

# **HISTOLOGY – BASIC TISSUE**

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## **Father of Girl Who Suffered Burns in Flight Eyes Suit vs Airliner**

The father of a six-year-old girl who sustained first-degree burns after a Cebu Pacific flight attendant accidentally poured hot water on her arm is considering filing charges against the employee and her company.

Source: [www.newsinfo.inquirer.net](http://www.newsinfo.inquirer.net)

Tuesday, June 3, 2014

# Objectives:

## EPITHELIUM

1. Exhibit competence in describing histologic characteristics of epithelial cells
2. Differentiate covering from glandular epithelium
3. Describe some specialized structure of epithelial cells
4. Discuss clinical conditions involving epithelial cells/tissues

## CONNECTIVE TISSUE

1. Describe the 3 components of connective tissue: cells, fibers and ground substance
2. Describe the characteristics of connective tissue cells
3. Describe 2 general classes of connective tissue proper: loose and dense
4. Differentiate white from that of brown adipose tissue

# Objectives

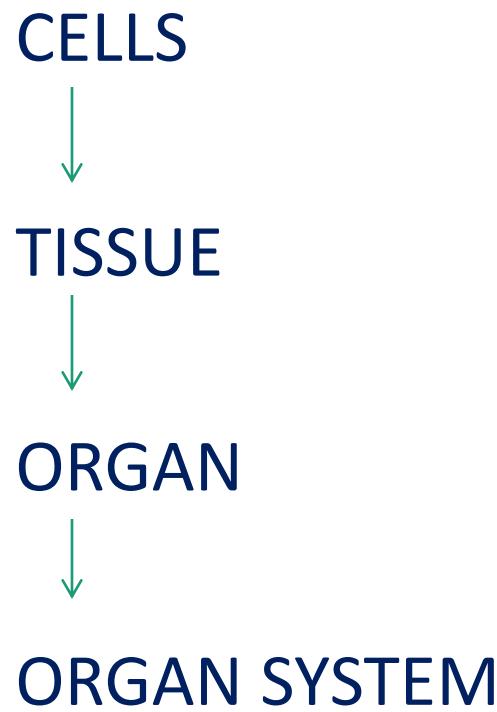
## CARTILAGE

1. Classify and describe the histologic characteristics of the 3 types of cartilages
2. Illustrate and discuss some medical conditions that involve the cartilage

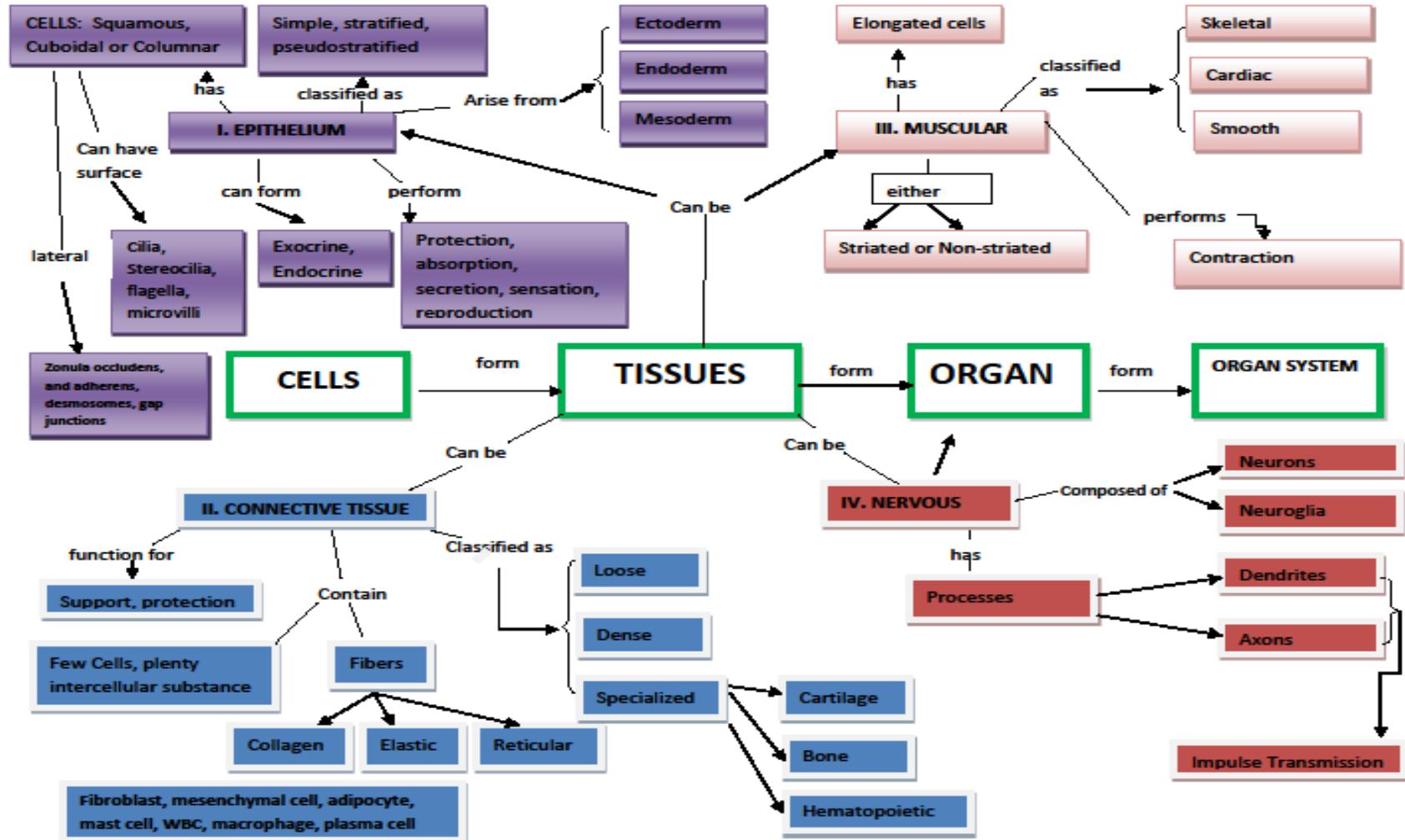
## BONE

1. Describe the characteristics of bone cells: osteoblasts, osteocytes, osteoclasts
2. Illustrate and discuss the types of bones – primary and secondary bones
3. Discuss the process of osteogenesis – intramembranous and endochondral
4. Illustrate and discuss certain medical conditions that involve the bone

# HISTOLOGIC ORGANIZATION OF THE BODY



# CONCEPT MAP - TISSUES



# BASIC/FUNDAMENTAL TISSUES

## TISSUE

**- a collection of similarly specialized cells united in the performance of a particular function.**

# **Basic/Fundamental types of tissues:**

- 1. Epithelial tissue**
- 2. Connective tissue**
- 3. Muscular tissue**
- 4. Nervous tissue**

**Table 4-1.** Main characteristics of the four basic types of tissues.

Tissue	Cells	Extracellular Matrix	Main Functions
Nervous	Intertwining elongated processes	None	Transmission of nervous impulses
Epithelial	Aggregated polyhedral cells	Very small amount	Lining of surface or body cavities, glandular secretion
Muscle	Elongated contractile cells	Moderate amount	Movement
Connective	Several types of fixed and wandering cells	Abundant amount	Support and protection

# **EPITHELIAL TISSUES/EPITHELIUM**

## **CHARACTERISTICS:**

1. Composed of aggregated cells
2. Small amount of extracellular matrix
3. Avascular
4. Great capacity for regeneration
5. Polarity
6. Main functions: lines or covers surfaces and body cavities; secretion

# Other functions

1. Protection
2. Secretion
3. Absorption
4. Sensation – neuroepithelial cells of taste buds & olfactory cells of nose
5. Contraction – myoepithelial cells
6. Excretion – epithelial cells of kidneys
7. Germ cell source /Reproduction – epithelial cells of testes / ovaries

# EPITHELIAL TISSUES/EPITHELIUM EMBRYONIC ORIGIN

- The only tissue type derived from ALL 3 embryonic germ layers
- ECTODERM:
  1. epidermis of the skin and its appendages
  2. epithelium of cornea
- ENDODERM:
  1. epithelium lining of digestive tract (except those of the mouth and anus w/c are derived from ectoderm)
  2. epithelial cells of liver, gallbladder, pancreas, the resp. tract, urinary bladder, & urethra

# EPITHELIAL TISSUES/EPITHELIUM EMBRYONIC ORIGIN

## MESODERM:

1. lining of the heart, blood, & lymphatic vessels
2. serous cavities together w/ epith. tissues present in urinary system (kidneys and their ducts, except urinary bladder), & in the male & female reproductive systems.

# General Classifications of Epithelium

2 Functional Groups:

A. Covering/Lining/Surface Epithelium

B. Glandular Epithelium

## A. SURFACE EPITHELIA

- Highly CELLULAR
- ABSENCE or little extracellular substance
- Lies on a basement membrane
- Generally AVASCULAR, nutrition by diffusion
- Capacity for regeneration
- Polarity
- (+) surface modifications

# Basal Lamina

- LM: thin film of extracellular substance
- EM: visible as dense structure;  
20-100 nm thick

3 layers

1. LAMINA LUCIDA
2. LAMINA DENSA
3. LAMINA FIBRORETICULARIS

# Basal Lamina

- Separates epithelial cells from underlying connective tissue
- Not pierced by blood vessel ↳ diffusion from underlying tissue
- main components – Type IV collagen, glycoproteins & proteoglycans

# CLASSIFICATION of SURFACE EPITHELIA

Based on:

- a. Number of cell layers
- b. Height & shape of cells
- c. Additionally, some cells maybe structurally specialized – keratinized, ciliated, stereociliated

## SURFACE EPITHELIA according to # of layers

### I. SIMPLE – one layer of cells

PSEUDOSTRATIFIED- 1 layer only but appear to consist >1 layer because nuclei occupy various planes

### II. STRATIFIED – more than 1 layer of cells

TRANSITIONAL – features in between stratified squamous & stratified cuboidal.

# SURFACE EPITHELIA

Classification according to shape \* of cells

1. Squamous – flat cells
2. Cuboidal – equally tall as they are wide
3. Columnar – taller than they are wide

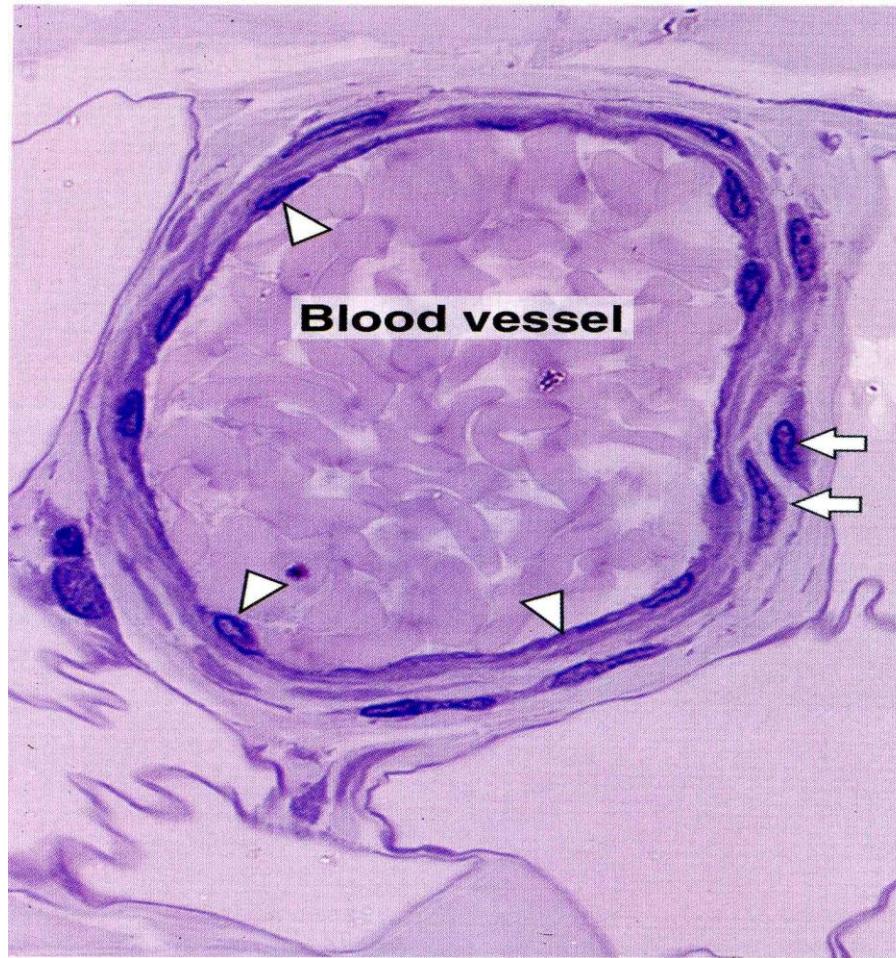
\* Most superficial layer of cells

# I.

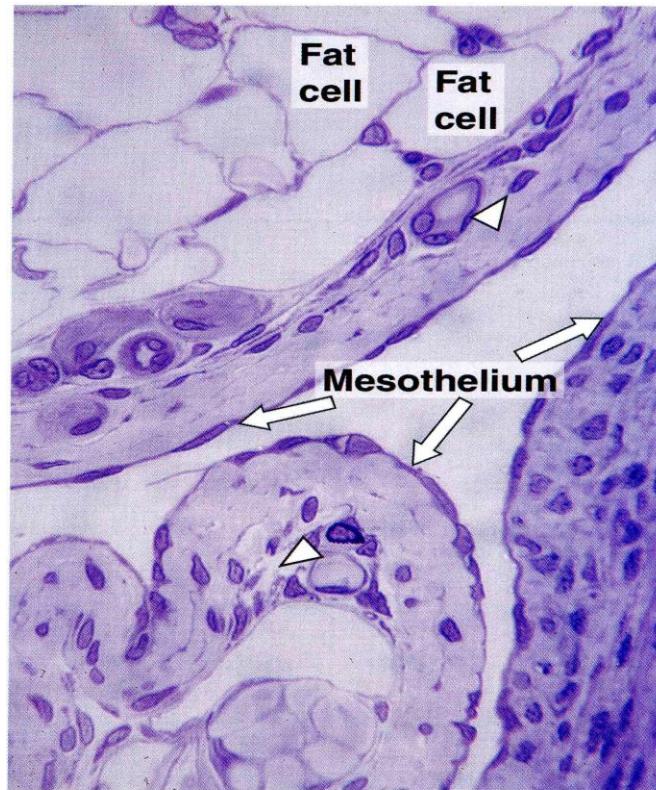
## Simple Squamous Epithelium

- serrated border; spindle-shaped on side view
  1. *Endothelium* – vascular system.  
Surface view – appears oblong
  2. *Mesothelium* – internal closed cavities such as pleura, pericardium and peritoneum.  
Surface view – polygonal
- seen in lung alveoli; parietal layer of Bowman's capsule in kidneys

# Simple Squamous Epithelium Endothelium

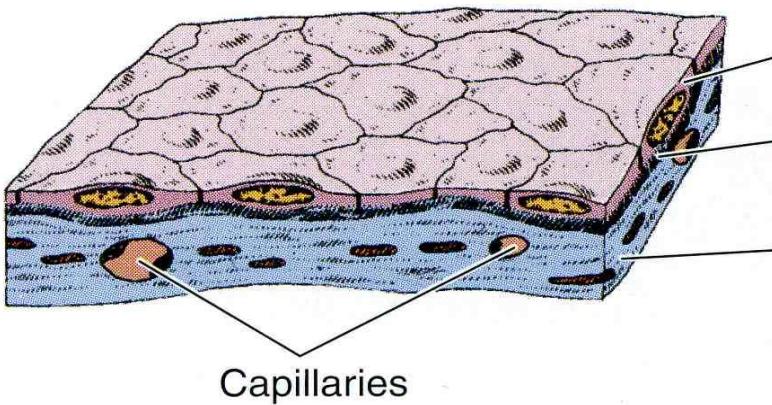


# Simple Squamous Epithelium



**Figure 4-14.** Simple squamous epithelium covering the peritoneum (mesothelium). Some blood capillaries are indicated by arrows. PT stain. Medium magnification.

**A** Simple squamous epithelium

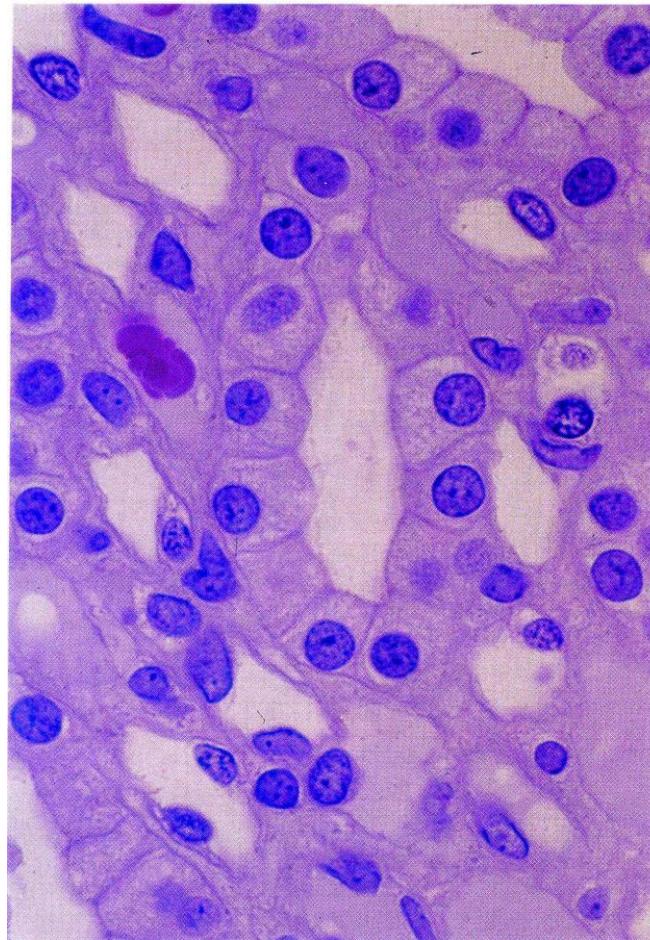


## II. Simple Cuboidal Epithelium

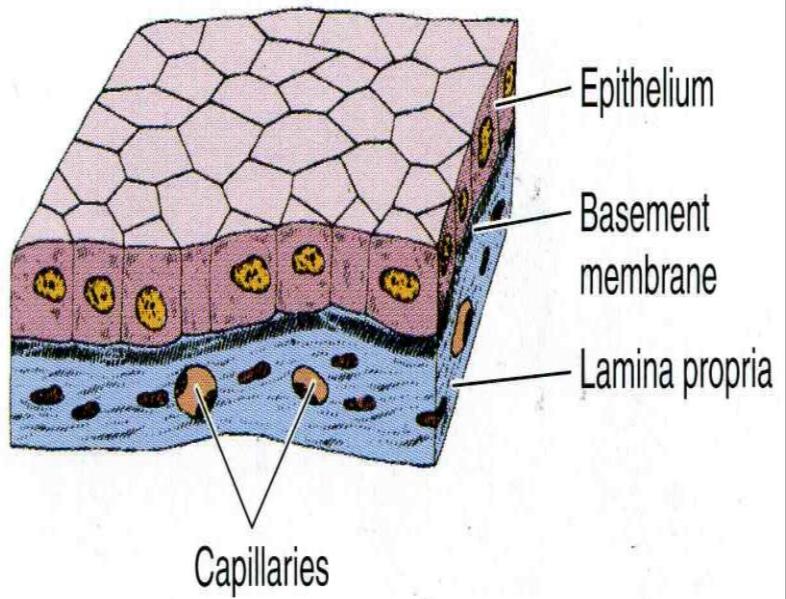
- side view- single row of square-like cells; round centrally located nuclei
- top view- polyhedral cells that fit each other
- Found in: ducts of salivary glands & the pancreas, collecting tubules of kidneys, thyroid gland follicles & surface of ovary.

