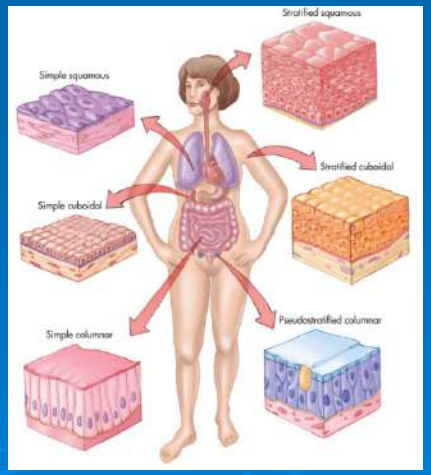
Health Science Occupations

Anatomy, Physiology and Disease

Chapter 4

Tissues & Systems: The Inside Story



Introduction

- ***Cells*** **are basic building blocks**
- **Similar cells are organized into *tissues* that perform similar functions.**
- ***Organ:*** **A collection of tissues designed to perform similar or several functions that work together to perform major specific activities & form systems.**
- **Ex: Kidneys, Heart, Lung, Brain**

Tissues

- Formed when there is collection of similar cells that act together to perform function
- Placed in a specific pattern to create functional walls, or tissues, of building
- Four main types:
  - Epithelial
  - Connective
  - Muscle
  - Nervous

Epithelial Tissue

- Covers & lines much of body
- Cells are packed tightly together, forming a sheet that usually has no blood vessels in it
- Further classified by shape, as well as arrangement (morphological)
- Example:
  - Flat or scale-like cells: squamous
  - Cube shaped: cuboidal
  - Column-like: columnar

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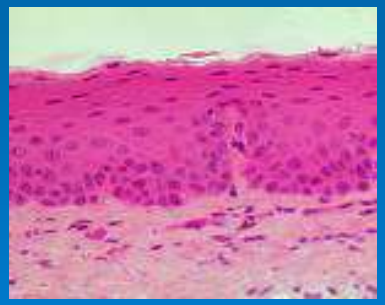
Epithelial Tissue cont'd

- Simple: When cells are arranged in single layer & are all same type of cell.
- Stratified: Are several layers deep, they are stratified & will be named by type of cell on outer layer.
- Pseudostratified: single layer of cells that looks stratified.

Simple



Stratified

Pseudostratified

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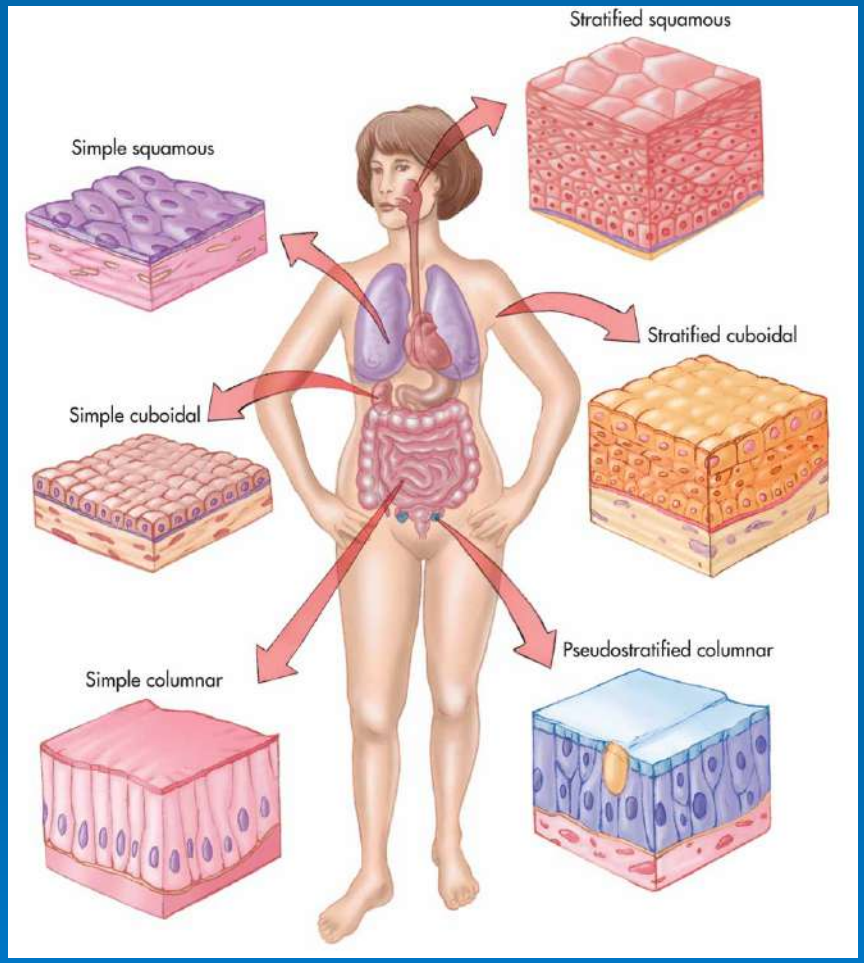
Stratified squamous
Simple squamous
Stratified cuboidal
Simple cuboidal
Pseudostratified columnar
Simple columnar

Membranes

- Sheet-like structures found throughout body that perform special functions
- Epithelial membranes can be:
  - Cutaneous: Skin which is 16% of body weight
  - Serous: 2 layered membrane with space in between

    1. Parietal- Lines walls of the cavity, produces serous fluid to reduce friction between different tissues & organs.
    2. Visceral- wraps around organs & produces serous fluid
  - Mucous: digestive, urinary, respiratory & reproductive tracts

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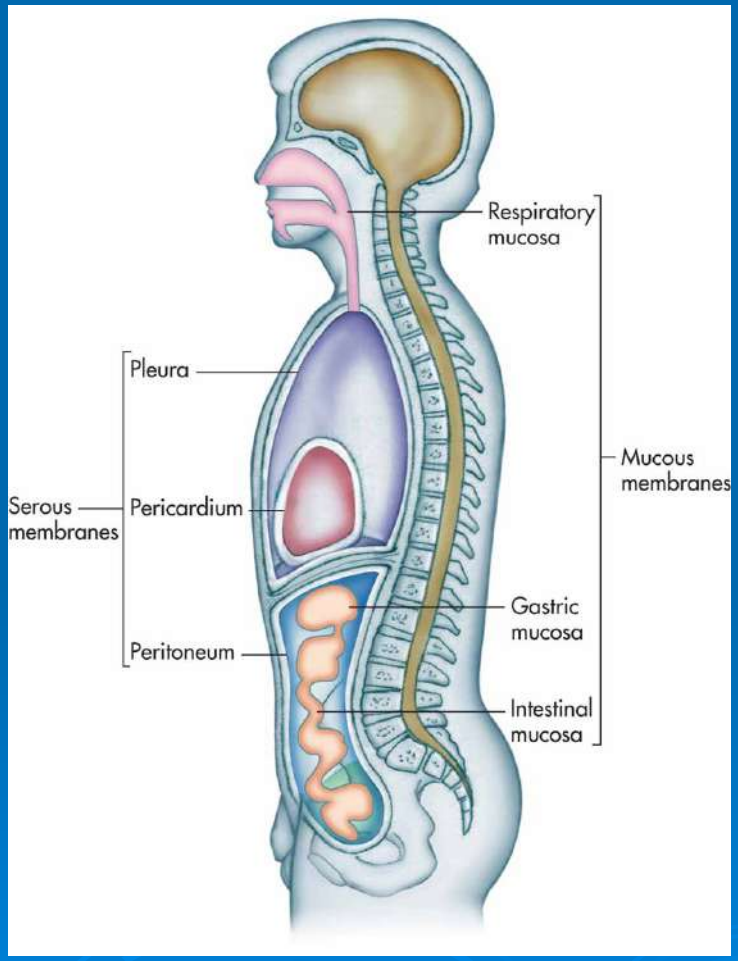
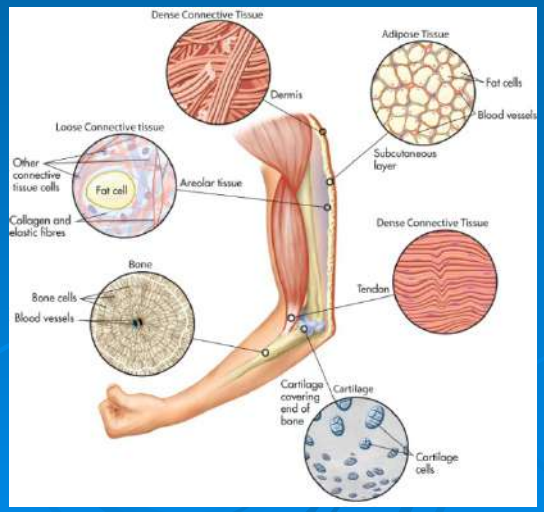
Membranes


