BHARATHIDASAN UNIVERSITY

Tiruchirappalli- 620024,
Tamil Nadu, India

Programme: M.Sc., Biomedical science

Course Title : Human Anatomy & Physiology

Course Code : BM12C2

Unit-I

TOPIC: Introduction to Anatomy

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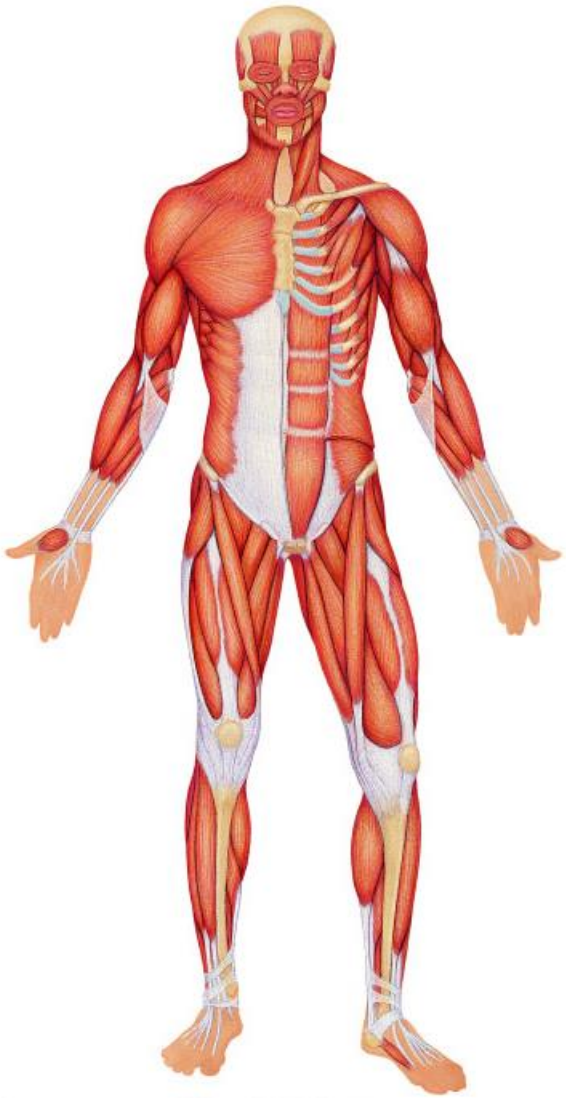


Introduction to Anatomy

CLASSIFICATION OF HUMANS

- Classification Scheme
  - Kingdom: Animalia
  - Phylum: Chordata
  - Subphylum: Vertebrata
  - Class: Mammalia
  - Order: Primate
  - Family: Hominidae
  - Genus: Homo
  - Species: Sapiens
- Scientific Binominal: Homo sapiens

Overview of Anatomy

- Anatomical terminology from ancient Greek and Latin
- Study of structure of body

- Branches of anatomy
  - Gross anatomy (or) Morphological Anatomy – naked eye
  - Microscopic anatomy (or) Histology
    - Cytology-
    - Histochemistry
  - Developmental anatomy
    - Embryology- Development of organ & tissue before birth
  - Applied Anatomy or Clinical anatomy- Understanding diseases
  - Comparative Anatomy-Different animals

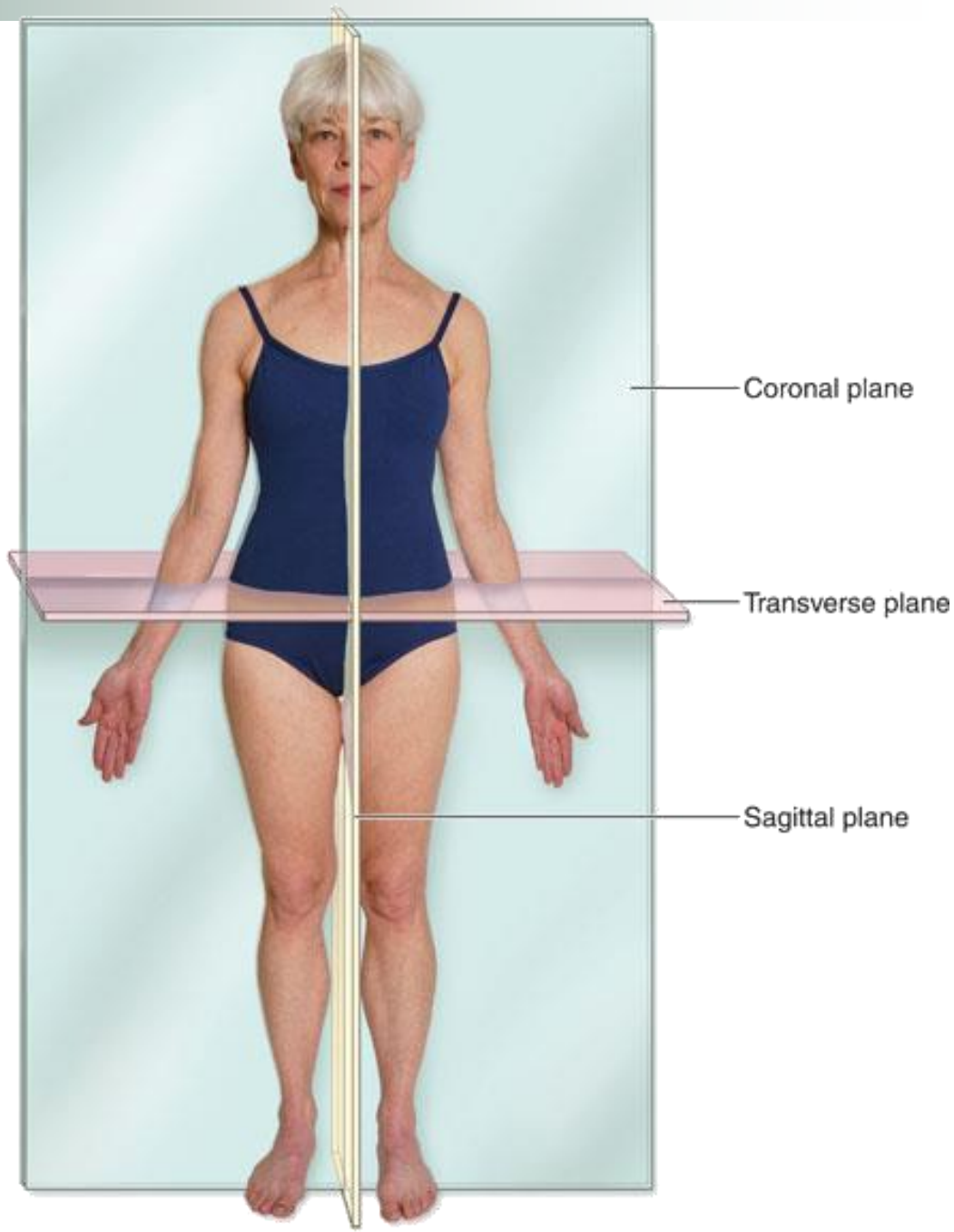
- Hierarchy of structural organization from simplest to most complex

Structural organization from simplest to most complex

- Chemical
- Cellular
- Tissue – group of cells similar in structure and function
- Organ – 2 or more tissue types performing specific function
- Organ system – group of organs acting together to perform specific function
- Human organism

Anatomical Terminology

- Anatomic position is a specific body position in which an individual stands upright with the feet parallel and flat on the floor.
- The head is level, and the eyes look forward toward the observer.
- The arms are at either side of the body with the palms facing forward and the thumbs pointing away from the body.



Body Planes

- Sometimes to gain a greater understanding of 3D images anatomists cut the image at different planes
- Three planes exists in 3D space

  -Two are parallel to the long axis of the body

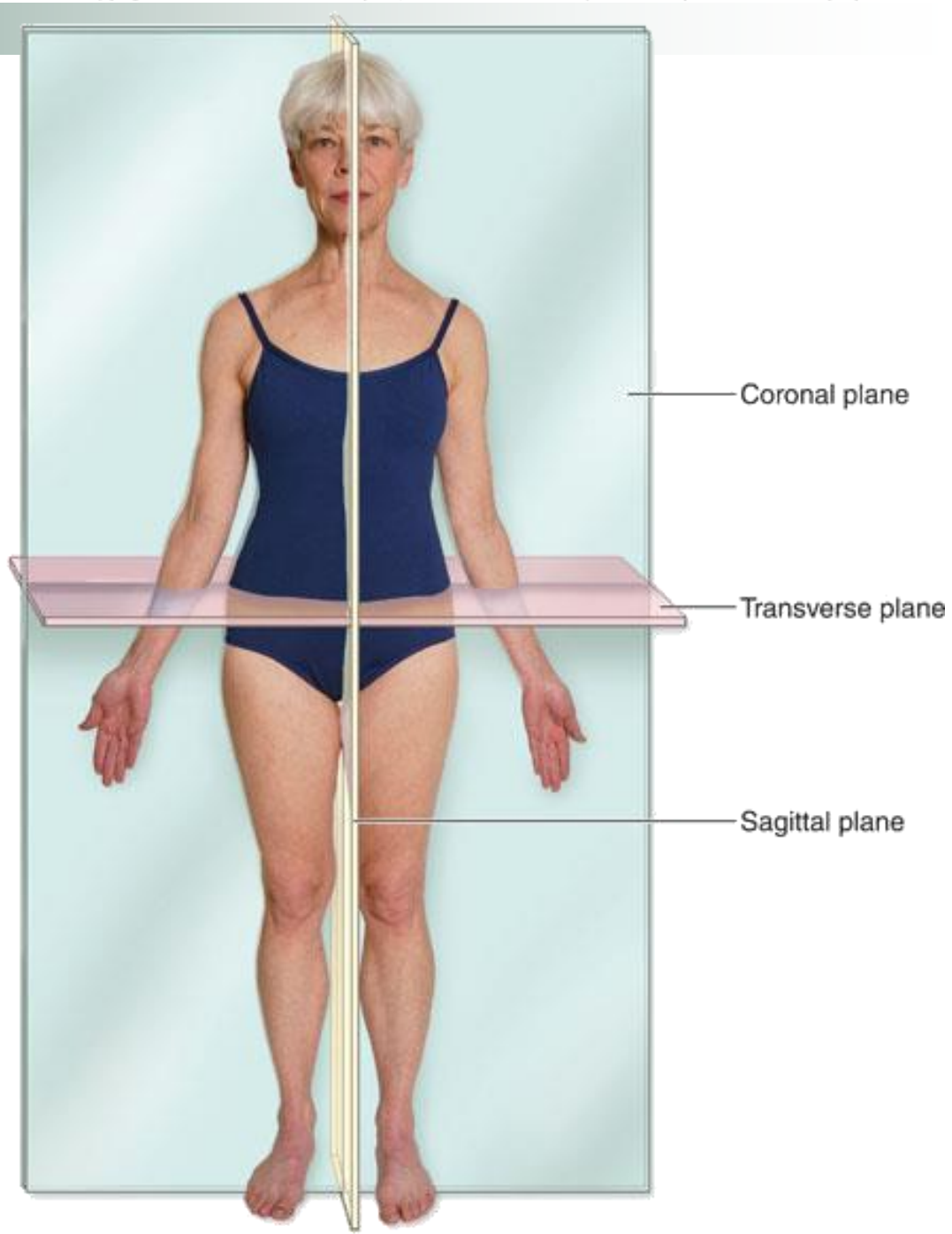
  -One is perpendicular to the long axis.