# Simple Cuboidal Epithelium

## Renal Tubule



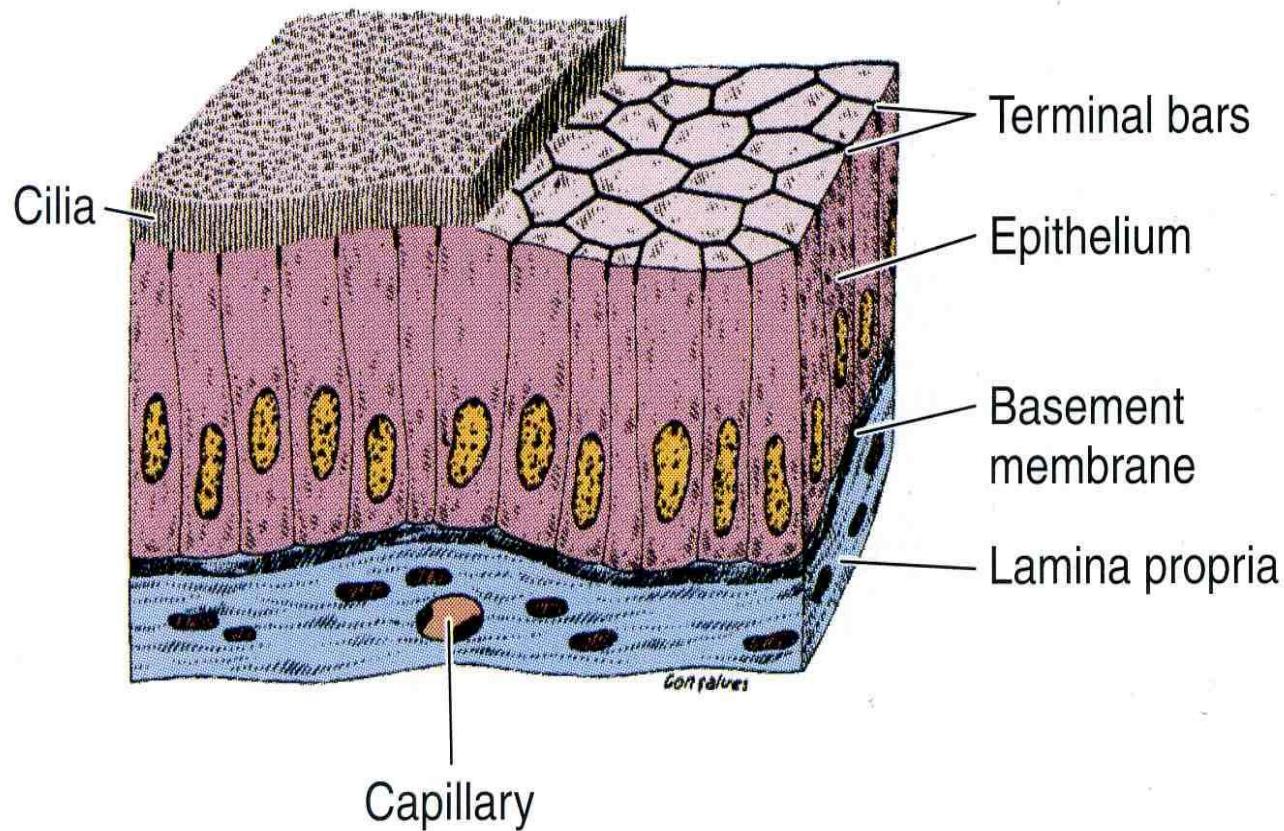
**B** Simple cuboidal epithelium



### III. Simple Columnar Epithelium

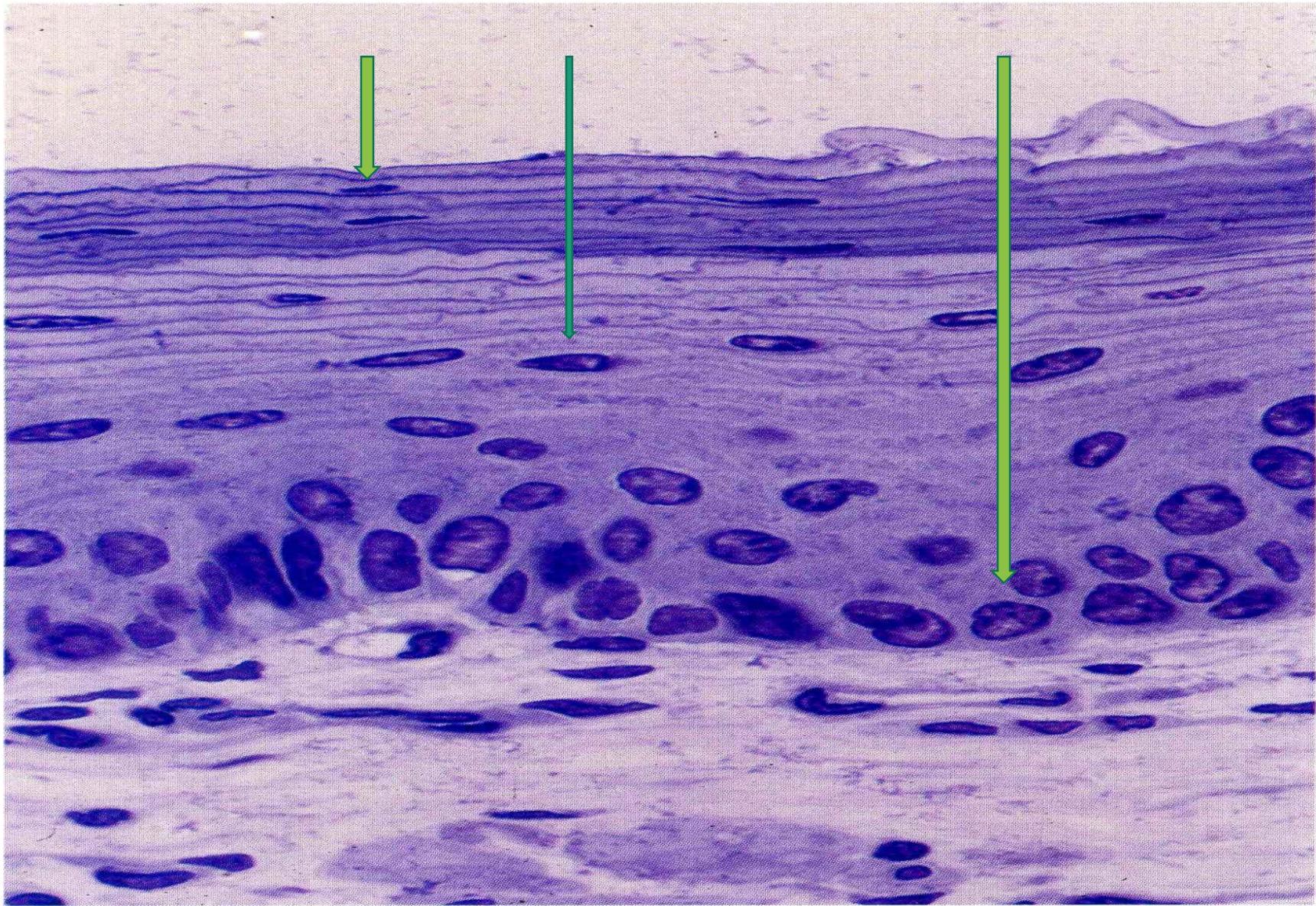
- nuclei are oval w/ long axes parallel to long axes of the cells, located basally
- found in the stomach, intestines, large ducts of some exocrine glands
- *Ciliated simple columnar epithelium*- oviducts, pulmonary bronchi

### C Simple ciliated columnar epithelium



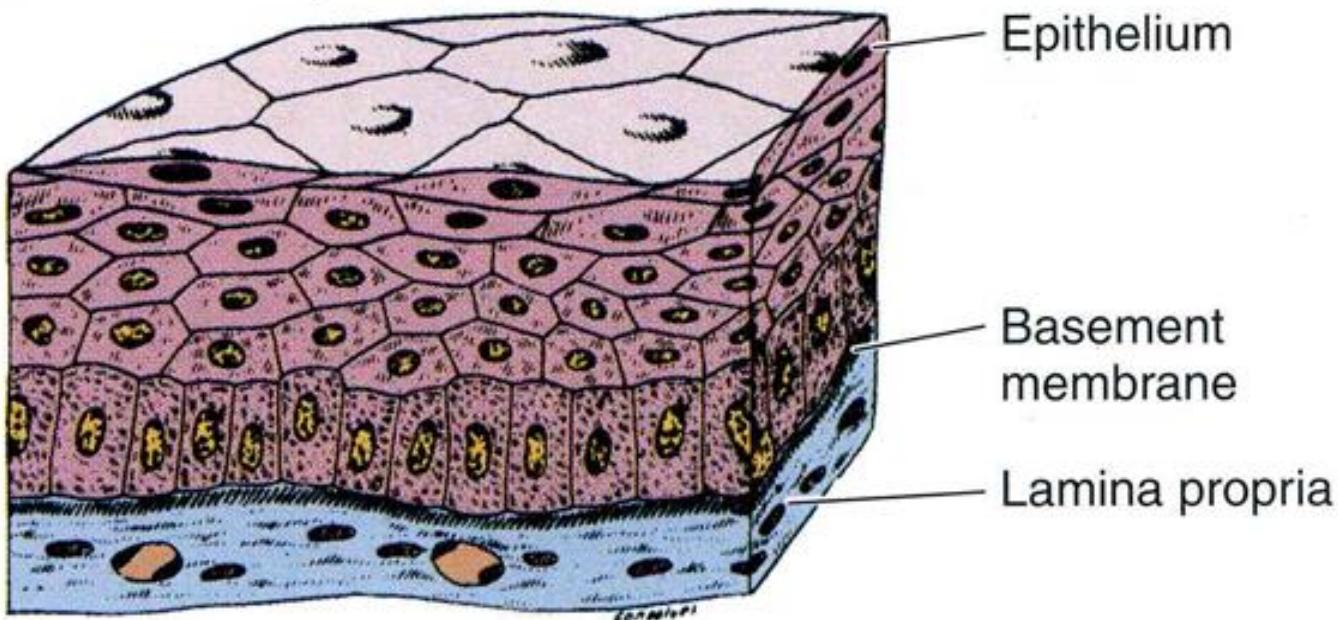
## IV. Stratified Squamous Epithelium

- most superficial layer – flat/plaque-like cells
  - Deepest layer – tall cuboidal or columnar
- 
- a. Keratinized SSE
  - b. Non-keratinized SSE



**Figure 4–17.** Stratified squamous nonkeratinized (moist) epithelium of the esophagus. PT stain. Medium magnification.

**A** Stratified squamous epithelium



## V. Stratified Cuboidal Epithelium

- usually consists of 2 or 3 layers of cuboidal cells
- larger ducts of major salivary glands

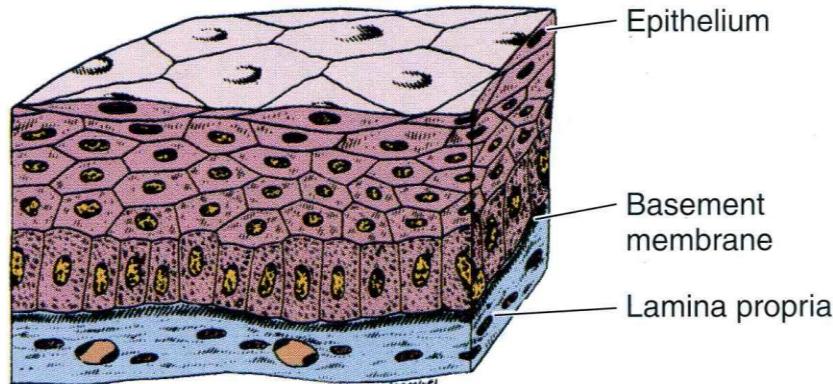
## VI. Stratified Columnar Epithelium

- consists of at least 2 layers of columnar cells; cells of deeper layers are sometimes cuboidal
- larger ducts of exocrine glands
- ciliated stratified columnar epithelium – parts of larynx

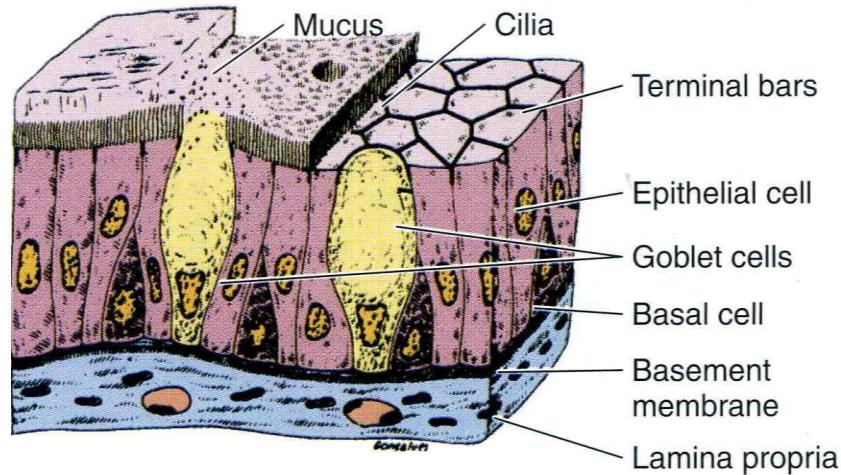
## VII. Pseudostratified Columnar Epithelium

- cells vary in shape & nuclei disposed in various levels but actually a single layer only
- found in membranous & spongy parts of the male urethra
- *Ciliated PSSE or respiratory epithelium* – larger passageways of resp. system ( trachea & bronchi)

**A** Stratified squamous epithelium



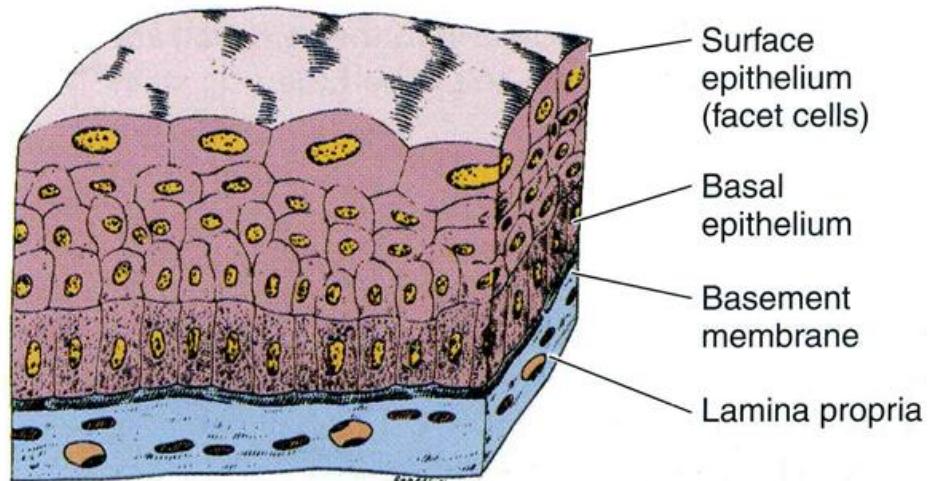
**C** Ciliated pseudostratified epithelium



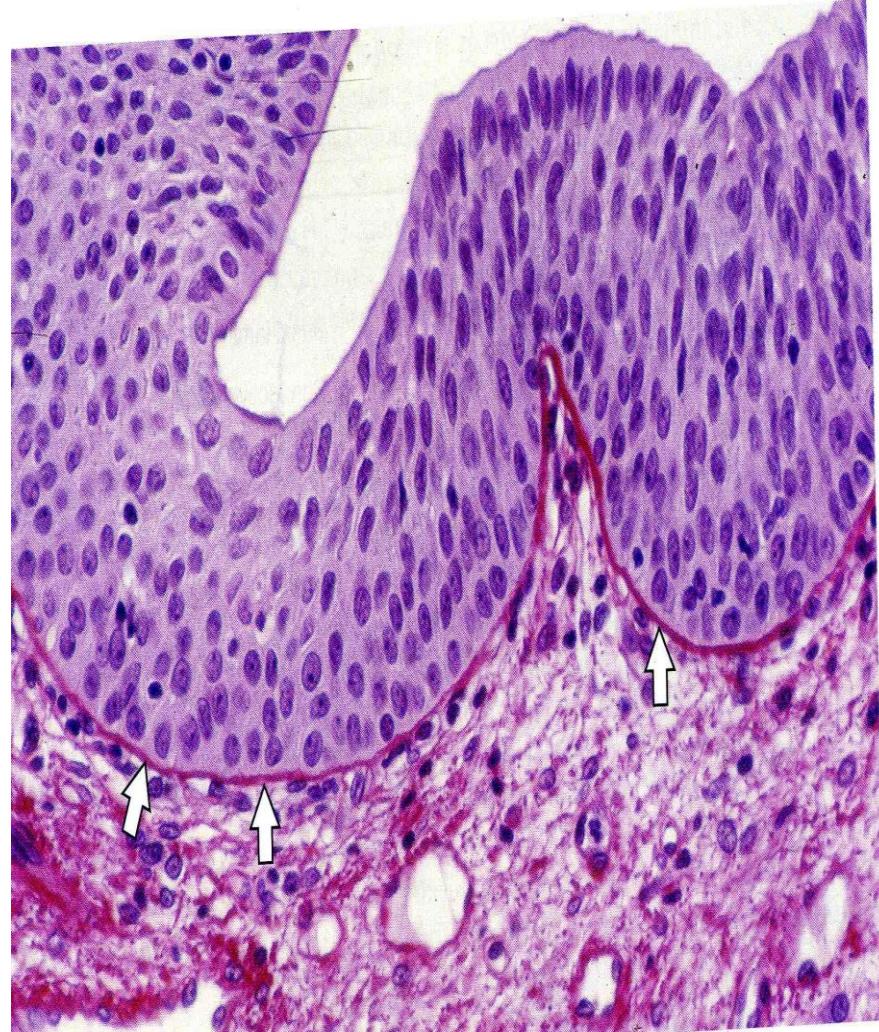
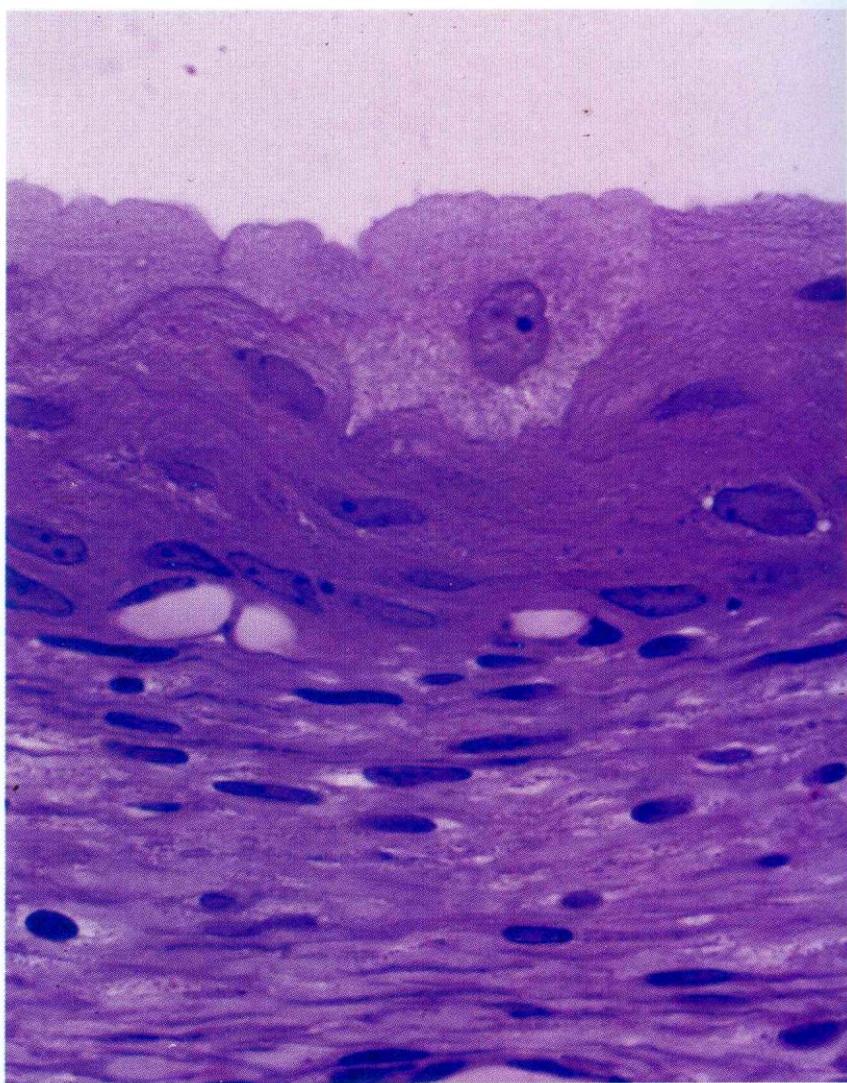
## VIII. Transitional Epithelium

- Found in urinary passages & urinary bladder
- designed to withstand stretching/contraction
- # of cell layers ↑ from calyces to urinary bladder
  - calyces- 2 to 3-cell thick
  - ureter – 4 to 5-cell thick
  - urinary bladder – up to 8-cell thick
- contracted – basal cells are cuboidal; superficial cells bulge into the lumen
- distended – basal cells are thin stratified squamous epith.

