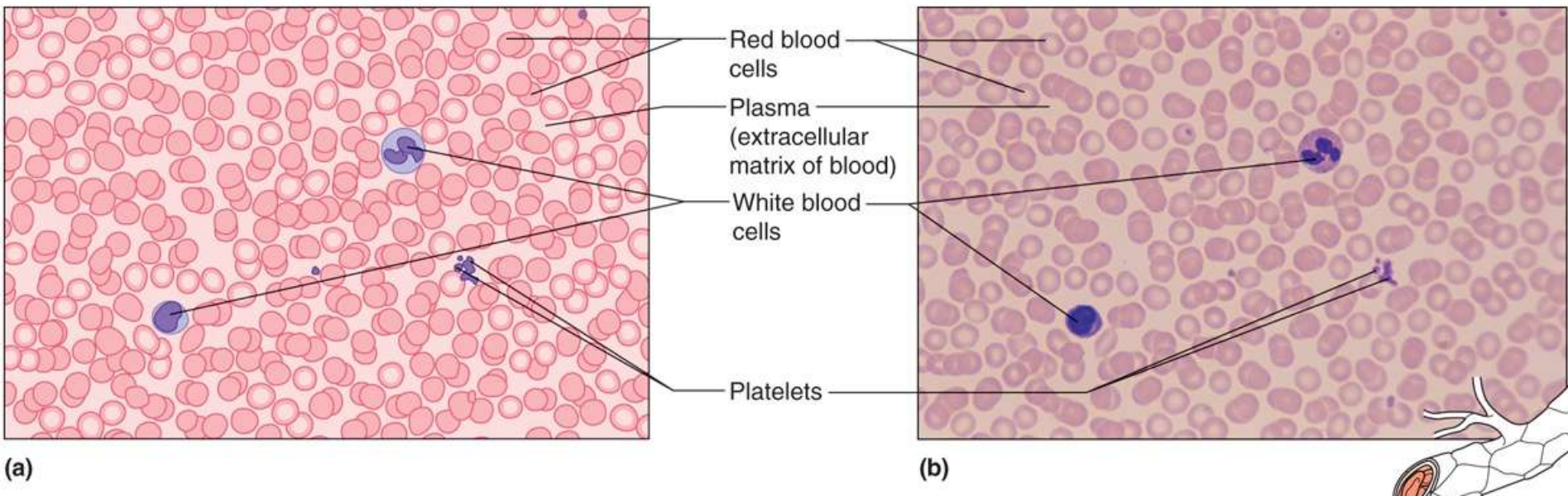
# Cartilage Tissue

- **Cartilage** differs from bone because it is like a plastic or gristle-like gel!



# Blood and Hemopoietic Tissue

- **Blood** is made up of red and white blood cells.
- **Hemopoietic tissue** is the bloodlike connective tissue found in the red marrow cavities of bones and in organs such as the spleen, tonsils and lymph nodes.



# Muscle Tissue

- These are the movement specialists of the body!
- They are slow to heal and are frequently replaced by scar tissue if injured.
- There are three kinds of muscle tissue