Anatomical Terminology

- A plane is an imaginary surface that slices the body into specific sections.
- The three major anatomic planes of reference are the coronal, transverse, and sagittal planes.

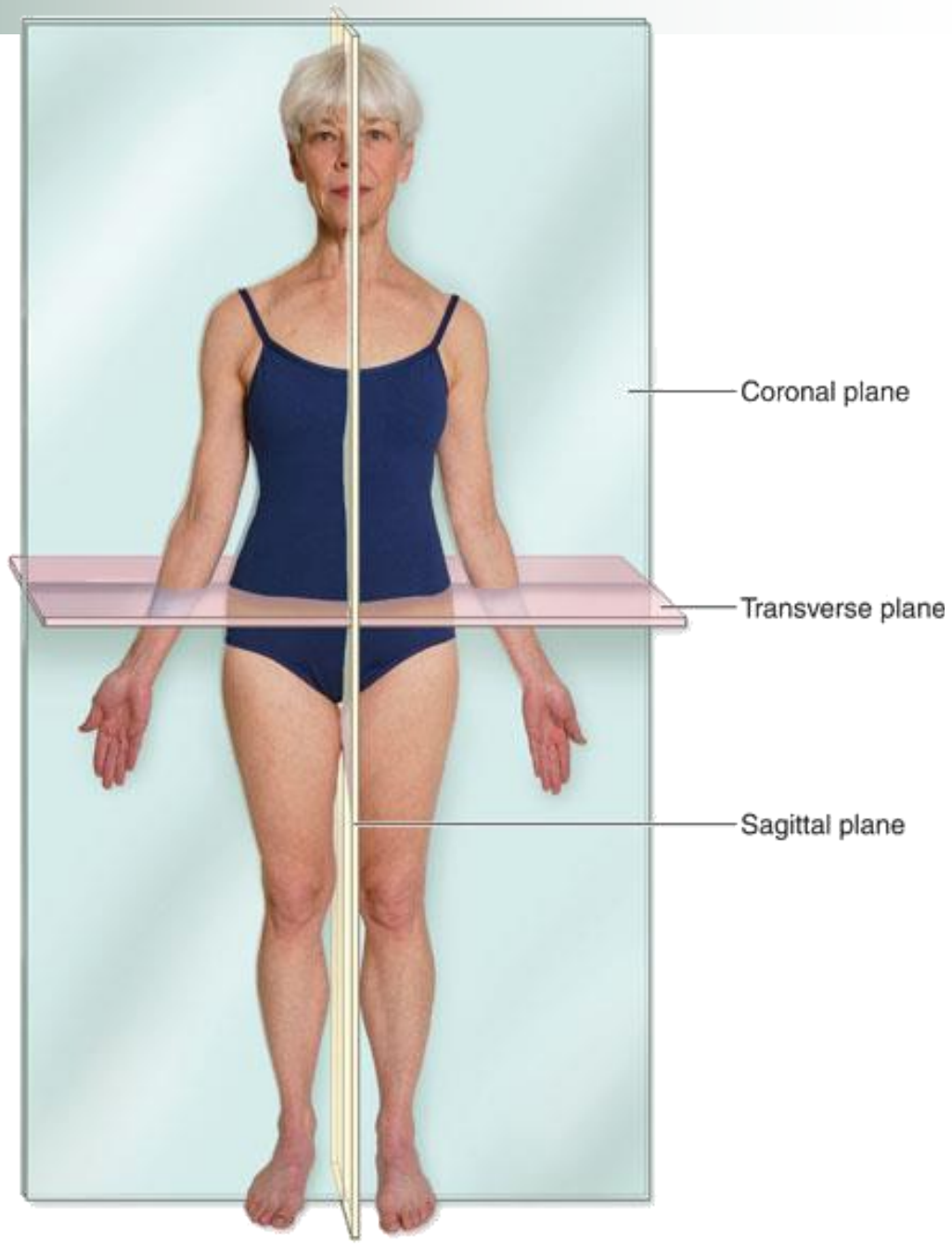
Sections and Planes

A coronal plane, also called a frontal plane, is a vertical plane that divides the body into anterior (front) and posterior (back) parts.



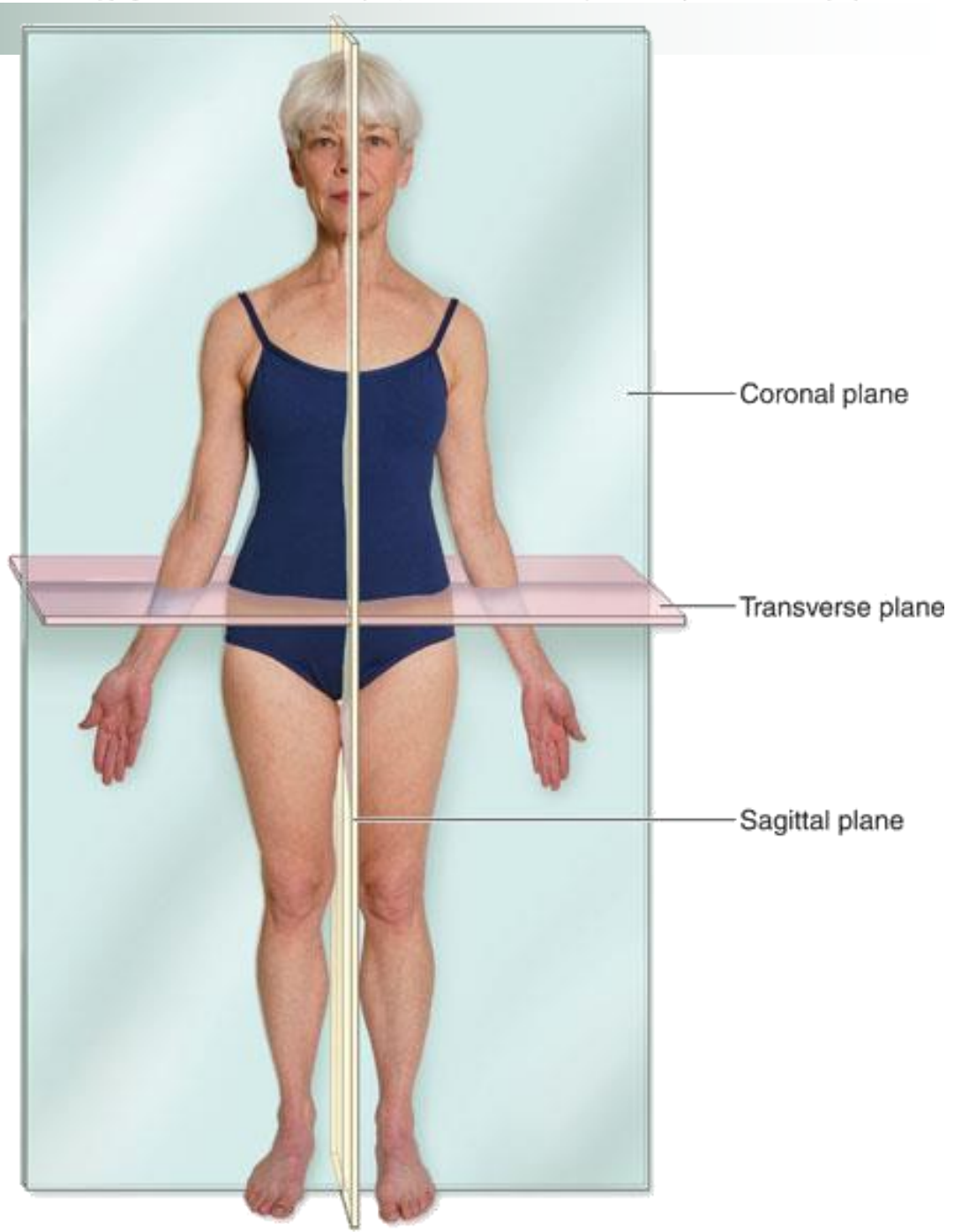
Sections and Planes

- A transverse plane, also called a cross-sectional plane or horizontal plane, cuts perpendicularly along the long axis of the body or organ separating it into both superior (upper) and inferior (lower) parts.



Sections and Planes

- A sagittal plane or median plane, extends through the body or organ vertically and divides the structure into right and left halves.



Sections and Planes

- A sagittal plane in the body midline is a midsagittal plane.
- A plane that is parallel to the midsagittal plane, but either to the left or the right of it, is termed a parasagittal (or sagittal) plane.
- A minor plane, called the oblique plane, passes through the specimen at an angle.

Body Planes

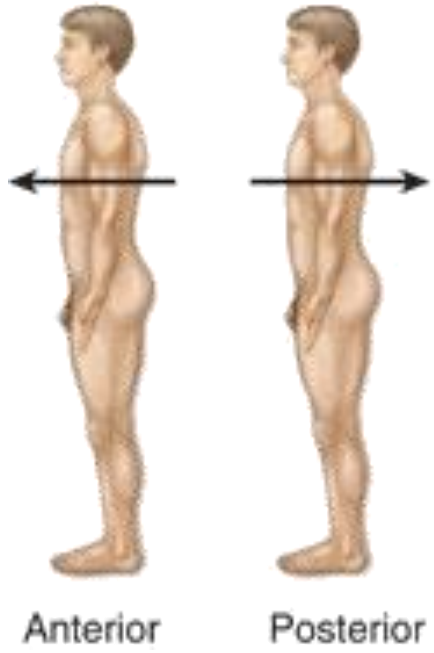
- Cuts made along any plane that lies diagonally between horizontal and vertical are called oblique sections
- **Oblique** sections are rarely used because normal planes of reference are not evident

Directional Terms of the Body

- Directional terms are precise and brief, and for most of them there is a correlative term that means just the opposite.