**B** Transitional epithelium



**Figure 4–12.** Diagrams of stratified and pseudostratified epithelial tissue. **A:** Stratified squamous epithelium. **B:** Transitional epithelium. **C:** Ciliated pseudostratified epithelium. The goblet cells secrete mucus, which forms a continuous mucous layer over the ciliary layer.



**Figure 4–18.** Stratified transitional epithelium of the urinary bladder (above) and the connective tissue of the lamina propria (below) with several fibroblasts. PT stain. Medium magnification.

# Surface Modifications of Epithelial Cells

## A. Apical Surfaces

### 1. MICROVILLI

- short finger-like processes
- core: network of actin filaments attached to inner surface of plasma membrane
- increase the surface area of cell (30-fold)
- *brush/striated borders*

## 2. CILIA (kinocilia)

- specialized for transport of fluid or mucus over the surface of epithelium
- motile, finger-like extensions of plasma membrane; beat sequentially or synchronously in 1 direction
- much longer than microvilli
- visible under LM

### 3. FLAGELLA

- same structure as with cilia but much longer
- among humans, (+) in only in spermatozoa (1 flagellum each)
- flagellum of spermatozoa – TAIL
- propel the cells along the female genital tract

## 4. STEREOCILIA

- non-motile; essentially only microvilli that are as long as cilia
- characteristic of epithelial cells of ductus epididymis; hair cells of inner ear

## B. LATERAL SURFACES ( Intercellular junctions, cell-to-cell attachments, junctional complexes)

- most developed in simple cuboidal & simple columnar epithelia

1. Zonula occludens \*
2. Zonula adherens \*
3. Desmosomes
4. Gap junctions

\* Juxtaluminal junctional complex or terminal bar – collective term for *zonula occludens* & *zonula adherens*

# 1. Zonula occludens (Tight junction)

- most apically situated
- located on the lateral surface of each epithelial cell immediately below its free surface → band, 0.1-0.3 um thick.
- adjoining cell membranes of cells **fuse**
- the “seal” prevents flow of materials b/w epithelial cells in either direction due to presence of the protein **CLAUDIN**

## 2. ZONULA ADHERENS (Belt desmosome; Band desmosome)

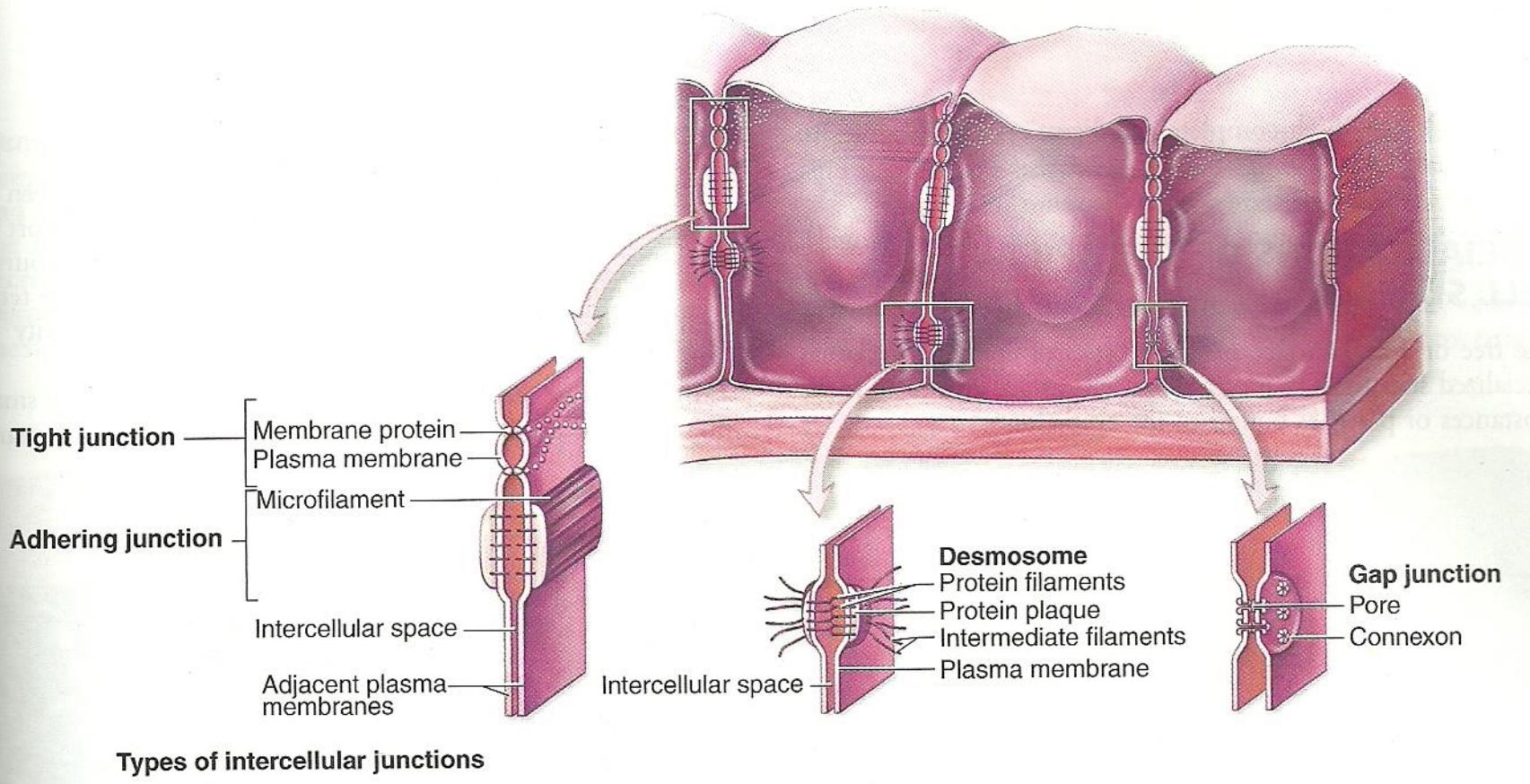
- just below zonula occludens
- a band that *encircle each epithelial cell*
- adhesion facilitated by **CADHERINS**
- cell membrane of cells are very close but don't fuse---w/  
intercellular space (15-20 nm wide)
- with numerous actin filaments forming terminal webs
- present in cells notably with microvilli or cilia

### 3. DESMOSOME (Macula adherens; spot desmosome)

- just below the zonula adherens
- consists of an *ovoid protein disc* or plaque that is split, w/ each half attached to cytoplasmic surface of cell membrane of 2 adjoining cells
- CHONS: placophilin, placoglobin and desmoplakin
- also encircle the cell but (-) band
- arranged as line around the cell
- LM: appear as *thickening* of the cell
- w/ wider intercellular space
- numerous in keratinized strat. squamous epithelium of skin

## 4. Gap Junction (Nexus, Communicating junctions)

- Broad areas where plasma membranes of adjoining epithelial cells are closely apposed but **not fused** w/ each other
- Connexins
- *Connexons*- tiny tubes that perforate each plasma membrane; allows exchange of ions & small molecules between the cells.



## C. BASAL

### 1. Hemidesmosomes

- structurally identical to half a desmosome
- integrins
- anchor the epithelial cells to the underlying basal lamina
- stratum basale of epidermis

**MV**

**ZO** —

**ZA** —

**D** —

## B. GLANDULAR EPITHELIUM

- Glands
- Secretions
- Categorized on the basis of how they release their secretions/ presence or absence of ducts
  1. Exocrine glands
  2. Endocrine glands

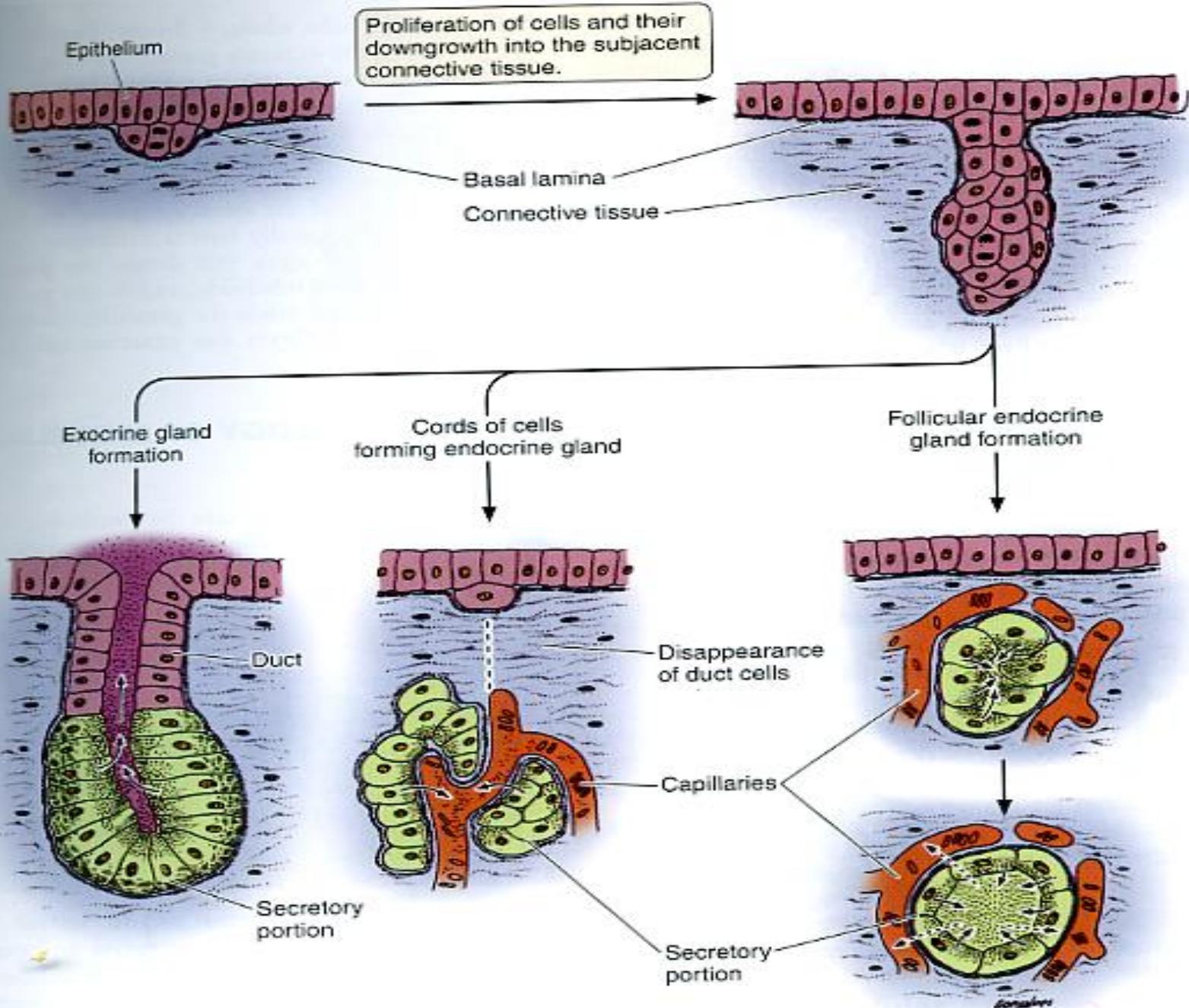
# B. GLANDULAR EPITHELIUM

## Exocrine Glands

- covering or lining epithelium
- With DUCTS
- Secretory cells maintain communication with the surface epithelium

## Endocrine Glands

- Arise in embryo as invagination or evagination of epithelium
- Has support system of CT, blood vessels and nerves
- Secrete hormones → into the blood or lymph
- ductless



## B. GLANDULAR EPITHELIUM ENDOCRINE GLANDS

Exist either as:

1. distinct organs – adrenals, thyroid gland
2. components of organs – islets of Langerhans (pancreas), certain cells of kidney, thymus, lungs, testes, ovaries, placenta, blood vessels & GIT.

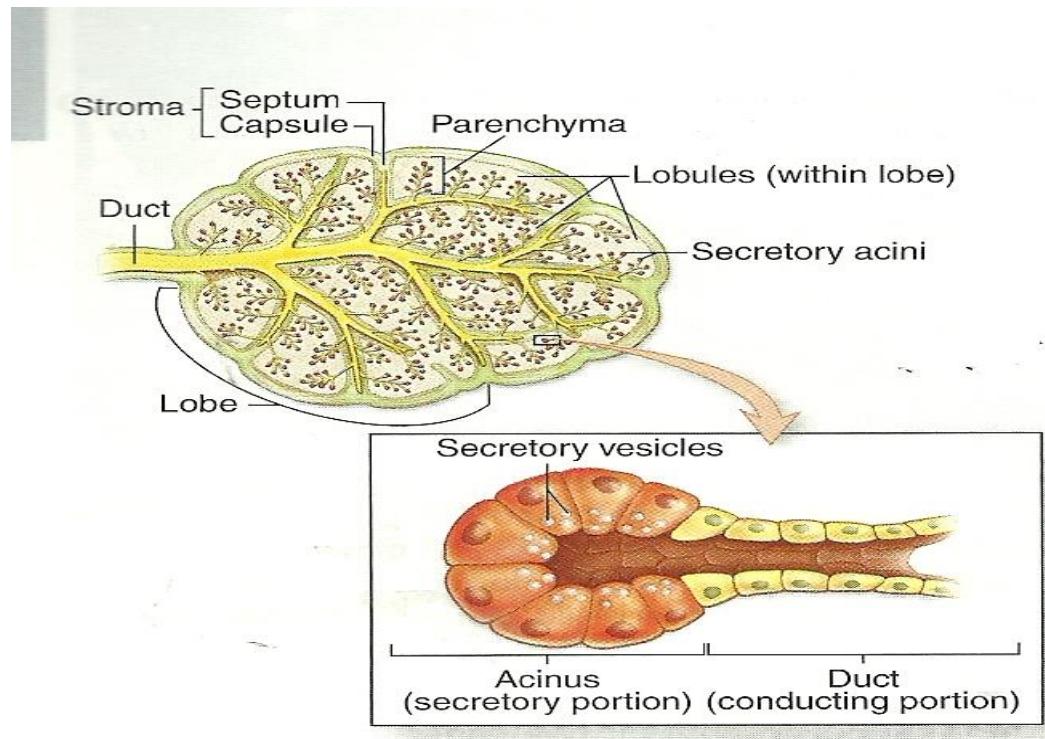
## B. GLANDULAR EPITHELIUM EXOCRINE GLANDS

- maintain their continuity with the covering epithelium.

Categorized according to complexity into:

### I. Complexity of secretions

1. Unicellular glands
2. Multicellular glands



## **1. Unicellular Exocrine Glands**

- simplest type; composed of only 1 cell
- mucous or goblet cells – digestive & respiratory tracts

## **2. Multicellular Exocrine Glands**

- a. Secretory epithelial sheet
- b. Intraepithelial gland
- c. Glands with ducts

## a. Secretory Epithelial Sheet

- most cells are secretory

1. Ependyma

2. Lining epithelium of stomach & uterus

## b. Intraepithelial gland

- group of secretory cells that gather around a small orifice that serves as duct → shallow invaginations w/in surface

1. Epithelium in spongy penile part of male urethra

### c. Exocrine Glands with Ducts

- most complex of the exocrine glands
- lie beneath the epithelium ; connected by a duct or a system of ducts

Classifications based on:

1. Morphology –

simple/compound/tubular/alveolar/  
branched/coiled

2. Nature of secretion-

mucus/serous/mixed

3. Mode of secretion-

merocrine/holocrine/apocrine

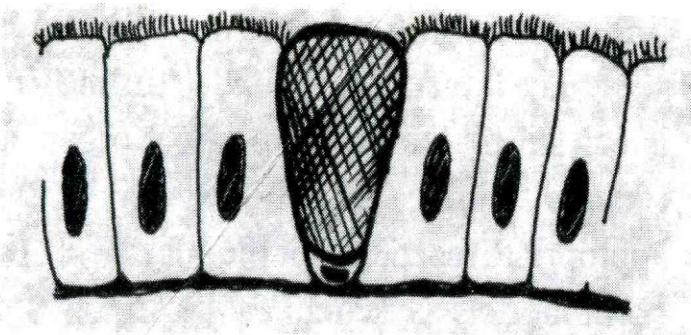


Fig. II-14. Diagram of a goblet cell (shaded area).

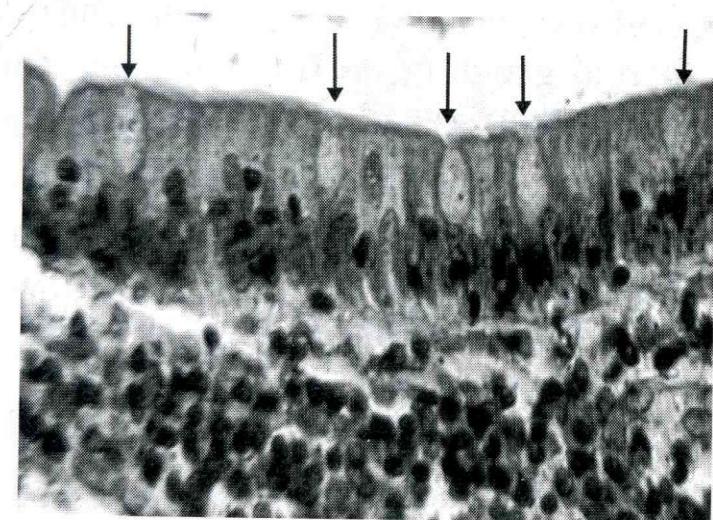


Fig. II-15. Goblet cells (at tip of arrows). Small intestine,  $x400$ .

