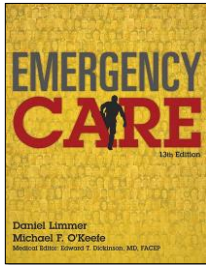


# Emergency Care

THIRTEENTH EDITION



## CHAPTER 6

### Anatomy and Physiology

Daniel Limmer  
Michael F. O'Keefe  
Medical Editor: Edward T. Dickinson, MD, FACP

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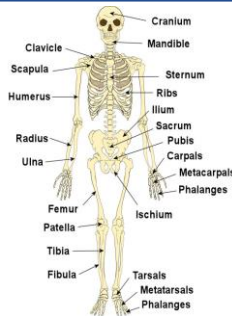
## Musculoskeletal System

- Three main functions
  - Gives the body shape
  - Protects vital internal organs
  - Provides for body movement
- Bone Injury
  - Rich in blood

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## Musculoskeletal System

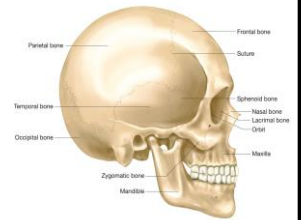
- Skeleton
  - Skull and spine,
  - Ribs and sternum,
  - Shoulders and upper extremities,
  - Pelvis and lower extremities



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## Musculoskeletal System

- Skull
  - Bony structure of the head
  - Enclose and protect brain
  - Cranium
    - Top, back, and sides
  - Face
    - Front of the skull
  - Facial Bones
    - Mandible, Maxillae, Nasal Bones, Orbits, Zygoma



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## Spinal Column

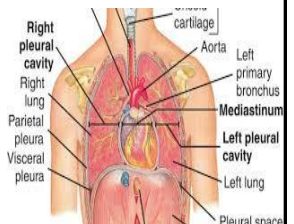
- Spinal column
  - Thirty-three vertebrae
  - Essential for movement, sensation, and vital functions



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## Thorax

- Thorax
  - Contains the heart, lungs, and major blood vessels
  - The thorax protects the heart, lungs, and major blood vessels

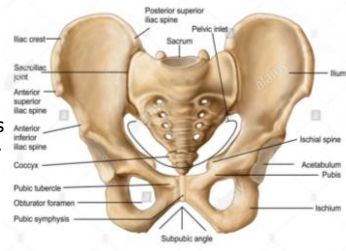


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## Musculoskeletal System

### • Pelvis

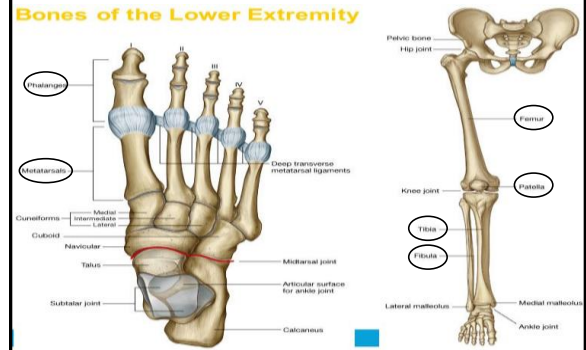
- Iliac crest - wings
- Ischium - inferior
- Pubis - anterior
- Hip joint
  - Acetabulum
  - Greater trochanter



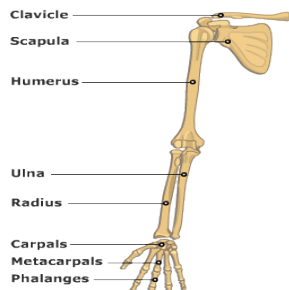
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## Lower Extremities

### Bones of the Lower Extremity



## Upper Extremities

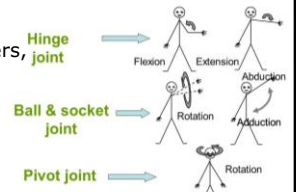


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## Musculoskeletal System

### • Joints

- Formed when bones connect to other bones
- Types of joints
  - Ankles, elbows, fingers, knees, toes
  - Hip, femur, shoulder
  - C1/C2, wrist

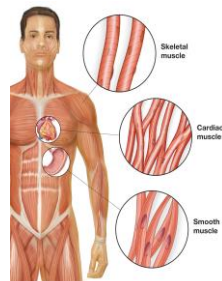


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## Musculoskeletal System

### • Muscles

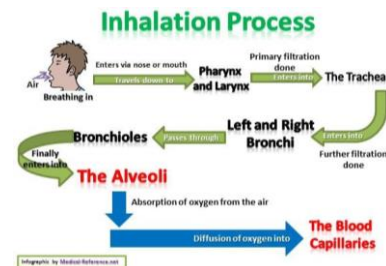
- Skeletal (Voluntary)
- Smooth (Involuntary)
- Cardiac
  - Automaticity
    - Heart has ability to generate and conduct own electrical impulses



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## The Respiratory System.....

