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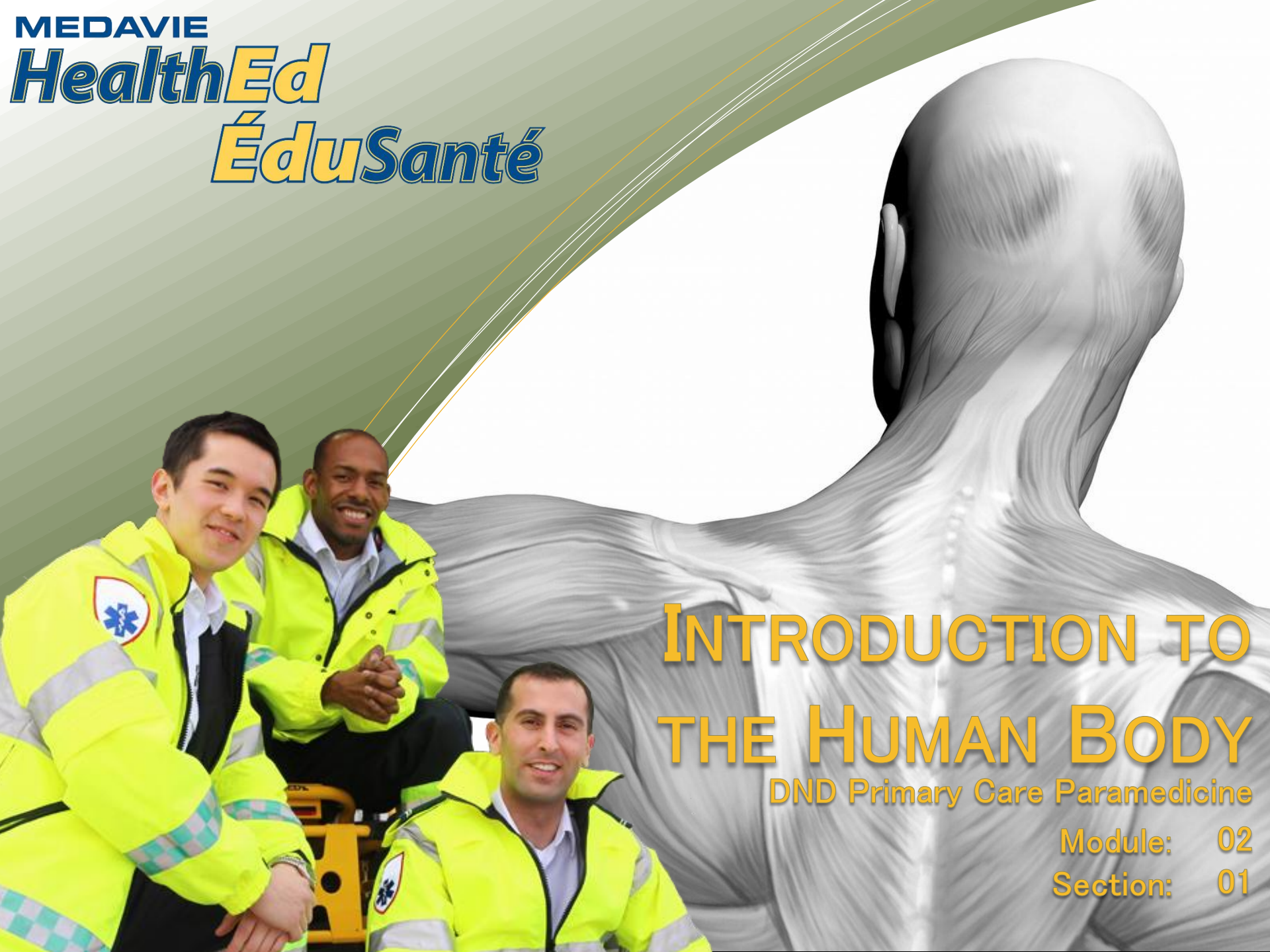


Introduction to the Human Body

DND Primary Care Paramedicine

Module: 02

Section: 01

Definitions

- Anatomy and physiology are branches of biology concerned with the form and functions of the body

- Anatomy:
  - The study of the shape and structure of the human body

Definitions

- Gross anatomy
  - Study of the body using only the naked eye
- Microscopic anatomy
  - Study of body parts using a microscope
    - Cytology: study of cells
    - Histology: study of tissues

Definitions

- Developmental anatomy
  - Study of human growth and development
- Pathological anatomy
  - Study of diseased body structures
- Systemic anatomy
  - Study of all aspects of the function of specific organ systems

Definitions

- Physiology
  - The study of the functions of organisms; subdivisions named according to:
    - Organism involved: human or plant physiology
    - Organizational level: molecular or cellular physiology
    - Systemic function: respiratory, neurovascular or cardiovascular physiology

Definitions

- Pathophysiology
  - The study of the biologic and physical manifestations of disease as they correlate with abnormalities and physiological disturbances.
  - Pathophysiology does not deal directly with the treatment of disease. Rather, it explains the processes within the body that result in the signs and symptoms of a disease.

Language of Science and Medicine

- Terminologia Anatomica
  - Official list of anatomical terms
  - Terms listed in Latin, English, and by number
  - Avoids use of eponyms (terms based on a person's name)
- Physiology terms do not have an official list but follow the same principles as Terminologia Anatomica

Anatomy and Physiology

- Anatomy and Physiology are interrelated since structure and function are closely connected
- Examples:
  - Cleft palate (anatomy) repaired so food will enter (physiology) the pharynx instead of the nasal cavity
  - Fractured bones (anatomy) are reset so they function (physiology)

Characteristics of Life

- A single criterion may be adequate to describe life, as in following examples:
  - Autopoiesis: living organisms are self-organized and self-maintaining
  - Cell theory: if it is made of one or more cells, it is alive

Characteristics of Life

- All living organisms have certain characteristics (life processes) to distinguish them from non-living forms

Life Processes

- Life processes that are considered most important in humans:
  - Responsiveness
  - Organization
  - Growth
  - Respiration
  - Digestion
  - Metabolism
  - Movement
  - Differentiation
  - Excretion
  - Reproduction

Characteristics of Life

- Responsiveness
  - Detecting internal and external changes and reacting to that change
- Organization
  - Each component has its own job to perform in cooperation with others

Characteristics of Life

- Growth
  - Increase of size whether through increase in number of cells or increase in the size of the cell itself

- Respiration
  - Exchange of O_2 and CO_2 between the cells and the environment and the transport of gases in and out of the blood

Characteristics of Life

- Digestion
  - Break down of complex foods into simple molecules that can be absorbed
- Metabolism
  - Includes all chemical reactions that occur in the body

Characteristics of Life

- Movement
  - The movement of molecules at the cellular level
  - Blood moving from one part of the body to another
  - Diaphragm moving with every breath
  - Muscle fibers shortening causing movement

- Differentiation
  - Simple cells form into specialized cells with specific structure and function (form tissues and organs)

Characteristics of Life

- Excretion
  - Removal of waste products of digestion and metabolism
- Reproduction
  - Formation of new cells for replacement and repair

Characteristics of Life

- Each characteristic is related to the sum total of all physical and chemical reactions
  - Metabolism
    - Catabolism
      - Complex substances are broken down into simpler substances creating energy
    - Anabolism
      - Simple substances combine to form complex substance (requires energy)

Life Factors

- The life processes are not enough for survival
- Life also depends on the following factors:
  - Water
  - Oxygen
  - Nutrients
  - Heat
  - Pressure

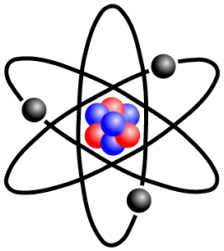
Life Factors

- Water
  - 60% of body weight
  - Transport of substances
  - Medium for chemical reaction
  - Regulates body temperature
- Oxygen
  - Needed for metabolic reactions

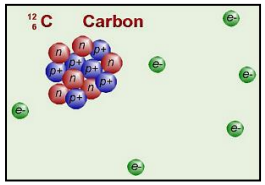
Life Factors

- Nutrients
  - Supply chemicals for energy
  - Raw material for new tissue growth, replacement and repair
- Heat
  - Needed for metabolic reactions to occur at an appropriate rate
- Pressure
  - Allows for exchange of gases and for circulation (BP)

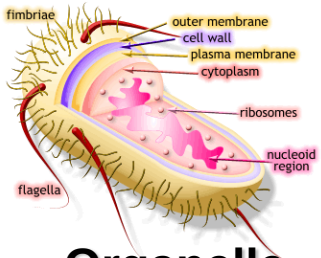
Levels of Organization



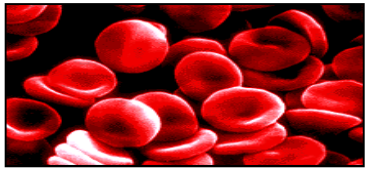
Atom



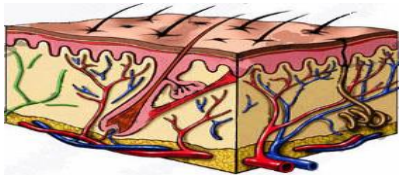
Chemical



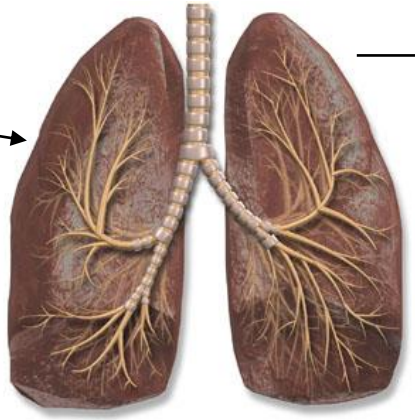
Organelle



Cells



Tissues



Organs

Systems

Total Organism

Organ Systems of the Body

Integumentary System

COMPONENTS: Skin, hair, nails, sweat and sebaceous glands

FUNCTIONS: Covers and protects body; regulates temperature

Skeletal System

COMPONENTS: Bones, cartilage, ligaments

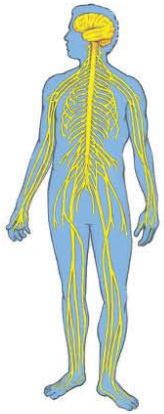
FUNCTIONS: Provides body framework and support; protects; attaches muscles to bones; provides calcium storage

Muscular System

COMPONENTS: Muscles

FUNCTIONS: Produces movement; maintains posture; provides heat

Nervous System



COMPONENTS: Brain, spinal cord, nerves, sense receptors

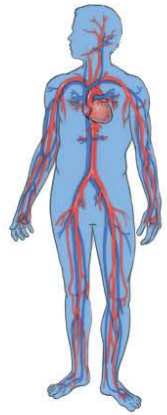
FUNCTIONS: Coordinates body activities; receives and transmits stimuli

