HISTOLOGY:
Study of Tissues

Four Types?

Two components of tissue?

These four tissue types have a wide range of functions, as shown in the following table.

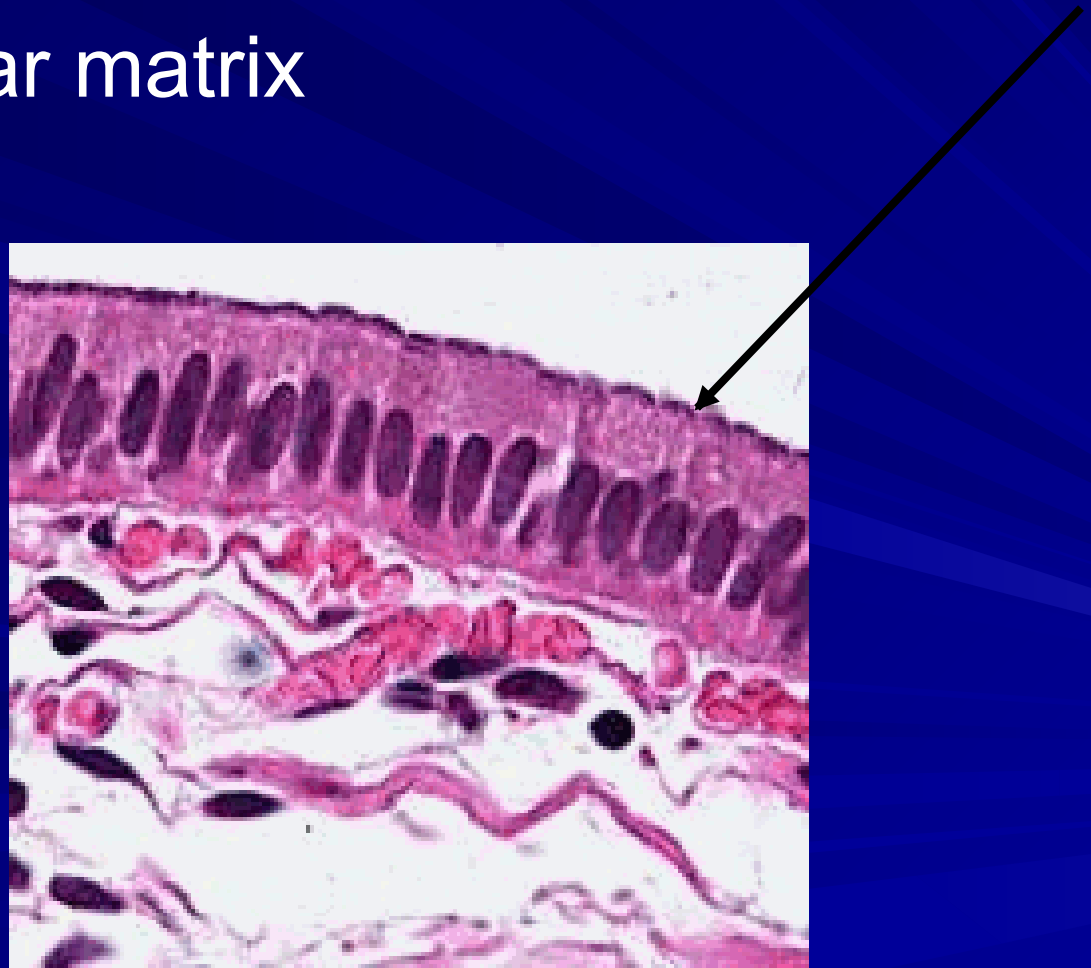
TABLE 5.1 TISSUES

TYPE	FUNCTION	LOCATION	DISTINGUISHING CHARACTERISTICS
Epithelial	Protection, secretion, absorption, excretion	Cover body surfaces, cover and line internal organs, compose glands	Lack blood vessels, readily divide; cells are tightly packed
Connective	Bind, support, protect, fill spaces, store fat, produce blood cells	Widely distributed throughout body	Mostly have good blood supply; cells are farther apart than cells of epithelia, with matrix in between
Muscle	Movement	Attached to bones, in the walls of hollow internal organs, heart	Contractile
Nervous	Transmit impulses for coordination, regulation, integration, and sensory reception	Brain, spinal cord, nerves	Cells connect to each other and other body parts

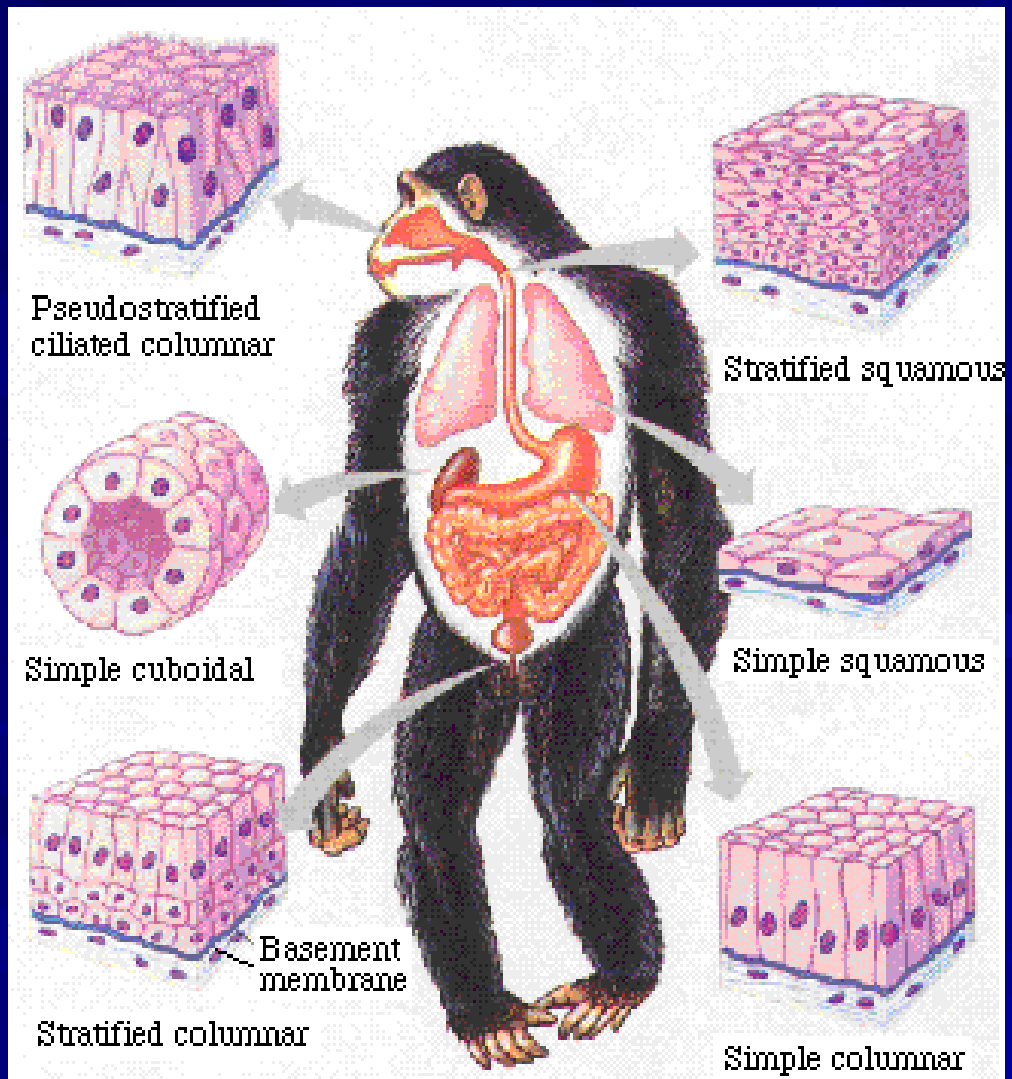
2 Components of Tissue

Cells

Extracellular matrix



Focus: Epithelium



GENERAL CHARACTERISTICS OF EPITHELIUM:

Epithelial tissues are anchored to a basement membrane, are made up of tightly packed cells containing little intercellular material, generally lack blood vessels, and are replaced frequently.

LOCATION

- Lining of body cavities
- Lining of digestive tract
- Lining of heart and blood vessels
- Lining of gland ducts
- Skin

FUNCTION OF EPITHELIUM

Protection

Absorption – one side of the tissue is always in contact w/ external opening (maintains homeostasis)

Secretions – hormones, mucus, enzymes

How epithelial tissues are classified:

SHAPE:

Squamous – thin, think “squished”

Cuboidal – cubed shape

Columnar – rectangular think “column”

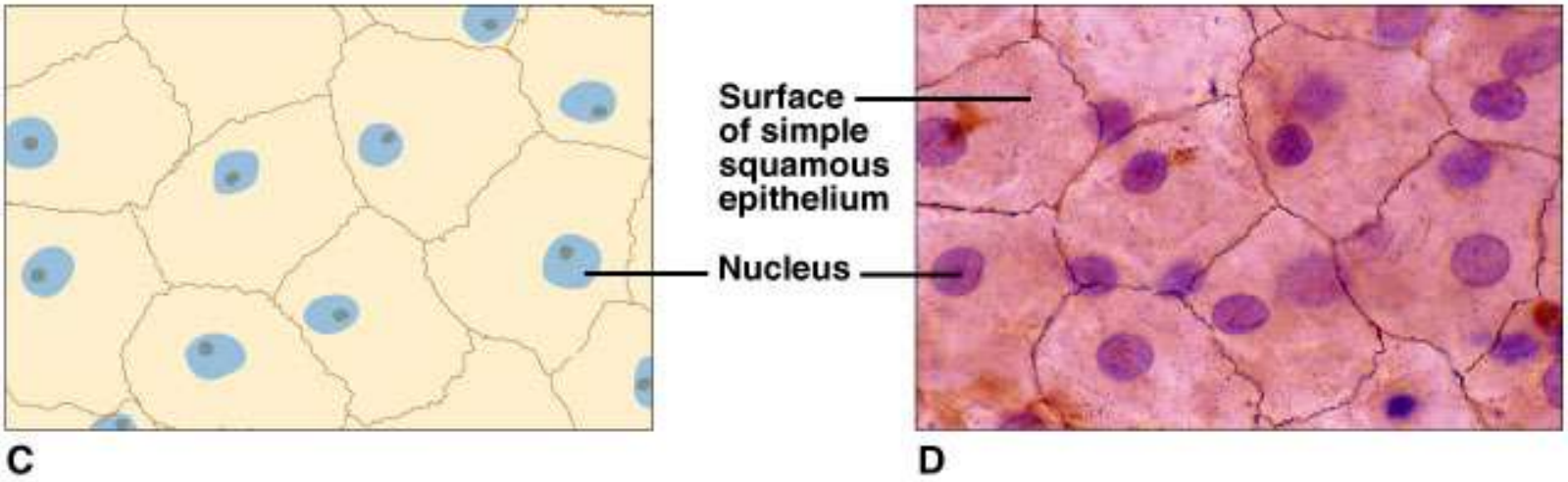
LAYERS:

- Simple = single layer
- Stratified = more than one layer

Types of epithelium

Simple squamous
Simple cuboidal
Simple columnar
Stratified cuboidal

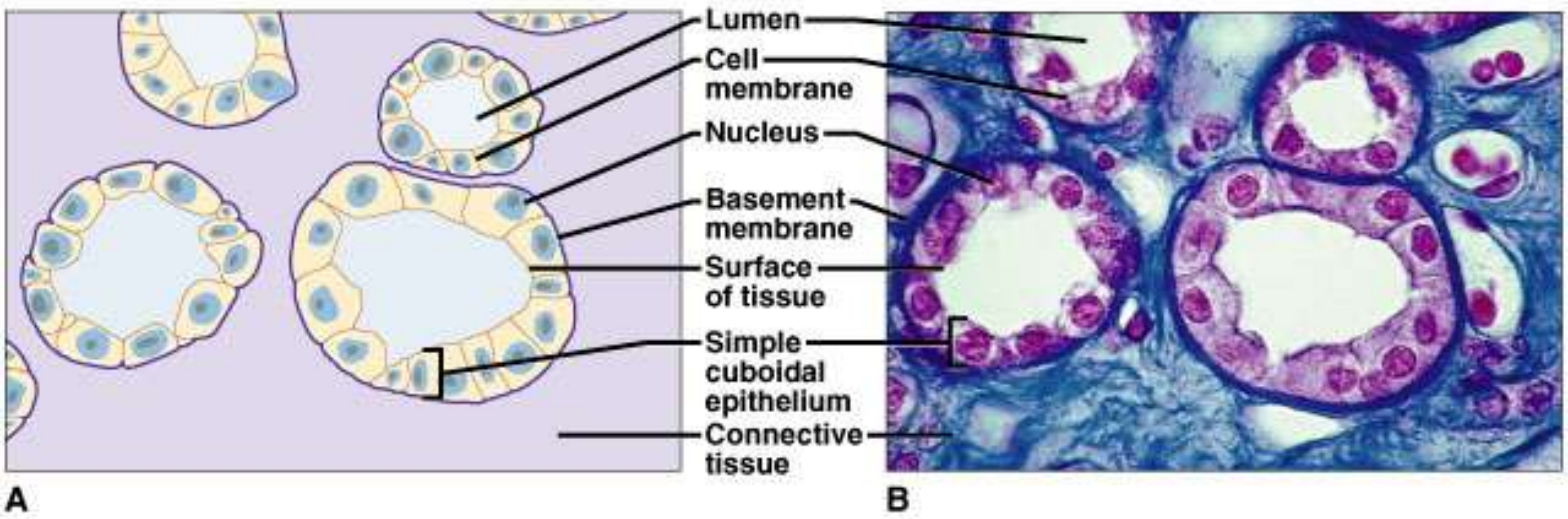
SIMPLE SQUAMOUS



B. Simple Squamous Epithelium

1. Simple squamous epithelium is made up of a single layer of thin, flattened cells.
2. Because it is suited for diffusion, it functions in the exchange of gases in the lungs and lines blood and lymph vessels as well as body cavities.

Simple Cuboidal

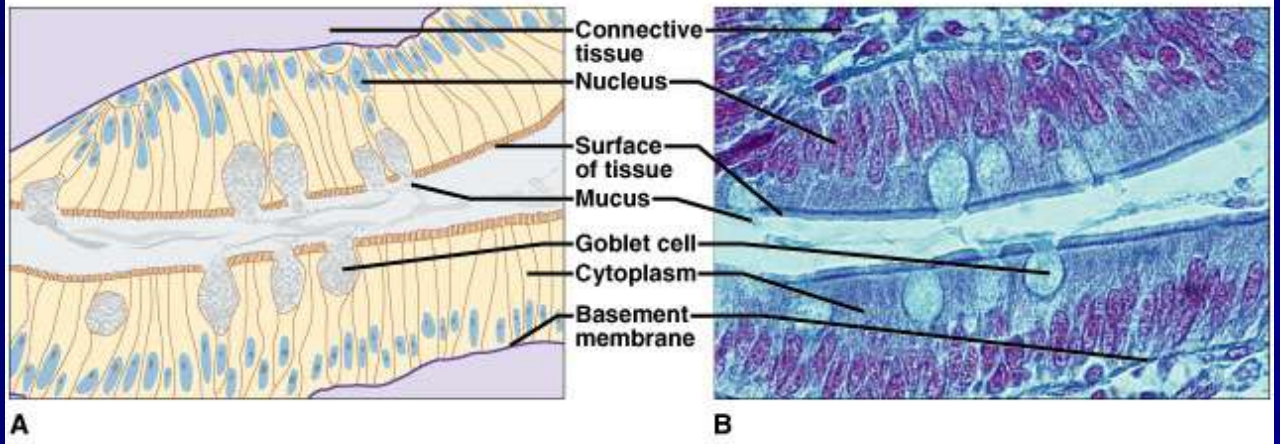


C.Simple Cuboidal Epithelium

1.Simple cuboidal epithelium consists of a single layer of cube-shaped cells with centrally located nuclei.

