

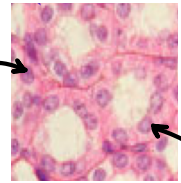
# Simple Epithelium

Simple = 1

(one row)  
 > Simple Squamous: flat & scale-like.



> Simple Cuboidal: cube-shaped



space

> Simple Columnar: tall & elongated

Ciliated: bronchi, uterine tubes, uterus

Non-ciliated: digestive tract and bladder



nuclei is

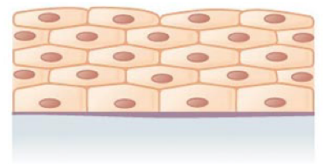


# Stratified Epithelium

> Stratified Squamous

- Protection against abrasion
- Keratinized: epidermis
- Non-keratinized: mouth, esophagus

full of keratin, no nucleus in epidermis

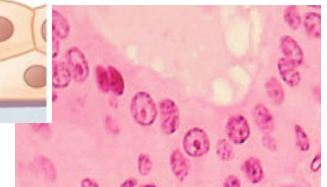
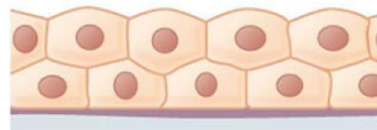


Stratified squamous epithelium

> Stratified cuboidal

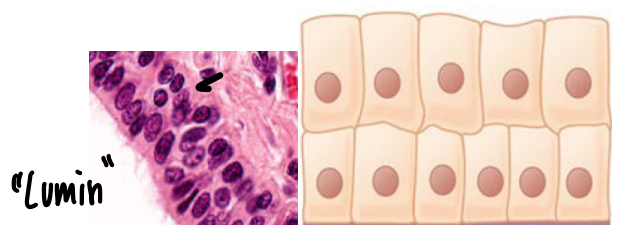
Protection

Sweat, salivary, and mammary glands



> Stratified Columnar

- Some protection, absorption, and secretion
- Ducts of certain glands, Cornea, parts of male urethra



"Lumen"

stacked nucleus

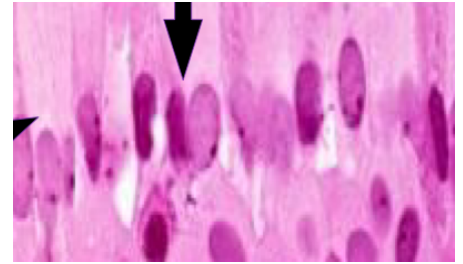
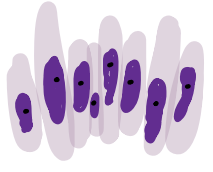


★ Always name "top" cell

# Specialized Epithelium

> Pseudostratified Columnar: appears to be stratified but actually has a single layer of irregularly shaped and diff. sized cells.

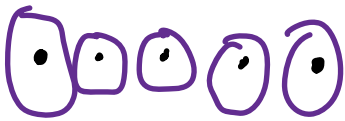
[in trachea]



- Ciliated: secretion and movement of mucous
  1. Lines most of the trachea and respiratory tract
- Non-ciliated: secretion
  2. Prostate

\* All attach to basement membrane

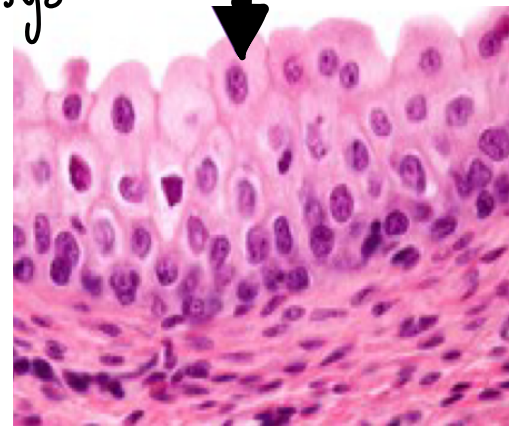
> Transitional: appears stratified squamous when stretched, and appears stratified cuboidal when relaxed.