Endocrine System

COMPONENTS: Pituitary, adrenal, thyroid, other ductless glands

FUNCTIONS: Regulates metabolic activities and body chemistry

Cardiovascular System



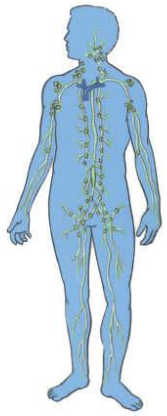
COMPONENTS: Heart, blood vessels, blood

FUNCTIONS:Transports material from one part of the body to another; defends against disease

Figure 1-2A *Organ systems of the body.*

Organ Systems of the Body—cont'd

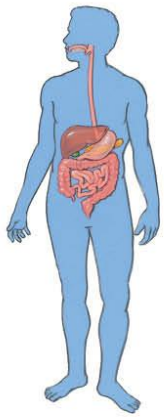
Lymphatic System



COMPONENTS: Lymph, lymph vessels, lymphoid organs

FUNCTIONS: Returns tissue fluid to the blood; defends against disease

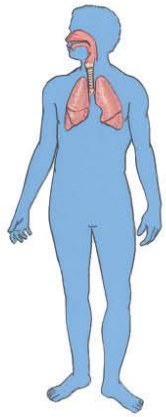
Digestive System



COMPONENTS: Mouth, esophagus, stomach, intestines, liver, pancreas

FUNCTIONS: Ingests and digests food; absorbs nutrients into blood

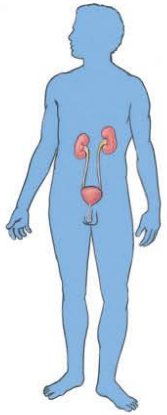
Respiratory System



COMPONENTS: Air passageways, lungs

FUNCTIONS: Exchanges gases between blood and external environment

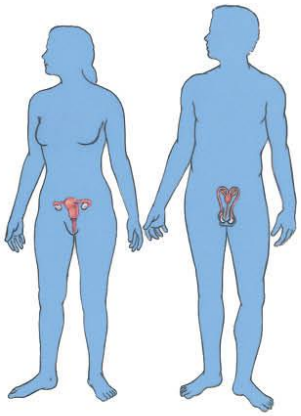
Urinary System



COMPONENTS: Kidneys, ureters, urinary bladder, urethra

FUNCTIONS: Excretes metabolic wastes; regulates fluid balance and acid-base balance

Reproductive System



COMPONENTS: Testes, ovaries, accessory structures

FUNCTIONS: Forms new individuals to provide continuation of the human species

Figure 1-2B *Organ systems of the body.*

Interaction of Structure and Function

- A relationship of structure and function is an important and unifying concept in the study of anatomy and physiology
- Anatomical structures often seem “designed” to perform specific functions because of their unique size, shape, form, or body location
- Understanding the interaction of structure and function assists in integration of otherwise isolated factual information

Cycle of Life: Life Span Considerations

- Structure and function of body undergo changes over the early years (developmental processes) and late years (aging processes)
- Body functions are less efficient during infancy (development) and old age (decline)

Cycle of Life: Life Span Considerations

- Young adulthood is period of greatest homeostatic efficiency
- Atrophy: term to describe the wasting effects of advancing age

Introduction to the Human Body

HOMEOSTASIS

Homeostasis

- What is it?
- Why do we have it?
- What makes it happen?

Claude Bernard
(1813 – 1878)

- Milieu interieur (the internal environment)

- Believed 3 relative constants of fluid environment were required to maintain healthy cells
  - Temperature
  - Pressure
  - Chemical composition

Walter B Cannon (1932)

- Suggested the name homeostasis for the relatively constant states of the body
- Greek meaning ‘homoios’ (the same) and ‘stasis’ (always or staying)

- Suggested that every regulatory mechanism of the body exists to maintain homeostasis
- Qualified that these factors did not remain fixed and immobile but rather relatively constant

- Examples:
  - Temperature, blood glucose, BP, electrolyte balances and blood gas levels

Homeostasis

- The bodies constant internal environment that must be maintained.
  - Internal environment must remain constant regardless of the external environment
  - If conditions in the cell change, mechanisms respond to try to restore conditions to normal
  - If unsuccessful, cells die leading to illness and eventually death

Homeostatic Control

- Mechanisms or Processes for maintaining homeostasis
  - May involve all of the internal organs and systems
- Any condition that disrupts homeostasis is a "stressor"

- Feedback Control Loops
  - Help accomplish this self regulation

Homeostatic Control Mechanisms

- Devices for maintaining or restoring homeostasis by self-regulation through feedback control loops
- Basic components of control mechanisms
  - Sensor mechanism
  - Integrating, or control, center
  - Effector mechanism
  - Feedback

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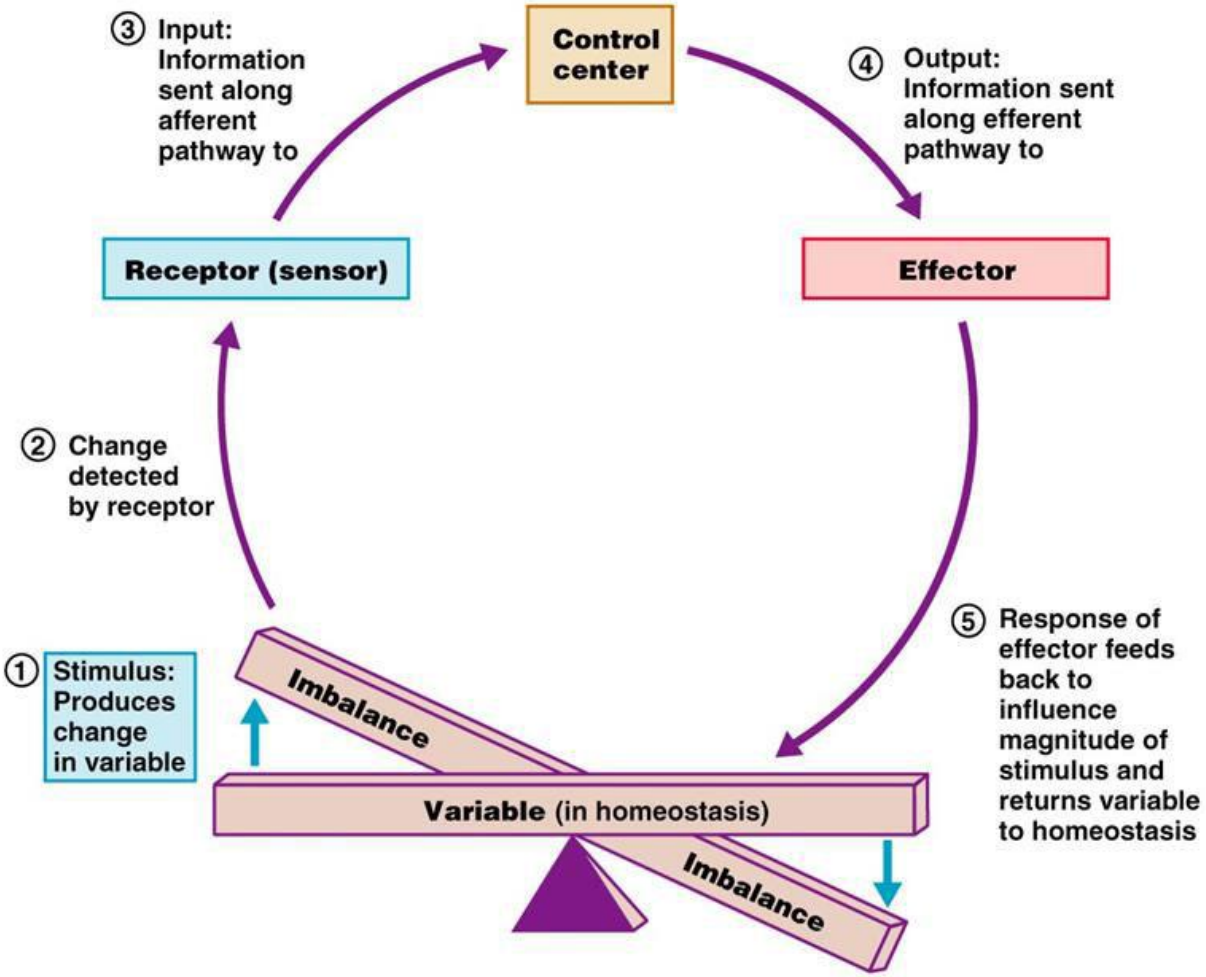
Homeostatic Control Mechanisms



