

The Human Body

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Introduction

- A working knowledge of anatomy is important.
- **Anatomy vs. Physiology vs. Pathophysiology**
- Knowledge of anatomy helps to communicate correct information:
 - To professionals, who know medical terms
 - To others, who may not understand medical terms

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Topographic Anatomy

- Superficial landmarks
 - Serve as guides to structures that lie beneath them
- Topographic anatomy applies to a body in the *anatomic position*.
 - Patient stands facing you, arms at side, palms forward.



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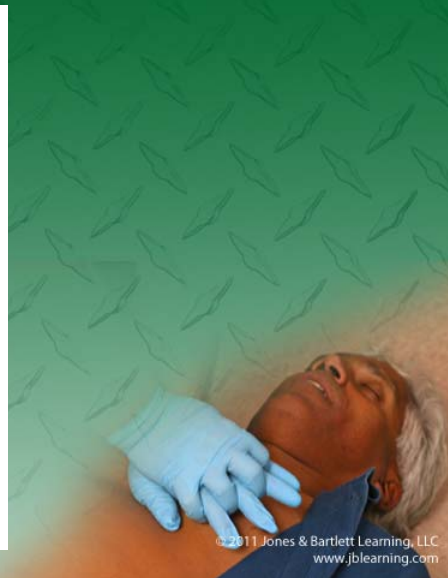
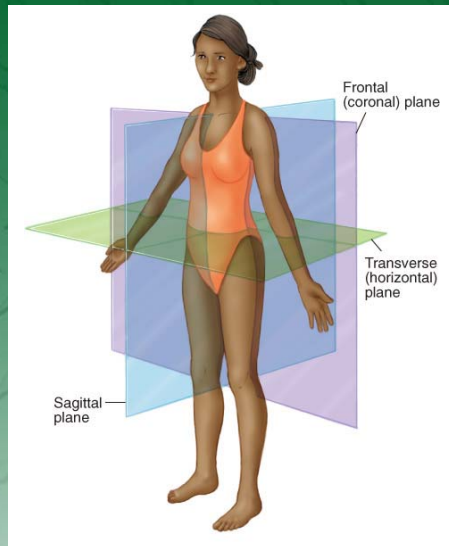
Planes of the Body (1 of 2)

- Imaginary straight lines that divide the body
- Three main areas
 - Coronal plane: front/back
 - Transverse (axial) plane: top/bottom
 - Sagittal (lateral) plane: left/right



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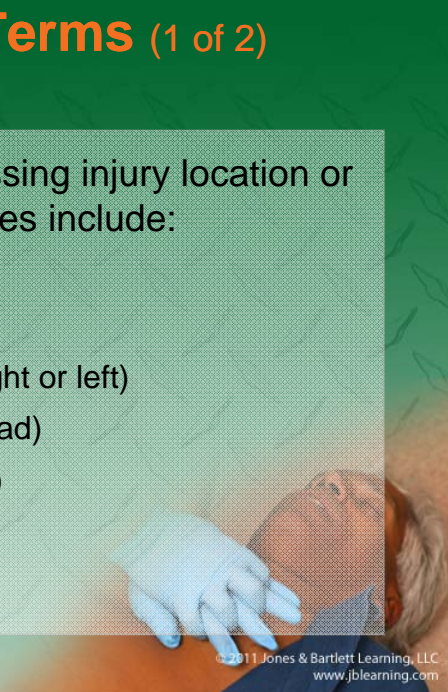
Planes of the Body (2 of 2)



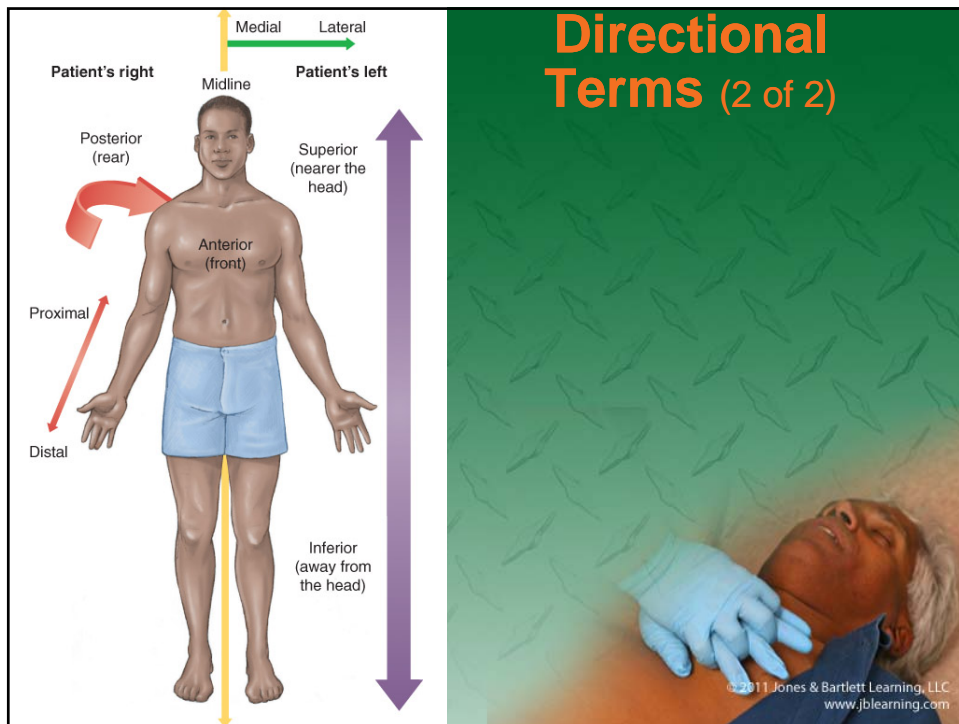
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Directional Terms (1 of 2)

- Important when discussing injury location or pain radiation. Examples include:
 - Anterior (ventral)
 - Posterior (dorsal)
 - Right, left (patient's right or left)
 - Superior (closest to head)
 - Inferior (closest to feet)



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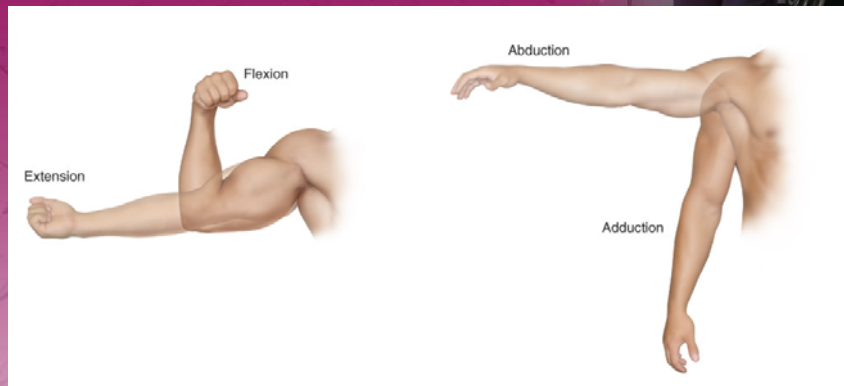
Movement Terms (1 of 2)

- *Flexion* is the bending of a joint.
- *Extension* is the straightening of a joint.
- *Adduction* is motion toward the midline.
- *Abduction* is motion away from the midline.