2.It functions in secretion and absorption in the kidneys, and in secretion in glands.

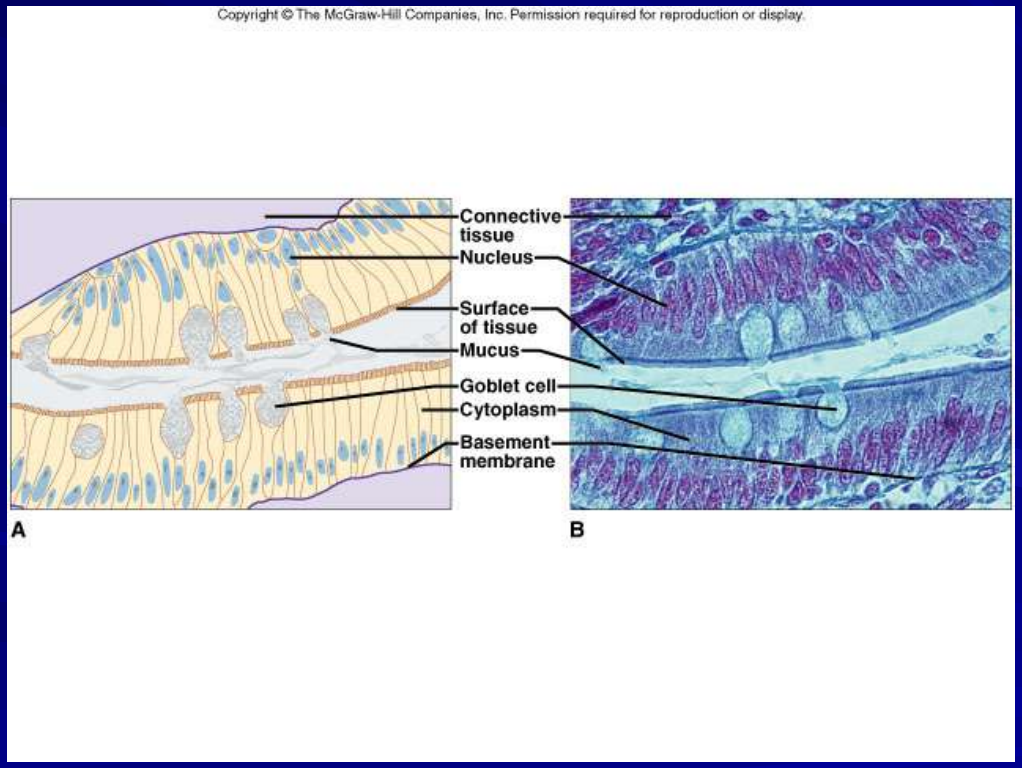
Simple Columnar



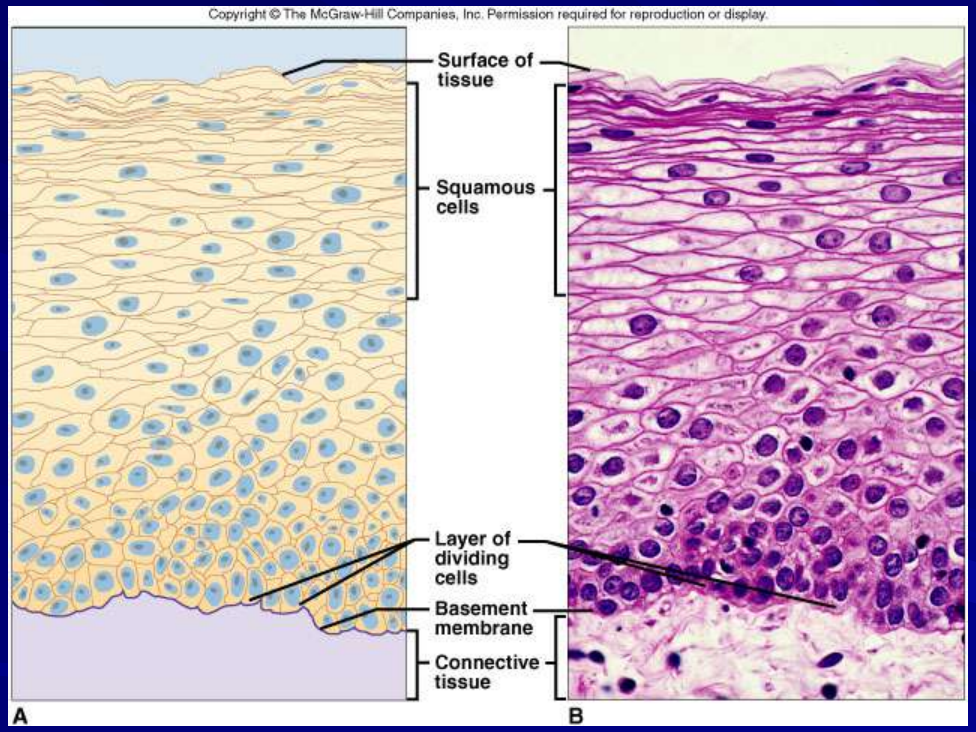
D. Simple Columnar Epithelium

1. Simple columnar epithelium is made up of a row of elongated cells whose nuclei are all located near the basement membrane. It may be ciliated.
2. It lines the uterus, stomach, and intestines where it protects underlying tissues, secretes digestive fluids, and absorbs nutrients.

3. In the intestine, these cells possess microvilli that increase the surface area available for absorption.
4. Mucus-secreting goblet cells can be found among columnar cells.



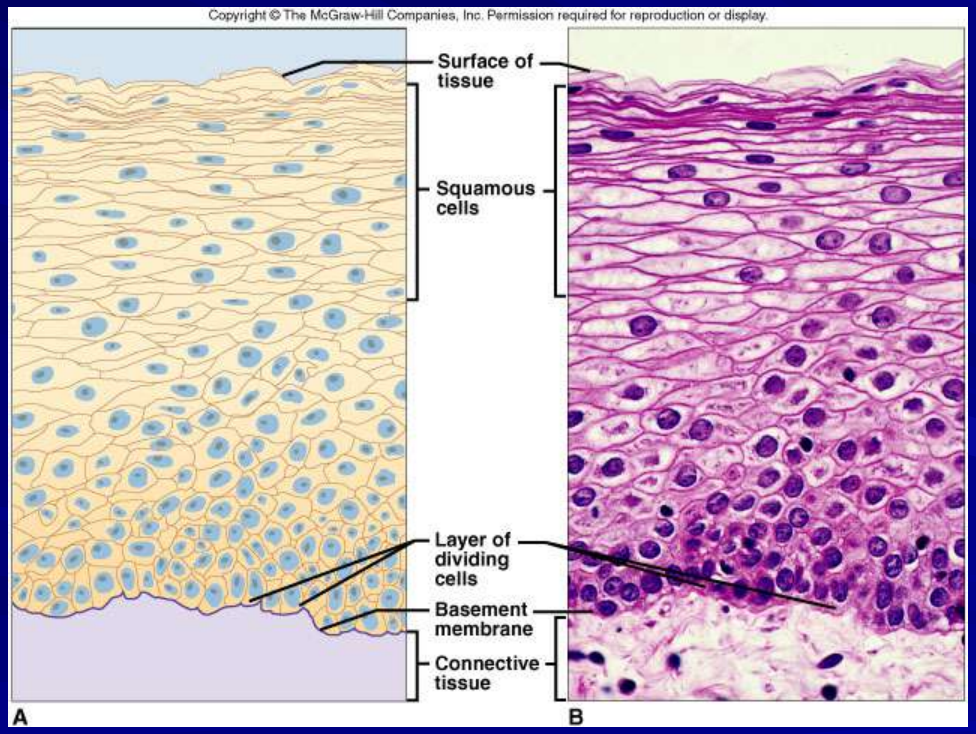
E. Stratified Squamous



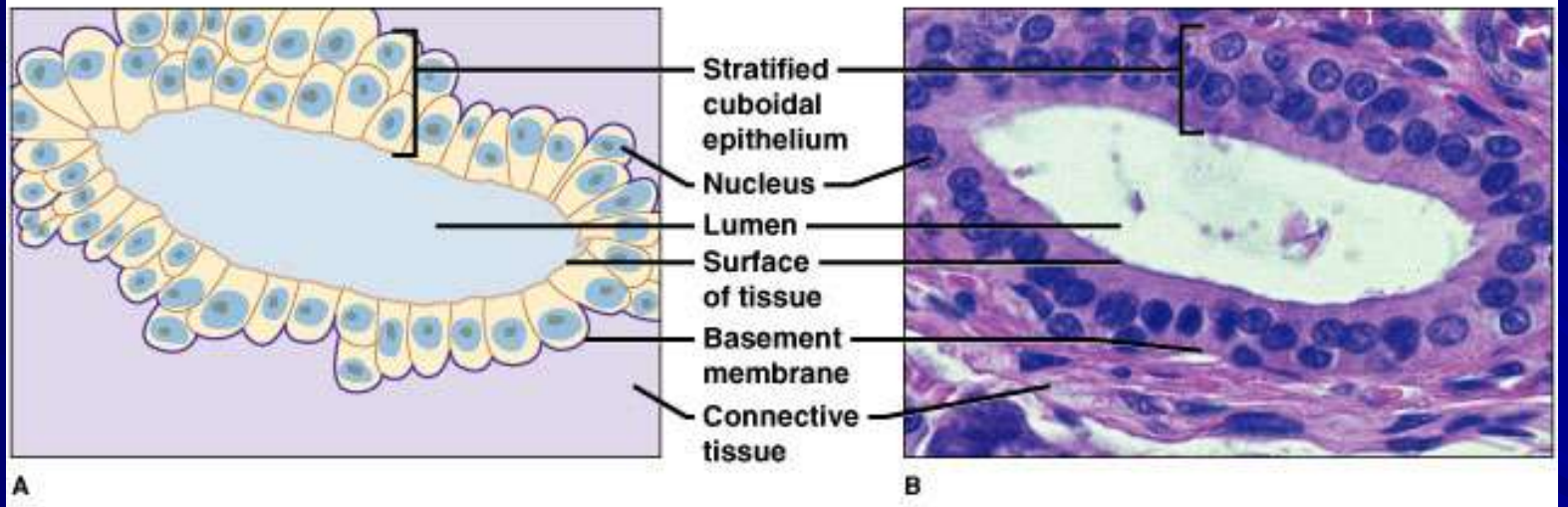
E. Stratified Squamous Epithelium

1. This type of tissue is made up of layers of flattened cells that are designed to protect underlying layers.
2. It makes up the outer layer of skin, and lines the mouth, throat, vagina, and anal canal.

3.In the skin, outer layers of cells undergo keratinization; however, this process does not occur where tissues remain moist in the throat, vagina, or anal canal.



STRATIFIED CUBOIDAL



F. Stratified Cuboidal Epithelium

1. This tissue consists of two to three layers of cuboidal cells lining a lumen of the mammary glands, sweat glands, salivary glands, and pancreas.
2. Several layers of cells provide greater protection than one single layer.

“special” types of epithelium

Pseudostratified cuboidal or columnar – “false layers”, looks like there is more than one layer b/c nucleus alignment in cells

Transitional epithelium – tissues that adjusts to various tensions (think bladder)

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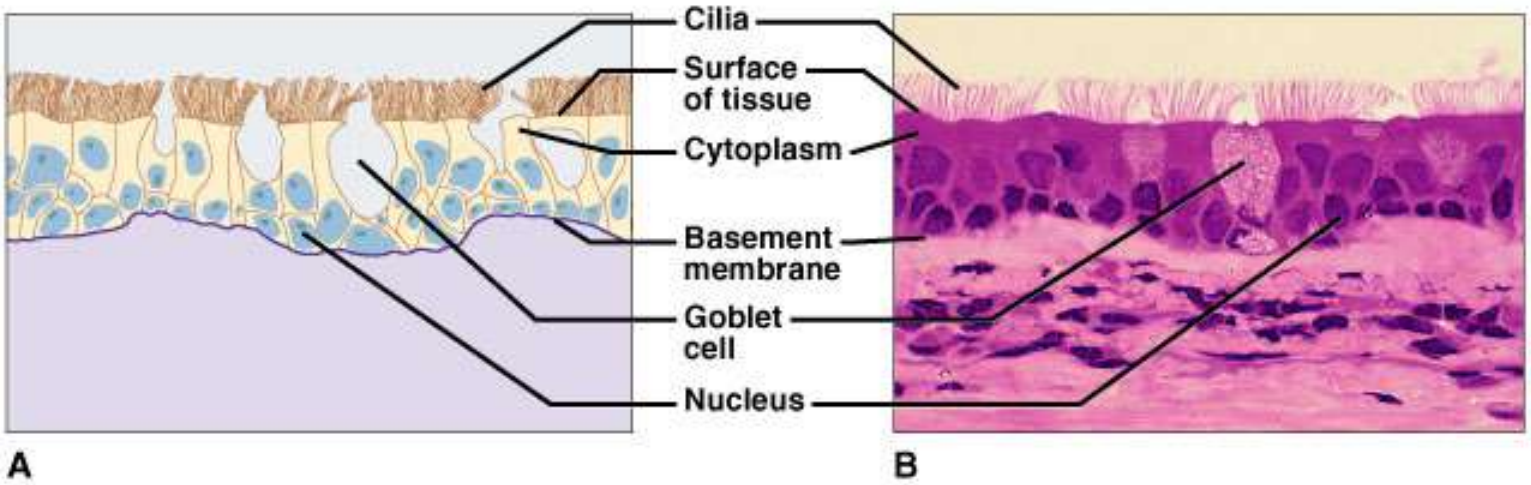
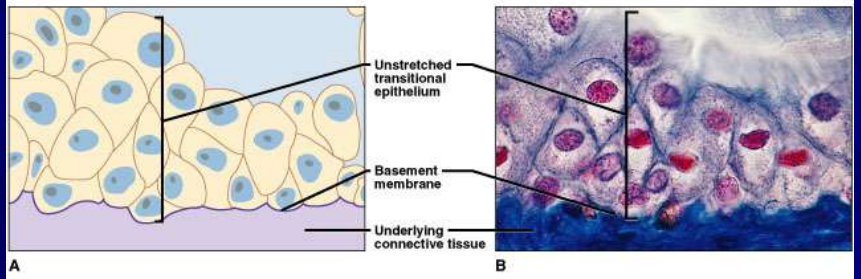
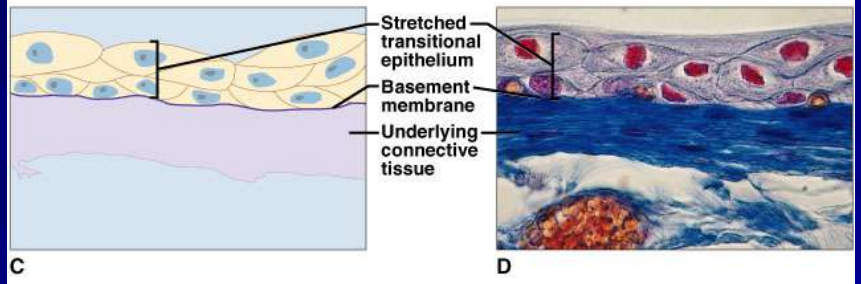


E. Pseudostratified Columnar Epithelium

1. These cells appear layered due to the varying positions of their nuclei within the row of cells, but are not truly layered.
2. Cilia may be present, along with mucus-secreting globlet cells, that line and sweep debris from respiratory tubes.