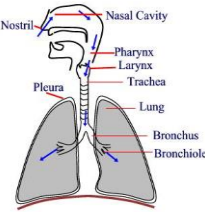
- Brings in oxygen via inhalation
- Excretes carbon dioxide via exhalation



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## Respiratory Anatomy

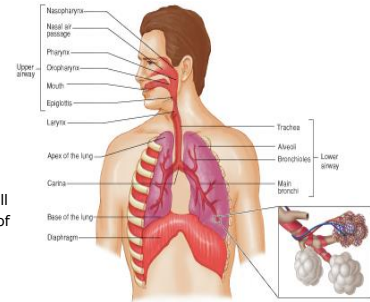
- Air enters - mouth and nose.
- Moves through -oropharynx and the nasopharynx.
- Air moves toward the lung
- Epiglottis
  - Closes over glottis



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## The Respiratory System: Anatomy

- Nose
- Mouth
- Throat
- Larynx
- Trachea
- Bronchi
- Bronchioles
- Lungs
- Diaphragm
- Muscles of chest wall
- Accessory muscles of breathing



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## Respiratory Physiology

- Ventilation
  - Simple movement of air into and out of the lungs
- Respiration
  - Exchange of gases between cells and bloodstream
- Oxygenation
  - Movement from higher to lower concentration
- Maintain acid-base balance
  - Eliminate excess CO<sub>2</sub>

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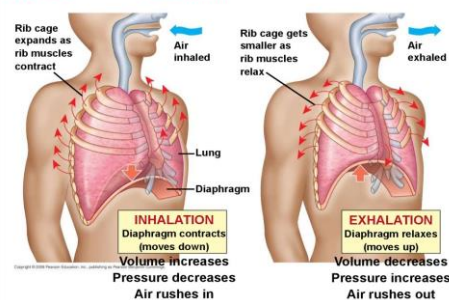
## Respiratory Physiology

- Oxygenated blood is carried from the lungs to heart, then is pumped to rest of the body.
- At the cellular level, oxygen (O<sub>2</sub>) is exchanged with cells for waste carbon dioxide (CO<sub>2</sub>).
- Deoxygenated blood returns to the heart, then to lungs to exchange waste CO<sub>2</sub> for O<sub>2</sub>.

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## Respiratory Physiology

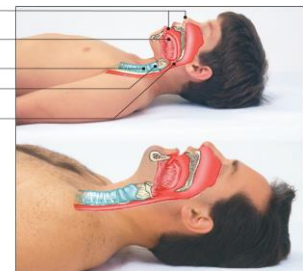
**Negative pressure breathing: H → L**



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## Respiratory Physiology

Child has smaller nose and mouth.  
In child, more space is taken up by tongue.  
Child's trachea is narrower.  
Cricoid cartilage is less rigid and less developed.  
Airway structures are more easily obstructed.

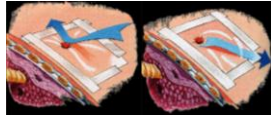


Comparison of child and adult respiratory anatomies.

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## Case Study

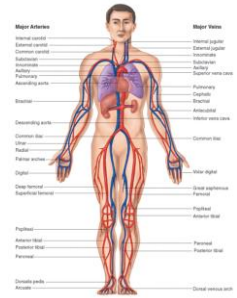
- ❑ How can a stab wound to the chest impair ventilation and oxygenation?
- ❑ How could applying an occlusive dressing over the chest wound be of benefit to the patient?
- ❑ What is adequate breathing?



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## Cardiovascular System

- Heart - **PUMP**
- Blood Vessels - **PIPES**
- Blood - **FLUID**



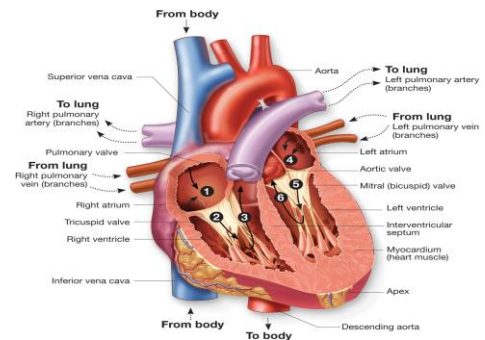
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## Anatomy of the Heart

