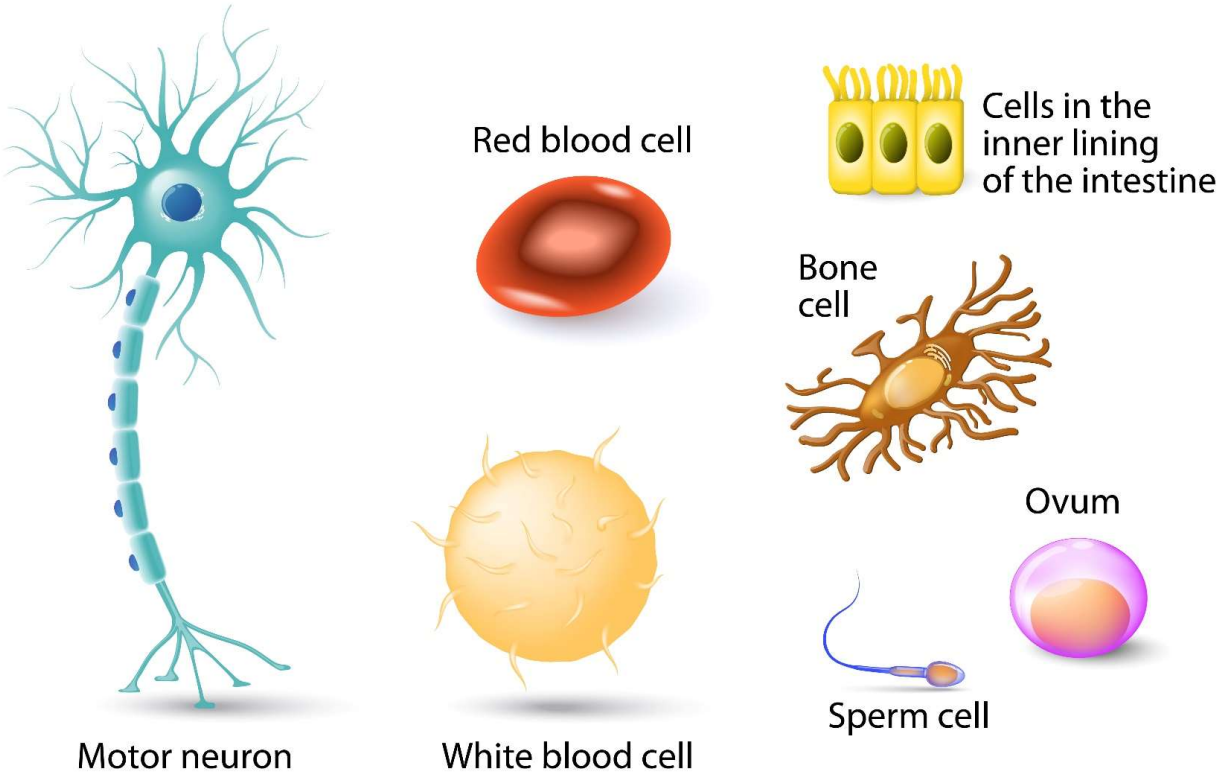
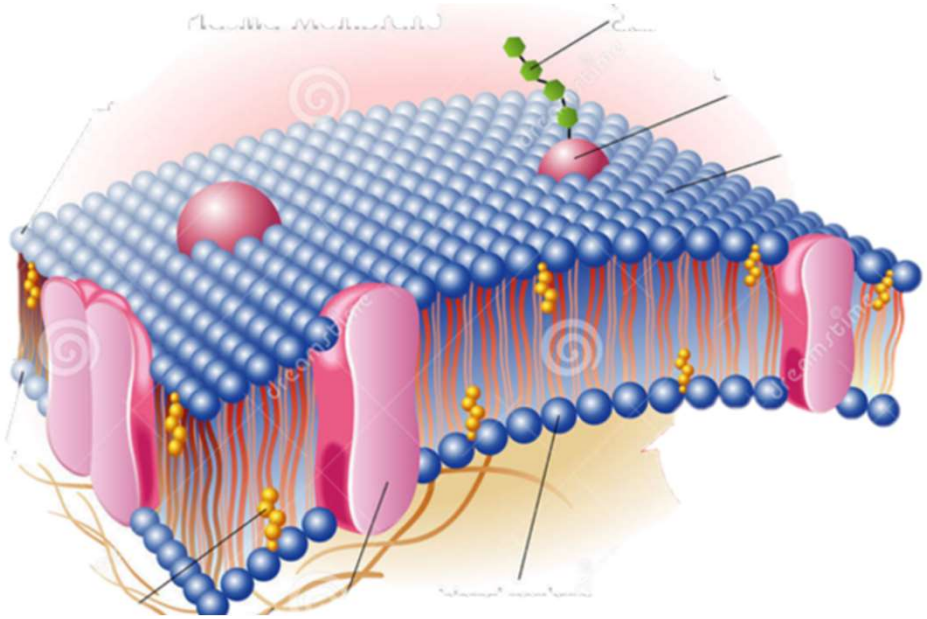
Human cell


Red blood cell
Cells in the inner lining of the intestine
Bone cell
Ovum
Sperm cell
Motor neuron
White blood cell

Cells and pathology



- Each cell has a plasma membrane that acts as a gateway to control the exchange of substances between the internal environment of the cell and the salty external environment surrounding the cell.
- Protein and carbohydrate molecules are integral to the plasma membrane ,involved in: nutrient transport, identifies cell, hormone receptors, anchoring, and chemical processes.

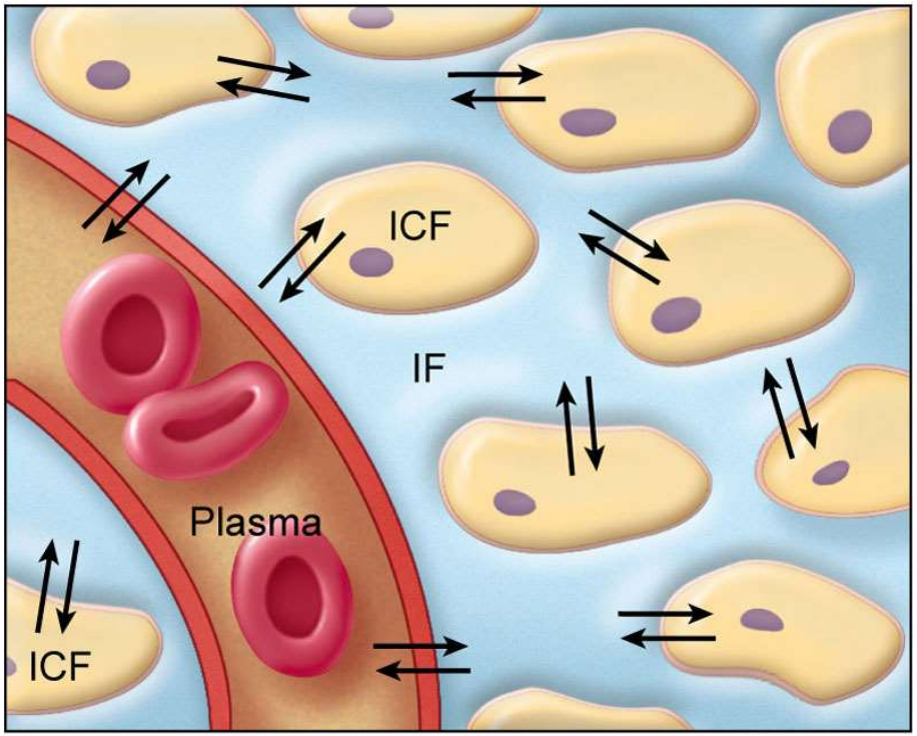
Transporting substances across the plasma membrane may or may not require energy.

Please familiarize yourself with active and passive transport processes.

Transport Process	Physiological example
Diffusion	CO2 leaving cells
Osmosis	H20 moving in/out of cells
Filtration	Selective filtration of blood by kidneys. H20 and small solutes are filtered, but larger proteins are not
Ion pump*	Moving ions such as calcium, or chloride against the concentration gradient
Phagocytosis/pinocytosis*	WBC's consuming bacteria
	* Requires energy input

- Human tissue is made up of cells and intercellular (non-cellular) materials in varying proportions.

Fluid compartments of the body



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Intracellular

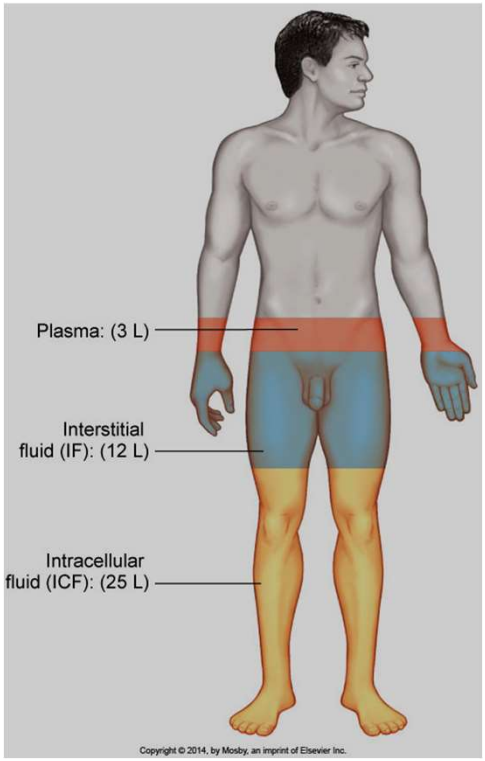
- All the fluid in all the cells of the body