I. Transitional Epithelium

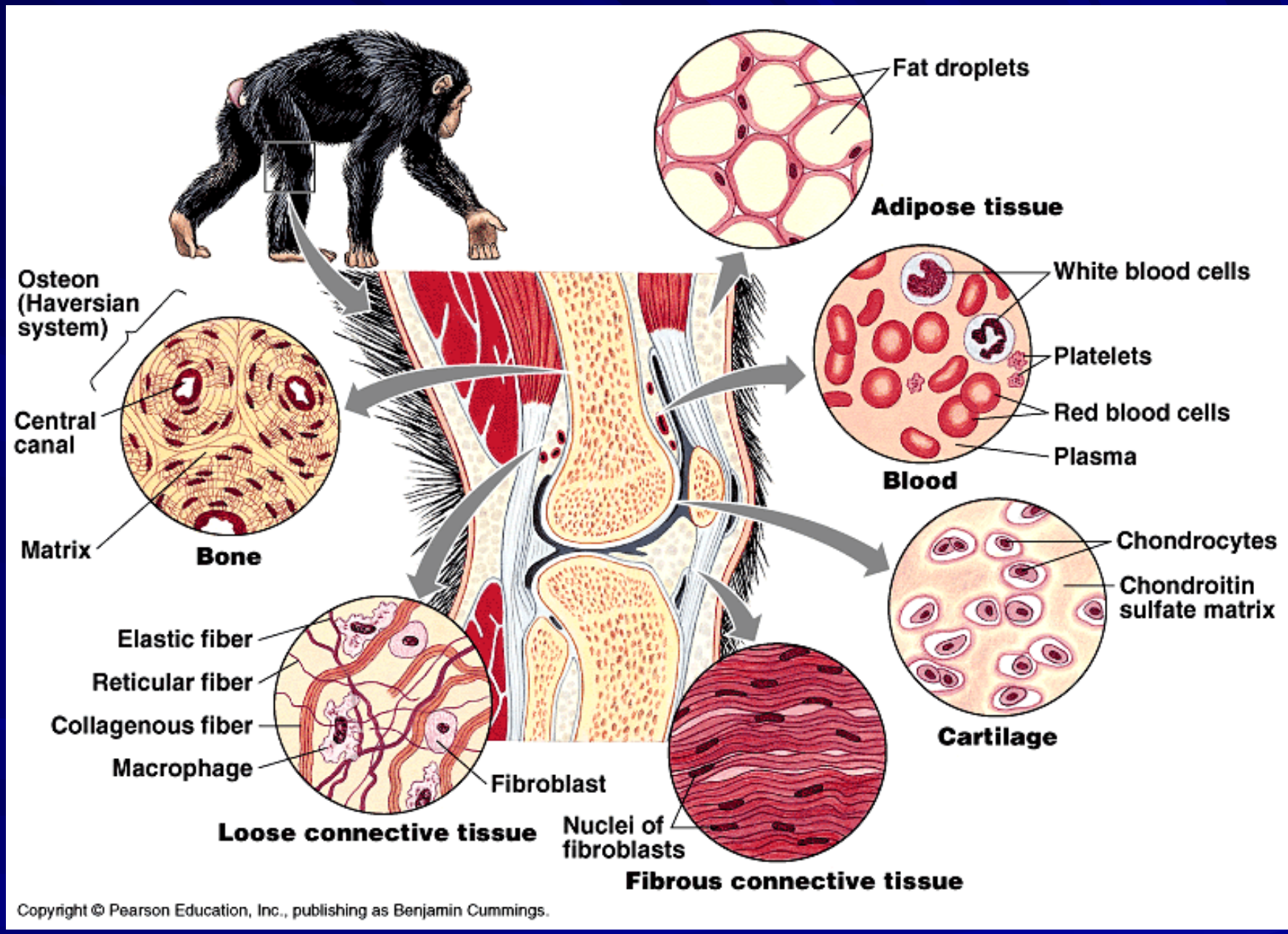
1. Transitional epithelium is designed to distend and return to its normal size, as it does in the lining of the urinary bladder.
2. This design provides distensibility and keeps urine from diffusing back into the internal cavity.

Practice

Connective Tissue

3 TYPES

- Connective tissue proper
- Fluid connective tissue
- Supporting connective tissue



General Characteristics:	General Functions:
Deep Tissues Never exposed to environment 3 basic components -Specialized cells -Fibers -Ground substance	Support and protection Transport of materials Store energy Defend body against pathogens

Connective tissue proper

Many types of cells in a syrupy ground substance

Ex of where found = tendons, surrounding organs, ligaments, surrounds respiratory passageway

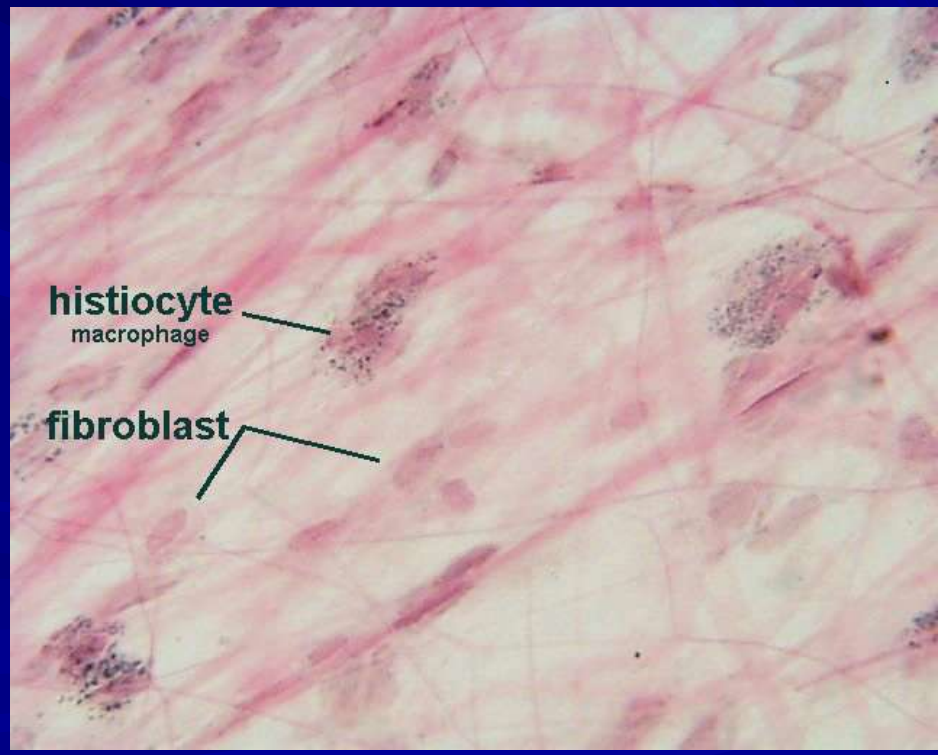
Two types of connective tissue

- loose connective
- dense connective

Connective tissue proper: CELLS

Fibroblasts
(slender and star-shaped cells)

Fibroblasts are large, long, flat, branching cells with large light colored nuclei. Fibroblasts are the most abundant cells in connective tissue proper. They are responsible for production and maintenance of fibers and ground substance.



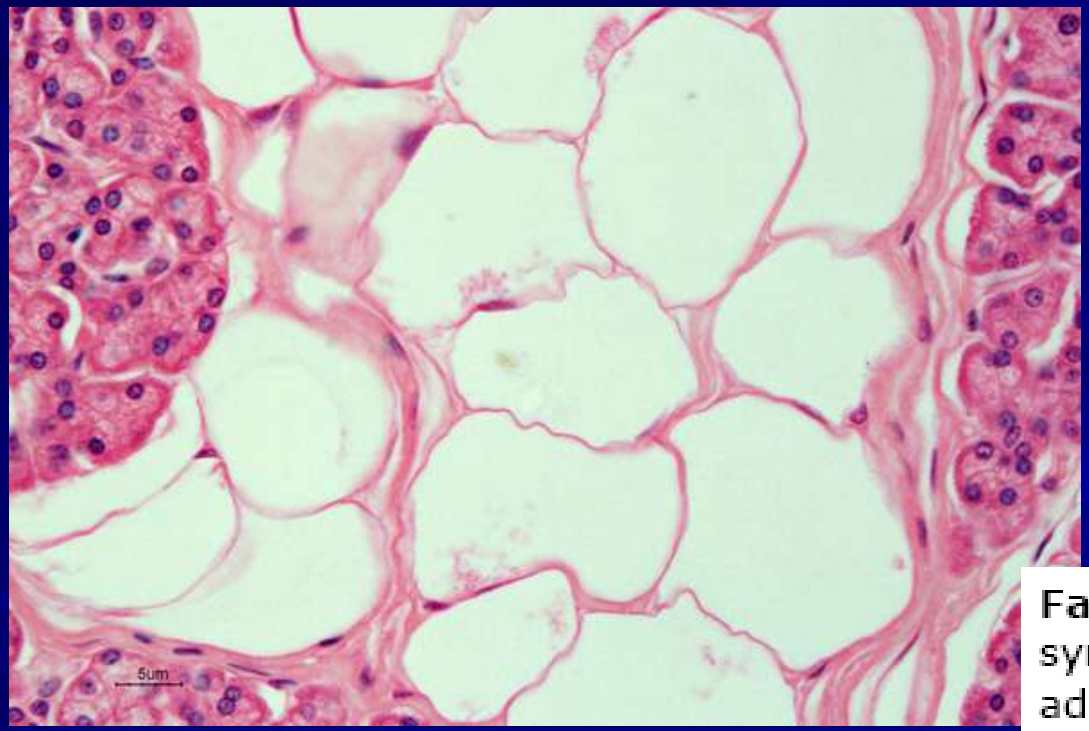
Connective tissue proper: CELLS

Macrophages

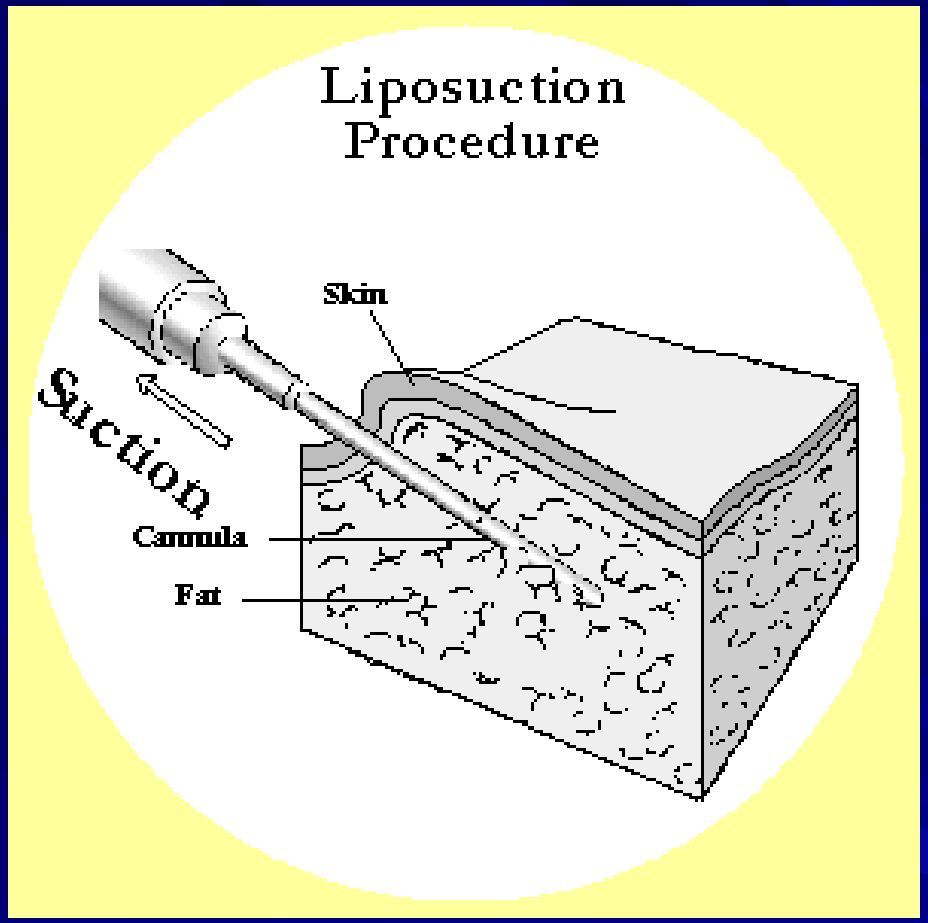
Macrophages are active phagocytes ("cell eaters"). The term macrophage is descriptive (*macro* means large and *phage* means to eat). So, the term macrophage means "big eater." Macrophages have an oval to irregular shape and have a small nucleus. In cases of inflammation, macrophages detach from fibers, change their shape to resemble an amoeba, and begin actively moving about the body. In the mobile state, macrophages are scavengers that engulf and destroy foreign material and damaged cells.

