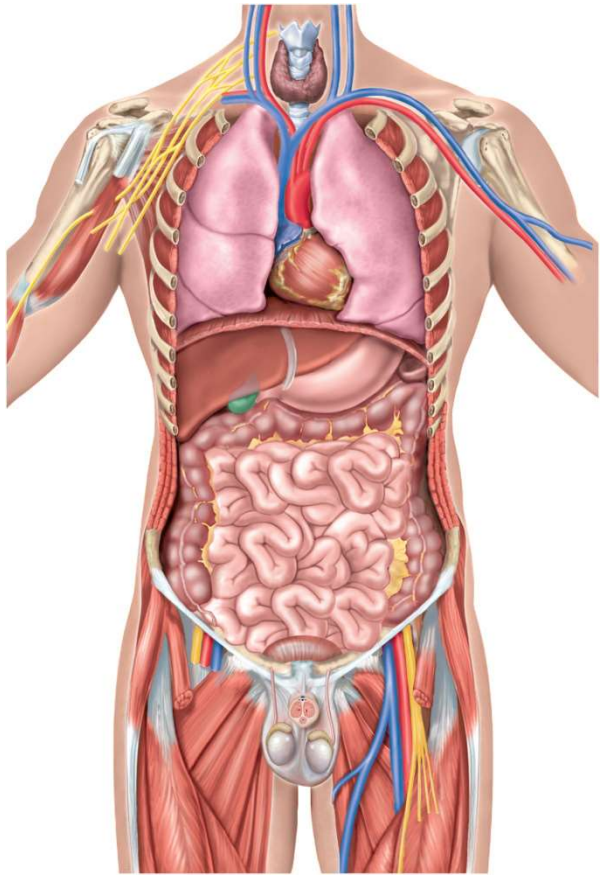
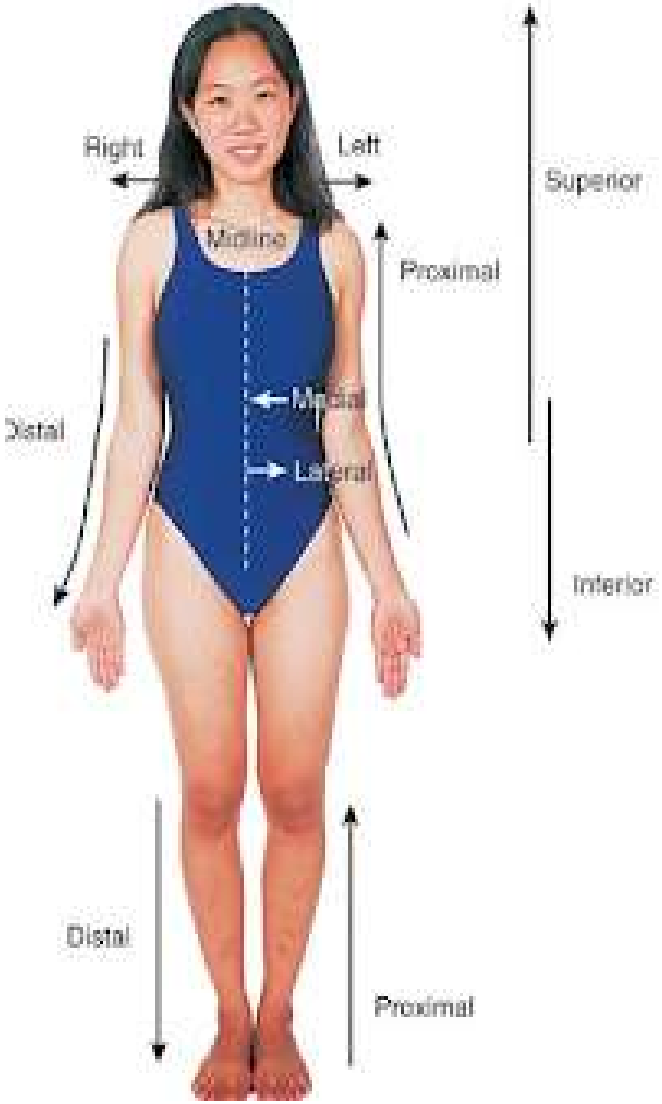
Atlas A

Orientation to Anatomy

- Anatomical position
- Anatomical planes
- Directional terms
- Body regions
- Body cavities and membranes
- Organ systems
- Visual survey of the body



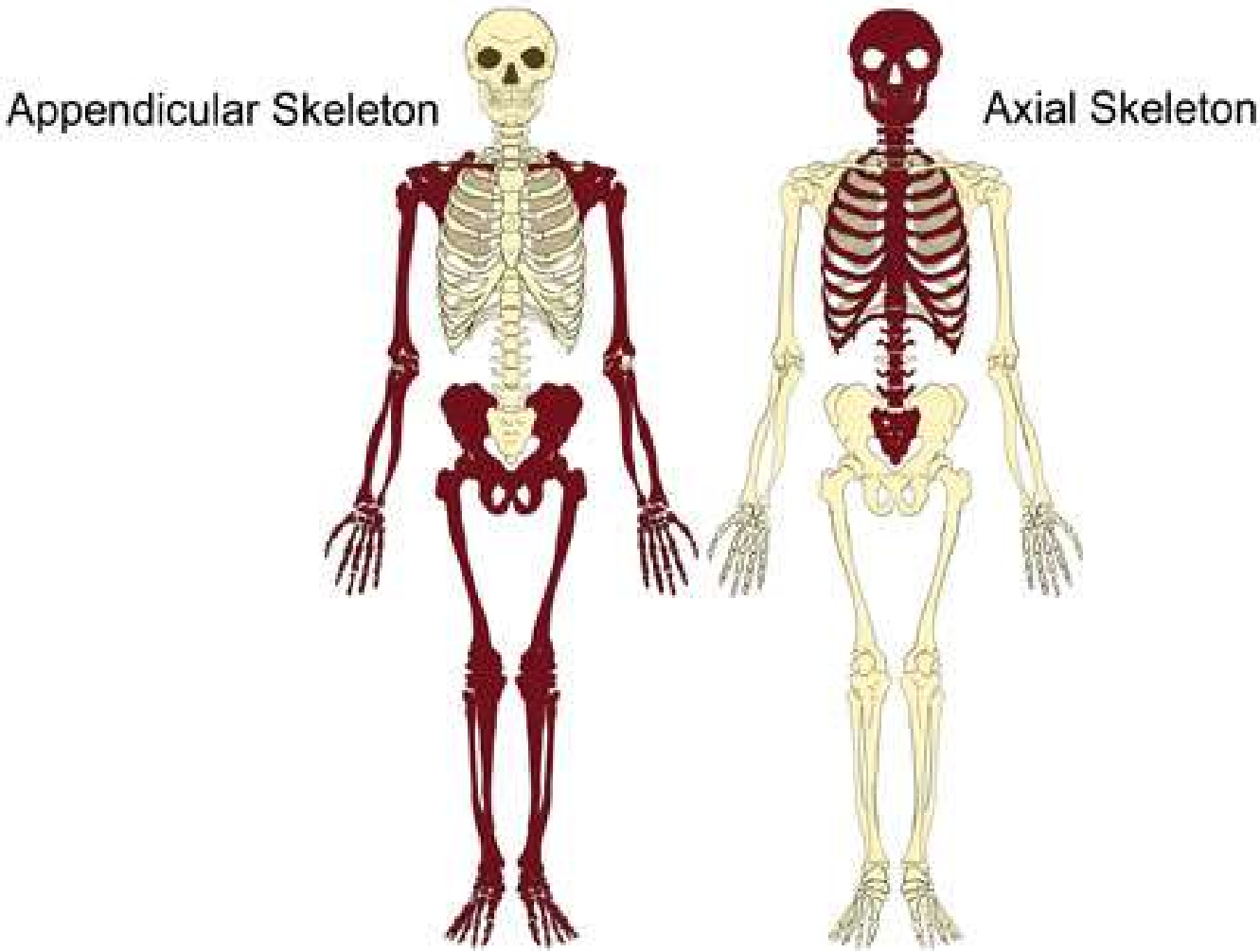
What is The Anatomical Position?



