Chapter 5
The Human Body

Learning Objectives

- Describe the anatomy and function of the respiratory system
- Describe the anatomy and function of the circulatory system
- Describe the anatomy and function of the musculoskeletal system

Learning Objectives

- Describe the components and function of the nervous system
- Given a body in a normal anatomical position, use directional terms to identify how body parts are related to one another
- Relate given surface landmarks with appropriate underlying anatomy
Learning Objectives

- Identify significance of injury to:
  - Respiratory system
  - Circulatory system
  - Nervous system
  - Musculoskeletal system
  - Integumentary system
  - Gastrointestinal/genitourinary system
  - Reproductive system
  - Endocrine system
  - Lymphatic system

Introduction

- Anatomy
  - Structure of body
- Physiology
  - Function of body

Body Directional Terms

- Normal anatomical position
  - Human body standing upright
  - Facing you
  - Arms at side
  - Palms of hands turned forward
Body Directional Terms

- **Midline**
  - Imaginary vertical line drawn down middle of body
- **Anterior**
  - Toward front of body
- **Posterior**
  - Toward back of body

- **Lateral**
  - Away from midline
- **Medial**
  - Toward midline
- **Superior**
  - Toward head
Body Directional Terms

- **Inferior**
  - Toward feet, below
- **Proximal**
  - Toward trunk of body
- **Distal**
  - Away from trunk

Body Directional Terms

- **Helpful prefixes**
  - **Arterio-**
    - Relating to arteries
  - **Hemo-**
    - Relating to blood
  - **Hyper-**
    - Excessive/above normal
  - **Hypo-**
    - Beneath something, a deficiency, below normal

Body Directional Terms

- **Helpful prefixes**
  - **Naso-**
    - Relating to nose
  - **Neuro-**
    - Relating to nervous system
  - **Oro-**
    - Relating to mouth
  - **Therm-**
    - Denoting heat
  - **Vaso-**
    - Relating to blood vessel
Regions of the Body

- **Head**
  - Cranium
    - Supports brain and face
- **Neck**
  - Supports head

Regions of the Body

- **Trunk (torso)**
  - Below neck
  - Contains three parts
    - Thorax (chest)
      - Heart
    - Lungs
    - Great vessels
    - Abdomen
    - Pelvis

Regions of the Body

- **Upper extremities**
  - Begin at shoulders and include:
    - Arm
    - Elbow
    - Forearm
    - Wrist
    - Hand
Regions of the Body

- Lower extremities
  - Hip
  - Thigh
  - Knee
  - Leg
  - Ankle
  - Foot

- Abdominal quadrants
  - Abdomen divided into four equal "quadrants"
Regions of the Body

- Following terms describe regions:
  - Left upper quadrant (LUQ)
  - Right upper quadrant (RUQ)
  - Left lower quadrant (LLQ)
  - Right lower quadrant (RLQ)

- Basic knowledge of organ location within abdominal quadrants
  - RUQ contains gallbladder and liver
  - LUQ contains stomach and spleen
  - RLQ contains appendix

- Basic knowledge of organ location within abdominal quadrants
  - Small and large intestine wind through all four quadrants
  - Pelvic organs, bladder, and female reproductive organs found within lower quadrants
  - Kidneys located behind abdominal cavity in retroperitoneal space and just to side of spinal column
  - First kidney found in RUQ, second found in LUQ
Respiratory system
- Delivers O₂ to blood
- Removes waste products
- Irreversible damage to organs can occur as early as 4 minutes without adequate supply of O₂
- Body functions may deteriorate if CO₂ levels rise above normal
- Emergency care starts with assessment and management
**Body Systems**

- Room air
  - Contains approximately 21% \( \text{O}_2 \)
- Air entering mouth
  - Passes through oropharynx
- Air entering nose
  - Passes through cavity above roof of mouth called nasopharynx

**Body Systems**

- Epiglottis
  - Located in posterior pharynx
  - Leaf-shaped flap keeps food and liquid from entering lungs during swallowing

**Body Systems**

- Respiratory system
  - When epiglottis opens:
    - Air enters trachea (windpipe)
    - Below larynx, trachea divides into two bronchi in lungs
    - Air reaches bronchioles
    - Each alveolus is covered in a net of small blood vessels called pulmonary capillaries
    - Air enters alveoli
    - Carbon dioxide moves from blood back into alveoli to be exhaled from respiratory system via lungs
Respiratory system

Ventilation
- Mechanical process of moving air in and out of airways
- Accomplished through movement of diaphragm and other muscles in chest wall

Diaphragm
- Dome-shaped muscle
- When muscle contracts:
  - Moves downward
  - Expands lung
  - Causes air to enter lung (inspiration)
  - Chest muscles assist by contracting to expand thorax
- When muscle relaxes:
  - Lung decreases in size
  - Air is pushed out (expiration)

Circulatory system

Heart
- Right side of heart
  - Low-pressure pump
  - Receives blood from vena cava that is low in O₂ levels but high in waste material
  - Right atrium
  - O₂-rich blood from lungs is pumped into it
Body Systems