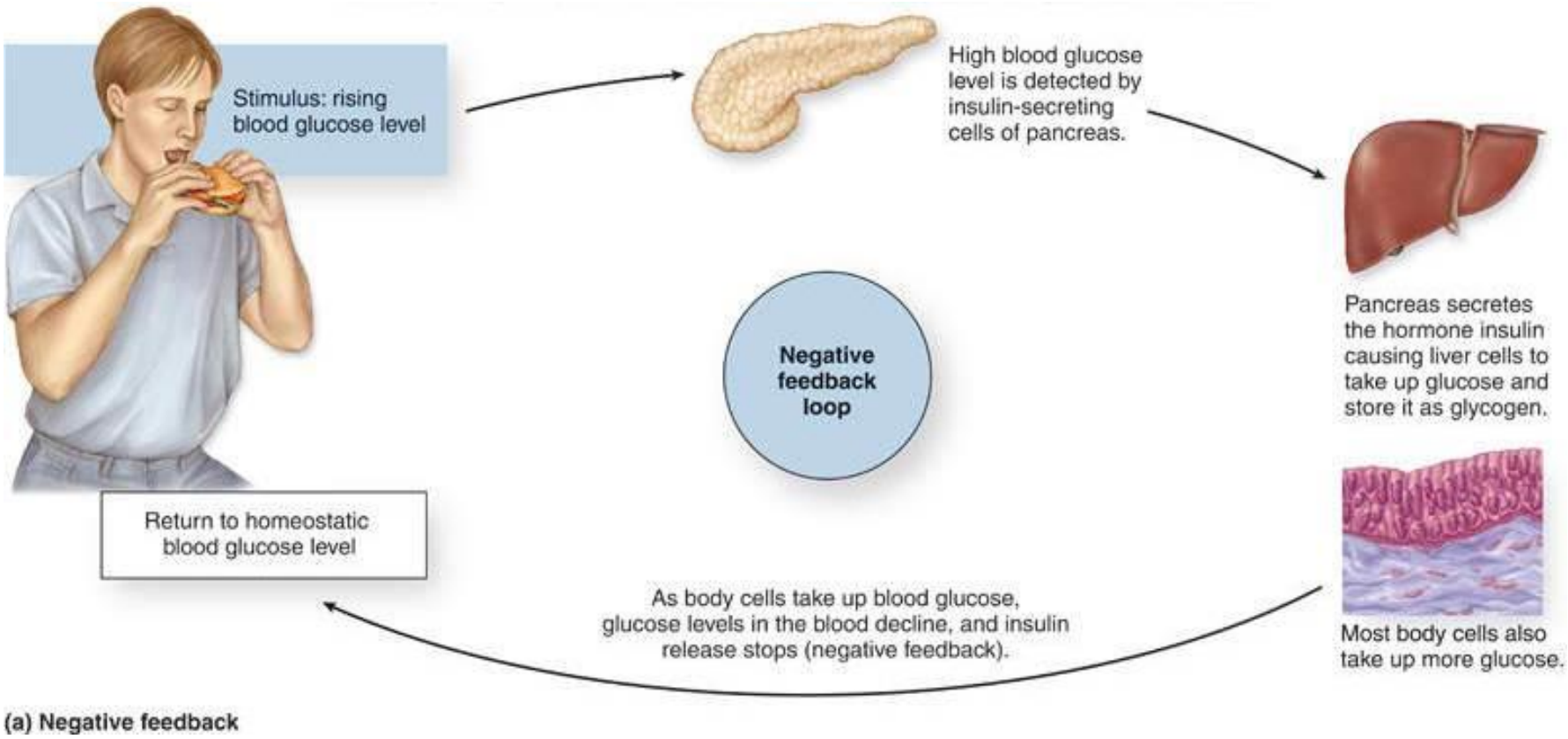
Feedback

- Negative Feedback
  - Inhibitory
  - Oppose change by creating an opposite response
  - Utilizing another function to balance the internal environment
  - Stabilize physiological variables
  - Are much more common than positive feedback control systems

Feedback

- Negative Feedback
  - Examples
    - Shivering to produce heat
    - Sweating to release heat
    - Maintenance of metabolism rates
    - Blood sugar regulation
    - RBC production

Feedback



(a) Negative feedback

Feedback

- Positive Feedback
  - Stimulatory
  - Destabilizing effects can be harmful and disrupt homeostasis
  - Brings fast completion of specific body function
  - Amplifies/accelerates or Reinforces the response

Feedback

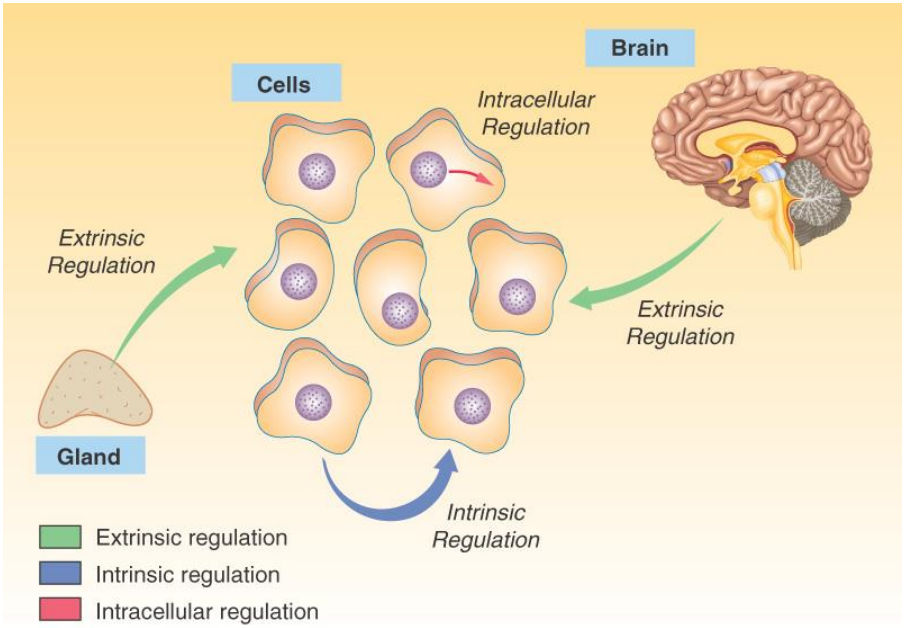
- Positive Feedback
  - Examples
    - Increasing uterine contractions by release of oxytocin
    - Lactation during suckling
    - Platelets release chemicals to stimulate more platelets

Feedback

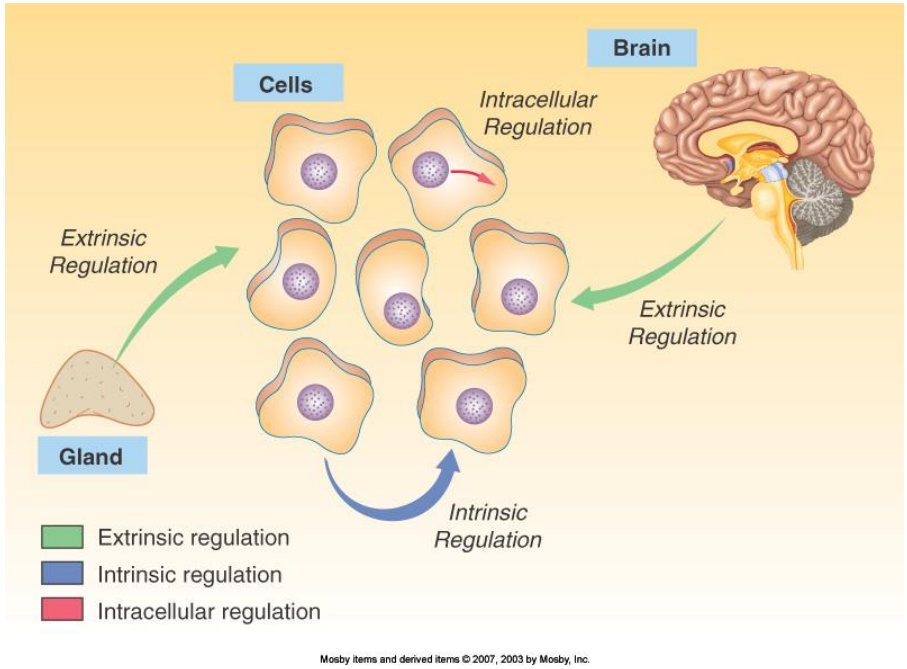
- Feed-forward
  - Information flows ahead to another process or feedback loop to trigger a change in anticipation of an event that will follow (food entering the stomach)

Homeostatic Control Mechanisms

- Levels of control
  - Intracellular control
    - Regulation within cells
    - Genes or enzymes can regulate cell processes

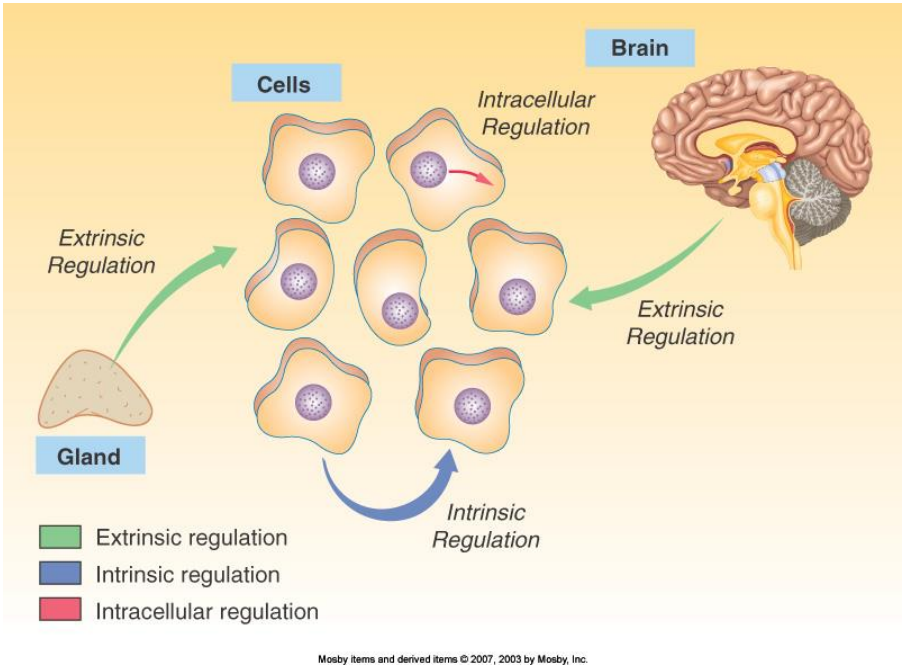


Homeostatic Control Mechanisms



- Levels of control
  - Intrinsic control (autoregulation)
    - Regulation within tissues or organs
    - May involve chemical signals
    - May involve other “built-in” mechanisms

Homeostatic Control Mechanisms



- Levels of control
  - Extrinsic control
    - Regulation from organ to organ
    - May involve nerve signals
    - May involve endocrine signals (hormones)

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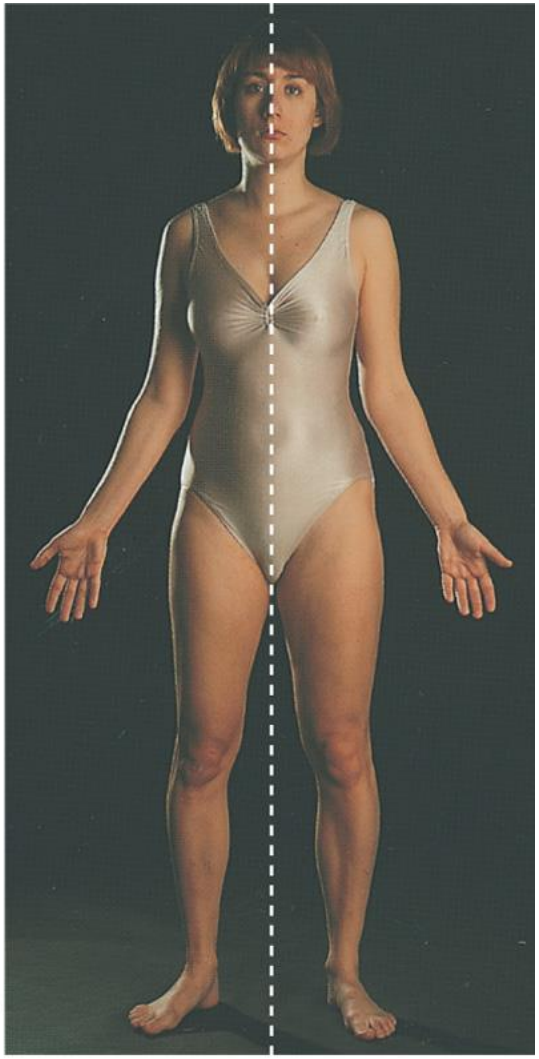
Introduction to the Human Body