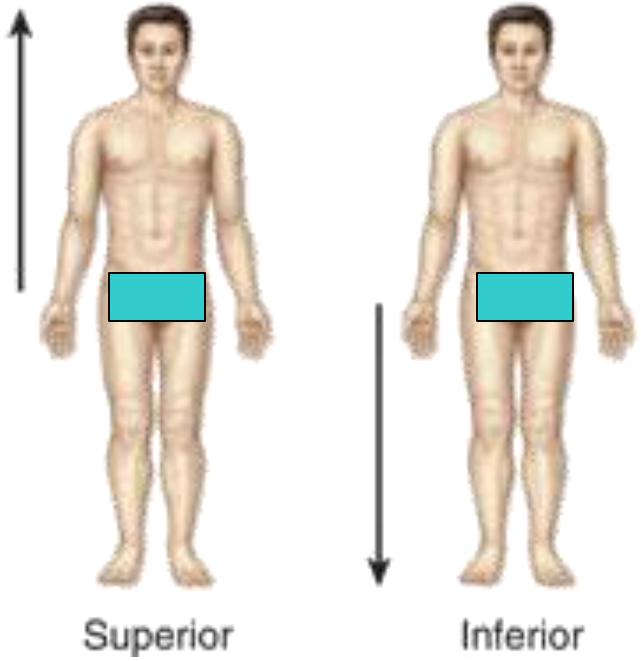
Relative and Directional Terms of the Body

- Relative to front (belly side) or back (back side) of the body :
  - **Anterior** = In front of; toward the front surface
  - **Posterior** = In back of; toward the back surface
  - **Dorsal** =At the back side of the human body
  - **Ventral** = At the belly side of the human body



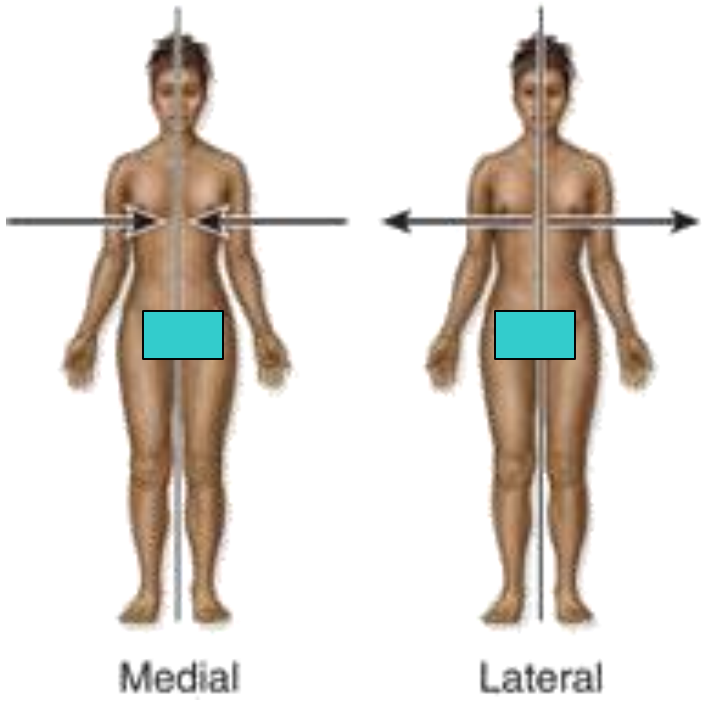
Relative and Directional Terms of the Body

- Relative to the head or tail of the body:
  - **Superior** = Toward the head or above
  - **Inferior** = Toward feet not head
  - **Caudal** = At the rear or tail end
  - **Cranial** = At the head end



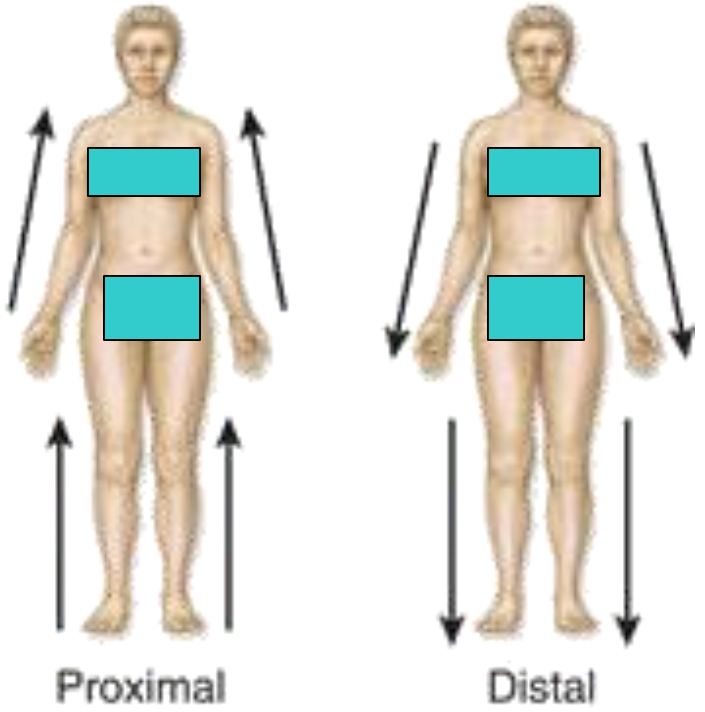
Relative and Directional Terms of the Body

- Relative to the midline or center of the body:
  - **Medial** = Toward the midline of the body
  - **Lateral** = Away from the midline of the body
  - **Deep** = On the inside, underneath another structure
  - **Superficial** = On the outside



Relative and Directional Terms of the Body

- Relative to point of attachment of the appendage:
  - **Proximal** = Closest to point of attachment to trunk
  - **Distal** = Furthest from point of attachment to trunk