A paramedic in a blue uniform stands next to an ambulance. The ambulance has 'EMERGENCY MEDICAL SERVICE' written on it. The paramedic is looking towards the camera.

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Movement Terms (2 of 2)



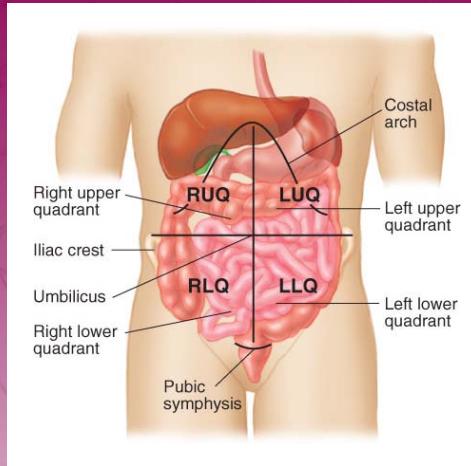
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Other Directional Terms (1 of 2)

- Many structures are bilateral, appearing on both sides of midline.
- Abdomen is divided into quadrants for communication purposes.
 - RUQ
 - LUQ
 - RLQ
 - LLQ

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Other Directional Terms (2 of 2)



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Anatomic Positions



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The Skeletal System: Anatomy

- Skeleton gives us our recognizable human form.
- Protects vital internal organs
- Contains
 - Bones
 - Ligaments
 - Tendons
 - Cartilage

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The Axial Skeleton (1 of 4)

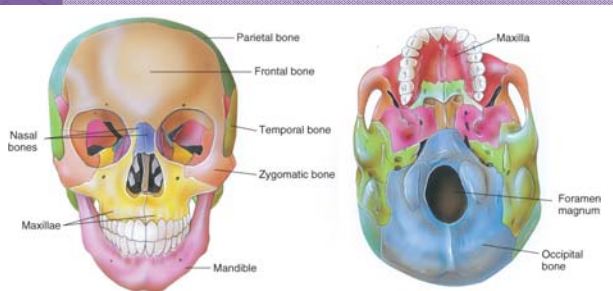
- Foundation on which the arms and legs are hung. Includes:
 - Skull
 - Spinal column
 - Thorax

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The Axial Skeleton (2 of 4)

- Skull

- Cranium—made up of 4 bones
- Face—made up of 14 bones
- Foramen magnum is the opening at base of skull to allow brain to connect to spinal cord.

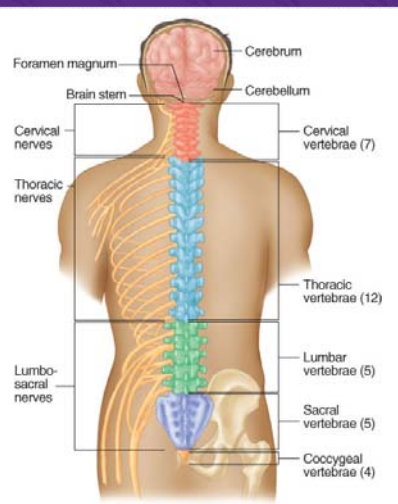


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The Axial Skeleton (3 of 4)

- Spinal column

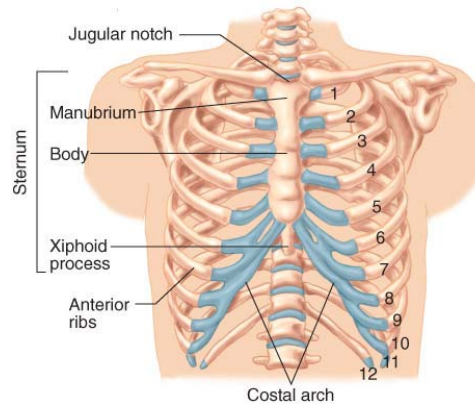
- Composed of 33 bones (vertebrae)
- Spine divided into 5 sections:
 - Cervical
 - Thoracic
 - Lumbar
 - Sacrum
 - Coccyx



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The Axial Skeleton (4 of 4)

- Thorax
 - Formed by of 12 thoracic vertebrae and 12 pairs of ribs
 - Thoracic cavity contains
 - Heart
 - Lungs
 - Esophagus
 - Great vessels



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The Appendicular Skeleton

- Arms, legs, their connection points, and pelvis
- Includes:
 - Upper extremity
 - Pelvis
 - Lower extremity

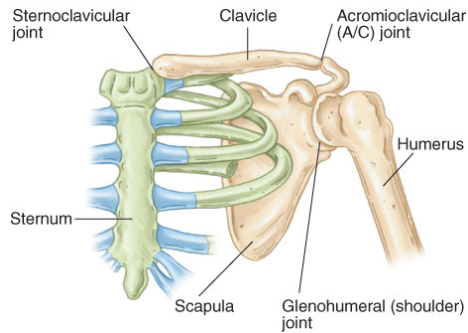
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The Upper Extremity (1 of 4)

- Upper extremity extends from shoulder girdle to fingertips
 - Composed of arms, forearms, hands, fingers

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The Upper Extremity (2 of 4)



- Shoulder girdle
 - Three bones come together, allowing arm to be moved:
 - Clavicle, scapula, humerus

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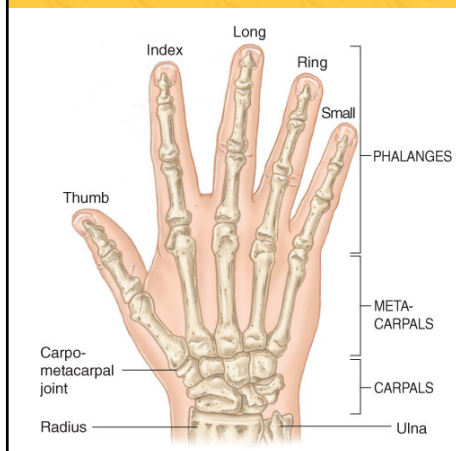
The Upper Extremity (3 of 4)

– Arm

- The humerus is the supporting bone of the arm.
- The forearm consists of the radius and ulna.
 - Radius on lateral side of forearm
 - Ulna on medial side of forearm

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The Upper Extremity (4 of 4)



– Wrist and hand

- Ball-and-socket joint
- Principal bones
 - Carpals, metacarpals, phalanges

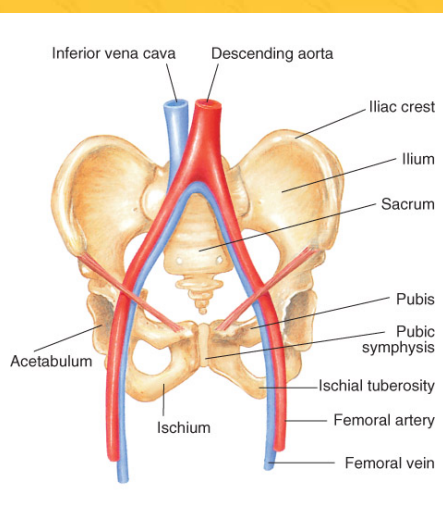
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The Pelvis (1 of 2)

- Closed bony ring consisting of three bones
 - Sacrum
 - Two pelvic bones
 - Each pelvic bone is formed by fusion of ilium, ischium, and pubis.