ANATOMICAL TERMINOLOGY

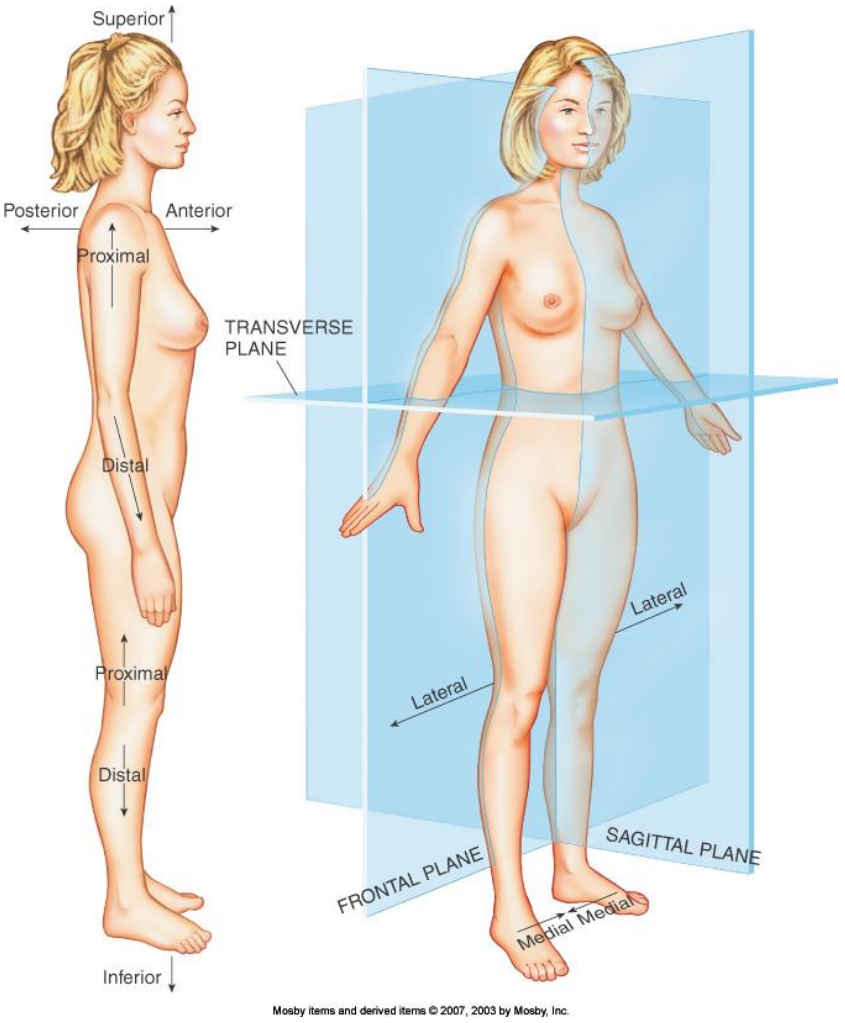
Anatomical Position



- Reference position
  - Body erect with arms at sides and palms forward
  - Head and feet pointing forward
- Bilateral symmetry
  - Confers balanced proportions
  - Ipsilateral structures are on the same side of the body in anatomical position
  - Contralateral structures are on opposite sides of the body in anatomical position

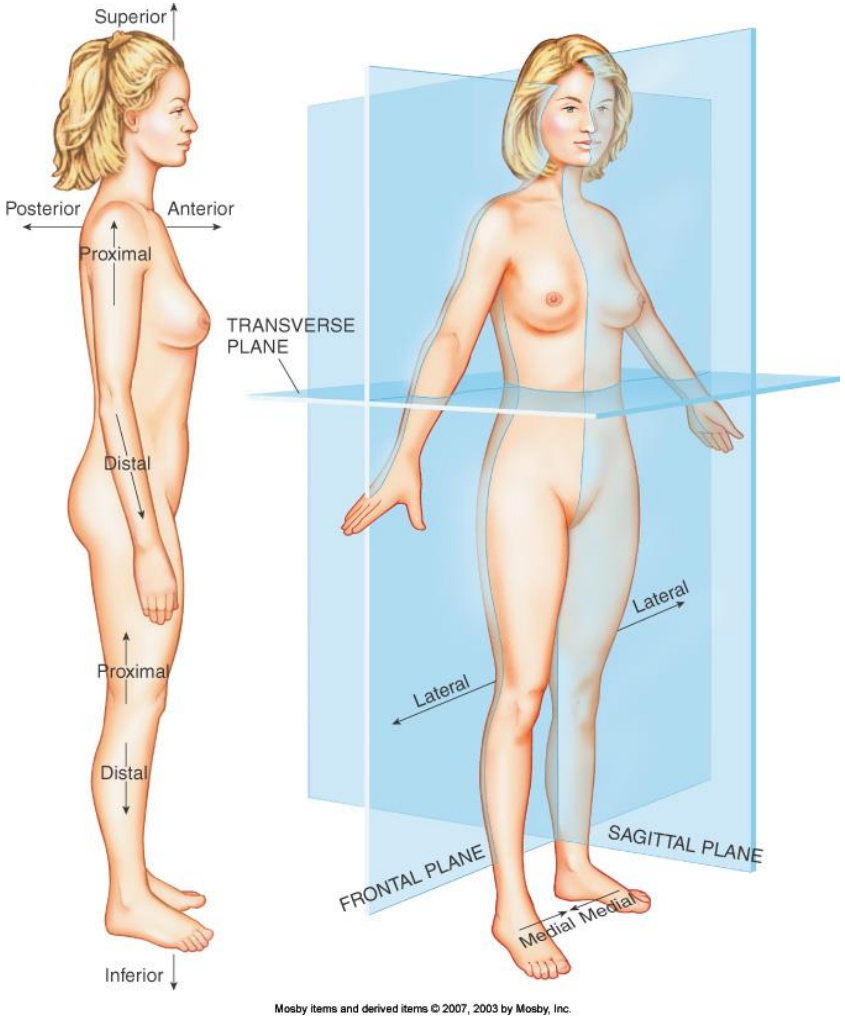
Body Planes and Sections

- Planes are lines of orientation along which cuts or sections can be made to divide the body, or a body part, into smaller pieces



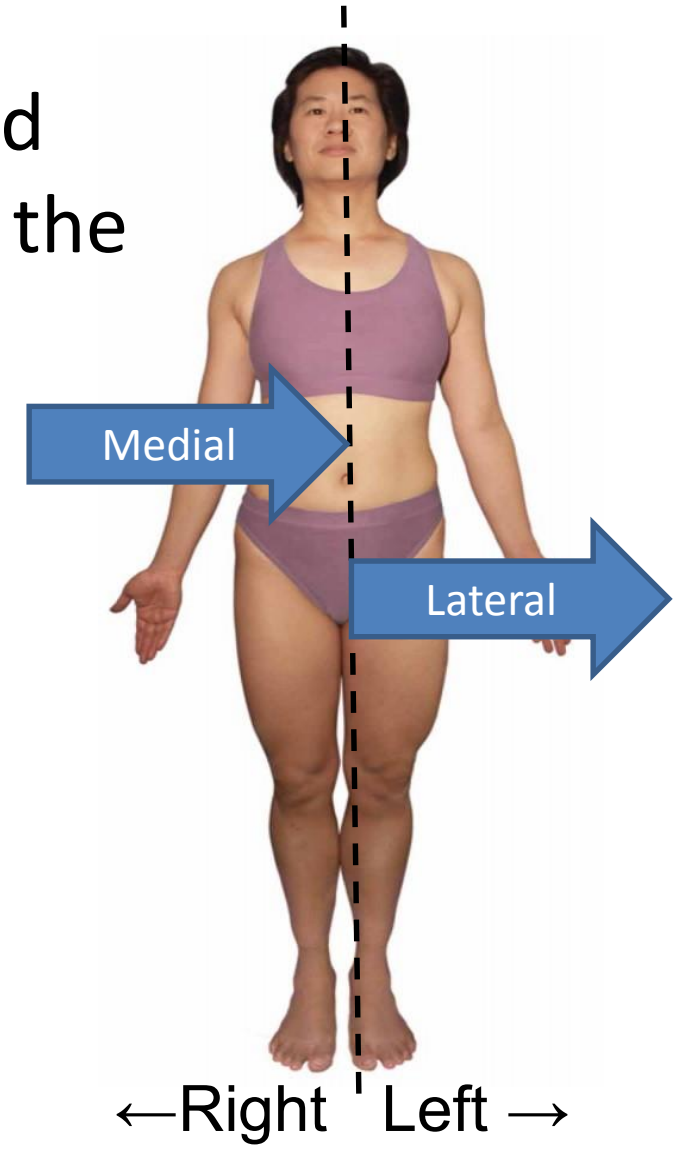
Body Planes and Sections

- Sagittal plane
  - Divides the body into left and right
    - Midsagittal (Midline)
      - Equal halves
    - Parasagittal
- Transverse (horizontal plane)
  - Divides the body into top and bottom
- Frontal (coronal plane)
  - Divides the body into front and back



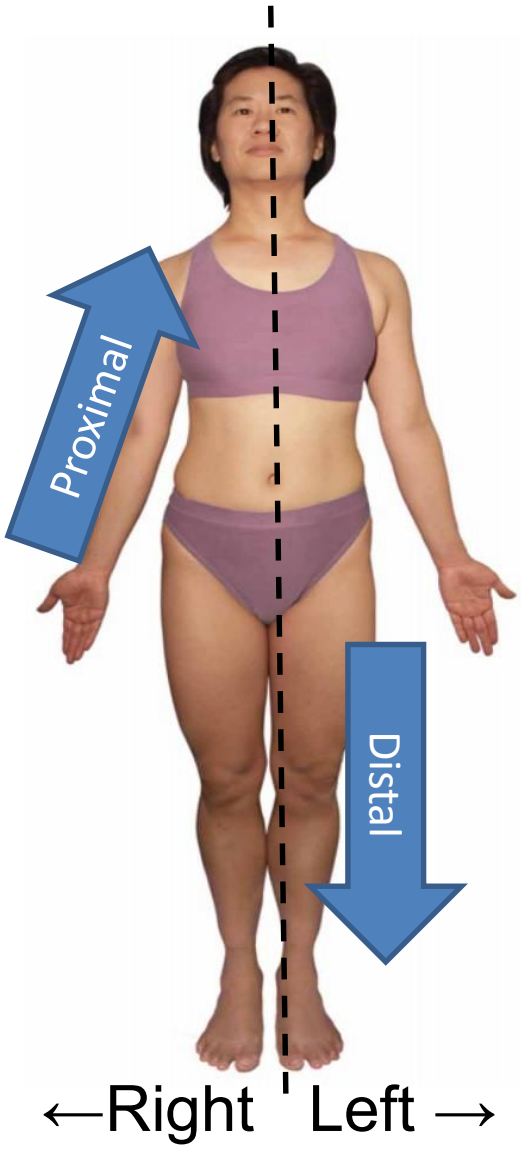
Anatomical Directions

- Positional sides are referenced based on the patient and not the clinician (Pt's right or left)
- Medial (toward midline)
- Lateral (away from midline)