Respiratory mucosa
Pleura
Serous membranes
Pericardium
Peritoneum
Mucous membranes
Gastric mucosa
Intestinal mucosa

Connective Tissue

- Most common of tissues, and is found scattered throughout body
- Found in organs, bones, nerves, muscles, membranes, and skin
- Holds things together and provides structure and support
- Can form fine, delicate webs or strong cord-like structures similar to wire cables



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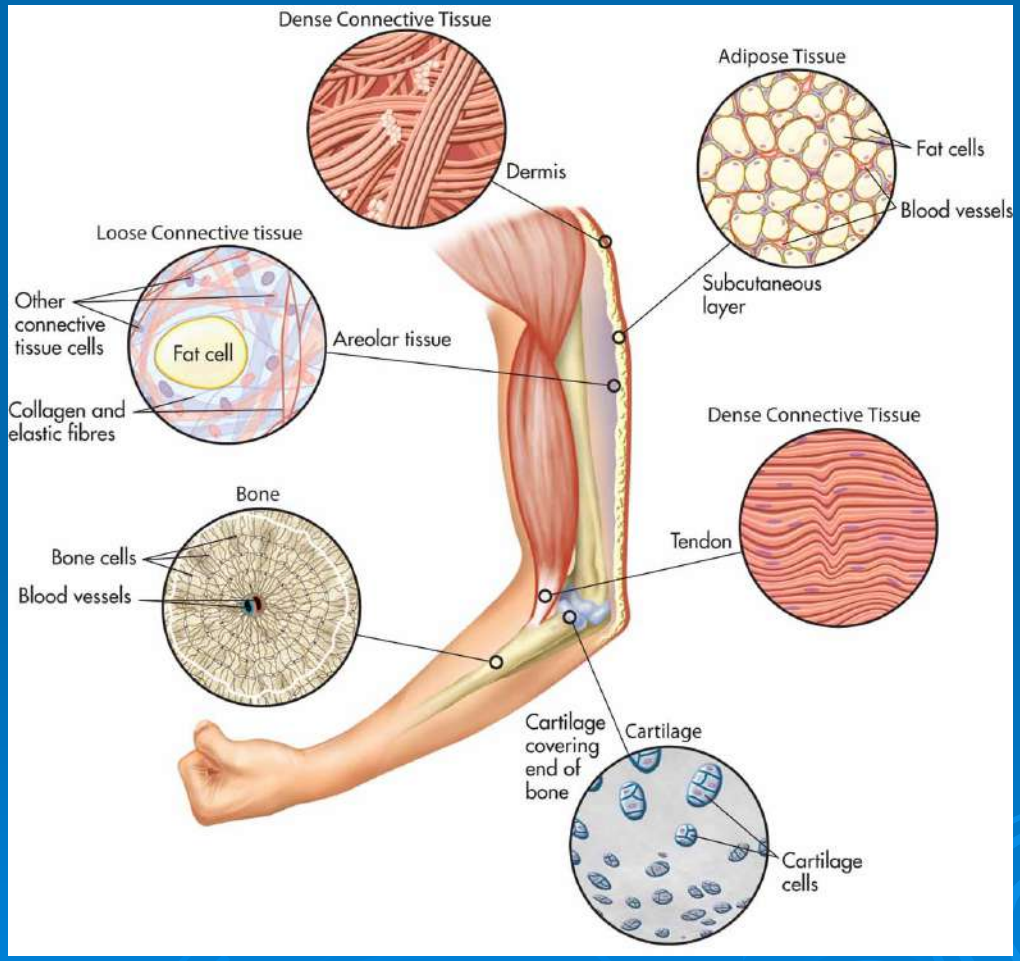
Dense Connective Tissue
Dermis
Adipose Tissue
Fat cells
Blood vessels
Subcutaneous layer
Loose Connective tissue
Other connective tissue cells
Fat cell
Areolar tissue
Collagen and elastic fibres
Dense Connective Tissue
Tendon
Bone
Bone cells
Blood vessels
Cartilage covering end of bone
Cartilage
Cartilage cells

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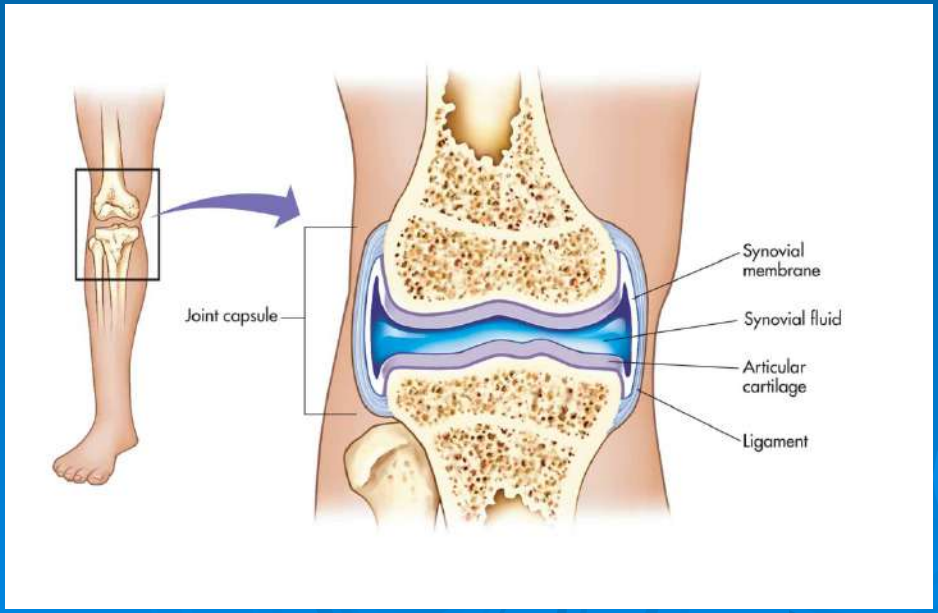
Synovial Membrane

- Membrane type associated with connective tissue
- Important membrane found in space between bone joints and produces slippery substance called Synovial fluid. This special fluid greatly reduces friction when joints move



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Muscle Tissue

- Provides means for movement
- This form of tissue has ability to shorten itself (contractility).
- Three types:
  - Skeletal
  - Cardiac
  - Smooth

Skeletal Muscle

- Called *striated* because of striped appearance
- Attached to bones; causes movement by contracting and relaxing
- Brain controls muscle contraction and relaxation; because these muscles are controlled consciously, they are called *voluntary muscles*
- Long, fiber-like cells with many nuclei in each cell

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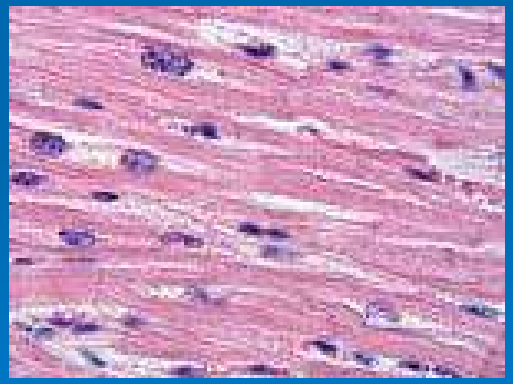
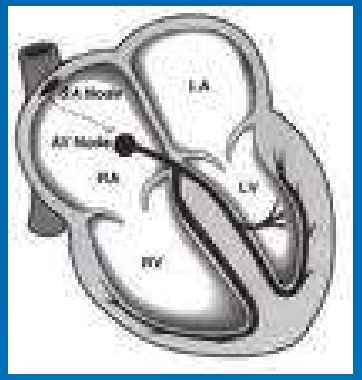
Cardiac Muscle