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The Pelvis (2 of 2)



- Posteriorly, the ilium, ischium, and pubis bones are joined by the sacrum
- Anteriorly, the pubic symphysis is where the right and left pubis are joined

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The Lower Extremity (1 of 4)

- Main parts are thigh, leg, foot.
- Upper leg: femur (thigh bone)
 - Longest bone in body, femur connects into acetabulum (pelvic girdle) by ball-and-socket joint.
 - Greater and lesser trochanter are where major muscles of thigh connect to femur.

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The Lower Extremity (2 of 4)

- Knee connects upper leg to lower leg
 - Kneecap (patella)
- Lower Leg
 - Tibia (shin bone)
 - Anterior of leg
 - Fibula
 - Lateral side of leg

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The Lower Extremity (3 of 4)

Labels for the anatomical diagram:

- Pelvis
- Femoral head
- Greater trochanter
- Lesser trochanter
- Femur
- Patella (knee cap)
- Fibula
- Tibia (shin bone)
- ANKLE
- FOOT
- HIP
- THIGH
- KNEE
- LEG
- Tarsals
- Metatarsals
- Phalanges

- Ankle
 - A hinge joint
 - Allows flexion/extension of foot

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The Lower Extremity (4 of 4)

Labels for the anatomical diagram:

- Achilles tendon
- Medial malleolus
- Talus
- Navicular
- Medial cuneiform
- Phalanges
- Metatarsal
- Calcaneus

- Foot
 - Contains 7 tarsal bones
 - 5 metatarsal bones form substance of foot
 - Toes are formed by phalanges

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Joints (1 of 2)

- Occur wherever two long bones come in contact
- Two types of joints
 - Hinge joint
 - Motion restricted to one plane
 - Ball-and-socket joint
 - Allows rotation and bending
 - Fixed Joint
 - Cranium

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Joints (2 of 2)



Hinge Joint



Ball-and-socket joint

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The Skeletal System: Physiology

- The skeletal system:
 - Gives body shape
 - Provides protection of fragile organs
 - Allows for movement
 - Stores calcium
 - Helps create blood cells

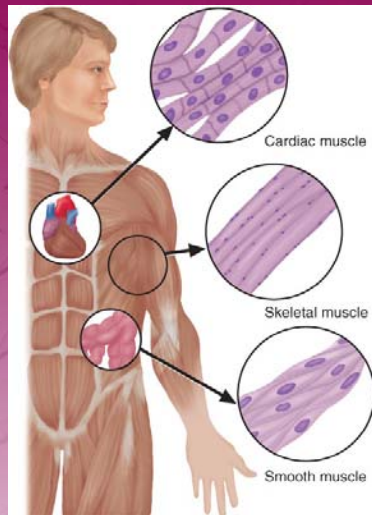
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The Musculoskeletal System: Anatomy (1 of 4)

- Musculoskeletal system provides:
 - Form
 - Upright posture
 - Movement
- More than 600 muscles attach to bone.
 - Called skeletal (or voluntary) muscles

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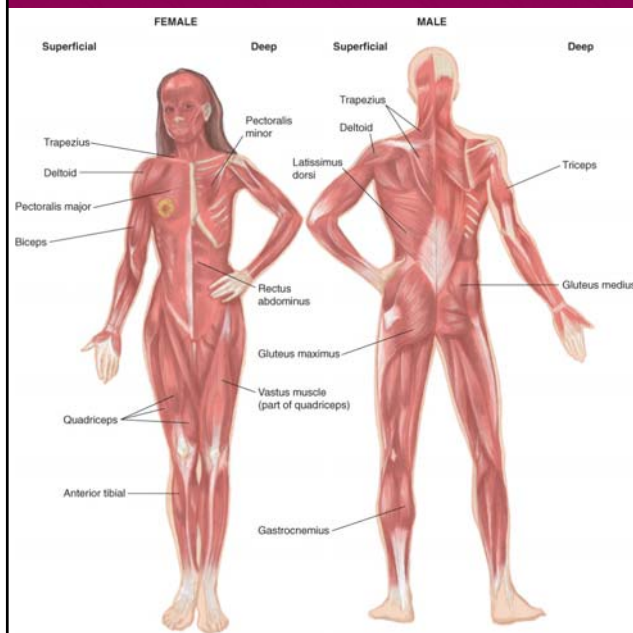
The Musculoskeletal System: Anatomy (3 of 4)



- Other types of muscle outside the musculoskeletal system
 - Smooth muscle
 - Cardiac muscle

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The Musculoskeletal System: Anatomy (4 of 4)



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The Musculoskeletal System: Physiology

- Contraction and relaxation of system make it possible to move and manipulate environment.
- A byproduct of this movement is heat.
 - When you get cold, you shiver (shake muscles) to produce heat.



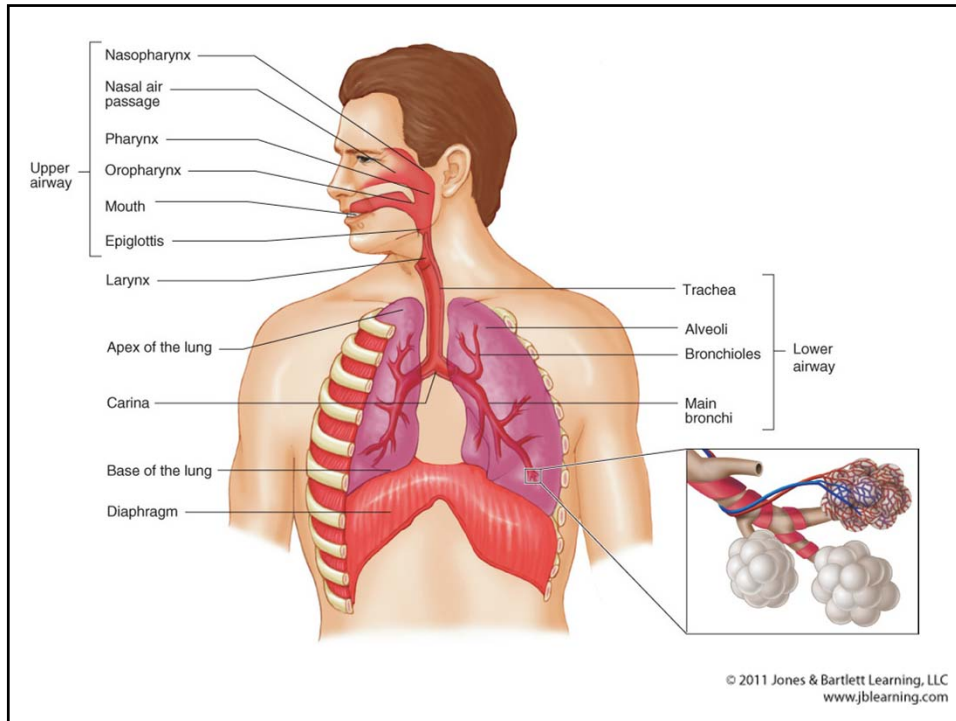
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The Respiratory System: Anatomy