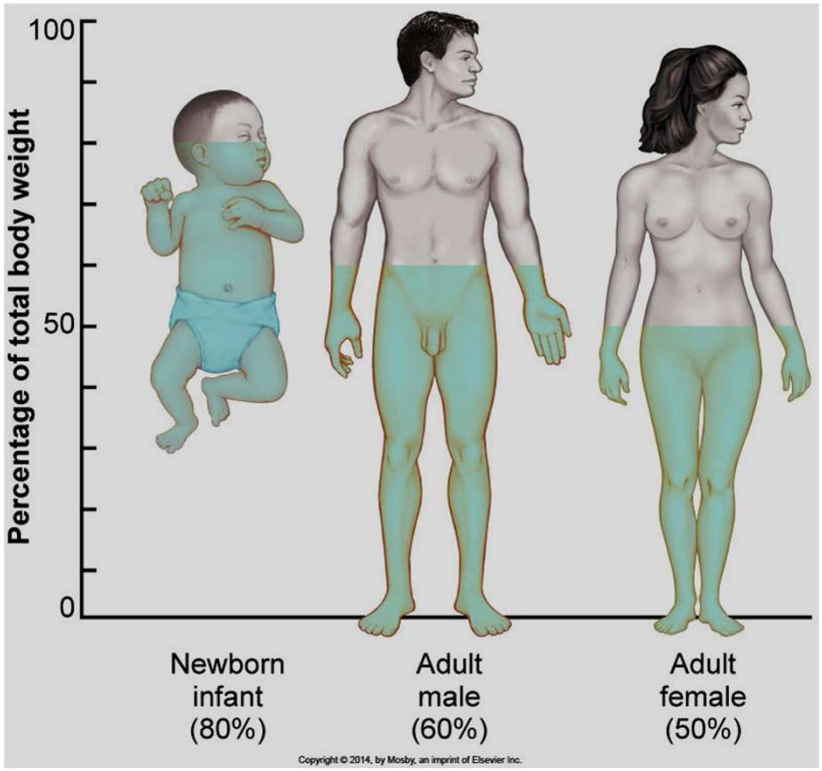
Interstitial fluid or matrix

- All the fluid between the cells for the body

Extracellular fluid

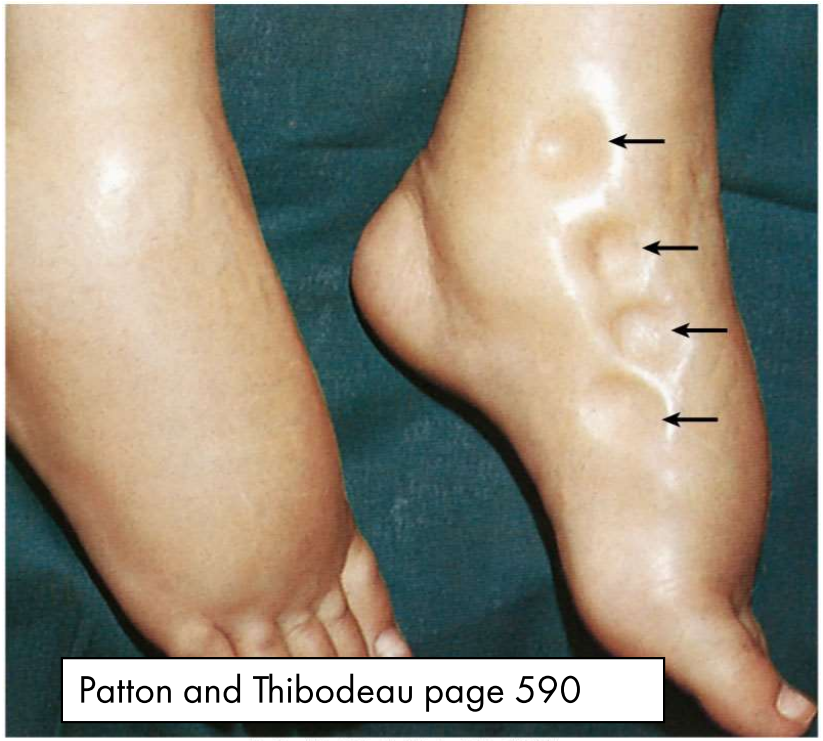
- All the fluid outside of the cells in the interstitial compartment, plasma, joint fluids, cerebrospinal fluid





Patton and Thibodeau fig. 21-2

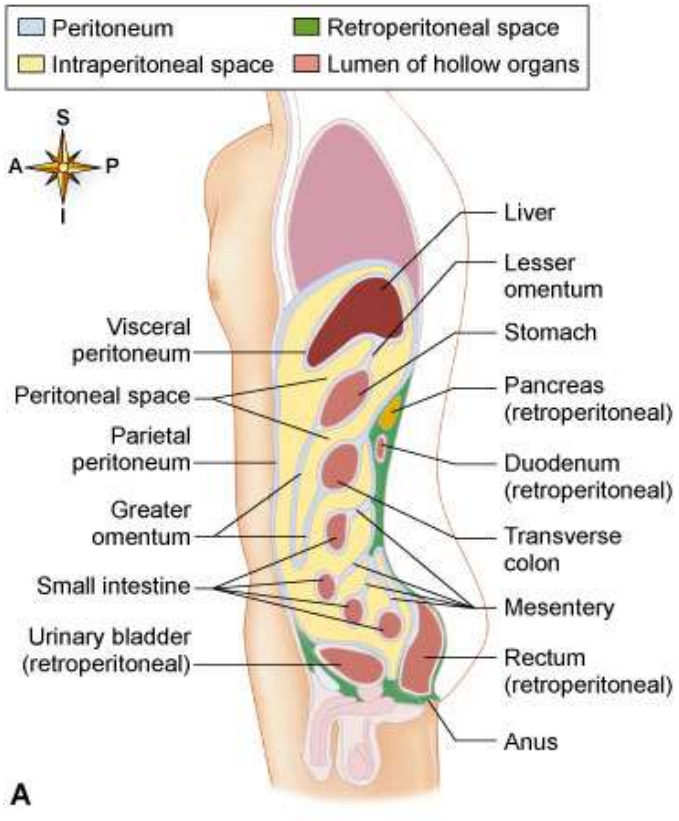
Fluid in the interstitial space

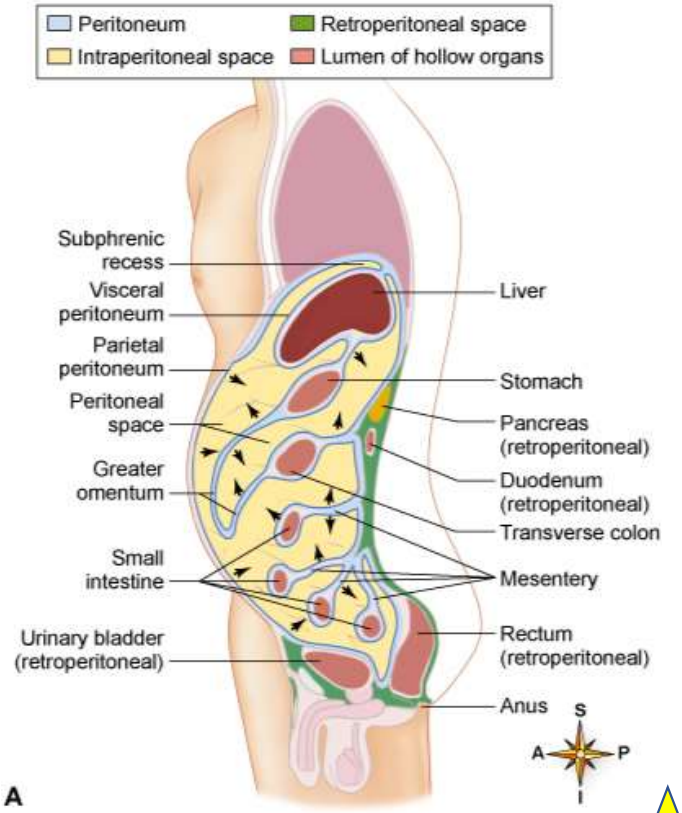


Patton and Thibodeau page 590

From Bloom A, Ireland J: *Color atlas of diabetes*, ed 2, St Louis, 1992, Mosby.

The medical term for this condition is:_____





Patton-Thibodeau Figures 18-23 and 24

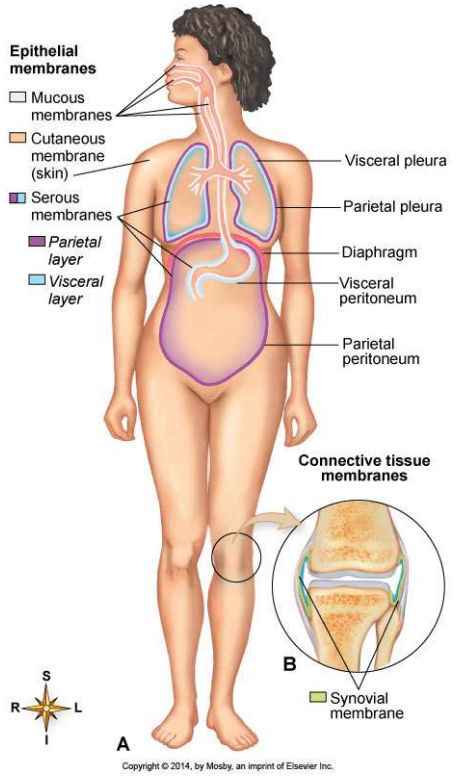
Types of human tissue

Four kinds of tissue are found in the human body:

1. Epithelial tissue → nutrients → food and O_2
2. Connective tissue → structure and safety
3. Muscle tissue → movement
4. Nervous tissue → thinking and feeling

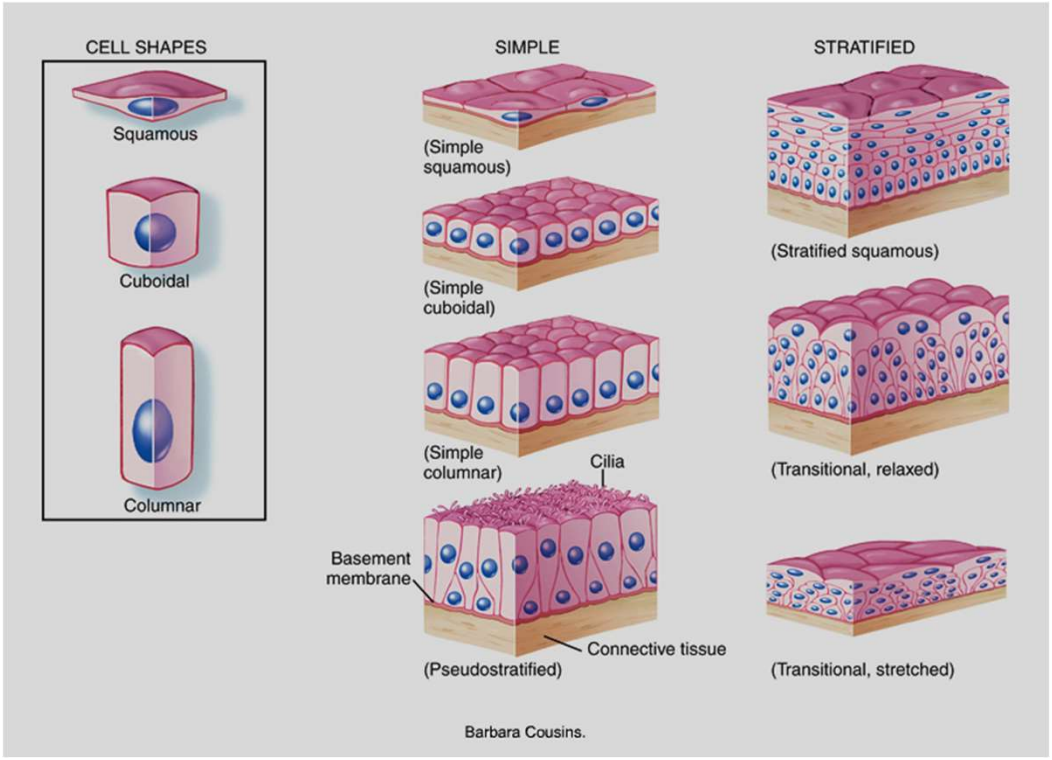
1. Epithelial tissue

- Forms mucous, serous and cutaneous membranes in the body
- Has little or no interstitial fluid or matrix. Cells are closely packed together in sheets
- Contains no blood vessels
- Is classified by shape and cellular arrangement



