Tissues - groups of cells with similar structures and functions

Four types of tissues:

1. *Epithelial*. . . "covering"
2. *Connective*. . . "support"
3. *Muscle*. . . "movement"
4. *Nerve*. . . "control"

Characteristics of Epithelial Tissue

-lining of the body "tube"
-Highly Cellular – composed almost entirely of cells
-Special contacts –tight junctions, desmosomes, and gap junctions (sometimes all 3 at once!) form continuous sheets
-Polarity – *apical* and *basal* surfaces
-Supported by connective tissue – reticular and basal laminae
-*Avascular* but *innervated* –no blood vessels, supplied by nerve fibers
-*Regenerative* – high rate of cell division (replaces lost cells)

Types of Epithelial Tissue

Simple (unlayered) vs. *Stratified* (layered)
Squamous (squashed) vs. *Cuboidal* (cube-like) vs. *Columnar* (column-like)

1. Simple squamous
2. Simple cuboidal
3. Simple columnar

4. Stratified squamous
5. Stratified cuboidal (rare in body)
6. Stratified columnar (rare in body)
7. Pseudostratified columnar

8. Transitional (mixture cuboidal and dome-shaped)
9. Glandular (secretory)

Epithelium	**Appearance/ Structure**	**Function**	**Found in**
Simple squamous	single layer of disc-like cells; sparse cytoplasm	Diffusion and filtration; formation of slick lining (important in vessels)	alveoli, glomeruli, lymphatic and blood vessels, serosae. . . **places where exchange of substances occurs**

Simple cuboidal	Single layer of cube-like cells	Secretion and absorption	Small glands and kidney tubules
Simple columnar	Single layer of column-like cells; may have cilia	Secretion and absorption, moving substances through passageways	*Ciliated*: small bronchi, uterine tubes, some regions of the uterus *Nonciliated*: Digestive tract and gallbladder lining
Stratified squamous	Multiple layers of disc-like cells; sparse cytoplasm; keratinized and unkeratinized forms	Resists abrasion	*Keratinized*: epidermis *Nonkeratinized*: mouth, esophagus, vagina
Stratified Cuboidal	Multiple layers of cube-like cells	Uncommon; some secretion	Uncommon: some in ducts of large glands
Stratified columnar	Multiple layers of column-like cells	Uncommon	Uncommon: some in male urethra and some transition areas
Pseudostratified columnar	Single layer of uneven columns, almost layered on one another; many have cilia	Secretes and propels mucus	Ciliated: upper respiratory passages Nonciliated: sperm-carrying ducts
Transitional	Layered: basal cells are cuboidal, surface cells are dome shaped	Stretches to permit distension	Urinary system linings
Glandular	one cell (*unicellular*) or multiple cells (*multicellular*) of various shapes	makes and secretes aqueous fluid externally (*exocrine*) or internally (*endocrine*)	Glands (duh) (ex: mammary, sweat, testes and ovaries, oil/sebaceous glands, adrenal, etc.)

Gland – one or more cells specializing in secreting a product

Endocrine Glands (detailed in ch. 16)

-Ductless, produce and secrete hormones

Exocrine Glands

-More numerous
-Secrete externally (onto skin or into body cavities)
-ex: mucous, sweat, oil/*sebaceous*, and salivary glands
-unicellular example: the goblet cell (makes and secretes mucus)
-Multicellular have 2 parts: *duct* and *secretory unit*

Multicellular Exocrine Glands

-Classified according to:
-Structure of their ducts (*simple* or *compound*)
-Structure of secretory units (*tubular*, *alveolar*, or *tubuloalveolar*)
-Mode of secretion
-*Merocrine* secretion – secretion by exocytosis (ex: pancreas, sweat, and salivary glands)
-*Holocrine* secretion – secretion by rupture of gland cells (ex: sebaceous (oil) glands)

Connective Tissue – most abundant tissue; found throughout body

Four Types:
1. *Connective Tissue proper* (soft; binds and resists tension, insulates)
2. *Cartilage* (firm, water-filled; resists compression; cushions & supports)
3. *Bone* (hard; resists compression and tension; supports and protects)
4. *Blood* (fluid; transports nutrients & gasses, enacts immune response)

Characteristics of Connective Tissue

-all types originate from embryonic *mesenchyme*
-most is *highly vascular*, some is *poorly vascularized* or *nonvascular*
-2 parts: nonliving *extracellular matrix* and living *cells*
-proportions of 3 matrix *fibers* largely define structure and function

Structural Elements of Connective Tissue

•*Matrix*

Ground substance – unstructured material that fills the space between cells

Fibers – collagen, elastic, or reticular

•*Cells*

Blasts (ex: Undifferentiated fibroblasts, chondroblasts, osteoblasts, and hematopoietic stem cells) form tissue
Cytes (ex: Mature fibrocytes, chondrocytes, osteocytes, erythrocytes and lymphocytes) maintain tissue