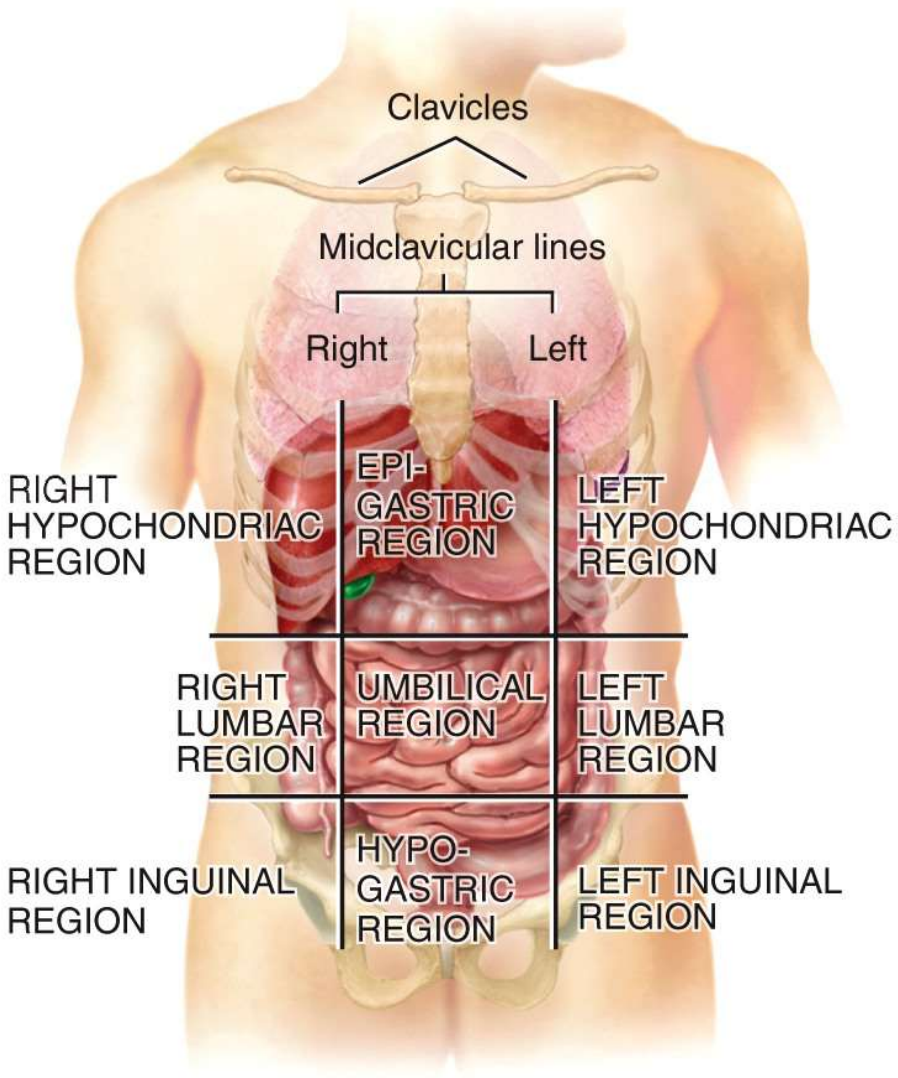
- **Person stands erect**
- **Feet flat on floor**
- **Arms at sides**
- **Palms, face & eyes facing forward**

- This is the standard frame of reference that is used when describing anatomical objects & procedures in dissection

