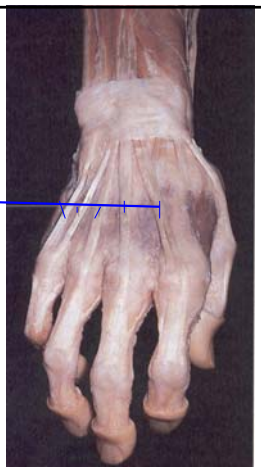
TISSUES

5

Unit One

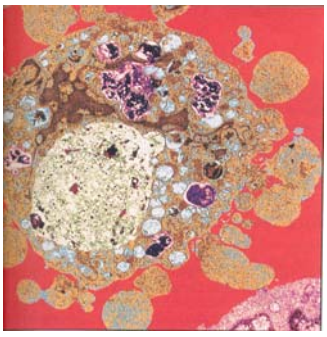
Chapter 5

Karen Webb Smith



Tendons of the hand

The white glistening appearance results from the collagen of which tendons are composed.



A cell undergoing apoptosis (programmed cell death)

I. Introduction

A. Cells are arranged in tissues that provide specific functions for the body.

***tissue cells are separated by intercellular materials (solid, semisolid, or liquid)**
minerals (solids) – separate bone tissue cells
plasma (liquid) – separates blood tissue cells

B. Cells of different tissues are structured differently, which leads to their differences in function.

***4 major types of tissues:**
epithelial, connective, muscle, and nervous

II. Epithelial Tissues

A. General Characteristics

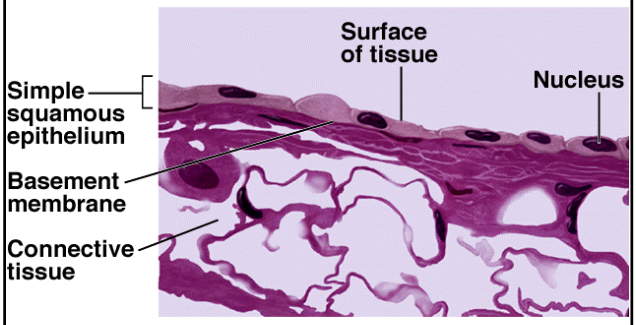
B. *always has a free surface, exposed to outside, or to an open space internally
*underside is anchored to connective tissue by a thin, nonliving layer called basement membrane
*usually no blood vessels, injuries heal quickly
*tightly packed (desmosomes)
*secretion, absorption, and excretion

TYPES: simple – single layer
stratified – 2 or more layers
squamous – thin & flat cells
cuboidal – cube-like cells
columnar – elongated, columnar cells

B. Simple Squamous Epithelium

*single layer of thin, flattened cells, nuclei are broad & thin
*substances pass easily through simple squamous by diffusion and filtration
*lines air sacs (alveoli) of lungs where O2 & CO2 are exchanged
*forms wall of capillaries, lines insides of blood & lymph vessels
*covers (parietal) membranes that line body cavities
*can be easily damaged; it is delicate

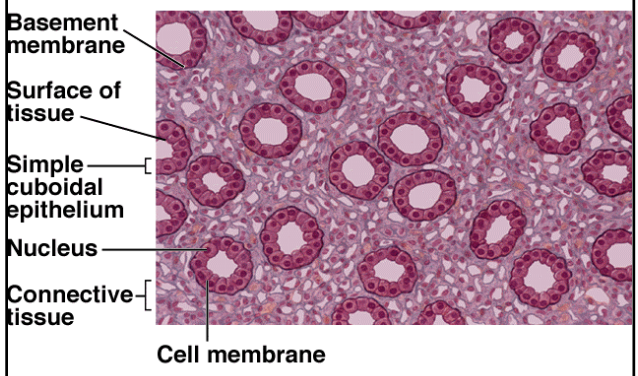
Simple Squamous Epithelium



C. Simple Cuboidal Epithelium

*single layer of cube-shaped cells
*centrally located spherical nuclei
*covers ovaries, lines kidney tubules, lines ducts of some glands (salivary glands), ducts of pancreas and liver
*kidneys – secretion & absorption
*glands – secretes glandular products