- Found in walls of heart
- Heart beat uses involuntary muscle cells
- Cells within tissue interlock with each other; makes for more efficient contraction





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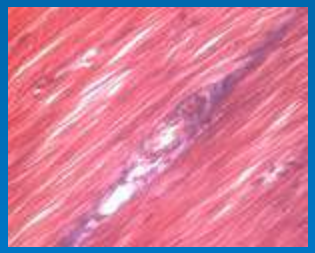
Smooth Muscles

- Forms walls of hollow organs such as in digestive system (often called **visceral tissue**) and blood vessels
- Are **involuntary** muscles
- Cells within tissue not as long and fibrous as skeletal muscles & each has only one nucleus



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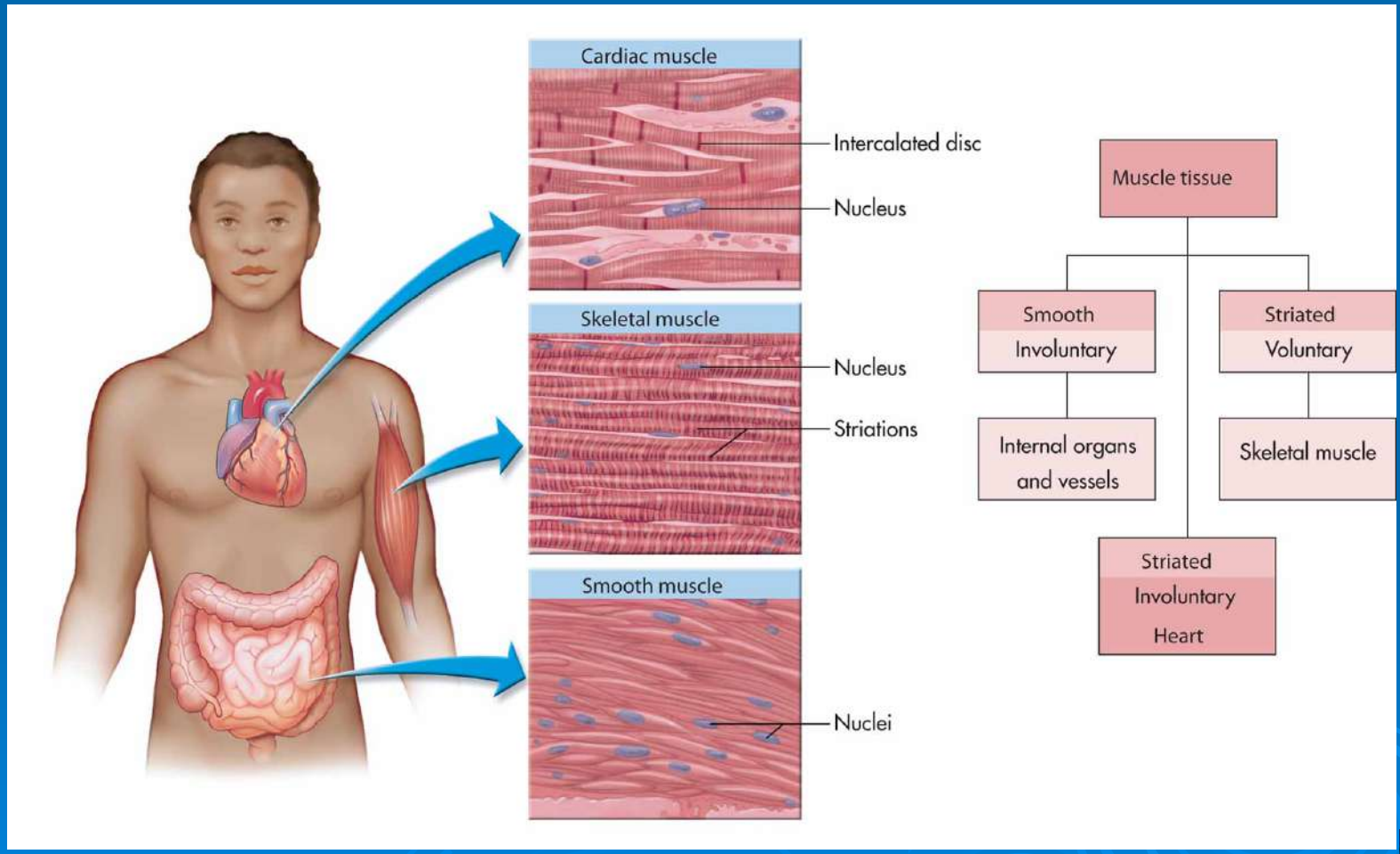
Cardiac, Skeletal & Smooth Muscle Tissue

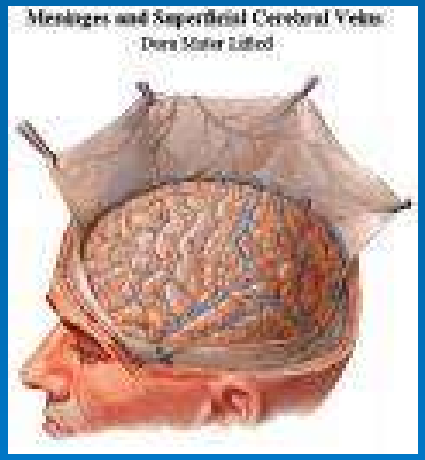


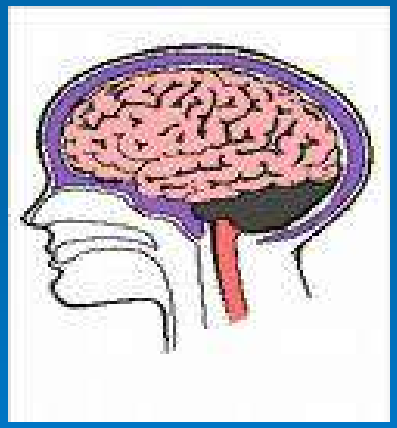
Nervous Tissue

- Acts as rapid messenger service for body; messages can cause actions to occur; two types:
  - Neurons: conduction of information
    - Dendrites: branch-like formations on neurons that receive sensory information
    - Axon: trunk-shaped structure that transports information away from cell body
  - Glia (or neuroglia): support and connection cells

Nervous Tissue Con't

- Membranes that cover brain and spinal cord called **meninges**.
- Many nerves have insulating layer called **Myelin Sheath**.





