Chapter 4
The Human Body

Overview
- Anatomic Terms
  - The Anatomic Position
  - Descriptive Anatomic Terms
- Body Systems
  - Respiratory System
  - Circulatory System
  - Musculoskeletal System
  - Nervous System
  - Skin
  - Digestive System
  - Endocrine System

Anatomic Terms
Anatomic Terms

- The anatomic position

Anatomic Terms

- Anatomic planes
  - Midline
  - Midclavicular line
  - Midaxillary line

Descriptive Anatomic Terms

- Prone
  - The patient lying flat on the stomach
Descriptive Anatomic Terms

- **Supine**
  - The patient lying flat on the back

Descriptive Anatomic Terms

- **Fowler’s position**
  - The patient lying on the back with a bend at the hips
    - Full Fowler’s
    - Semi-Fowler’s

Descriptive Anatomic Terms

- **Trendelenburg position**
  - The patient lying flat on the back, on an incline, and with feet elevated approximately 12 inches above the head
Descriptive Anatomic Terms

- Shock position
  - The patient lying flat on the back, bent at the hips with feet lifted approximately 12 inches off the ground

Body Systems

Respiratory System

- The respiratory system takes oxygen from the air and makes it available for the blood to transport to every cell and rids the body of excess carbon dioxide
Respiratory System

- The airway
  - Upper airway
    - Extends from the mouth and nose to the trachea
  - Lower airway
    - Extends from the trachea to the alveoli

Upper Airway

- Nose and mouth
  - Pharynx
    - Oropharynx
    - Nasopharynx
  - Epiglottis
    - Leaf-shaped structure that prevents food and liquid from entering the trachea during swallowing
Lower Airway

- Trachea (windpipe)
- Cricoid cartilage
  - Firm cartilage ring forming the lower portion of the larynx
  - Larynx (voice box)
  - Bronchi
    - Two major branches of the trachea to the lungs; bronchus subdivides into smaller air passages ending at the alveoli
- The lungs
- Diaphragm

Respiratory Terminology

- Ventilation
  - The movement of air

- Respiration
  - The exchange of gases
Ventilation

- Inhalation (active)
  - Diaphragm and intercostal muscles contract, increasing the size of the thoracic cavity
  - Diaphragm moves slightly downward, flares lower portion of rib cage
  - Ribs move upward/outward

  This creates a negative pressure in the chest cavity

Ventilation

- Air flows into the lungs because of the negative pressure

Ventilation

- Exhalation
  - Diaphragm and intercostal muscles relax, decreasing the size of the thoracic cavity
    - Diaphragm moves upward
    - Ribs move downward/inward
  - Air is expelled from the lungs
Respiration

- Alveolar respiration
  - Gas exchange in the lungs

- Cellular respiration
  - Gas exchange in the tissues of the body

Alveolar Respiration

- Alveolar/capillary exchange
  - Oxygen-rich air enters the alveoli during each inspiration
  - Oxygen-poor blood in the capillaries passes into the alveoli
  - Oxygen enters the capillaries as carbon dioxide enters the alveoli

Cellular Respiration

- Capillary/cellular exchange
  - Cells give up carbon dioxide to the capillaries
  - Capillaries give up oxygen to the cells
Normal Breathing

- Normal respiration should be effortless

Normal Respiratory Rates

- Adult—12-20/minute
- Child—15-30/minute
- Infant—25-50/minute
Assessing Breathing

- Rate
- Rhythm
- Quality
- Breath sounds
- Chest expansion
- Effort of breathing
- Depth (tidal volume)

Effort of Breathing

- Accessory muscles
  - Additional muscles used to draw air into the chest
  - Includes the muscles of the neck, abdomen, and chest

Use of accessory muscles is a sign of respiratory distress!