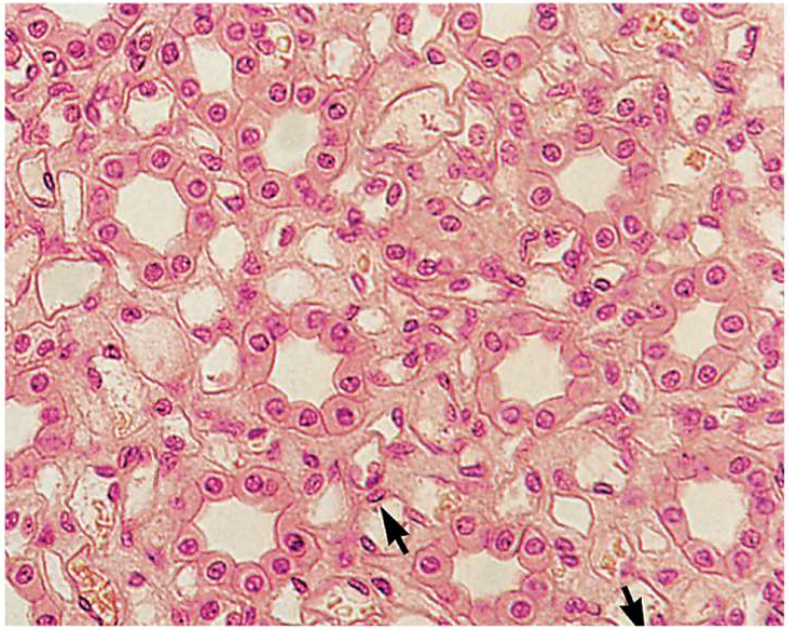
Patton and Thibodeau 7-1

Epithelial tissue classifications



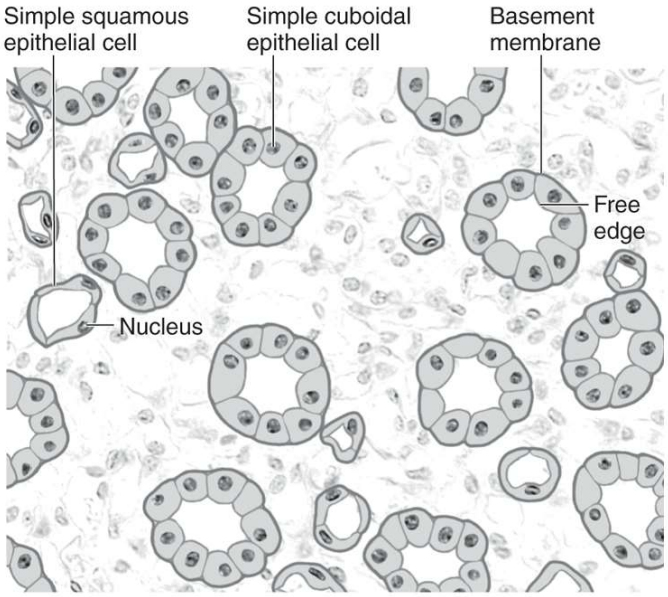
The alveoli in the lungs

Simple squamous epithelium is one cell thick and allows for gas exchange



A

From Gartner LP, Hiatt JL: *Color textbook of histology*, ed 3, Philadelphia, 2007, Saunders.

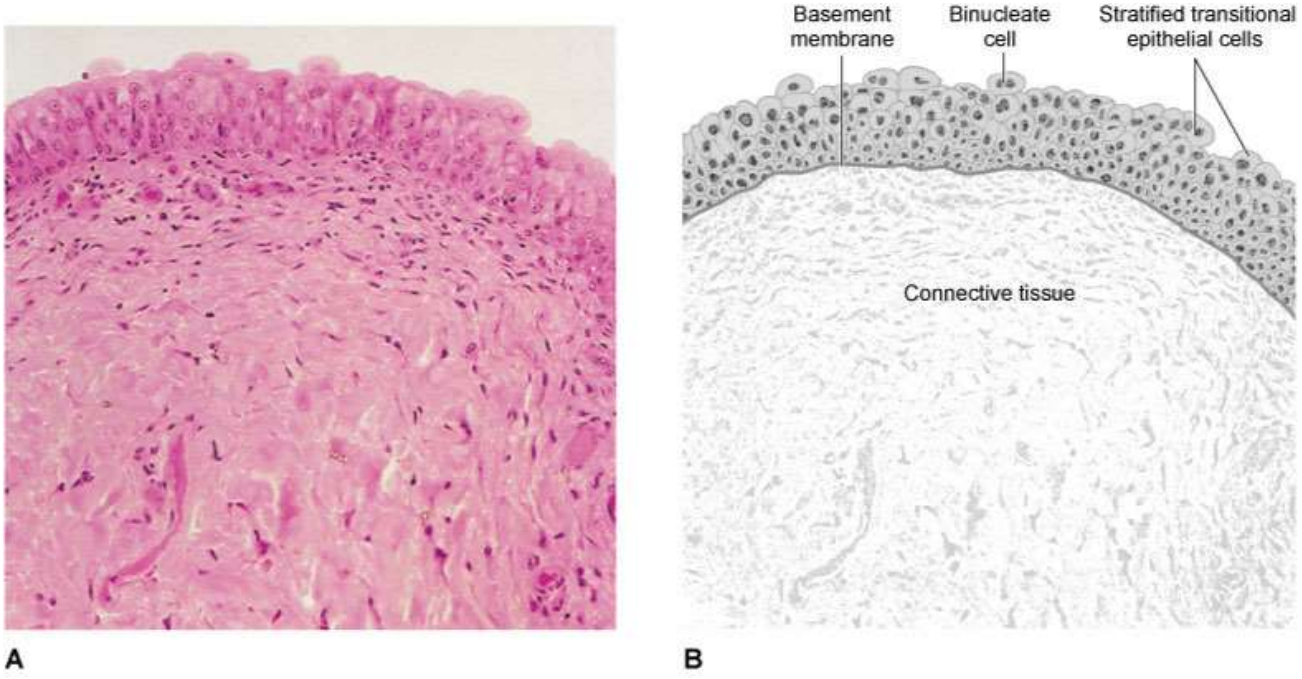


B

Barbara Cousins.

Bladder epithelium

Stratified transitional epithelium is stretchy



A, From Gartner LP, Hiatt JL: *Color textbook of histology*, ed 3, Philadelphia, 2007, Saunders. *B*, Barbara Cousins.

Patton and thibodeau fig. 4-6

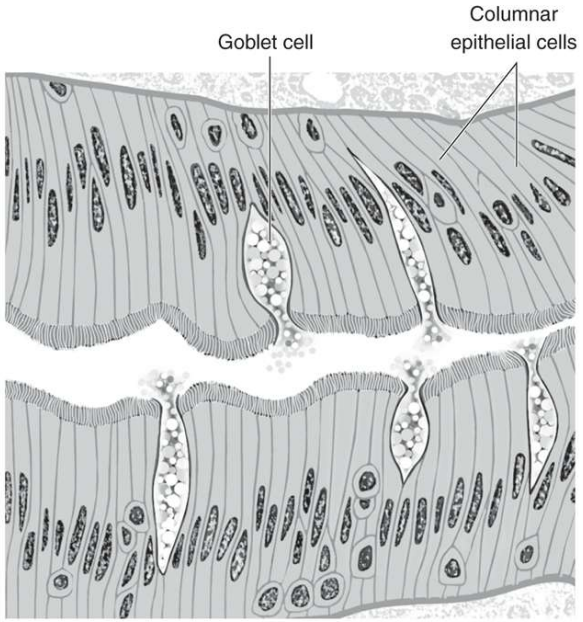
Lining of the GI tract

Simple columnar epithelium has more surface area for absorption of nutrients



A

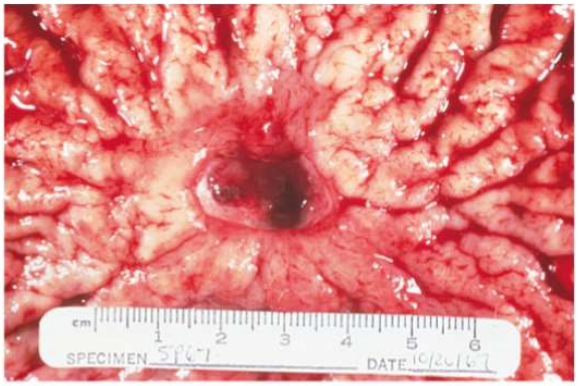
From Gartner LP, Hiatt JL: *Color textbook of histology*, ed 3, Philadelphia, 2007, Saunders.



B

Barbara Cousins.