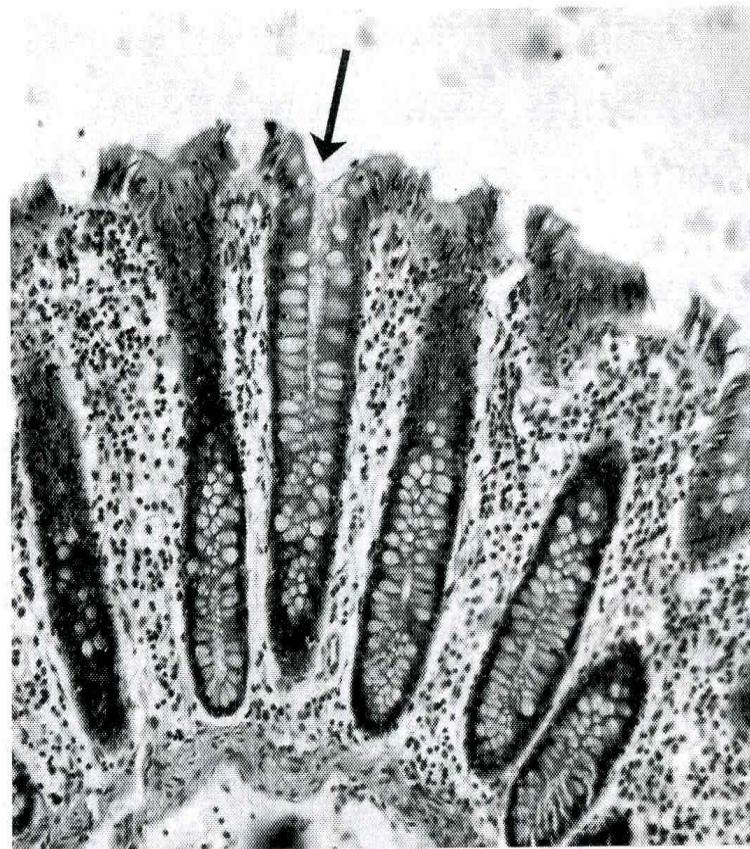
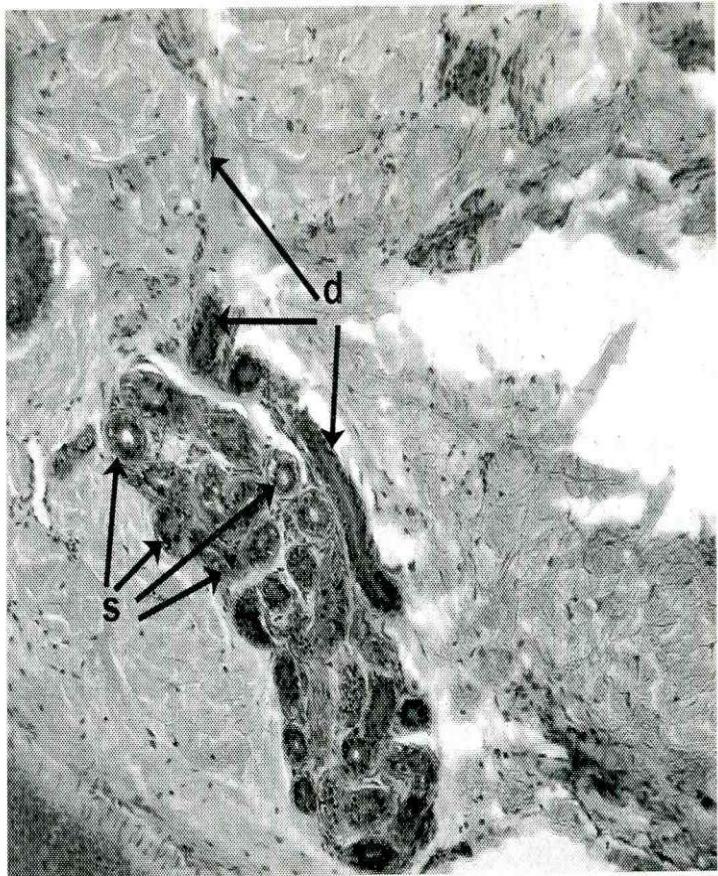
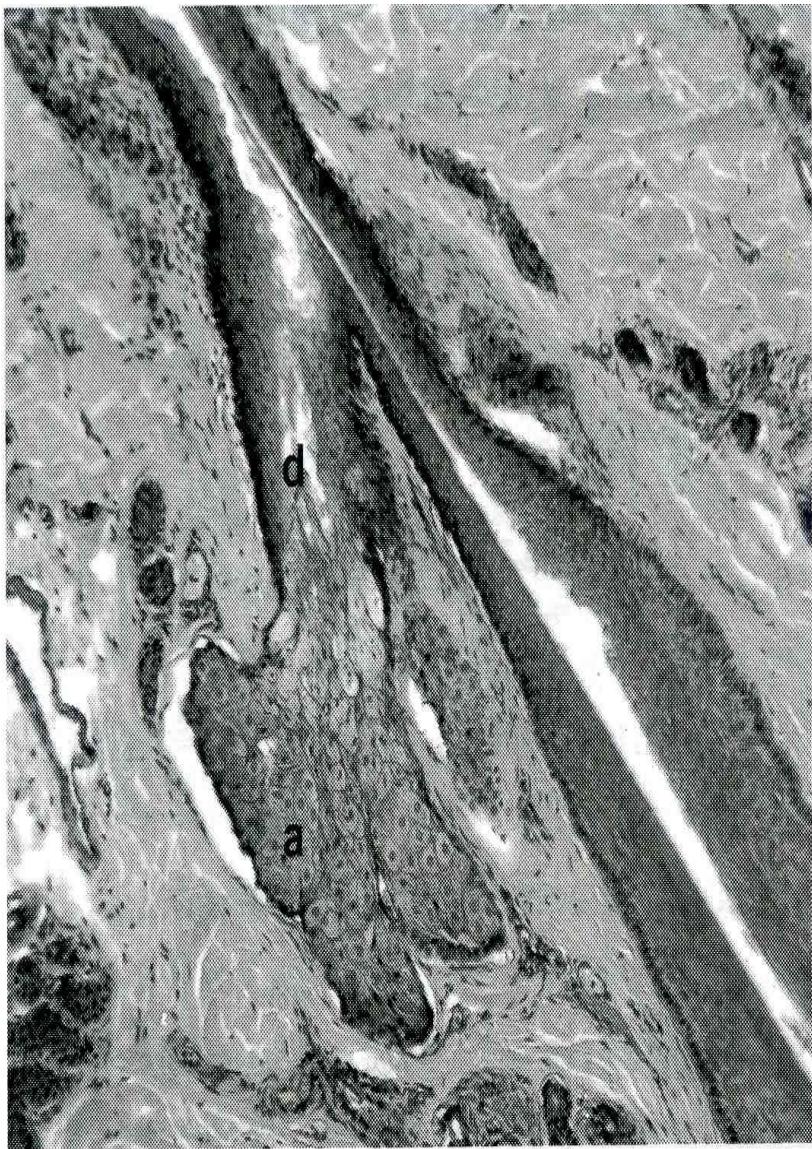


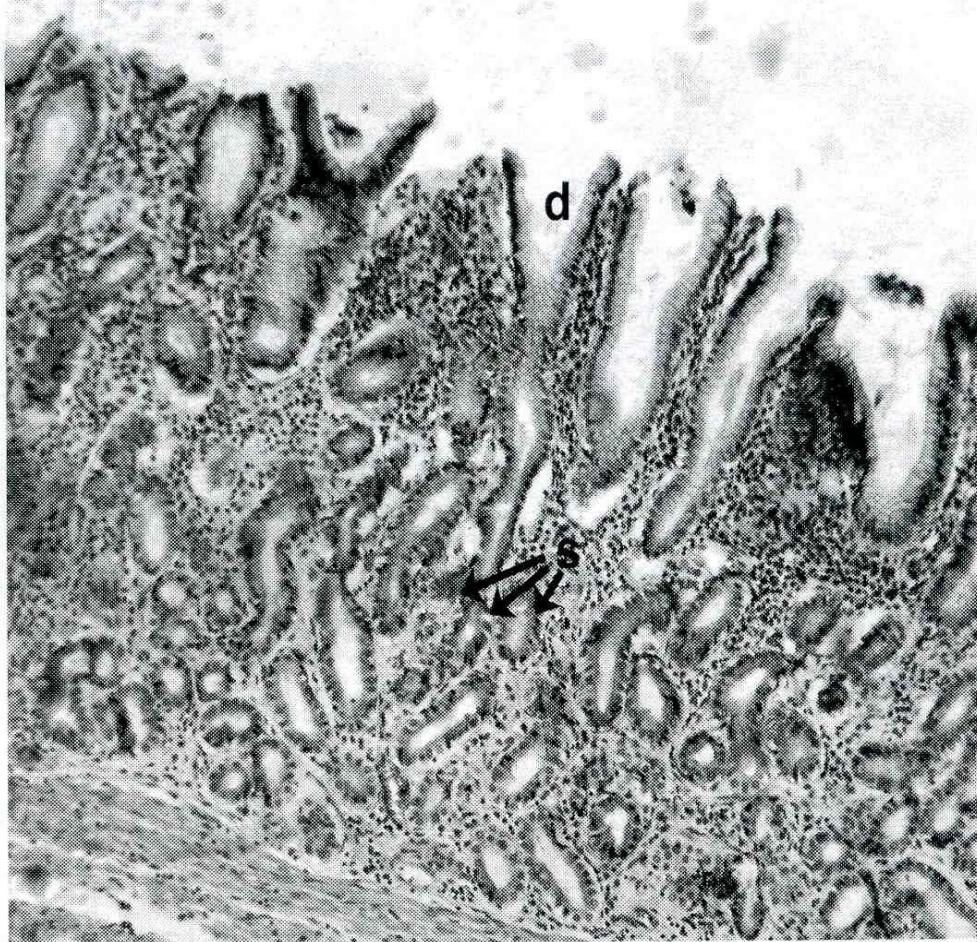
Fig. II-17. Simple tubular glands. Large intestine,  $x100$ . Arrow points to orifice of duct.



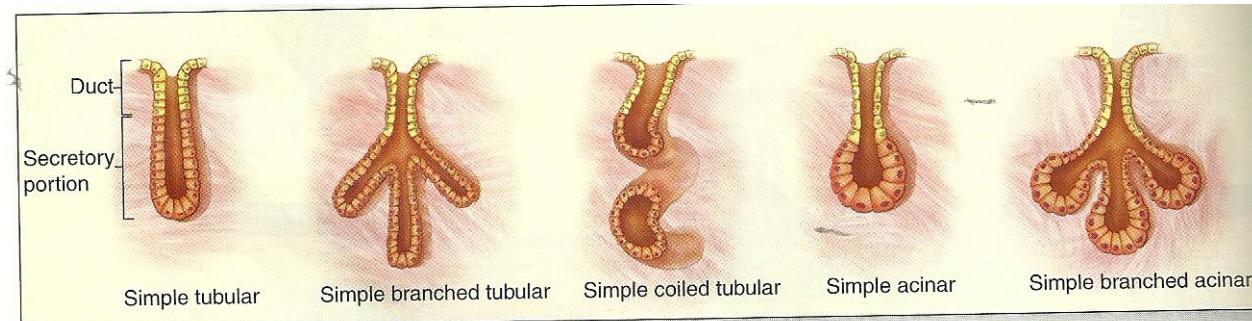
**Fig. 11-19. Simple coiled tubular gland.** Sweat gland, x100. Note that the secretory portions (**s**) that are lined with simple cuboidal epithelia drain into a duct (**d**) that is lined with stratified cuboidal epithelia.



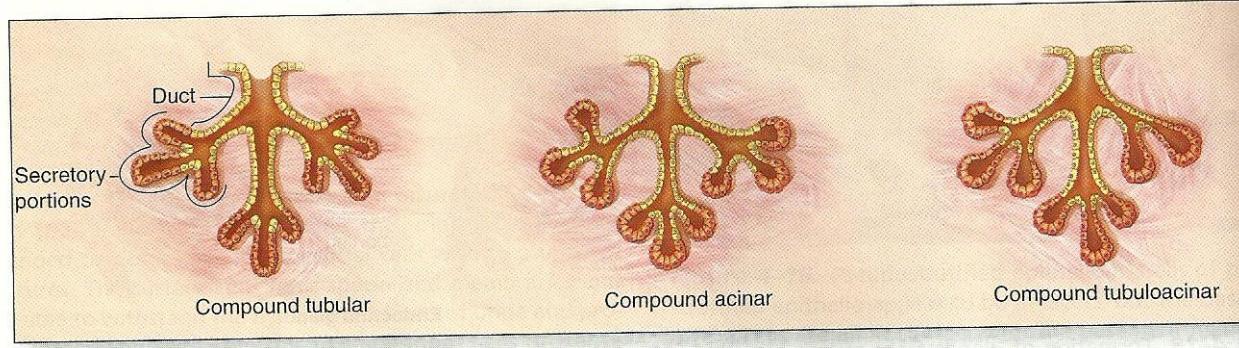
**Fig. II-18. Simple branched alveolar gland.** Sebaceous gland, x100. (**a** = alveoli, **d** = duct).

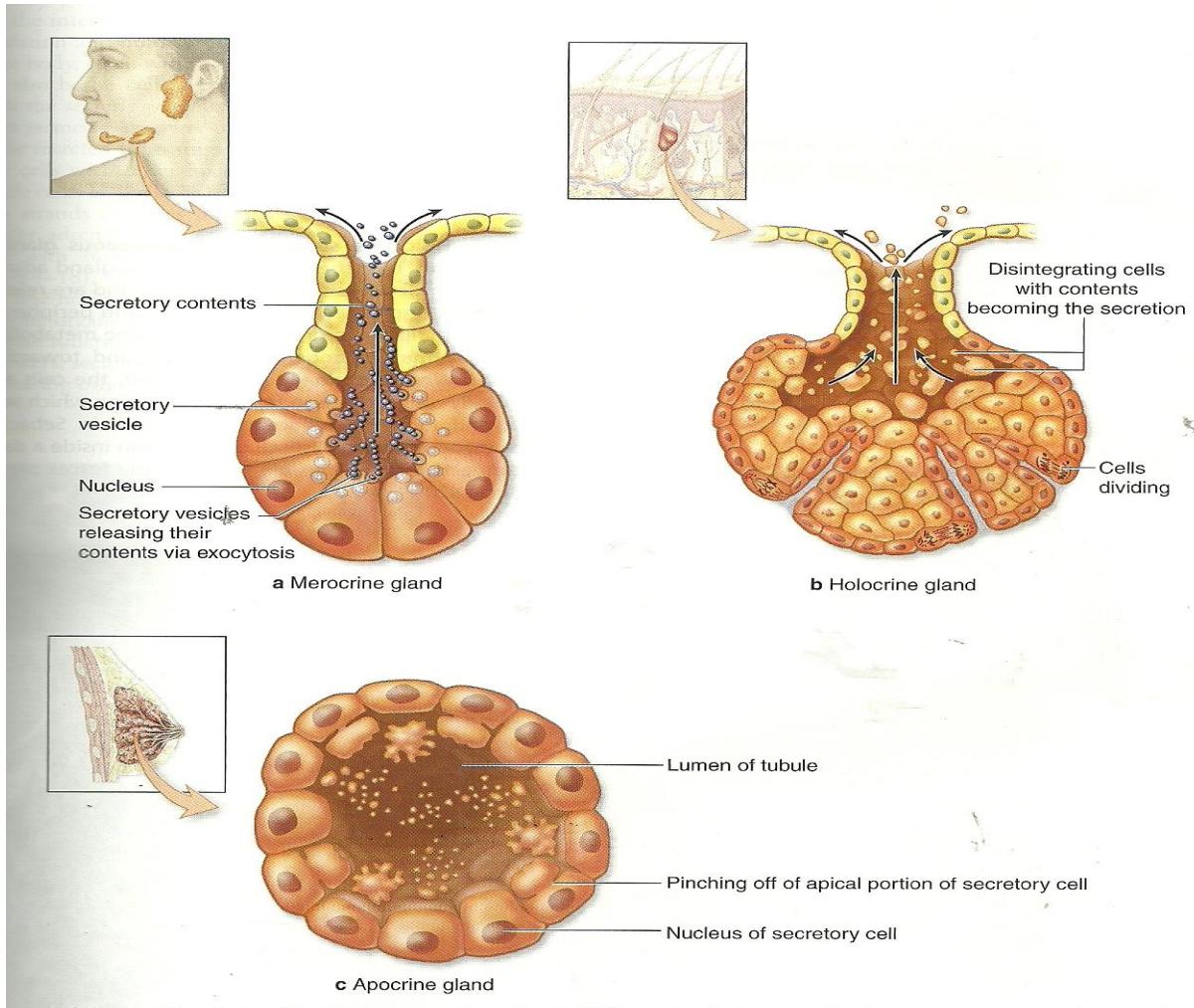


**Fig. II-20. Simple branched tubular gland.**  
*Stomach, pyloric area, x100. Note that several branches of the secretory portion of the gland (s) empty into a single duct (d).*



a Simple glands



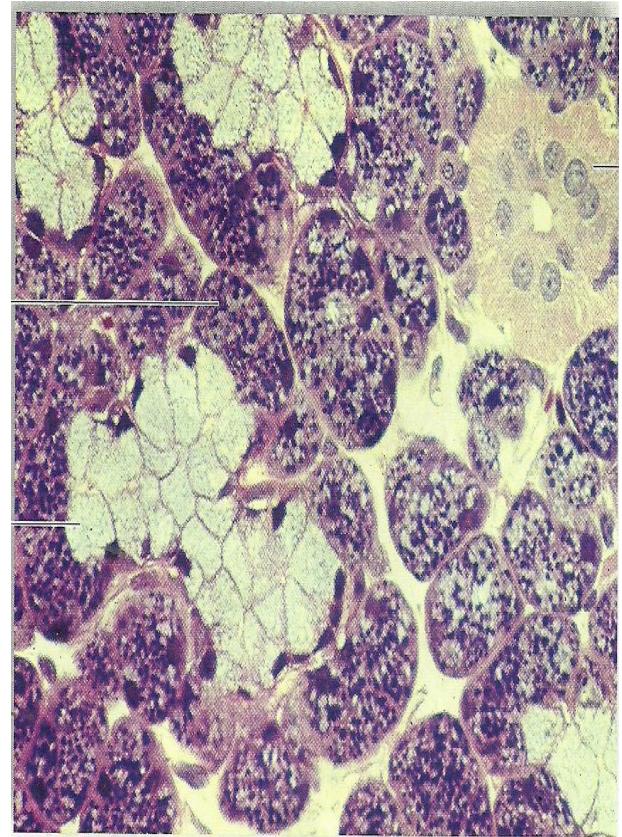
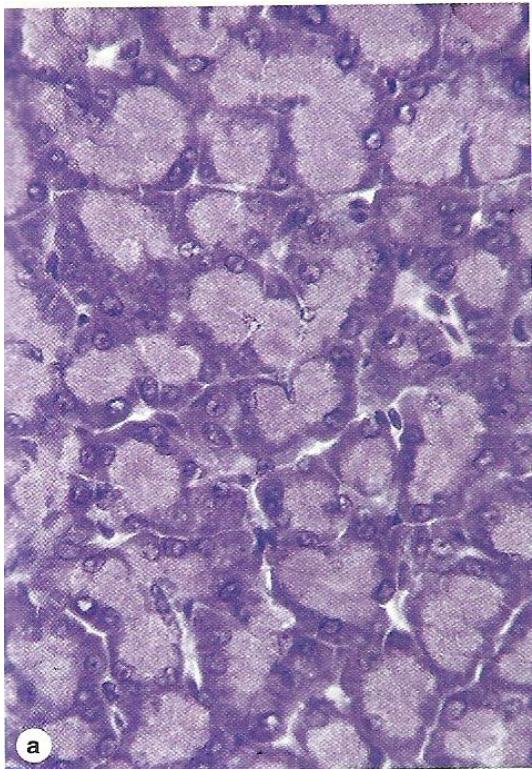