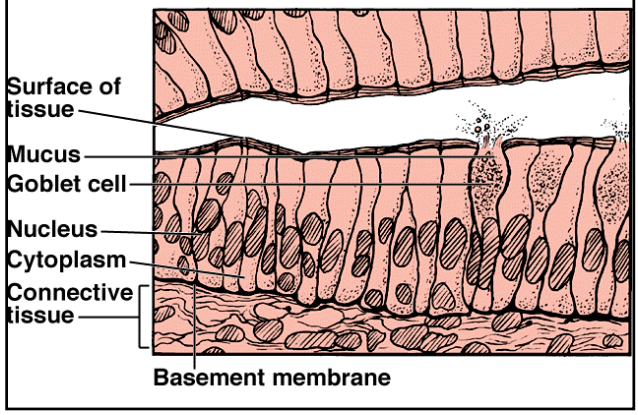
Simple Cuboidal Epithelium



D. Simple Columnar Epithelium

- *elongated cells, single layer, nuclei are level & near the basement membrane
- *lines the uterus, stomach, & intestines
- *tissue is thick so it is protective
- *secretes digestive fluids
- *absorbs nutrients from digested foods
- *microvilli aid in absorption
- *goblet cells (glandular cells) secret mucus onto the tissues

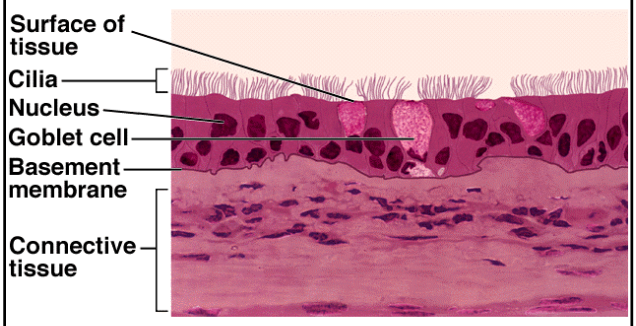
Simple Columnar Epithelium



E. Pseudostratified Columnar Epithelium

- *cells appear layered (stratified), but are not
- *cells reach the basement membrane
- *often are fringed with cilia
- *can have goblet cells (secrete mucus)
- *lines passages of these systems:
  - respiratory – trap dust & microorganisms
  - reproductive – cilia aid in moving egg cells

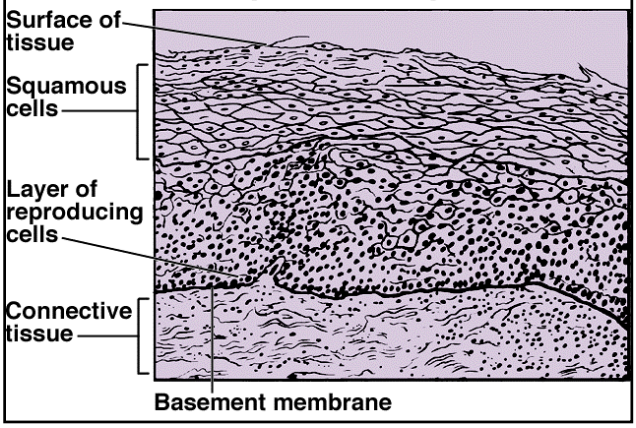
Pseudostratified Columnar Epithelium



F. Stratified Squamous Epithelium

*many layers of cells; relatively thick
*cell reproduction occurs in the deepest layers
*epidermis (outermost layer of skin) is stratified squamous epithelium
*keratinization occurs in outer layers providing skin's protective covering
*lines oral cavity, throat, vagina, & anal canal