- Allows for structures to expand and contract
- Appear stratified squamous when stretched
- Appear stratified cuboidal when relaxed
- Almost exclusively found in the bladder, uterus, and urethra

→ only in the urinary system

relaxed state

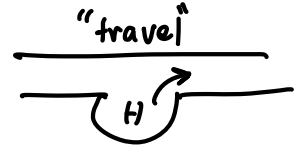


# Glandular Epithelium

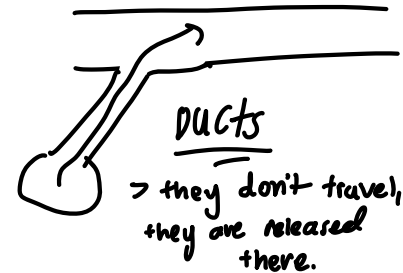
## • Gland

- Structure made of one or more cells modified to synthesize and secrete chemical substances
- Formed by an ingrowth of epithelial tissue
- Two functional groups

1. **Endocrine** – secrete **hormones** directly into the blood or lymphatic vessels
  - Targets organs far from site of release
  - Pituitary, thymus, adrenal cortex, and gonads
2. **Exocrine** – secrete product onto an epithelial surface via **ducts**
  - Local activity
  - Salivary glands, sweat glands, oil glands, mammary glands, liver



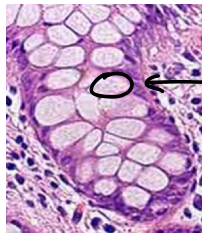
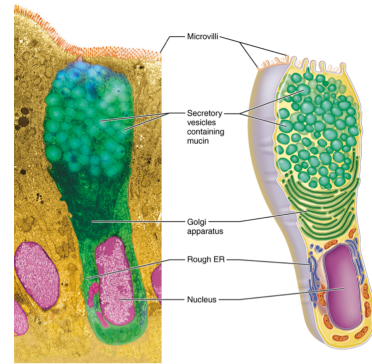
"duct-less"  
 > Goes to target organ



★ know the difference!

## • Unicellular Exocrine Glands

- Scattered throughout epithelial lining of intestines and respiratory tubes
- **Goblet cells produce mucin** → form of sugar
  1. Glycoprotein (sugar) that dissolves in water when secreted
  2. Mucin + water = mucus
  3. Covers, protects, and lubricates many internal body surfaces



Goblet cells w/ mucin storage.

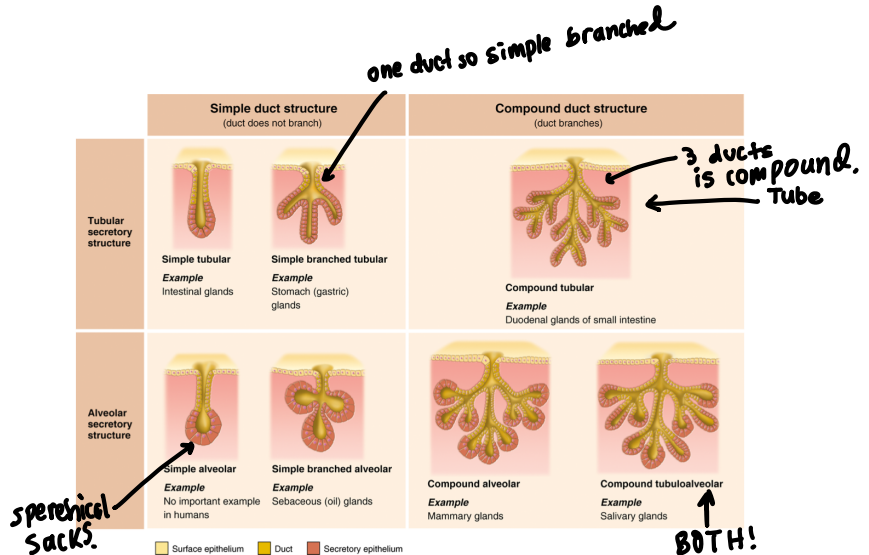
## • Multicellular Exocrine Glands

- Two basic parts

1. **Epithelium-walled duct**
  - Classified by structure of their ducts
  - ① - **Simple**: unbranched duct
  - ② - **Compound**: branched duct
2. **Secretory unit**
  - Classified by structure of secretory unit

Based off shape!