Anatomical Directions

- Proximal
  - Closer to point of attachment
- Distal
  - Farther from point of attachment

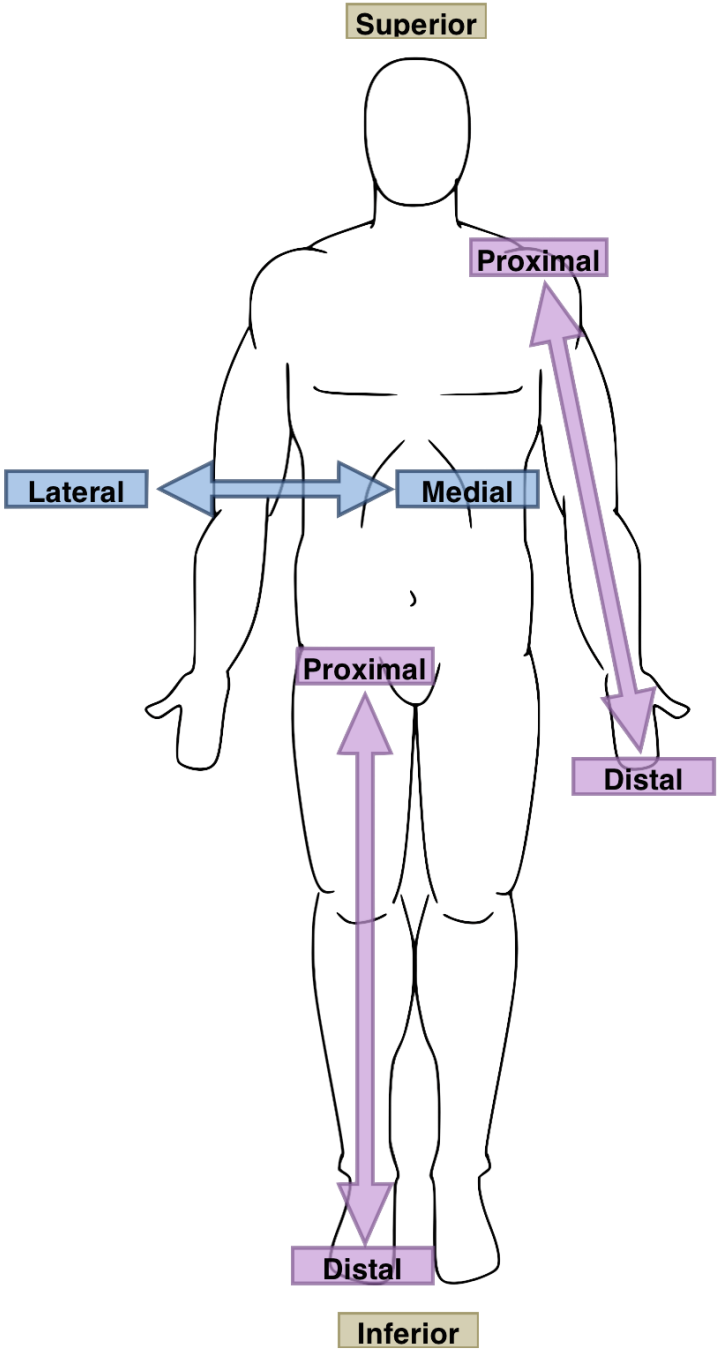


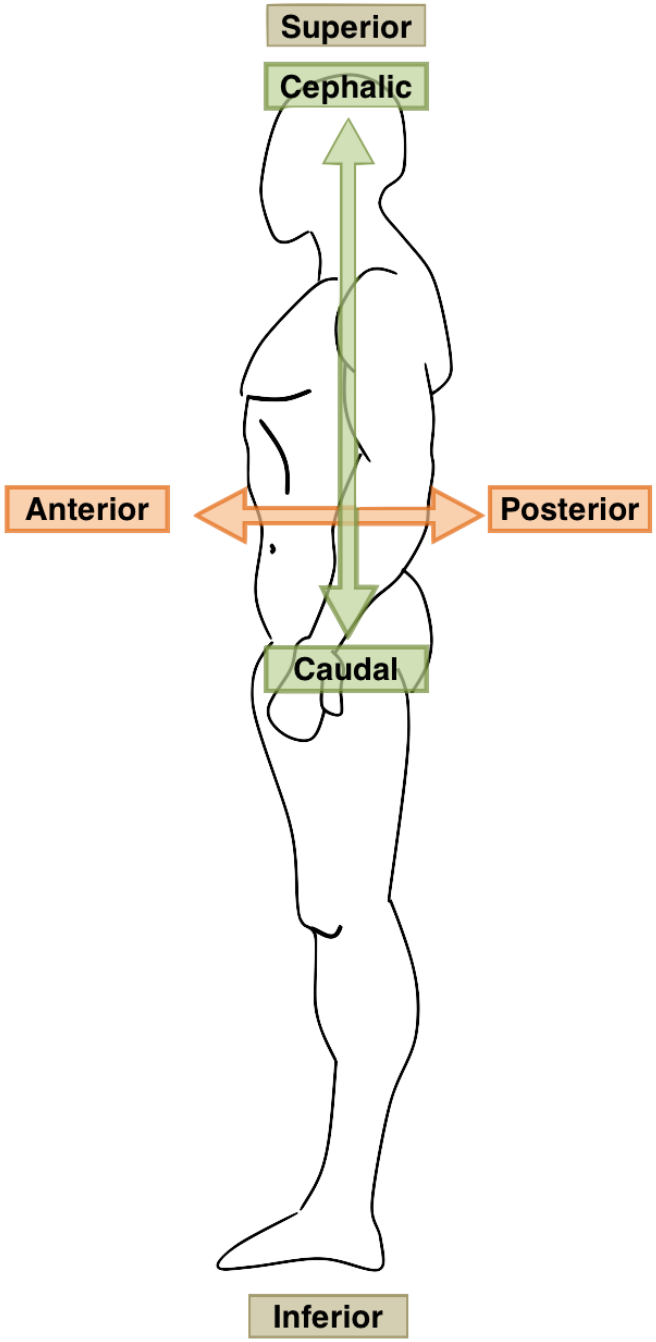
Directional Terms

- Superior (Above)
  - Cephalic
    - Towards the head
- Inferior (Below)
  - Caudal
    - Towards the tail of the spine

Directional Terms

- Anterior (The front of the body)
  - Ventral
    - Pertaining to the front
- Posterior (The back of the body)
  - Dorsal
    - Pertaining to the back/top


Superior
Proximal
Lateral
Medial
Proximal
Distal
Distal
Inferior


Superior
Cephalic
Anterior
Posterior
Caudal
Inferior

Anatomical Directions

- Superficial — Near the surface
- Deep — Into the layer

- Visceral — Inner layer (towards the viscous)
- Parietal — Outer layer (wall)