Bones in Axial & Appendicular Skeleton



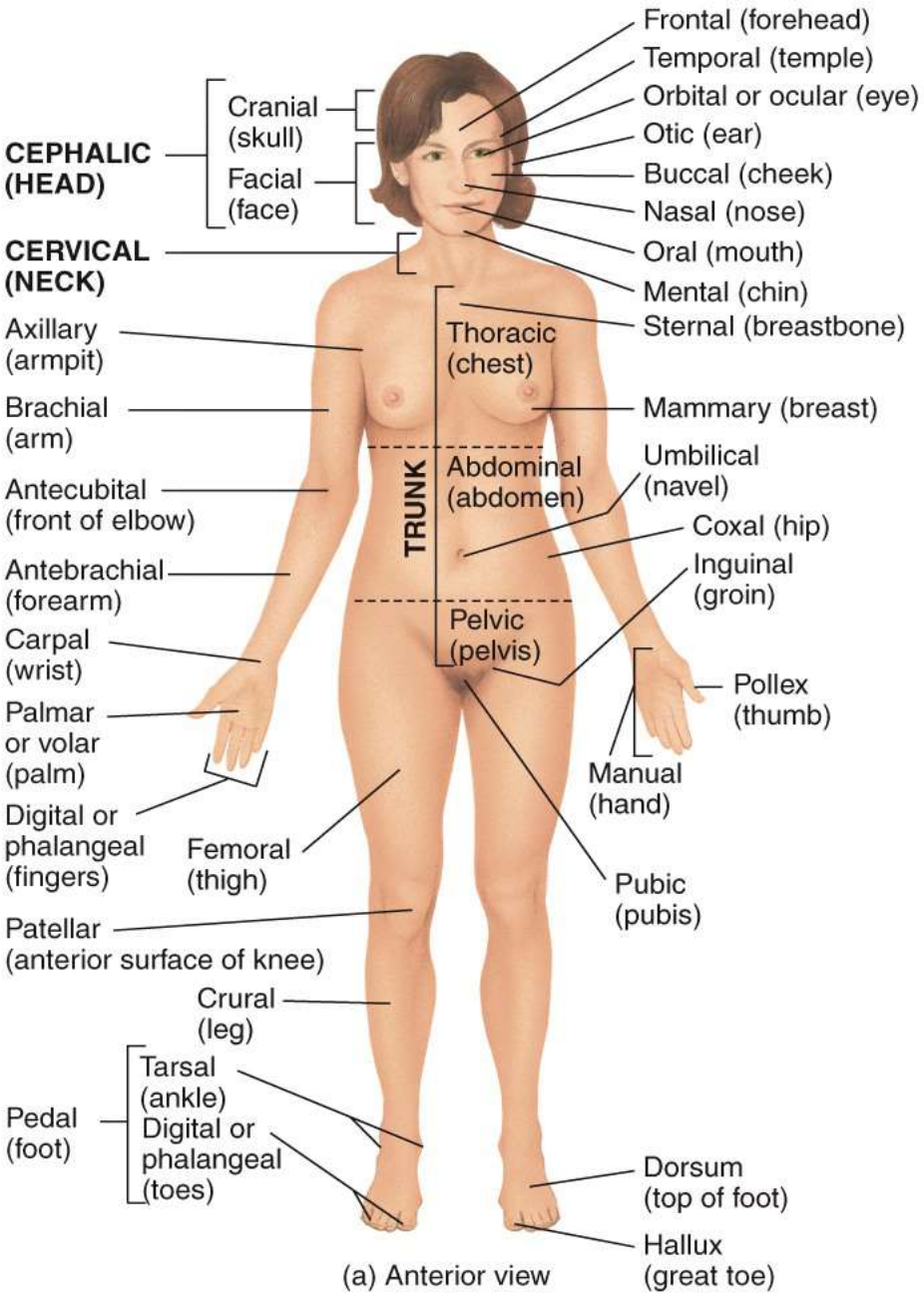
Nine Abdominopelvic Regions



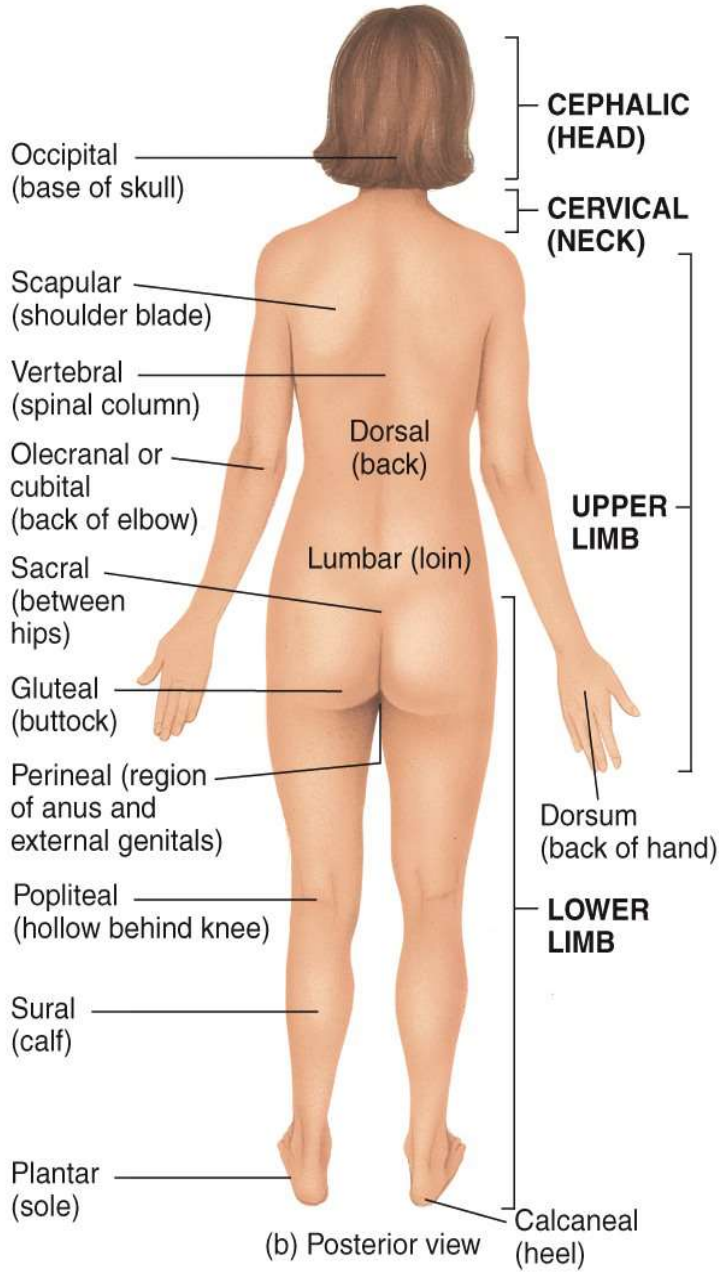
(a) Anterior view showing location of abdominopelvic regions

DIRECTIONAL TERM	DEFINITION	EXAMPLE OF USE
Superior (soo′-PĒR-ē-or) (**cephalic** or **cranial**)	Toward the head, or the upper part of a structure.	The heart is superior to the liver.
Inferior (in-FĒ-rē-or) (**caudal**)	Away from the head, or the lower part of a structure.	The stomach is inferior to the lungs.
Anterior (an-TĒR-ē-or) (**ventral**)*	Nearer to or at the front of the body.	The sternum (breastbone) is anterior to the heart.
Posterior (pos-TĒR-ē-or) (**dorsal**)	Nearer to or at the back of the body.	The esophagus (food tube) is posterior to the trachea (windpipe).
Medial (MĒ-dē-al)	Nearer to the midline (an imaginary vertical line that divides the body into equal right and left sides).	The ulna is medial to the radius.
Lateral (LAT-er-al)	Farther from the midline.	The lungs are lateral to the heart.
Intermediate (in′-ter-MĒ-dē-at)	Between two structures.	The transverse colon is intermediate to the ascending and descending colons.
Ipsilateral (ip-si-LAT-er-al)	On the same side of the body as another structure.	The gallbladder and ascending colon are ipsilateral.
Contralateral (KON-tra-lat-er-al)	On the opposite side of the body from another structure.	The ascending and descending colons are contralateral.
Proximal (PROK-si-mal)	Nearer to the attachment of a limb to the trunk; nearer to the origination of a structure.	The humerus (arm bone) is proximal to the radius.
Distal (DIS-tal)	Farther from the attachment of a limb to the trunk; farther from the origination of a structure.	The phalanges (finger bones) are distal to the carpals (wrist bones).
Superficial (soo′-per-FISH-al) (**external**)	Toward or on the surface of the body.	The ribs are superficial to the lungs.
Deep (Internal)	Away from the surface of the body.	The ribs are deep to the skin of the chest and back.

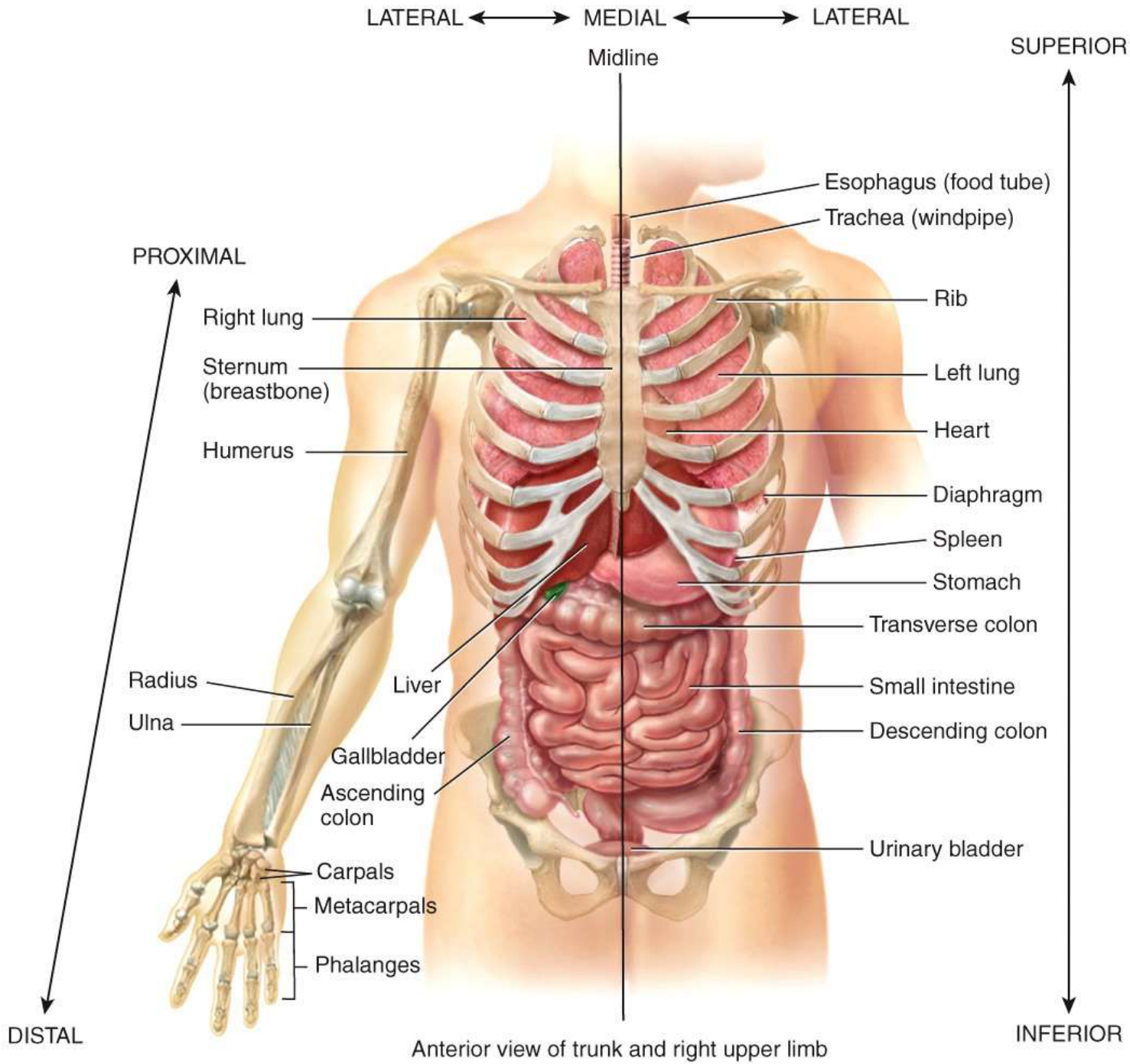
*Note that the terms *anterior* and *ventral* mean the same thing in humans. However, in four-legged animals *ventral* refers to the belly side and is therefore *inferior*. Similarly, the terms *posterior* and *dorsal* mean the same thing in humans, but in four-legged animals *dorsal* refers to the back side and is therefore *superior*.