- **Tubular**: tube like
- **Alveolar**: spherical sacs
- **Tubuloalveolar**: both



BOTH!

# • Exocrine Glands

## - Merocrine

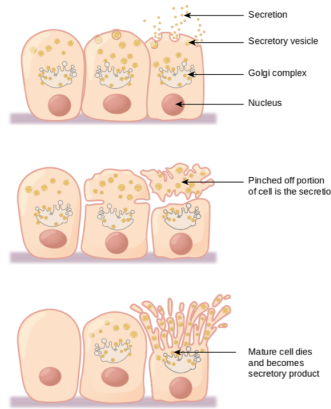
1. Utilization of exocytosis

## - Apocrine

2. Budding of cell membrane

## - Holocrine

3. Entire cell disintegration



to release substances

★ comes off & goes where it needs to.

★ whole cell dies & releases all substance inside.

# Lateral Surface Features

- **Cell junctions:** allow varying degrees of interaction between cells

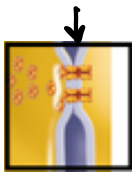
1. Tight junctions — found near top.
2. Anchoring junctions
3. Gap junctions

> Prevents things going inbetween cells

creates a "seal"

> keeps th cells together

Be able to describe



> provides space so that cells can communicate w/ one another

lateral surface of epi cells.

# • Basal Surface Features

## - Basement membrane

1. **Basal lamina:** supporting sheet between the epithelium and the connective tissue deep to it
  - Acts as a selective filter as well as scaffolding
2. **Reticular layers**

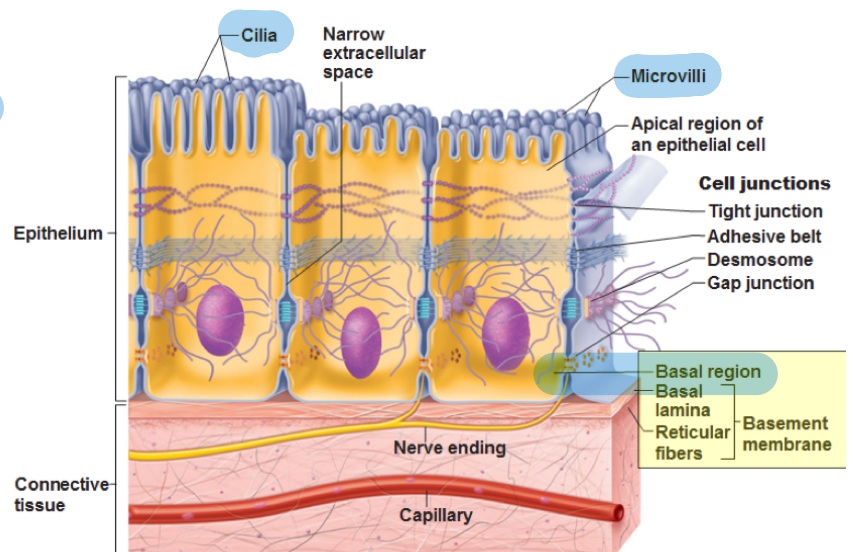
# • Apical Surface Features

- **Microvilli:** fingerlike extensions of the plasma membrane

1. Increase surface area across which small molecules enter or leave

- **Cilia:** whiplike, highly motile extensions (conveyor belt)