Anatomical Terminology

Supine

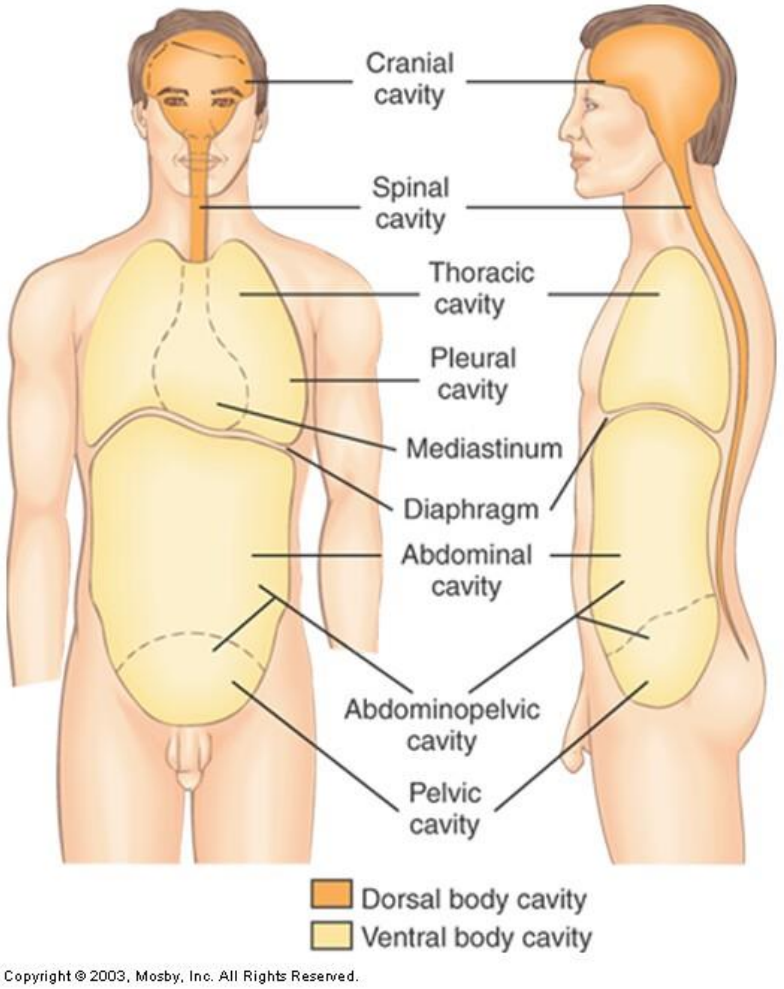
Prone

Right Lateral Recumbent

Left Lateral Recumbent

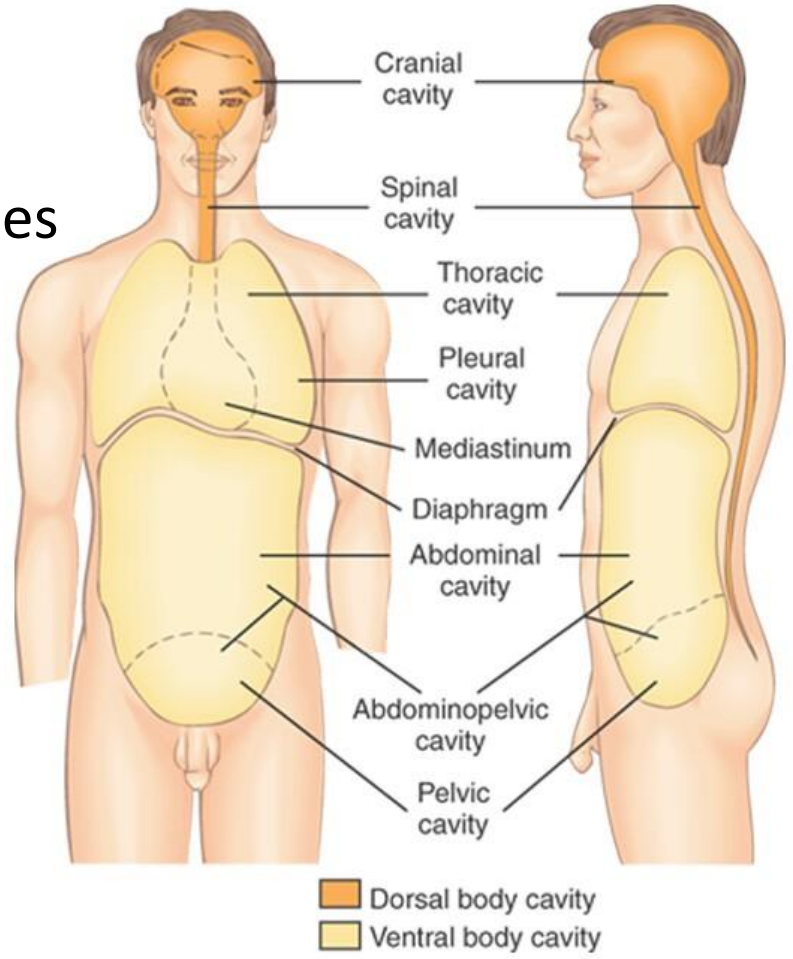
Body Cavities

- Dorsal Cavity
  - Cranial Cavity
  - Spinal Cavity



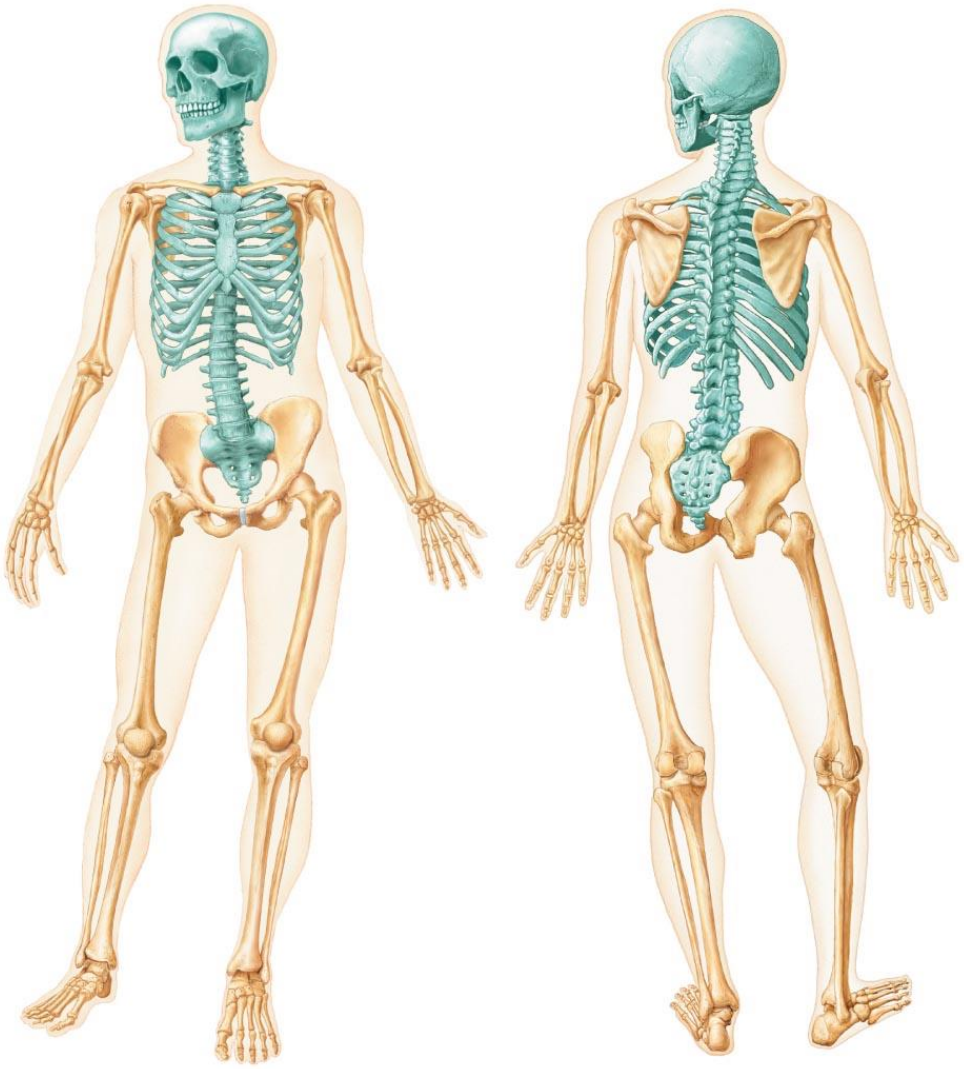
Body Cavities

- Ventral Cavity
  - Thoracic cavity
    - Right and left pleural cavities
    - Mediastinum
  - Abdominopelvic cavity
    - Abdominal cavity
    - Pelvic cavity



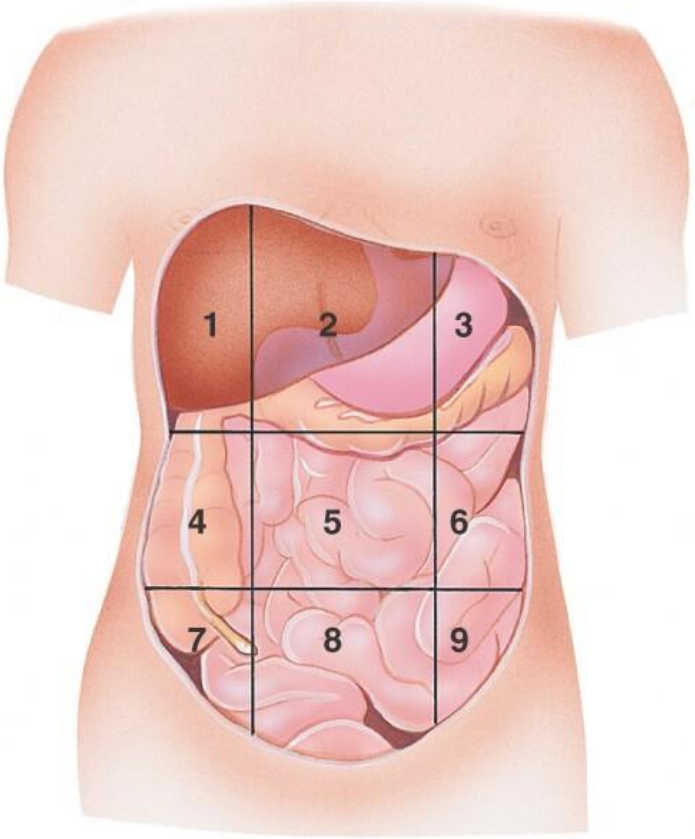
Body Regions

- Axial Skeleton (green)
  - Skull
  - Vertebrae
  - Sternum, ribs
  - Sacrum
- Appendicular Skeleton (tan)
  - Pectoral girdle
  - Pelvic girdle
  - Extremities



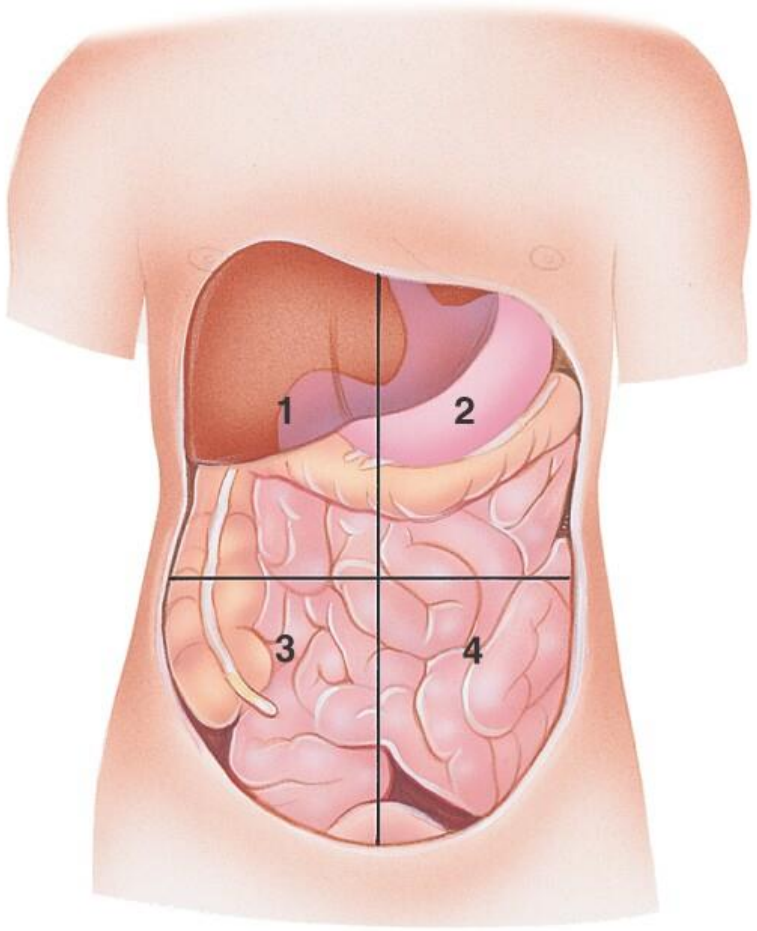
Abdominal Regions

1. Rt hypochondriac
2. Epigastric
3. Lt hypochondriac
4. Rt Lumbar
5. Umbilical
6. Lt lumbar
7. Rt iliac (inguinal)
8. Hypogastric
9. Lt iliac (inguinal)



Abdominopelvic Quadrants

1. Upper right quadrant (URQ)
2. Upper left quadrant (ULQ)
3. Lower right quadrant (LRQ)
4. Lower left quadrant (LLQ)



Body Structure Terms

- Terms related to organs
  - Lumen (luminal)
  - Central
  - Peripheral
  - Medullary (medulla)
  - Cortical (cortex)
  - Apical (apex)
  - Basal (base)