- Structures of the body that contribute to respiration (the process of breathing)



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Upper Airway (1 of 3)

- Includes:
 - Nose
 - Mouth
 - Tongue
 - Jaw
 - Oral cavity

Upper Airway (2 of 3)

- Upper airway includes (cont' d)
 - Pharynx
 - Nasopharynx
 - Oropharynx
 - Laryngopharynx
 - Larynx is anterior
 - Esophagus is posterior



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Upper Airway (3 of 3)

- Upper airway (cont' d)
 - Epiglottis
 - Prevents food and liquid from entering trachea



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Lower Airway

- Larynx is the dividing line between upper and lower airway.
 - Adam's apple/thyroid cartilage is anterior.
 - Cricoid cartilage/cricoid ring forms lowest portion of larynx.
- Trachea (windpipe)
 - Ends at carina, dividing into right and left bronchi leading to bronchioles

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Lungs (1 of 2)

- The two lungs are held in place by:
 - Trachea
 - Arteries and veins
 - Pulmonary ligaments
- Divided into two lobes
 - Bronchi and bronchioles end with alveoli.
 - Alveoli allow for gas exchange.

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Lungs (2 of 2)

- Lungs are covered by smooth, glistening tissue called pleura



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Thyroid cartilage

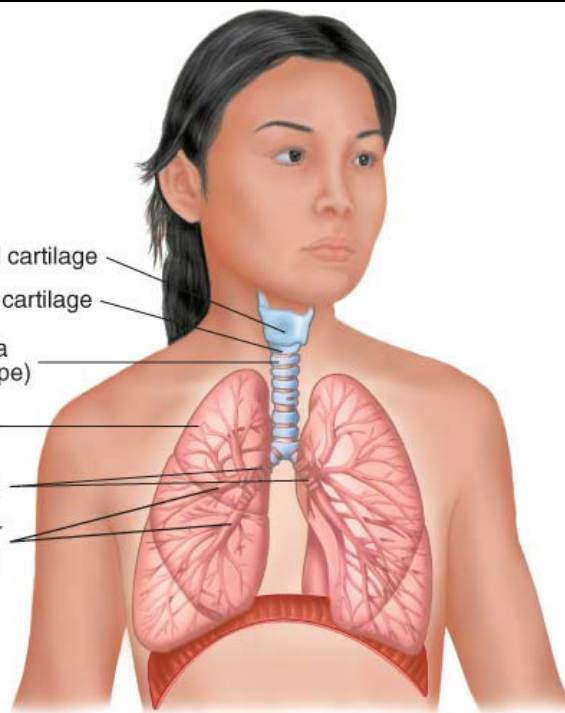
Cricoid cartilage

Trachea
(windpipe)

Alveoli

Main
bronchi

Smaller
bronchi

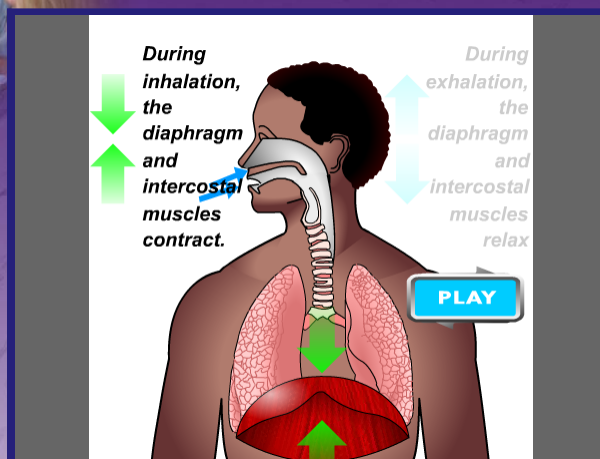


Muscles of Breathing (1 of 2)


- Diaphragm is primary muscle.
- Also involved are:
 - Intercostal muscles
 - Abdominal muscles
 - Pectoral muscles

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Muscles of Breathing (2 of 2)




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The Respiratory System: Physiology (1 of 7)

- Function is to provide body with oxygen and eliminate carbon dioxide.
- Ventilation and respiration are two separate, interdependent functions of the respiratory system.

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The Respiratory System: Physiology (2 of 7)

- *Respiration* is the exchange of oxygen and carbon dioxide in alveoli and tissue.
 - Brain stem controls breathing.
 - **Hypercarbic drive is main system**
 - Hypoxic drive is backup system.

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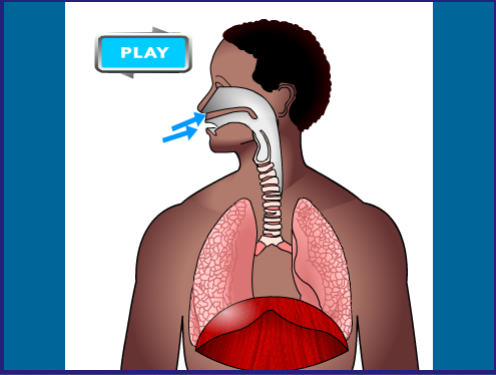
The Respiratory System: Physiology (5 of 7)

- *Respiration* (cont' d)
 - Medulla initiates ventilation cycles.
 - Dorsal respiratory group (DRG)
 - Initiates inspiration
 - Ventral respiratory group (VRG)
 - Provides forced inspiration or expiration when needed
 - » Speaking
 - » COPD Exhalation


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The Respiratory System: Physiology (6 of 7)

- *Ventilation* is simple air movement into and out of the lungs.




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The Respiratory System: Physiology (7 of 7)

- You provide ventilation when you administer oxygen – **but...**
- Tidal volume is amount of air moved into or out of lungs in a single breath.

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Characteristics of Normal Breathing

- Normal rate and depth (tidal volume)
- Regular rhythm or pattern of inhalation and exhalation
- Good audible breath sounds on both sides of chest
- Regular rise and fall movement on both sides of the chest
- Movement of the abdomen
- →NOT TOO INTERESTING←

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Inadequate Breathing Patterns in Adults