2. Propel substances along epithelial surfaces



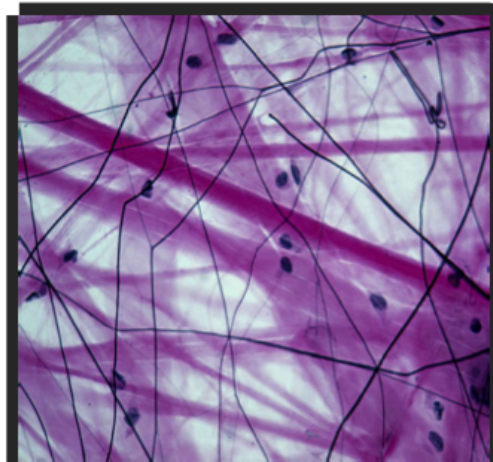
# Connective Tissue

- Support and connect other tissues
- Few cells but large amounts of **extra cellular matrix**

- Important functions

- Form basis of the skeleton
- Store and carry nutrients
- Surround blood vessels, nerves, and organs
- Lead fight against infection

few cells, ton of other stuff



- **Cells**

- Produce the extracellular matrix (ECM)

- **Protein Fibers**

- Provide structural support and function depends on type of tissue

- **Ground Substance**

- Viscous gel-like substance composed of water and large organic molecules

$$ECM = PF + GS$$

blasts = produce something

- Cell Types

- **Fibroblasts**

1. Principle cells of connective tissue
2. Produce the protein fibers and ground substance
3. **Fibrocyte**: maintain matrix

- **Chondroblasts**

4. Produce the matrix of cartilages

5. **Chondrocyte**: maintain matrix

→ protein fibers & ground substance (water)  
→ everything but cell

- **Osteoblasts**

6. Produce the matrix of bones
7. **Osteocyte**: maintain matrix

## Cell Types

- **Mesenchymal**

1. Stem cell that may differentiate into any type of connective tissue cells

- **Adipocyte**

2. Store lipids/fat

- **Macrophage**

3. Engulf foreign debris

## Fiber Types

- **Collagen** - 'lighter'

1. Provides great tensile strength to tissues
  - Resist stretching to the point of breakage
2. Tendon, ligament, etc.

- **Elastic**

3. Mostly composed of **elastin**
4. Allows tissue to stretch but then return to original state
5. Skin

- **Reticular**

6. Form supporting "nets" within connective tissue
7. Liver, bone marrow, etc.

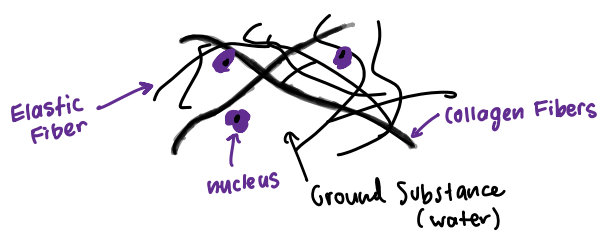
→ Blood

# Loose Connective Tissue

(very spread out)

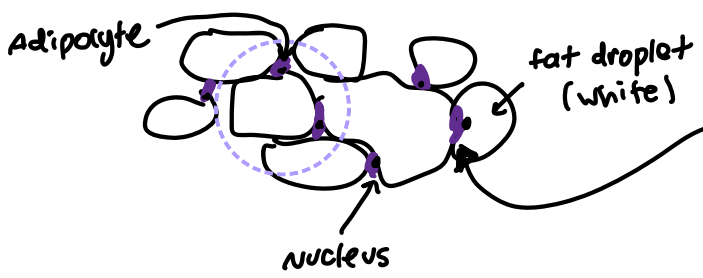
## ① Areolar connective Tissue :

- Equal amounts of cells, fibers, and ground substance
- Little specialization
- Very common and found throughout body
  1. Between muscle fibers, surrounds blood vessels, supports organs, underlies epithelia



## ② Adipose Connective Tissue :

- Specialized to store lipids or fat
  1. Energy storage
- **Adipocytes** contain large cytoplasm filled with fat
  2. Nucleus pushed to edge
- Very little ECM
- Richly vascularized
- Provides protection, cushioning, and insulation



# Dense Connective Tissue

(compacted together)

## Comparison to Loose CT

- More collagen fibers
- Fewer cells
- Densely packed ECM

Resists strong pulling forces

## Dense Regular CT

← Tissue fibers are parallel

1. Mostly collagen fibers
- Great tensile strength
  - Poorly vascularized
  - Tendons and Ligaments

No room for blood vessels.