Body Regions

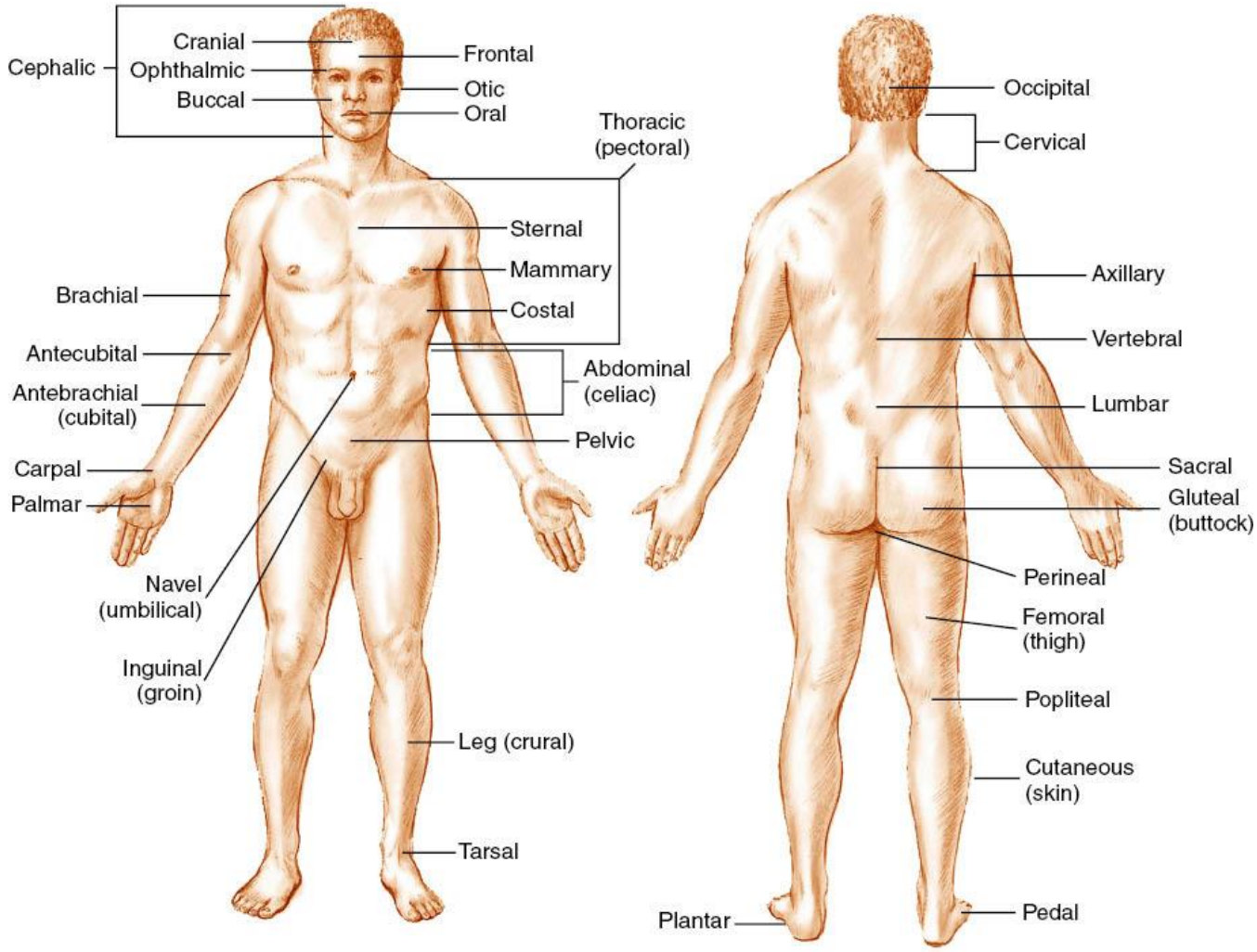
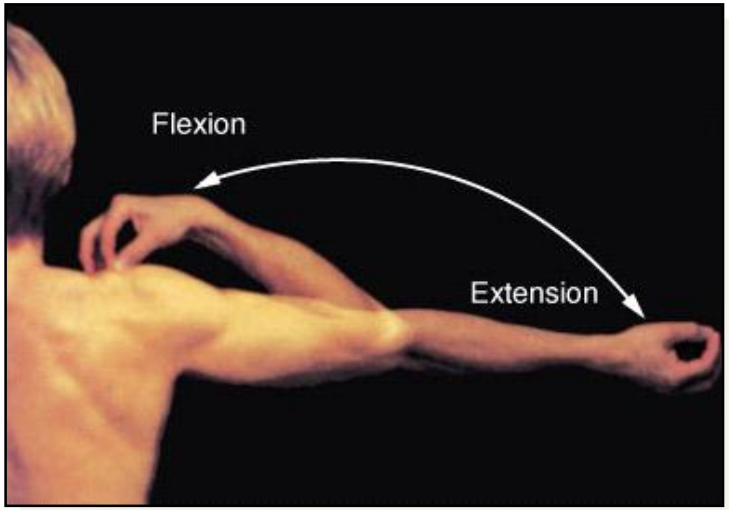


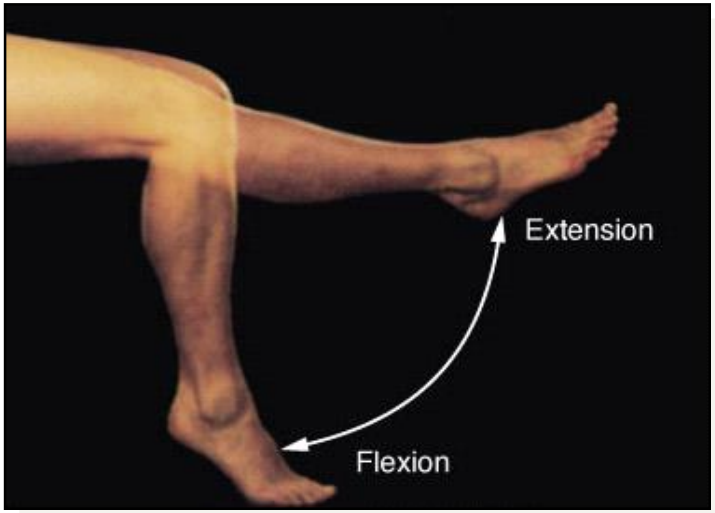
Figure 1-10 *Terms for selected regions of the body.*