Connective tissue proper: CELLS

Adipose cells (stores fat)



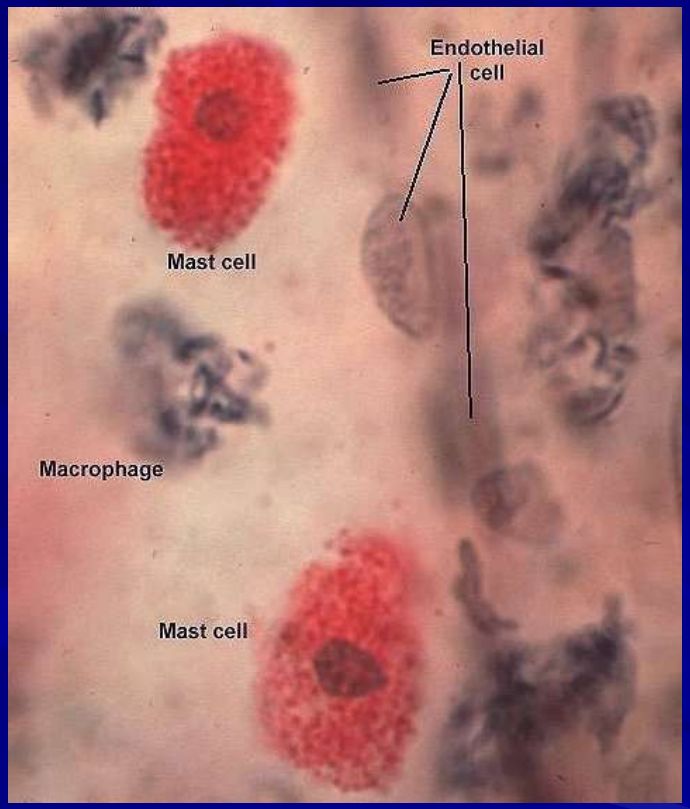
Fat cells, also called **adipose cells**, synthesize and store fats. A mature adipose cell accumulates so much fat that the nucleus and cytoplasm are pushed to the sides of the cell.


Liposuction Procedure
Skin
Suction
Cannula
Fat

Connective tissue proper: CELLS

Mast Cells

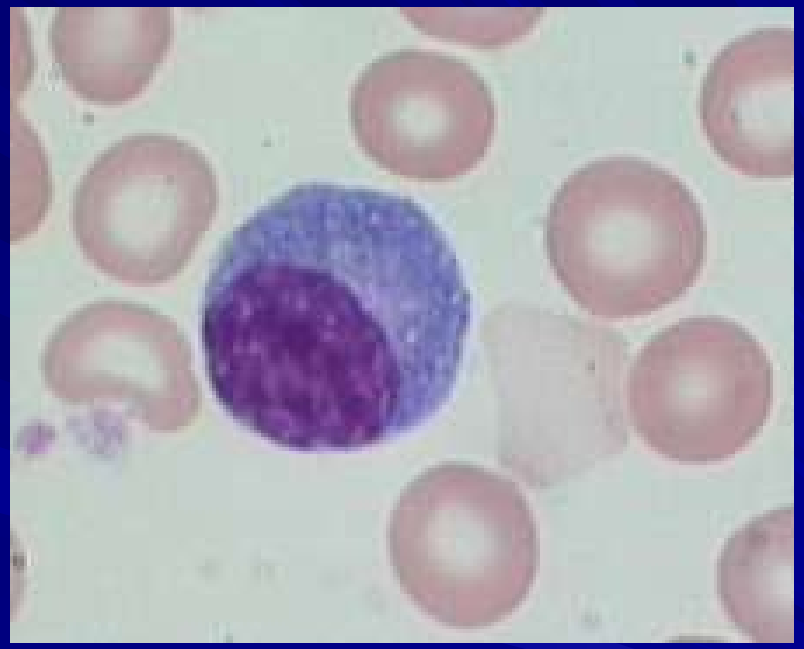
Mast cells are relatively large cells with irregular shapes and small pale nuclei. They are often found near blood vessels. Their cytoplasm is crowded with dark staining secretory granules. These granules contain heparin (a compound that prevents blood from clotting as it circulates throughout the body) and histamine (a compound that initiates the inflammatory response and allergic reactions.



Connective tissue proper: CELLS

Plasma Cells

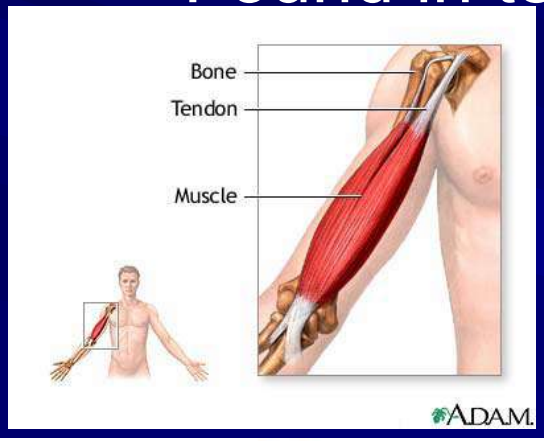
Plasma cells are a specific type of white blood cell. Plasma cells are oval-shaped and have a large, dark nucleus located off center. They are the main producers of antibodies that help defend the body against infection and cancer.

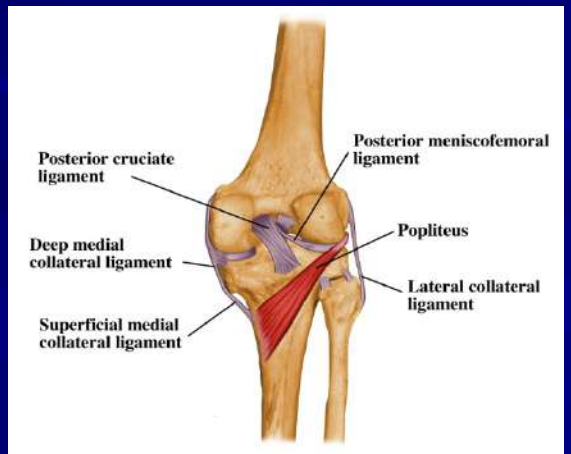


Connective tissue proper: FIBERS

Collagen

- Found in tendons and ligaments





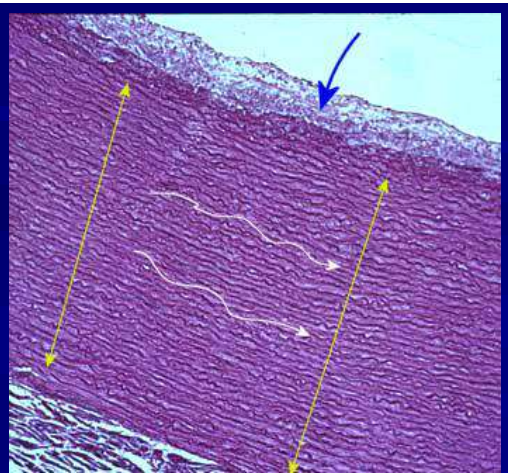
Collagen (collagenous) fibers are composed of the protein collagen. These fibers are thick, sturdy, strong, flexible, and unstretchable. They are the most common type of fiber found in connective tissue. They appear blue or pink when stained.

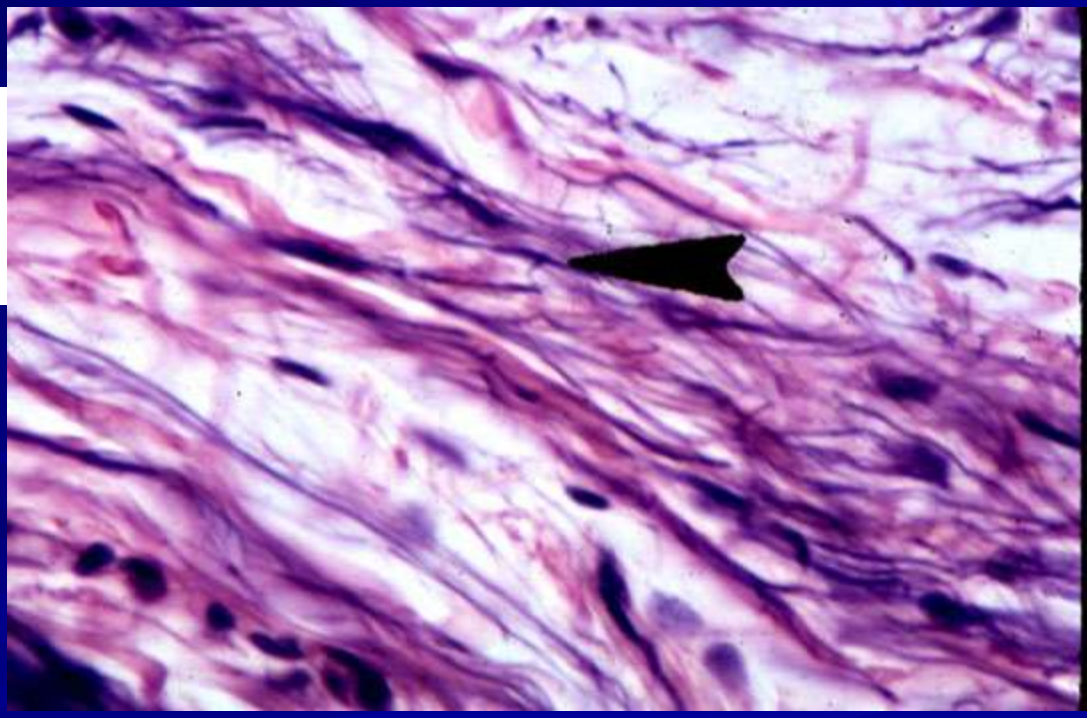
Connective tissue proper: FIBERS

Elastic Fibers

- Rare but important
- Found between vertebrae and aorta

Elastic fibers are composed of the protein elastin. These fibers stretch easily and appear wavy, curly, and black.



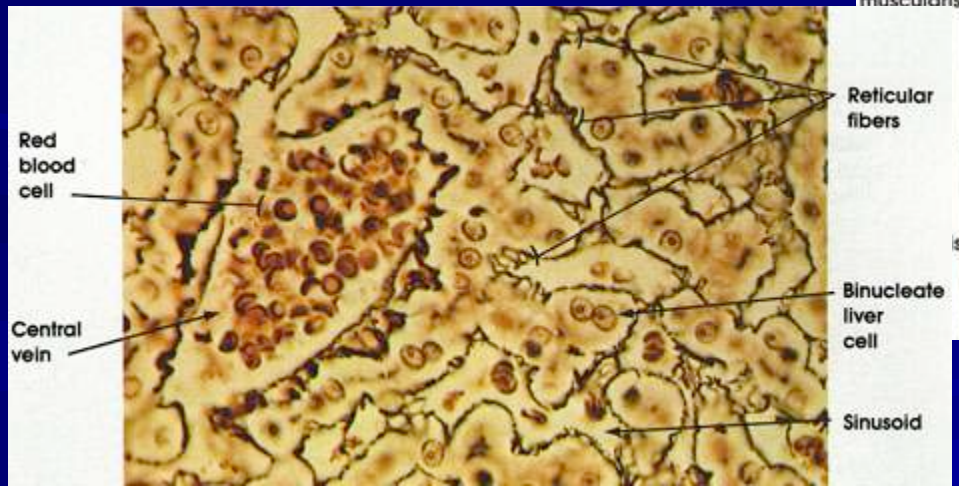


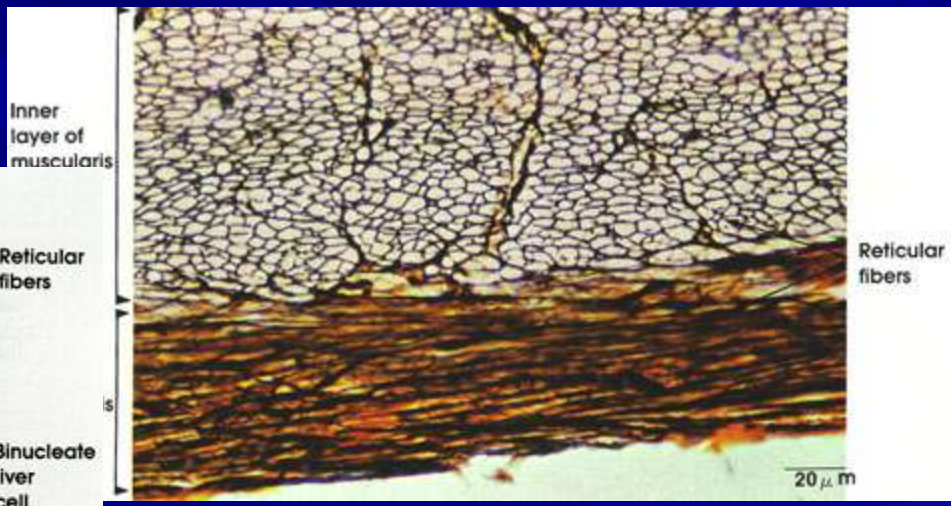
Connective tissue proper: FIBERS

Reticular Fibers

– holds blood vessels to surface of organs

Reticular fibers are the least common of the fibers found in connective tissue. These thin fibers form a branching, interwoven framework within organs that provides support for the tissues in the organ.

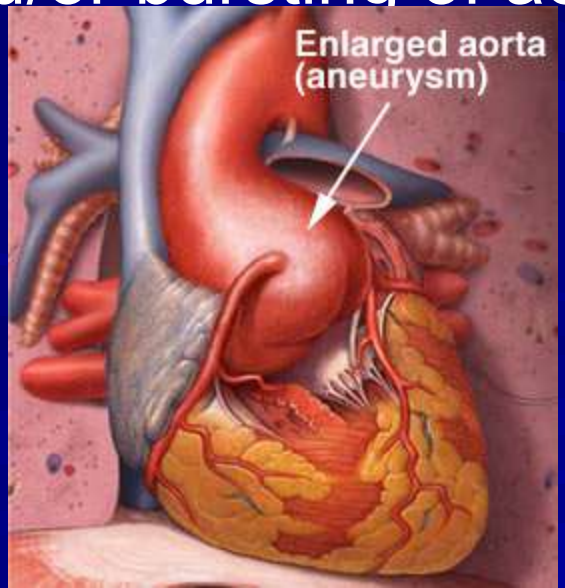




Marfan Syndrome

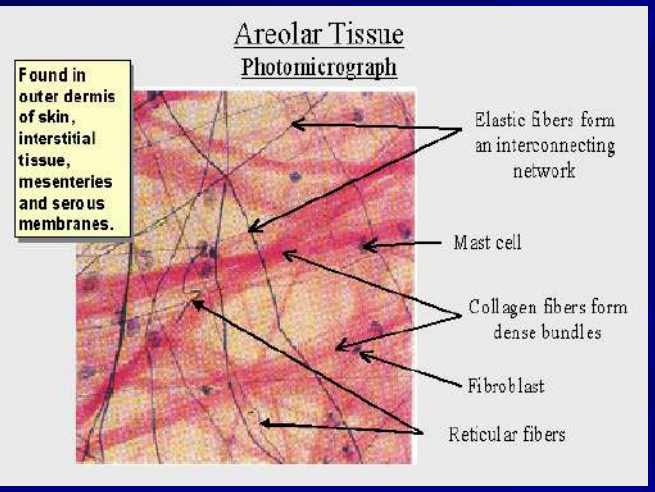
Genetic disorder that effects the production of connective tissue