- Four chambers
  - Two atria (upper areas)
  - Two ventricles (lower areas)
- Pathway of blood through heart
  - Right atrium
  - Right ventricle
  - Left atrium
  - Left ventricle

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## Anatomy of the Heart



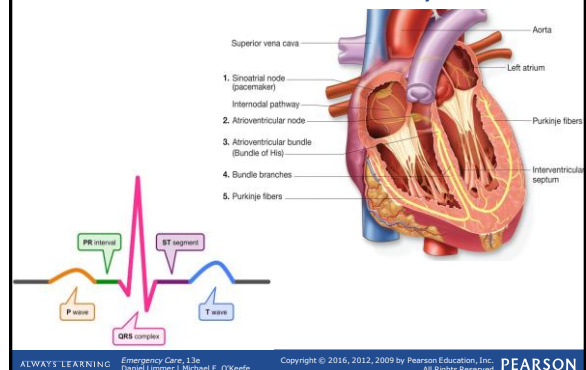
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## Heart Structure and Function



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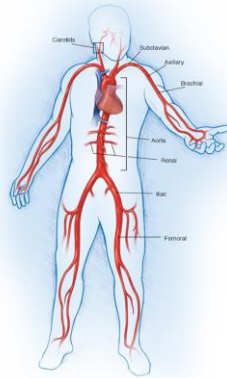
## Cardiac Conduction System



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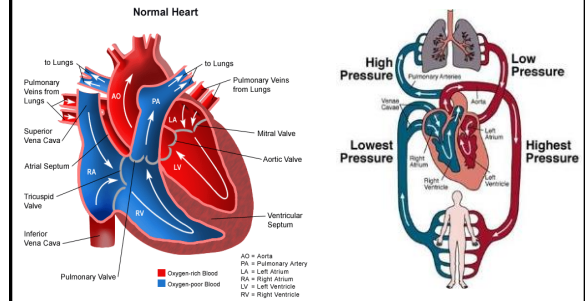
## Circulation of the Blood

- Important arteries:
  - Coronary arteries
  - Aorta
  - Pulmonary artery
  - Carotid artery
  - Femoral artery
  - Brachial artery
  - Radial artery
  - Posterior tibial artery
  - Dorsalis pedis artery



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## Circulation of the Blood



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## Composition of the Blood

- Plasma
  - More than half the volume of the blood
- Red blood cells
  - Carry hemoglobin, red color
- White blood cells
  - WBCs, leukocytes, white corpuscles
- Platelets
  - Help with clotting

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## Pulse

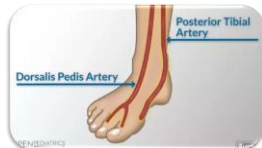
- Pressure wave of blood flowing down an artery when the left ventricle contracts
- Can be felt by compressing an artery over a bone

*continued on next slide*

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## Pulse

- Peripheral (outer parts of body) pulse
  - Radial
  - Brachial
  - Posterior tibial
  - Dorsalis pedis
- Central (core of body) pulse
  - Carotid
  - Femoral



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## Blood Pressure

- Force blood exerts against the walls of blood vessels
- Systolic (upper reading)
  - Arterial pressure when left ventricle contracts
- Diastolic (lower reading)
  - Pressure when left ventricle refills
- Special Note:
  - Avoid taking blood pressure on the side of a woman's body where a mastectomy has been performed.

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## Perfusion

- Adequate circulation of blood and exchange of oxygen and waste products
- Cells are oxygenated and carbon dioxide is removed
- Interaction of respiratory system and cardiopulmonary system
- Hypoperfusion (shock)
  - When flow becomes inadequate
  - Insufficient supply of oxygen and nutrients

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## Lymphatic System

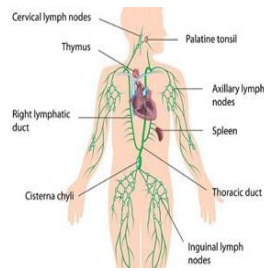
- Functions
  - Absorbs fat from digestive tract
  - Maintain balance of fluid
- Lymph nodes interspersed along course of lymph vessels
- Supports the circulatory system and immune system

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## Lymphatic System

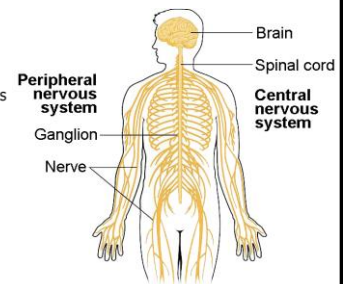
- Lymphoid organs
  - Adenoids
  - Tonsils
  - Spleen
  - Thymus gland
  - Nodes