Ground Substance –medium through which nutrients diffuse between blood capillaries and cells; composed of
Interstitial fluid – surrounds cells
Adhesion proteins – fibronectin and laminin; connect cells to matrix
Proteoglycans – protein core w/ attached GAGs; trap H_20

Fibers
Collagen – tough; provides high tensile strength; called "white fibers"
Elastic – long, thin fibers; allow for stretch; called "yellow fibers"
Reticular – very fine collagen fibers; form delicate support networks

Cells
Types:
-*blasts* (**form** connective tissue proper, cartilage, bone, or blood)
-*cytes (***maintain** connective tissue proper, cartilage, bone, or blood)
-misc*:* fat cells, defense cells, platelets, macrophages, and mast cells

Types of Connective Tissue (see table 4.1 on p. 134 and histological plates)

Connective Tissue Proper
Loose
Areolar – widely distributed; has all 3 fiber types; cushions; cells: macrophages, mast cells, some WBCs
Adipose – under skin, around organs; has adipocytes full of triglyceride droplets; stores food, insulates, cushions
Reticular – found in lymph nodes, bone marrow, spleen, has reticular fibers, forms supportive *stroma* for other cells
Dense
Regular – make up tendons, ligaments, aponeuroses; made of parallel collagen and elastin fibers
Irregular – found in dermis, digestive submucosa, joint capsules; made of irregular collagen and elastin fibers; resists tension
Elastic – found in arteries, vertebral column, bronchi; like dense regular tissue w/ more elastin; allows stretch and recoil
Connective Tissue: Cartilage

Hyaline Cartilage – firm, amorphous matrix w/ imperceptible collagen fibers; found in embryonic skeleton, end of long bones, nose, trachea, larynx, btwn ribs; resists compression; cells are chondrocytes in lacunae

Elastic Cartilage – found in external ear and epiglottis; like hyaline, but with more elastin; supports and allows flexibility

Fibrocartilage – found in intervertebral discs, pubic symphisis, discs of knee joint; like hyaline but less firm; resists tension and compression

Connective Tissue: Bone (osseus tissue)

-like cartilage (made of collagen fibers), but hardened by Ca salts
-*Osteocytes* are found in *lacunae* and are well vascularized
-Supports, protects, and provides levers for muscular action
-Stores calcium, minerals, and fat
-Marrow is site of *hematopoesis*
-Compact bone – outer layer of skeletal bone
-Spongy bone – internal layer of skeletal bone; also called cancellous bone

Connective Tissue: Blood

-Red and white cells (RBCs and WBCs) in a fluid matrix (plasma)
-formed in bone tissue, found in blood vessels
- transports respiratory gases, nutrients, and wastes

Epithelial Membranes

Cutaneous – skin
Mucous – lines body cavities open to the exterior (ex: linings of digestive and respiratory tracts)
Serous – moist membranes found in closed ventral body cavity
Ex: parietal and visceral pleura, parietal and visceral pericardium, parietal and visceral peritoneum

Nervous Tissue

-Branched neurons with long cellular processes and support cells
-Transmit electrical signals
-Found in the brain, spinal cord, and peripheral nerves

Muscle Tissue: Skeletal

-Long, cylindrical, multinucleate cells with obvious striations
-Initiates and controls voluntary movement

-Found in skeletal muscles that attach to bones or skin

Muscle Tissue: Cardiac

-Branching, striated, uninucleate cells; interlock at intercalated discs
-Propels blood into circulation
-Found in the walls of the heart

Muscle Tissue: Smooth

- unstriated, spindle-shaped cells with central nuclei
-Propels substances along internal passageways (called *peristalsis*)
-Found in the walls of hollow organs

Tissue Repair

1) Inflammation (immediate response to trauma; non-repairative)
-Dilation of blood vessels
-Increase in vessel permeability
-Redness, heat, swelling, immune response, clotting, and scabbing

2) Organization (1st step in actual tissue repair)
-blood clot is replaced with granulation tissue
-fibroblasts bridge gap w/ collagen fibers
-macrophages clean up
-surface epithelium multiply/migrate/cover up

3) Regeneration and/or fibrosis (permanent repair)
-surface epithelium regenerates
-scab detaches
-fibrous tissue matures; begins to resemble the adjacent tissue
Results in fully regenerated epithelium with underlying scar tissue (hopefully)

Developmental Aspects

-Primary germ layers: ectoderm, mesoderm, and endoderm **(pic p.141)**
-Three layers of cells formed early in embryonic development
-Specialize to form the four primary tissues

1. Epithelial tissues arise from all three germ layers
2. Muscle and connective tissue arise from mesoderm (mesenchyme)
3. Nerve tissue arises from ectoderm