# Glands according to nature of secretion

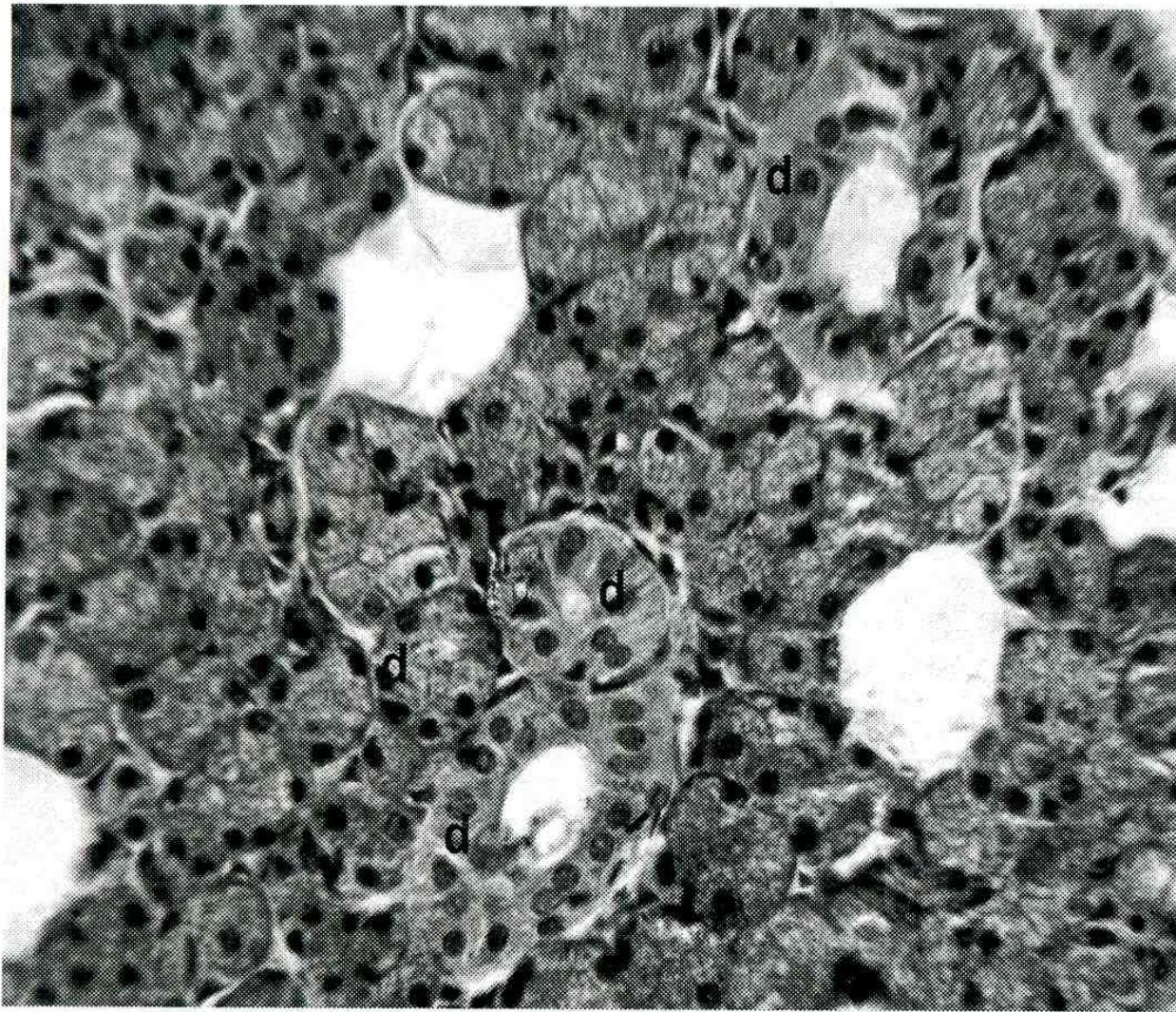
Serous

Mucous

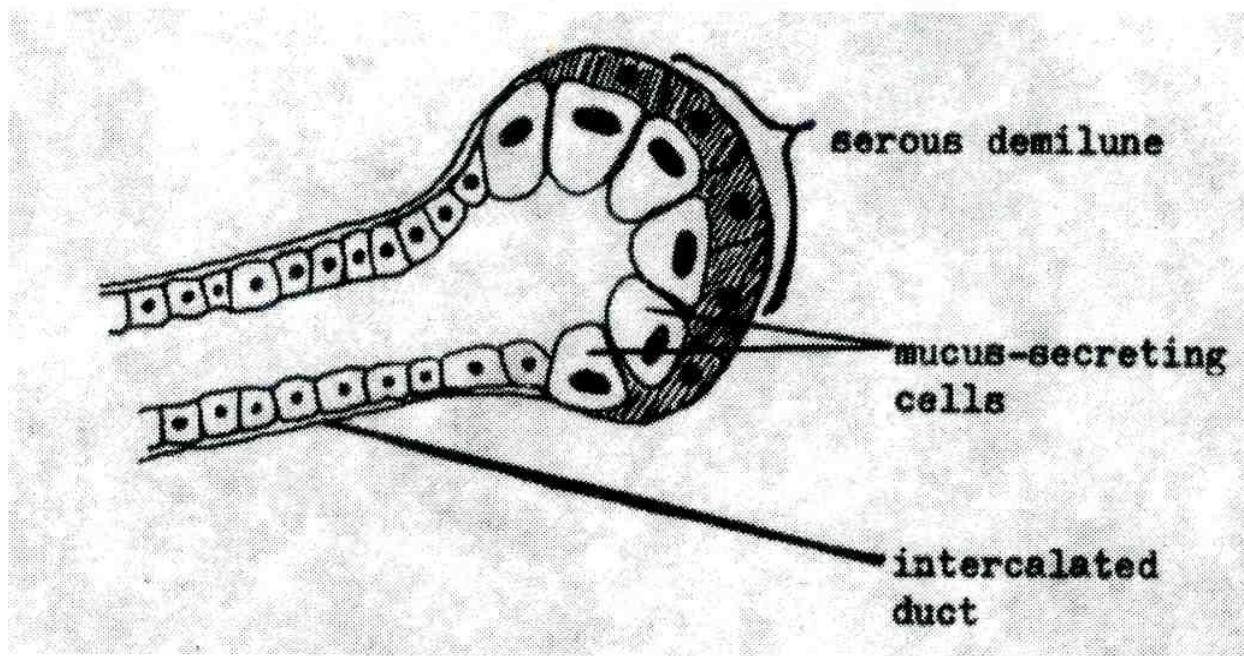
Mixed



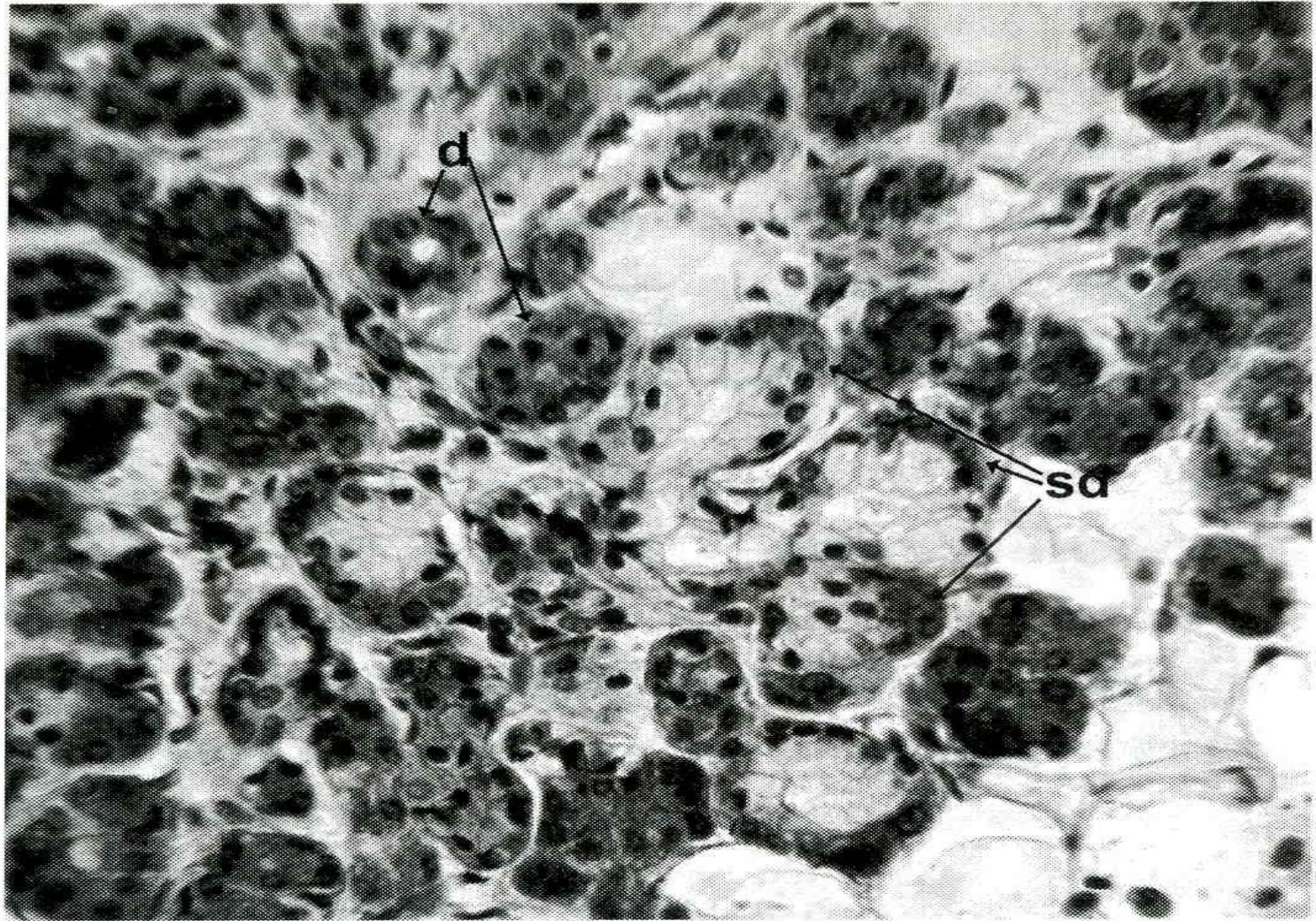
**Figure 4–24.** Serous cells. Serous acinar cells have a small central lumen. Each acinar cell is roughly spherical.



**Fig. II-22. Compound alveolar gland. Parotid gland, x400. Note the various sizes of the ducts (d).**

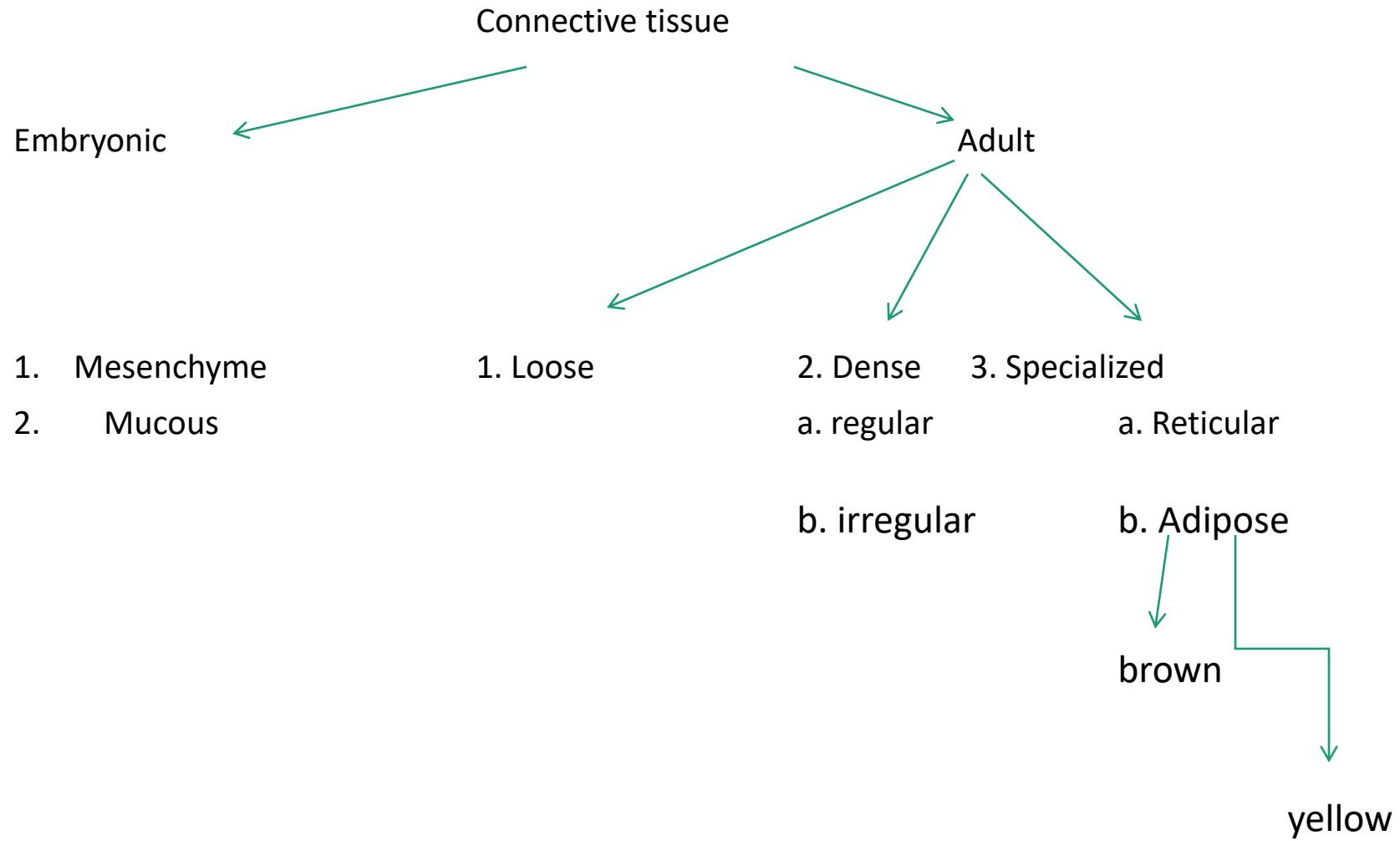


**Fig. II-23. Diagram of a mixed alveolus.**



**Fig II-24. Mixed gland showing mixed acini with serous demilunes (sd). Submaxillary gland, x400. Darker alveoli are serous alveoli. Some ducts (d) are also shown.**

# CONNECTIVE TISSUE



# CONNECTIVE TISSUE PROPER

➤ **mesodermal in origin**

➤ **Functions:**

- 1. support & packaging**
- 2. storage**
- 3. transport**
- 4. defense**
- 5. repair**

➤ **General characteristics:**

- a. FEW cells (than epithelium)**
- b. ABUNDANT intercellular substance**

## **CONNECTIVE TISSUE PROPER COMPONENTS**

- 1. Amorphous intercellular substance/matrix –  
GROUND SUBSTANCE**
- 2. FIBERS**
- 3. CELLS**

# CONNECTIVE TISSUE PROPER COMPONENTS

## GROUND SUBSTANCE

- amorphous, homogenous, transparent & hydrated gel
- Large amount of water
- Proteoglycans, glycosaminoglycans and glycoproteins (laminin, fibrinopeptides, etc.)

# CONNECTIVE TISSUE PROPER COMPONENTS

## Connective tissue fibers:

### 1. Collagen Fibers (Collagenous)

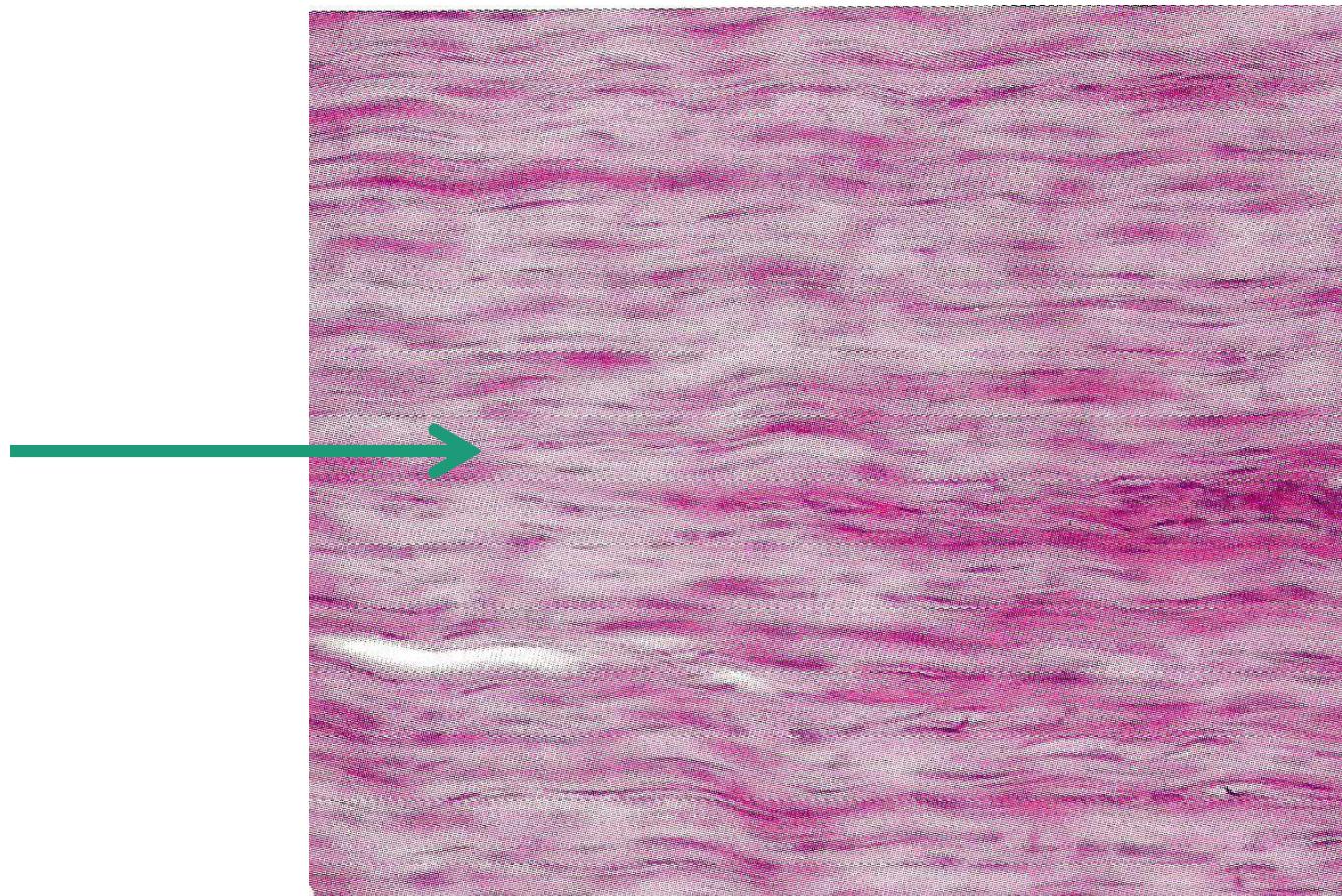
- most abundant, produced mainly by fibroblast
- Types I,II,III make up all collagen fibers in the connective tissue

- high tensile strength; sl. flexible but inelastic
- long colorless threads,(+)longitudinal striations due to their longitudinally coursing fibrillar structure; white in tendons
- H&E prep: acidophilic
- procollagen(fibroblast)→tropocollagen

