

Structure and Function

- Anatomy
 - Describes the **structures** of the body
 - What they are made of
 - Where they are located
 - Associated structures
- Physiology
 - Is the study of
 - Functions of anatomical structures
 - Individual and cooperative functions

Anatomy and Physiology Integrated

- Anatomy
 - **Gross anatomy**, or macroscopic anatomy, examines large, visible structures
 - *Surface anatomy*: exterior features
 - *Regional anatomy*: body areas
 - *Systemic anatomy*: groups of organs working together
 - *Developmental anatomy*: from conception to death
 - *Clinical anatomy*: medical specialties

Anatomy and Physiology Integrated

- Anatomy
 - **Microscopic anatomy** examines cells and molecules
 - *Cytology*: study of cells and their structures
 - cyt- = cell
 - *Histology*: study of tissues and their structures

Anatomy and Physiology Integrated

- Physiology
 - **Cell physiology:** processes within and between cells
 - **Special physiology:** functions of specific organs
 - **Systemic physiology:** functions of an organ system
 - **Pathological physiology:** effects of diseases

Levels of Organization

- **The Chemical (or Molecular) Level**
 - Atoms are the smallest chemical units
 - Molecules are a group of atoms working together
- **The Cellular Level**
 - Cells are a group of atoms, molecules, and organelles working together
- **The Tissue Level**
 - Tissues are a group of similar cells working together
- **The Organ Level**
 - An organ is a group of different tissues working together

Levels of Organization

- **The Organ System Level**
 - Organ systems are a group of organs working together
 - Humans have 11 organ systems

- **The Organism Level**
 - A human is an organism

Levels of Organization

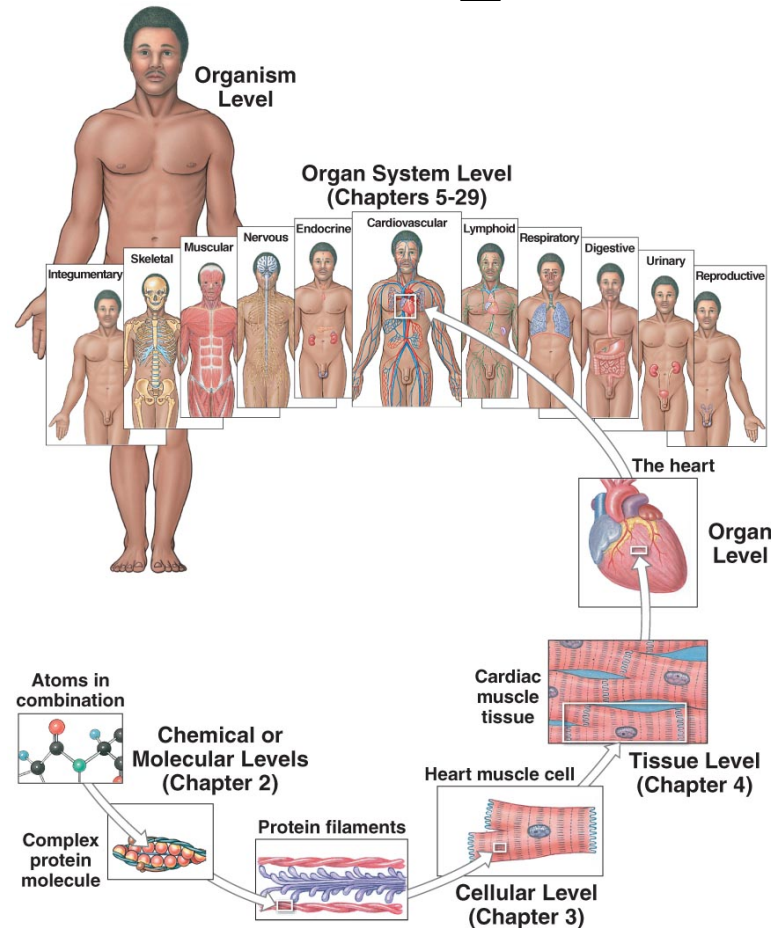
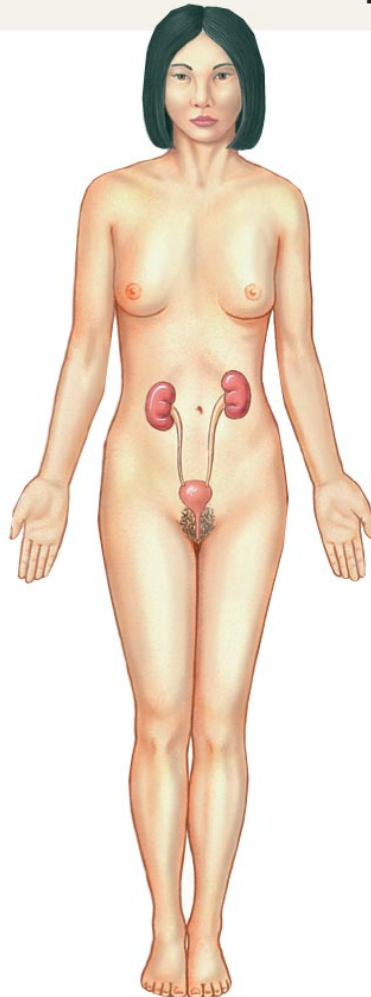


FIGURE 1–1 Levels of Organization.