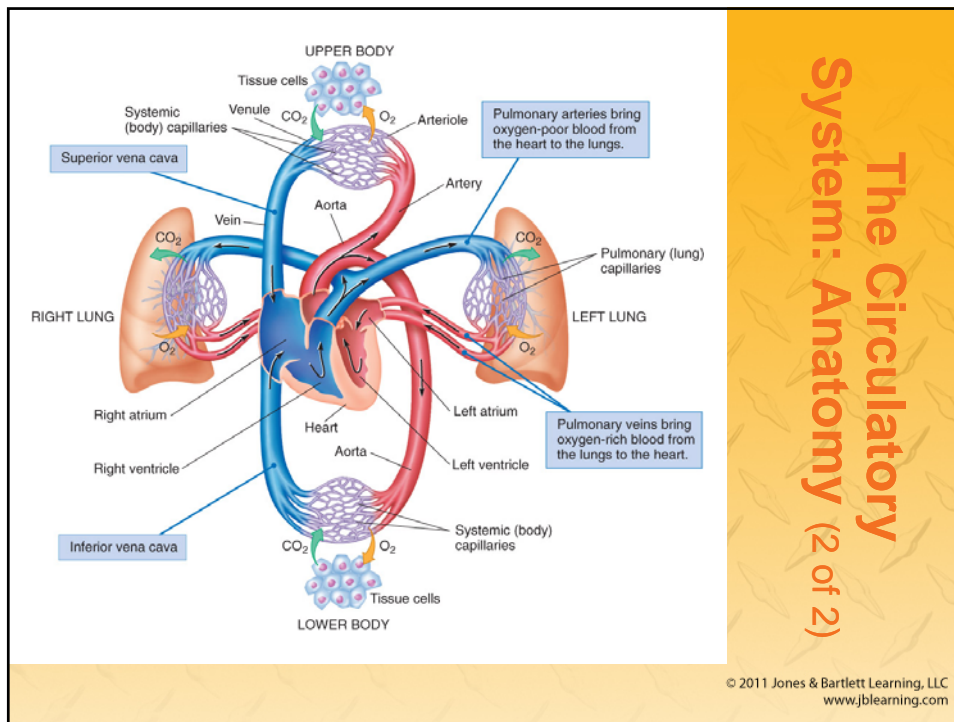
- Labored breathing
- Muscle retractions
- Pale, cyanotic, cool, damp skin
- Tripod position
- **Agonal gasps (gaspings breaths)**
- Nasal Flaring
- **Pursed lip breathing**

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The Circulatory System: Anatomy (1 of 2)


- Complex arrangement of connected tubes
 - Arteries, arterioles, capillaries, venules, veins
- Two circuits
 - Systemic circulation—body
 - Pulmonary circulation—lungs

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The Heart (1 of 7)

- Hollow muscular organ the size of an adult's clenched fist
- Made of specialized cardiac muscle (myocardium)
- Works as two paired pumps
 - Septum divides right and left sides.



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The Heart (2 of 7)

- Each side is divided into:
 - Atrium (upper chamber)
 - Ventricle (lower chamber)

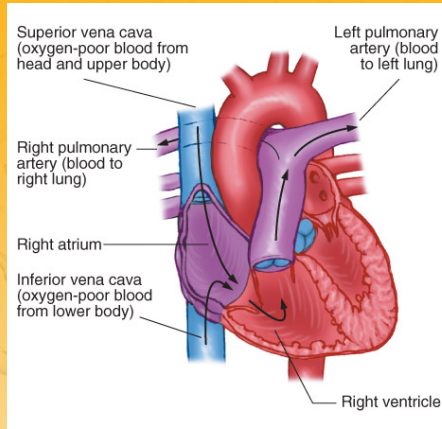
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The Heart (3 of 7)

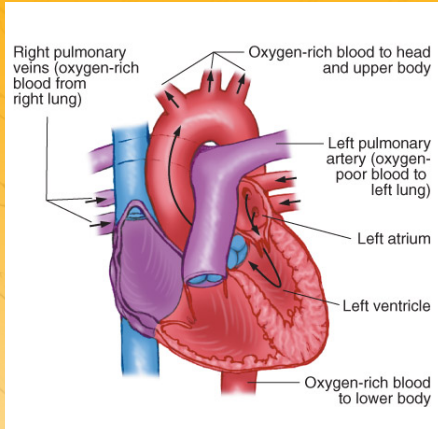
- Circulation
 - Heart receives its blood from aorta.
 - Right side receives blood from veins.
 - Left side receives blood from lungs.

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The Heart (4 of 7)



Right side

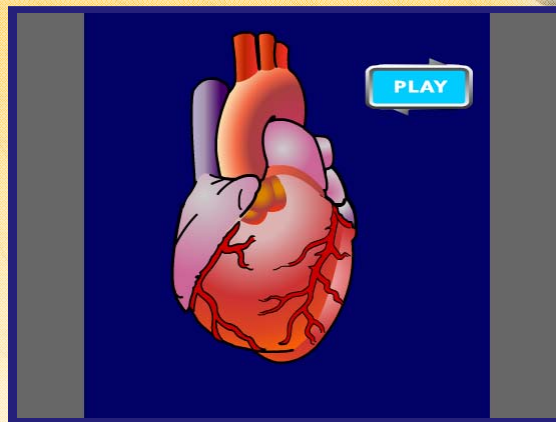


Left side

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The Heart (5 of 7)

- Circulation and **CPR**



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The Heart (6 of 7)

- Normal resting heart rate (HR) is 60 to 100 beats/min.
- Stroke volume (SV)
 - Amount of blood moved by one beat
- Cardiac output (CO)
 - Amount of blood moved in 1 minute
 - $HR \times SV = CO$

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The Heart (7 of 7)

- In 1 minute, body's entire blood volume (5 to 6 L) is circulated through all the vessels.
- Electrical conduction network
 - Causes smooth, coordinated contractions
 - Contractions produce pumping action

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Arteries (1 of 4)

- Arteries carry blood from heart to all body tissues.
 - Branch into arterioles
 - Arterioles branch into capillaries
- Pulse is created by blood pumping out of left ventricle into major arteries.

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Arteries (2 of 4)

- Major arteries
 - Aorta (heart)
 - Pulmonary (right ventricle)
 - Carotid (neck)
 - Femoral (thigh)
 - Posterior tibial (lower leg)
 - Dorsalis pedis (foot)

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Arteries (3 of 4)

- Major arteries (cont' d)
 - Brachial (upper arm)
 - Radial (lower arm)



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Major Arteries

- Internal carotid
- External carotid
- Common carotid
- Subclavian
- Innominate
- Axillary
- Pulmonary
- Ascending aorta
- Brachial
- Descending aorta
- Common iliac
- Ulnar
- Radial
- Palmar arches
- Digital
- Deep femoral
- Superficial femoral
- Popliteal
- Anterior tibial
- Posterior tibial
- Peroneal
- Dorsalis pedis
- Arcuate

Major Veins

- Internal jugular
- External jugular
- Innominate
- Subclavian
- Axillary
- Superior vena cava
- Pulmonary
- Cephalic
- Brachial
- Antecubital
- Inferior vena cava
- Common iliac
- Volar digital
- Great saphenous
- Femoral
- Popliteal
- Anterior tibial
- Peroneal
- Posterior tibial
- Dorsal venous arch

Arteries (4 of 4)

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Capillaries

- Connect arterioles to venules
- Fine end divisions of arterial system
- Allow contact between blood and cells
- Billions of capillaries in body

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Veins

- *Usually* return oxygen-depleted blood to the heart
- Superior vena cava carries blood returning from head, neck, shoulders, upper extremities.
- Inferior vena cava carries blood from abdomen, pelvis, lower extremities.
- Join at right atrium

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Spleen

- Solid organ located under rib cage
- Filters blood
- Is particularly susceptible to injury from blunt trauma
 - Can lead to severe internal bleeding


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Blood Composition

- Plasma
- Red blood cells (erythrocytes)
- White blood cells (leukocytes)
- Platelets

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The Circulatory System: Physiology (1 of 2)



- Blood pressure is pressure blood exerts against walls of arteries.
- When left ventricle of heart contracts, it pumps blood from ventricle into aorta.
 - Called systole