- Circulatory system
  - Heart
    - Left side of heart
      - High-pressure pump
        - Pumps O₂-rich blood out through aorta to begin its cycle through body again
        - Muscle mass greater than right side muscle mass
  - Heart muscle consists of:
    - Four individual chambers
    - Two valves located between upper and lower chamber
Body Systems

- Circulatory system
  - Heart muscle consists of:
    - Two valves located between upper and lower chamber
    - Allow blood to flow only in one-way direction
    - Blood low in O₂ is pumped from inferior vena cava and superior vena cava into right atrium
    - Blood from right atrium is pumped through a one-way valve into right ventricle
    - Blood from right ventricle is pumped out of heart, through pulmonary arteries, into lungs for gas exchange.

- Circulatory system
  - Heart muscle consists of:
    - Two valves located between upper and lower chamber
    - Blood high in O₂ from lungs is pumped through pulmonary veins into left atrium of heart
    - Blood from left atrium is pumped through a one-way valve into left ventricle
    - Blood from left ventricle is pumped from heart, through aorta, to body
    - Each time left ventricle of heart contracts, it sends pulse wave of blood into arteries.
Body Systems

- Circulatory system
  - Blood
    - Carries O₂ and other nutrients to cells
    - Carries CO₂ and other waste away from cells
    - Pumped through closed system of highly organized network of blood vessels
      - Arteries
        - Arterioles
        - Capillaries
        - Venules
        - Veins

Body Systems

- Circulatory system
  - Arteries
    - System of large-sized vessels
    - Blood enters system after it leaves left side of heart
    - Carry oxygenated blood away from heart
Body Systems

- Circulatory system
  - Arteries
    - Aorta
      - Leaves left ventricle of heart extending upward, then arches downward toward chest and abdomen
      - Several major arteries branch from aorta
      - Supply blood to heart muscle (coronary arteries), head (carotid arteries), upper extremities, and internal organs
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Body Systems

- Circulatory system
  - Aorta
    - Continues downward through chest and into lower abdomen
    - Splits into two large arteries that pass through pelvis to lower extremities
      - Each femoral artery is major artery for thigh
      - Can be palpated in groin area near crease between abdomen and thigh
      - Femoral artery continues to smaller arteries of leg and foot

Body Systems

- Circulatory system
  - Arterioles
    - Vessels that become smaller as blood continues through arterial system
    - Connect to tiny capillaries, found in all tissues of body
  - Capillaries
    - Supply the cells of the body with O₂ and nourishment
    - Carry away carbon dioxide and other waste products from cells of body
Body Systems

- Circulatory system
  - Venules
    - Small vessels
    - Blood enters after it leaves tissue capillaries
    - Empty into veins
  - Veins
    - Carry blood toward heart
    - Small vessels join others to form larger veins as they carry away blood with waste
    - Vena cava

Body Systems

- Nervous system
  - Controls voluntary and involuntary activities of body
  - Provides for higher mental functions
    - Thought
    - Emotion
    - Memory
Body Systems

• Nervous system
  ➢ Two main components
    • Central nervous system (CNS)
    • Peripheral nervous system (PNS)

Body Systems

• Nervous system
  ➢ CNS consists of:
    • Brain
      ➢ Corner center of body
      ➢ Controls everything from muscle movements to emotional response
    • Spinal cord
      ➢ Extends downward from brain through center of spinal column
      ➢ Carries messages between brain and rest of body

Body Systems

• Nervous system
  ➢ PNS
    • System of nerves
      • Carry messages between body and CNS
    • Two types of nerves
      • Motor nerves
      • Sensory nerves
Body Systems

- Musculoskeletal system
  - Consists of:
    - Bones
    - Joints
    - Connective tissues
    - Muscles

Musculoskeletal System

- Skeletal system
  - Can be divided into two main sections
    - Axial skeleton
      - Central portion of skeletal system
      - Skull
      - Spinal column
      - Thorax
  - Appendicular skeleton
    - "Hangs" from central (axial) skeletal section
    - Upper extremities
    - Pelvis
    - Lower extremities
Musculoskeletal System

Skeletal system
- Skull is divided into two parts
  - Cranium
  - Face
Musculoskeletal System

- Skeletal system
  - Spinal column
    - Connects to skull
    - Collection of 33 individual bones called vertebrae

Musculoskeletal System

- Skeletal system
  - Spinal column
    - Slightly S-shaped
    - Holds body upright
    - Allows for bending and twisting
    - Surrounds and protects the spinal cord

Musculoskeletal System

- Skeletal system
  - Thorax
    - Composed of 12 pairs of ribs
      - Ribs connected to spinal column in back
      - Some are connected to sternum (breastbone) in front

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Musculoskeletal System

- Skeletal system
  - Xiphoid process
    - Lower portion of sternum
    - Important landmark to know when delivering chest compressions during CPR
  - Clavicle (collarbone)
    - Connects upper sternum to scapula (shoulder blade)
    - Located in posterior chest
  - Shoulder joint
    - Formed by clavicle and scapula