(a) Anterior view

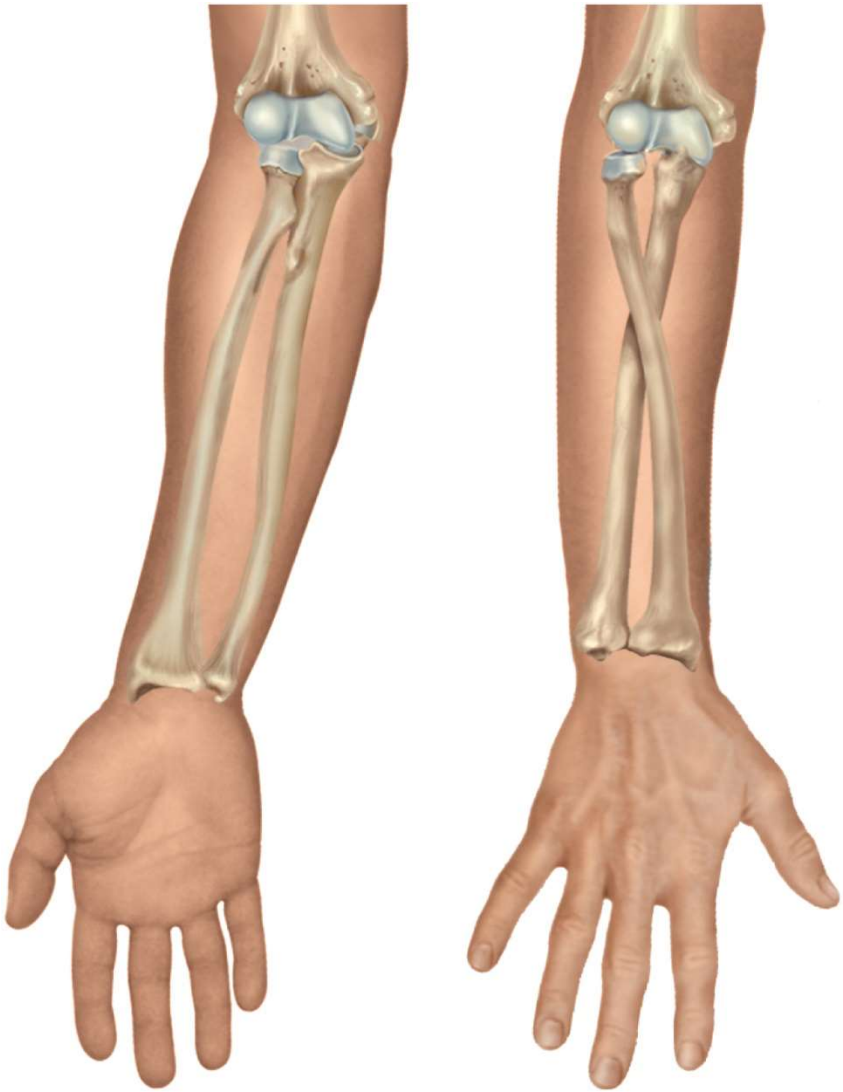


(b) Posterior view



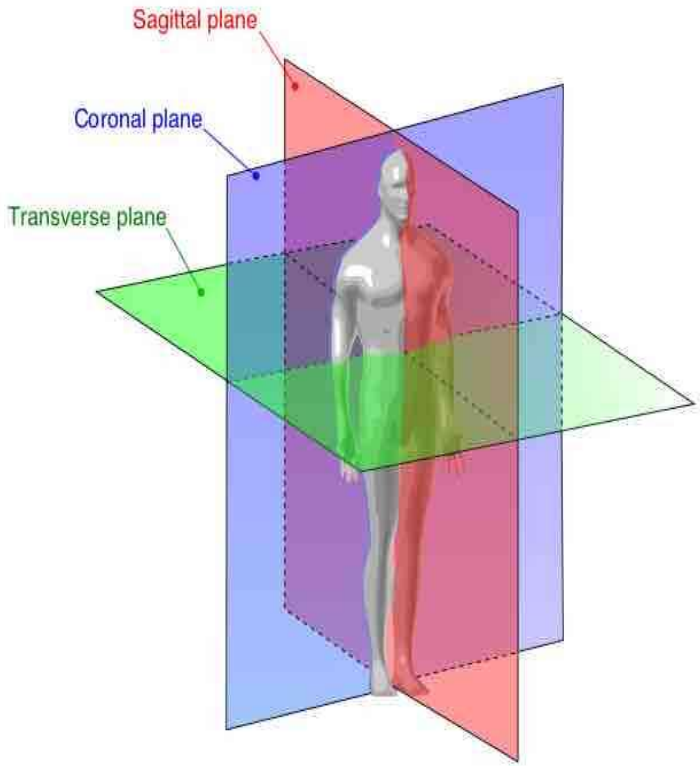
Anterior view of trunk and right upper limb

Forearm Positions



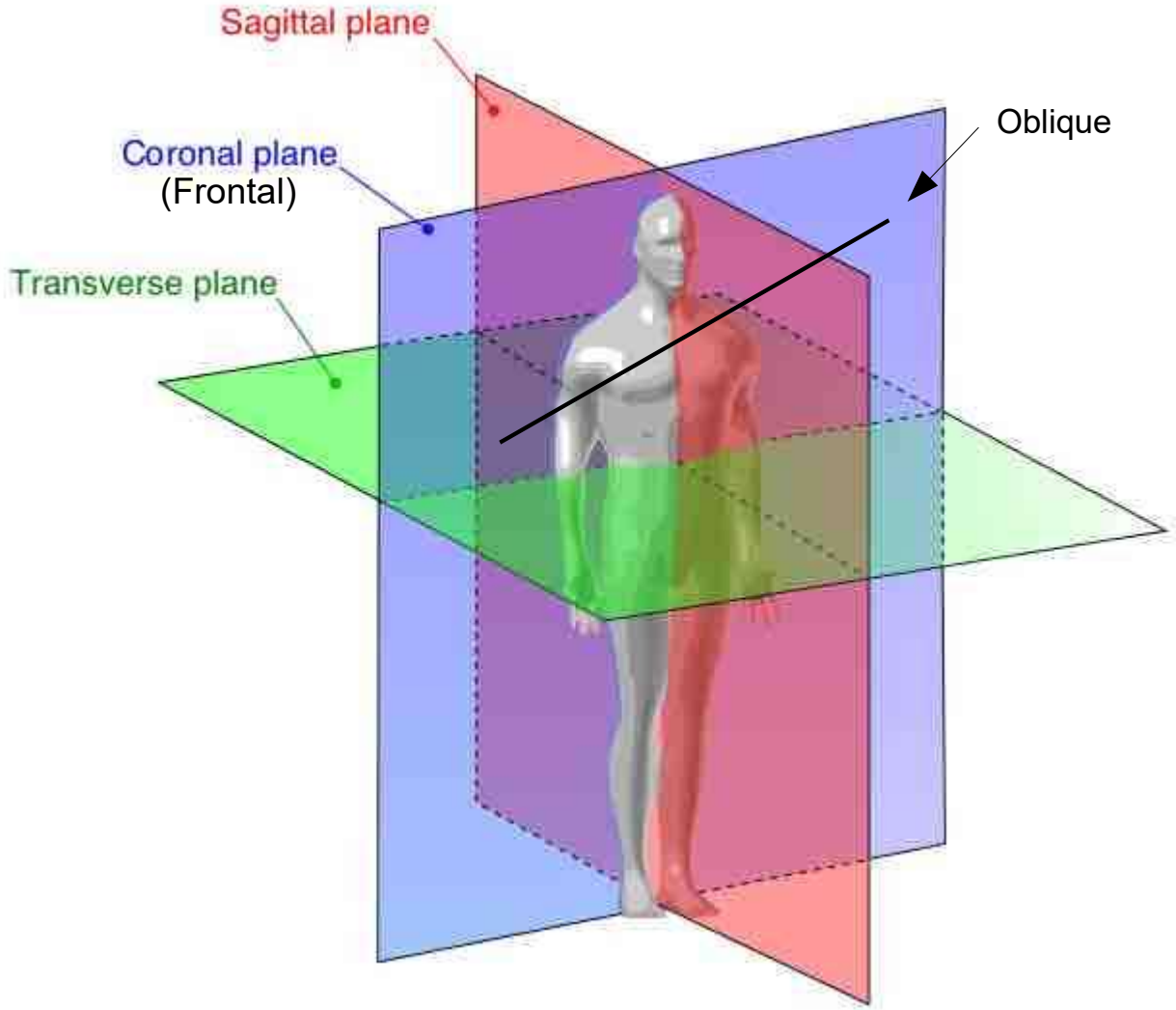
- When **supinated**
  - palms face forward or upward
  - radius & ulna are parallel
- When **pronated**
  - palms face rearward or downward
  - radius & ulna are crossed