Stratified Squamous Epithelium

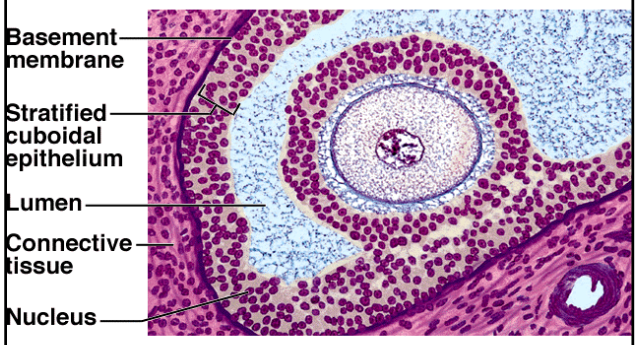


II. Epithelial Tissues

G. Stratified Cuboidal Epithelium

*2-3 layers of cuboidal cells that form the lining of a lumen > good protection
*lines larger ducts of mammary glands, sweat glands, salivary glands, & pancreas
*forms lining of developing ovarian follicles & seminiferous tubules

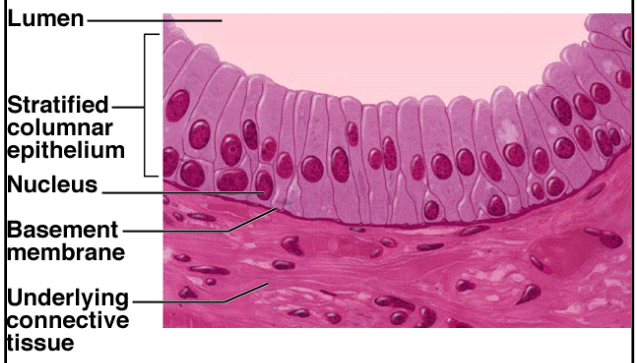
Stratified Cuboidal Epithelium



H. Stratified Columnar Epithelium

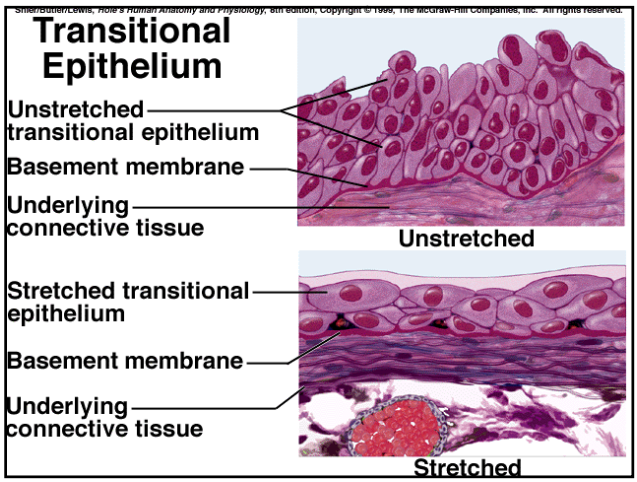
*consists of several layers of cells
*superficial (outer) layers are elongated
*basal layers are cube-shaped
*found in vas deferens, part of male urethra, & in parts of the pharynx

Stratified Columnar Epithelium



I. Transitional Epithelium

*specialized to change when necessary (tension)
*layered cuboidal cells that will stretch
*forms inner lining of urinary bladder
*lines ureters & part of the urethra
*can provide expandable linings (urinary tract contents from diffusing back into the body)



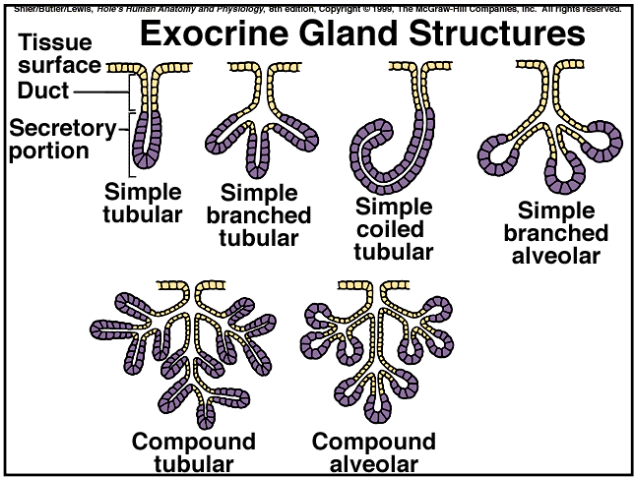
J. Glandular Epithelium

*composed of specialized cells that can produce & secrete substances into ducts or into body fluids
*are found within columnar or cuboidal epithelium