Epithelial tissue and mucous membranes

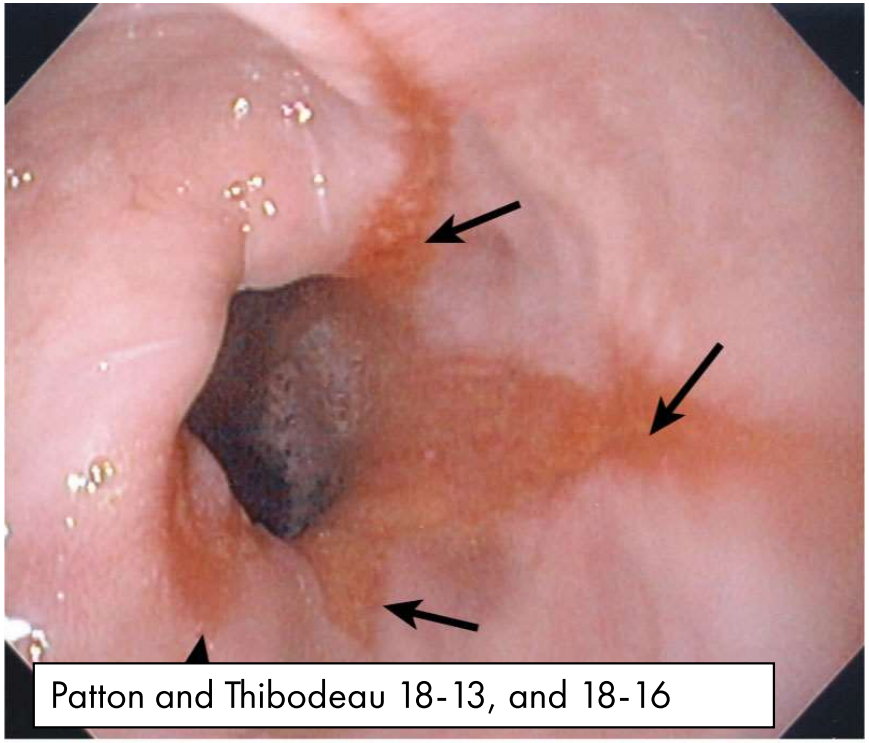


A



B

B, From Kumar V, Abbas AK, Fausto N: *Robbins and Cotran pathologic basis of disease*, ed 7, Philadelphia, 2005, Elsevier.



Patton and Thibodeau 18-13, and 18-16

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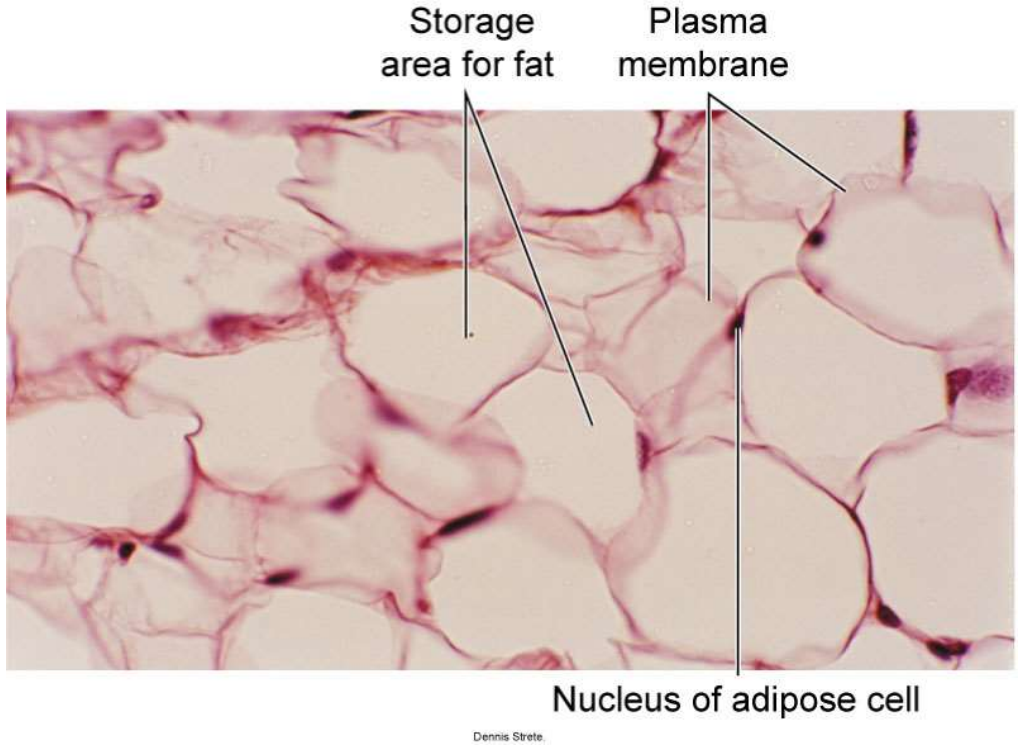
2. Connective tissue

- Is the most abundant and widely found type of tissue in the body
- Is largely composed of an intercellular matrix containing a few cells and various types of structural fibers
- Varies in strength, elasticity, blood supply, and ability to heal

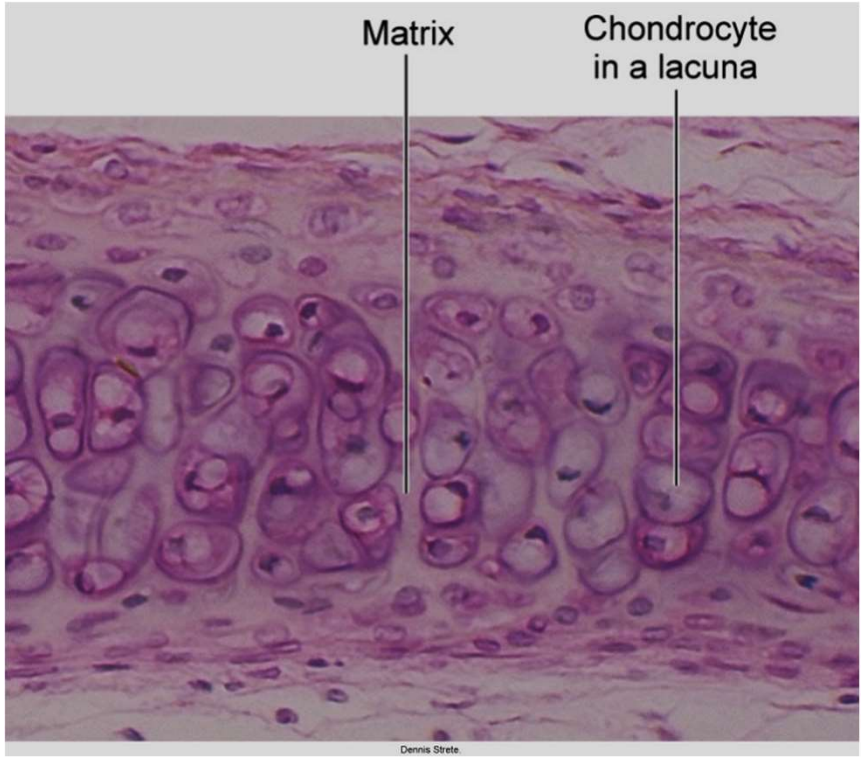
Types of connective tissue

- Loose fibrous tissue (areolar) – the "glue" that holds body organs together
- Adipose "fat" tissue
- Dense fibrous tissue – (tendons)
- Bone and cartilage
- Blood and hematopoietic tissue (eg. Bone marrow)