- Dense Regular CT
  - Dense Regular **Collagenous** CT



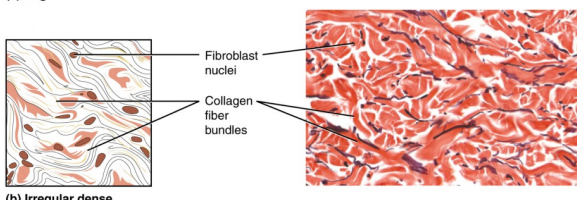
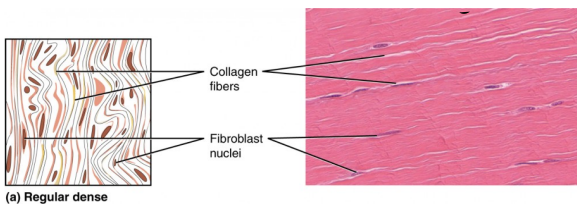
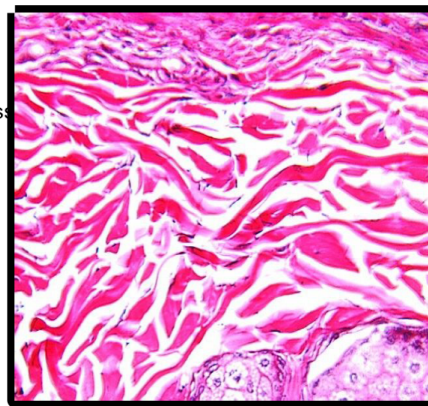
Going the same way

- Dense Regular **Elastic** CT
  1. Contains elastic as well as collagen fibers
  2. Vocal folds and between vertebrae



## Dense Irregular CT

- Tissue fibers randomly interwoven
  1. Greater strength in all directions but less resistant in one direction
- Dense Irregular **Collagenous** CT
  2. Dermis of the skin
- Dense Irregular **Elastic** CT
  3. Arterial walls
    - Elastic fibers allow for greater recoil



↳ Both dense, but one is reg and other is irregular

# Supportive Connective Tissue

## Cartilage and Bone

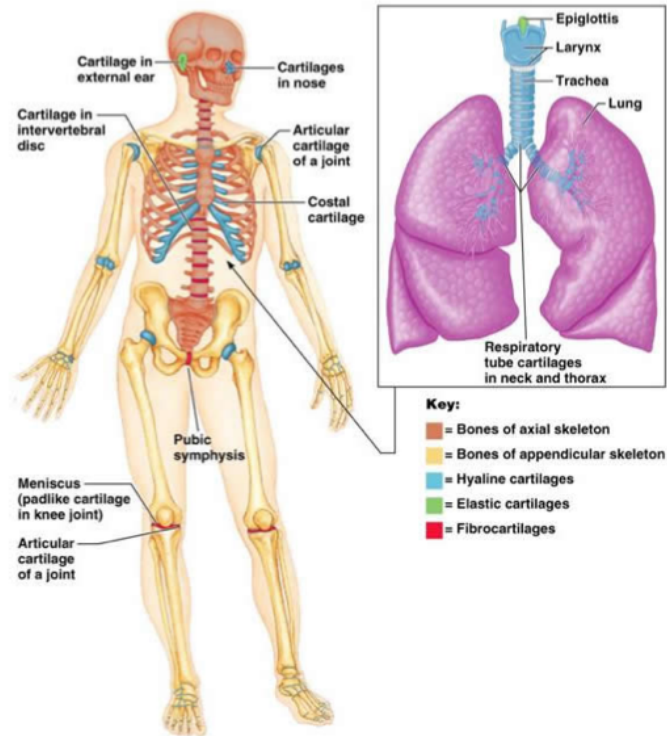
- Allow body to maintain posture and protect internal organs