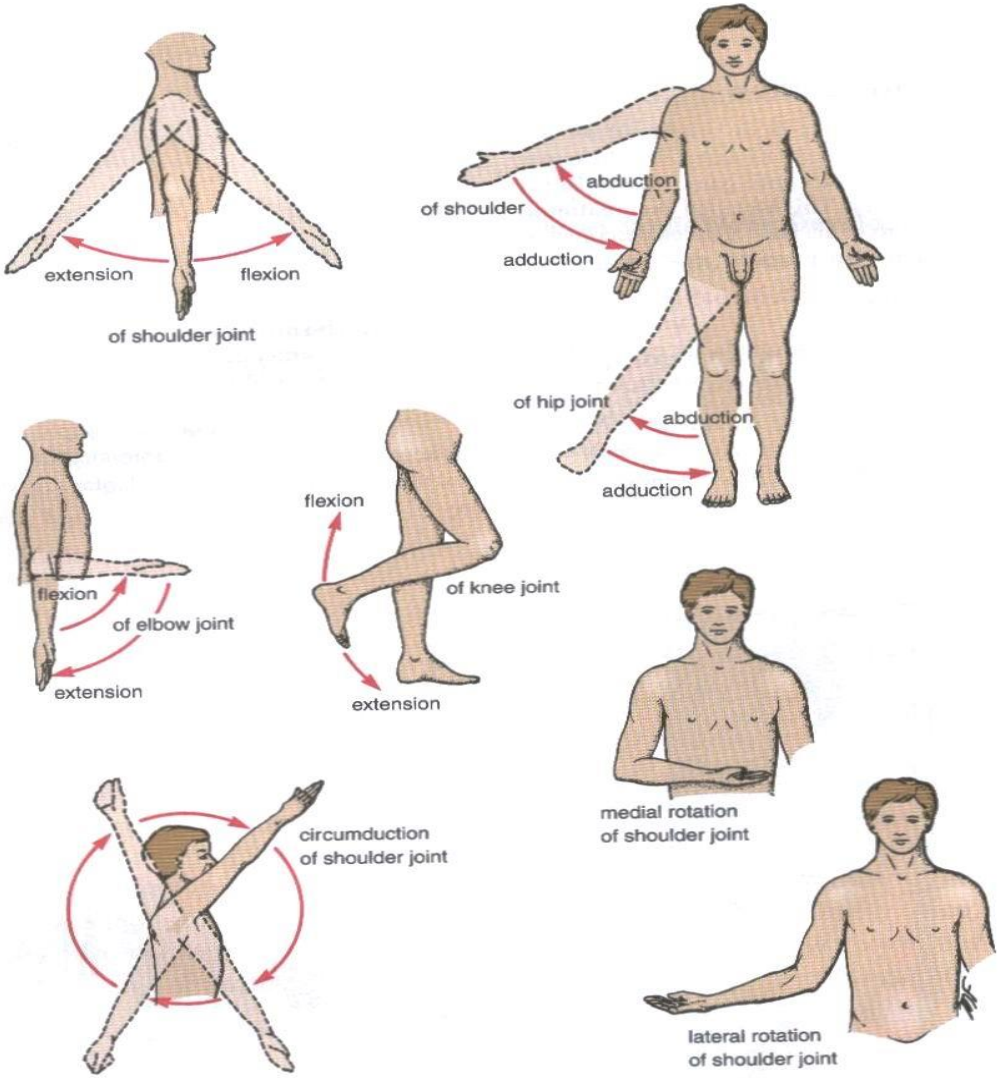


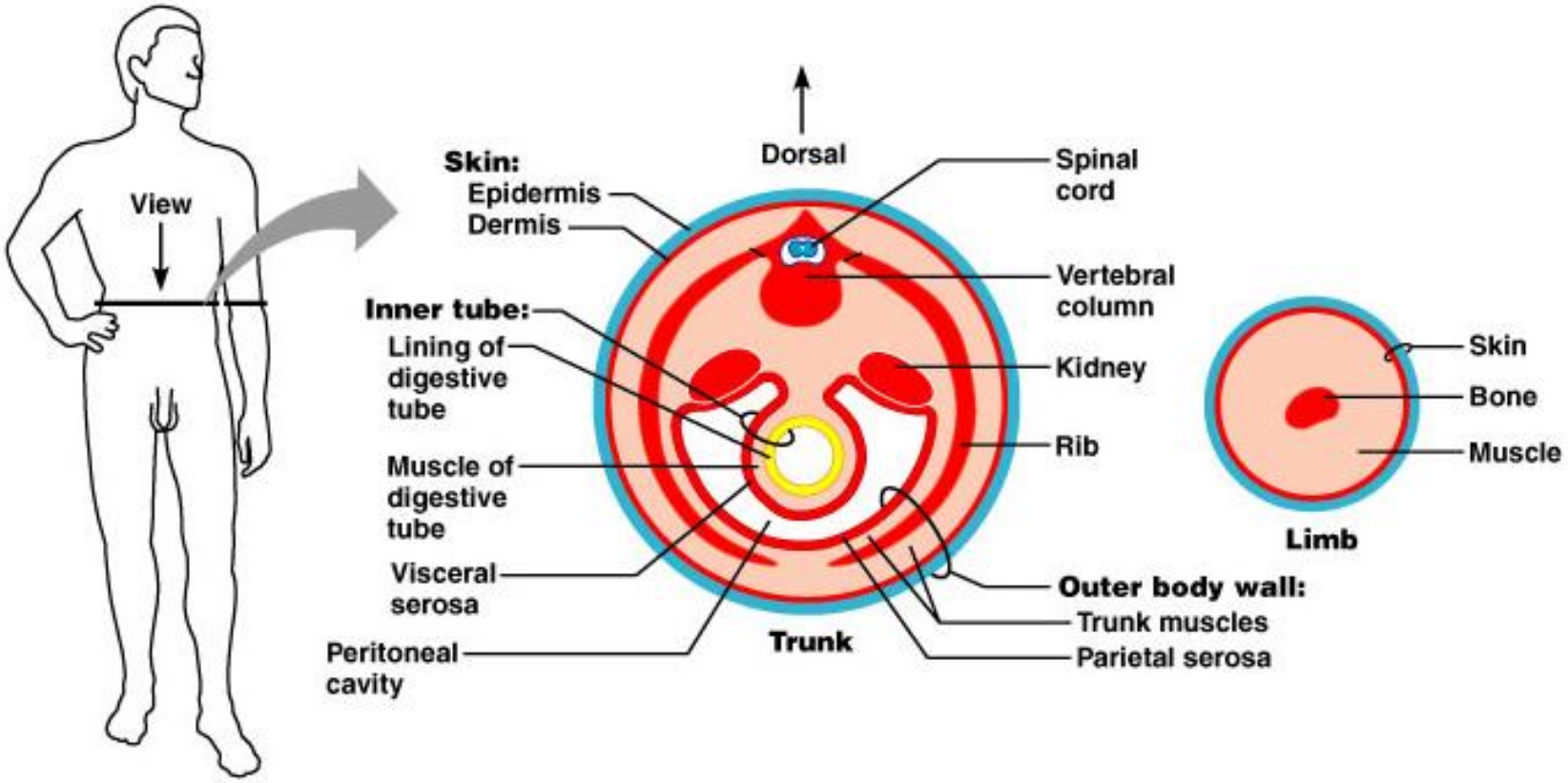
Alternate Terms

- Ventral (= Anterior)- Palmar
- Dorsal (= Posterior)- Dorsum

Body Regions

- The human body is partitioned into two main regions, called the axial and appendicular regions.
  - the **axial region** includes the head, neck, and trunk which comprise the main vertical axis of our body
  - our limbs, or appendages, attach to the body's axis and make up the **appendicular region**


extension
flexion
of shoulder joint
abduction
of shoulder
adduction
of hip joint
abduction
adduction
flexion
of elbow joint
extension
flexion
of knee joint
extension
circumduction
of shoulder joint
medial rotation
of shoulder joint
lateral rotation
of shoulder joint


View
Dorsal
Skin:
Epidermis
Dermis
Spinal cord
Vertebral column
Inner tube:
Lining of digestive tube
Kidney
Rib
Muscle of digestive tube
Visceral serosa
Peritoneal cavity
Trunk
Outer body wall:
Trunk muscles
Parietal serosa
Skin
Bone
Muscle
Limb

Anatomical Variability

- Humans vary slightly in both external and internal anatomy
- Over 90% of all anatomical structures match textbook descriptions, but:
  - Nerves or blood vessels may be somewhat out of place
  - Small muscles may be missing
- Extreme anatomical variations are seldom seen

Body Cavities

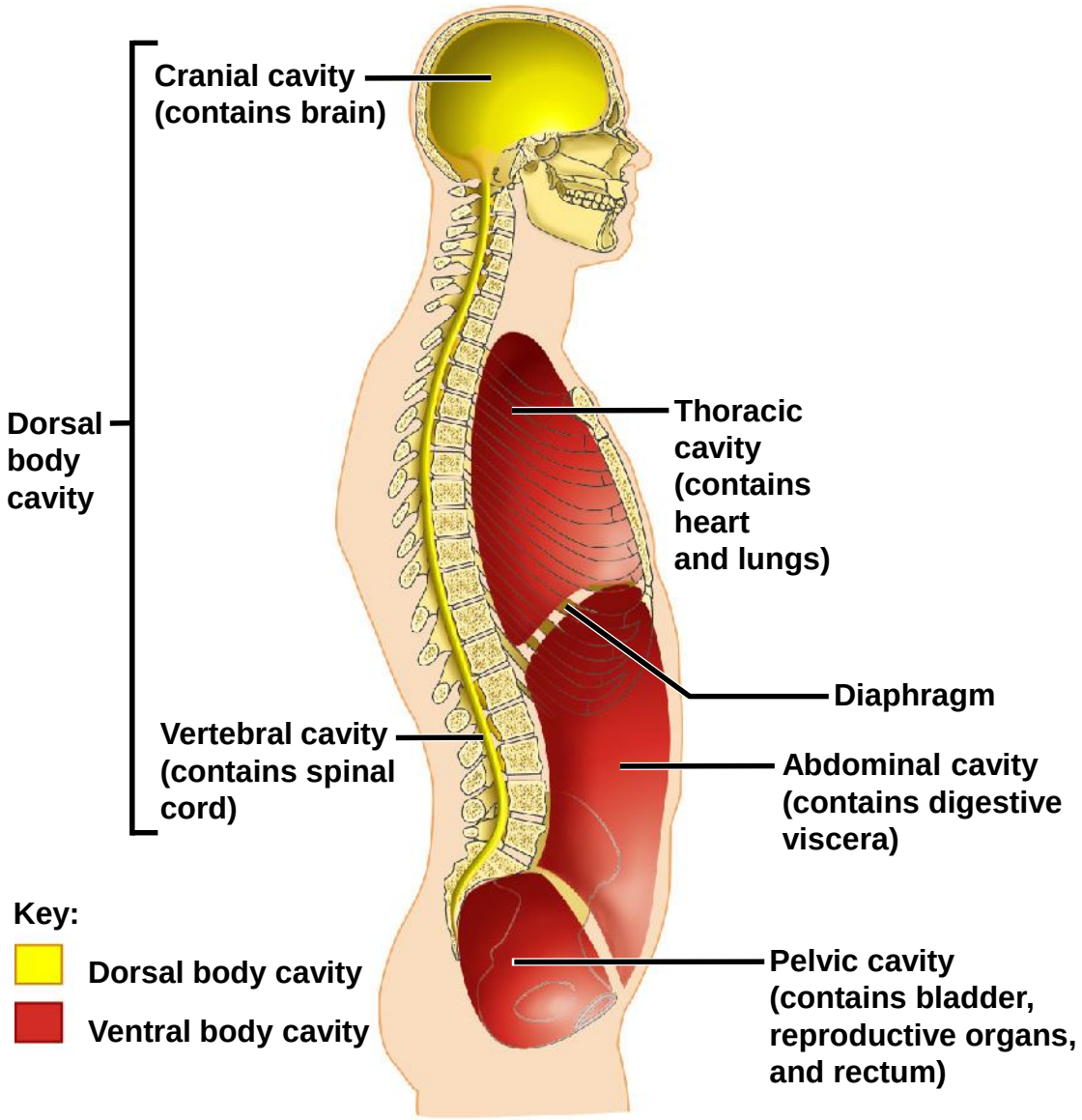
- **Dorsal cavity** protects the nervous system, and is divided into two subdivisions
  - Cranial cavity – within the skull; encases the brain
  - Vertebral cavity – runs within the vertebral column; encases the spinal cord

- **Ventral cavity** houses the internal organs (viscera), and is divided into two subdivisions
  - Thoracic
  - Abdominopelvic

Other Cavities

- Oral cavity
- Nasal cavity
- Orbital cavities
- Middle ear cavities
- Synovial cavities

Body Cavities



(a) Lateral view

Figure 1.9a

Ventral Body Cavity Membranes

Called serous membranes or serosa

- Serous cavities are slit-like spaces lined by serous membranes (serosa):
  - Parietal serosa forms the outer wall of the cavity
  - Visceral serosa covers the visceral organ
- Serous fluid separates the serosae