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The Circulatory System: Physiology (2 of 2)



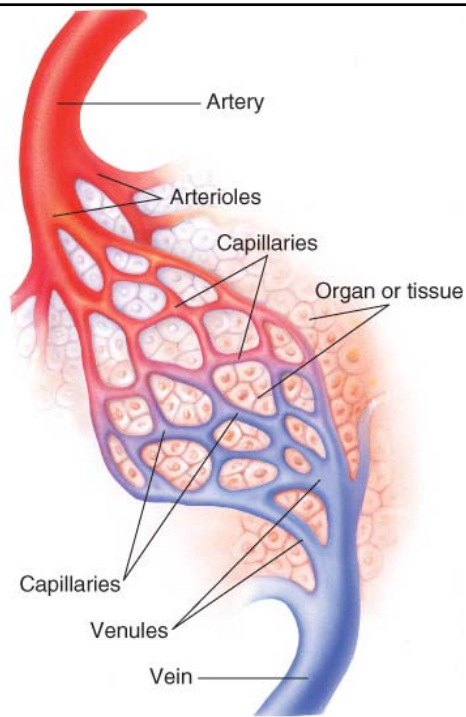
- When muscle of ventricle relaxes, ventricle fills with blood.
 - Called diastole
- Blood pressure readings
 - Systolic blood pressure (Top #)
 - Diastolic blood pressure (Bottom #)

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Normal Circulation in Adults (1 of 2)

- “Automatically” adjusted and controlled
- Perfusion is circulation of blood in organ or tissue in adequate amounts to meet the needs of cells.

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Normal Circulation in Adults (2 of 2)

- Blood enters organs and tissues through arteries.
- Blood leaves organs and tissues through veins.

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Inadequate Circulation in Adults

- The system can adjust to small blood loss.
 - Vessels constrict.
 - Heart pumps more rapidly.
- With a large loss, adjustment fails, and patient goes into shock.

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The Function of Blood

- Fighting infection
- Transporting oxygen
- Transporting carbon dioxide
- Controlling pH
- Transporting wastes and nutrients
- Clotting (coagulation)

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Nervous System Control of the Cardiovascular System (1 of 2)

- Sympathetic nervous system is responsible for fight-or-flight response.
 - Sends commands to adrenal glands
 - Epinephrine and norepinephrine are secreted to stimulate heart and blood vessels.

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Nervous System Control of the Cardiovascular System (2 of 2)

- Blood vessels have alpha-adrenergic receptors.
- Heart and lungs have beta-adrenergic receptors.
- Parasympathetic nervous system also has effects on cardiovascular system.
 - Addresses actions that do not require immediate response

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The Nervous System: Anatomy and Physiology (1 of 2)

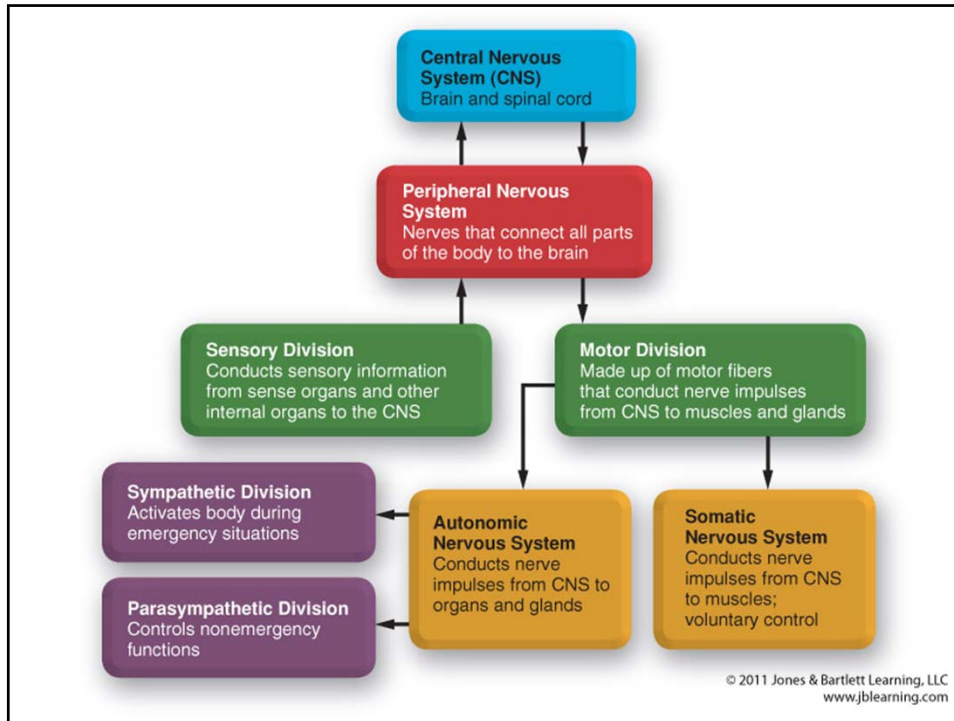
- The nervous system is perhaps the most complex organ in body
- Consists of:
 - Brain
 - Spinal cord
 - **“Central Nervous System”**

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The Nervous System: Anatomy and Physiology (2 of 2)

- Divided into two main portions:
 - Central nervous system (CNS)
 - Peripheral nervous system (PNS)

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Central Nervous System (1 of 2)

The diagram shows a sagittal section of the human brain. Labels include: **Cerebrum** (the large, outer part of the brain), **Brain stem** (the central part of the brain), and **Cerebellum** (the smaller, lower part of the brain).

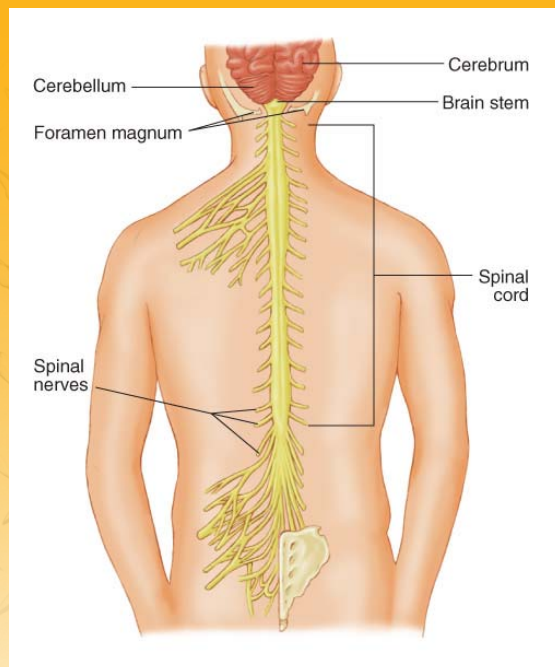
- **Brain**
 - Controlling organ of the body
 - Subdivisions
 - Cerebrum
 - Cerebellum
 - Brain stem

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Central Nervous System (2 of 2)

- Spinal cord
 - Continuation of the brain
 - Transmits messages between brain and body

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Peripheral Nervous System (1 of 3)



- Divided into two main portions:
 - Somatic nervous system
 - Autonomic nervous system

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Peripheral Nervous System (2 of 3)

- Somatic nervous system
 - Transmits signals from brain to voluntary muscles (allows for walking, talking)
- Autonomic nervous system
 - Involuntary actions (digestion, dilation)
 - Split into two areas
 - Sympathetic nervous system (fight-or-flight)
 - Parasympathetic nervous system (slows body)

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Peripheral Nervous System (3 of 3)

- Two types of nerves within peripheral nervous system
 - Sensory nerves carry information from body to CNS.
 - Motor nerves carry information from CNS to muscles.