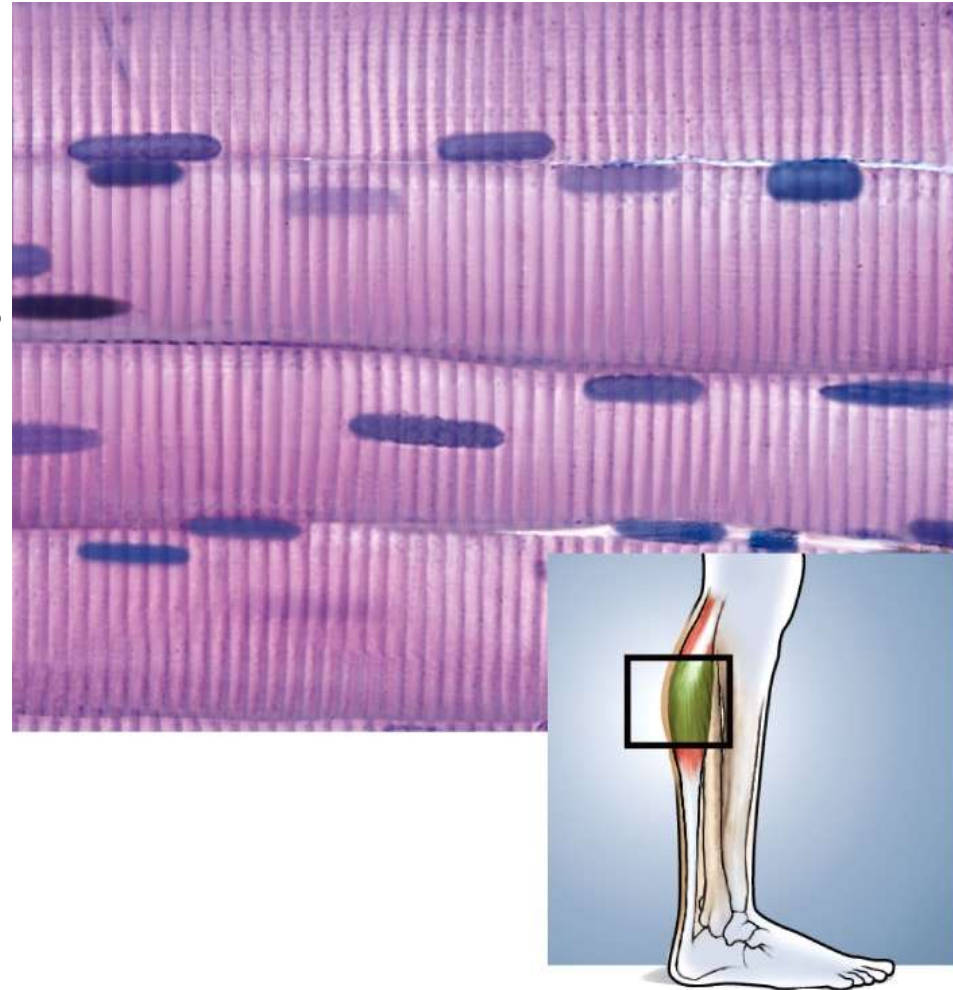
# 3 Types of Muscle Tissue

## 1) **Skeletal muscle** tissue

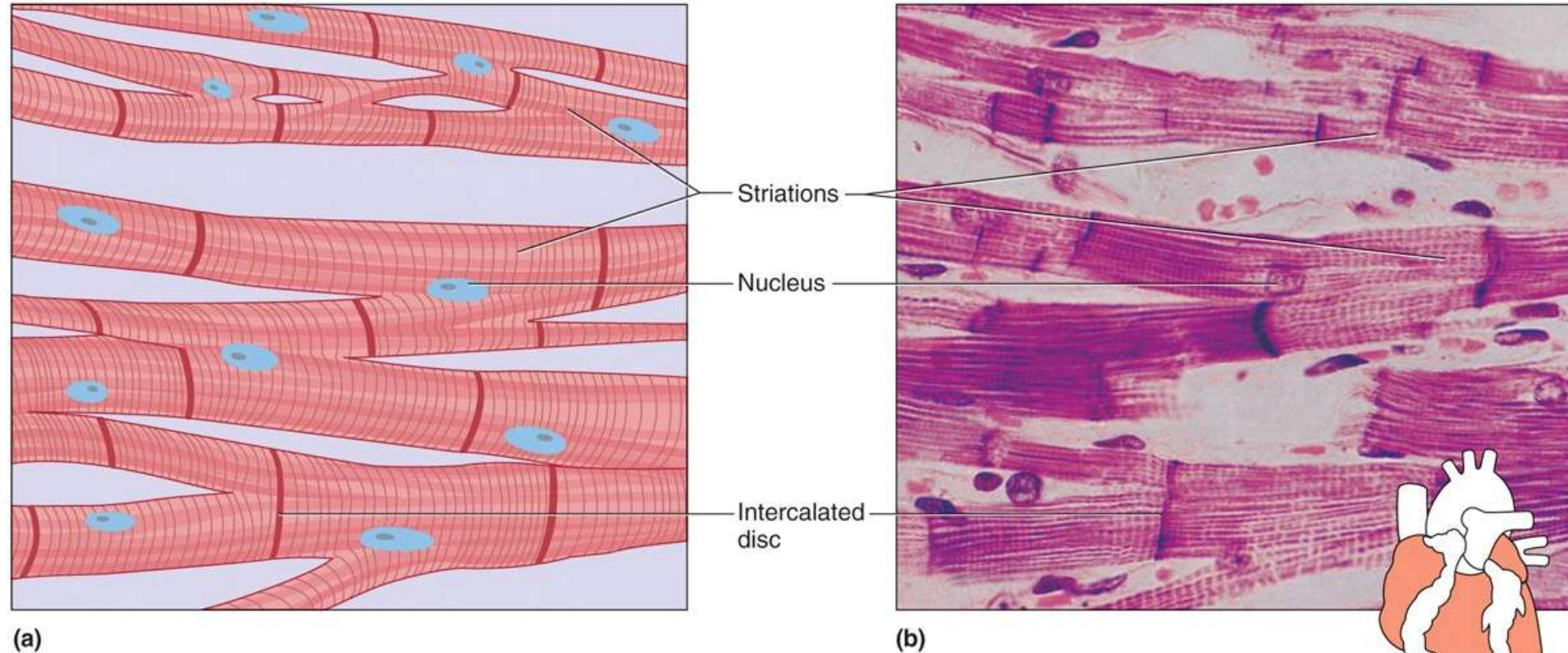
is attached to bones.