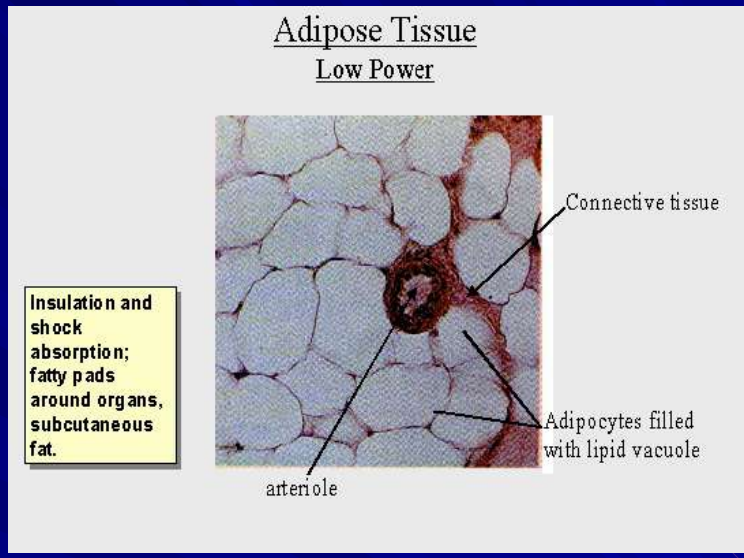
- Effects just about every system in the body
- Especially dangerous for blood vessels: collapse and/or bursting of aorta

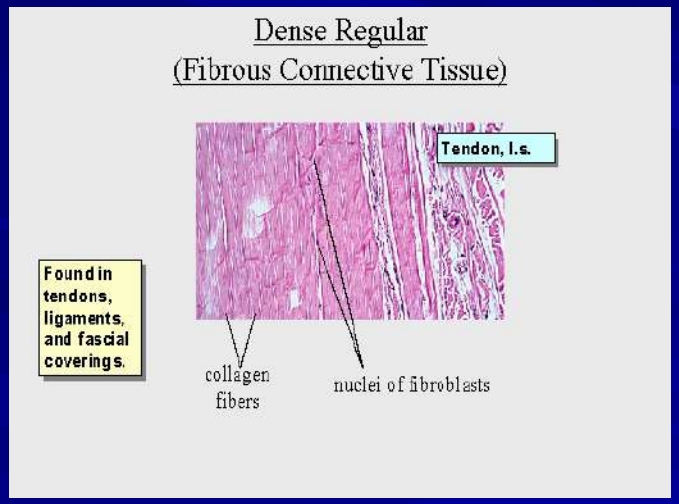


Connective tissue proper: GROUND SUBSTANCE

- Loose (aka areolar)
- Dense
- Adipose



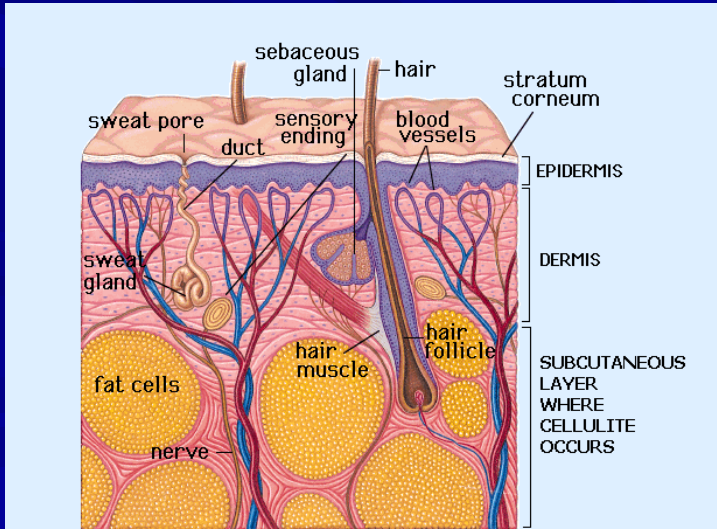




Connective tissue proper: GROUND SUBSTANCE

Loose connective (areolar)

- "packing material"
- Fills spaces between organs, supports epithelium
- Forms a layer that separates skin from deeper structures like muscles
- Highly vascularized, shots given in this tissue for quick transport of drugs



Connective tissue proper: GROUND SUBSTANCE

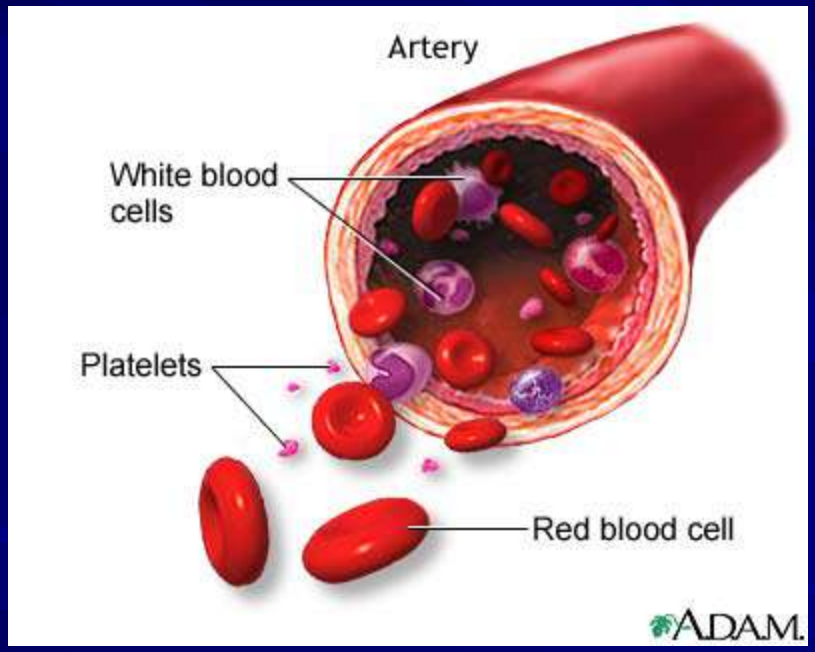
Adipose

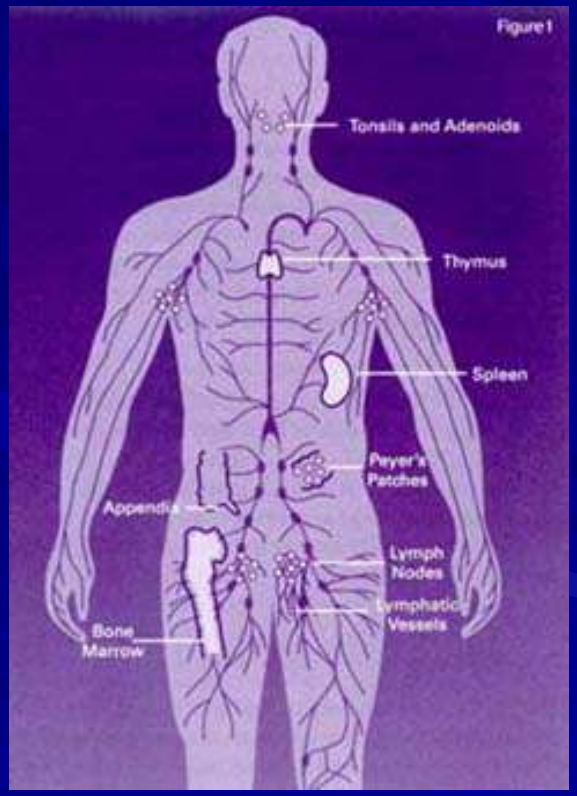
- Cushioning and energy storage
- Found under skin of groin, buttocks, breasts and abdomen
- Also fills bony sockets behind eyes
- dominant connective tissue of thoracic and abdominopelvic cavities

Connective tissue proper: GROUND SUBSTANCE

Fluid Connective Tissue

Blood and Lymph





Supporting Connective Tissue

Cartilage – ground substance surrounding chondrocytes (cartilage cells) called matrix, matrix is firm gel

Bone – matrix is rigid because of calcification and contains osteocytes (bone cells) (more next chapter)

Supporting Connective Tissue: CARTILAGE

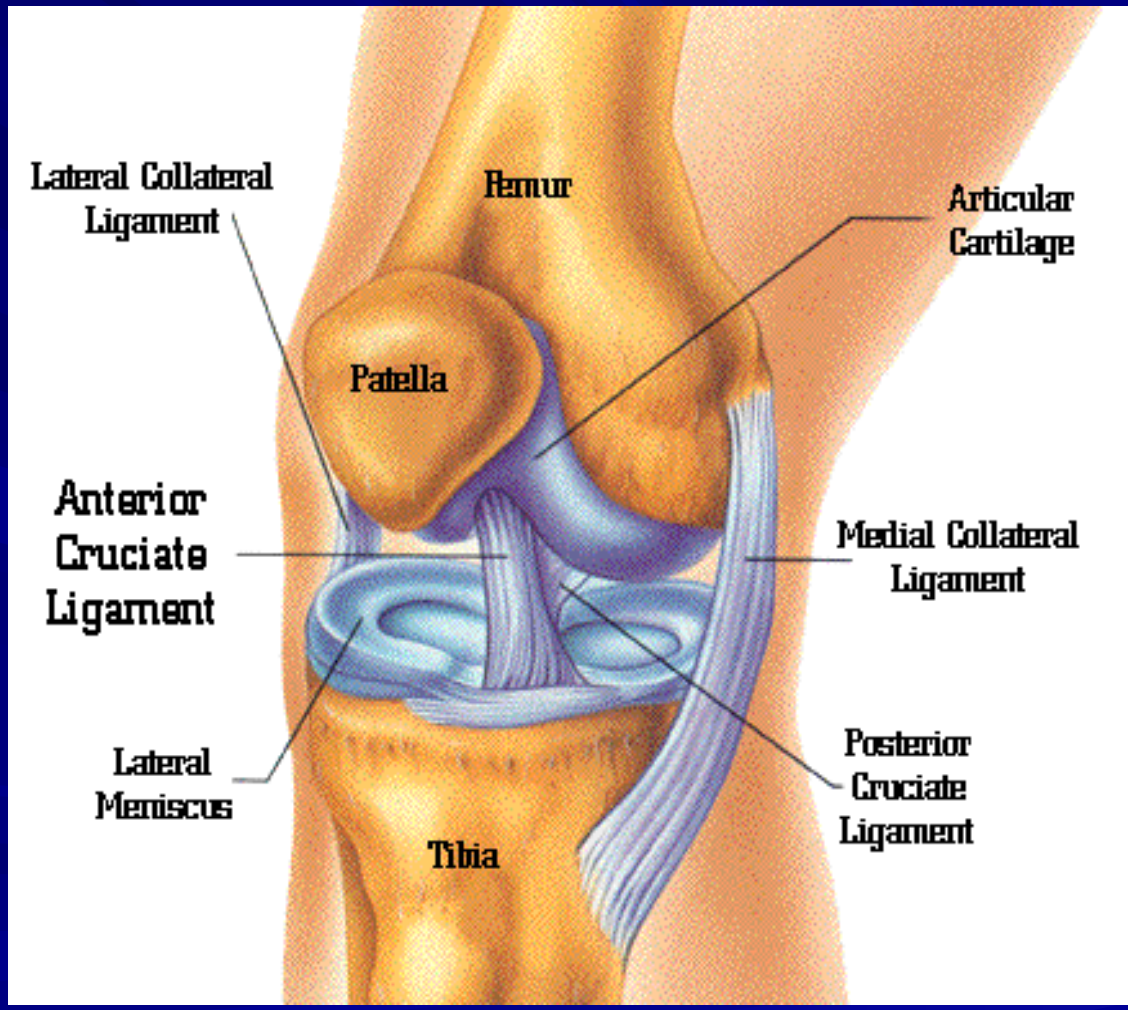
Hyaline – found between ribs and the sternum, along passageway of respiratory tract, opposing surfaces of bones with many joints (elbow and knee)

Elastic – outer ear, epiglottis and tip of nose

Fibrocartilage – between vertebrae, pubic bones of pelvis, some joints and tendons

Cartilage and Knee Injuries

- Cartilages are avascular so they heal poorly
- New research in growing and replacing cartilage has showed promise in dog studies



YOUR TURN

Now practice your own microscope skills and identify the various types of epithelial and connective tissues

Lab Book: Lab #8 and #9, pages 63-71

Rules for proper microscopic drawings

1. Don't even think of starting your drawing unless you have a **PENCIL! Drawings in PEN are UNACCEPTABLE!** This is for two reasons:

(a) You can **erase** pencil!

(b) You can **shade in areas** more easily in pencil.

Drawing rules continued

2. Each Drawing **must include clear, proper labels!**

Always include the name of the tissue, location and **magnification** (100x or 430x)

Drawing rules continued

3. Labels should start on the **outside** of the circle. **The circle indicates the field of view as seen through the eyepiece.** All arrows should end with **the point touching the object to be labeled.**

4. Epithelial cells should **always** include **at least** the following **five** labels: *Cell membrane, Basement membrane, Nucleus, Chromatin, Cytoplasm.*

5. Connective tissues: label cell type and fibers

Histology Drawings

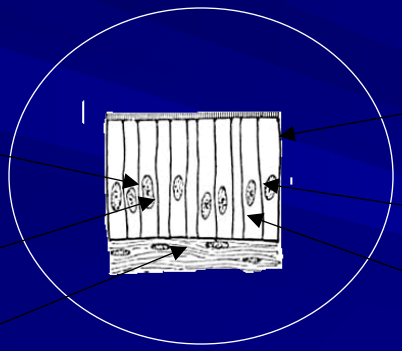
RULES

- Pencils ONLY
- Maximize space for best details
- LABELS!!

Tissue Drawing Example

Simple Columnar Epithelium

SIMPLE COLUMNAR EPITHELIUM



Small Intestine

430X

PAGE 66 and PAGES 70-71

We must share – please take care of slides and put back **properly** for next person. Slots are numbered!!