## • Three Types

- Hyaline
- Elastic
- Fibrocartilage

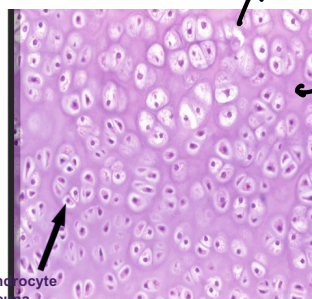
## • Share similar structural components

- Firm and flexible
- No blood vessels or nerves
- Gel-like matrix
- **Chondroblasts** and **Chondrocytes**
- **Lacunae**: cavities for cells in the ECM



## • Hyaline Cartilage

- Most common type
- Found in
  1. Fetal skeleton, sternal ends of ribs, nose, trachea, larynx
  2. **Articular Cartilage**: ends of long bones
- Rich in collagen
- 3. Support and flexibility

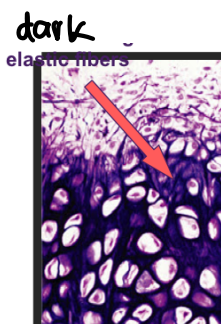


← purp is ECM

★ Collagen have no bundles

## Elastic Cartilage

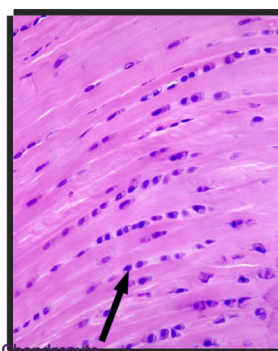
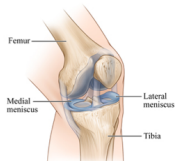
- Contain elastic fibers
- Ridged support and elasticity
  1. Maintain shape after stretching
- Epiglottis and external ear



★ dark cartilage

## • Fibrocartilage

- Contain thick bundles of collagen fibers
- Tough, high tensile strength, ability to absorb compressive shock
- Intervertebral discs, pubic symphysis, menisci of knee



"Shock Absorber."

★ no blood vessels

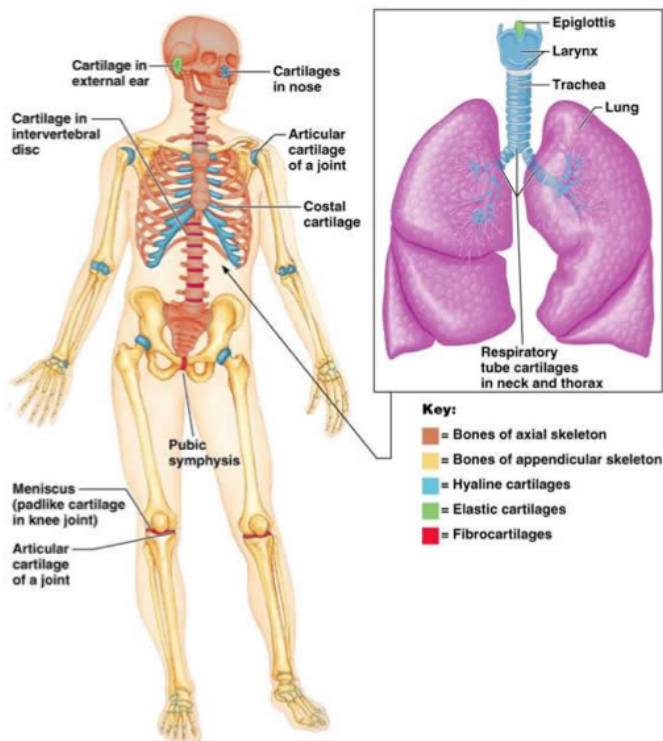
★ bundles!