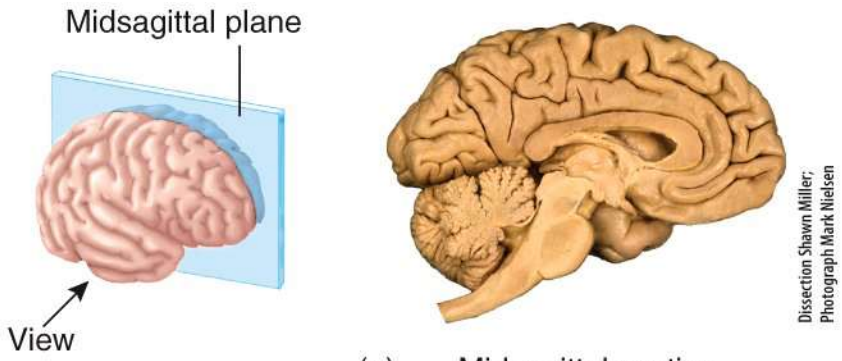
Anatomical Planes and Sections



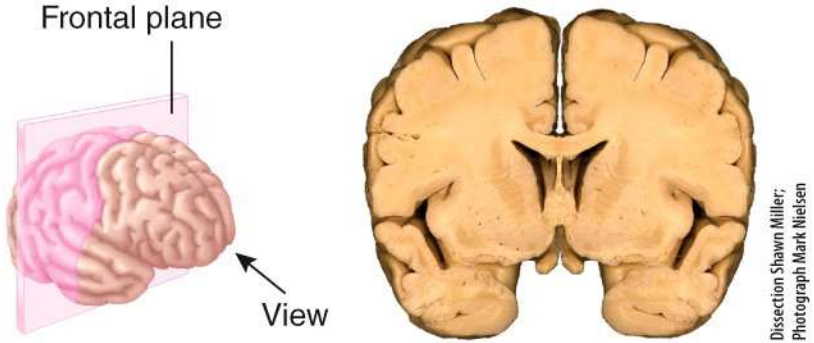
- **Sections** implies actual cut or slice to reveal internal anatomy
- **Plane** implies an imaginary flat surface passing through the body
  - **Sagittal plane** divides body into right and left regions /// **median (midsagittal) plane** divides body or organ into equal halves
  - **Frontal (coronal) plane** divides body into anterior (front) & posterior (back) portions
  - **Transverse (horizontal) plane** divides the body into superior (upper) & inferior (lower) portions