Adipose (fat) tissue

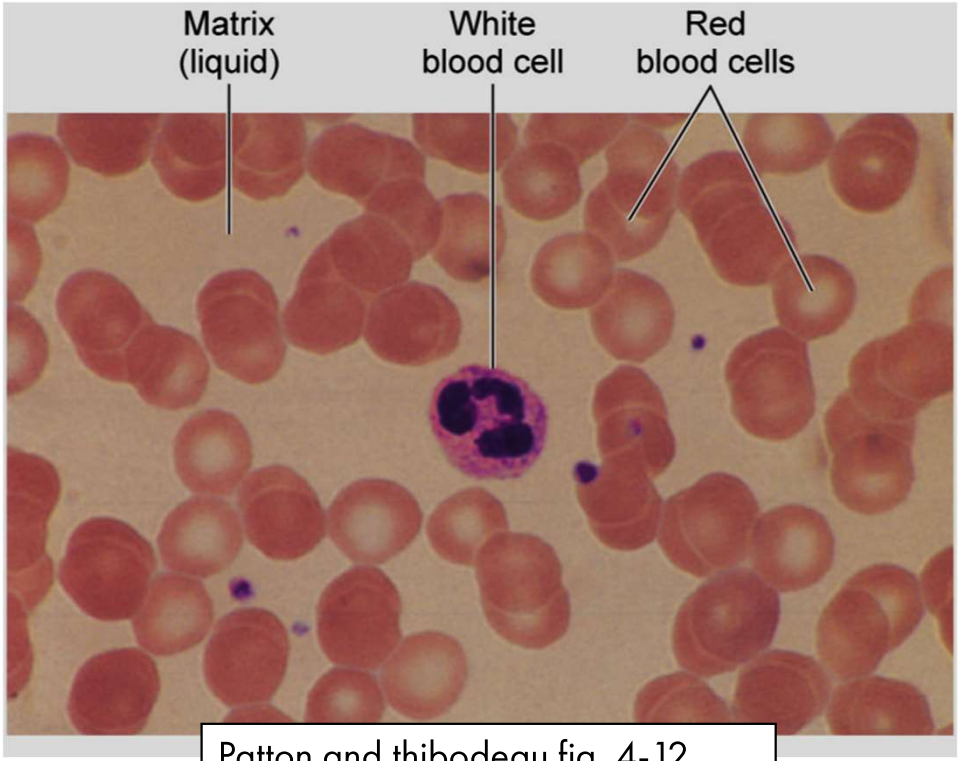


Cartilage



Patton and thibodeau fig. 4-11

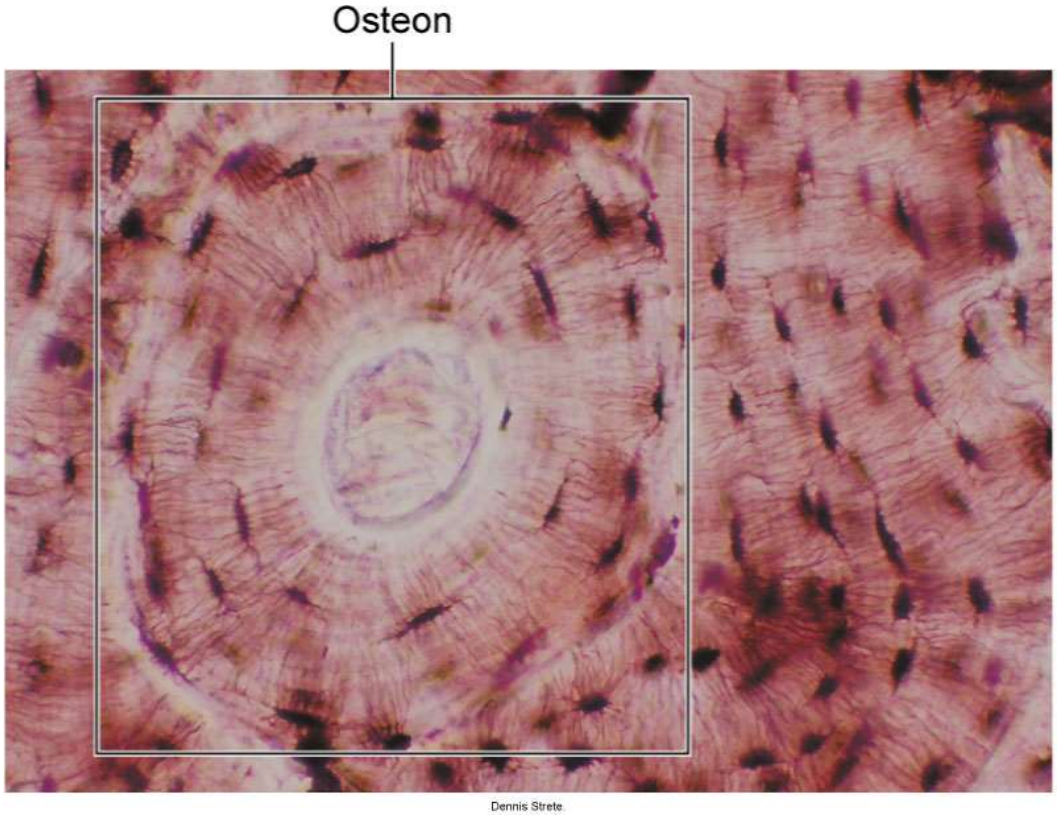
Blood



Patton and thibodeau fig. 4-12

Calcified matrix and osteocytes in compact bone

Bone tissue



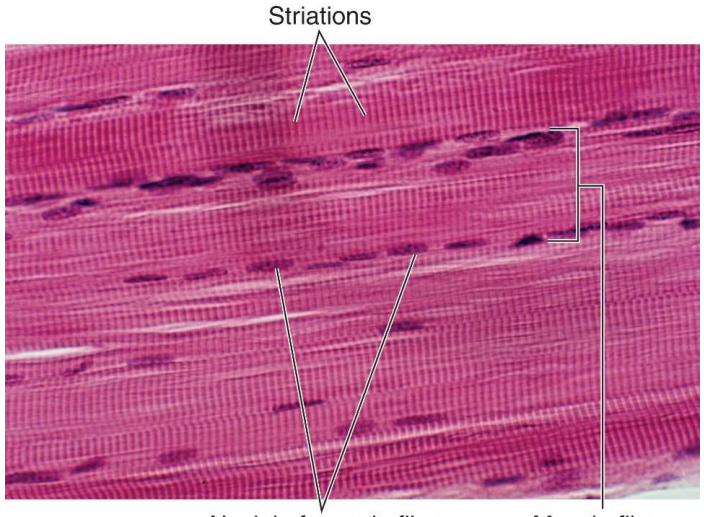
Patton and thibodeau fig. 4-10

3. Muscle tissue

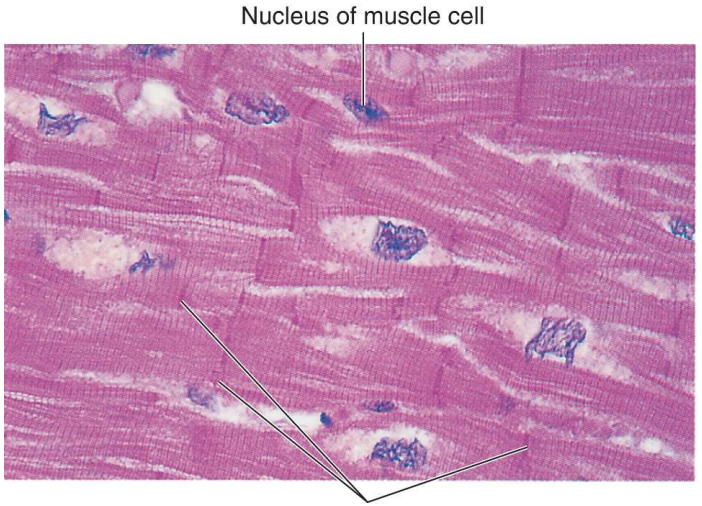
- **Skeletal muscle tissue**-attaches to bones; also called striated or voluntary; control is voluntary; striations apparent when viewed under a microscope

- **Smooth-muscle tissue**-also called nonstriated (visceral) or involuntary; no cross striations; found in blood vessels and other tube-shaped organs
- **Cardiac muscle tissue**-also called striated or involuntary; composes heart wall; ordinarily cannot control contractions

Skeletal vs Cardiac Muscle

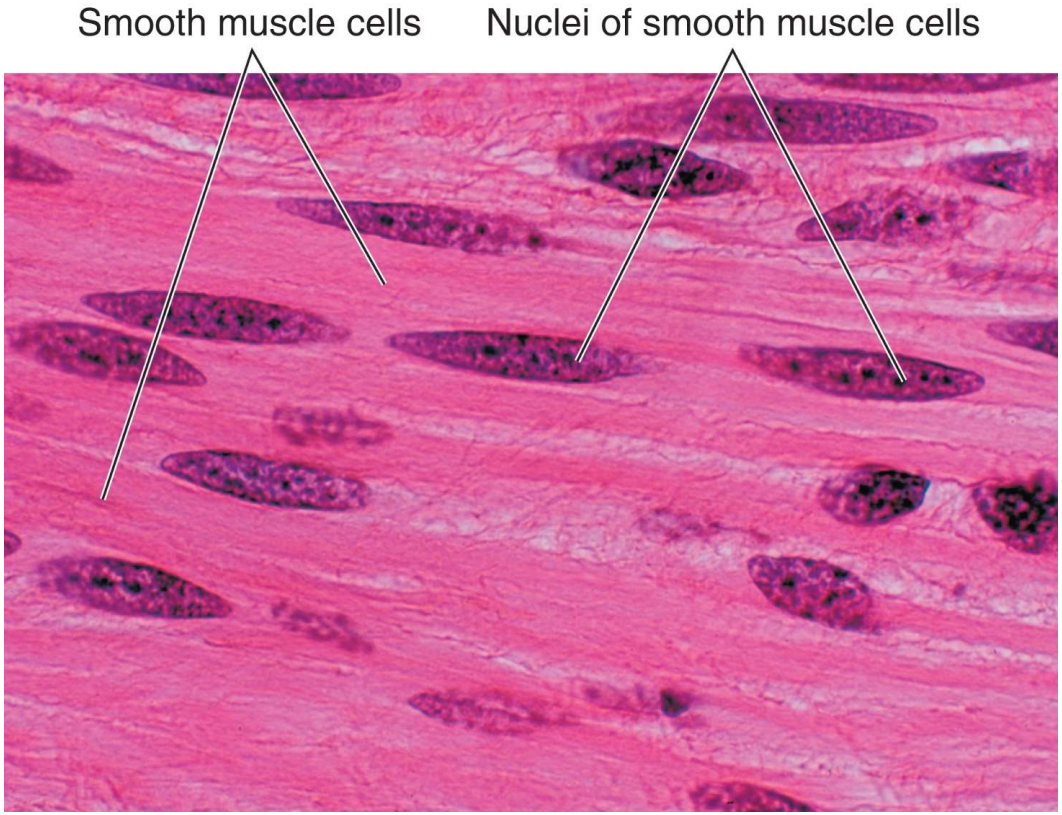


Courtesy of Dennis Strete.



Courtesy of Ed Reschke.

Smooth Muscle



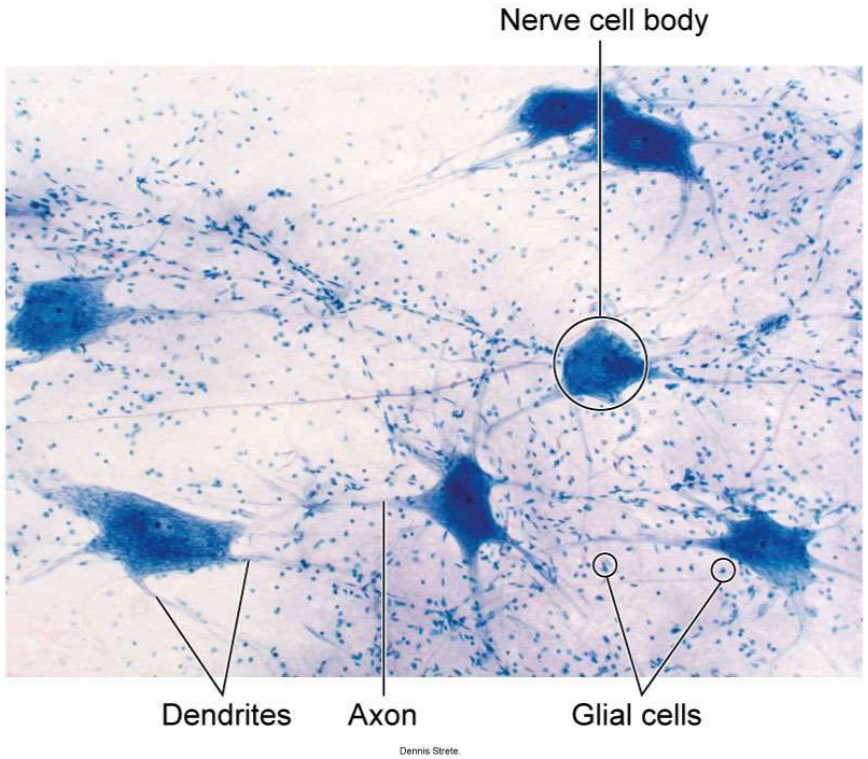
Courtesy of Dennis Strete.