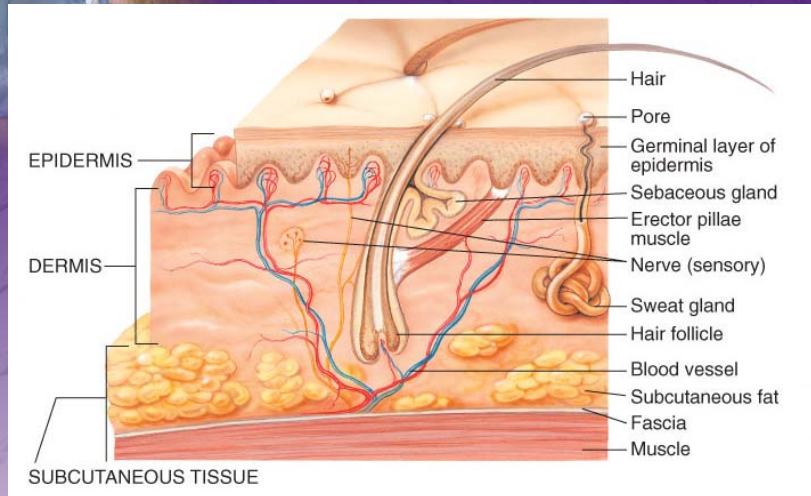
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The Integumentary System (Skin): Anatomy (1 of 2)

- Two layers
 - Epidermis (superficial)
 - Dermis (deeper)
- Below the skin lies subcutaneous tissue.
 - Fat that insulates and serves as energy reservoir

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The Integumentary System (Skin): Anatomy (2 of 2)



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The Integumentary System (Skin): Physiology

- **Skin is the largest single organ**
- **Three major functions**
 - Protect the body in the environment
 - Regulate body temperature
 - Transmit information from environment to brain

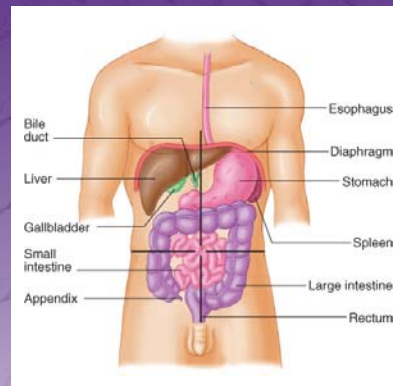
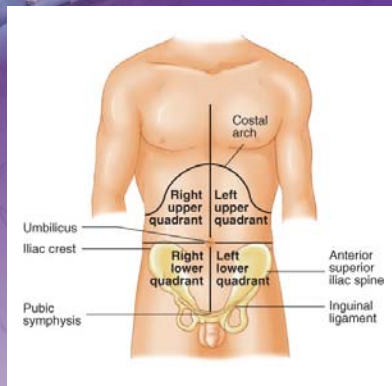
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The Digestive System: Anatomy (1 of 4)

- Function of system is digestion.
- Abdomen is second major body cavity.
 - Contains major organs of digestion and excretion
 - Quadrants are easiest way to identify areas
 - RUQ/LUQ
 - RLQ/LLQ

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The Digestive System: Anatomy (2 of 4)



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The Digestive System: Anatomy (3 of 4)

- Mouth
 - Lips, cheeks, gums, teeth, tongue
 - Salivary glands
- Oropharynx
- Esophagus
- Stomach
- Pancreas

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The Digestive System: Anatomy (4 of 4)

- Liver
- Small intestine
- Large intestine
- Appendix
- Rectum

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The Digestive System: Physiology

- Enzymes are added to food.
 - By salivary glands, stomach, liver, pancreas, small intestine
- Enzymes convert food into basic sugars, fatty acids, amino acids.
 - Further processed by liver
 - Circulated via blood throughout body

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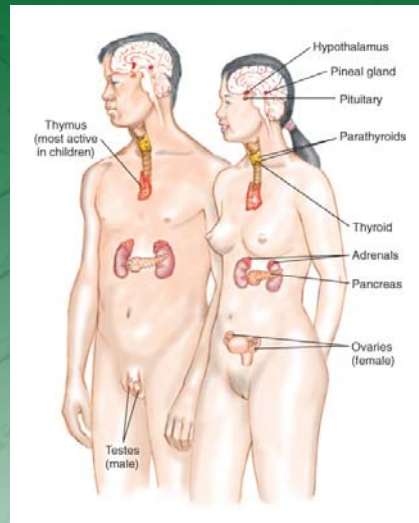
The Endocrine System: Anatomy and Physiology (1 of 2)

- Complex message and control system
- Integrates many body functions
- Hormones are released directly into bloodstream.
 - Examples: epinephrine, norepinephrine, insulin



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The Endocrine System: Anatomy and Physiology (2 of 2)



The endocrine system controls release of hormones in the body.



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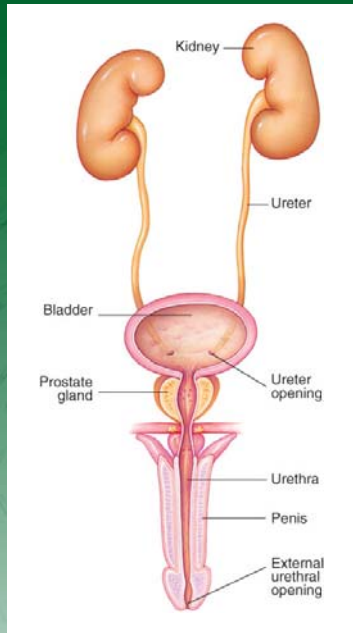
The Urinary System: Anatomy and Physiology (1 of 2)

- Controls fluid balance in the body
- Filters and eliminates wastes
- Controls pH balance



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The Urinary System: Anatomy and Physiology (2 of 2)

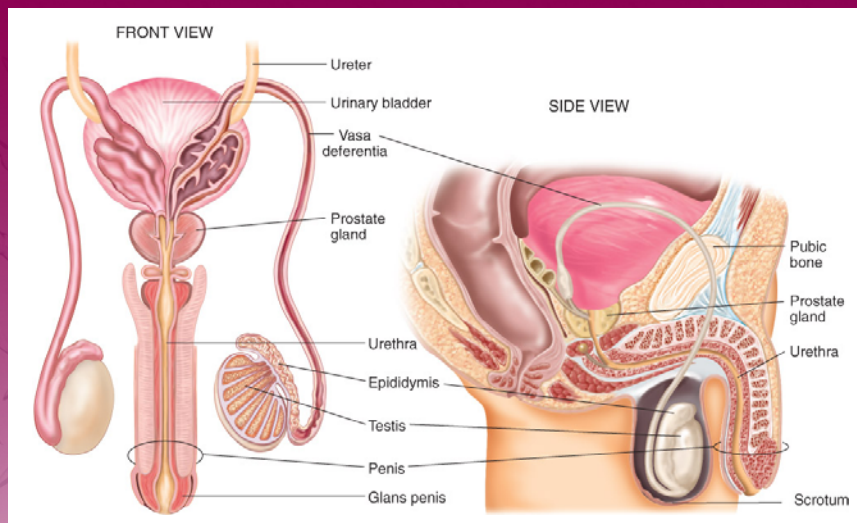


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The Genital System: Anatomy and Physiology (1 of 2)