Levels of Organization

THE URINARY SYSTEM



Major Organs:

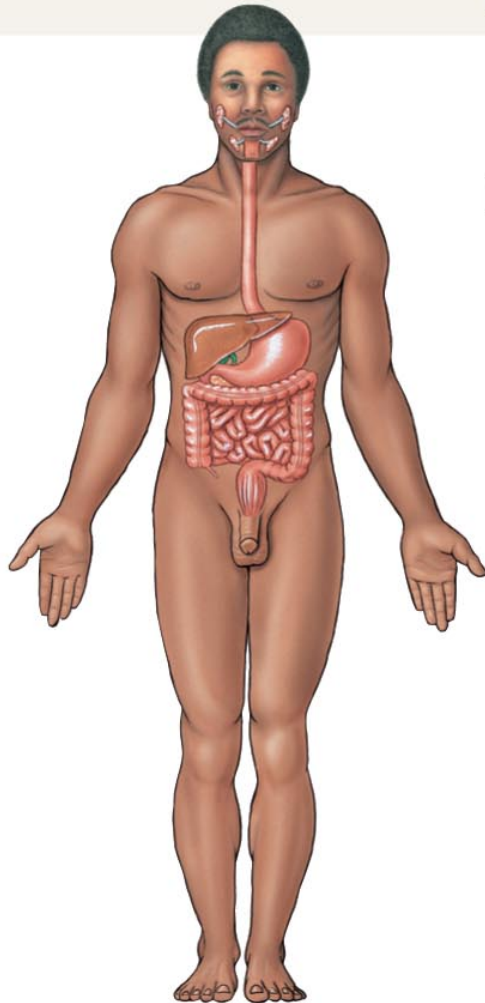
- Kidneys
- Ureters
- Urinary bladder
- Urethra

Functions:

- Excretes waste products from the blood
- Controls water balance by regulating volume of urine produced
- Stores urine prior to voluntary elimination
- Regulates blood ion concentrations and pH

Levels of Organization

THE DIGESTIVE SYSTEM



Major Organs:

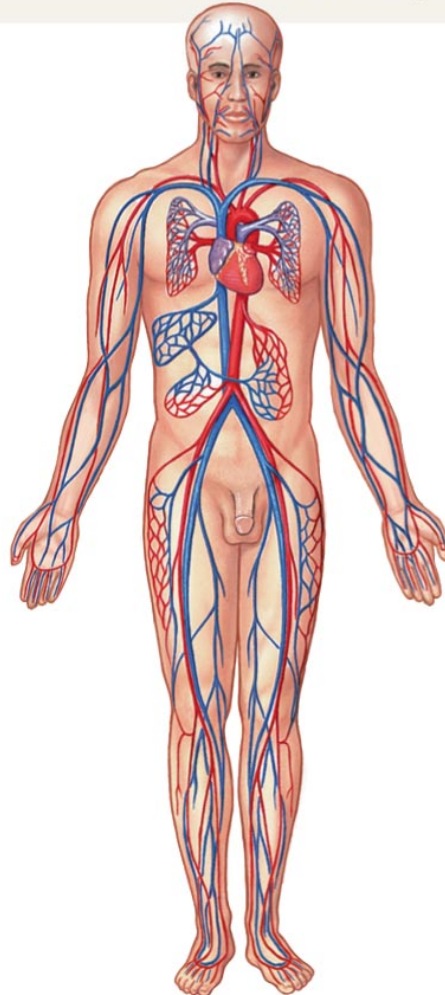
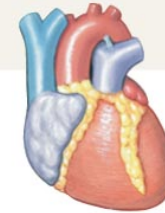
- Teeth
- Tongue
- Pharynx
- Esophagus
- Stomach
- Small intestine
- Large intestine
- Liver
- Gallbladder
- Pancreas

Functions:

- Processes and digests food
- Absorbs and conserves water
- Absorbs nutrients (ions, water, and the breakdown products of dietary sugars, proteins, and fats)
- Stores energy reserves

Levels of Organization

THE CARDIOVASCULAR SYSTEM



Major Organs:

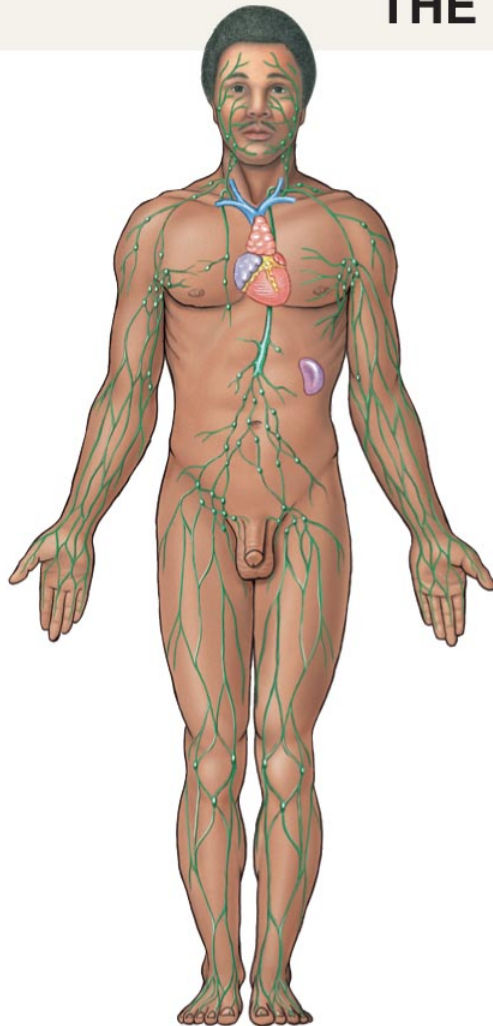
- Heart
- Blood
- Blood vessels

Functions:

- Distributes blood cells, water, and dissolved materials, including nutrients, waste products, oxygen, and carbon dioxide
- Distributes heat and assists in control of body temperature

Levels of Organization

THE LYMPHOID SYSTEM



Major Organs:

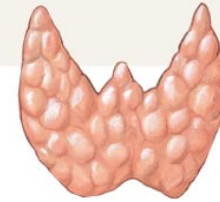
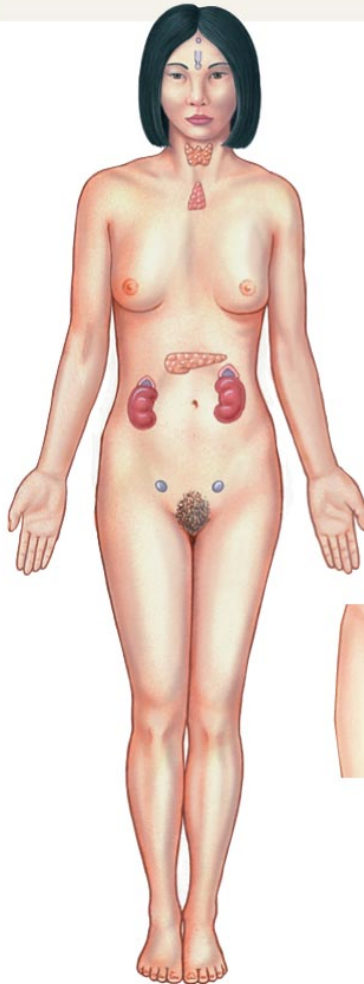
- Spleen
- Thymus
- Lymphatic vessels
- Lymph nodes
- Tonsils

Functions:

- Defends against infection and disease
- Returns tissue fluids to the bloodstream

Levels of Organization

THE ENDOCRINE SYSTEM



Major Organs:

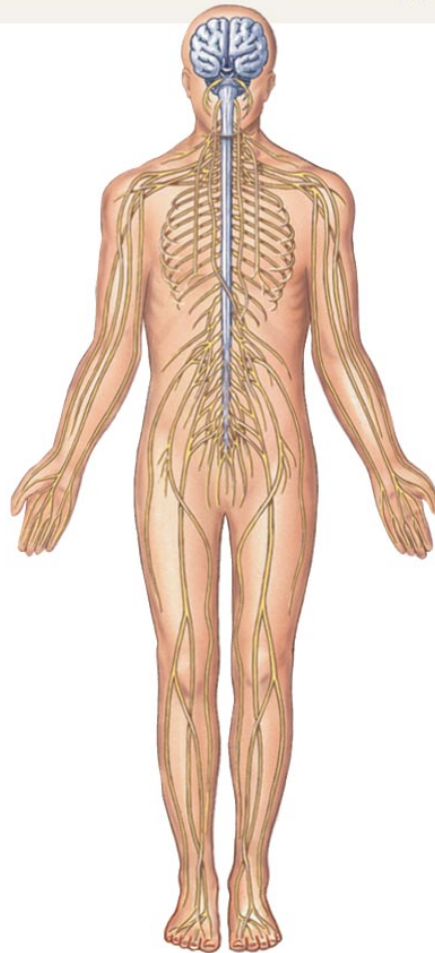
- Pituitary gland
- Thyroid gland
- Pancreas
- Suprarenal glands
- Gonads (testes and ovaries)
- Endocrine tissues in other systems

Functions:

- Directs long-term changes in the activities of other organ systems
- Adjusts metabolic activity and energy use by the body
- Controls many structural and functional changes during development

Levels of Organization

THE NERVOUS SYSTEM



Major Organs:

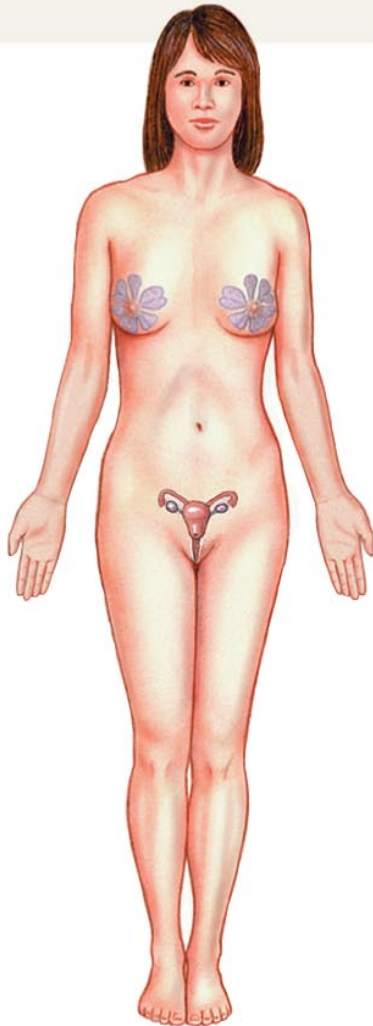
- Brain
- Spinal cord
- Peripheral nerves
- Sense organs

Functions:

- Directs immediate responses to stimuli
- Coordinates or moderates activities of other organ systems
- Provides and interprets sensory information about external conditions

Levels of Organization

THE FEMALE REPRODUCTIVE SYSTEM



Major Organs:

- Ovaries
- Uterine tubes
- Uterus
- Vagina
- Labia
- Clitoris
- Mammary glands

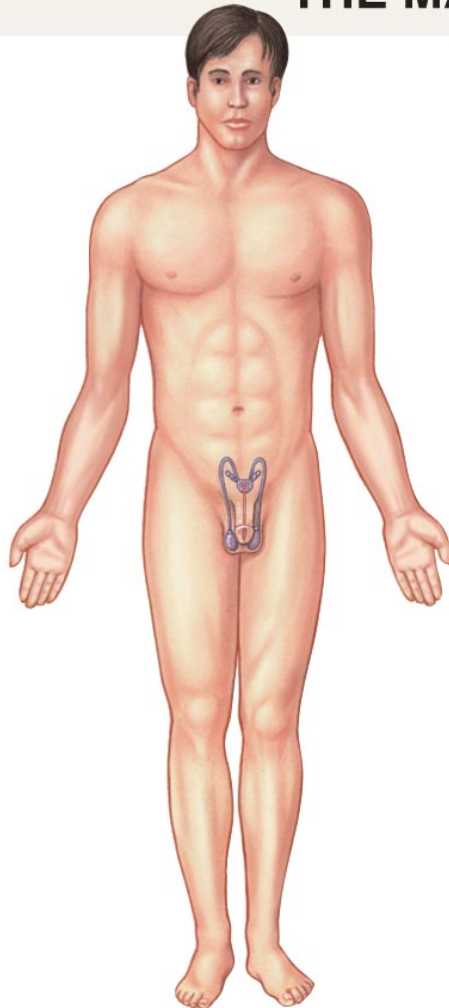
Functions:

- Produces female sex cells (oocytes) and hormones
- Supports developing embryo from conception to delivery
- Provides milk to nourish newborn infant
- Sexual intercourse



Levels of Organization

THE MALE REPRODUCTIVE SYSTEM



Major Organs:

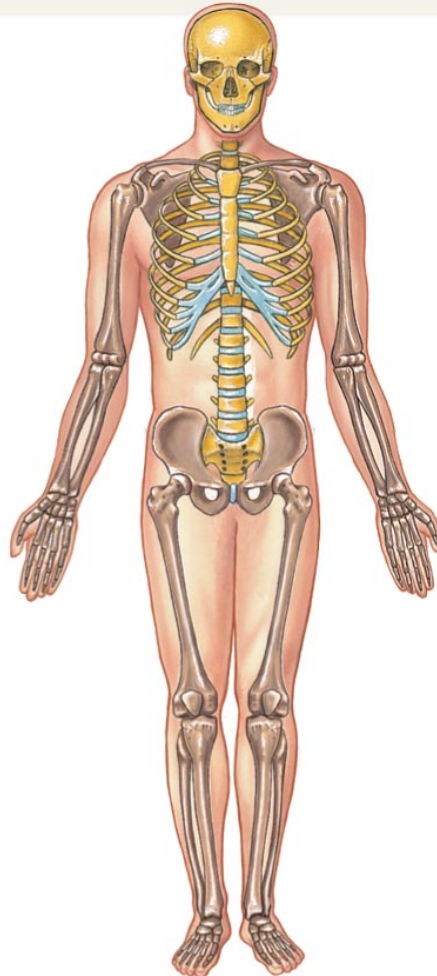
- Testes
- Epididymides
- Ductus deferens
- Seminal vesicles
- Prostate gland
- Penis
- Scrotum

Functions:

- Produces male sex cells (sperm), suspending fluids, and hormones
- Sexual intercourse

Levels of Organization

THE SKELETAL SYSTEM



Major Organs:

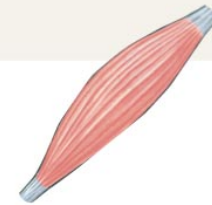
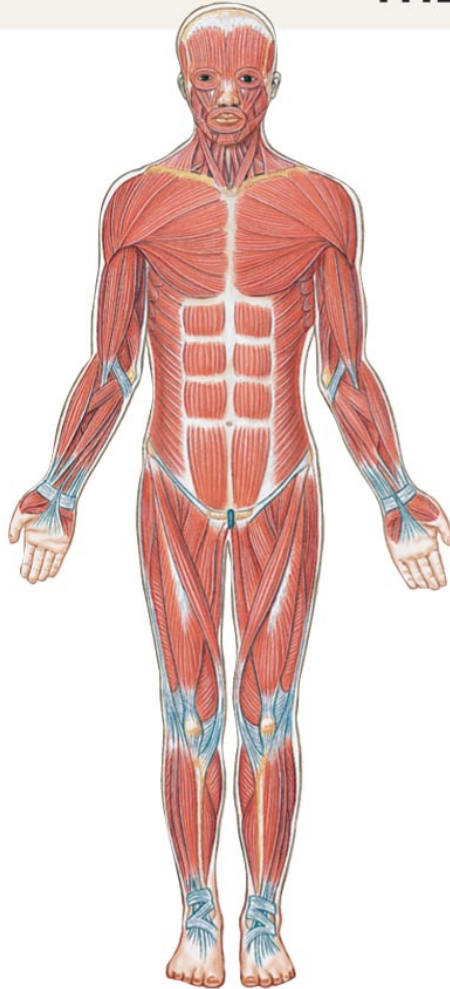
- **Bones**
- **Cartilages**
- **Associated ligaments**
- **Bone marrow**

Functions:

- **Provides support and protection for other tissues**
- **Stores calcium and other minerals**
- **Forms blood cells**

Levels of Organization

THE MUSCULAR SYSTEM



Major Organs:

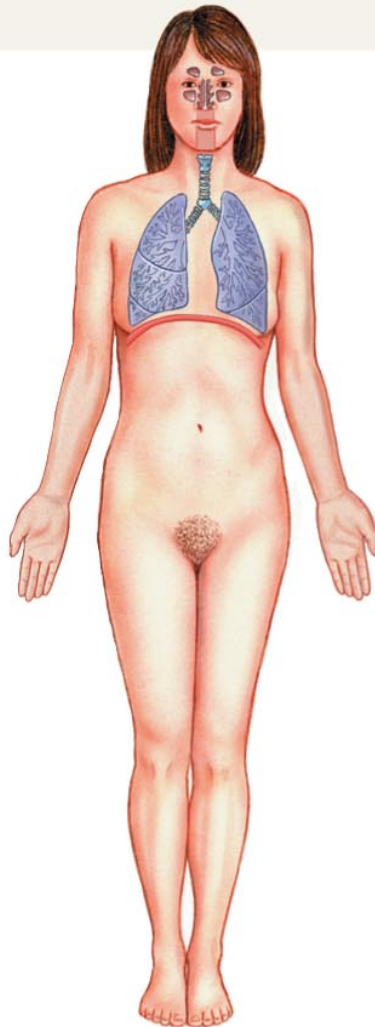
- **Skeletal muscles and associated tendons**