Musculoskeletal System

- Skeletal system
  - Upper extremities
    - Humerus
      - Connects to shoulder joint at its proximal end
      - Distal end of humerus meets radius and ulna at elbow
Musculoskeletal System

- Skeletal system
  - Upper extremities
    - Radius
      - Located at lateral side of forearm
    - Ulna
      - On the medial side
    - Wrist
      - Composed of many carpals

Musculoskeletal System

- Skeletal system
  - Upper extremities
    - Phalanges
      - Small bones of fingers
    - Pelvis
      - Composed of two large bones attached to lower portion of spinal column
      - Large, bony ring
      - Forms cradle in lower abdomen

Musculoskeletal System
Musculoskeletal System

Skeletal system

Lower extremities

Femur
  - Longest single bone in body
  - At distal end lies at knee joint

Patel (kneecap)
  - Covers anterior knee to protect joint
  - Distal to the knee are two bones that compose leg
    - Larger tibia ( shin bone)
    - Smaller fibula
    - Distal ends of these two bones connect to foot at ankle joint

Tarsals
  - Bones of the ankle

Phalanges
  - Multiple smaller bones form toes

Ligaments
  - Connective tissue that holds together the bones of the human skeleton
Musculoskeletal System

- Skeletal system
  - Lower extremities
    - Joint
      - Where two bones come together
      - Allows for movement
    - Fibrous tissue (cartilage)
      - Lines surface of joints
      - Allows smooth movement
      - Provides cushioning between two bones

Musculoskeletal System

- Muscular system
  - Helps give body shape and protects internal organs
    - Three different types of muscles:
      - Voluntary (skeletal muscles)
      - Involuntary (smooth muscles)
      - Cardiac

Musculoskeletal System

- Muscular system
  - Voluntary (skeletal muscles)
    - Attached to bones by tendons
    - Contraction creates movement
Musculoskeletal System

- Muscular system
  - Involuntary (smooth muscles)
    - Found in walls of tubular structures such as:
      - Blood vessels
      - Small airways of lungs (bronchioles)
      - Gastrointestinal tract
      - Urinary system
    - Muscles work involuntarily

Musculoskeletal System

- Muscular system
  - Cardiac
    - Found only in heart
    - Works constantly and automatically
    - Requires continual supply of oxygen-rich blood as fuel
    - Can survive only a very short interruption of blood flow
Integumentary System

- Protects body from environment and harmful substances
- Helps regulate body temperature
- Provides sensory input to brain

Integumentary System

- Skin
  - Keeps body from becoming dehydrated
  - Provides barrier
  - Plays major role in regulation of body temperature
  - Helps rid body of excess heat
  - Retains heat as needed
  - Sensory nerves

Integumentary System

- Skin
  - Divided into three layers
    - Epidermis
      - Outermost layer
      - Cells within this layer give skin its color
Integumentary System

- Skin
  - Divided into three layers
    - Dermis
      - Second layer of skin
      - Contains blood vessels
      - Hair follicles
      - Sweat glands
      - Oil glands
      - Nerves
    - Subcutaneous layer
      - Below dermis
      - Fatty tissue that holds water and nutrients
      - Provides insulation and cushioning to body
      - Thickness varies from body part to body part and person to person
Gastrointestinal and Urinary Systems

- Responsible for processing food and eliminating waste from body
- Digestive tract begins in mouth, continues to esophagus and stomach into small and large intestines

- Mechanical and chemical processes occur to absorb nutrients and water
- Leftover waste is eliminated as fecal material
- Blood carrying nutrients and water from digestive tract filters through liver and kidneys
  - Nutrients and water are absorbed
  - Any extra water/waste is eliminated as urine

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Reproductive System

- System of structures and hormones required for reproduction
- Closely associated with urinary system
  - Sometimes referred to as genitourinary system

Reproductive System

- Consists of:
  - Ducts
  - Glands
  - Males
    - Penis
  - Females
    - Ovaries
    - Fallopian tubes
    - Uterus
    - Vagina
Endocrine System

- Composed of glands that produce chemicals known as hormones
- Endocrine glands include:
  - Pituitary
  - Thyroid
  - Parathyroid
  - Adrenal glands
  - Ovaries
  - Testes
  - Pancreas

Endocrine System

- Hormones
  - Give strength, endurance, ability to move fuel into cells to create energy and participate in reproduction
  - Hormone insulin
    - Produced in pancreas
    - Helps regulate amount of sugar (glucose) in body
Lymphatic System

- Provides links between digestive and circulatory systems by transporting vitamins and nutrients from digestive tract into blood
- Works as bridge from tissues to circulatory system by removing fluid and waste from tissues and transporting them into circulatory system

Lymphatic System

- Fluid and waste can be transported to liver and kidneys to be filtered out and eliminated
- Participates in immune response by transporting special substances to attack foreign bodies and fight infection

Questions?