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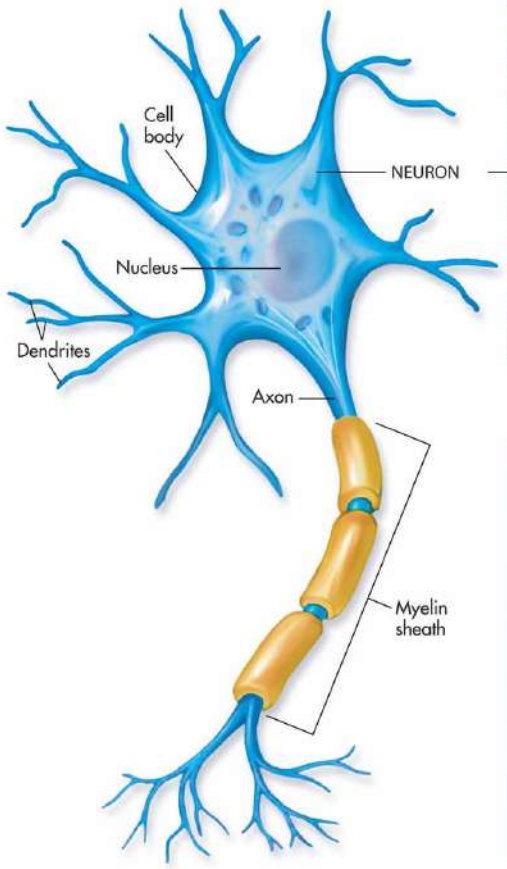
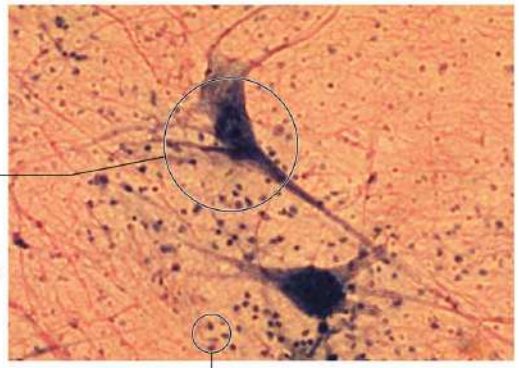
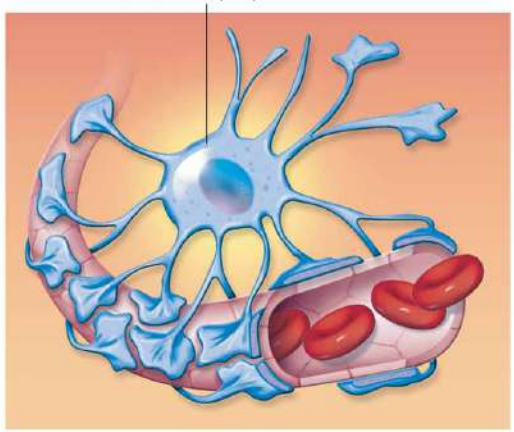
2 Types of Nerve Cells





NEUROGLIA (Glia)



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Meningitis

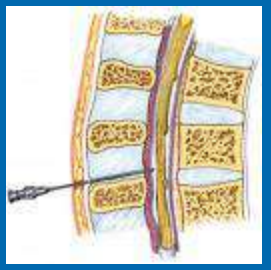
- Inflammation of meninges (membranes that cover brain and spinal cord); caused by bacteria or virus
- Bacterial form can spread via droplets from sneezing or coughing; can also spread through contact with saliva of infected person; college students & military personnel in crowded situations at higher risk.

Meningitis Cont'd

- Once infected, you become carrier of disease
- Only some people who become carriers will develop disease.
- In others, immune system actually destroys & removes pathogen before illness develops.

Symptoms of Meningitis

- non-specific headaches
- fever
- nausea
- neck-stiffness
- skin rash
- hearing loss
- Neurologic/brain damage
- Renal (kidney) failure



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Mortality vs Morbidity

- Bacterial form has approximately 10% fatality rate.
- Vaccine available for prevention
  - Does not protect against all pathogens that can cause meningitis.
  - Has been associated with adverse reactions, including headaches, dizziness, vomiting, convulsions, & even death.

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TABLE 4-2 Universally Recommended Vaccinations

POPULATION	VACCINES
All young children	Measles, mumps, and rubella
	Diphtheria-tetanus toxoid and pertussis
	Poliomyelitis
	Haemophilus influenzae type B
	Hepatitis B
	Varicella
Previously unvaccinated or partially vaccinated adolescents	Hepatitis B
	Varicella
	Measles, mumps, and rubella
	Tetanus-diphtheria toxoid
All adults	Tetanus-diphtheria toxoid
All adults aged >65 years	Influenza
	Pneumococcal

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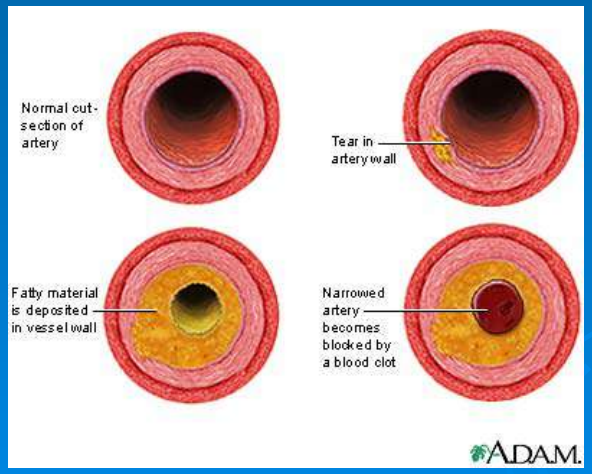
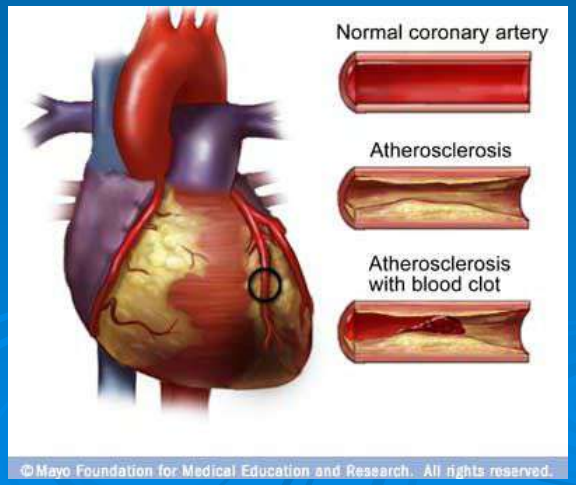
Pathology Connection: Blood Sugar & Tissue Damage

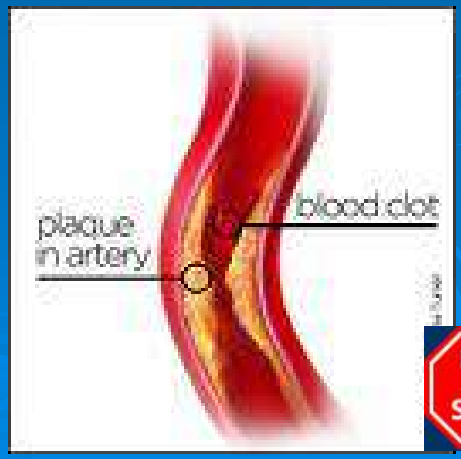
- Diabetes (& high blood sugar) can cause damage to body tissues.
- Since glucose cannot be moved inside body cells, cells must burn fats & proteins in body for energy.
- As body uses up protein, tissues start to break down, becomes difficult to produce more tissue.
- Results in "**Ketoacidosis**."
- With impaired tissue production, wounds become more difficult to heal, & infections become harder to fight.

Blood Sugar & Tissue Damage (cont'd)

- Lipids released from fat so that cell can burn lipids for energy.
  - Lipids can deposit around inside walls of blood vessels (**atherosclerosis** develops).
  - Deposits cause impaired blood flow to tissues
- Together, tissue break down, deficient blood flow, & impaired wound healing mean that diabetics prone to tissue death & gangrene; can lead to loss of toes, feet, & even legs.







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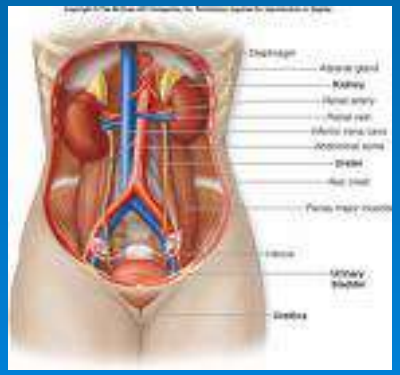
Organs

- 2 or more types of tissues organizing in such a way as to accomplish something that tissues cannot do on their own.
- Some occur singularly; brain, thyroid, & some in pairs, kidneys, adrenal glands.
- Vital ones are those you can't live without
- Others, like spleen, appendix, or gallbladder, can be removed without causing problems.