Functions:

- **Provides movement**
- **Provides protection and support for other tissues**
- **Generates heat that maintains body temperature**

Levels of Organization

THE RESPIRATORY SYSTEM



Major Organs:

- Nasal cavities
- Sinuses
- Larynx
- Trachea
- Bronchi
- Lungs
- Alveoli

Functions:

- Delivers air to alveoli (sites in lungs where gas exchange occurs)
- Provides oxygen to bloodstream
- Removes carbon dioxide from bloodstream
- Produces sounds for communication

Levels of Organization

THE INTEGUMENTARY SYSTEM



Major Organs:

- Skin
- Hair
- Sweat glands
- Nails

Functions:

- Protects against environmental hazards
- Helps regulate body temperature
- Provides sensory information

Homeostasis

- **Homeostasis:** all body systems working together to maintain a stable internal environment
 - Systems respond to external and internal changes to function within a **normal range** (body temperature, fluid balance)

Anatomical Terminology

- Superficial Anatomy
 - **Anatomical position:** hands at sides, palms forward
 - **Supine:** lying down, face up
 - **Prone:** lying down, face down

Anatomical Terminology

- Superficial Anatomy
 - **Anatomical Landmarks**
 - References to palpable structures
 - **Anatomical Regions**
 - Body regions
 - Abdominopelvic quadrants
 - Abdominopelvic regions
 - **Anatomical Directions**
 - Reference terms based on subject