Tidal Volume

- The amount of air exchanged in one breath
Considerations for Infants and Children

Adults versus Children – Respiratory Anatomy

- Mouth and nose
  - In general, all structures are smaller and more easily obstructed than in adults

- Tongue
  - Infants’ and children’s tongues take up proportionately more space in the mouth than adults

- Trachea (windpipe)
  - Narrower tracheas that are obstructed more easily by swelling
  - Softer and more flexible in infants and children

- Cricoid cartilage
  - Less developed and less rigid

- Chest wall is softer
  - Tend to depend more heavily on the diaphragm for breathing
The heart pumps blood to the body organs through the cardiovascular system.

This process is so vital to life that any interruption for more than a few minutes can mean death to the individual.

- Heart
- Blood vessels
  - Arteries
  - Veins
  - Capillaries
- Blood
Heart

- **Structure and function**
  - **Atrium**
    - Right
    - Receives blood from the veins of the body and the heart
    - Pumps oxygen-poor blood to the right ventricle
    - Left
    - Receives blood from the pulmonary veins (lungs)
    - Pumps oxygen-rich blood to left ventricle
  - **Ventricle**
    - Right
    - Receives blood from the right atrium
    - Pumps oxygen-poor blood to the lungs
    - Left
    - Receives blood from the left atrium
    - Pumps oxygen-rich blood to the body

Heart

- **Valves prevent backflow of blood**
Heart

- Structure and function
  - Cardiac conductive system
    - Heart is more than a muscle
    - Specialized contractile and conductive tissue in the heart
    - Electrical impulses create coordinated contraction
  - Automaticity
    - The ability of cardiac muscle cells to generate their own impulses

Blood Vessels

- Arteries
- Arterioles
- Capillaries
- Venules
- Veins

Arteries

- Carry blood away from the heart to the rest of the body
- Major arteries
  - Coronary
  - Aorta
  - Pulmonary
  - Carotid
  - Femoral
  - Radial
  - Brachial
  - Posterior tibial
  - Dorsalis pedis
Arteries

Arterioles

- The smallest branches of an artery leading to the capillaries

Capillaries

- Tiny blood vessels that connect arterioles to venules

- Found in all parts of the body

- Allow for the exchange of nutrients and waste at the cellular level
Capillaries

Venules

- The smallest branches of a vein leading to the capillaries

Veins

- Vessels that carry blood back to the heart
- Major veins
  - Pulmonary vein
    - Carries oxygen-rich blood from the lungs to the left atrium
  - Venae cavae
    - Superior
    - Inferior
      - Carries oxygen-poor blood back to the right atrium

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Veins

Blood

- Red blood cells
  - Give the blood its color
  - Carry oxygen to organs
  - Carry carbon dioxide away from organs
- White blood cells
  - Part of the body’s defense against infections
- Plasma
  - Fluid that carries the blood cells and nutrients
- Platelets
  - Essential for the formation of blood clots

Pulse

- Left ventricle contracts, sending a wave of blood through the arteries
  - Can be palpated anywhere an artery simultaneously passes near the skin surface and over a bone
  - Peripheral
    - Radial
    - Brachial
    - Posterior tibial
    - Dorsalis pedis
  - Central
    - Carotid
    - Femoral
Pulse

Blood Pressure
- A measure of the pressure exerted against the walls of the arteries during contraction and relaxation of the heart
  - Systolic
    - Pressure exerted against the walls of the artery when the left ventricle contracts
  - Diastolic
    - Pressure exerted against the walls of the artery when the left ventricle is at rest

Perfusion
- The process of delivering oxygenated blood to the organs and removing waste products and carbon dioxide
  - Cellular respiration
Perfusion

- Shock (hypoperfusion)
  - Widespread inadequate tissue perfusion

Shock

- Signs and symptoms
  - Pale or cyanotic skin
  - Cool or cold skin
  - Rapid weak pulse
  - Altered mental status
  - Rapid breathing
  - Nausea and vomiting
  - Low or decreasing blood pressure
  - A LATE SIGN!