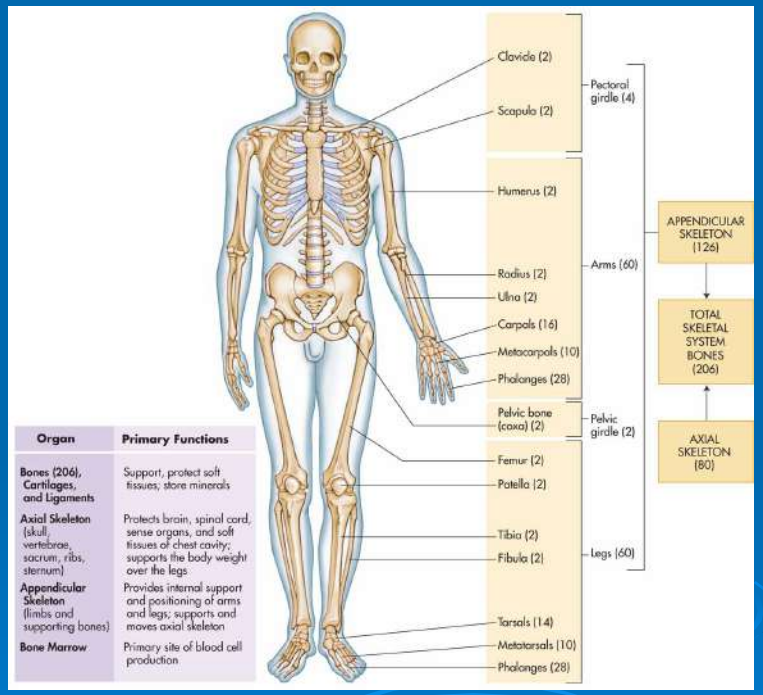


Systems

- Formed by organs that work together to accomplish something more complex than what single organ can do on its own.
- Each is interrelated, often depending on each other for proper functioning of body.

Skeletal System

- Functions
  - Provides support & structure for body
  - Protects organs
  - Provides movement
  - Stores variety of minerals
- Main components
  - Bones
  - Joints
  - Ligaments
  - Cartilage



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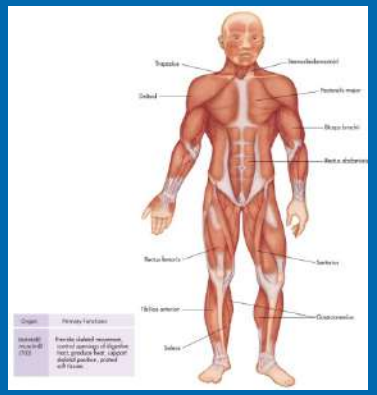
Muscular System

- Voluntary muscles
  - Movement created by conscious thought
  - Skeletal muscles attached to bones
- Involuntary muscles
  - Perform without conscious thought
  - Classified as smooth or cardiac muscle
  - Found in blood vessels, airways, and organs



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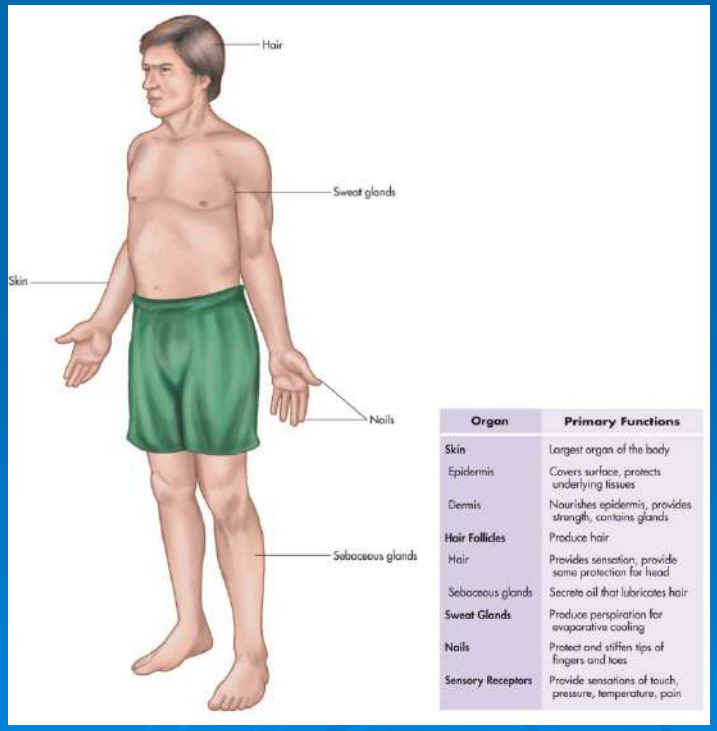
Integumentary System

- Includes skin (body's first line of protection)
- Regulates temperature through sweating, shivering, and changes in diameter of blood vessels in skin.
- Sensory information received from outside world (heat, cold, pain, pressure, etc.) comes from sensors in skin.

End Of Slide

Integumentary System Con't

- Glands in skin help lubricate & waterproof skin, & inhibit growth of unwanted bacteria.
- Main components of system: skin, hair, sweat glands, sebaceous glands, & nails.



Organ	Primary Functions
Skin	Largest organ of the body
Epidermis	Covers surface, protects underlying tissues
Dermis	Nourishes epidermis, provides strength, contains glands
Hair Follicles	Produce hair
Hair	Provides sensation, provide some protection for head
Sebaceous glands	Secrete oil that lubricates hair
Sweat Glands	Produce perspiration for evaporative cooling
Nails	Protect and stiffen tips of fingers and toes
Sensory Receptors	Provide sensations of touch, pressure, temperature, pain

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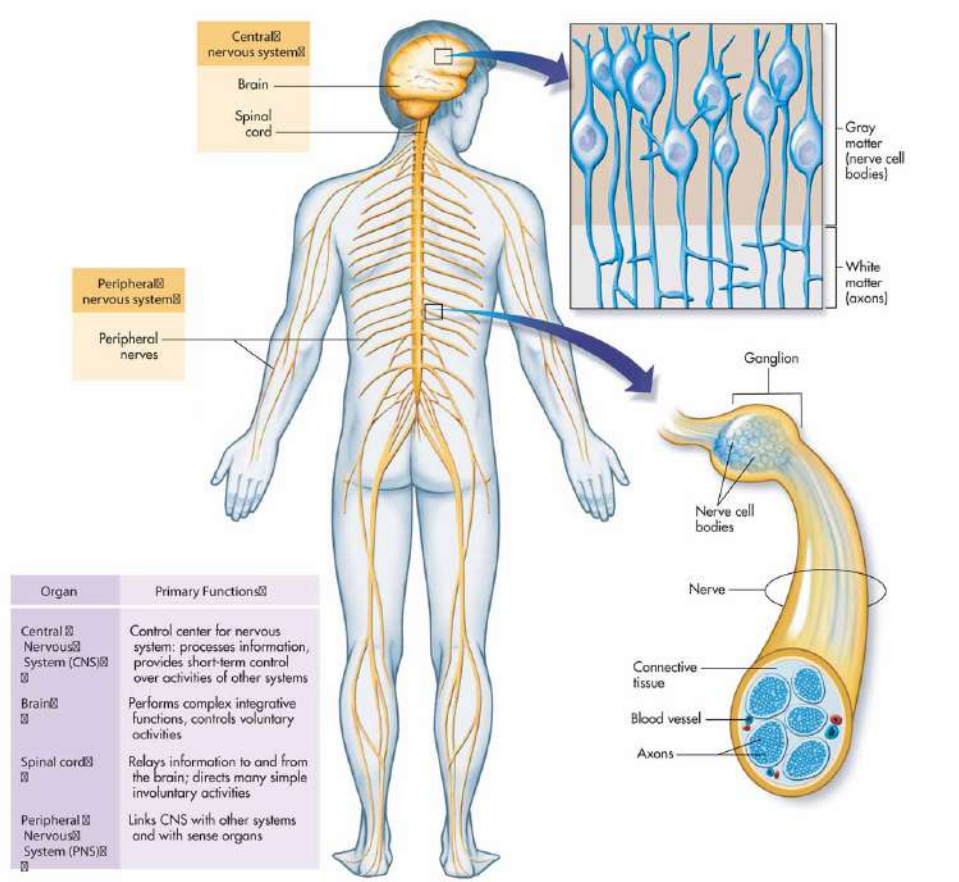
Nervous System