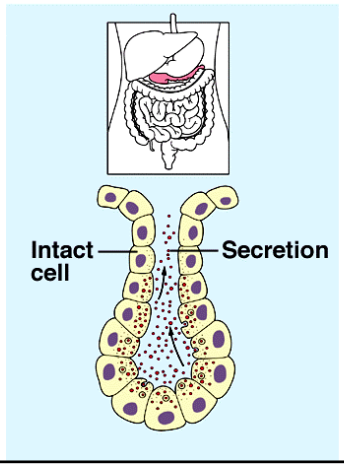
*exocrine glands – secrete products into ducts that open onto an internal/external surface
*endocrine glands – secrete products into tissue fluid or blood

More about exocrine glands:

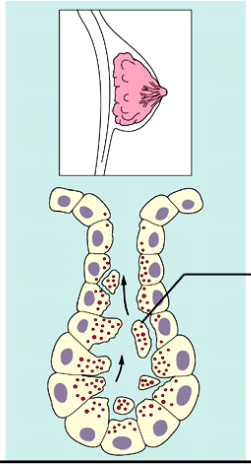
*can be single cell (goblet) or multicellular glands: 2 groups:
1) simple gland – has one duct
2) compound gland – has a branched duct
*tubular glands – epithelial lined tubes terminating in alveolar glands (sac-like dilations)
*can also be classified according to the way they secrete their products:
• merocrine – secrete fluid products by exocytosis
salivary, pancreatic, & sweat glands
•apocrine – lose part of cell itself during secretion
mammary & ceruminous glands (ear canal)
•holocrine – release entire cells - sebaceous glands
-merocrine glands can be serous or mucous cells
-serous fluid – linings of body cavities
-mucous cells secrete a thicker mucus



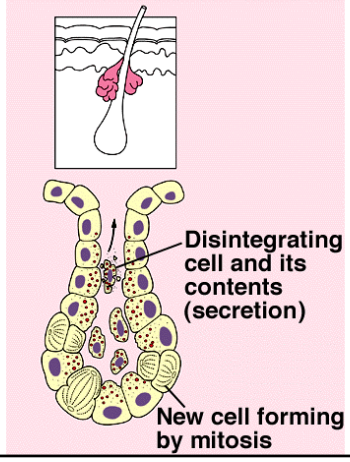
Merocrine Gland



Apocrine Gland



Holocrine Gland



III. Connective Tissues

A. General Characteristics

- *found throughout the body
- *bind, support, protect, fill spaces, store fat, produce blood cells, guard against infections, help repair damaged tissue
- *have intercellular material = matrix
- *matrix – fibers, ground substance from fluid – semisolid – solid
- *cells can reproduce
- *have vascularity = good blood supply; & well nourished
- *bone & cartilage have rigidity
- *loose, adipose, & dense connective tissues are more flexible

B. Major Cell Types : *2 types*

- fixed cells – numerous; include:
  - fibroblasts – most common, large, star-shaped, produce fibers by secreting protein into the matrix of connective tissues
  - mast cells – large, located near blood vessels, release
    - heparin – protein that prevents blood clotting,
    - histamine – promotes reactions associated with inflammation & allergies (asthma & hay fever)
- wandering cells – temporarily appear (injury)
  - macrophages – originate as white blood cells, many, can be attached but can move about, they are specialized to carry on phagocytosis, are scavenger cells & help in immunity

C. Connective Tissue Fibers

*fibroblasts produce 3 types of fibers:

1) collagenous – thick threads of the structural protein collagen, long parallel bundles, great tensile strength, important in ligaments & tendons
   - *dense connective tissue (white) - dense
   - *loose connective tissue – sparse
2) elastic – bundles of microfibrils in elastin, can branch, form networks, found in vocal cords, air passages, & respiratory system, yellow in color
3) reticular – thin, collagenous fibers, many branches, form support networks in many tissues (liver, spleen, & lymphatic organs)

Connective tissue categories:

Proper:

1. loose, dense, adipose, reticular, & elastic

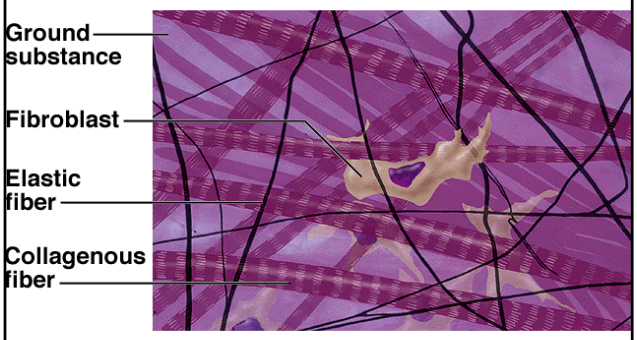
Specialized:

2. cartilage, bone, & blood

D. Loose Connective Tissue

*also called areolar tissue
*forms thin membranes throughout the body
*fibroblasts (cells) are separated by some distance
*fibroblasts are separated by gel-like ground substance that contains many collagenous & elastic fibers which the fibroblasts secrete
*binds organs to skin
*fills areas (spaces) between muscles
*has many blood vessels

Loose Connective Tissue



E. Adipose Tissue

FAT = adipocytes

*form of loose connective tissue

*fat is stored in cytoplasm of adipocytes

*as accumulation of fat occurs adipose tissue is formed

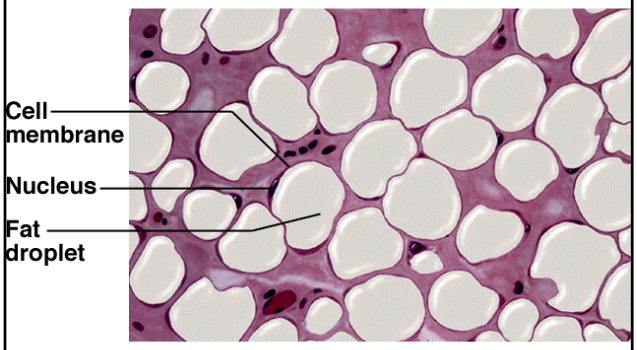
*adipose tissue is found around organs, spaces between muscles, & etc.

*cushions joints, some organs, insulates skin, stores energy in fat molecules

*a person is born with a set # of fat cells

* diet reflects amount of adipose tissue

Adipose Tissue



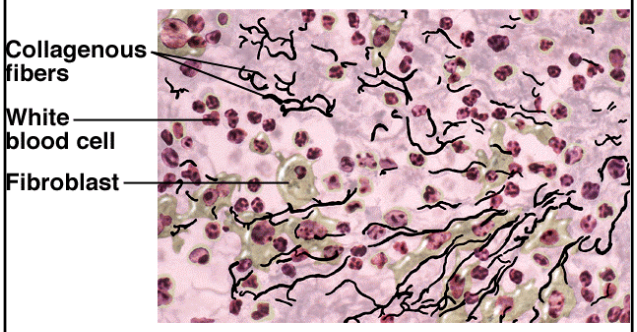
F. Reticular Connective Tissue

*reticular means network

*composed of thin, collagenous fibers in a 3D network

*supports walls of internal organs (liver, spleen, & lymphatic organs)

Reticular Connective Tissue



III. Connective Tissues

G. Dense Connective Tissue

*tightly packed, thick, collagenous fibers, elastic fibers, & some fibroblasts

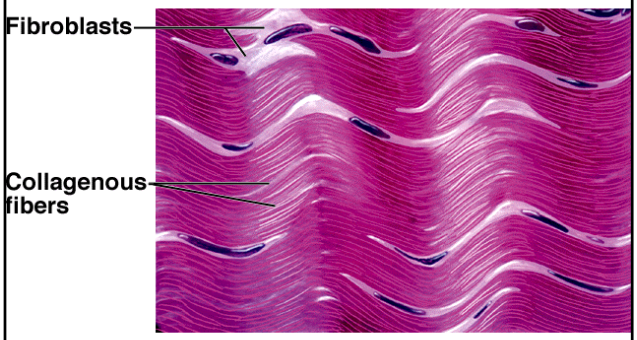
*collagen in this tissue is quite strong; can be pulled

*binds body parts together = tendons & ligaments

*blood supply is poor = so repairs slowly (sprain)