Anatomical Planes and Sections

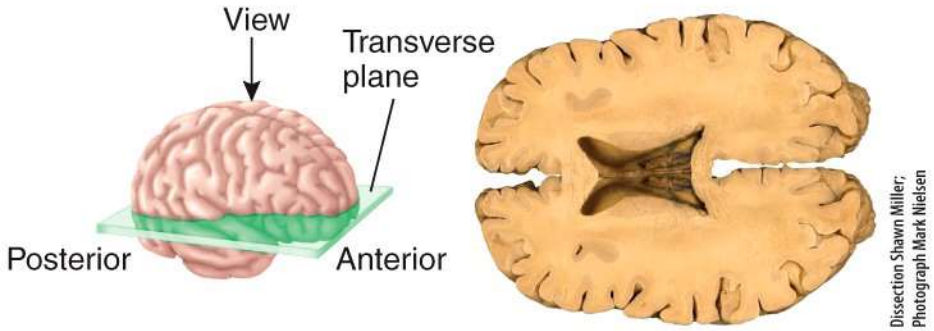




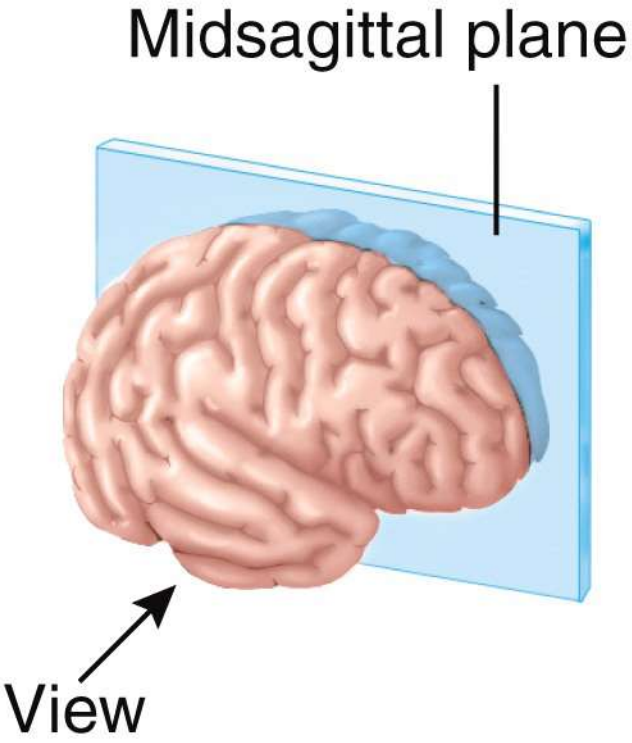
(a) Midsagittal section

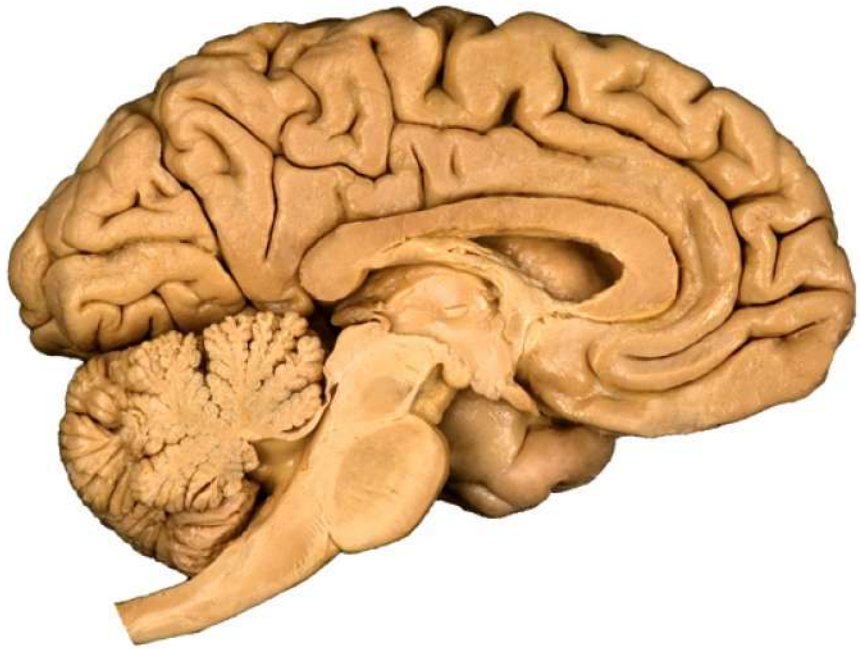


(b) Frontal section



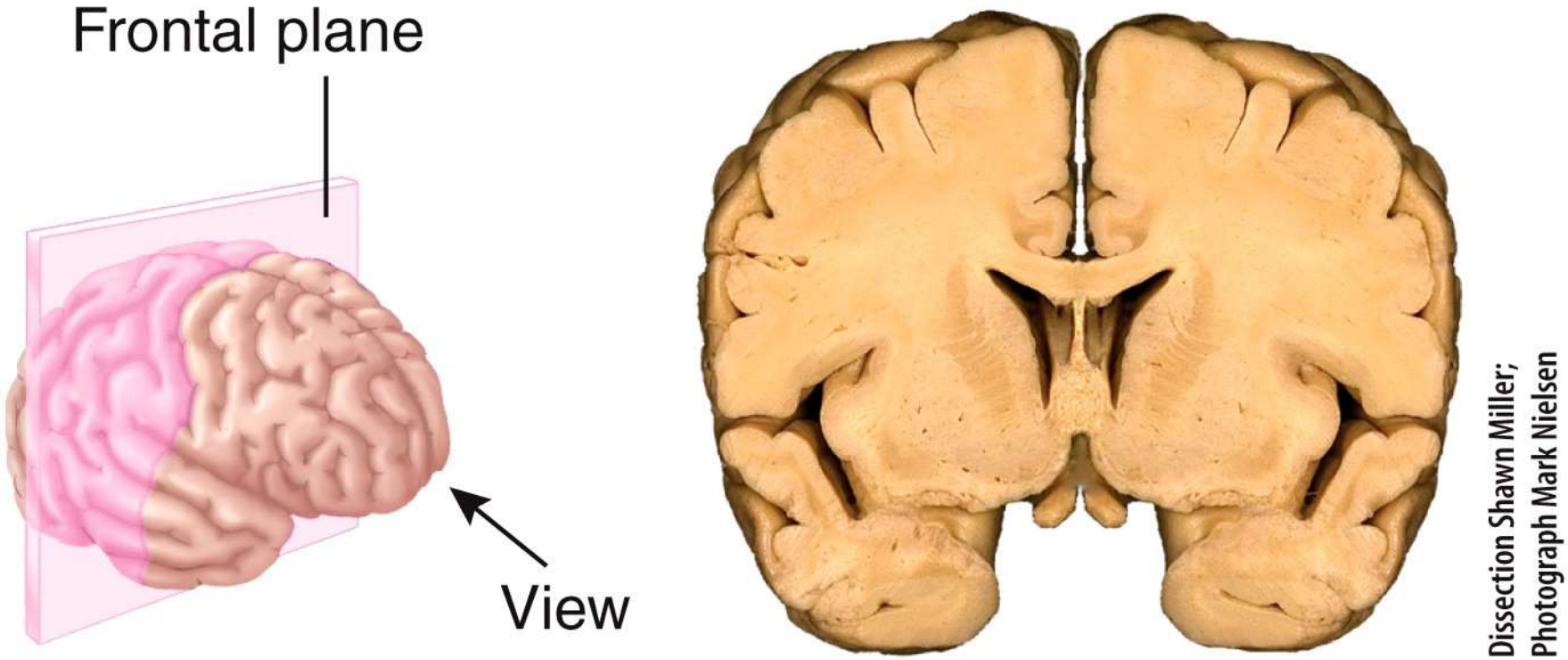
(c) Transverse section



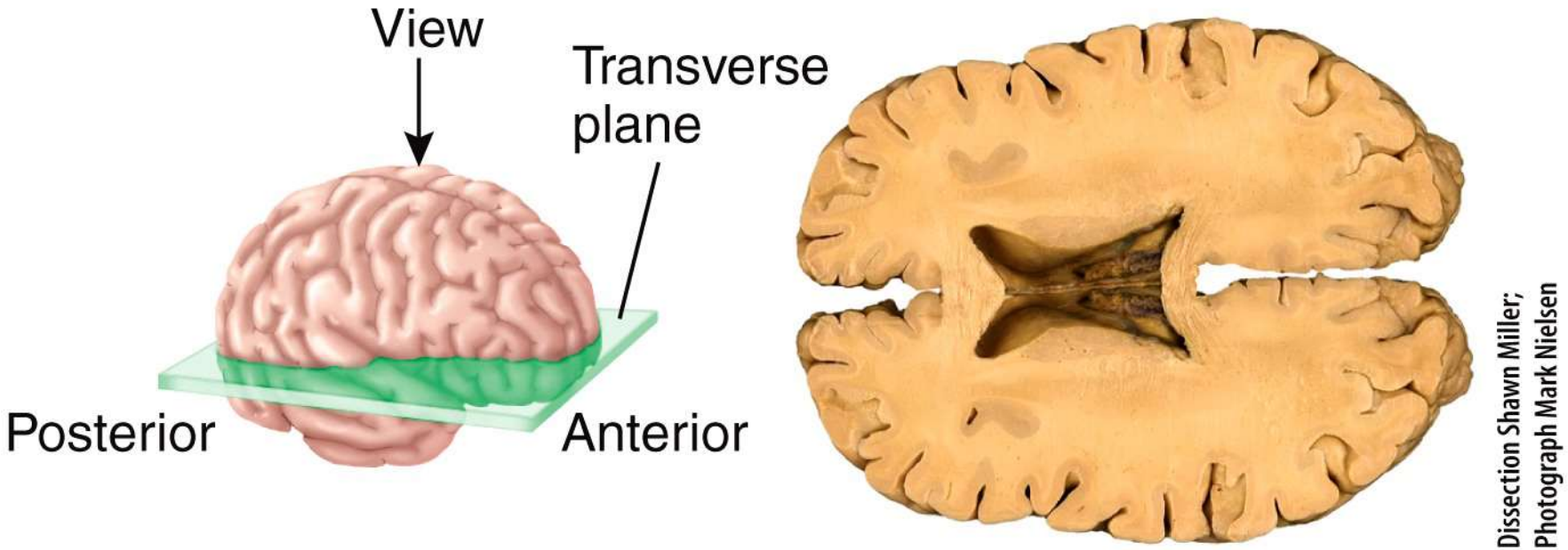


Dissection Shawn Miller;
Photograph Mark Nielsen

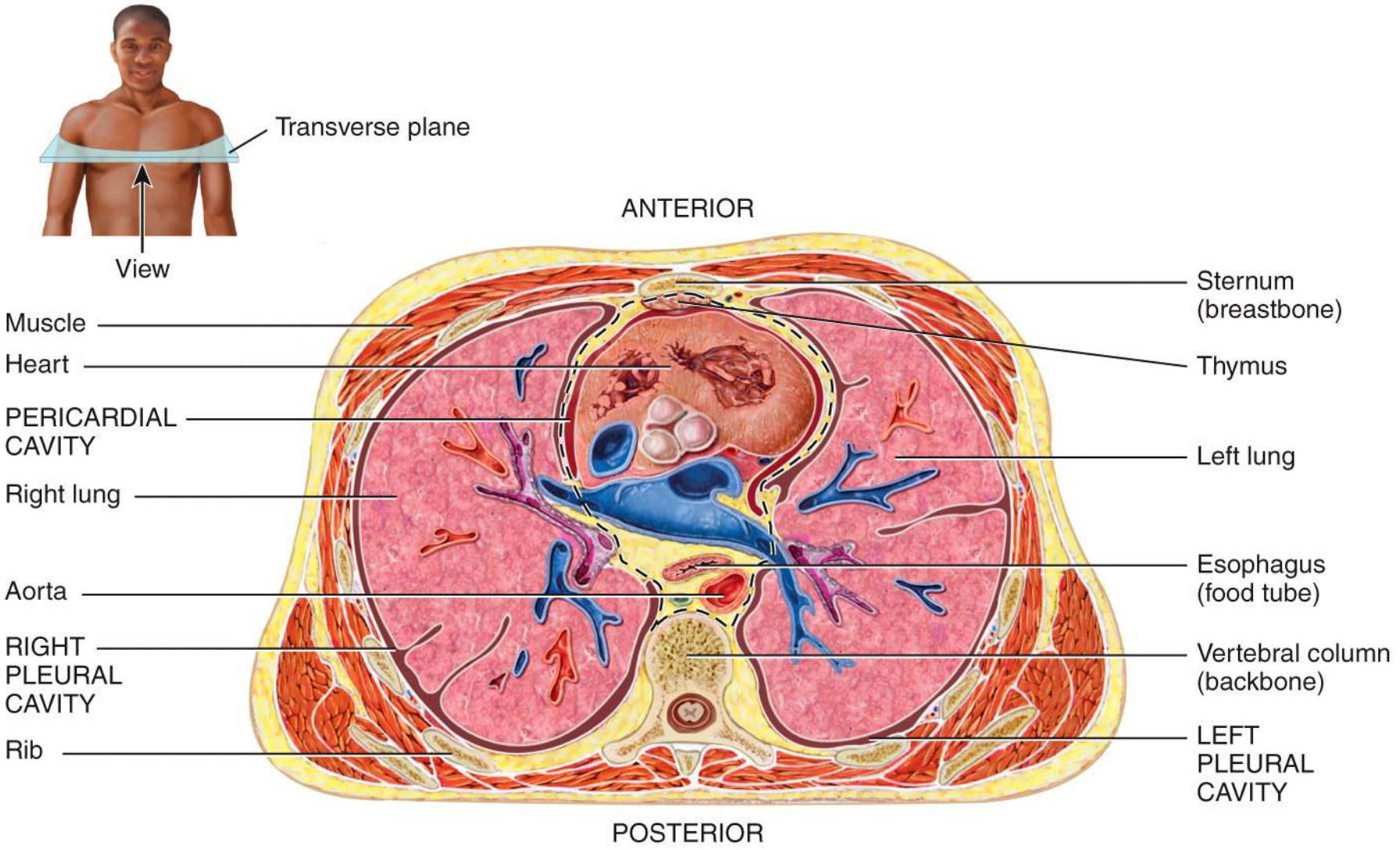
(a) Midsagittal section



(b) Frontal section

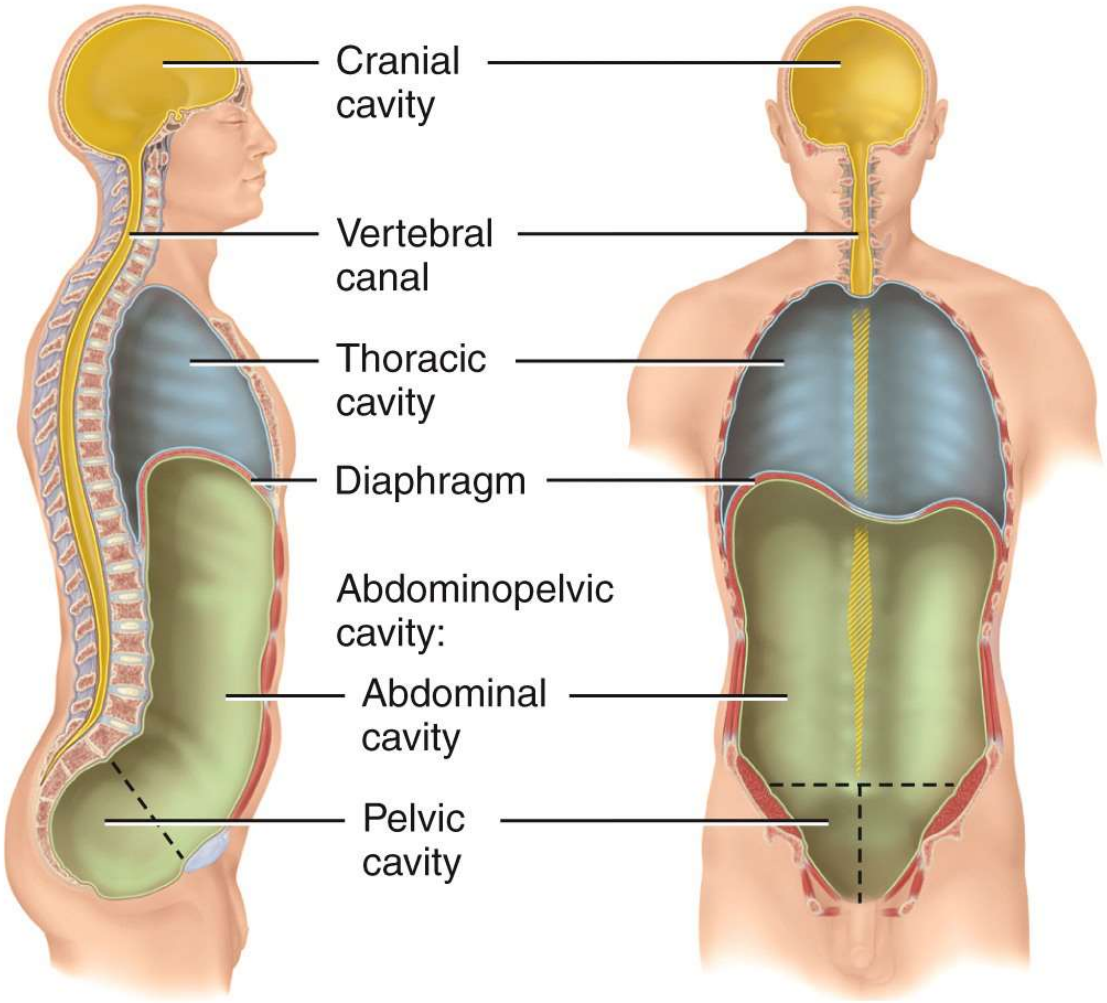


(c) Transverse section



(b) Inferior view of transverse section of thoracic cavity

Dorsal vs Ventral Cavities

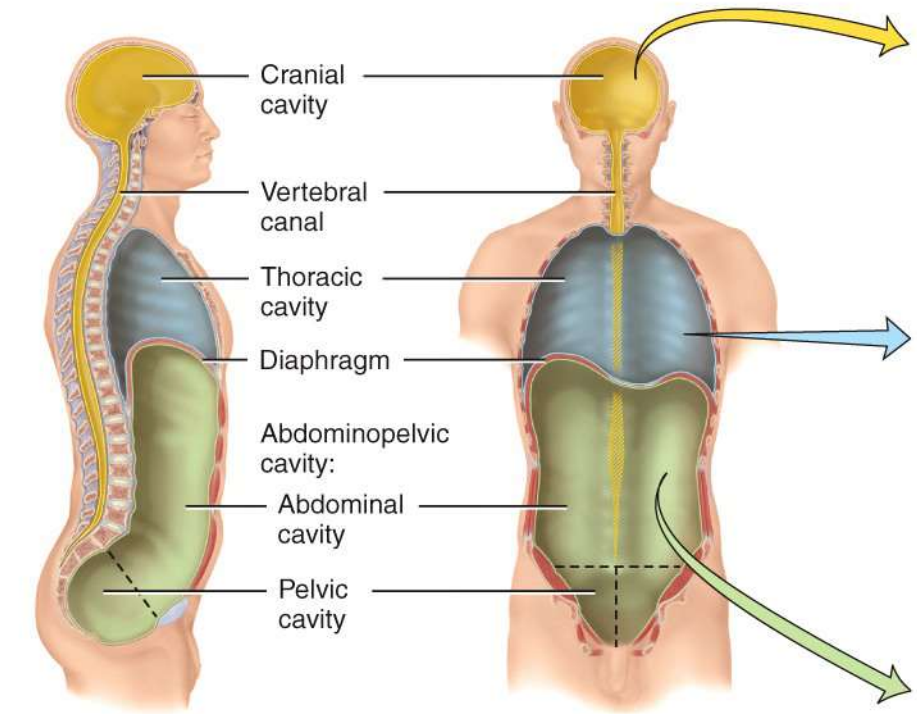


(a) Right lateral view

(b) Anterior view

Dorsal = cranial and vertebral cavities

Ventral = thoracic and abdominopelvic

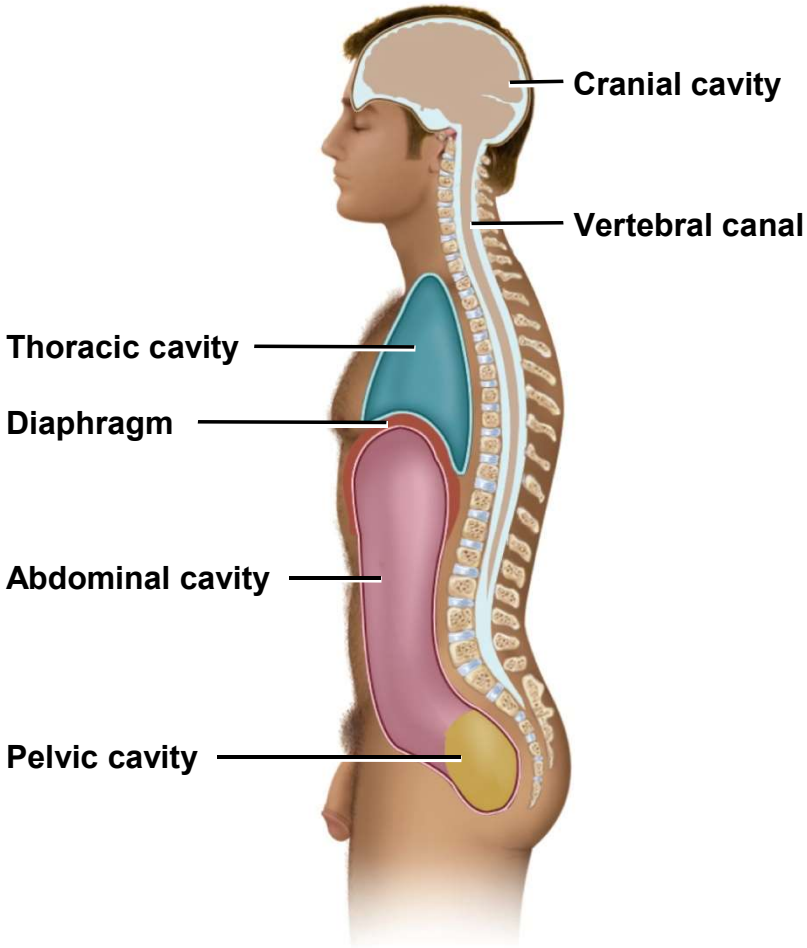