- Controls reproductive processes
- Male system consists of
 - Testicles
 - Epididymis
 - Vasa Deferentia
 - Penis

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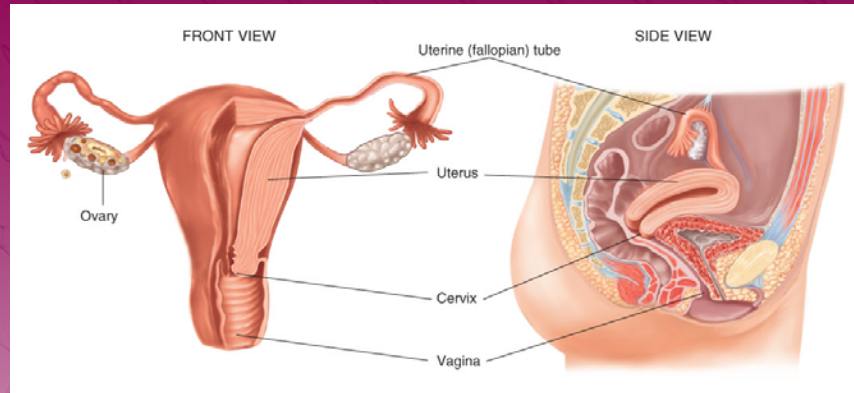
Male System

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The Genital System: Anatomy and Physiology (2 of 2)

- Female system consists of
 - Ovaries
 - Fallopian tubes
 - Uterus
 - Cervix
 - Vagina

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Female System

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Life Support Chain (1 of 3)

- All cells in body require oxygen, nutrients, and removal of waste.
- Circulatory system is the carrier of these supplies and wastes.
- If interference occurs, cells become damaged and die.

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Life Support Chain (2 of 3)

- Adenosine triphosphate (ATP)
 - Involved in energy metabolism
 - Used to store energy
- Aerobic metabolism uses oxygen.
- Cells switch to anaerobic metabolism when oxygen is limited.
 - Lactic acid is damaging waste product.

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Life Support Chain (3 of 3)

- Movement of oxygen, waste, nutrients occurs by diffusion.
- pH is critical to diffusion.
 - Measure of acidity or alkalinity
- Body spends large amount of energy to maintain normal pH.

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Pathophysiology

- The study of functional changes that occur when body reacts to disease
- Respiratory compromise can lead to:
 - Shock
 - Alteration of cellular metabolism

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Review



1. The _____ lies in the retroperitoneal space.
 - A. liver
 - B. spleen
 - C. kidneys
 - D. stomach

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Review

Answer: C

Rationale: The kidneys lie in the retroperitoneal space—the space behind the abdominal cavity. The spleen, liver, and stomach are all located within the anterior (true) abdomen.

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Review



2. The cartilaginous tip of the sternum is called the:
- A. costal arch.
 - B. manubrium.
 - C. angle of Louis.
 - D. xiphoid process.

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Review

Answer: D

Rationale: The xiphoid process projects from the lower part of the sternum. It is made of cartilage, and, relative to other parts of the sternum (eg, manubrium, angle of Louis), is soft to palpation.

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Review



3. A person with bilateral femur fractures has:
- A. fractured one of his or her femurs.
 - B. fractured both of his or her femurs.
 - C. one femur fractured in two places.
 - D. fractured the lateral aspect of the femur.

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Review

Answer: B

Rationale: The term bilateral refers to both sides of the body with reference to the midline. Therefore, bilateral femur fractures would indicate that both femurs are fractured.

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Review



4. The MOST prominent landmark on the anterior surface of the neck is the:
- A. mastoid process.
 - B. cricoid cartilage.
 - C. thyroid cartilage.
 - D. cricothyroid membrane.

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Review

Answer: C

Rationale: The thyroid cartilage, commonly referred to as the “Adam's Apple,” is the most prominent landmark on the anterior (front) surface of the neck. The cricoid cartilage is located directly inferior to (below) the thyroid cartilage; it is a less prominent landmark.

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Review



5. Insulin is produced in the:

- A. liver.
- B. pancreas.
- C. thyroid gland.
- D. adrenal glands.

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Review

Answer: B

Rationale: The pancreas is a solid organ that produces both insulin and digestive juices. Insulin is produced in the islets of Langerhans, which are a part of the pancreas.

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Review



6. The medial aspect of a bone is that part of a bone that lies:
- A. nearer to the feet.
 - B. nearer to the back.
 - C. closer to the midline of the body.
 - D. away from the midline of the body.

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Review

Answer: C

Rationale: The term medial means toward the midline of the body, while lateral means away from the midline of the body. A part of the body that is nearer to the back is said to be posterior; if it is nearer to the feet, it is said to be inferior.

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Review



7. The normal resting adult heart rate is:

- A. 50 to 70 beats/min.
- B. 60 to 100 beats/min.
- C. 80 to 110 beats/min.
- D. 110 to 120 beats/min.

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Review

Answer: B

Rationale: The normal resting heart rate for an adult is 60 to 100 beats/min. Bradycardia exists when the adult heart rate is less than 60 beats/min, and tachycardia exists when it is greater than 100 beats/min.

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Review



8. The left atrium of the heart receives _____ blood from the _____.
- A. oxygenated, lungs
 - B. deoxygenated, body
 - C. oxygenated, body
 - D. deoxygenated, lungs

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Answer: A

Rationale: The left atrium receives oxygenated blood from the lungs via the pulmonary veins. The right atrium receives deoxygenated blood from the body via the vena cavae.

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Review



9. The largest part of the brain is the:
- A. cerebrum.
 - B. brain stem.
 - C. cerebellum.
 - D. foramen magnum.

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Review

Answer: A

Rationale: The three major parts of the brain are the cerebrum, the brain stem, and the cerebellum. The largest part of the brain is the cerebrum, which is sometimes called the “grey matter.” The cerebellum—sometimes called the “athletes brain”—is the smallest part of the brain. The brain stem is responsible for vital functions such as heart rate, breathing, and blood pressure. The foramen magnum is the large opening at the base of the skull through which the spinal cord passes.

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Review



10. Which of the following statements about red blood cells is FALSE?
- A. They contain iron.
 - B. They carry oxygen.
 - C. They help to fight infection.
 - D. They give color to the blood.

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Review

Answer: C

Rationale: The hemoglobin molecules in red blood cells contain iron, give color to the blood, and carry oxygen. White blood cells play a role in helping the body to fight infection.