- Other smaller cavities: in head, between joints

Serous Membrane Relationship

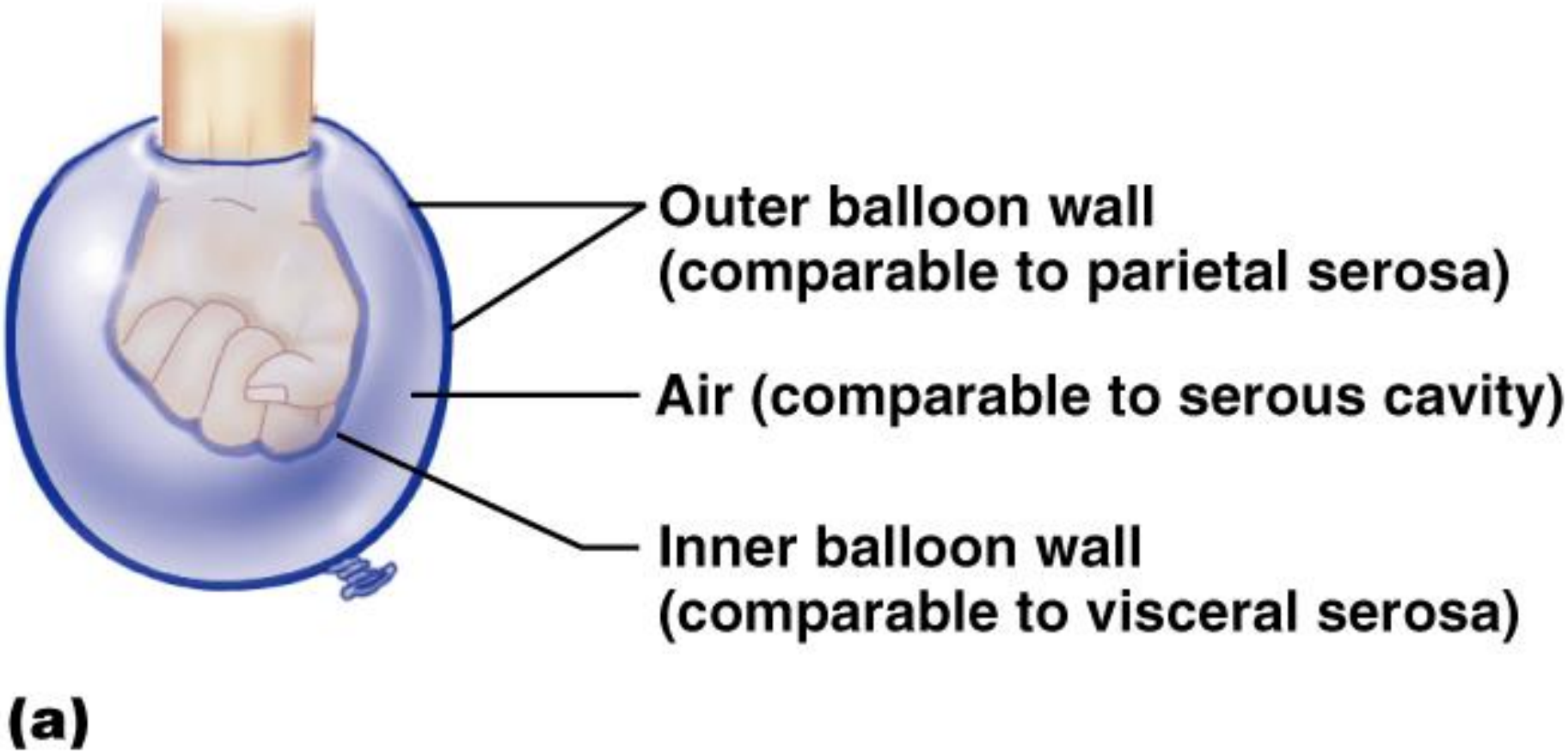
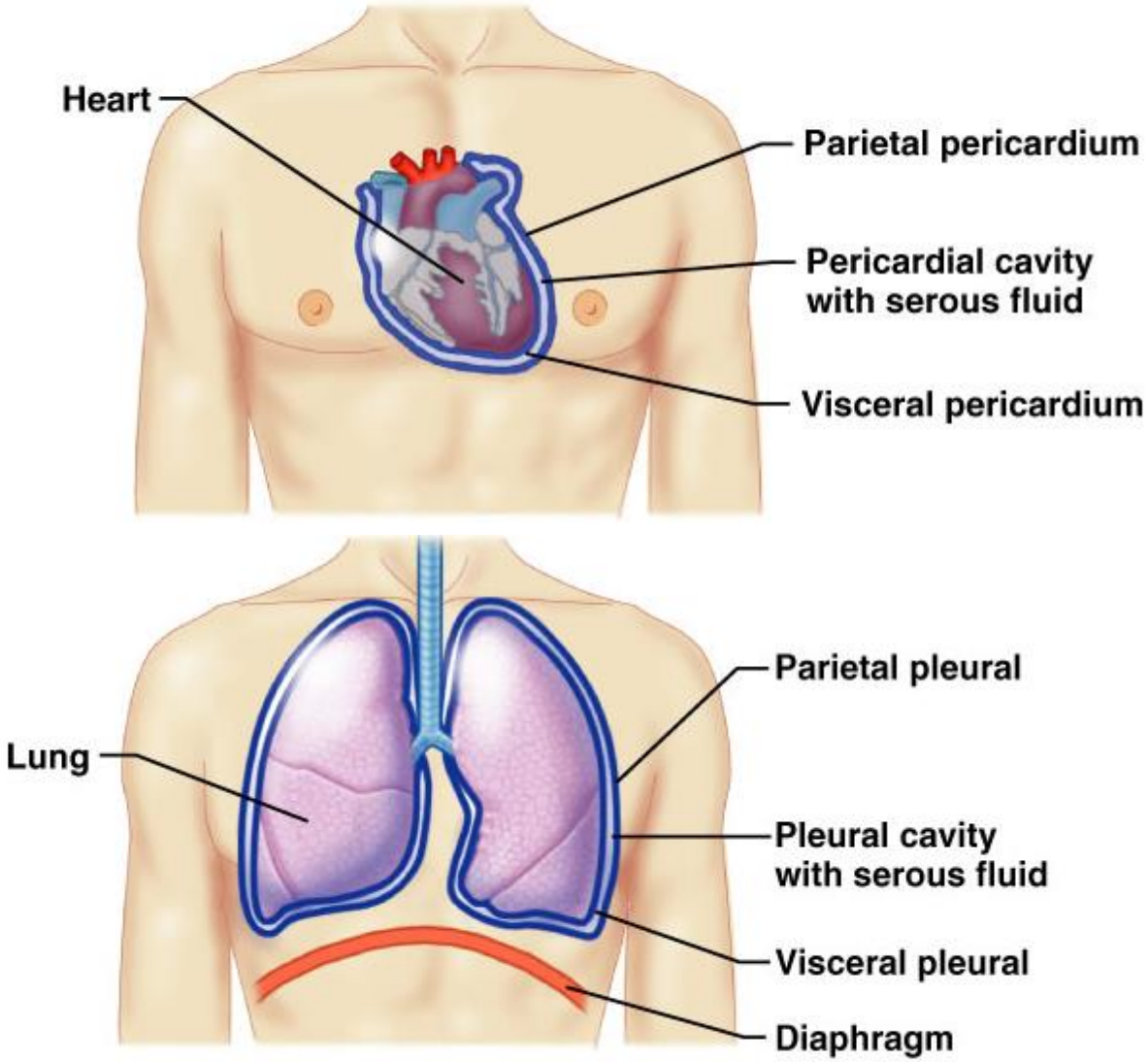


Figure 1.10a

Naming of serous membranes (serosa)



1.) parietal or visceral

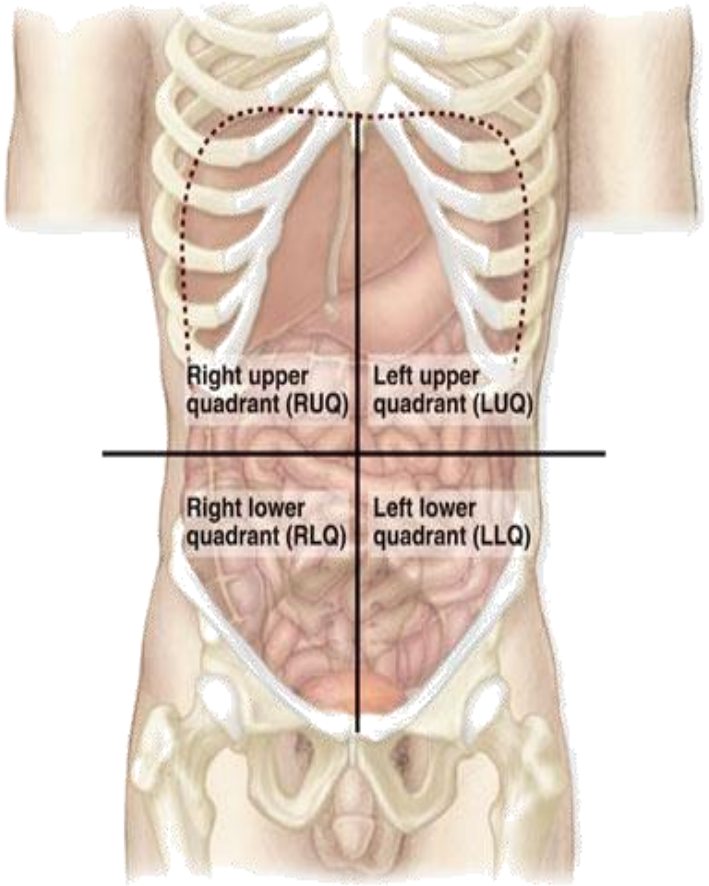
Parietal serosa forms the outer wall of the cavity
Visceral serosa covers the visceral organ

2.) pericardial, pleural, or peritoneal*

Pericardial: heart
Pleural: lungs
Peritoneal: abdominal

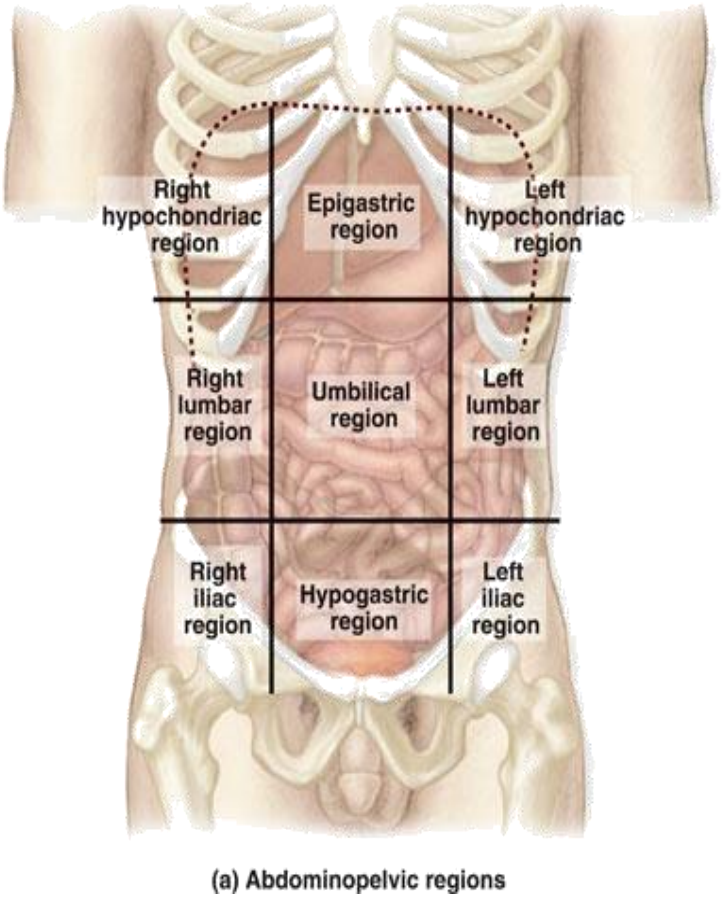
Abdominal Divisions

- Quadrants: 4
  - Right Upper Quadrant
  - Right Lower Quadrant
  - Left Upper Quadrant
  - Left Lower Quadrant



(b) Abdominopelvic quadrants

Abdominal Divisions



(a) Abdominopelvic regions

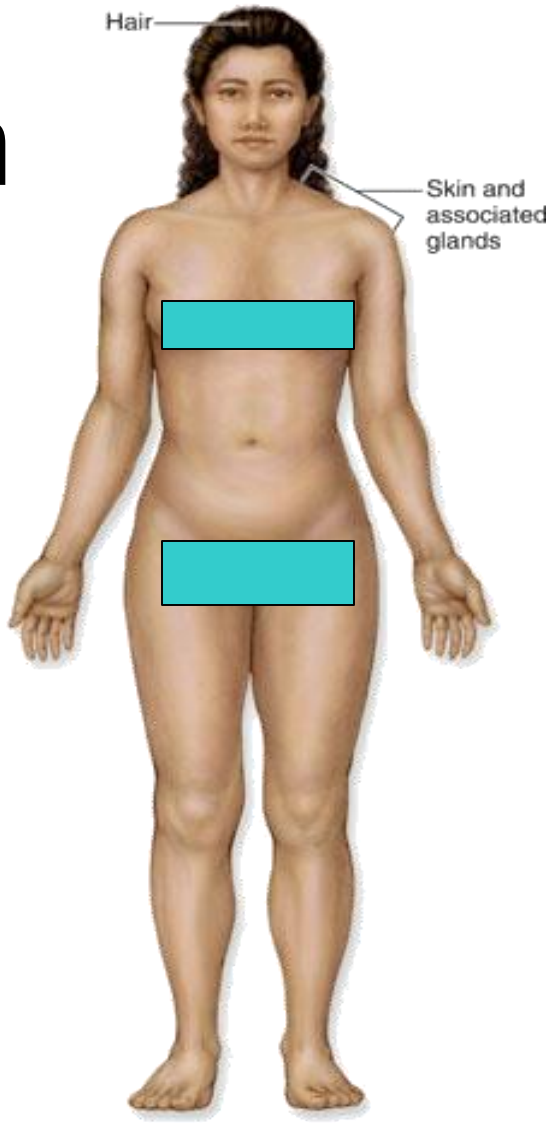
- Regions: 9
  - Rt Hypochondriac region
  - Rt Lumbar region
  - Rt Iliac (Inguinal) region
  - Epigastric region
  - Umbilical region
  - Hypogastric (Pubic) region
  - Lt Hypochondriac region
  - Lt Lumbar region
  - Lt Iliac (Inguinal) region