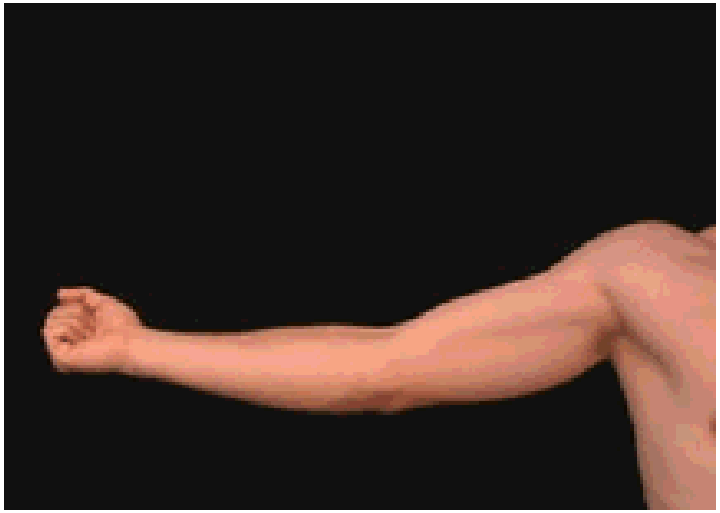
Introduction to the Human Body

TYPES OF MOVEMENT

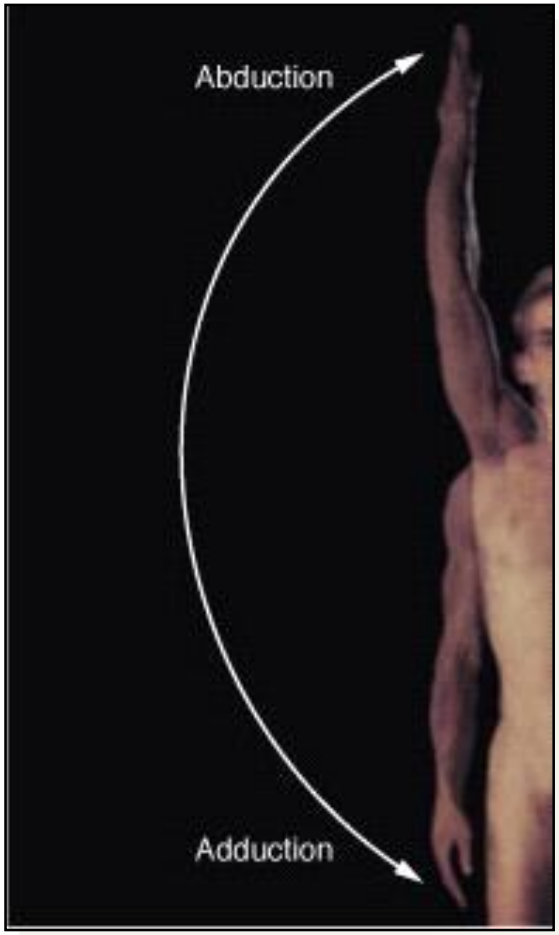
Flexion and Extension

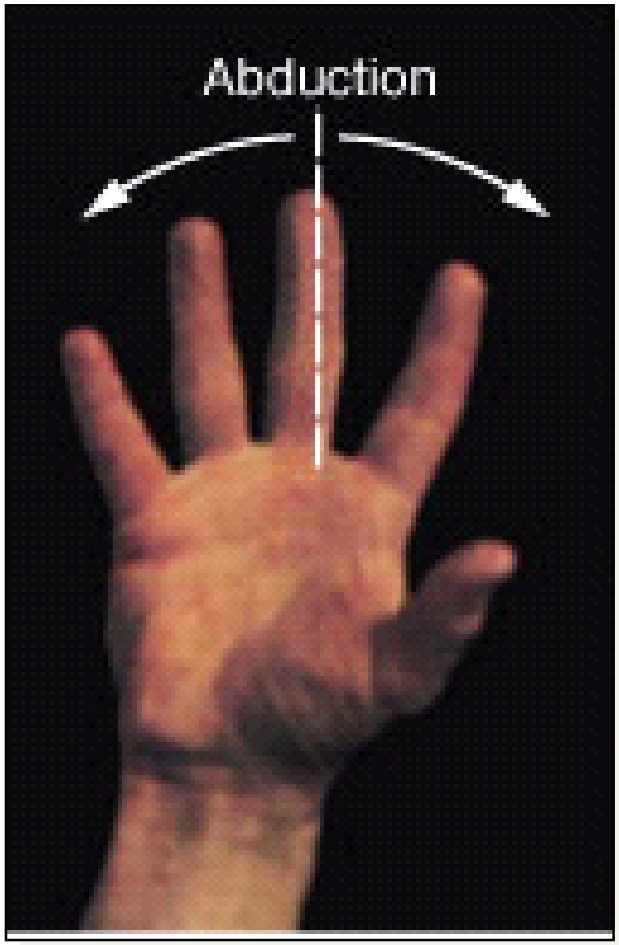


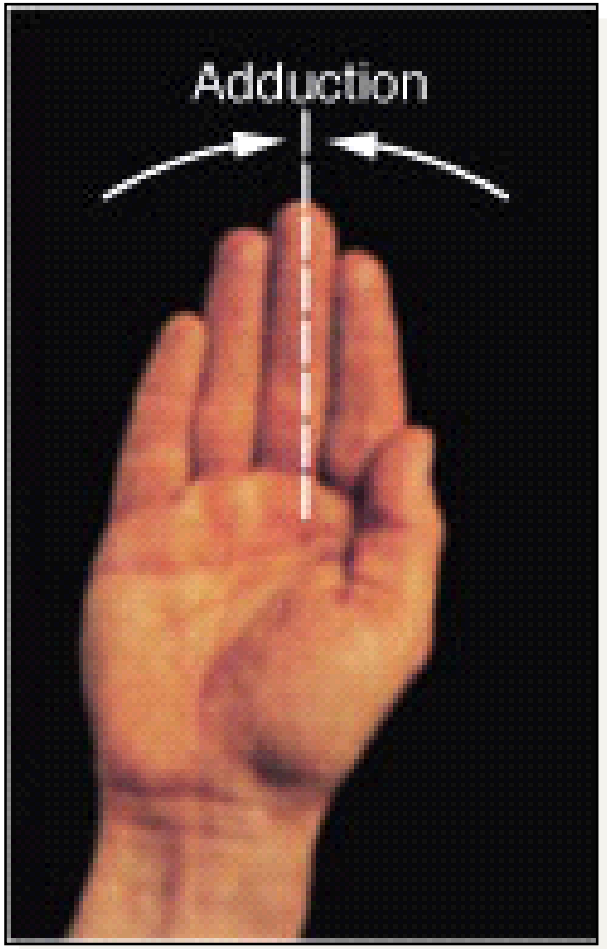




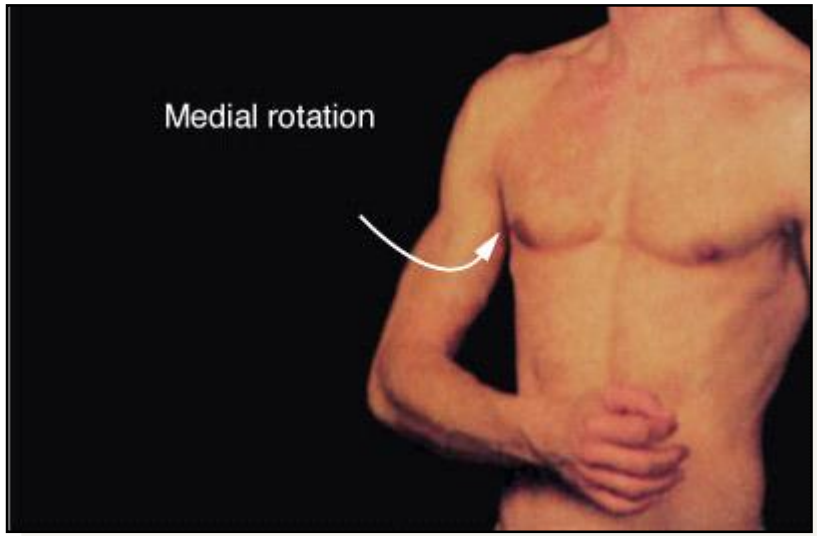
Abduction and Adduction

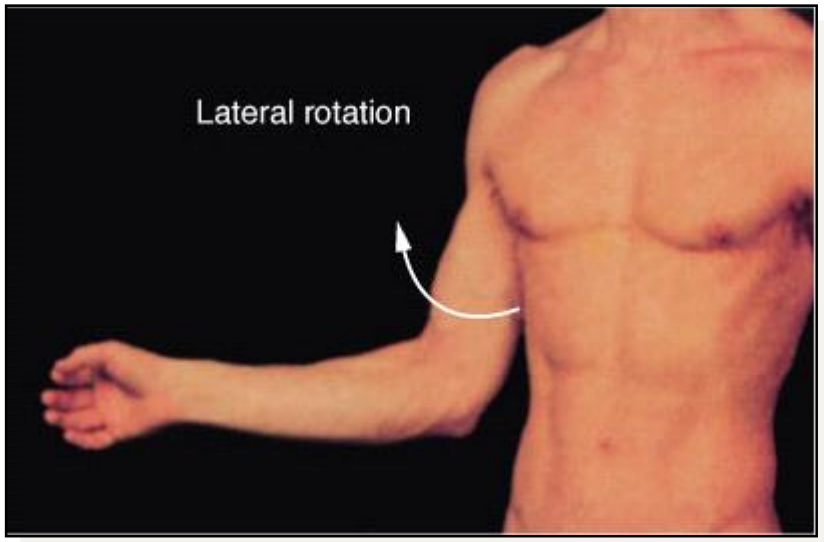




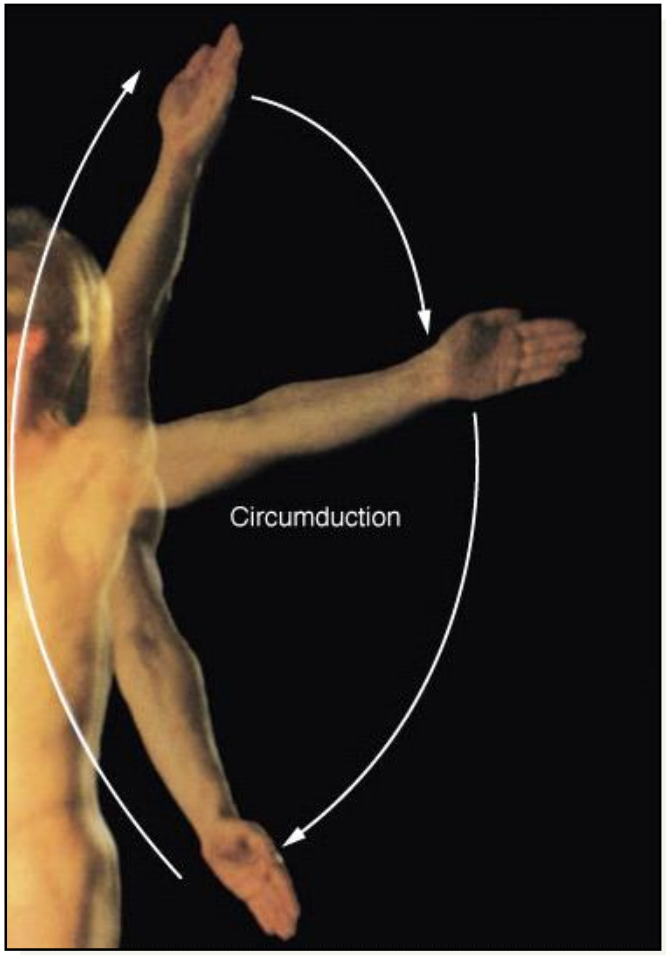


Medial and Lateral Rotation

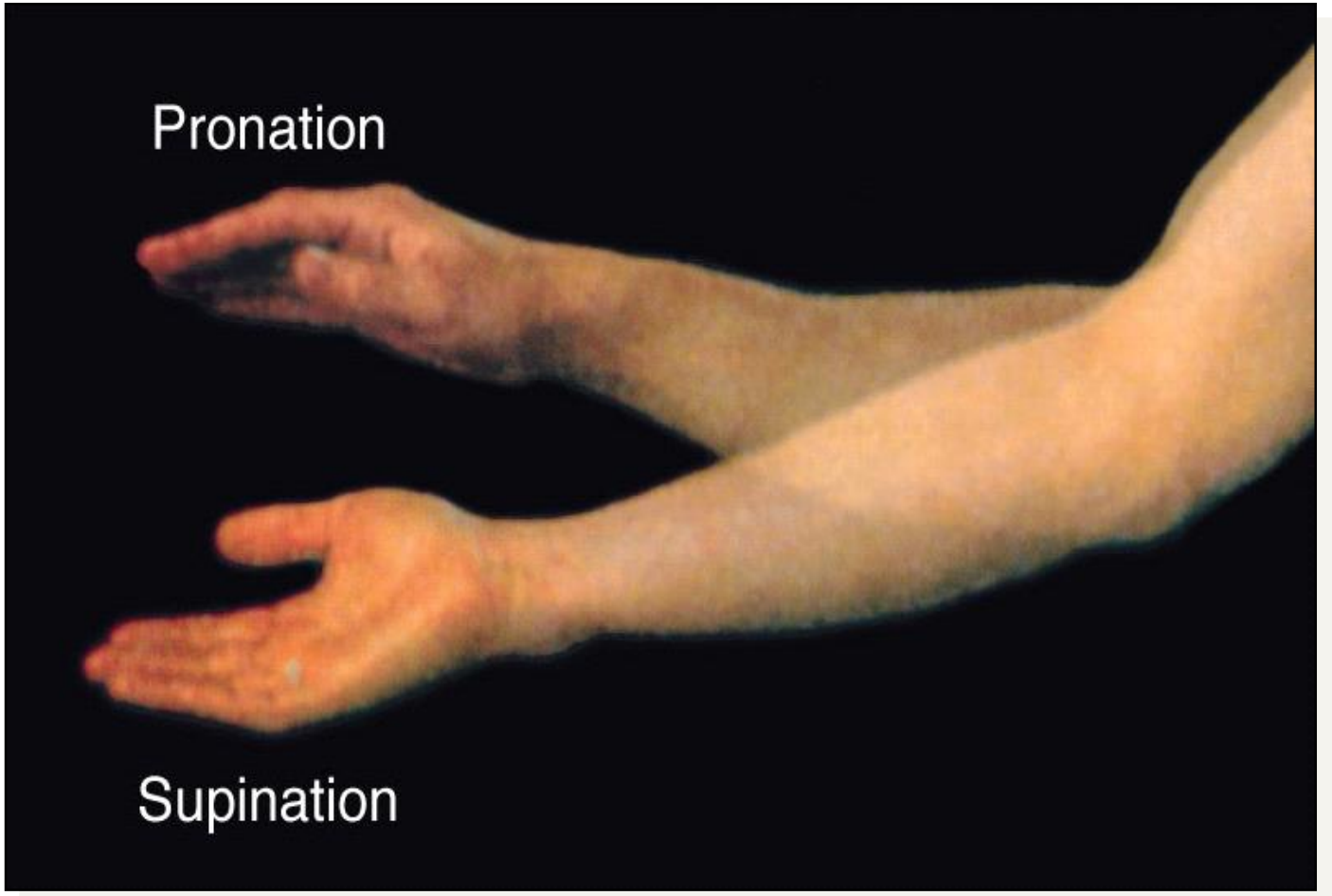




Circumduction



Pronation and Supination



Dorsiflexion and Plantar Flexion