- Sends and receives messages, stimulated by body's internal & external environments.
- Conscious sensations occur as result of stimulation of our sensory receptors.
- Main parts of system: spinal cord, brain, peripheral nerves, nerve cells, and spinal fluid; special sensory organs: eyes, ears, nose, tongue, & skin.
- Three main functions:
  - Sensory messages
  - Processing & interpreting messages
  - Sending messages

Nervous System



Organ	Primary Functions
Central Nervous System (CNS)	Control center for nervous system: processes information, provides short-term control over activities of other systems
Brain	Performs complex integrative functions, controls voluntary activities
Spinal cord	Relays information to and from the brain; directs many simple involuntary activities
Peripheral Nervous System (PNS)	Links CNS with other systems and with sense organs

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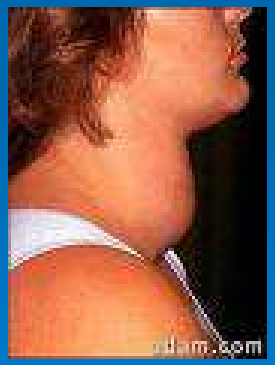
Endocrine System

- Acts as control center for virtually all of body's organs.
- Endocrine glands release chemicals called hormones that are circulated via cardiovascular system, regulating metabolic processes & utilizing metabolites for growth and reproduction.

Hypothyroidism



Goiter

Thyroxin

Hyperthyroidism

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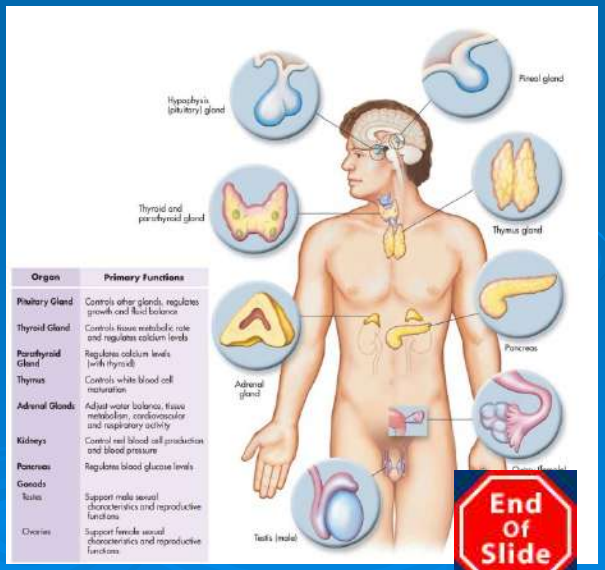
Endocrine System Cont'd

- Helps regulate fluid & electrolyte balance; helps cope with stresses produced by infection & trauma.
- Main components of system: hypothalamus, pineal, pituitary, thyroid, parathyroid, thymus, & adrenal glands, pancreas, & gonads, plus large variety of hormones.



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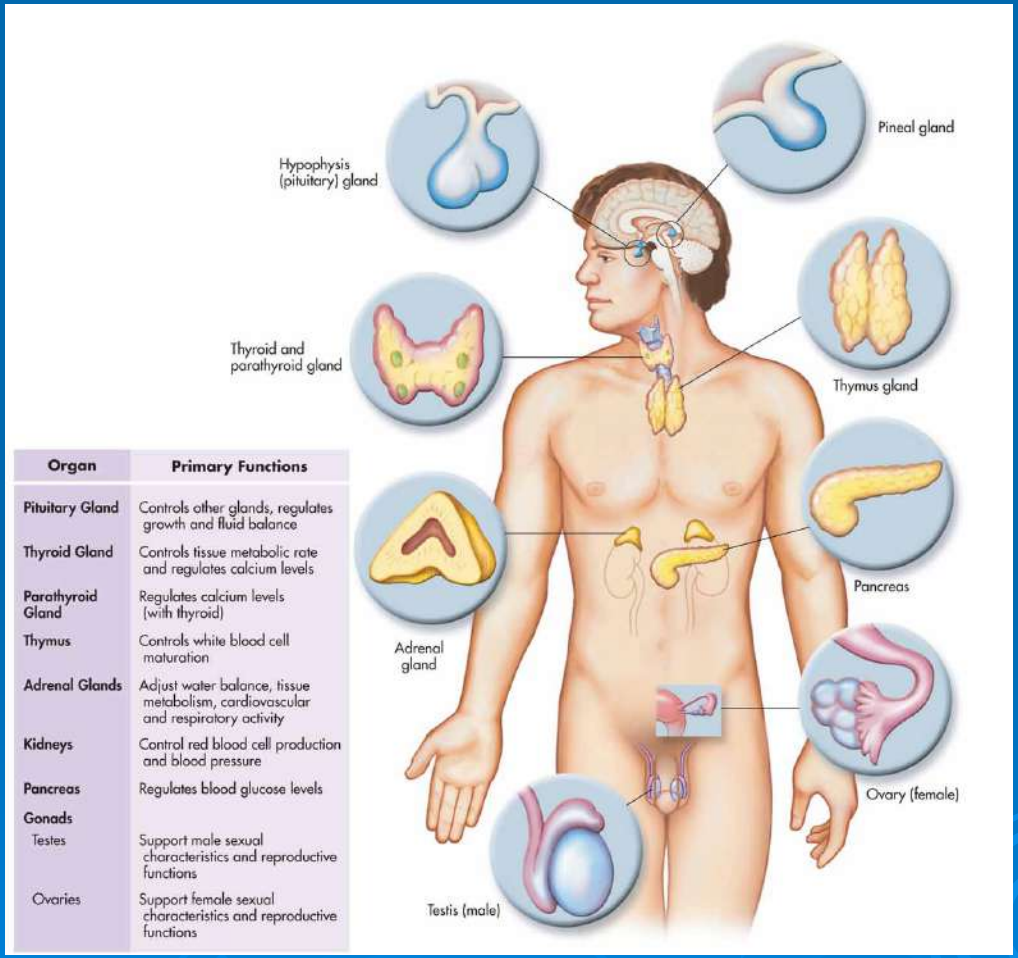
Endocrine System Cont'd

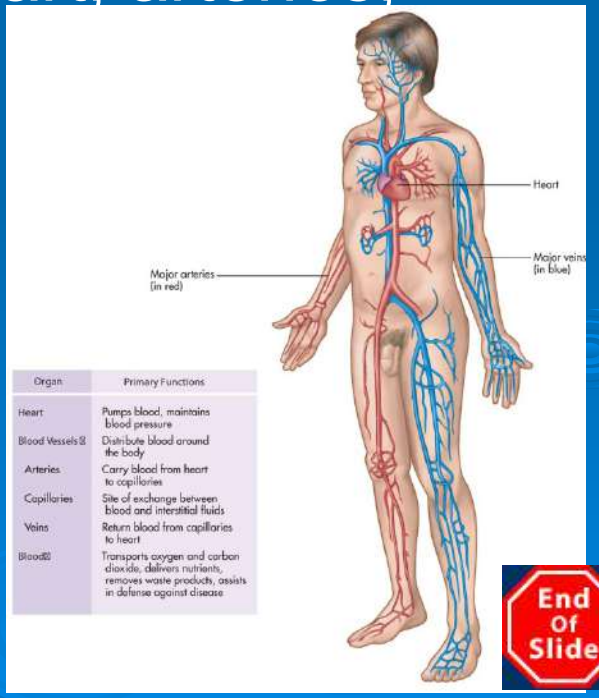


Organ	Primary Functions
Pituitary Gland	Controls other glands, regulates growth and fluid balance
Thyroid Gland	Controls tissue metabolic rate and regulates calcium levels
Parathyroid Gland	Regulates calcium levels (with thyroid)
Thymus	Controls white blood cell maturation
Adrenal Glands	Adjust water balance, tissue metabolism, cardiovascular and respiratory activity
Kidneys	Control red blood cell production and blood pressure
Pancreas	Regulates blood glucose levels
Gonads	
Testes	Support male sexual characteristics and reproductive functions
Ovaries	Support female sexual characteristics and reproductive functions

End Of Slide

Cardiovascular System

- Main transportation system to each cell of body
- Water, oxygen, and variety of nutrients & substances required for life transported to cells, while waste products removed from cells.
- Main components of system: heart, arteries, veins, capillaries, & blood.