# Collagen fibers



# Collagen Fibers



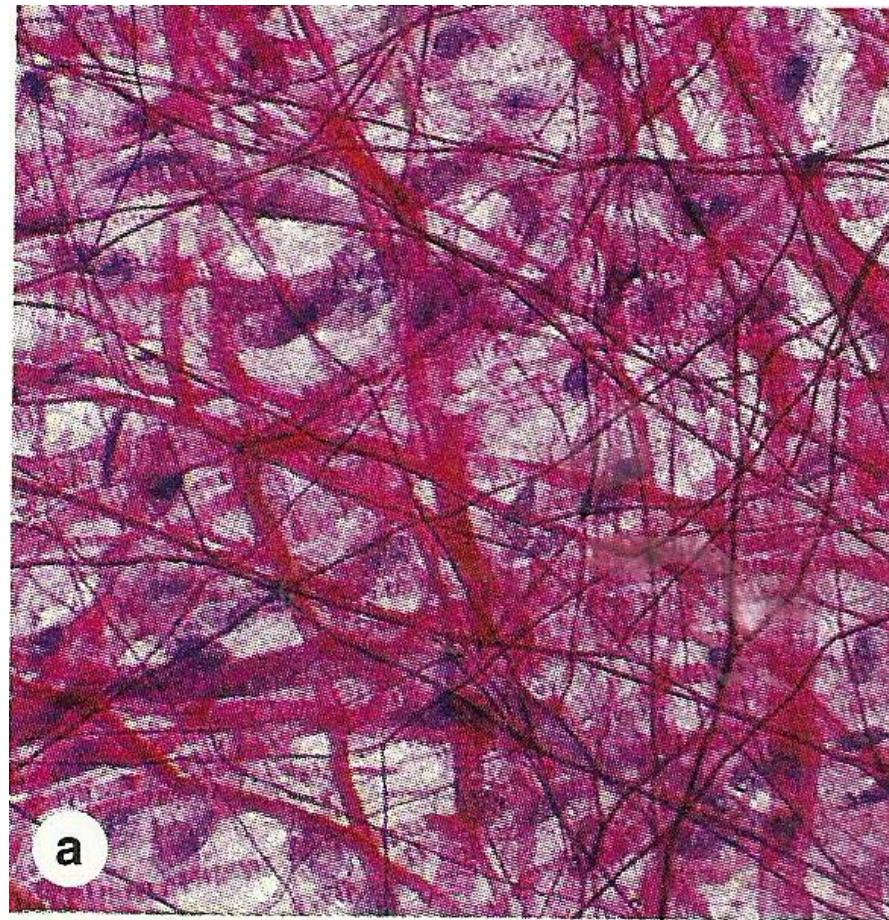
	67-nm banded fibrils	picrosirius birefringent, nonargyrophilic fibers	dentin	tension
II [ $\alpha_1$ (II)] <sub>3</sub>	300-nm molecule, 67-nm banded fibrils	Loose aggregates of fibrils, birefringent	Cartilage, vitreous body	Resistance to pressure
III [ $\alpha_1$ (III)] <sub>3</sub>	67-nm banded fibrils	Thin, weakly birefringent, argyrophilic fibers	Skin, muscle, blood vessels, frequently together with type I	Structural maintenance in expandible organs
V [ $\alpha_1$ (V)] <sub>3</sub>	390-nm molecule, N-terminal globular domain	Frequently forms fiber together with type I	Fetal tissues, skin, bone, placenta, most interstitial tissues	Participates in type I collagen function
X [ $\alpha_1$ (XI)] [ $\alpha_2$ (XI)] [ $\alpha_3$ (XI)]	300-nm molecule	Small fibers	Cartilage	Participates in type II collagen function
<b>Fibril-associated collagen</b>				
IX [ $\alpha_1$ (IX)] [ $\alpha_2$ (IX)] [ $\alpha_3$ (IX)]	200-nm molecule	Not visible, detected by immunocytochemistry	Cartilage, vitreous body	Bound glycosaminoglycans; associated with type II collagen
XII [ $\alpha_1$ (XII)] <sub>3</sub>	Large N-terminal domain; interacts with type I collagen	Not visible, detected by immunocytochemistry	Embryonic tendon and skin	Interacts with type I collagen
XIV [ $\alpha_1$ (XIV)] <sub>3</sub>	Large N-terminal domain; cross-shaped molecule	Not visible; detected by immunocytochemistry	Fetal skin and tendon	
<b>Collagen that forms anchoring fibrils</b>				
VII [ $\alpha_1$ (VII)] <sub>3</sub>	450 nm, globular domain at each end	Not visible, detected by immunocytochemistry	Epithelia	Anchors skin epidermal basal lamina to underlying stroma
<b>Collagen that forms networks</b>				
IV [ $\alpha_1$ (IV)] <sub>2</sub> [ $\alpha_1$ (IV)]	Two-dimensional cross-linked network	Not visible, detected by immunocytochemistry	All basement membranes	Support of delicate structures, filtration

## 2. Elastic fibers

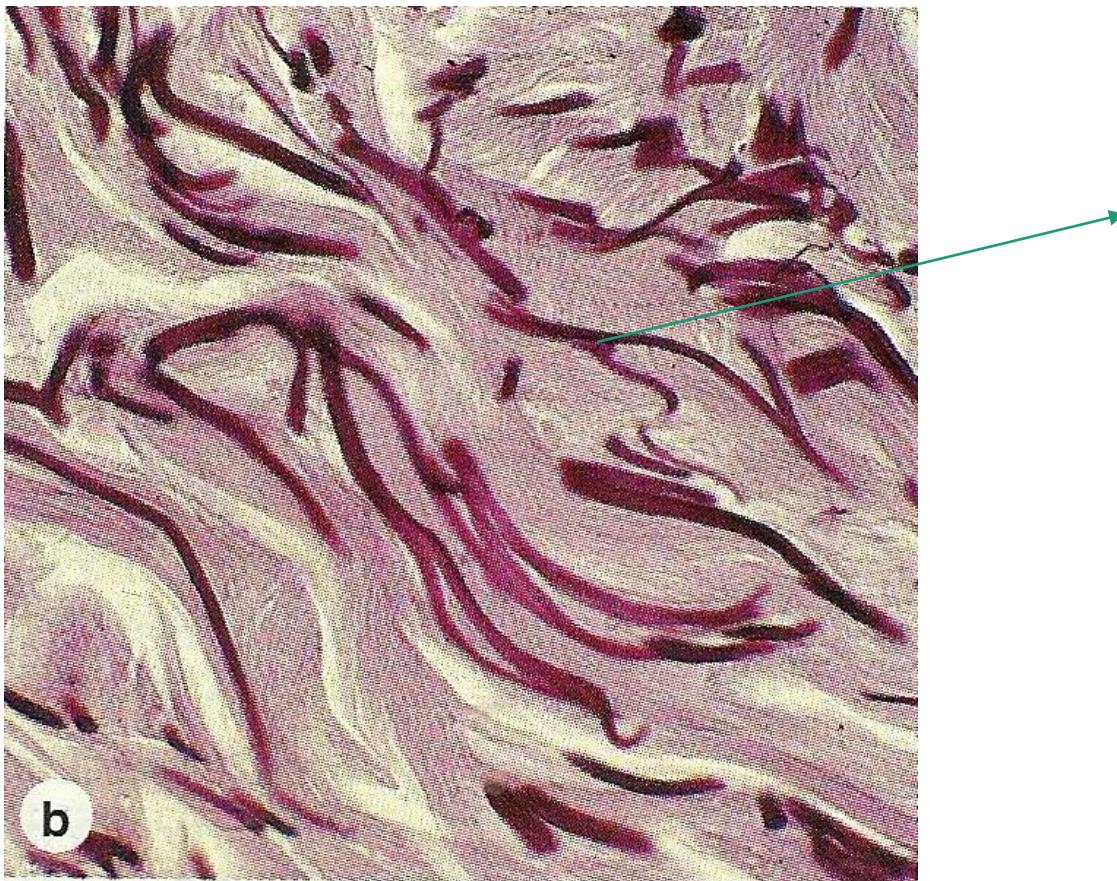
- fine, highly refractile (1 um diameter)
- less tensile strength but very elastic
- distribution: ligamentum flava; auditory tube, auricle, external acoustic meatus, external nose, epiglottis, some parts of larynx
- made up of the protein ELASTIN, from TROPOELASTIN produced by fibroblasts and smooth muscles

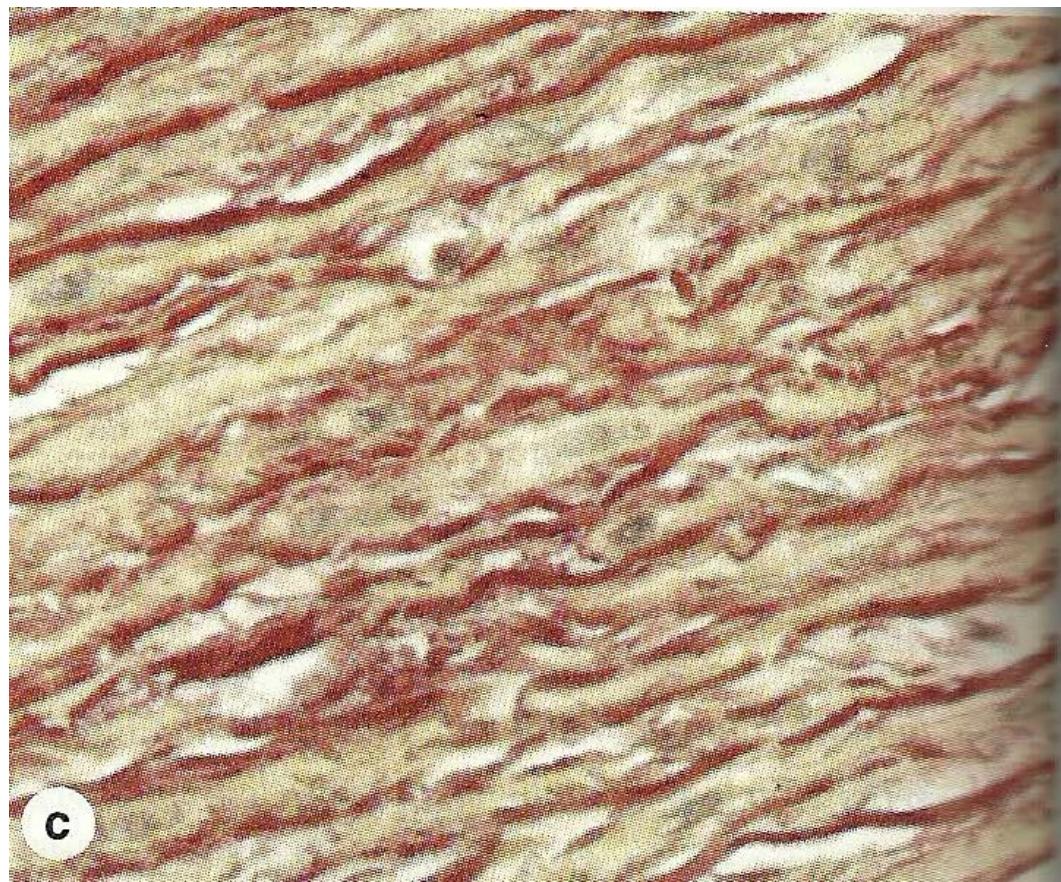
- fibers branch & anastomose
- *yellow* in fresh specimen
- H&E prep: pinkish-yellow refractile fibers
- Orcein stain- dark blue to black
- Tropoelastin

# Collagen and Elastic Fibers



# Elastic Fibers

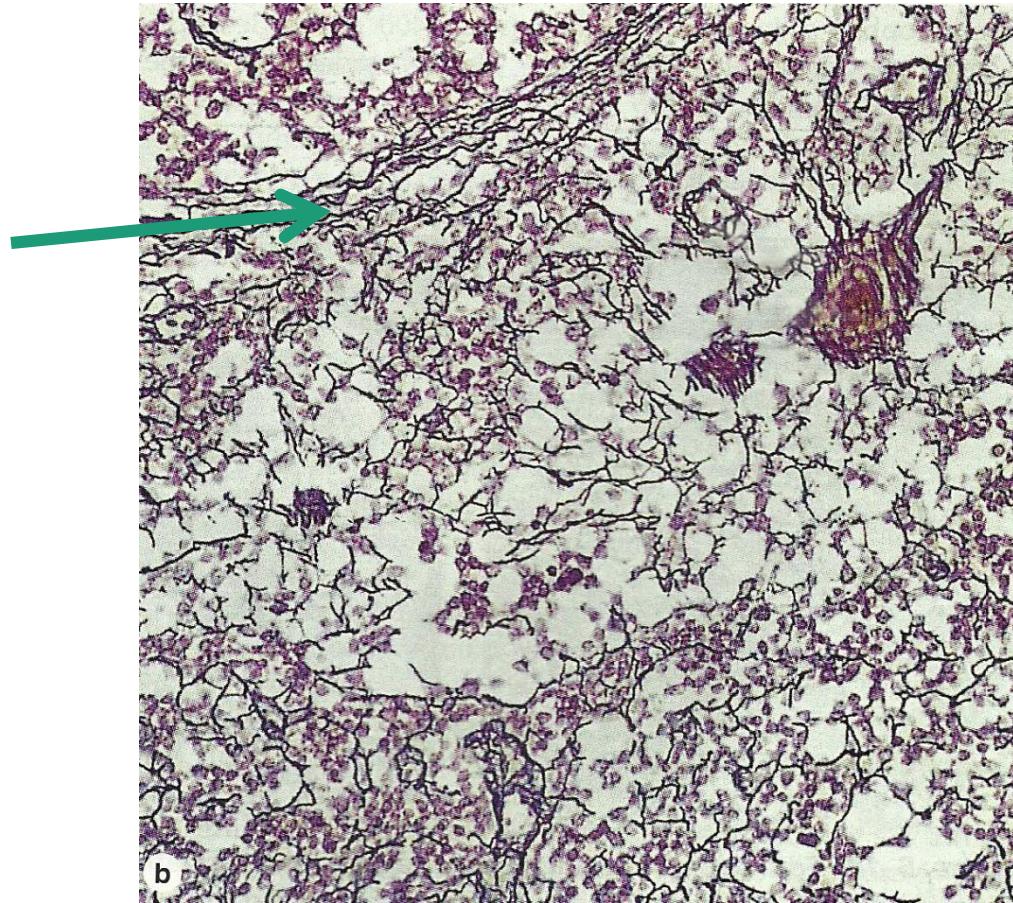




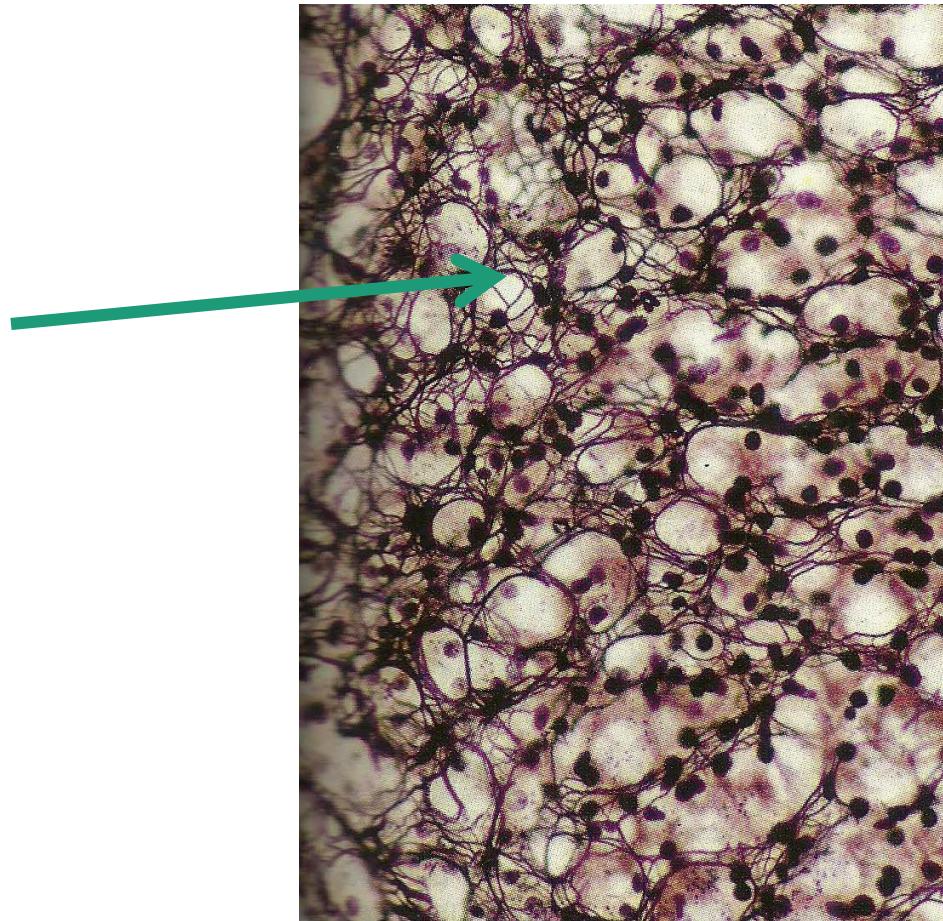
### 3. Reticular fibers (Argyrophilic)

- similar to collagen fibers; mostly type III
- very fine(0.5-2.0 um diam); branch,  
anastomose → networks
- sparse distribution, usually in lymphoid organs,  
hematopoietic tissue

# Reticular Fibers



# Reticular Fibers



# Mesenchyme

- Undifferentiated cells
- Pluripotential
- Will give rise to cells to the connective tissue

# CONNECTIVE TISSUE PROPER COMPONENTS

## Connective Tissue Cells:

1. Fibroblasts – most common; produce collagen, elastin and ground substance
2. Adipose cells (Fat cells; adipocytes)
  - store lipids

### 3. Macrophages and mononuclear phagocytes

- voracious phagocytes- 2<sup>nd</sup> line  
of non immune defense

- differentiate from monocytes

- wide distribution

- lungs-pulmonary alveolar macrophages

- liver- Kupffer cells

- CT- histiocytes

- nervous system – microglia

- skin- Langerhan's cells

- bone - osteoclasts

- Fixed & Free macrophages
- Resident & inflammatory macrophages
  - *Resident macrophage* - not very immunologically active but phagocytic
  - *Activated Macrophages* – enhanced phagocytic & antigen-processing activity

#### 4. Mast cells – large cells containing coarse basophilic granules in their cytoplasm.

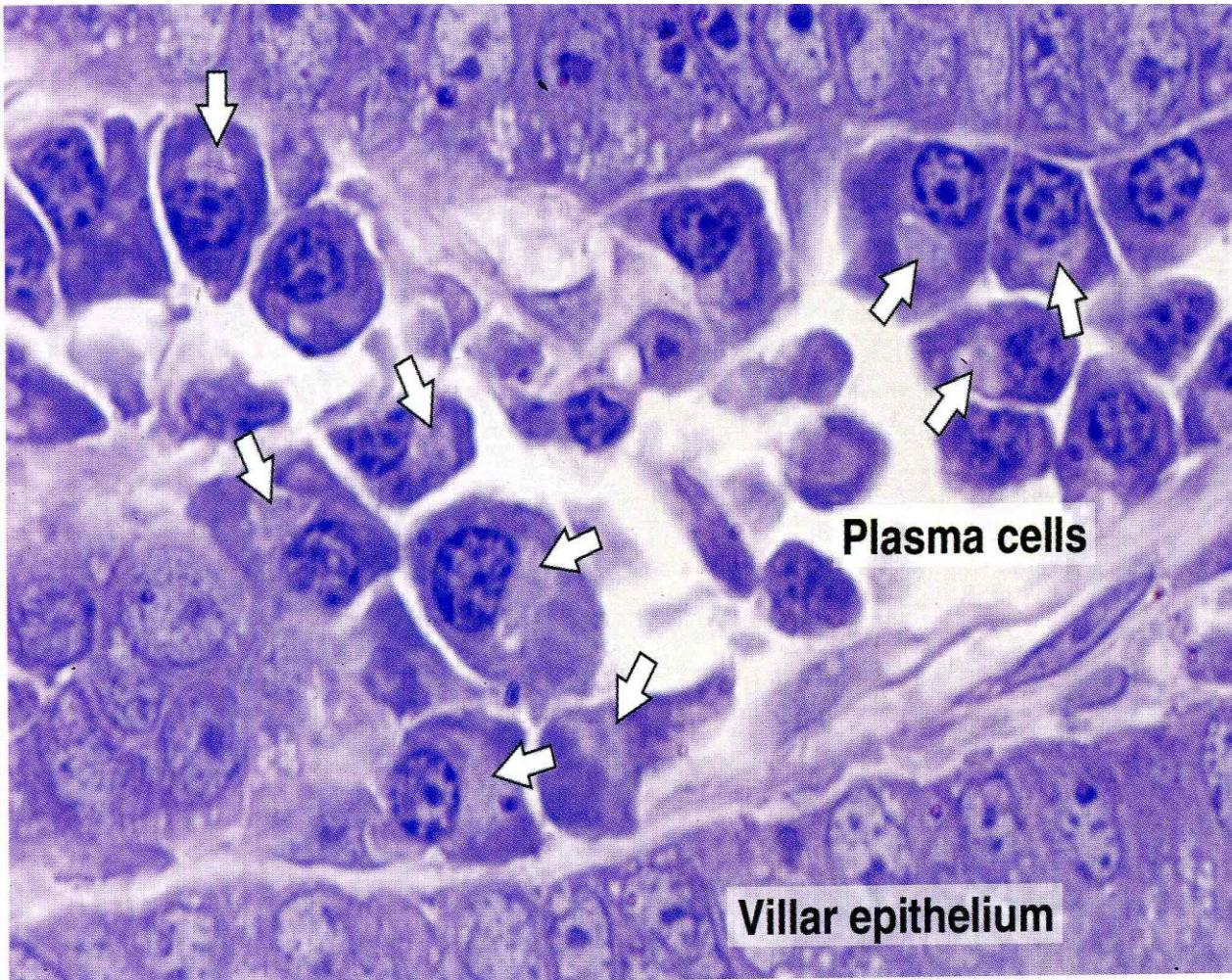
- sparse; lamina propria of GIT & resp., underneath the skin & along small BV
- produce heparin, histamine; PGs, cytokines, leukotrienes,

