Histology

- Complements study of gross anatomy
- Tissues are groups of cells with common and related functions.
- Primary tissue types:
  - Epithelial (covering), Connective (support), Muscle (movement), Neural (control).

Epithelial Tissue

- Occurs in the body as:
  - Covering, lining, glandular epithelium
- Functions include:
  - Protection, absorption, filtration, secretion.

Epithelial Tissue Characteristics

- Composed of close packed cells; tiny amount of extra-cellular material in narrow spaces between them.
- Specialized contacts - Form continuous sheets; junctions.
- Apical surface, lateral, base
Epithelial Classification

• **Number of layers:** Simple (single cell) layer for absorption, filtration, & thin barrier. Stratified (two or more) layers common in high abrasion areas.

• **Shape:** Squamous, Cuboidal, Columnar (nuclear shape conforms to cell shape)

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**Simple Epithelia**

• **Simple Squamous:** Cells laterally flattened; located in areas of filtration/rapid diffusion.
  
  *Endothelial lining* provides frictionless lining; blood vessels/heart chambers.
  
  *Mesothelial* epithelium found lining organs.

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**Simple Epithelia (cont’d)**

• **Simple Cuboidal:** Spherical nuclei; absorption & secretion; kidney tubules and secretory ducts.

• **Simple Columnar:** Single layer of tall cells aligned in rows; some have cilia; absorption & secretion.

• **Pseudostratified Columnar:** Cells vary in height; absorption & secretion; trachea.
**Stratified Epithelia**

- **Stratified Squamous**: Most widespread (in areas of wear and tear); superficial cells less viable than deep cells; epidermis is keratinized, other areas non-keratinized.

- **Stratified Columnar**: Rare tissue; forms large gland ducts and male urethra.

- **Transitional**: Basal cells are cuboidal/cylindrical, apical cells vary in shape according to distension of organ; urinary bladder.

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**Connective Tissue**

- **Found throughout entire body but never exposed.**

- **Classes**: (1) Connective tissue proper (2) cartilage (3) bone (4) blood.

- **Functions**: (1) binding/support (2) protection (3) insulation (4) transportation.

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**Characteristics of Connective Tissue**

- Have common origin (*mesenchyme*)

- Varying degrees of vascularity (cartilage, dense connective, bone)

- Extracellular matrix: separates *living* from *non-living* material; bears weight, withstands tension, & endures *physical trauma*. 
Ground Substance
Unstructured materials fills space between cells and contains fibers; interstitial fluid, cell adhesion proteins

Fibers:
- **Collagen**: Thick, strong, most abundant; high tensile strength.
- **Elastic**: Long, thin, elastin; where elasticity is needed (skin, lungs, and blood vessel walls).
- **Reticular**: Fine, collagenous fibers; support soft tissues.

Fixed Cells
Fibroblasts, osteoblasts, chondroblasts, macrophages, adipocytes, melanocytes.

Wandering Cells
Free macrophages, mast cells (histamine), microphages (neutro-, eosinophils).

Connective Tissue Proper

Loose Connective Tissue
- **Areolar**: Most widely distributed CT; supports and binds other tissues, reinforces organs, stores nutrients.
- **Adipose**: Adipocytes predominate (90%), oil droplet occupies cell volume displacing nuclei; tissue vascularized; insulation & shock absorber.
DENSE CONNECTIVE TISSUE

**Dense regular**: Parallel collagen fibers/ poorly vascularized; enormous tensile strength; found in tendons, ligaments.

**Dense irregular**: Irregularly arranged collagen fibers, found in dermis, fibrous coverings of kidneys, bones, cartilages, muscles, and nerves.

Supportive Connective Tissue

**Cartilage**

- Chondroitin sulfate
- Withstands tension & compression
- Flexible, avascular and lacks nerve fibers.
- Predominant cell types: chondroblasts, chondrocytes.

**Hyaline Cartilage**

- Most abundant cartilage.
- Chondrocytes (1-10%) of cartilage vol.
- Located in nose, costal cartilages, tracheal rings, larynx, embryonic skeleton, and epiphyseal plates.

**Elastic Cartilage**

- Similar to hyaline; elastin fibers
- External ear and epiglottis
Supportive CT (cont’d)

Fibrocartilage
- Matrix dominated by densely interwoven collagen fibers
- Compressible & tension resistant.
- Intervertebral discs, pubic symphysis, meniscus.

Bone (Osseous tissue)
- Bone matrix similar to cartilage; more collagen fibers & inorganic salts (hydroxyapatites)
- Supports/protects softer tissue; hematopoietic; vascularized
- Osteoblasts, osteocytes

Fluid Connective Tissue
- Blood
- Matrix: H2O, salts, proteins (blood fibers evident during clotting)
- RBCs, leukocytes, platelets
- Transportation

Muscle Tissue
- Highly cellular
- Vascularized
- Myofilaments (actin/myosin)
- Skeletal (striated), cardiac, smooth
**Muscle Tissue (cont’d)**

**Skeletal muscle**
- Striated
- Attached to bones
- Somatic movements
- Large multinucleated myocytes
- Satellite cells-regenerative properties

**Cardiac muscle**
- Exclusive to contractile walls of heart
- Contractions propel blood
- Uninucleate; intercalated discs
- Pacemaker cells establish regular rate of contractions (involuntary)

**Smooth muscle**
- Striations absent
- Spindle shaped/central nucleus.
- GI and urinary tract, uterus, blood vessels.
  - Contract via *pacesetter cells*
Nervous Tissue

**Neurons** - Specialized for conduction; longest cells in body; poor regenerative properties.
- **Soma**
- **Axon**
- **Dendrite**

**Neuroglia** - Supportive framework for neural tissue (regulate interstitial composition & nutrient supply)

Integumentary System

Skin

3 regions
- **Epidermis**
- **Dermis**
- **Hypodermis**
Epidermis

- Keratinized stratified squamous
- 4-5 layers

Cell types
- Keratinocytes
- Melanocytes
- Merkel cells
- Langerhans’ cells

Epidermal layers

- Stratum basale
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum
- Stratum corneum

Dermis

- “Second” skin
- Fibroblasts, macrophages, mast cells, WBCs
- 2 layers: papillary, reticular
- Hypodermis
- Striae
Sweat/sebaceous glands

- Eccrine
- Apocrine
- Ceruminous
- Mammary
- Sebaceous

Nail structure

- Scalelike modification of epidermis
- Eponychium
- Hyponychium

Hair

- Filamentous strands of dead keratinized cells
- Produced by follicles
- Shaft projects from skin
- Root in skin
- Pigmented by melanocytes
- Arrector pili
Hair (cont’d)

• Distribution: entire body except palms, soles, lips, nipples, genitalia regions

• Hair types: vellus, intermediate, terminal