Pathology Connection: Septicemia

- Also called Sepsis or blood poisoning; condition in which pathogen is present in blood.
- Sepsis can lead to multi-system infection
  - Blood can spread bacteria to organs
  - Once bacteria get in organs, they adversely affect organ function.

Septicemia Cont'd

- Signs and symptoms related to sepsis syndrome
  - Fever
  - Chills
  - Tachypnea
  - Tachycardia
  - Skin lesions or rash (erythema)
  - Hypoxemia
  - Changes in mental status
  - Hypotension

End Of Slide

Septicemia Cont'd

- Sepsis syndrome: infection causes decrease in blood perfusion to organs along with other systemic signs.
- **Septic shock**: decreased perfusion to organs causes critical drop in blood pressure.

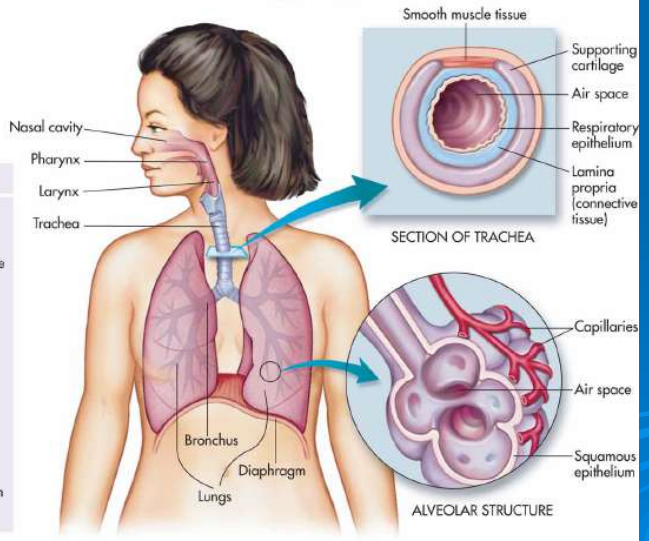
Septicemia Cont'd

- Multiple Organ Dysfunction Syndrome (MODS or multi-system failure) can develop if septic shock not quickly and effectively treated
  - As number of involved organ systems increases, mortality rate rises; can approach 100% if continued for more than 4 hospital days, depending on patient.

Respiratory System

- Supplies cells with oxygen and removes carbon dioxide.
- Filters, warms, and moistens air we breathe
- Mucous lining of airway helps trap foreign particles & pathogens.

Organ	Primary Functions
Nasal Cavities	Filter, warm, humidify air; detect smells
Pharynx	Chamber shared with digestive tract; conducts air to larynx
Larynx	Protects opening to trachea and contains vocal cords
Trachea	Filters air, traps particles in mucus; cartilages keep airway open
Bronchi	Same as trachea
Lungs	Include airways and alveoli; volume changes responsible for air movement
Alveoli	Sites of gas exchange between air and blood



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Respiratory System Con't

- System also helps maintain proper acid-base balance.
- Main parts of system: nose, nasal cavity, trachea, larynx, pharynx, bronchial tubes, & lungs.

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Nasal Cavities	Filter, warm, humidify air; detect smells
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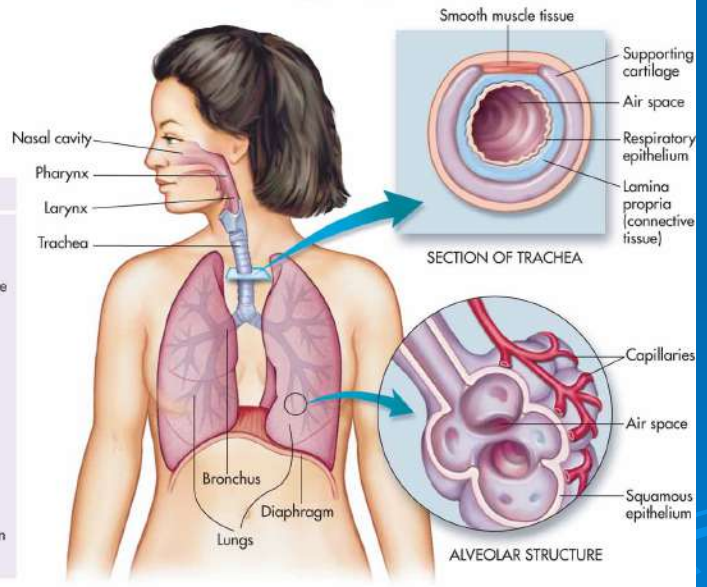

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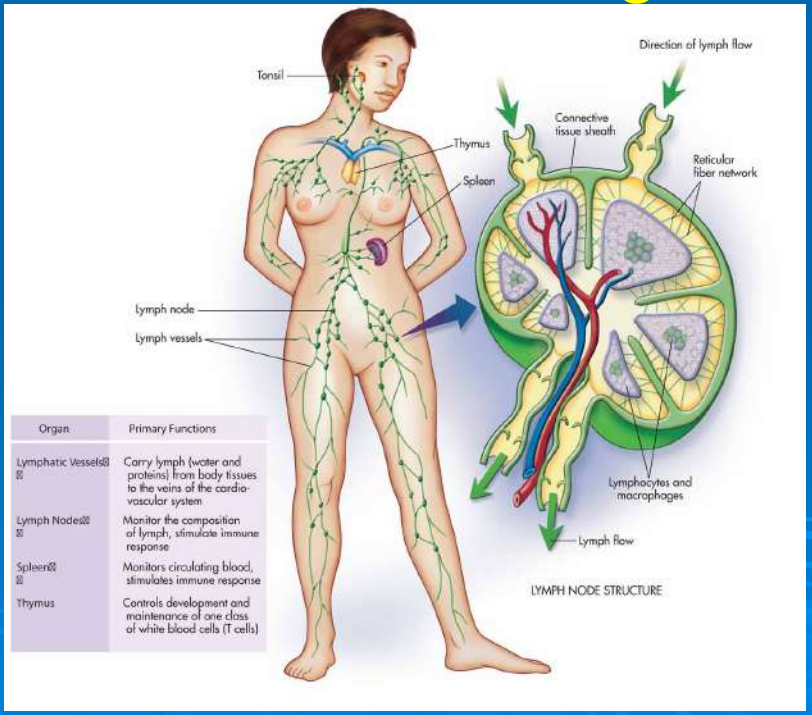
Lymphatic System

- Responsible for helping to maintain proper fluid balance & protect us from infection.
- Special structures, called lymph nodes, act as filters to capture unwanted infectious agents.