When viewed under a scope, skeletal muscle has many cross sections and nuclei per cell.

They have long and thread-like cells called fibers that help produce voluntary and controlled body movements.



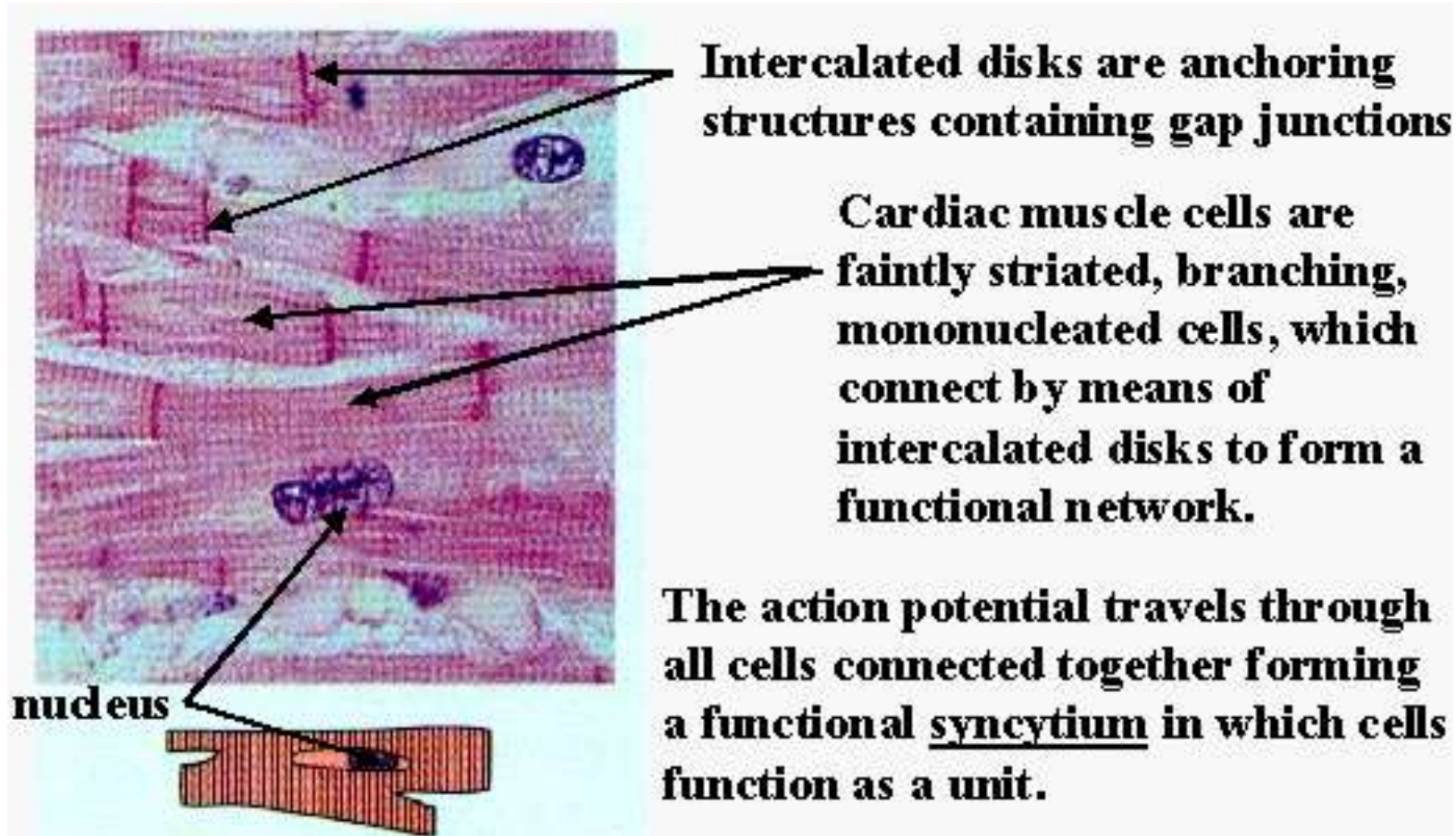
## 2) Cardiac Muscle Tissue



Forms the walls of the heart and the regular but **INVOLUNTARY** contractions of cardiac muscle to produce a heartbeat. Notice they form interlocking branching cross striations to make an interlocking mass of contractile tissue.

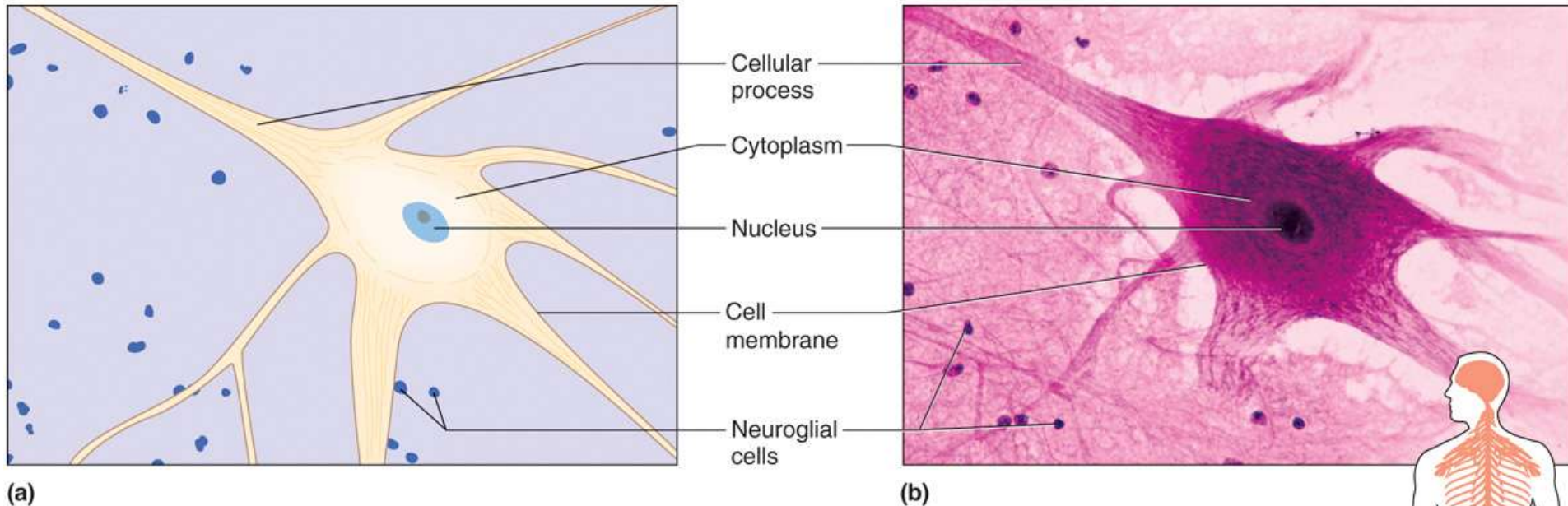
# Cardiac Muscle aka Smooth Muscle Tissue

- **Smooth muscle** is INVOLUNTARY—meaning it is not under conscious or willful control.



# 3) Nervous Tissue

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**Nervous tissue** is responsible for **RAPID** communication between the body's structures in order to control body function. The nerve cells are called **neurons** and the special connecting supportive cells are called **glia**.

# So, let's review...

- In your notebook, write the answers to these questions, and then we'll go over them together...
1. How many types of tissues are there? Name them.
  2. What are the types of epithelium? What is the epithelium's list of jobs?
  3. What are the types of connective tissue and what is the lists of its jobs?
  4. Why is nervous tissue shaped the way it is?