Anatomical Terminology

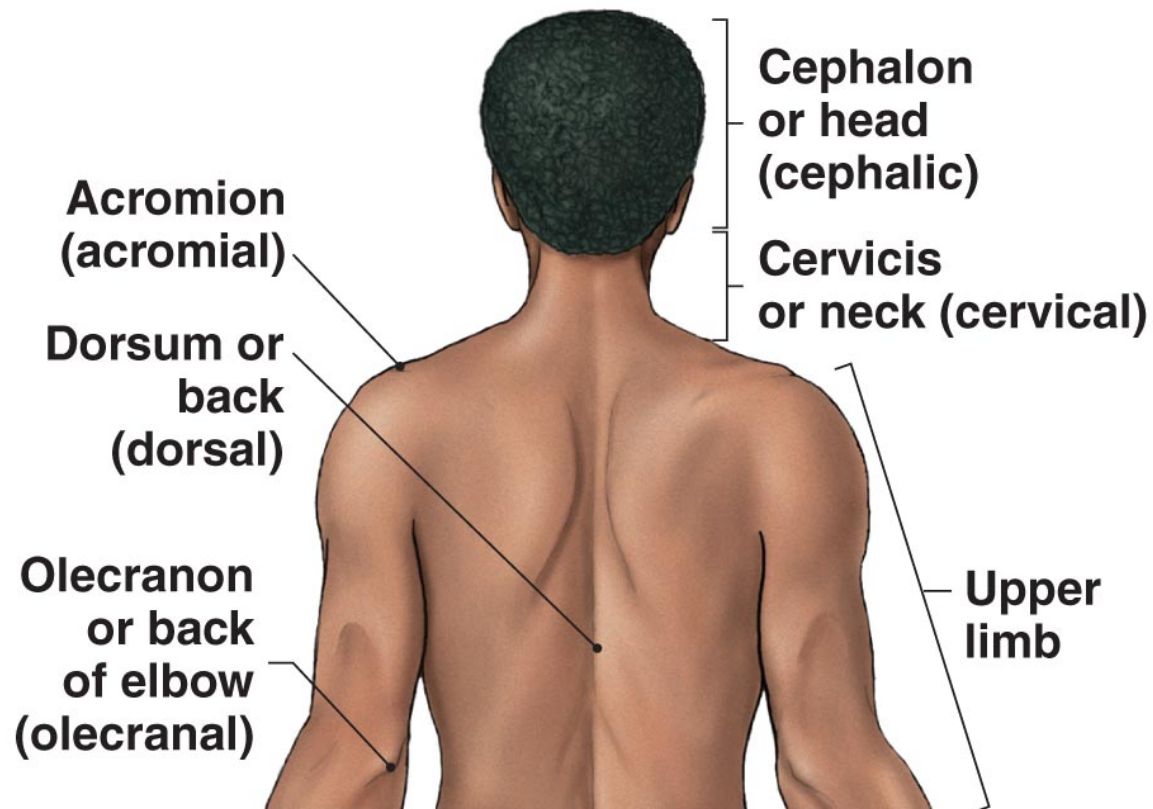


FIGURE 1–6 Anatomical Landmarks. Posterior

Anatomical Terminology

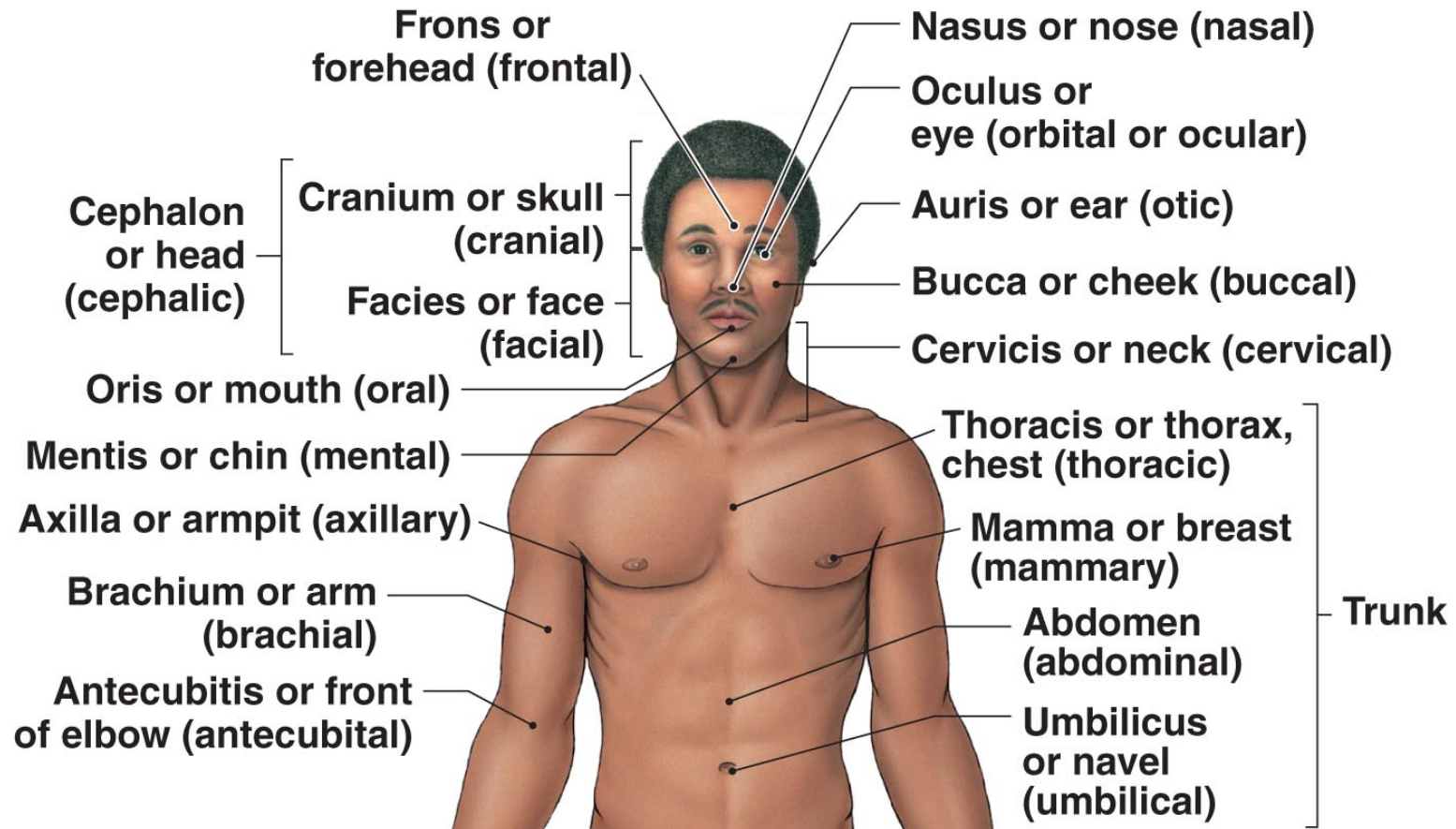


FIGURE 1–6 Anatomical Landmarks. Anterior

Anatomical Terminology

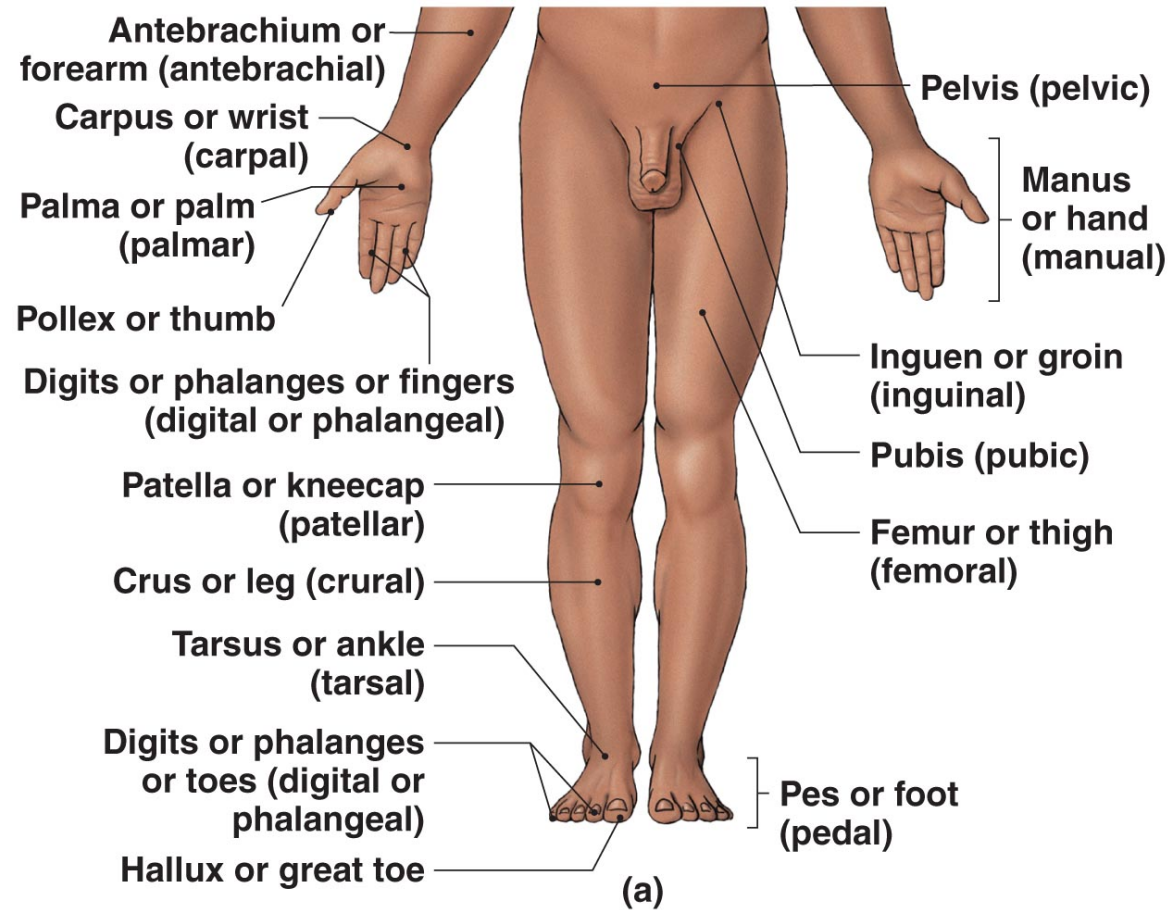