Organ	Primary Functions
Lymphatic Vessels	Carry lymph (water and proteins) from body tissues to the veins of the cardiovascular system
Lymph Nodes	Monitor the composition of lymph, stimulate immune response
Spleen	Monitors circulating blood, stimulates immune response
Thymus	Controls development and maintenance of one class of white blood cells (T cells)

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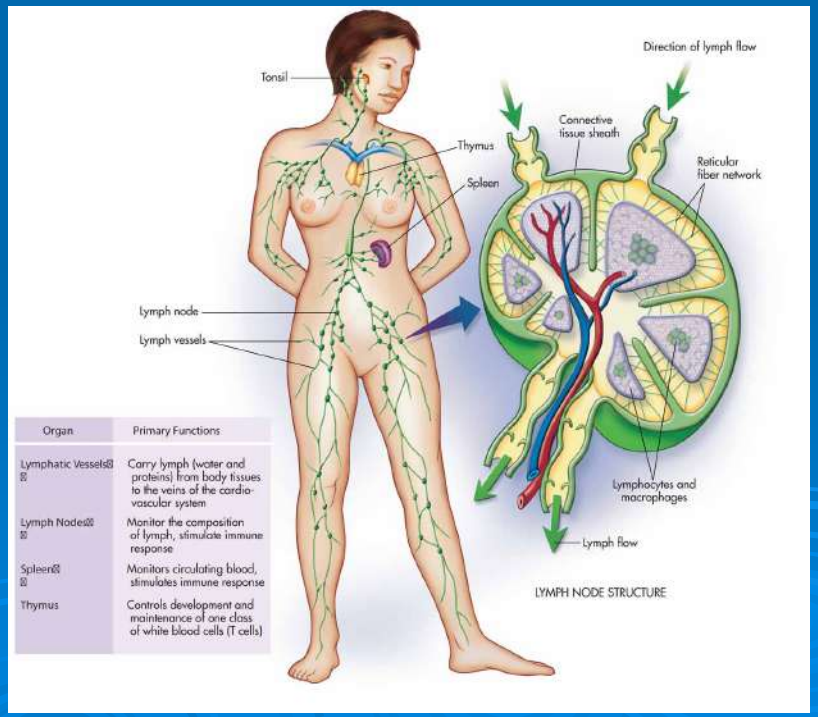
Lymphatic System Con't

- Produces special white cells, called T-lymphocytes, to fight infection.
- Major parts of system: lymph vessels, lymph ducts, lymph nodes, thymus gland, tonsils, & spleen.



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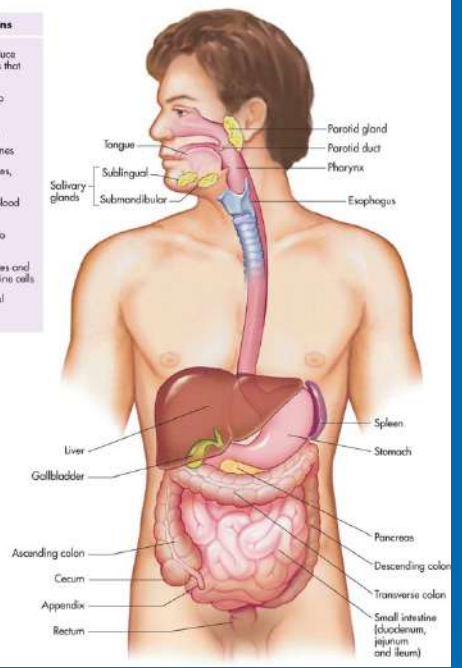
Gastrointestinal (Digestive) System

- Breaks down nutrients mechanically & chemically into usable substances.
- Absorbs nutrients for transportation to cells
- Transports waste products out of body
- Main parts of system: mouth, pharynx, esophagus, stomach, sm & lg intestines, accessory organs, bowel, & anal canal.

Organ	Primary Functions
Salivary Glands	Provide lubrication, produce buffers and the enzymes that begin digestion
Pharynx	Passageway connected to esophagus
Esophagus	Delivers food to stomach
Stomach	Secretes acids and enzymes
Small Intestine	Secretes digestive enzymes, absorbs nutrients
Liver	Secretes bile, regulates blood chemistry
Gallbladder	Stores bile for release into small intestine
Pancreas	Secretes digestive enzymes and buffers; contains endocrine cells
Large Intestine	Removes water from fecal material, stores waste



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Pathology Connection:
Body Image

Obesity:

- **Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life** expectancy and/or increased health problems.

Pathology Connection:

Anorexia Nervosa

- Condition in which there is progressive & severe weight loss.
- Avoid eating or eat too little food to sustain healthy weight.
- Pts deny problem

Pathology Connection:
Bulimia

- Pt has eating binges, overeats, then attempts to get rid of food by vomiting or using laxatives to avoid weight gain.

Urinary System

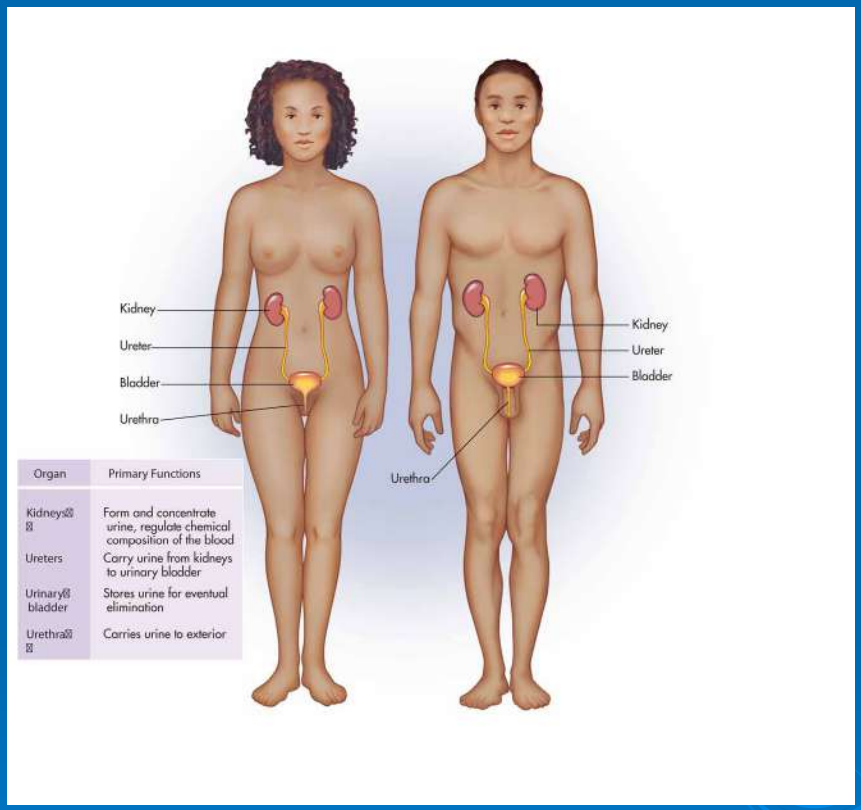
- Important role in elimination of waste products, electrolytes, drugs, & other toxins, & excessive water.

Functions:

- H2O regulation, BP regulation, regulation of RBCs, electrolyte balance, & pH balance.

Main Parts:

- kidneys, ureters, urinary bladder, and urethra.



Organ	Primary Functions
Kidneys	Form and concentrate urine, regulate chemical composition of the blood
Ureters	Carry urine from kidneys to urinary bladder
Urinary bladder	Stores urine for eventual elimination
Urethra	Carries urine to exterior

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Reproductive System

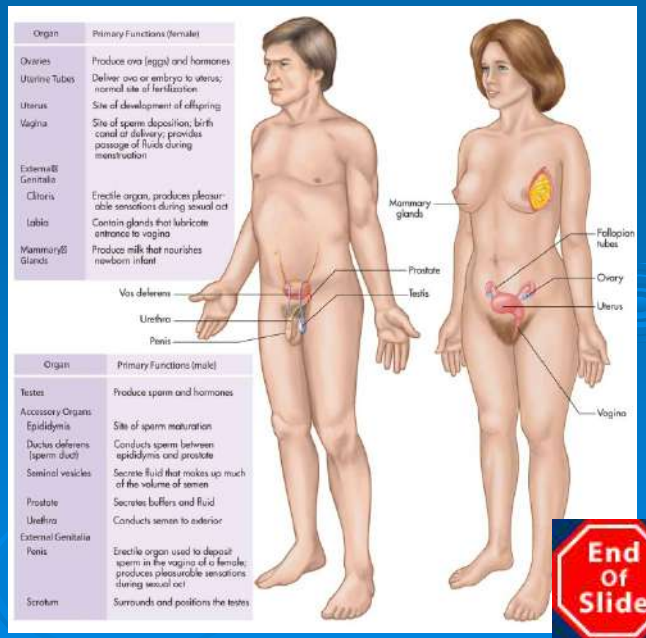
- Combined with urinary system to make genitourinary system.
- Purpose: to make new humans

Main female parts:

- ovaries, uterus, fallopian tubes, eggs, & vagina

Main male parts:

- testes, sperm, and penis



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