Organ systems

- Skeletal
- Muscular
- Nervous
- Endocrine
- Cardiovascular
- Lymphatic/immune
- Respiratory
- Digestive
- Urinary
- Reproductive

Integumentary System

- Components
  - Skin
  - Hair, nails
- Function
  - External covering
  - Protection
  - Synthesis of Vitamin D
  - Location of Sense receptors

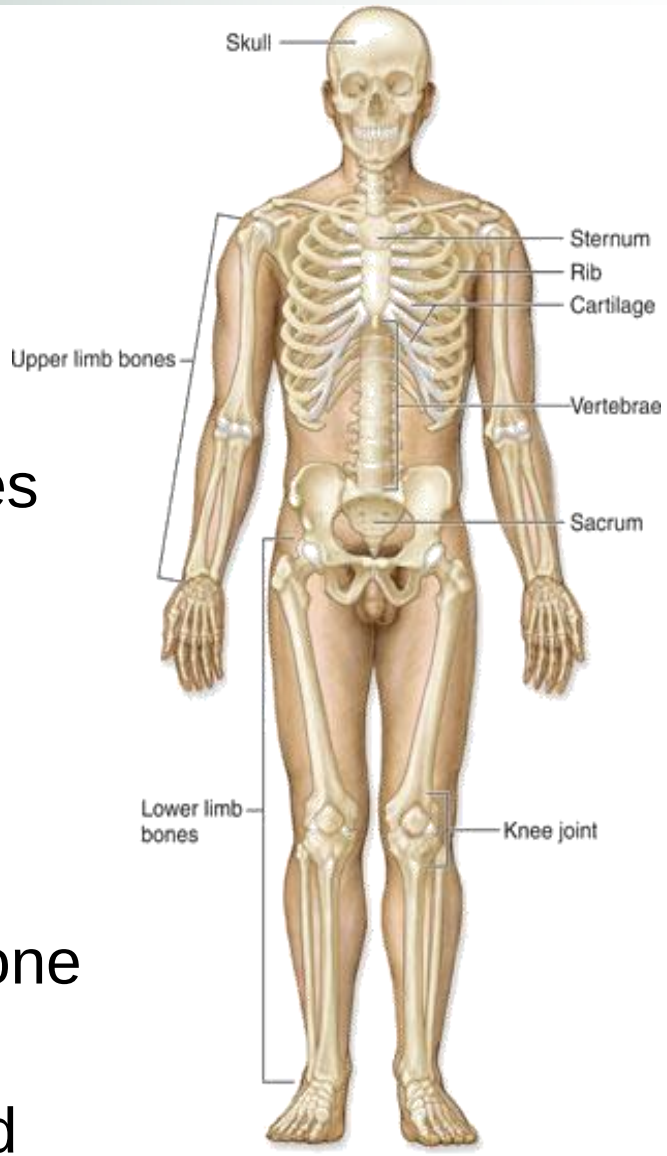


Integumentary System (Chapter 5)

Provides protection, regulates body temperature, site of cutaneous receptors, synthesizes vitamin D, prevents water loss.

Skeletal System

- Components
  - Bones
  - Joints and adjacent cartilages
- Function
  - Support
  - Protection
  - Movement
  - Blood cell production (red bone marrow)
  - Mineral storage (calcium and phosphorus)

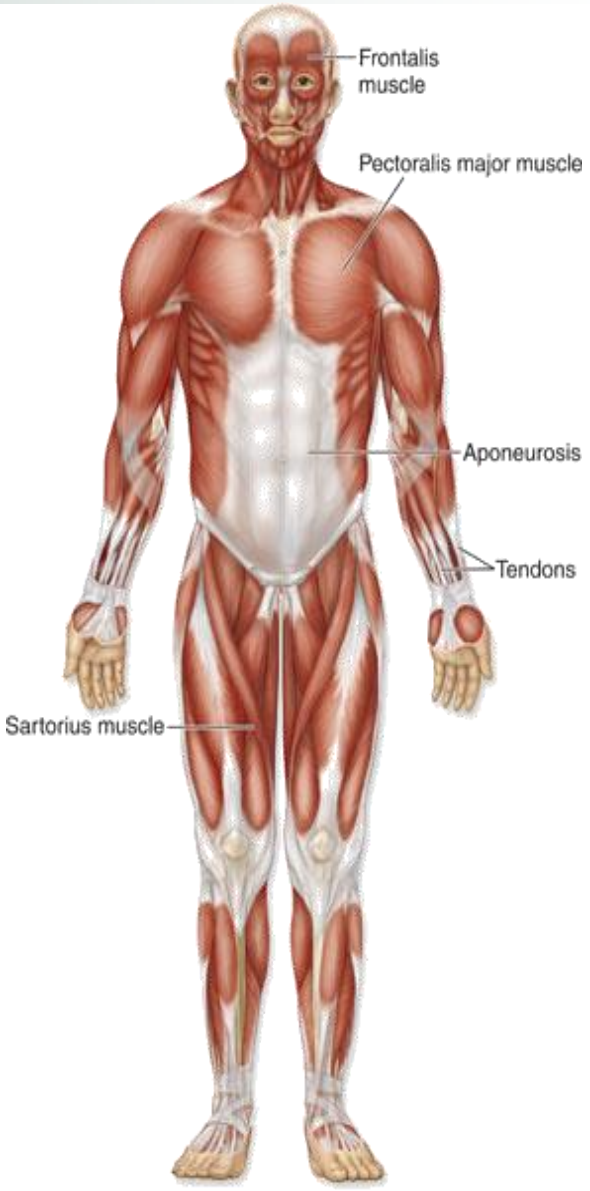


Skeletal System (Chapters 6–9)

Provides support and protection, site of hemopoiesis (blood cell production), stores calcium and phosphorus, allows for body movement.

Muscular System

- Components
  - Skeletal Muscles
  - Associated Connective Tissues (tendons)
- Function
  - Locomotion
  - Manipulation of the environment
  - Facial expression (communication)
  - Maintain posture
  - Produce heat



Muscular System (Chapters 10–12)

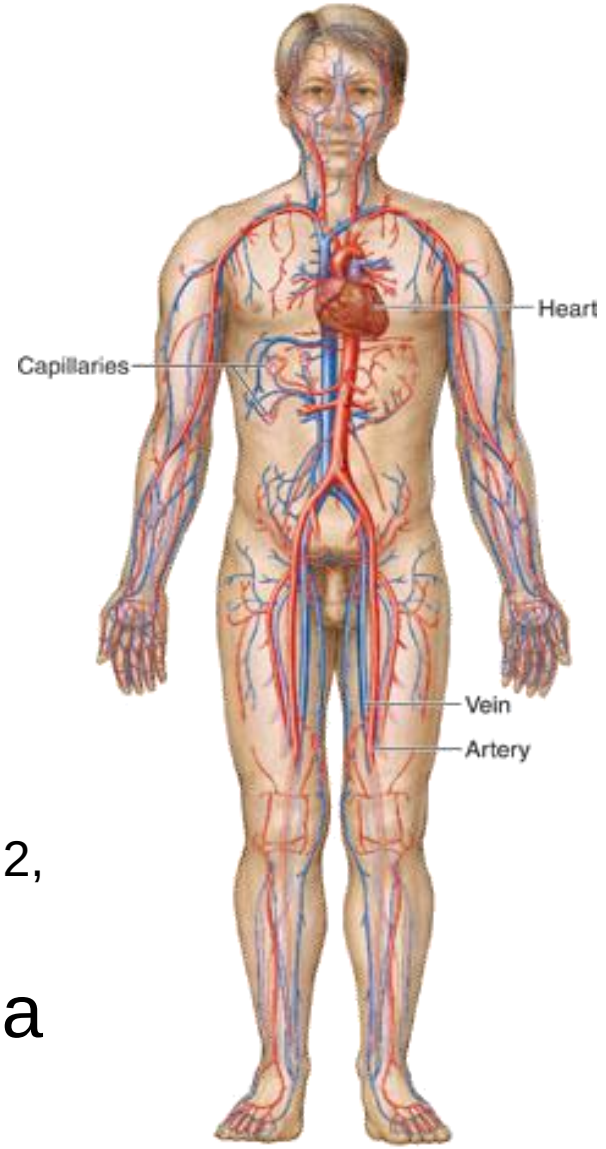
Produces body movement, generates heat when muscles contract.

Circulatory System

- Components
  - Cardiovascular System
  - Lymphatic System
- Function
  - Transportation of materials
  - Within the body
  - To and from internal and external environments

Cardiovascular System

- Components
  - Heart
  - Vessels
- Function
  - Transportation of blood
  - Blood contains O_2 and CO_2, nutrients, wastes, etc.
  - Blood composed of plasma and cells

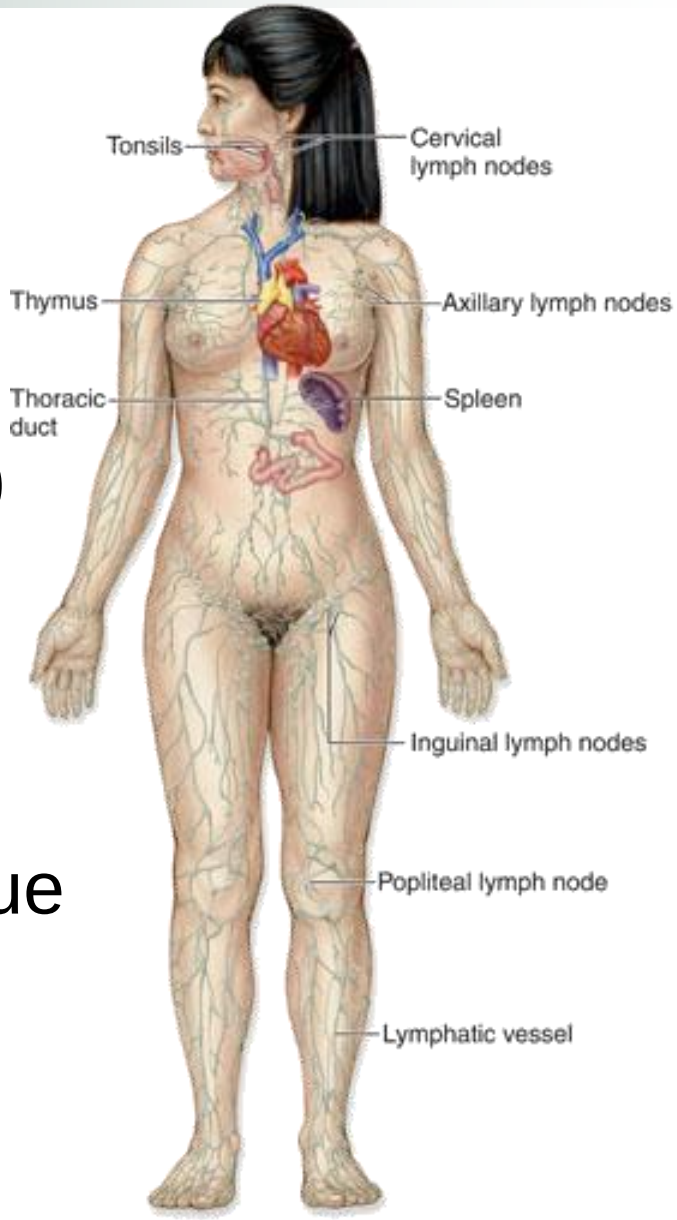


Cardiovascular System (Chapters 21–23)

Consists of a pump (the heart) that moves blood through blood vessels in order to distribute hormones, nutrients, and gases, and pick up waste products.