4. Nervous tissue

- Neurons
  - All neurons have a cell body and two types of processes: axon and dendrite
  - Axon (one) carries nerve impulse away from cell body
  - Dendrites (one or more) carry nerve impulse toward the cell body

- Glia (neuroglia)—supportive and connecting cells

Nervous Tissue



Tissue Repair

- Usually accomplished by means of regeneration of tissue
    - Epithelial and connective tissues regenerate easily
    - Skeletal muscle can regenerate when injured
    - Smooth and cardiac muscle are less able to regenerate with more severe damage
    - Nervous tissues have limited abilities to repair themselves, but not aslimited as once thought

Pathophysiology

- Mechanisms of disease
  - Genetic mechanisms
  - Infectious mechanism (pathogenic organisms and particles)
  - Neoplastic mechanism (tumors and cancer)
  - Traumatic mechanism (physical and chemical agents)
  - Metabolic mechanism (endocrine imbalances or malnutrition
  - Inflammatory Mechanism
    - Autoimmunity
    - Inflammation
    - Degeneration

Risk Factors

- Genetic factors
- Age
- Lifestyle
- Stress
- Environmental factors
- Preexisting conditions

Aging

- In adulthood-
  - Growth plates fully close in adult; other structures, such as the sinuses, acquire adult placement
  - Adulthood characterized by maintenance of existing body tissues
  - Degeneration of body tissue begins in adulthood

Older Adulthood

- Degenerative changes characterize older adulthood, or senescence
- Every organ system of the body undergoes degenerative changes
  - A variety of mechanisms of aging have been described
  - The free-radical theory of aging states that the number of oxygen free radicals increases as one ages, thus increasing the rate of cellular damage
- Senescence culminates in death – process of growing old

Effects of Aging on Tissues

- Skeletal system
  - Aging causes changes in the texture, calcification, and shape of bones
  - Bone spurs develop around joints
  - Bones become porous and fracture easily
  - Degenerative joint diseases, such as osteoarthritis, are common

- Integumentary system
  - With age, skin “sags” and becomes thin, dry, and wrinkled (or inelastic)
  - Pigmentation problems are common
  - Frequent thinning or loss of hair occurs

- Central nervous system
  - Risk of dementia, or loss of memory, with aging
  - Other degenerative conditions affecting nervous system
  - Some risk of depression

- Cardiovascular system
  - Degenerative heart and blood vessel disease is among the most common and serious effects of aging
  - Fat deposits in blood vessels (atherosclerosis) decrease blood flow to the heart and may cause complete blockage of the coronary arteries
  - Hardening of arteries (arteriosclerosis) may result in rupture of blood vessels, especially in the brain (stroke)
  - Hypertension, or high blood pressure, is common in older adulthood

- Respiratory system
  - Calcification of costal cartilages causes rib cage to remain in expanded position, resulting in barrel chest
  - Wasting of respiratory muscles decreases respiratory efficiency
  - Respiratory membrane thickens; movement of oxygen from alveoli to blood is slowed

- Urinary system
  - Nephron units decrease in number by 50% between ages 30 and 75
  - Blood flow to kidney, and therefore ability to form urine, decreases
  - Bladder problems, such as inability to void completely, are caused by muscle wasting in the bladder wall

- Special senses
  - All sense organs show a gradual decline in performance with age
  - Cataracts and glaucoma affect the eyes
  - Loss of hearing
  - Decreased sense of smell and taste

Tumors and Cancer

- Neoplasms (tumors)—abnormal growths of cells
  - Benign tumors remain localized
  - Malignant tumors spread, forming secondary tumors
  - Metastasis—cells leave primary tumor and start a secondary tumor at new location

- Classification of tumors
  - Benign, epithelial tumors
    - Papilloma—fingerlike projection
    - Adenoma—glandular tumor
    - Nevus—small, pigmented tumor
  - Benign, connective tissue tumors
    - Lipoma—adipose (fat) tumor
    - Osteoma—bone tumor
    - Chondroma—cartilage tumor

- Classification of tumors
  - Carcinomas (malignant epithelial tumors)
    - Melanoma—involves melanocytes
    - Adenocarcinoma—glandular cancer
  - Sarcomas (connective tissue cancers)
    - Lymphoma—lymphatic cancer
    - Osteosarcoma—bone cancer
    - Myeloma—bone marrow tumor
    - Fibrosarcoma—cancer of fibrous tissue

Causes of Cancer

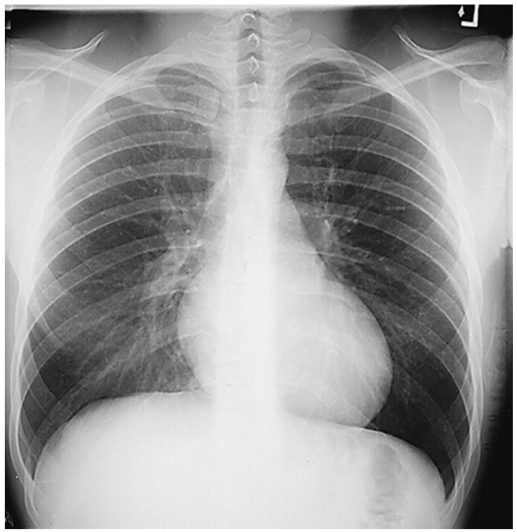
- Causes of cancer—varied and still not clearly understood
  - Cancer involves hyperplasia (growth of too many cells) and anaplasia (development of undifferentiated cells)

Tissues and radiographic appearances

It is important to understand the nature of body tissue because different shades of grey in radiography are caused by variations in tissue density and thickness.



Remember, the more dense a tissue is, the more "white" it appears

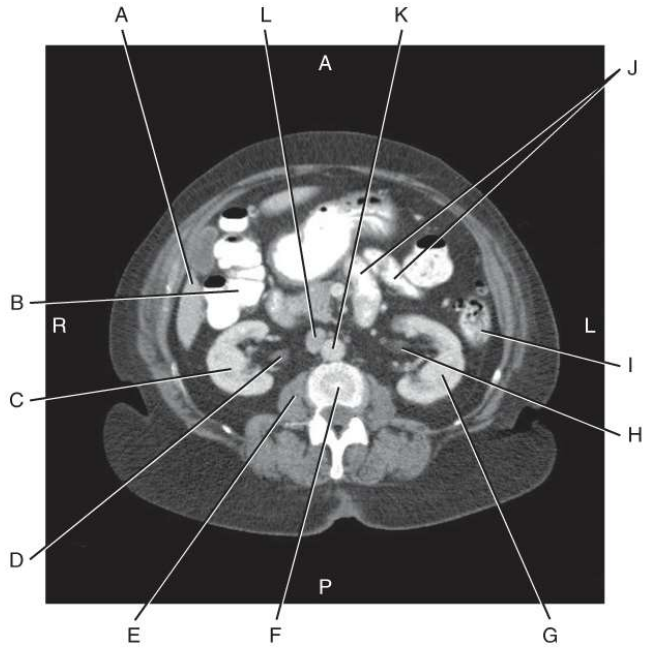


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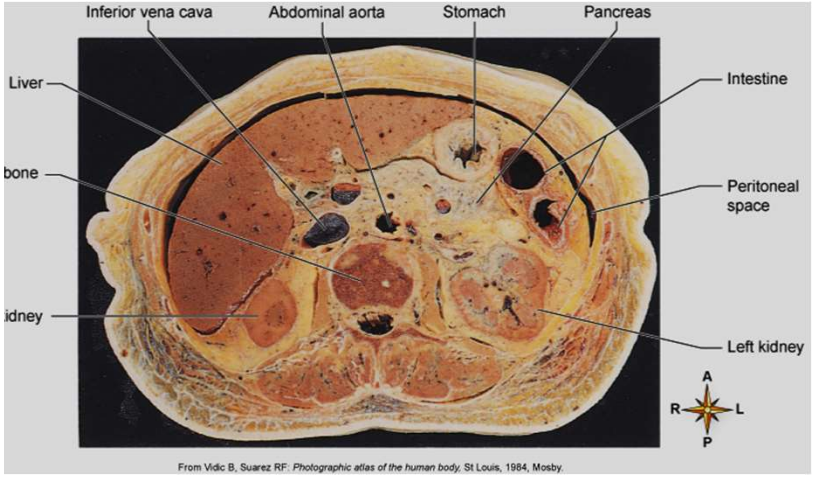


Air
Water/fluid
Blood
Fat
Bone

The structure of tissues, and pathological processes, cause varying textures and shades of black, white and grey to be visualized



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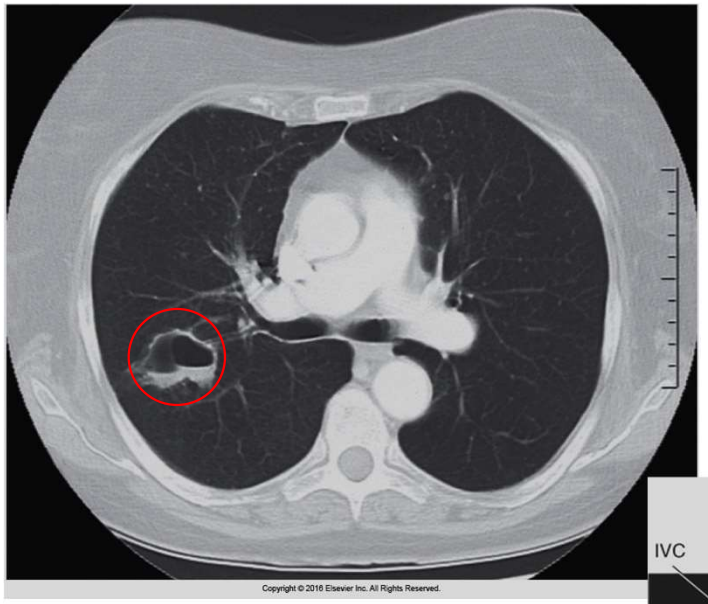
From Vidic B, Suarez RF: *Photographic atlas of the human body.* St Louis, 1984, Mosby.