*<u>irregular</u> dense connective tissue fibers are even thicker so tissue can sustain tension; is found in dermis

Dense Connective Tissue



H. <u>Elastic Connective Tissue</u>

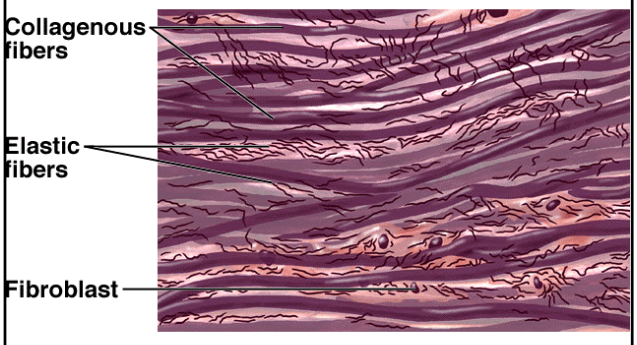
*yellow elastic fibers in parallel strands or in branching networks

*between fibers are collagenous fibers & fibroblasts

*found in attachments between vertebrae

*found in layers of internal hollow organs = larger arteries, portions of heart, & airways that have an elastic quality

Elastic Connective Tissue



I. Cartilage
*rigid for support, attachments, protection, forms models for new bones
*matrix composed of collagenous fibers in gel-like ground substance
*rich in protein-polysaccharide complex + H2O
*chondrocytes (cartilage cells) occupy small chambers called lacunae in matrix
*perichondrium – connective tissue that encloses cartilaginous structures
*cartilage has no blood supply, blood vessels are in the surrounding perichondrium; (so cartilage can get nutrients by diffusion) >torn cartilage heals slowly; chondrocytes do not reproduce often
(continued next slide)

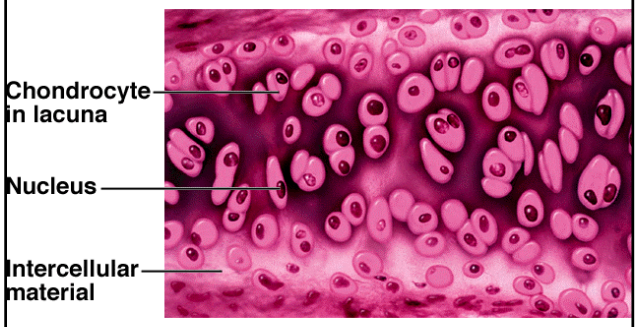
3 types of cartilage:

1. hyaline cartilage – most common, found on ends of bones in joints, soft area of nose, & rings in air passages, parts of embryo's skeleton begins as cartilage, important in bone growth & repair

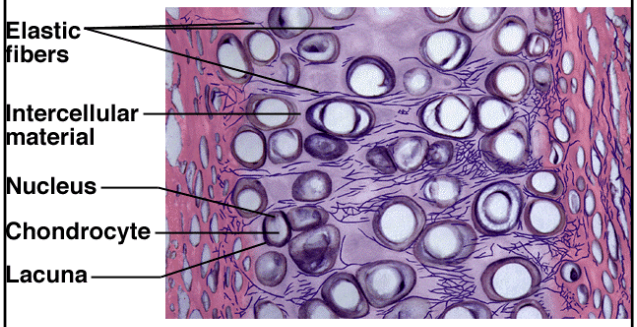
2. elastic cartilage – somewhat flexible, matrix contains many elastic fibers, framework for ears, & parts of the larynx

3. fibrocartilage - tough, contains collagenous fibers, forms pads (disks) between bones in vertebrae, cushions bones in knees & pelvic girdle