Musculoskeletal System
**Skeletal System**
- The skeletal system is the scaffolding of the body
- Gives the body shape and rigidity
- Protects the vital internal organs
- Enables movement

**The Skull**
- Skull
  - Houses and protects the brain
- Orbit
- Nasal bone
- Maxilla
- Mandible
- Zygomatic bone

**Spinal Column**
- Cervical (neck) — 7 vertebrae
- Thoracic (upper back) — 12 vertebrae
- Lumbar (lower back) — 5 vertebrae
- Sacral (back wall of the pelvis) — 5 vertebrae
- Coccyx (tailbone) — 4 vertebrae
Ribs
- 12 pairs
- Attached posterior to the thoracic vertebrae
  * Pairs 1-10 are attached anterior to the sternum
  * Pairs 11 and 12 are floating

Sternum (Breastbone)
- Manubrium (superior portion of sternum)
- Body (middle)
- Xiphoid process (inferior portion of sternum)
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Pelvis
- Ilium
- Pubic symphysis
- Ischium
- Acetabulum

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Upper extremity
Lower extremity

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Lower Extremities
- Femur (thigh)
- Patella (kneecap)
- Tibia (shin, lower leg)
- Fibula (lower leg)
- Medial and lateral malleolus
- Tarsals and metatarsals (foot)
- Calcaneus (heel)
- Phalanges (toes)
Lower Extremities
- Patella
- Tibia
- Fibula
- Femur

Foot
- Phalanges
- Metatarsals
- Tarsals

Upper Extremities
- Clavicle (collar bone)
- Scapula (shoulder blade)
- Acromion (tip of shoulder)
- Humerus (superior portion of upper extremity)
- Olecranon (elbow)
- Radius (lateral bone of forearm)
- Ulna (medial bone of forearm)
- Carpals (wrist)
- Metacarpals (hand)
- Phalanges (fingers)
Upper Extremity

Joints
- Where bones connect to other bones
- Types
  - Ball and socket
  - Hinged

Hinge Joint
Muscular System

- Function
  - Gives the body shape
  - Protects internal organs
  - Provides for movement
Muscular System

Types
- Voluntary
- Involuntary
- Cardiac

Voluntary (skeletal)
- Attached to the bones
- Form the major muscle mass of the body
- Controlled by nervous system and brain
- Can be contracted and relaxed by the will of the individual
- Responsible for movement

Involuntary (smooth)
- Found in the walls of the tubular structures of the gastrointestinal tract and urinary system, as well as the blood vessels and bronchi
- Control the flow through these structures
- Carry out the automatic muscular functions of the body
- Individuals have no direct control over these muscles
- Respond to stimuli such as stretching, heat, and cold
Muscular System

- Cardiac
  - Found only in the heart
    - Involuntary muscle
      - Has its own supply of blood through the coronary artery system
      - Can tolerate interruption of blood supply for only very short periods
    - Automaticity—the ability of the muscle to contract on its own

Nervous System

- Function
  - Controls the voluntary and involuntary activity of the body
Nervous System

- Central nervous system
  - Brain
  - Spinal cord

- Cranial nerves (12)
- Spinal nerves
  - Cervical (8)
  - Thoracic (12)
  - Lumbar (5)
  - Sacral (5)
  - Coccyx (1)

Peripheral Nervous System

- Brain
- Spinal cord

Nervous System

- Peripheral nervous system
  - Sensory
    - Impulses carry information from the body to the brain and spinal cord
  - Motor
    - Impulses carry information from the brain and spinal cord to the body

Skin
Skin

- Protects the body from the environment, bacteria, and other organisms
- Helps regulate the temperature of the body
- Senses heat, cold, touch, pressure, and pain; transmits this information to the brain and spinal cord

Layers

- Epidermis
  - Outermost layer of skin
- Dermis
  - Deeper layer of skin containing sweat and sebaceous glands, hair follicles, blood vessels, and nerve endings
- Subcutaneous layer

Digestive System
Digestive System

- Provides the body with energy from food
- Foods passes through hollow organs from the stomach to the anus
- Nutrients are absorbed into the bloodstream through the small intestine

Endocrine System

- Secretes chemicals, such as insulin and adrenaline, responsible for regulating body activities and functions
Summary

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  - Endocrine System