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## Nervous System

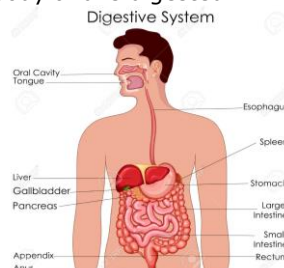
- Peripheral nervous system
  - Sensory nerves
  - Motor nerves
- Autonomic nervous system
  - Involuntary motor functions



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## Digestive System

- Provides the mechanisms by which food travels through the body and is digested
- Consists of:
  - Stomach
  - Small intestine
  - Large intestine
- Accessory Organs:
  - Liver
  - Gallbladder
  - Pancreas
  - Spleen
  - Appendix



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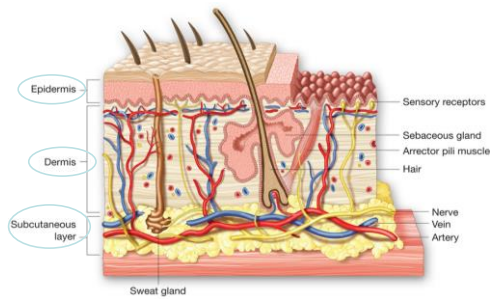
## Integumentary System

- Functions
  - Protection
  - Water balance
  - Temperature regulation
  - Excretion
  - Shock (impact) absorption

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## Layers of the Skin



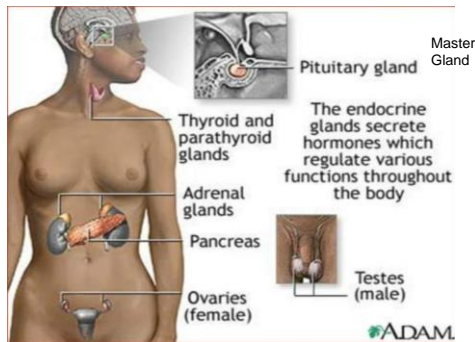
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## Endocrine System

- Made of glands throughout the body
  - Remove, concentrate, or alter materials from the blood
  - Secrete them back into body
- Glands secrete proteins called hormones
  - Regulate mood, growth, metabolism, sexual development, and more

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## Endocrine System



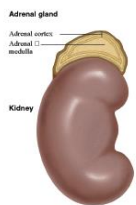
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## The Pancreas

- Organ of both the endocrine system and digestive system
- Produces insulin and glucagon
- Insulin causes uptake and metabolism of sugar, fatty acids, amino acids.
- Glucagon stimulates breakdown of glycogen to glucose.
  - Also stimulates liver and kidneys to produce glucose

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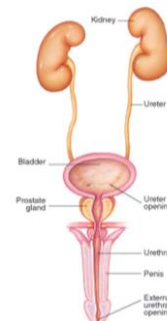
## The Adrenal Glands



- Located on top of each kidney
- Secrete:
  - Sex hormones
  - Hormones vital in maintaining water and salt balance
  - Adrenaline (mediates "fight-of-flight" response)
  - Epinephrine and norepinephrine

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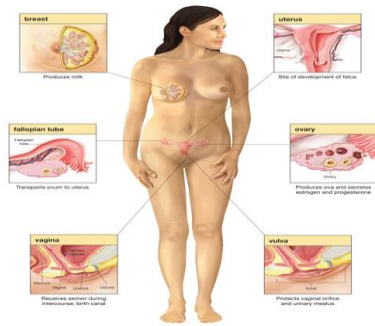
## Renal System



- Kidneys
- Ureters
  - Transport urine to bladder from kidneys
- Bladder
- Urethra
  - Excretes urine from the bladder to external environment

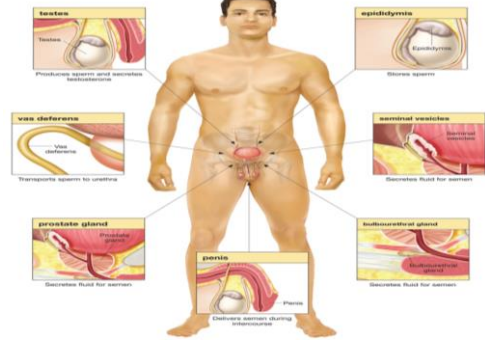
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## Female Reproductive System



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## Male Reproductive System



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## Remember

- Cellular metabolism requires a constant supply of oxygen and glucose; absence of either component disrupts normal metabolism.
- Cardiopulmonary system combines the functions of respiratory and cardiovascular systems to provide oxygen at the cellular level.

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Questions?

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