TWO SLIDE BOXES: LABELED

- Epithelium = blue box
- Connective tissues = black box

Epithelium

SIMPLE SQUAMOUS
- Simple squamous
- Squamous cheek cells

SIMPLE CUBOIDAL
- Simple cuboidal
- Thyroid gland

SIMPLE COLUMNAR
- Stomach
- Jejunum
- Esophagus and stomach

PSEUDOSTRATIFIED COLUMNAR
- no slides available

STRATIFIED SQUAMOUS
- Skin hairy mammal
- Stratified epithelium

Colon
- TRANSITIONAL
- Mammal urinary bladder

Connective

LOOSE CONNECTIVE
Areolar
ADIPOSE
no slide available
DENSE CONNECTIVE
no slide available
HYALINE CARTILAGE
Hyaline cartilage
ELASTIC CARTILAGE
Elastic cartilage
FIBROCARTILAGE – replace with
INTRAMEMBRANOUS
Intramembranous fetal skull
BONE
Femur
Blood
Blood human

2. Match the epithelial tissue with the correct description.

C

D

B

A

E

F

3. Match epithelium with correct location.

E

F

A

D

C

B

4. Match epithelium tissue with the correct function.

C

D

B

A

F

E

5. Basement membrane function?

Holds epithelial cells to next layer of tissue

6. Match description with the correct tissue type.

B

A

C

D

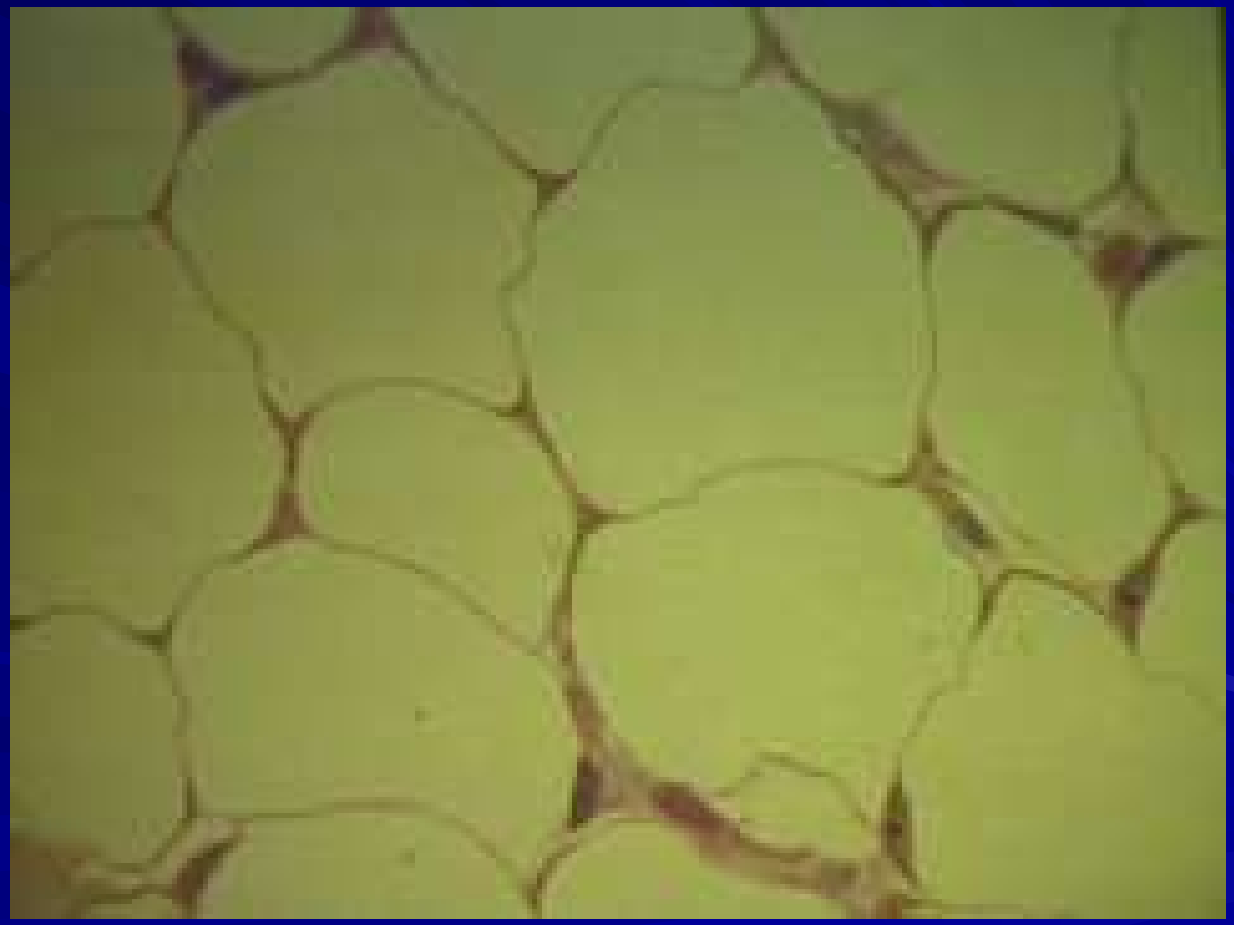
D

C

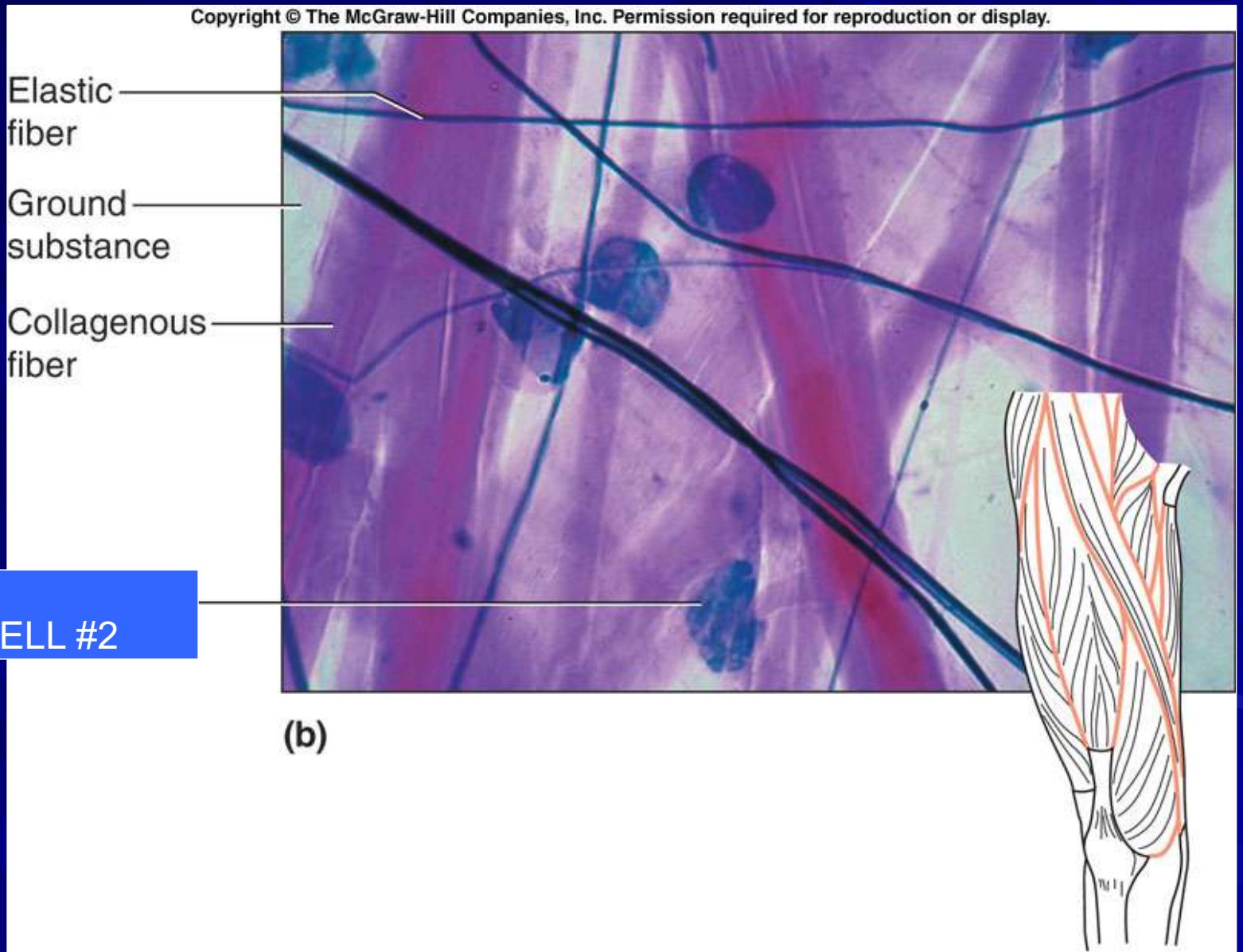
B

11. Identify each of the cells in the connective tissue.

Cell #1



Cell #2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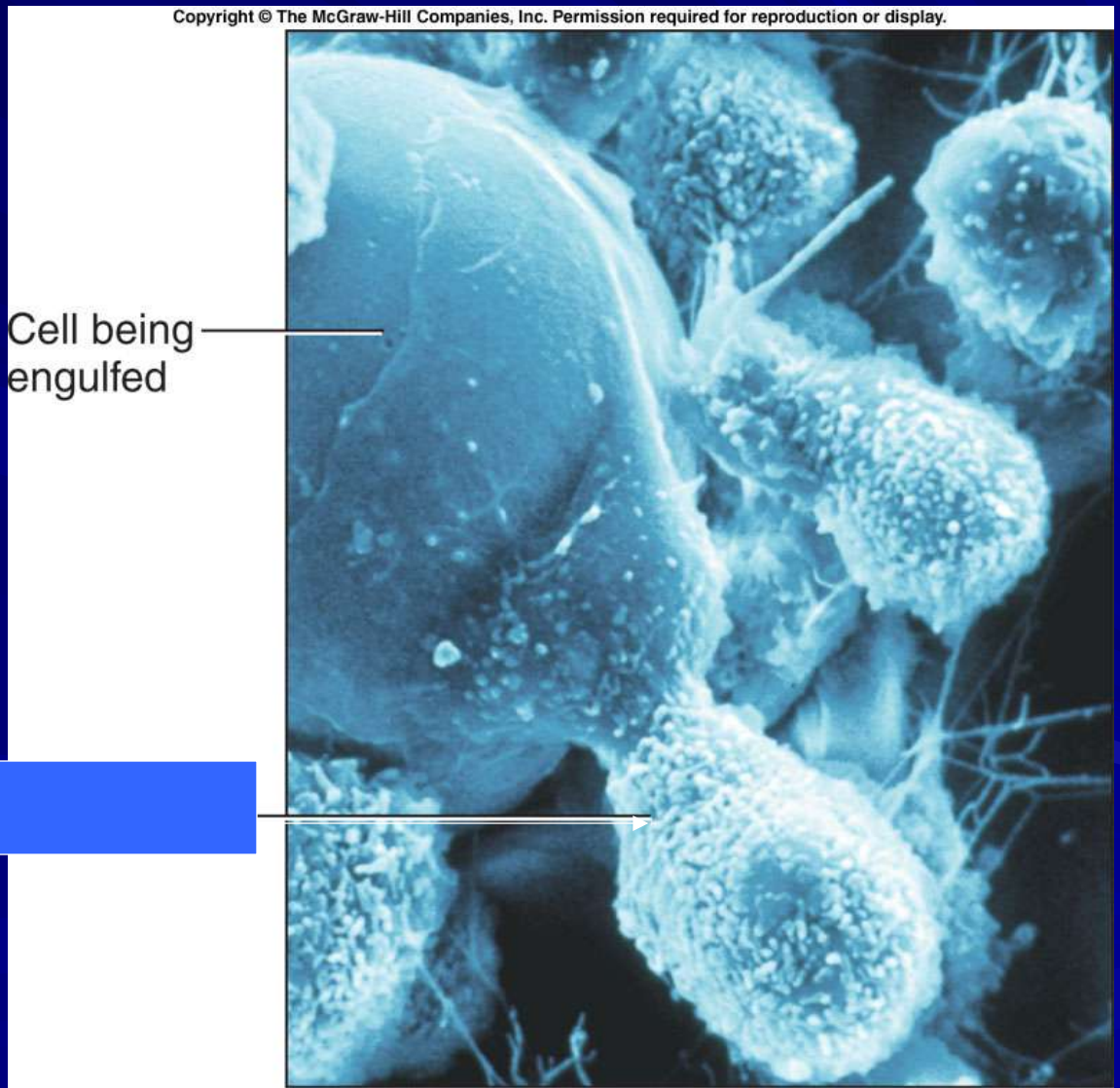
Elastic fiber
Ground substance
Collagenous fiber
CELL #2
(b)

Cell #3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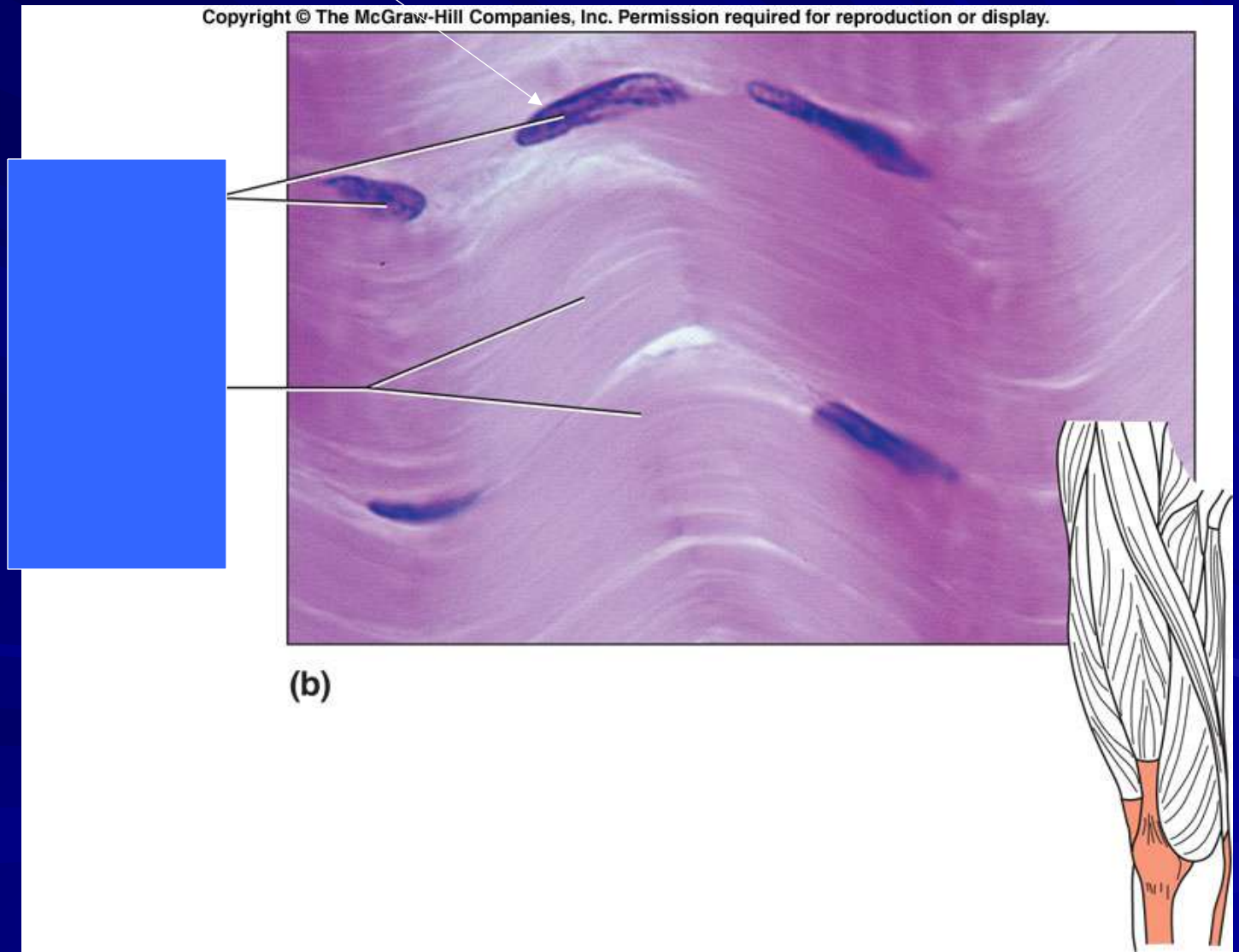
Cell being engulfed