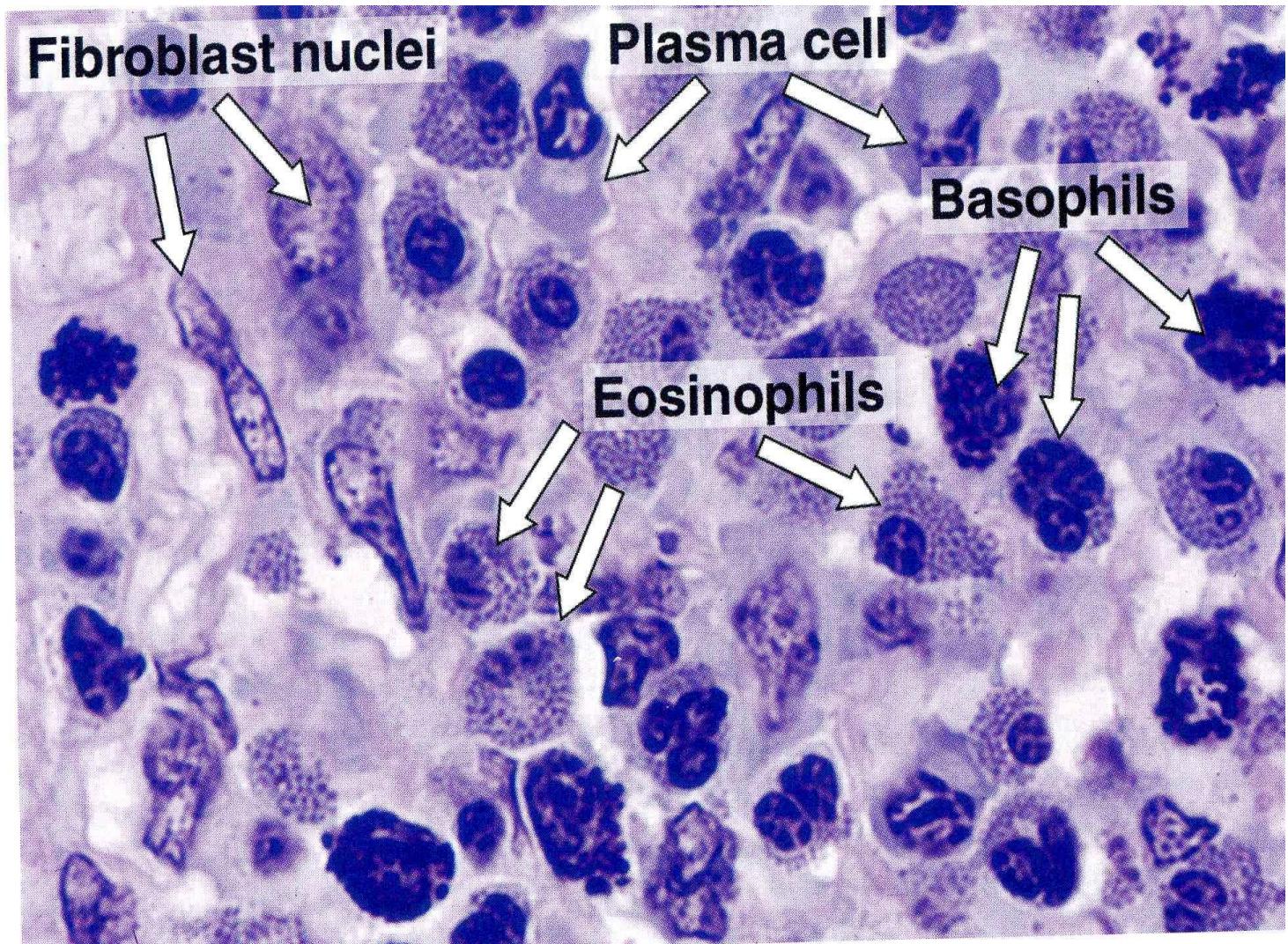
## 5. Plasma Cells

- large cell with clock-face or cart-wheel appearance
- derived from lymphocytes
- produce *antibodies*

## 6. Leukocytes or WBC

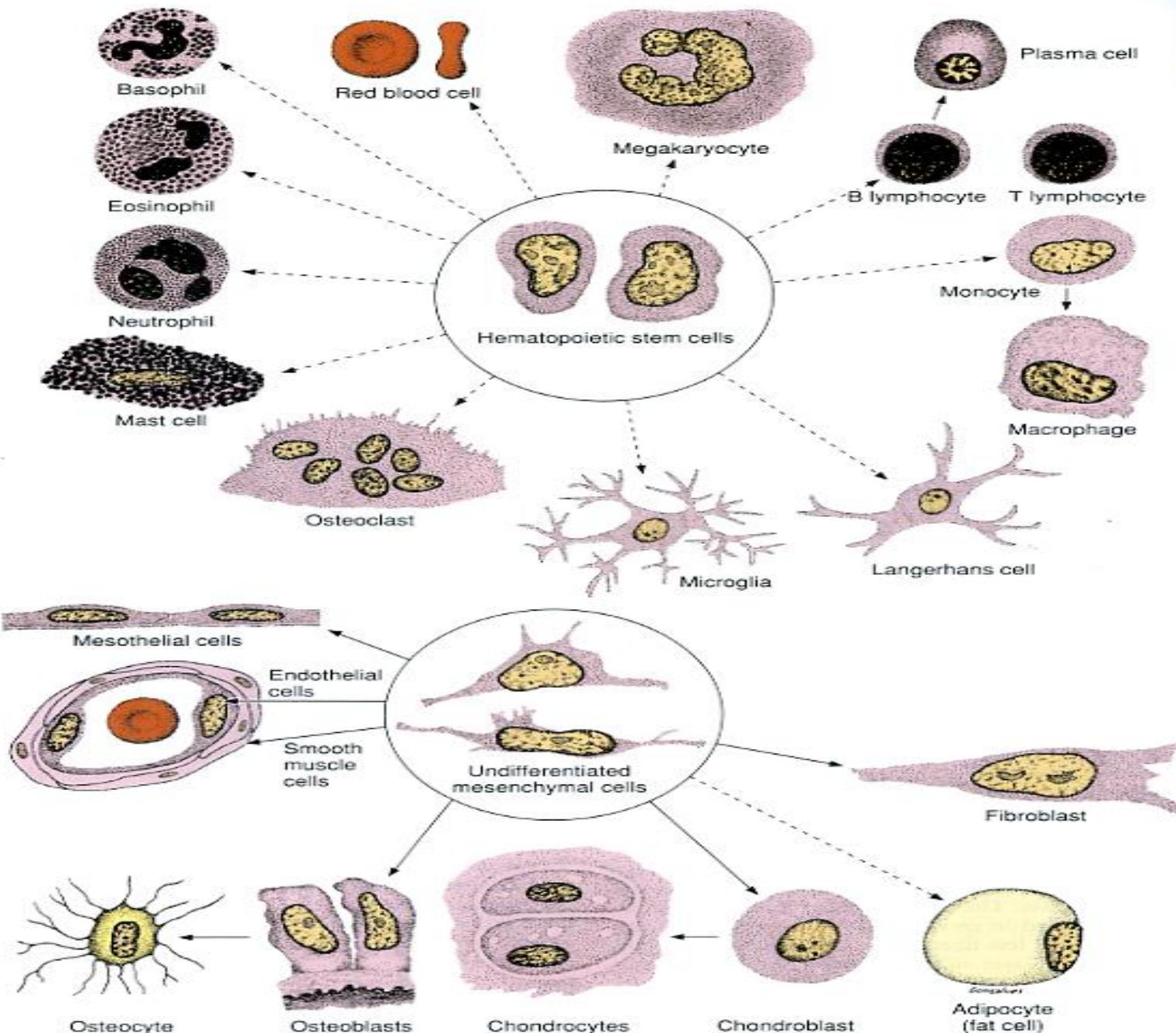
- exclusively produced in BM except for lymphocytes (adults)





**Table 5-1.** Functions of connective tissue cells.

Cell Type	Representative Product or Activity	Representative Function
Fibroblast, chondroblast, osteoblast	Production of fibers and ground substance	Structural
Plasma cell	Production of antibodies	Immunological (defense)
Lymphocyte (several types)	Production of immunocompetent cells	Immunological (defense)
Eosinophilic leukocyte	Participation in allergic and vasoactive reactions, modulation of mast cell activities and the inflammatory process	Immunological (defense)
Neutrophilic leukocyte	Phagocytosis of foreign substances, bacteria	Defense
Macrophage	Secretion of cytokines and other molecules, phagocytosis of foreign substances and bacteria, antigen processing and presentation to other cells	Defense
Mast cell and basophilic leukocyte	Liberation of pharmacologically active molecules (eg, histamine)	Defense (participate in allergic reactions)
Adipose (fat) cell	Storage of neutral fats	Energy reservoir, heat production



**Table 5-2.** Distribution and main functions of the cells of the mononuclear phagocyte system.

Cell Type	Location	Main Function
Monocyte	Blood	Precursor of macrophages
Macrophage	Connective tissue, lymphoid organs, lungs, bone marrow	Production of cytokines, chemotactic factors, and several other molecules that participate in inflammation (defense), antigen processing and presentation
Kupffer cell	Liver	Same as macrophages
Microglia cell	Nerve tissue of the central nervous system	Same as macrophages
Langerhans cell	Skin	Antigen processing and presentation
Dendritic cell	Lymph nodes	Antigen processing and presentation
Osteoclast	Bone (fusion of several macrophages)	Digestion of bone
Multinuclear giant cell	Connective tissue (fusion of several macrophages)	Segregation and digestion of foreign bodies

# Classifications of Connective Tissue

## A. CONNECTIVE TISSUE PROPER

### 1. LOOSE(AREOLAR) CONNECTIVE TISSUE

- abundant ground substance; many cells;
- little collagen fibers, random distribution
- hypodermis of skin, tunica adventitia of BV, lamina propria & submucosa of GIT, respiratory, and urogenital tracts

# Connective Tissue Proper

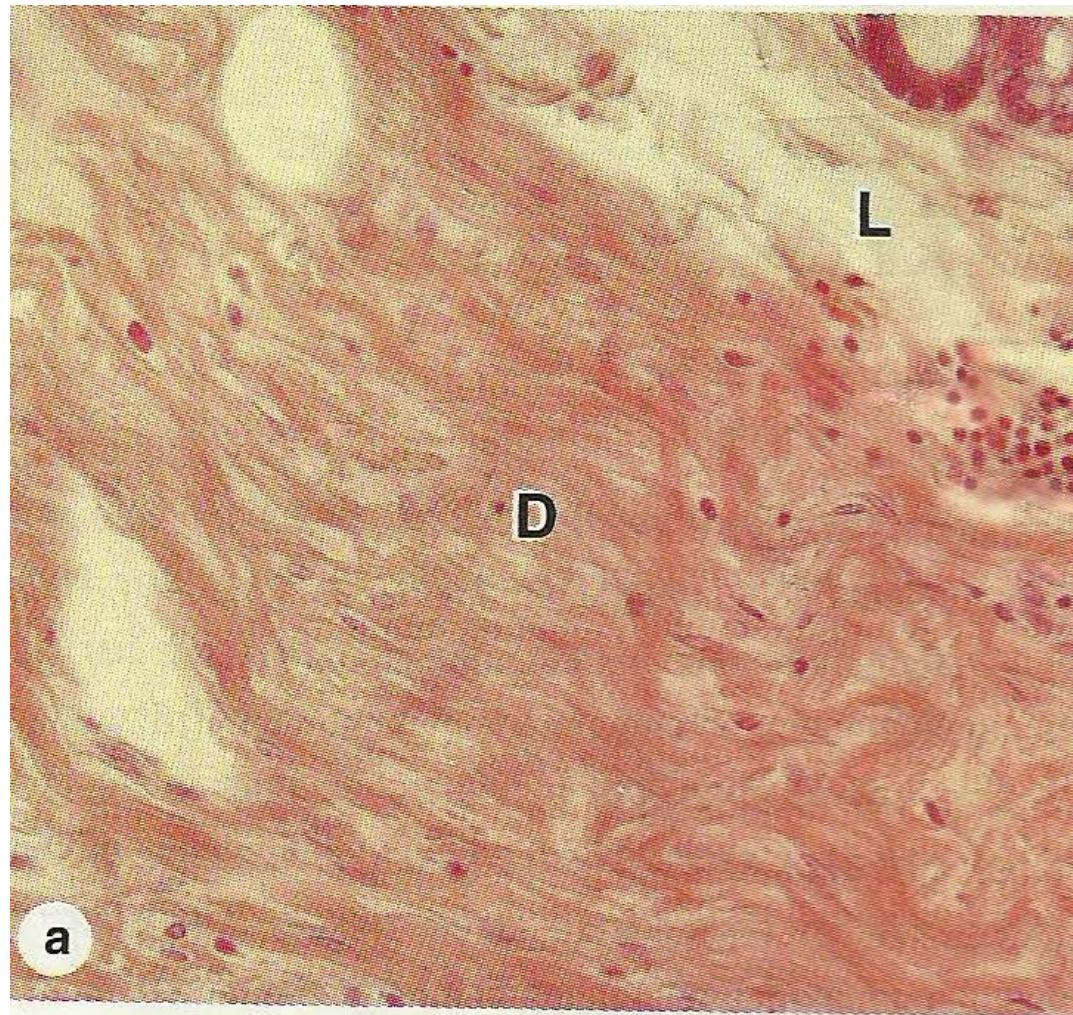
## 2. Dense Irregular Connective Tissue

- little ground substance
- few fibroblasts
- collagen arranged randomly
- dermis, organ capsules, submucosa of digestive tract

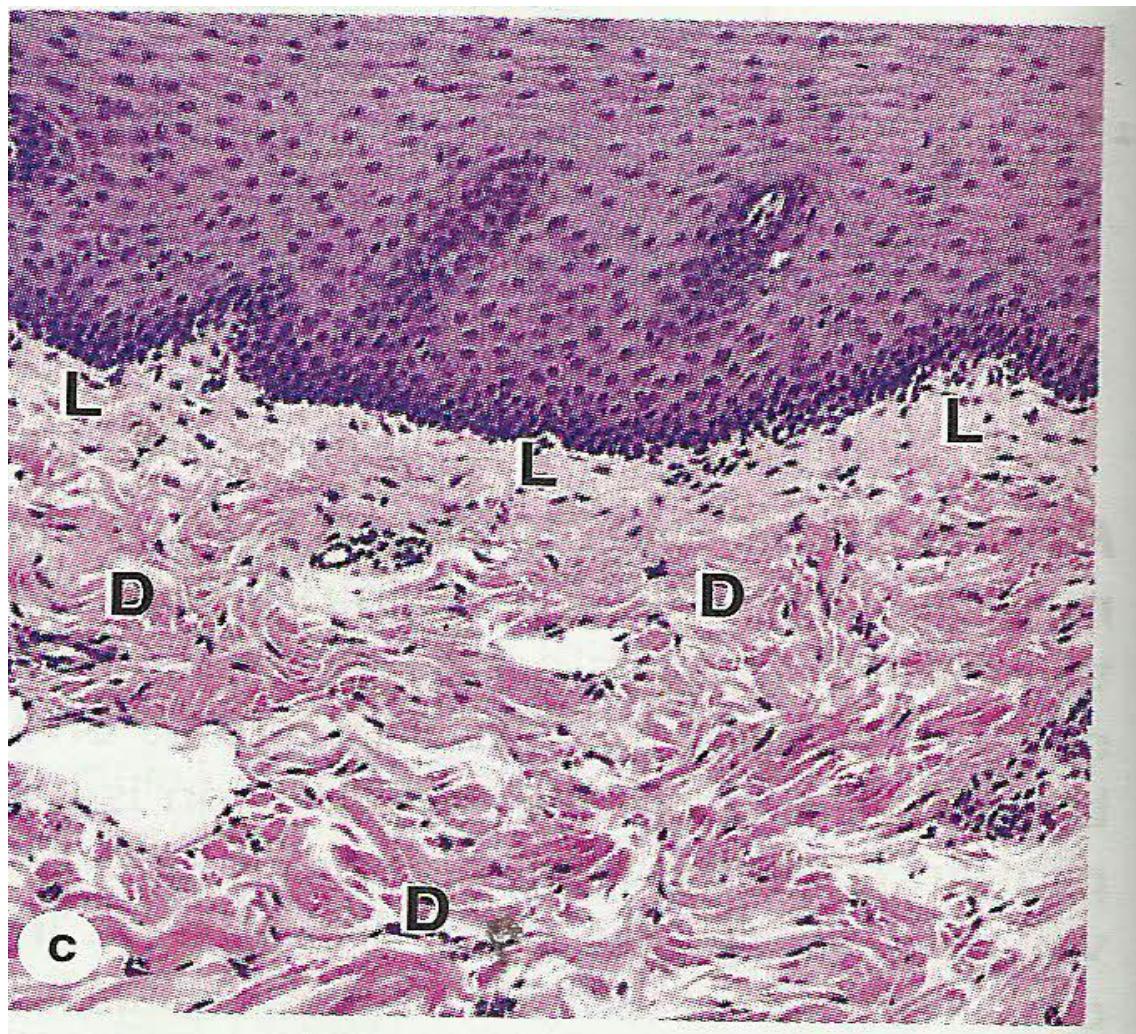
## 3. Dense Regular Connective Tissue

- parallel bundles of collagen, few fibroblasts
- ligaments, tendons, aponeurosis