FIGURE 1–6 Anatomical Landmarks. Anterior

Anatomical Terminology

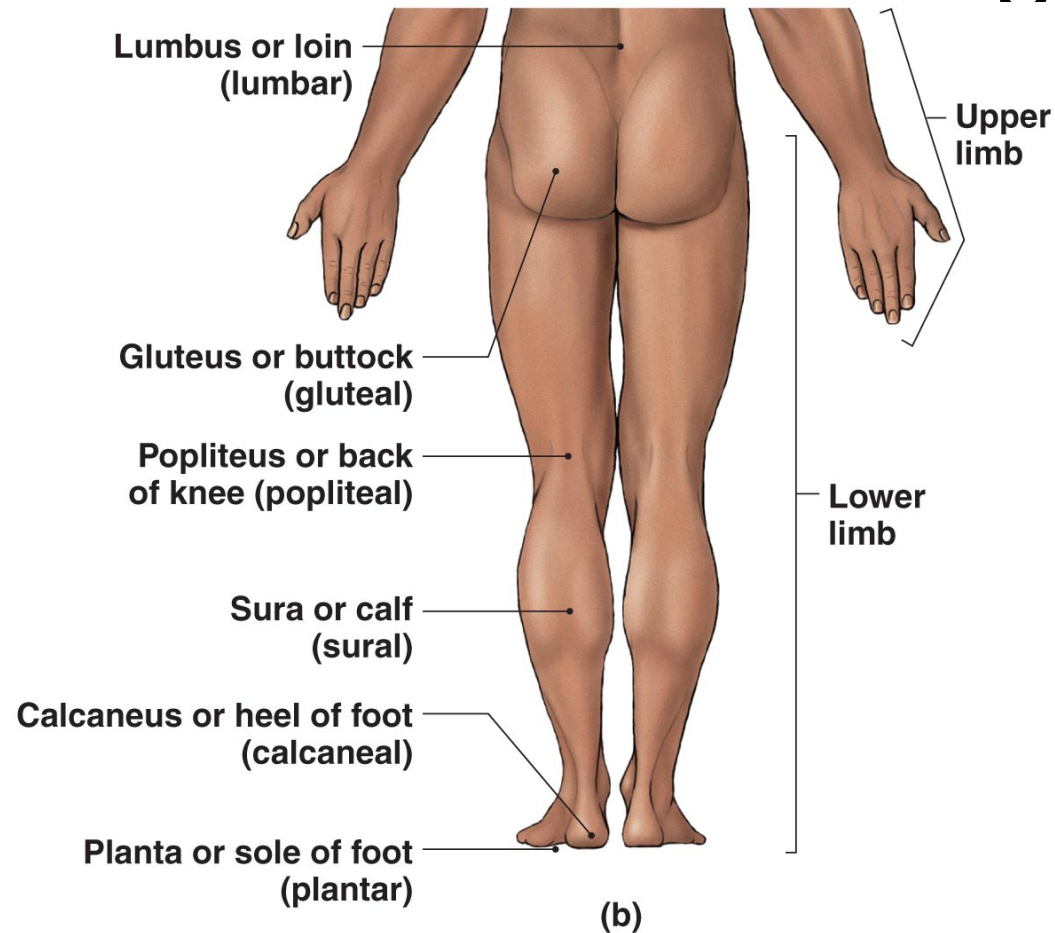


FIGURE 1–6 Anatomical Landmarks. Posterior

Anatomical Terminology

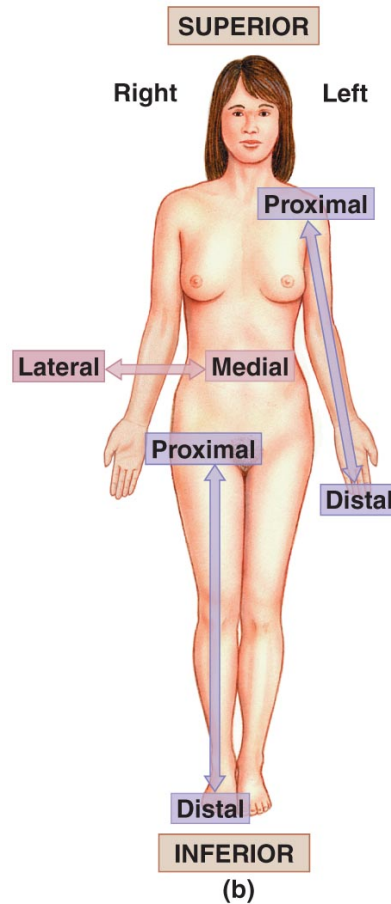


FIGURE 1–8 Directional References. An Anterior View.