Cell #4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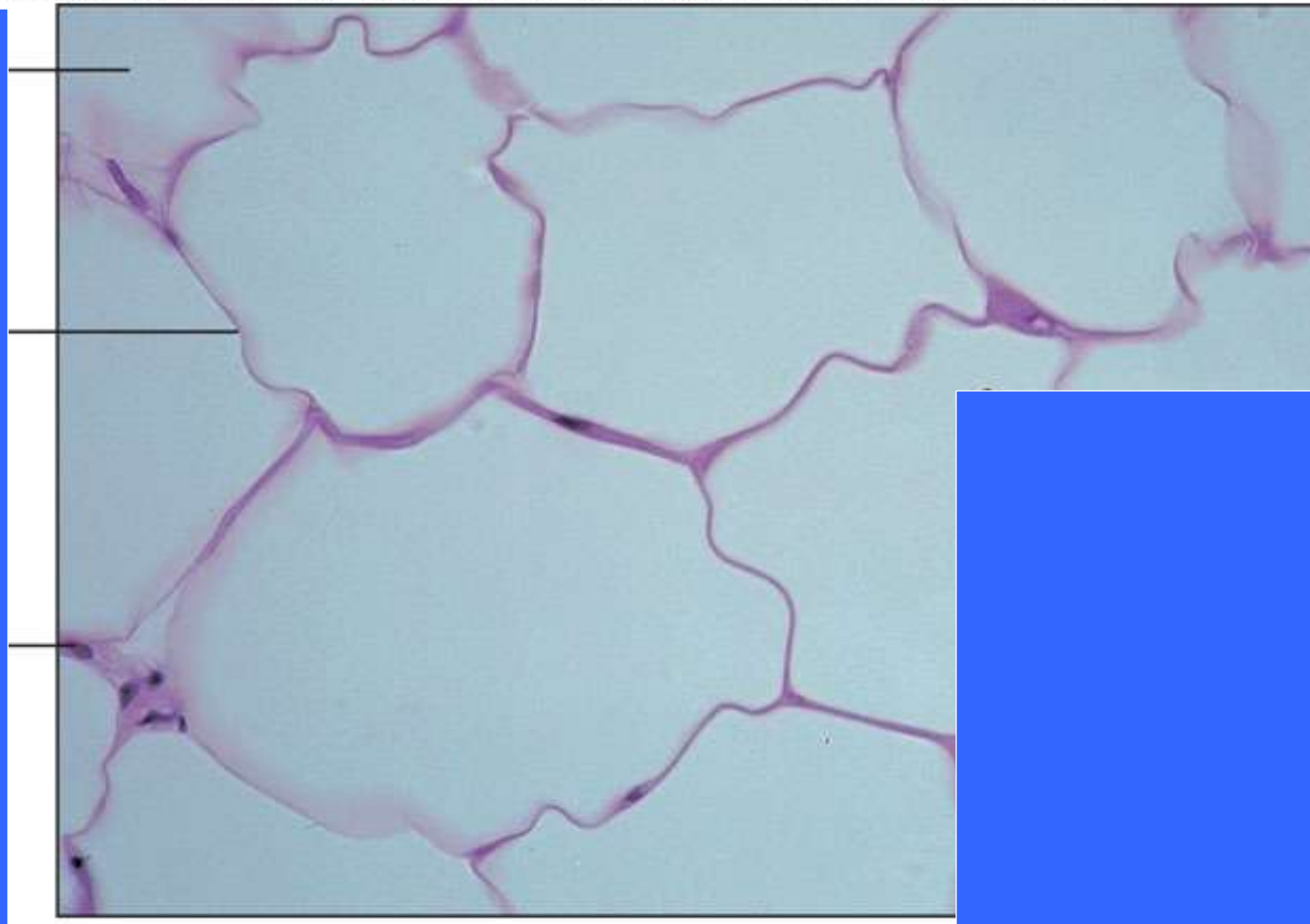
(b)



(b)

12 ID connective tissue cell and description.

P – Oval, dark nucleus

Ms – Irreg shape

A- Large round, cytoplasm pushed to side

Ms –Oval to irreg., small nuclei

F – large, flat branching

F – most abundant

F- production of fibers

Ma – active phagocytes
Ma – big eaters
Ma – engulf and destroy damaged cell
A – synthesizes and stores fat
Ms – heparin and histamine
Ms – releases compound that prevents blood from clotting as it flows
Ms- initiates allergic response
P – produces antibodies
P – fights infection

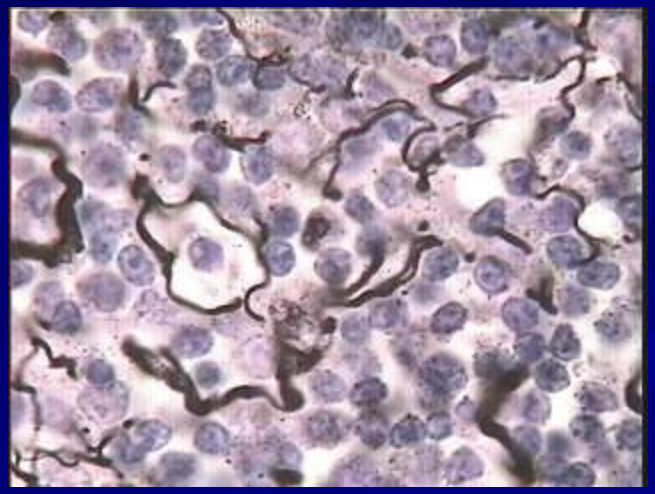
19. Fibers

E
C
C

C
E
R
E
R

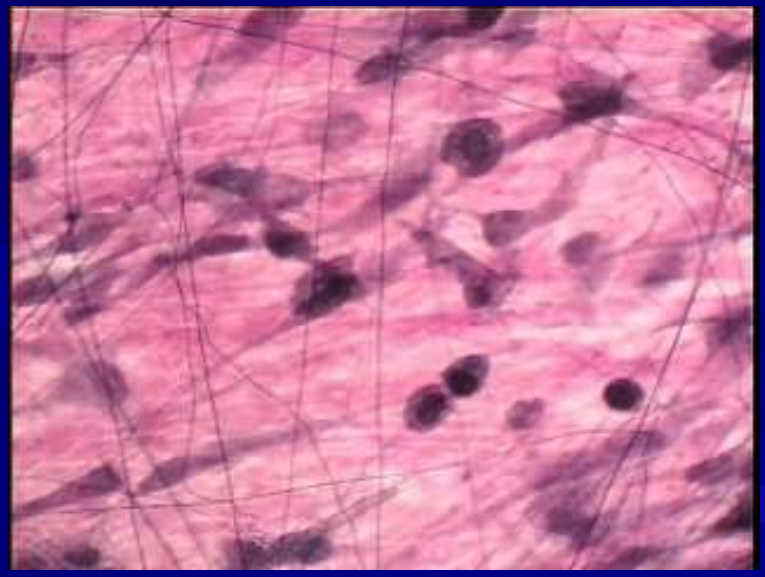
26. ID the Connective Tissue Proper: Adipose, Loose or Dense