Tissue density and thickness is affected by disease processes that alter the structure of tissues and the distribution of ICF, IF and ECF:

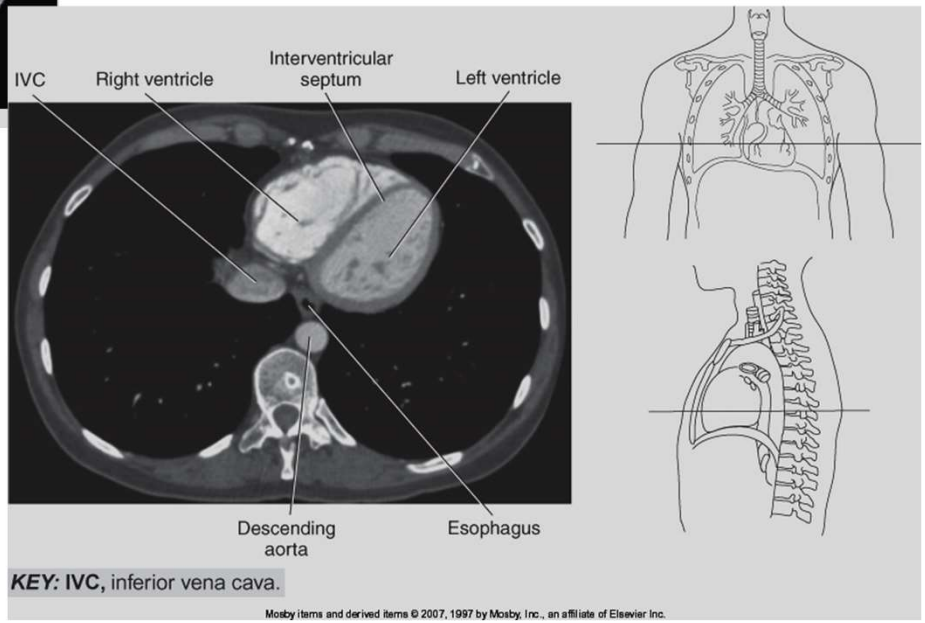
ICF - intracellular fluid, fluid found inside the cell

IF – interstitial fluid, fluid found in the spaces around cells

ECF – extracellular fluid, fluid found outside the cell


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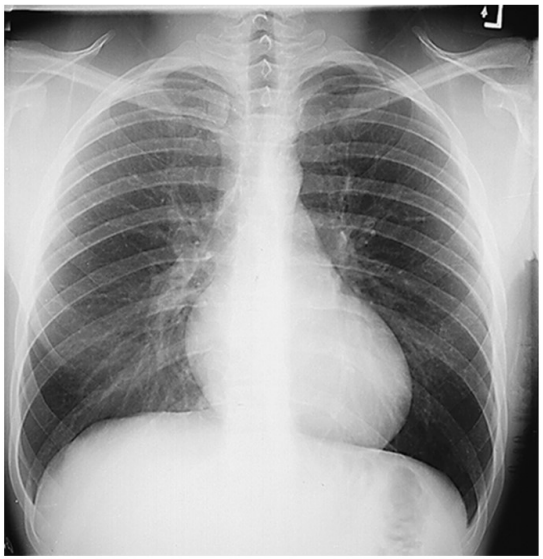
Eisenburg 3-22



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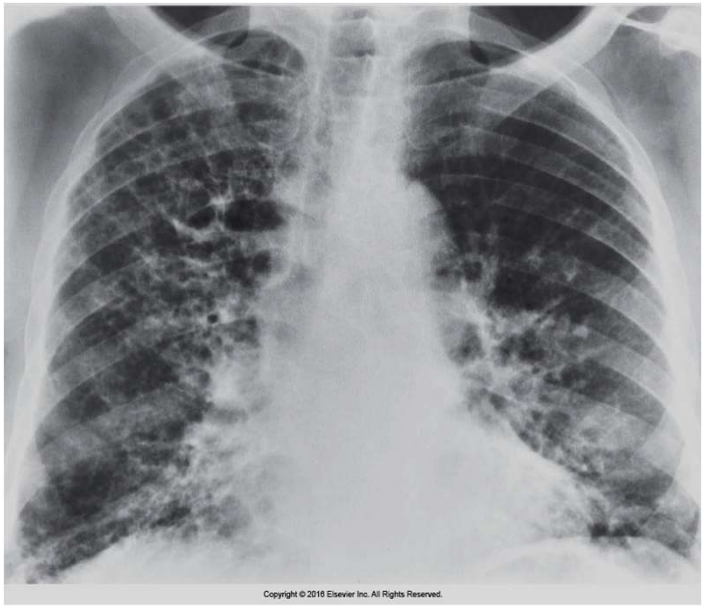
Here the CT machine settings have been manipulated to “light up” the lung pathology (circled in red) more effectively

Coughing due to chronic conditions can cause dense scar tissue to form in the airways which alters the appearance of the lung fields on a chest x-ray



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Bontrager 2-53

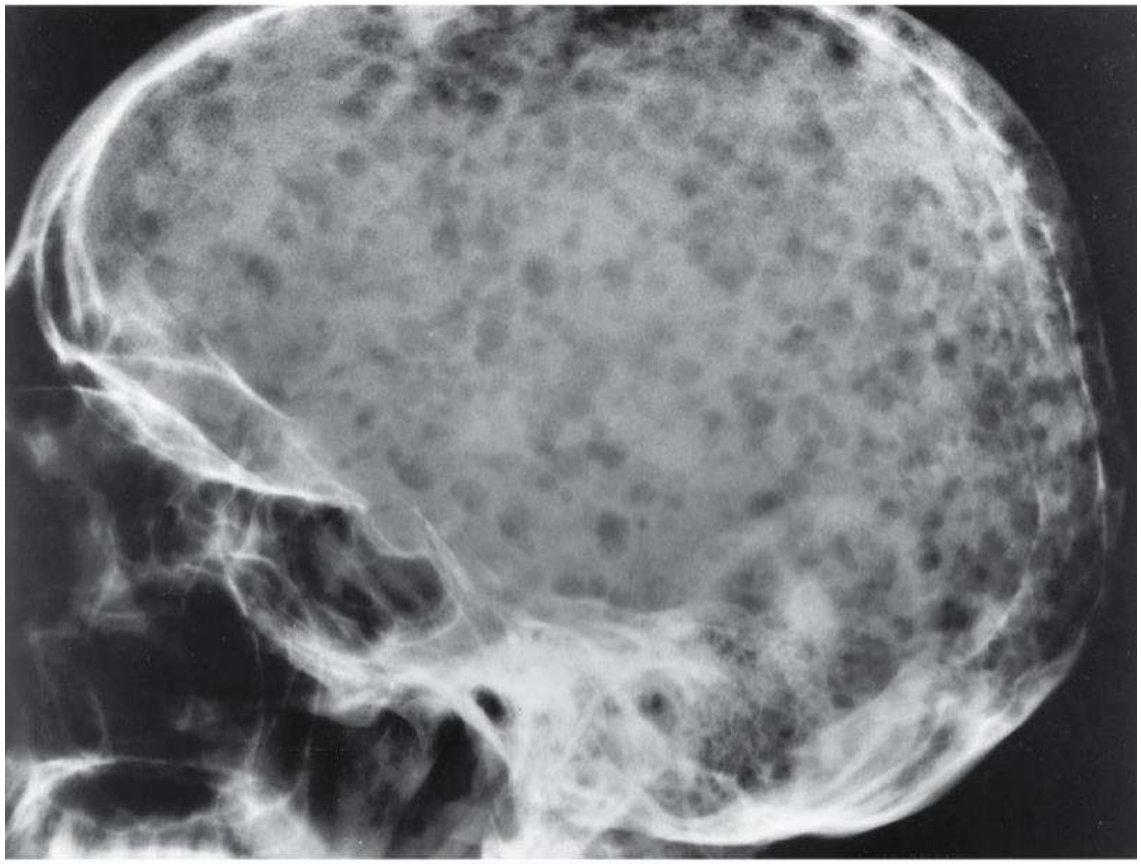


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Eisenberg 3-40

Multiple myeloma, blood cancer, starts in plasma cells in bone marrow

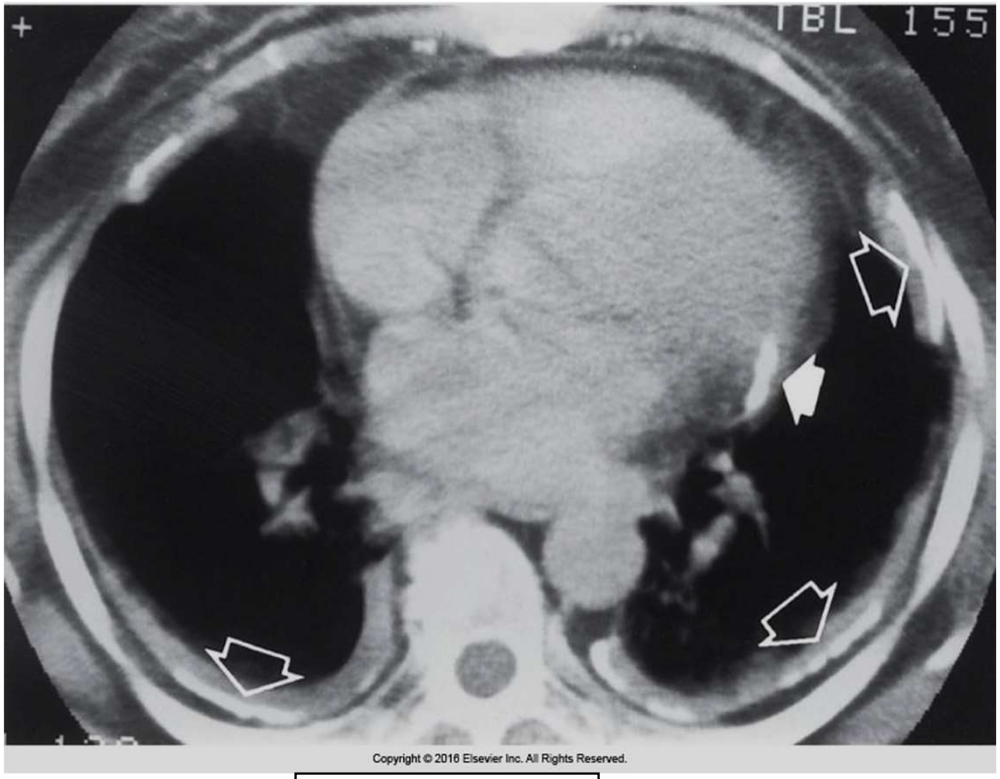
Eisenburg 4-77



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Asbestosis – lung disease, prolonged exposure to high concentrations of asbestos filters in air

Asbestos is a mineral fiber that occurs in rock and soil. Has been used in variety of building materials.