Anatomical Terminology

TABLE 1–3 Directional Terms (see Figure 1–8)

Term	Region or Reference	Example
Anterior	The front; before	The navel is on the <i>anterior</i> surface of the trunk.
Ventral	The belly side (equivalent to anterior when referring to human body)	The navel is on the <i>ventral</i> surface of the trunk.
Posterior or dorsal	The back; behind	The shoulder blade is located <i>posterior</i> to the rib cage.
Cranial or cephalic	The head	The <i>cranial</i> , or <i>cephalic</i> , border of the pelvis is on the side toward the head rather than toward the thigh.
Superior	Above; at a higher level (in human body, toward the head)	In humans, the cranial border of the pelvis is <i>superior</i> to the thigh.
Caudal	The tail (coccyx in humans)	The hips are <i>caudal</i> to the waist.
Inferior	Below; at a lower level	The knees are <i>inferior</i> to the hips.
Medial	Toward the body's longitudinal axis; toward the midsagittal plane	The <i>medial</i> surfaces of the thighs may be in contact; moving medially from the arm across the chest surface brings you to the sternum.
Lateral	Away from the body's longitudinal axis; away from the midsagittal plane	The thigh articulates with the <i>lateral</i> surface of the pelvis; moving laterally from the nose brings you to the cheeks.
Proximal	Toward an attached base	The thigh is <i>proximal</i> to the foot; moving proximally from the wrist brings you to the elbow.
Distal	Away from an attached base	The fingers are <i>distal</i> to the wrist; moving distally from the elbow brings you to the wrist.
Superficial	At, near, or relatively close to the body surface	The skin is <i>superficial</i> to underlying structures.
Deep	Farther from the body surface	The bone of the thigh is <i>deep</i> to the surrounding skeletal muscles.

Anatomical Terminology

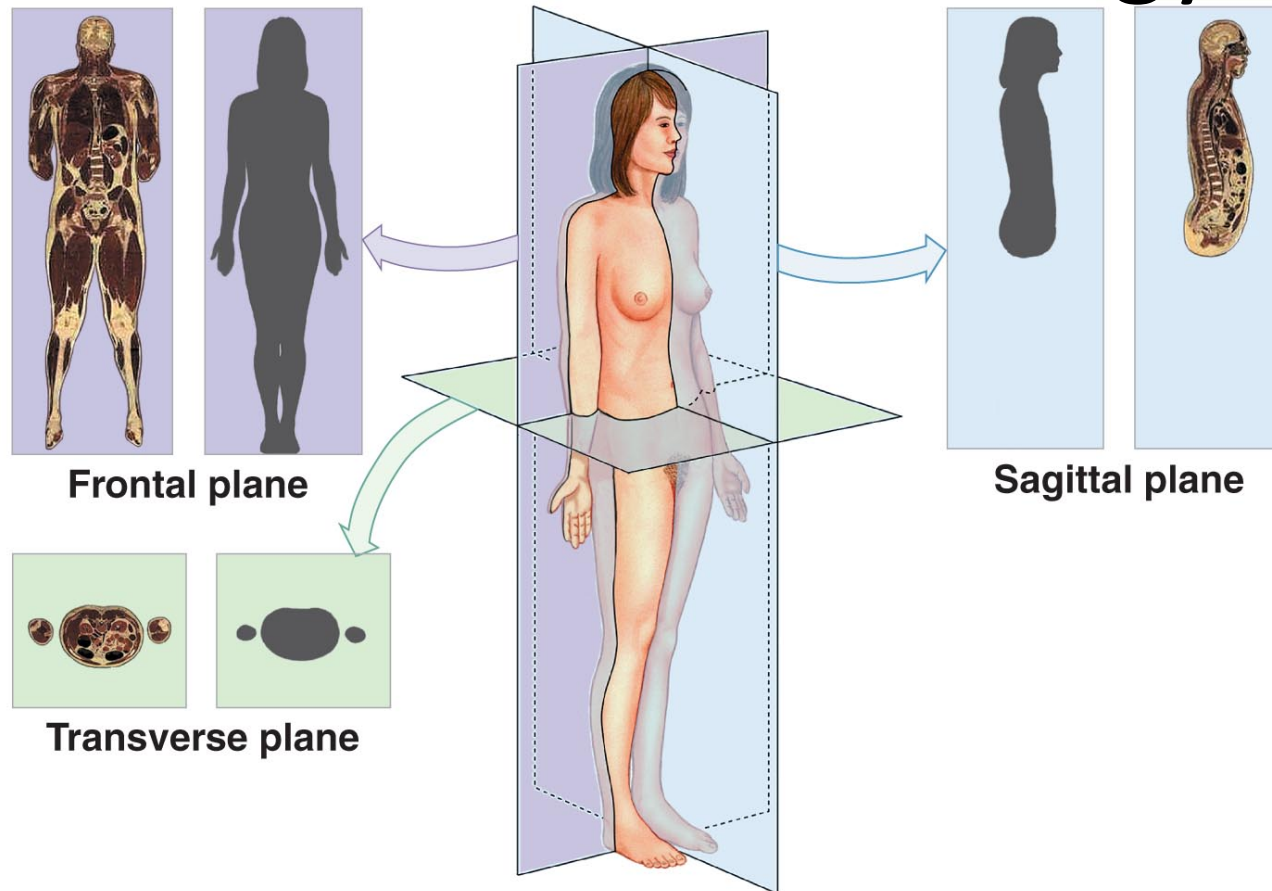


FIGURE 1–9 Sectional Planes.

Anatomical Terminology

TABLE 1–4 Terms That Indicate Sectional Planes (see Figure 1–9)

Orientation of Plane	Plane	Directional Reference	Description
Perpendicular to long axis	Transverse or horizontal	Transversely or horizontally	A <i>transverse</i> , or <i>horizontal</i> , <i>section</i> separates superior and inferior portions of the body. A cut in this plane is called a <i>cross section</i> .
Parallel to long axis	Sagittal	Sagittally	A <i>sagittal section</i> separates right and left portions. You examine a sagittal section, but you section sagittally.
	Midsagittal		In a <i>midsagittal section</i> or <i>median section</i> , the plane passes through the midline, dividing the body into right and left sides.
	Parasagittal		A <i>parasagittal section</i> , which is a cut parallel to the midsagittal plane, separates the body into right and left portions of unequal size.
	Frontal or coronal		Frontally or coronally