Lymphatic System

- Components
  - Lymphatic Organs (spleen, lymph nodes, thymus, etc.)
  - Lymphatic Vessels
- Function
  - Transportation of lymph
  - Lymph is derived from tissue fluid
  - Houses white blood cells

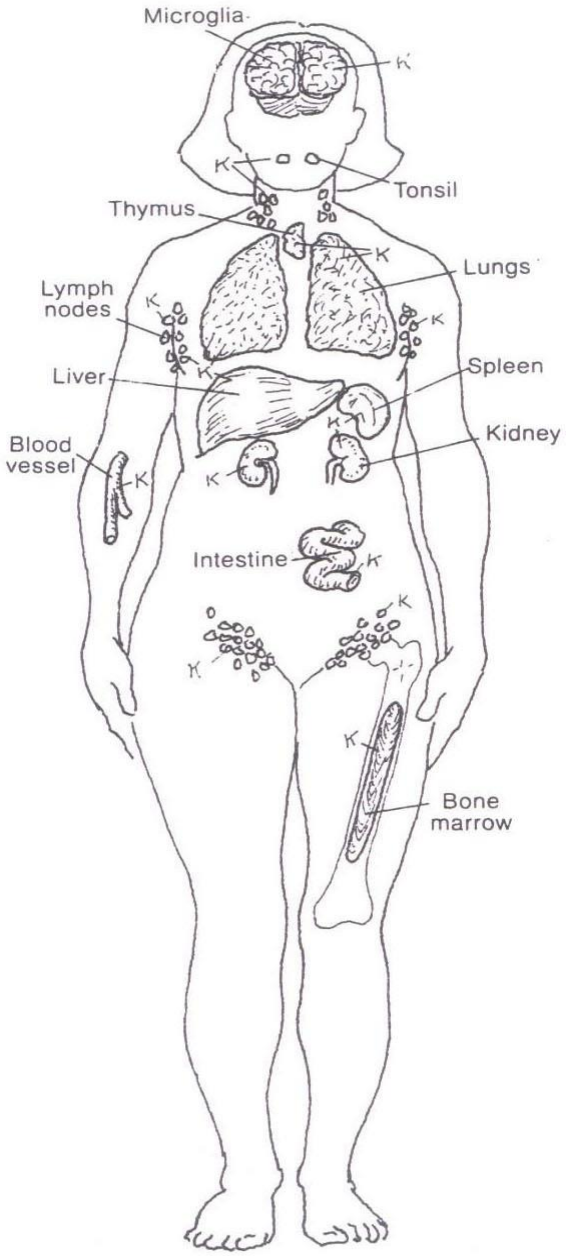


Lymphatic System (Chapter 24)

Transports and filters lymph (interstitial fluid) and initiates an immune response when necessary.

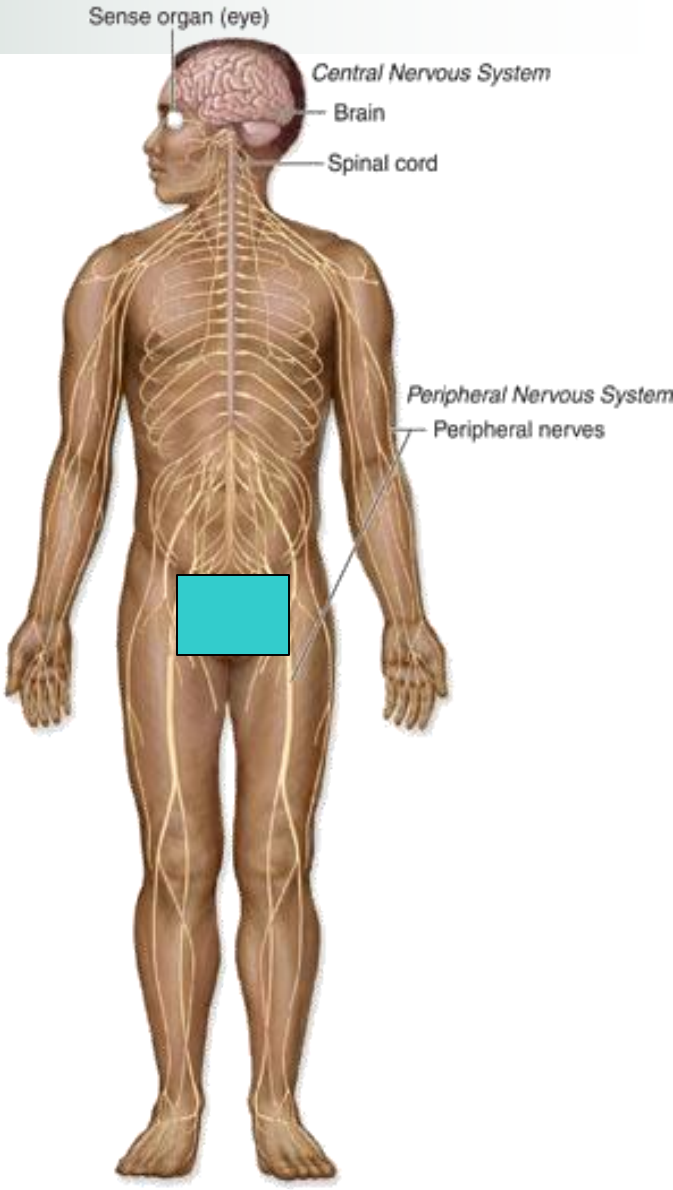
Immune System

- Components
  - Immune Organs (red bone marrow, thymus, etc.)
  - White blood cells (lymphocytes, macrophages, etc.)
- Function
  - Defense (Immune response)



Nervous System

- Components
  - Brain, Spinal cord (CNS)
  - Nerves (PNS), sense receptors
- Function
  - Control system (fast, “hard wired”)
  - Response to external and internal environments

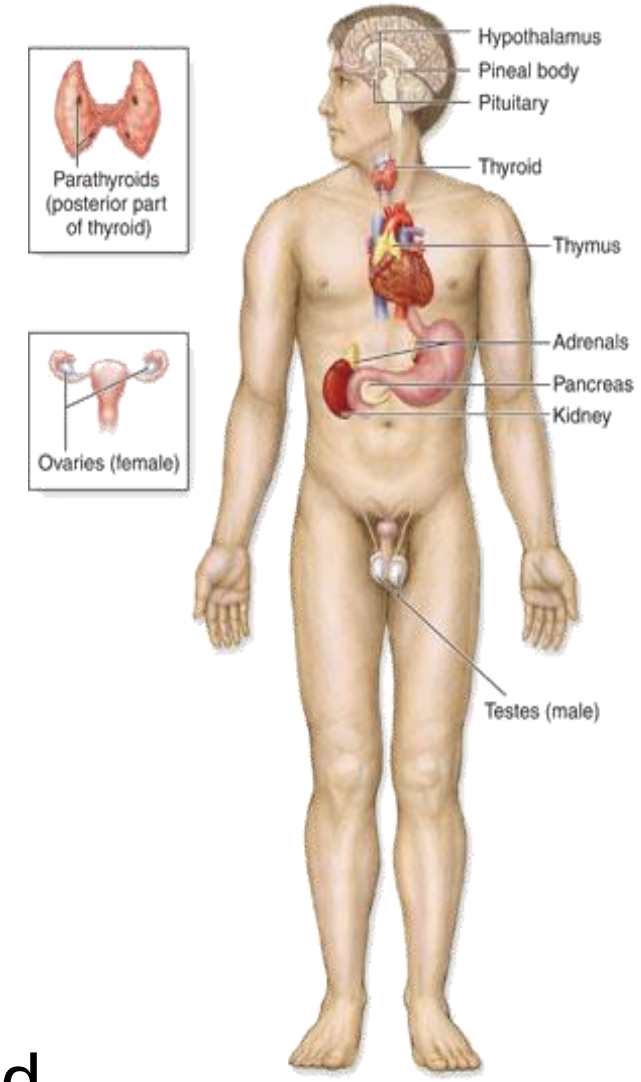


Nervous System (Chapters 14–19)

A regulatory system that controls body movement, responds to sensory stimuli, and helps control all other systems of the body. Also responsible for consciousness, intelligence, memory.