Eisenberg 3-50

Orthopedic Surgery repairs

Eisenberg 4-88

Calcified callus that has formed around fracture site, changes the appearance and density of the tissues

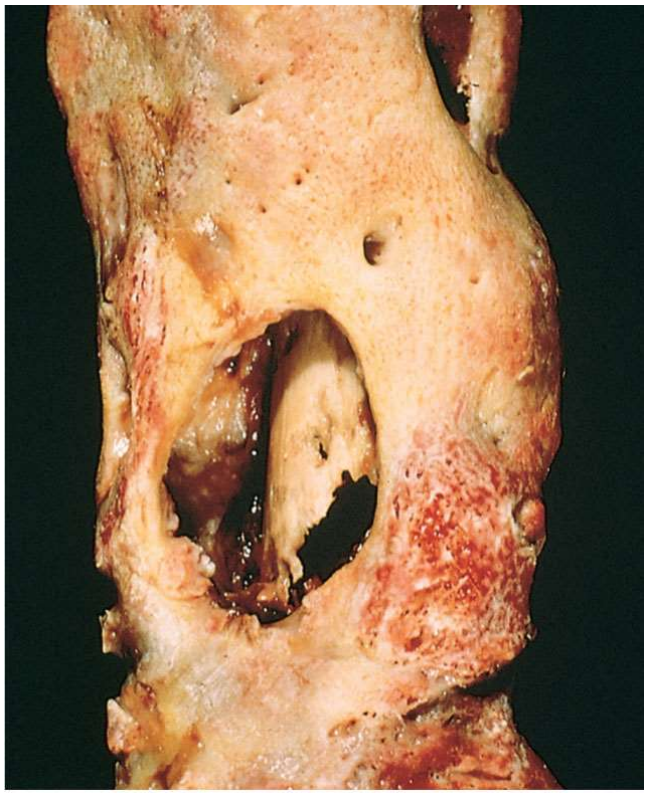


Gout - form of arthritis that causes pain and swelling in joints
Buildup of extra uric acid, sharp crystals can form in joints, usually the big toe

Eisenberg 4-52

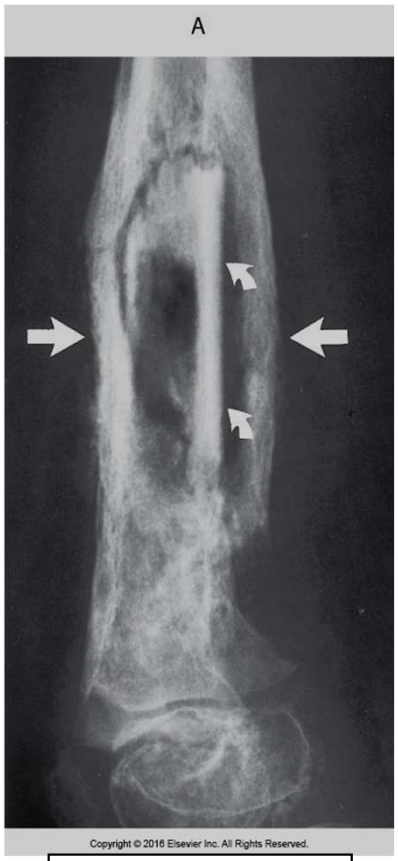

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Osteomyelitis – infection of the bone or joint, acute or chronic. Caused by bacteria, fungi or other germs.



From Kumar V: *Robbins basic pathology*, ed 9, Philadelphia, 2013, Saunders.

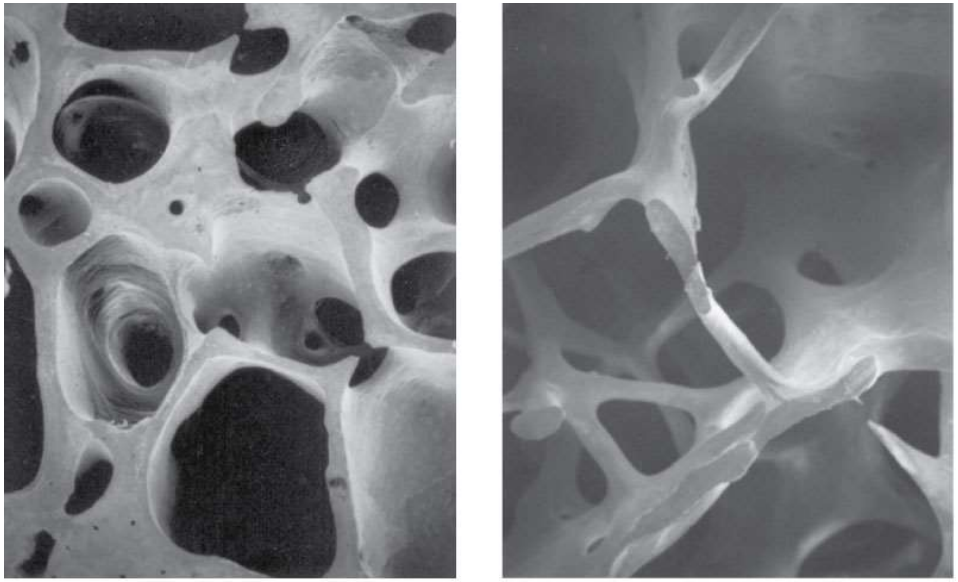
Patton and Thibodeau 8-34



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Eisenberg 4-39

Periarticular osteoporosis – RA (rheumatoid arthritis) - bone loss around the small joints of the hand, decrease in bone mass and density



A B

From Dempster DW et al: A simple method for correlative light and scanning electron microscopy of human iliac crest bone bipsies, *J Bone Miner Res* 1:15, 1986.

Patton and Thibodeau 8-30

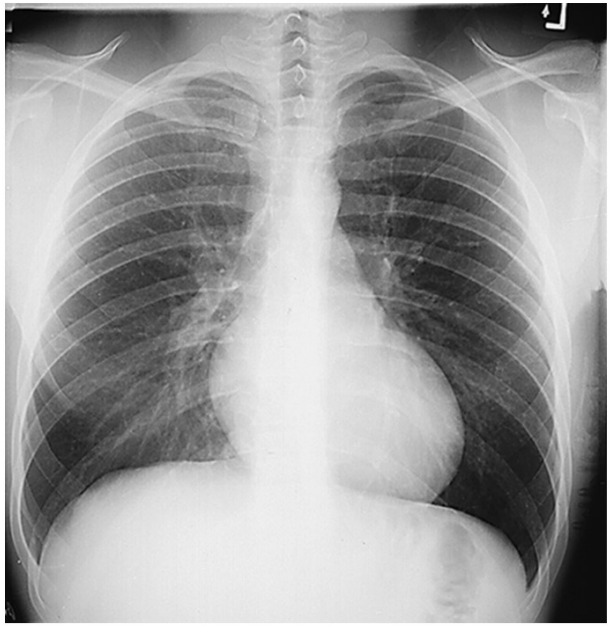


from Brown JC, Forrester DM: Arthritis. In Eisenberg RL, Amberg JR, editors: *Critical diagnostic pathways in radiology*. Philadelphia, 1981, Lippincott.

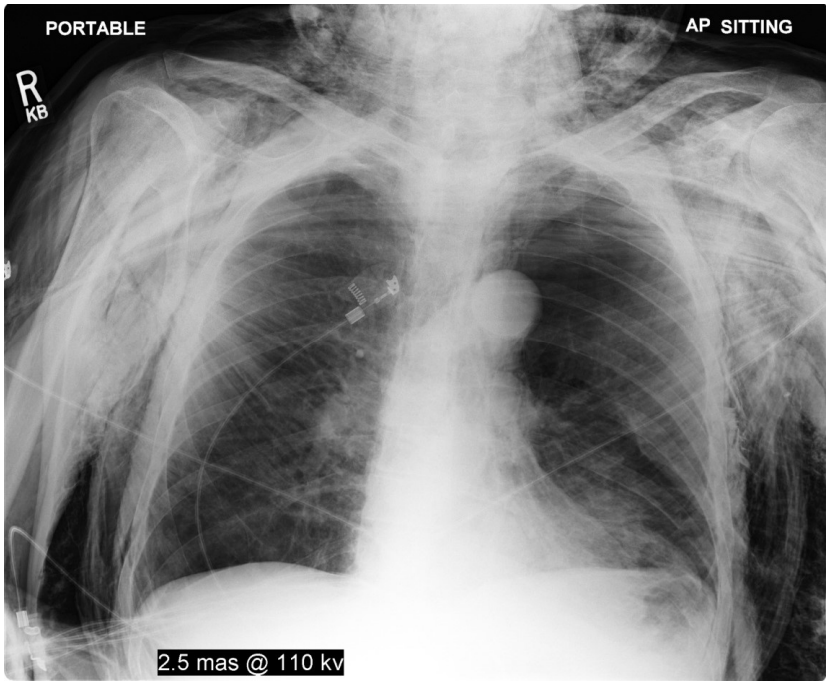
Eisenberg 4-14

Subcutaneous emphysema - air trapped in tissue under the skin

Areas of radiolucency (dark, less dense)

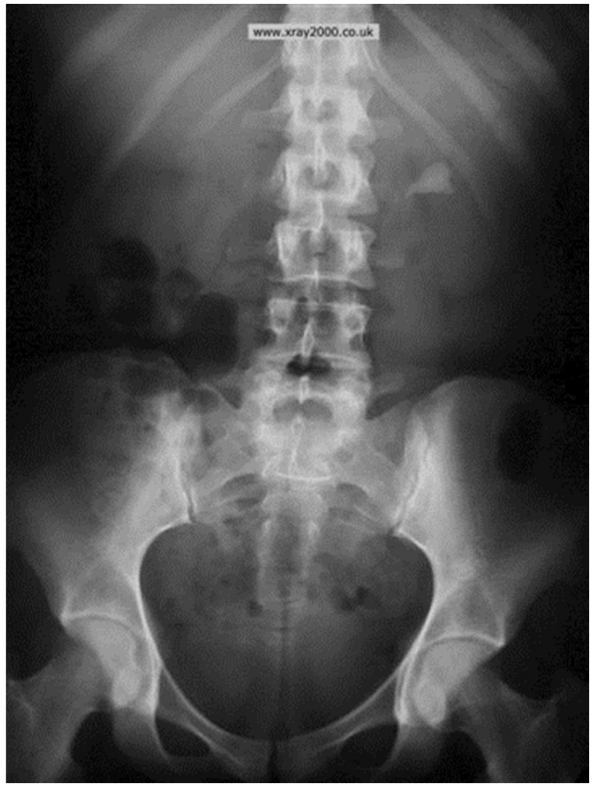


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Sait digital library

Chronic pancreatitis – inflammation of the pancreas



Fluid buildup around the pancreas



Cholelithiasis – gallstones, hardened pieces of bile in the gallbladder or bile ducts. Bile – digestive fluid produced by the liver and stored in the gallbladder. Bile breaks down fats into fatty acids.