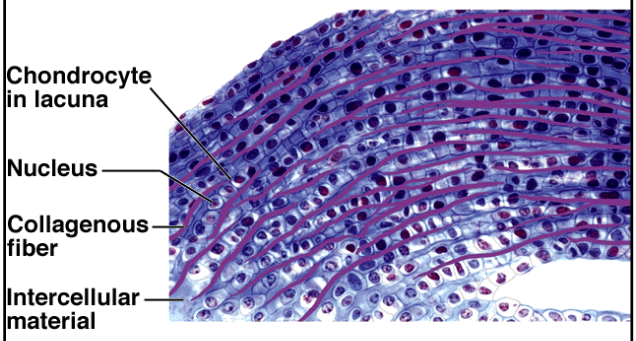
Hyaline Cartilage



Elastic Cartilage



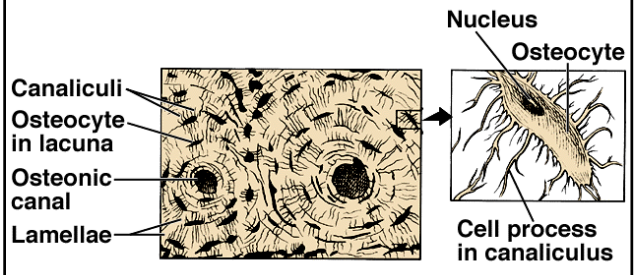
Fibrocartilage



J. Bone (osseous tissue)

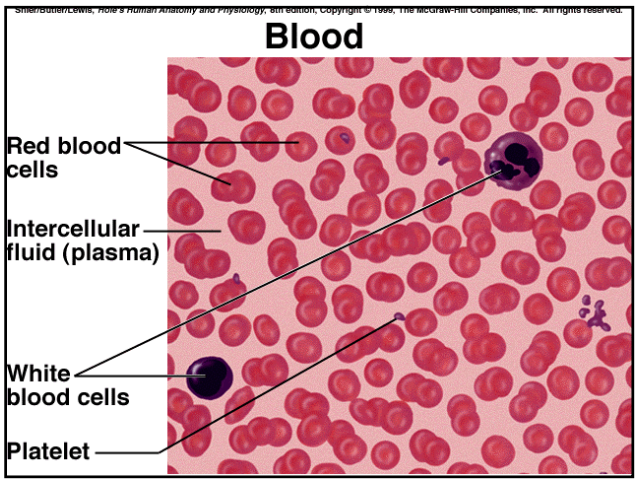
- *hardness due to mineral salts in matrix (Ca phosphate & Ca carbonate), collagenous
- *supportive, protective, attachment for muscles
- *contains red marrow which forms blood cells, stores & releases inorganic salts
- * osteocytes (bone cells) deposit matrix in layers called lamellae around longitudinal tubes called osteonic (Haversian) canals
- *osteocytes found in lacunae; form concentric circles; osteon – Haversian system
- *osteonic canals contain blood vessels
- *canaliculi & gap junctions help move materials

Bone



K. Blood

- *cells suspended in matrix blood plasma
  1. red blood cells – transport gases
  2. white blood cells – fight disease
  3. platelets – cell fragments that aid in clotting
- *blood cells form in hematopoietic tissues in red bone marrow
- *only red cells function entirely within blood vessels
- *white blood cells migrate through capillary walls



Types of Membranes

*** epithelial membranes & underlying connective tissues are organs

***3 Major types of epithelial membranes
serous, mucous, & cutaneous (a 4th type - synovial membranes that line joints will be discussed later)

A. Serous Membranes
*line body cavities that don't open to outside
*form inner linings of thorax & abdomen; cover organs
*layer of simple squamous & thin layer of loose connective
*secrete serous fluid = helps keep surfaces of membranes moist

B. Mucous Membranes

***line cavities & tubes that open to outside

(oral & nasal cavities, tubes of digestive, respiratory, urinary, & reproductive systems)
*epithelium overlying a layer of loose connective tissue (type varies with location)

*specialized cells secrete mucus

C. Cutaneous Membrane

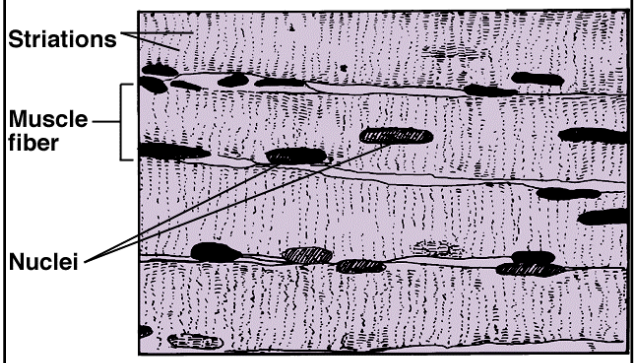
an organ of the integument & is called skin