Fibrocartilage: contains thick bundles collagen fibers.



# Bone

- Toughest **connective Tissue**
- Comprises the body skeleton
  - Structure and protects internal organs
- Structure
  - **Ridged ECM**
  - **Mostly collagen fibers**
  - Mineralized ground substance
  - **Osteoblasts and Osteocytes**
- Two Types
  - Compact Bone
  - Trabecular/Cancellous Bone



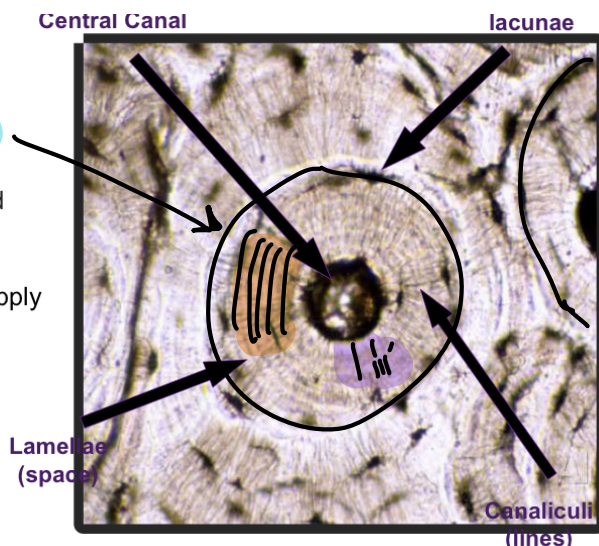
## Bone

★ Identify 4 things

(Circle)

### • Compact Bone

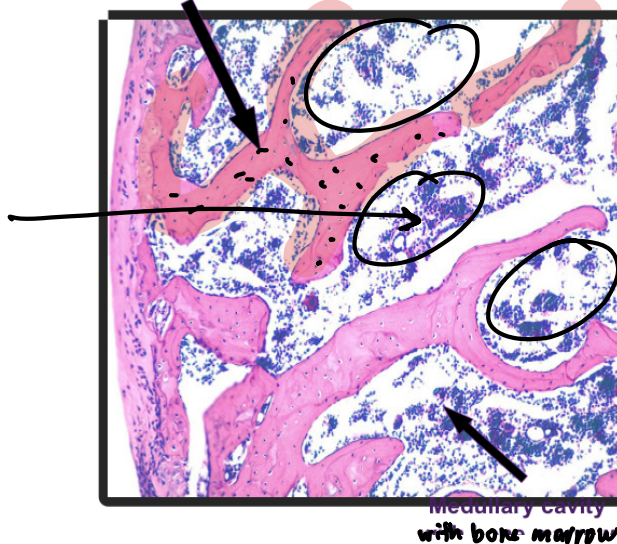
- Consists of repeating **Osteons**
  1. **Lacunae**: housing
  2. **Lamellae**: concentrically arranged matrix **(Lines)**
  3. **Canaliculi**: connecting channels
  4. **Central Canal**: allow for blood supply



trabeculae w/ lacuna & osteocytes

★ Know!

- **Trabecular Bone**
  - "Spongy" → bone
  - **Trabeculae**: mesh network of thin plates of bones
    1. **Medullary cavity**: location of bone marrow
  - Lighter and less structural strength compared to compact bone
  - Interior and ends of bones



# Fluid Connective Tissue

- Blood and lymph
- **Blood** Composed of various cells
  - ✱ - **Erythrocytes**: red blood cells
    1. Carry respiratory gases
  - ✱ - **Leukocytes**: white blood cells
    2. Role in immunity
  - ✱ - **Thrombocytes**: platelets
    3. Formation of blood clots
- **Plasma**: liquid ECM