Loose - reticular



Tissue #2

Loose - mesentary

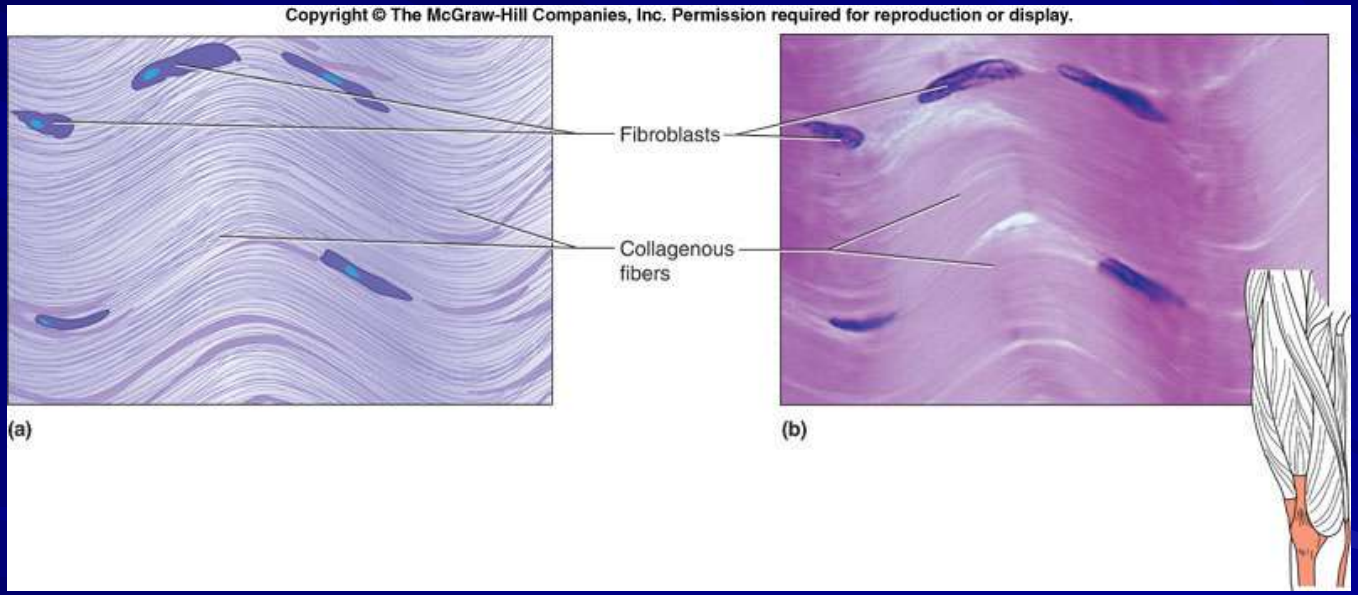


Tissue #3

Adipose

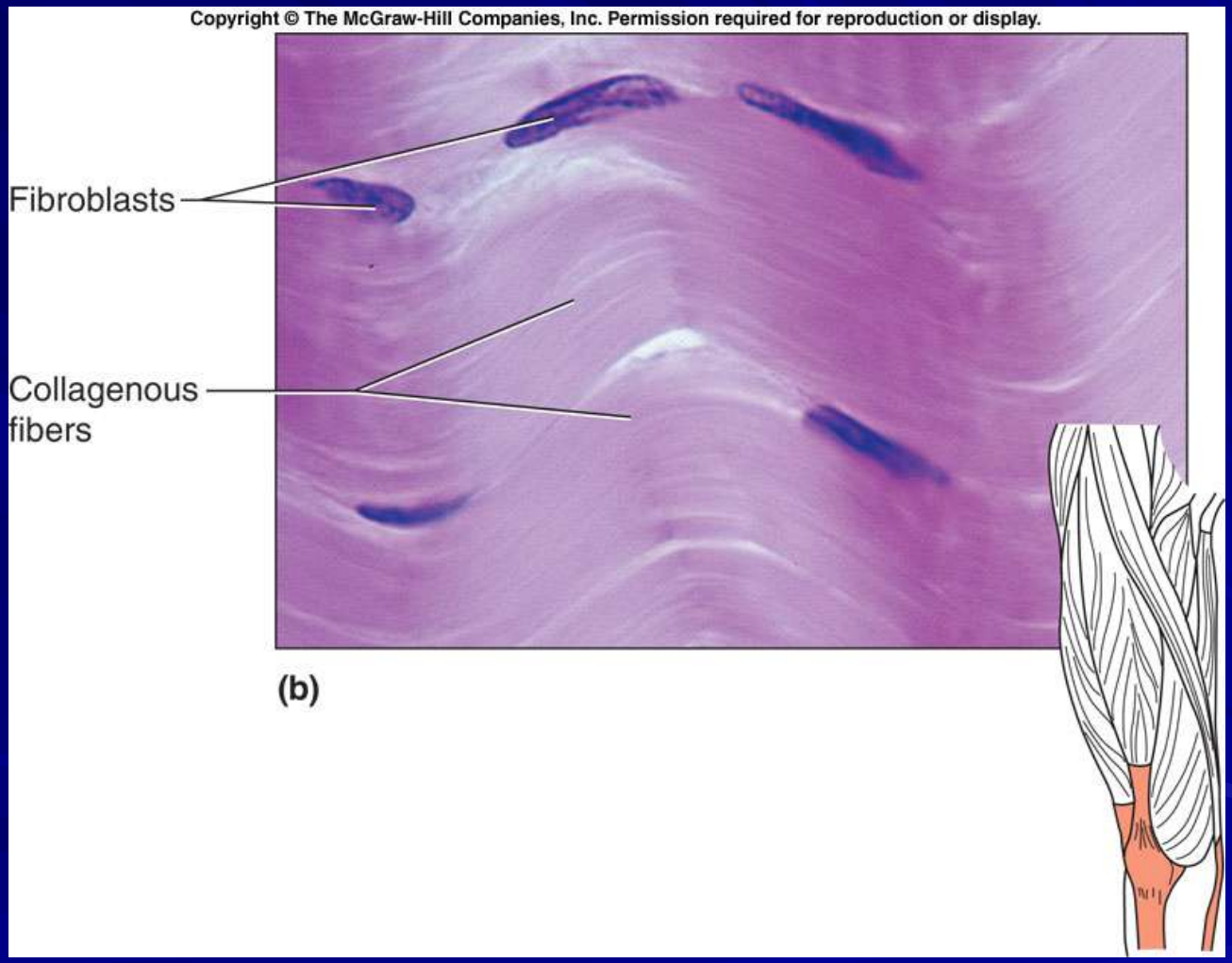
Tissue #4

Dense



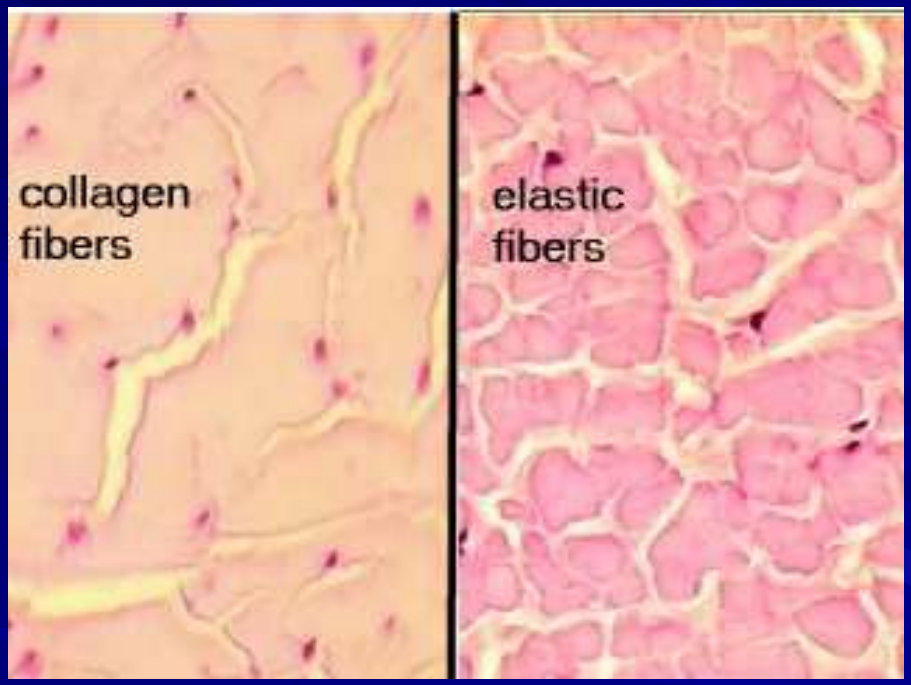
Tissue #5

DENSE



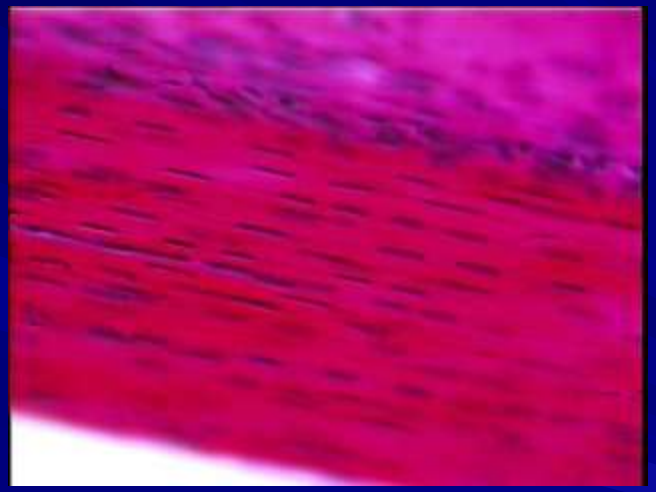
Tissue # 6

DENSE



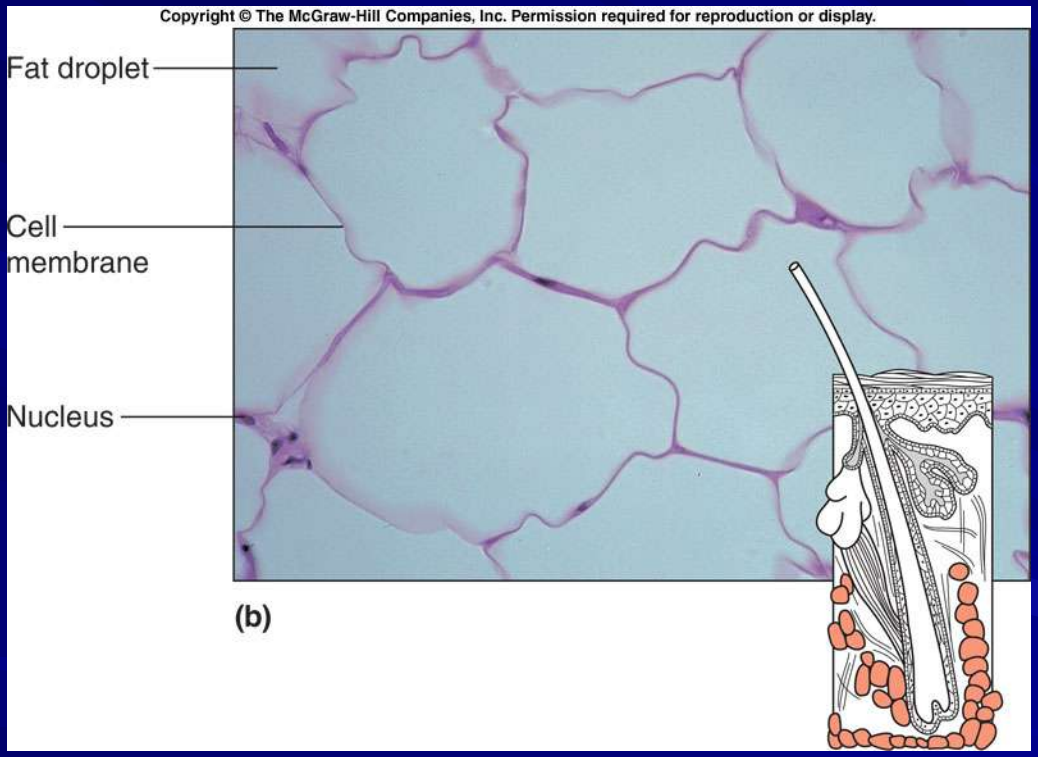
Tissue #7

DENSE



Tissue #8

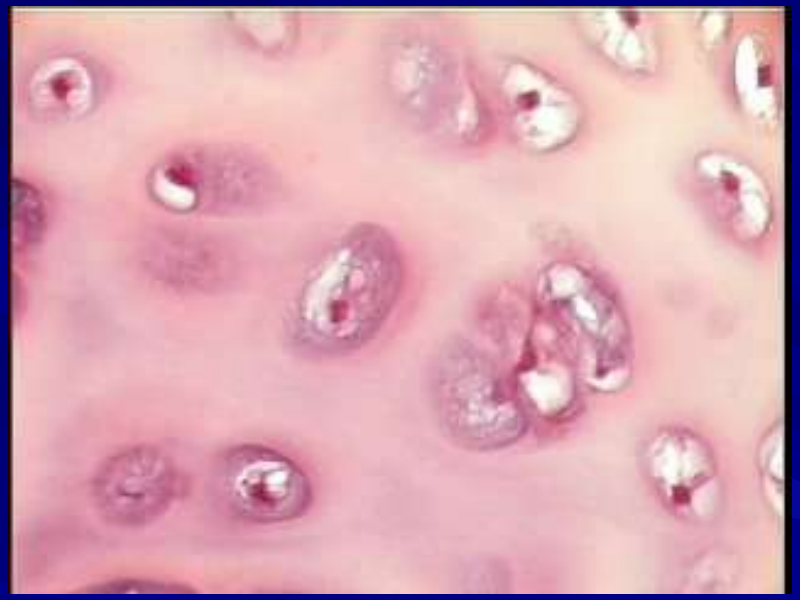
ADIPOSE



TYPE OF CARTILAGE: Supporting Connective Tissue

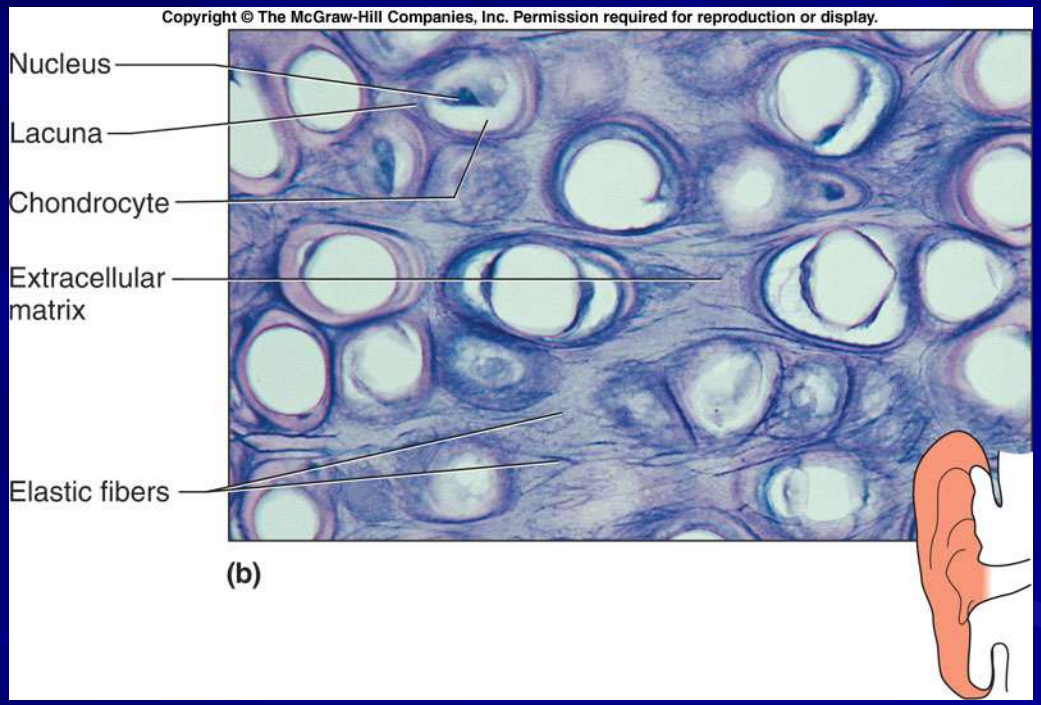
Tissue #9

hyaline



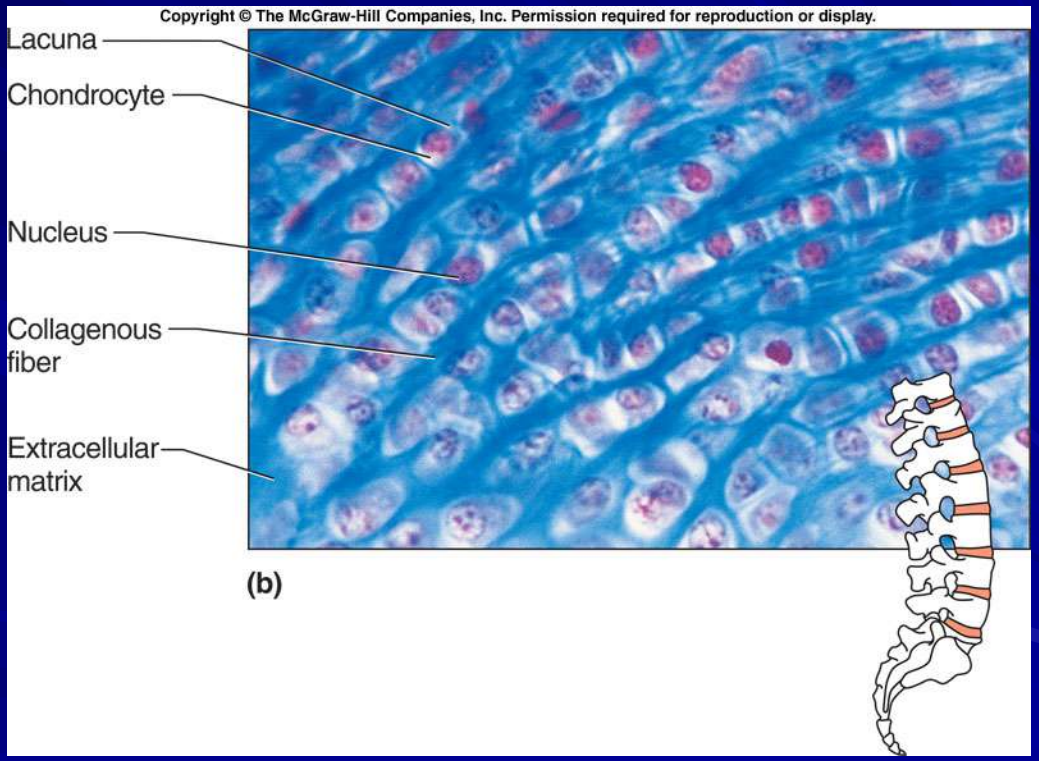
Tissue #10

ELASTIC



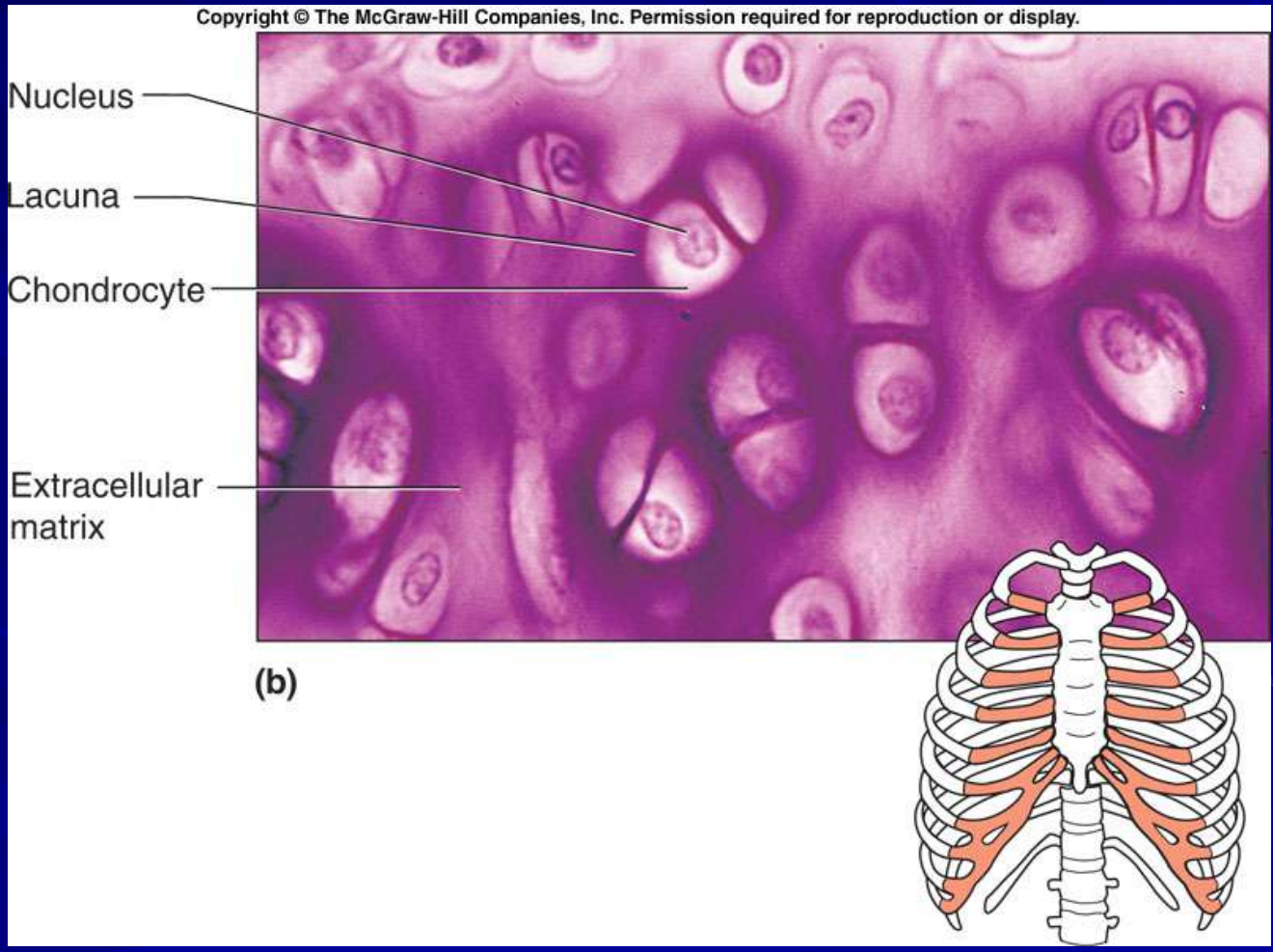
Tissue #11

Fibrocartilage



Tissue #12

Hyaline



28. Location of connective tissue

Loose

Loose

Adipose

Adipose

Dense

Dense

29. ID cartilage function

Hyaline – prevents bone of bone contact

Elastic – tolerates slight distortion

Hyaline

Hyaline

Fibrocartilage

Elastic

Chapter 5 Tissue Test Review

Epithelium Tissue
and
Connective Tissue

Test layout

Part I = identification

Part II and Part III = matching (refer to lab book

Part IV = multiple choice

What to study

Pictures of tissues (lab book, textbook, PPT and your flashcards)

Use you notes to complete matching in lab book

TGT review game played in class