IV. Muscle Tissues

A. General Characteristics
*muscle fibers can contract, move body parts

B. Skeletal Muscle Tissue
*voluntary muscle that attaches to bones
* have striations, stimulated by nerve cells that cause fibers to contract (sliding filament theory)
*move head, neck, trunk, limbs, allow for facial expressions, write, talk, sing, chew, swallow, & breathe

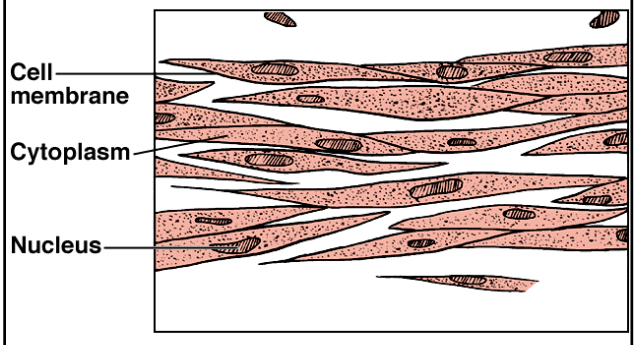
Skeletal Muscle Tissue



C. Smooth Muscle Tissue

*no striations, is involuntary
*cells are spindle-shaped, shorter than skeletal muscles
*moves food through digestive tract, constricts blood vessels, empties urinary bladder
*found in walls of hollow internal organs – stomach, intestines, urinary bladder, uterus, & blood vessels

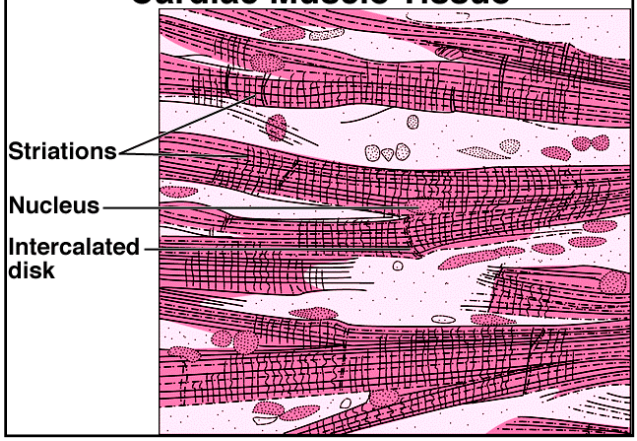
Smooth Muscle Tissue



D. Cardiac Muscle Tissue

*found only in the heart
*cells are striated, joined end-to-end
*has intercalated disks - junction between cells - only in cardiac tissue
*involuntary
*makes up most of the heart
*pumps blood through heart chambers & into blood vessels

Cardiac Muscle Tissue

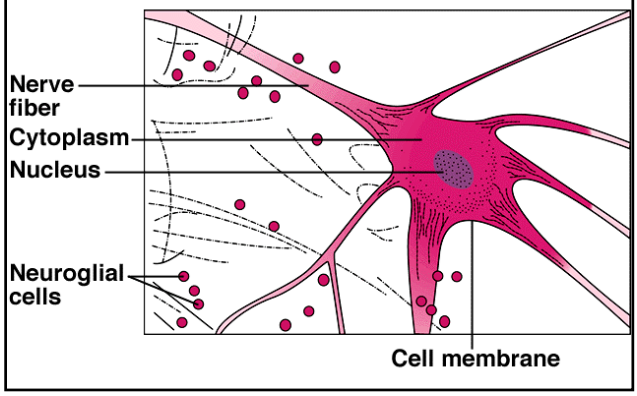


V. Nervous Tissues

A. Nervous tissues are found in the brain, spinal cord, and nerves.

B. Neurons, or nerve cells, conduct nervous impulses while helper cells, or neuroglia, support and nourish the neurons.

Nerve Cell



auf Wiedersehen

Remember – At the end of the chapter is a Chapter Summary that is your Study Guide for the Chapter 5 test.