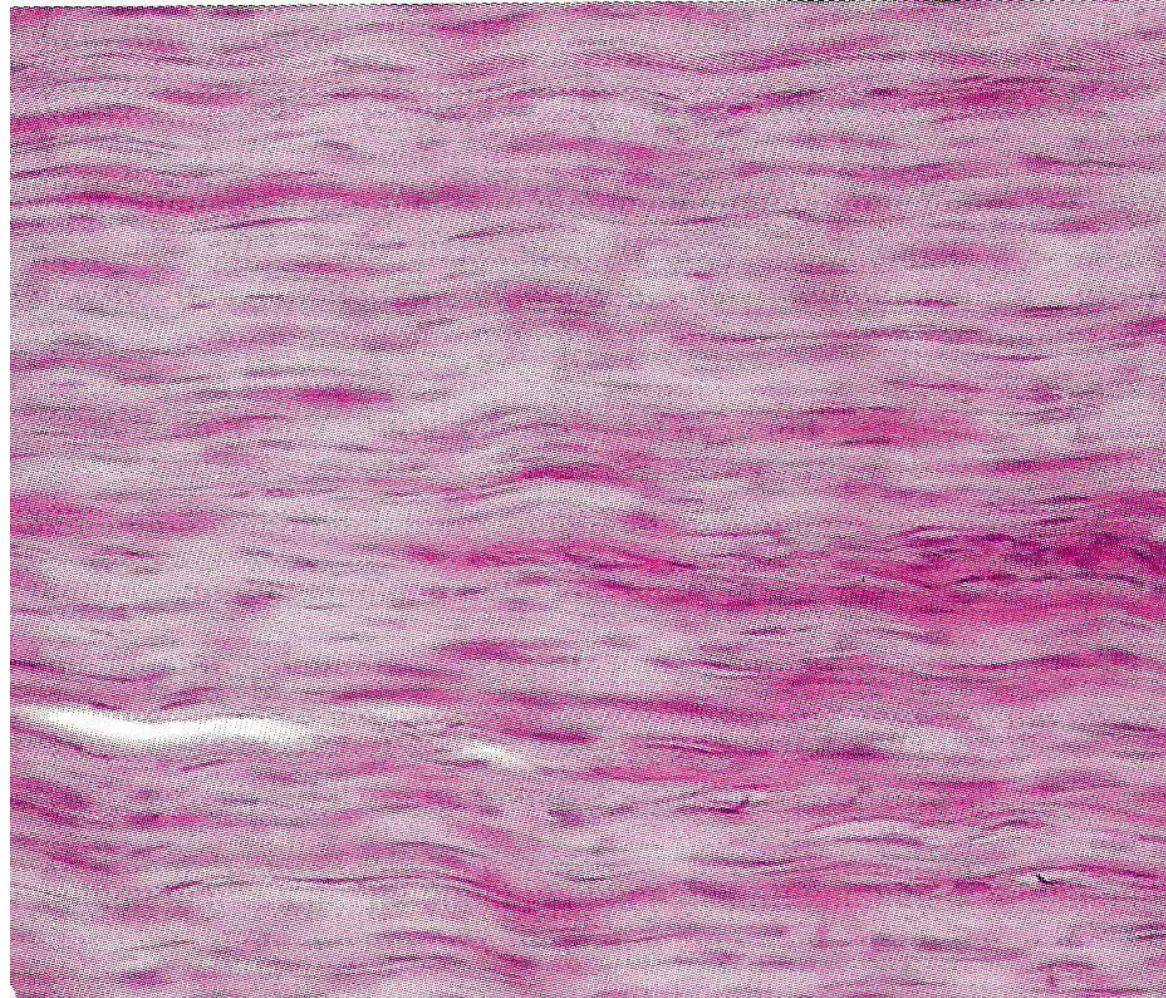
# Dense Irregular Connective Tissue



# Dense Irregular Connective Tissue



# Dense Regular Connective Tissue



## B. Embryonic Connective Tissue

### 1. Mesenchyme

- sparse undifferentiated cells, uniformly distributed matrix with sparse collagen
- found in mesodermal layer of embryo

### 2. Mucoid Connective Tissue

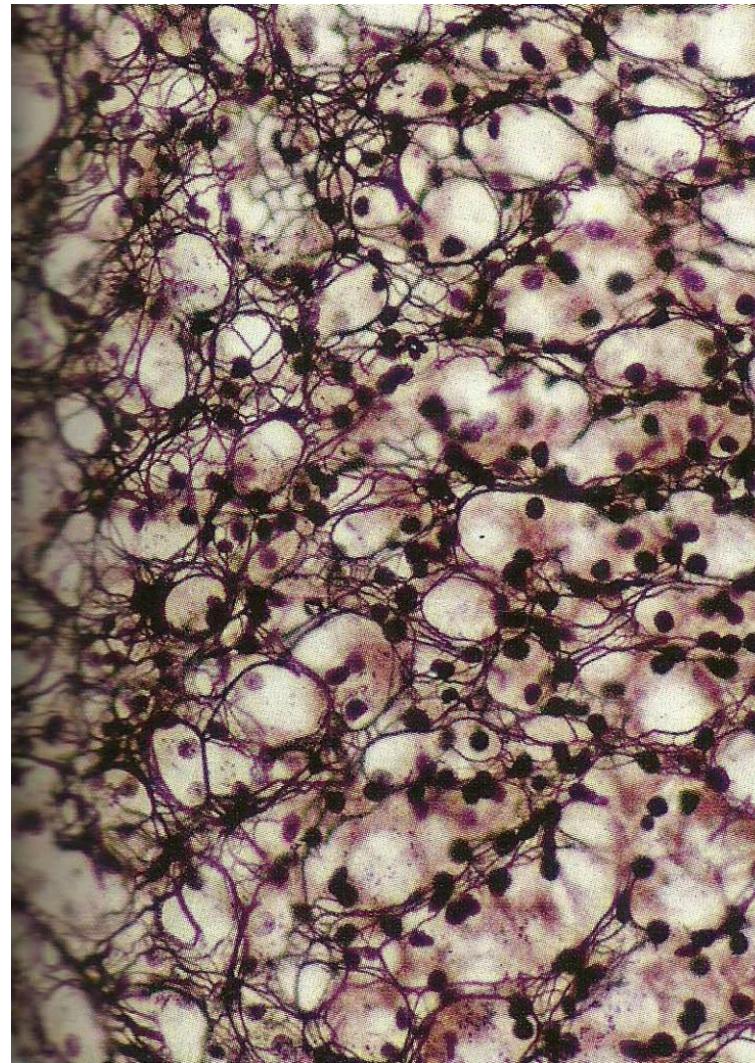
- random fibroblasts and collagen fibers in viscous matrix
- umbilical cord

# C. Specialized Connective Tissue

## 1. Reticular Connective Tissue

- with reticulin fibers (Collagen III)  
with fibroblasts
- bone marrow, liver, pancreas, adrenals,  
lymphoid organs

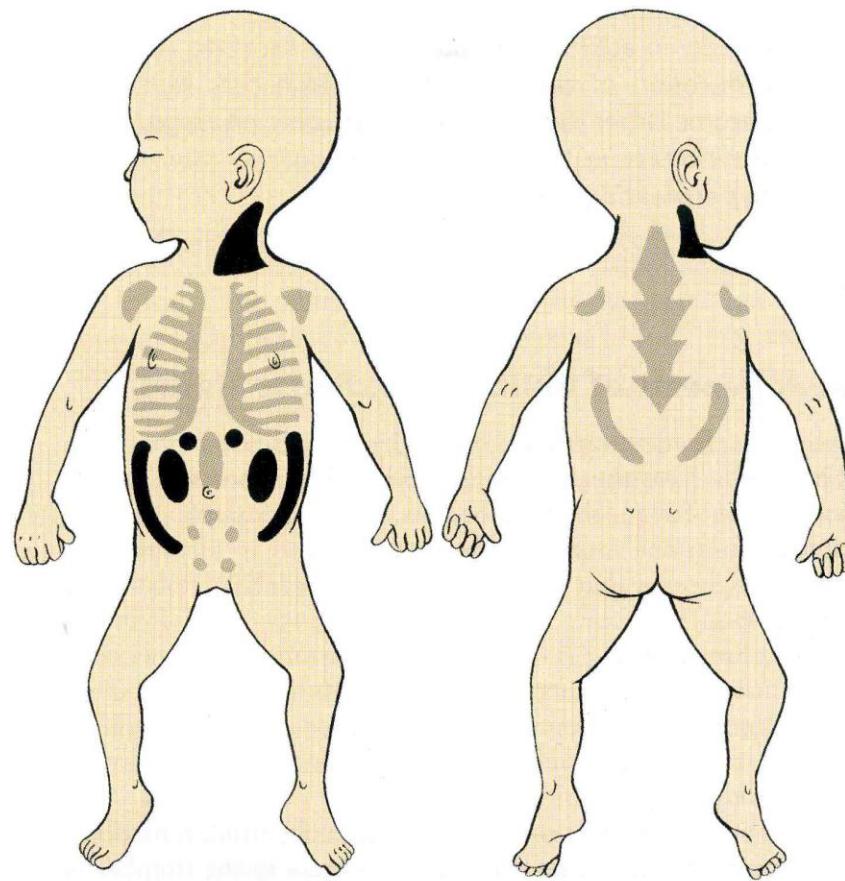
# Reticular Connective Tissue



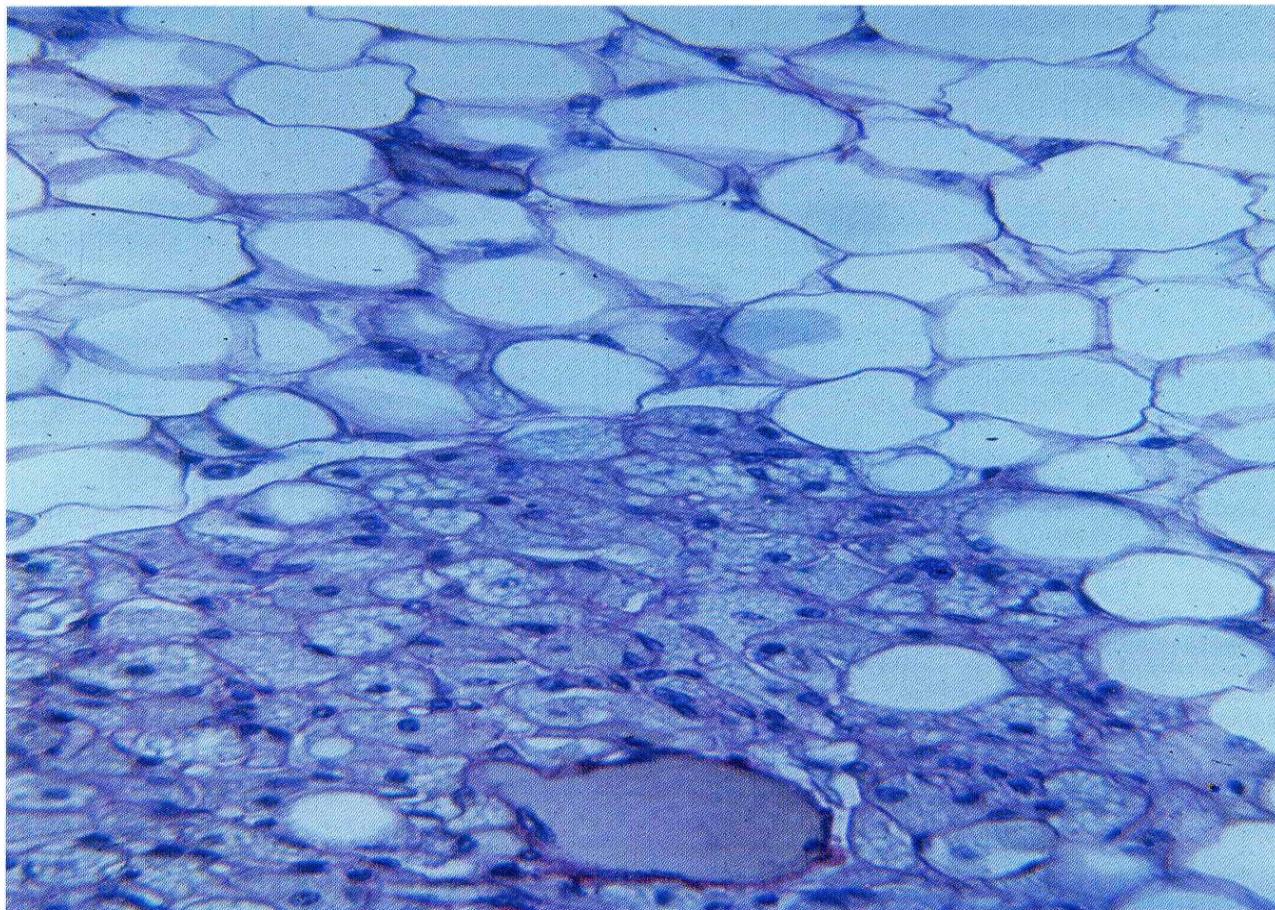
## 2. Adipose Tissue

- largest energy storage site; thermal insulator; shock absorber (around kidneys & soles of feet)
- 2 forms:
  - a. Yellow(white)- single fat vacoule
  - b. Brown – numerous droplets; richly supplied with mitochondria
    - ↓ in # with age
    - in NB, in the neck & back-
    - 2-5% of body weight

# Distribution of brown adipose tissue:

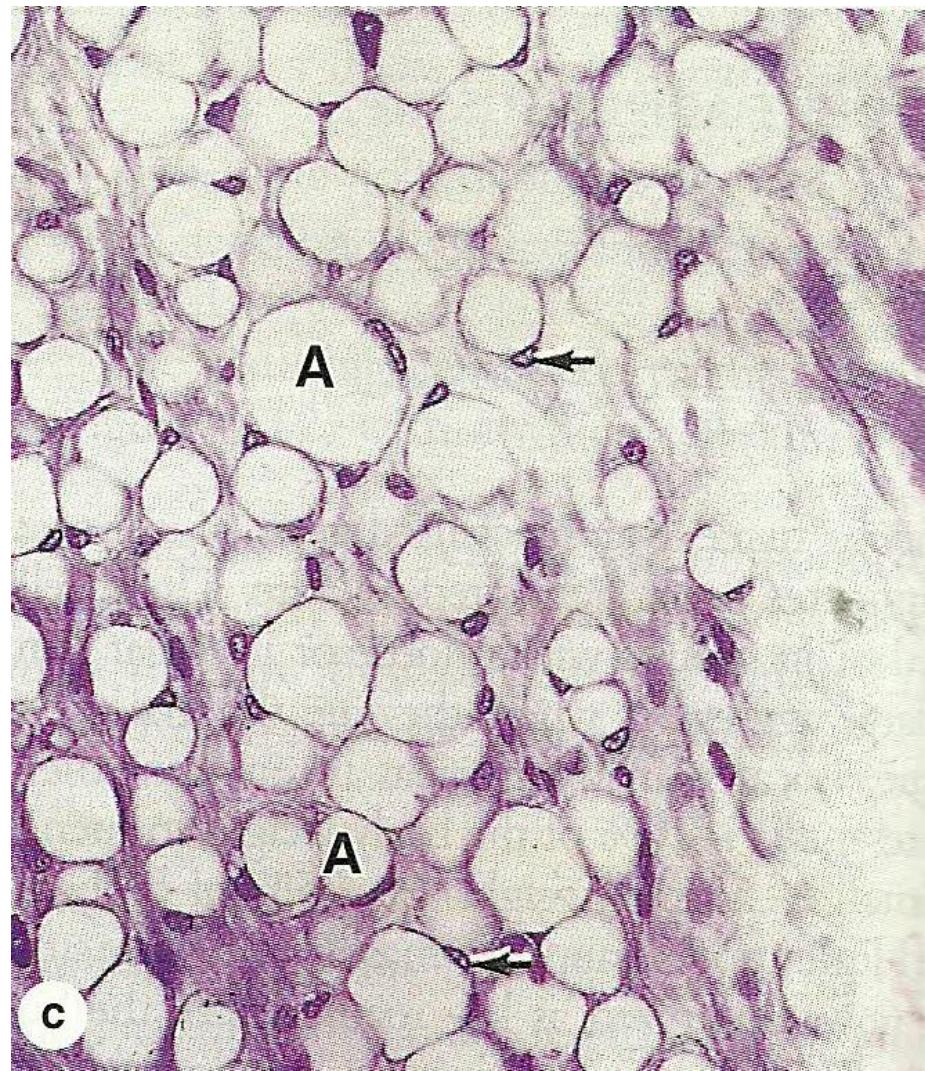


# Adipose Connective Tissue

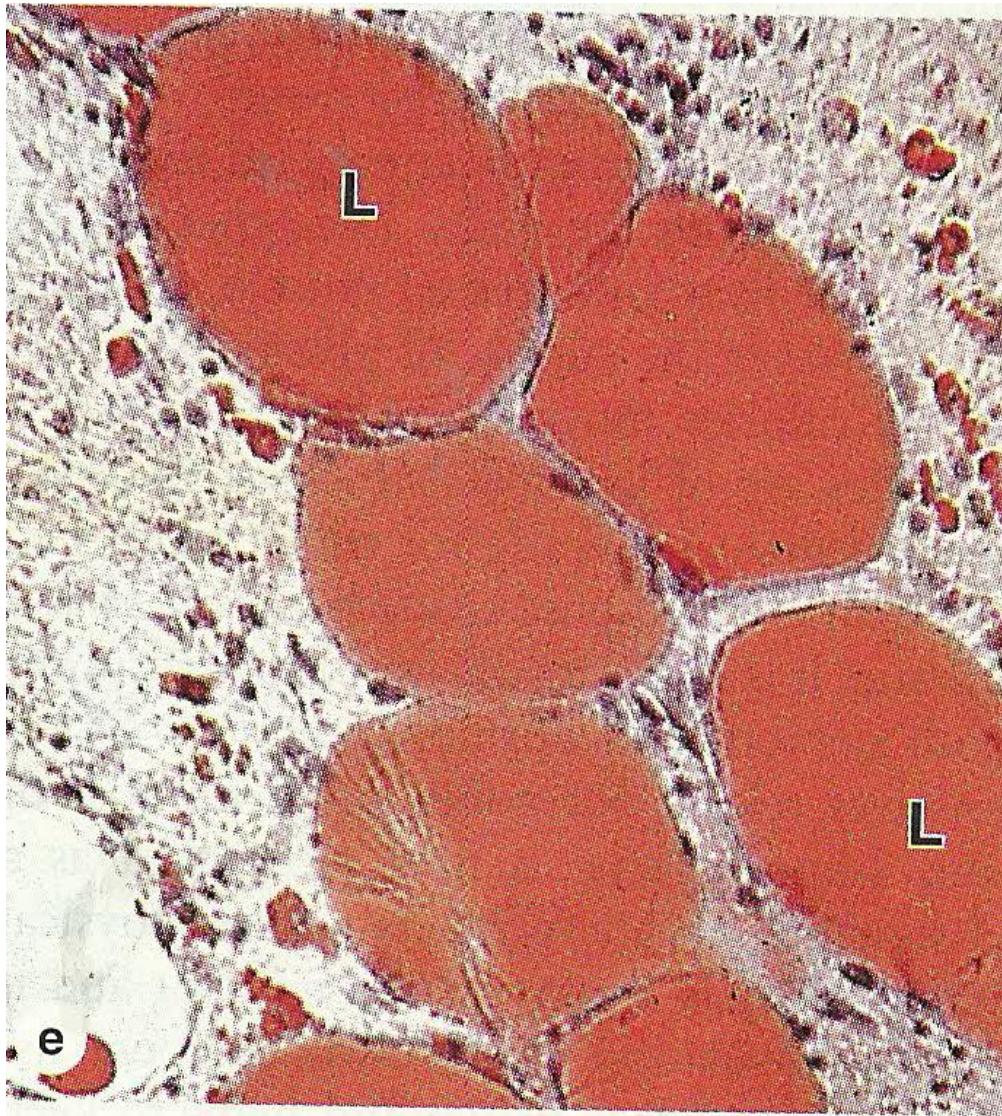


**Figure 6–5.** Photomicrograph of multilocular adipose tissue (lower portion) with its characteristic cells containing central spherical nuclei and multiple lipid droplets. For comparison, the upper part of the photomicrograph shows unilocular tissue. PT stain. Medium magnification.

# Adipose Connective Tissue



# Adipose Connective Tissue



# Adipose Connective Tissue