Endocrine System

- Components
  - Glands that secrete hormones
  - E.g.:Pituitary, pancreas,
  - thyroid
- Function
  - Control system (slow, “chemical”)
  - Regulates processes such as growth, reproduction and nutrient use

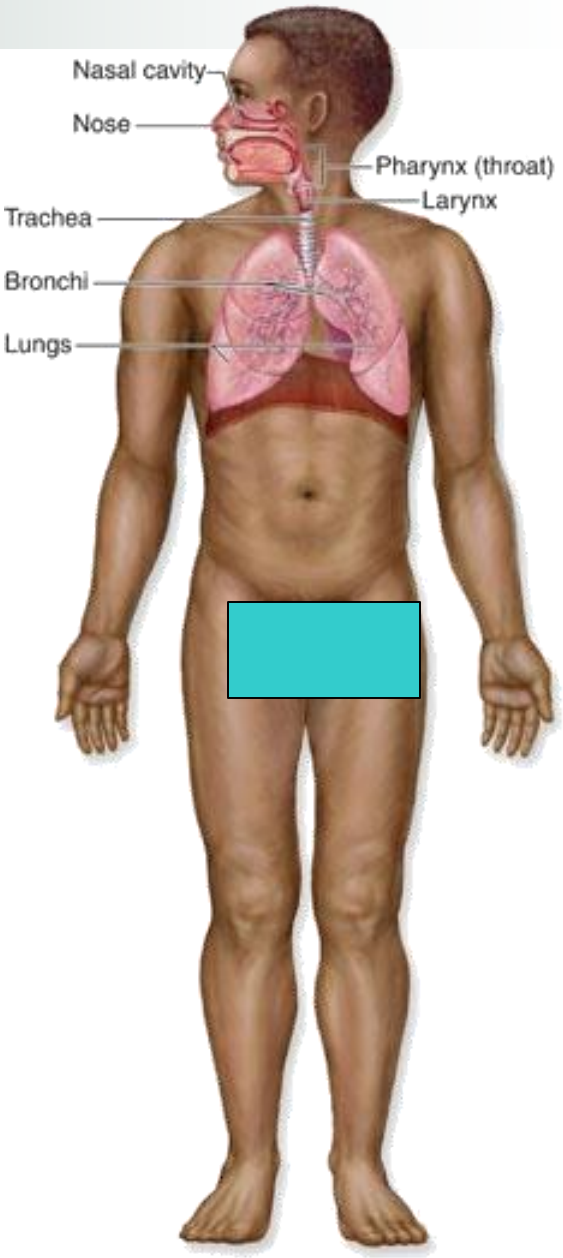


Endocrine System (Chapter 20)

Consists of glands and cell clusters that secrete hormones, some of which regulate body and cellular growth, chemical levels in the body, and reproductive functions.

Respiratory System

- Components
  - Lungs
  - Tubing (trachea, bronchus, etc.)
  - Larynx (vocal cords)
- Function
  - Exchange of respiratory gases (O_2 and CO_2)
  - Between blood and atmosphere
  - Voice production

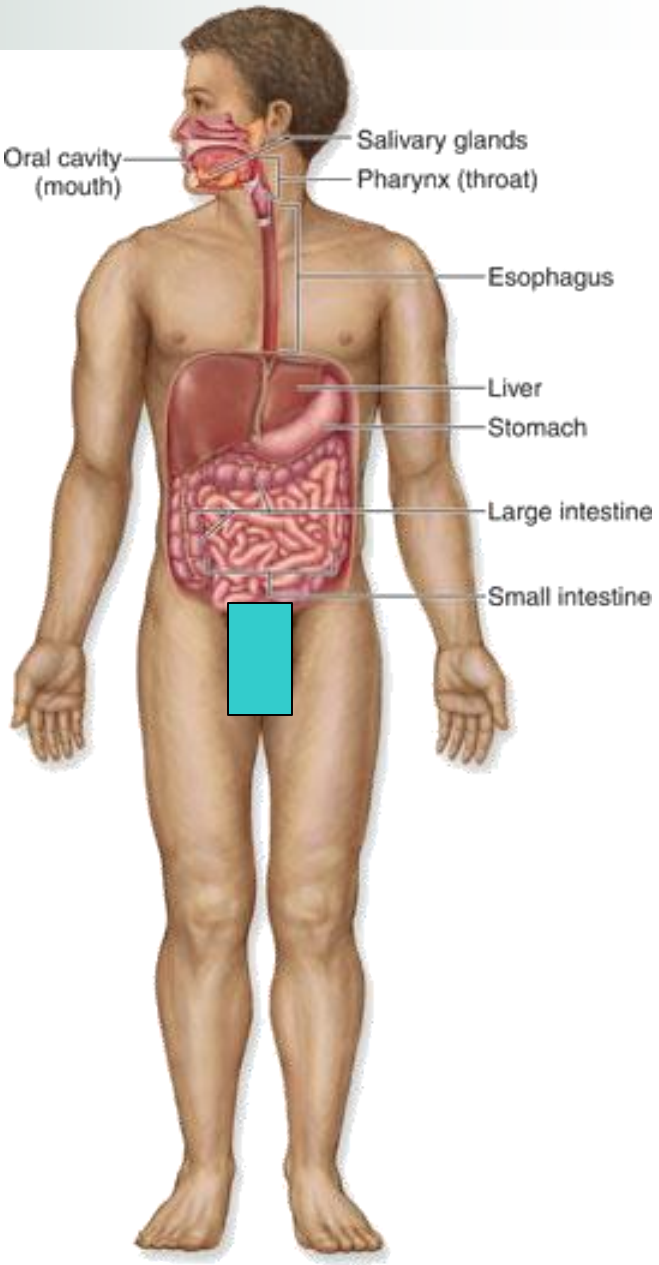


Respiratory System (Chapter 25)

Responsible for exchange of gases (oxygen and carbon dioxide) between blood and the air in the lungs.

Digestive System

- Components
  - Alimentary canal (mouth, pharynx, esophagus, stomach, small intestine, large intestine)
  - Accessory structures(liver, salivary glands, etc.)
- Function
  - Break down food into small, absorbable pieces
  - Between blood and lumen
  - Eliminate waste

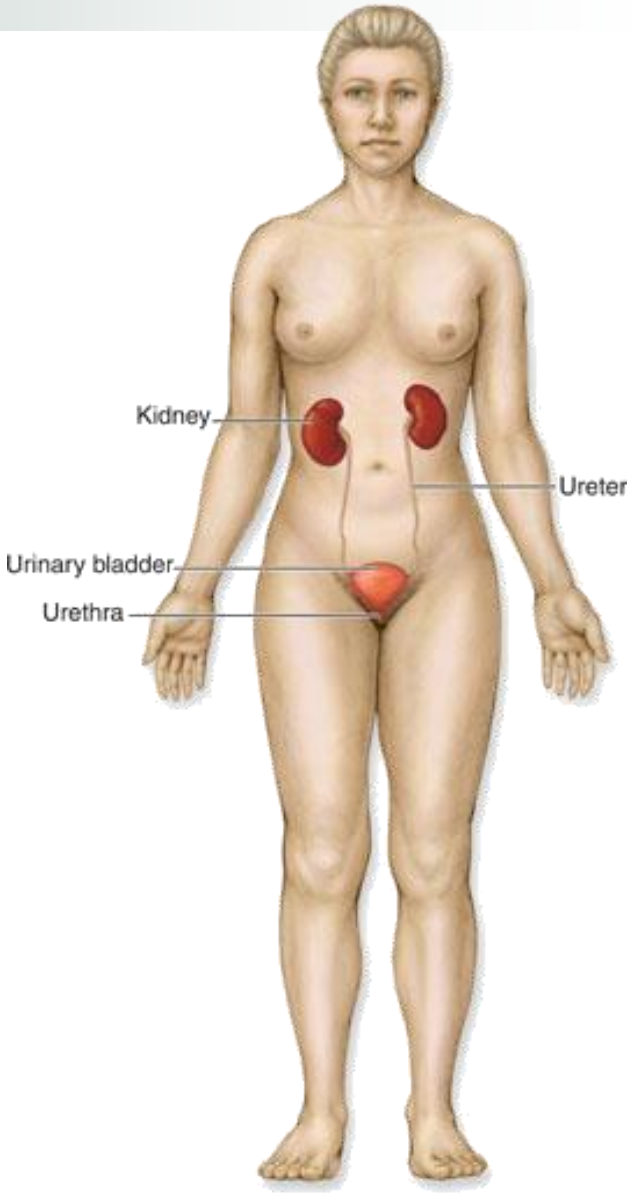


Digestive System (Chapter 26)

Mechanically and chemically digests food materials, absorbs nutrients, and expels waste products.

Urinary System

- Components
  - Kidneys, Ureters, Urinary bladder, Urethra
- Function
  - Eliminate waste (nitrogen) from blood
  - Between blood and external environment
  - Regulates water, electrolytes, acid/base

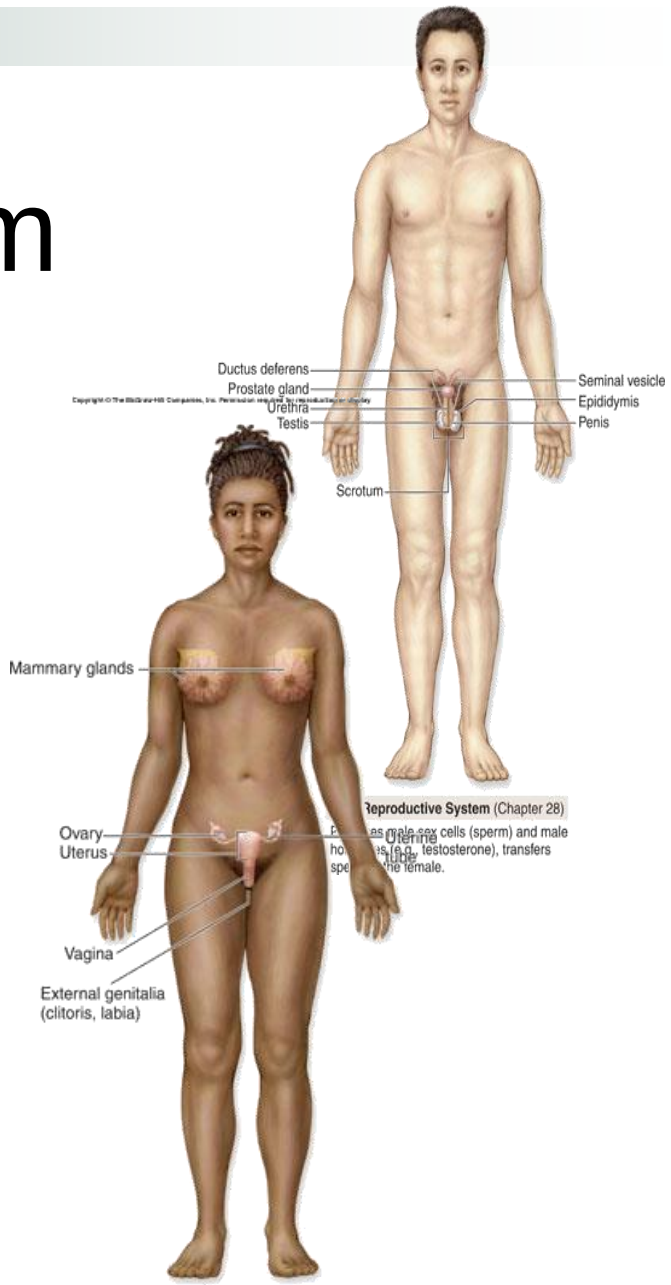


Urinary System (Chapter 27)

Filters the blood and removes waste products from the blood, concentrates waste products in the form of urine, and expels urine from the body.

Reproductive System

- Components
  - Male Reproductive System
  - Female Reproductive System
- Function
  - Perpetuation of the species
  - Hormones influence structure and function
  - Sexually bimorphic species



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