(a) Right lateral view (b) Anterior view

CAVITY	COMMENTS
Cranial cavity	Formed by cranial bones and contains brain.
Vertebral canal	Formed by vertebral column and contains spinal cord and the beginnings of spinal nerves.
Thoracic cavity*	Chest cavity; contains pleural and pericardial cavities and the mediastinum.
Pleural cavity	A potential space between the layers of the pleura that surrounds a lung.
Pericardial cavity	A potential space between the layers of the pericardium that surrounds the heart.
Mediastinum	Central portion of thoracic cavity between the lungs; extends from sternum to vertebral column and from first rib to diaphragm; contains heart, thymus, esophagus, trachea, and several large blood vessels.
Abdominopelvic cavity	Subdivided into abdominal and pelvic cavities.
Abdominal cavity	Contains stomach, spleen, liver, gallbladder, small intestine, and most of large intestine; the serous membrane of the abdominal cavity is the peritoneum.
Pelvic cavity	Contains urinary bladder, portions of large intestine, and internal organs of reproduction.

* See Figure 1.10 for details of the thoracic cavity.

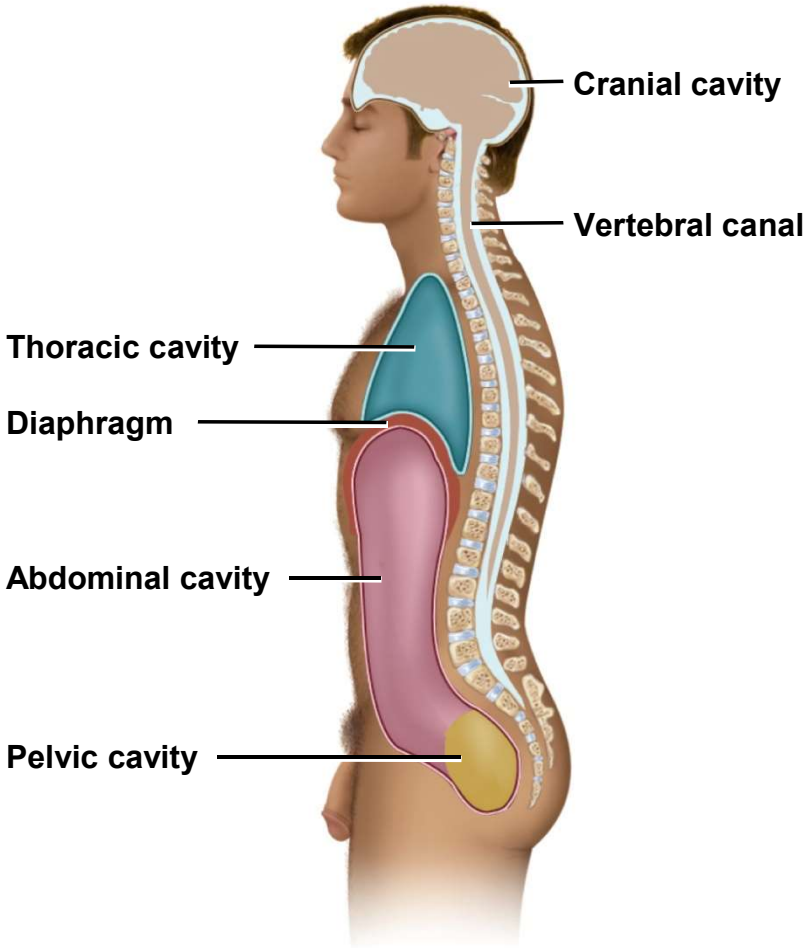
Major Body Cavities and Membranes



(a) Left lateral view

- **Cranial cavity**
- **Vertebral canal** // meninges membranes
- **Thoracic cavity**
- **Abdominopelvic cavity** // abdominal cavity and pelvic cavity
- Cavities not open to external environment lined with serous membranes // secrete fluid like substance
- Stuff inside cavities called the viscera

Cranial Cavity & Vertebral Canal

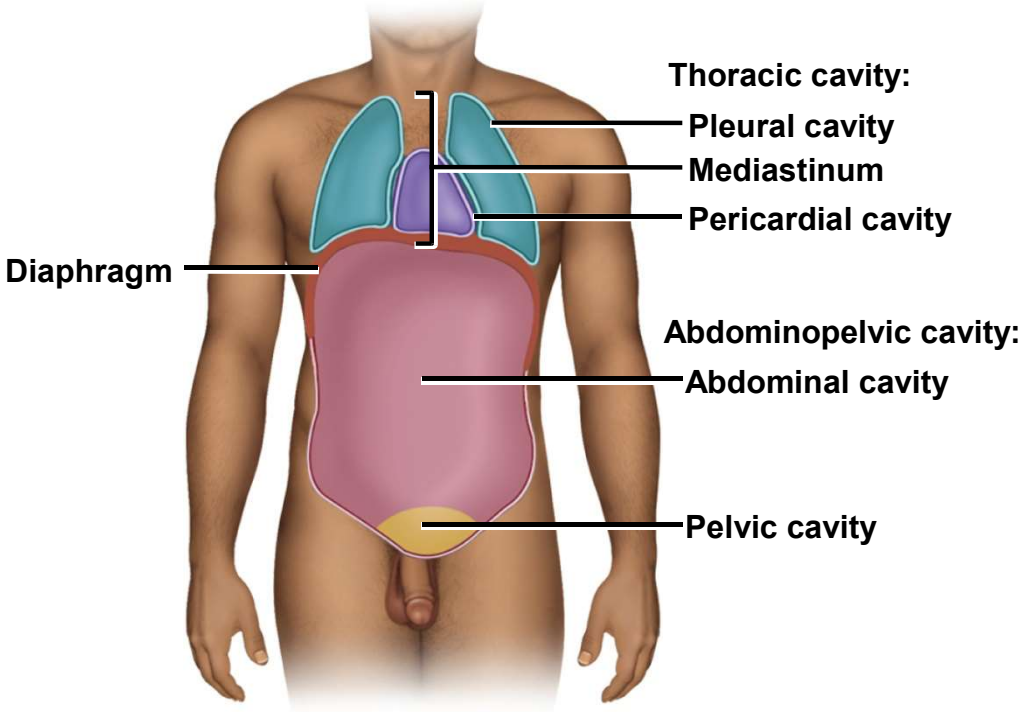


(a) Left lateral view

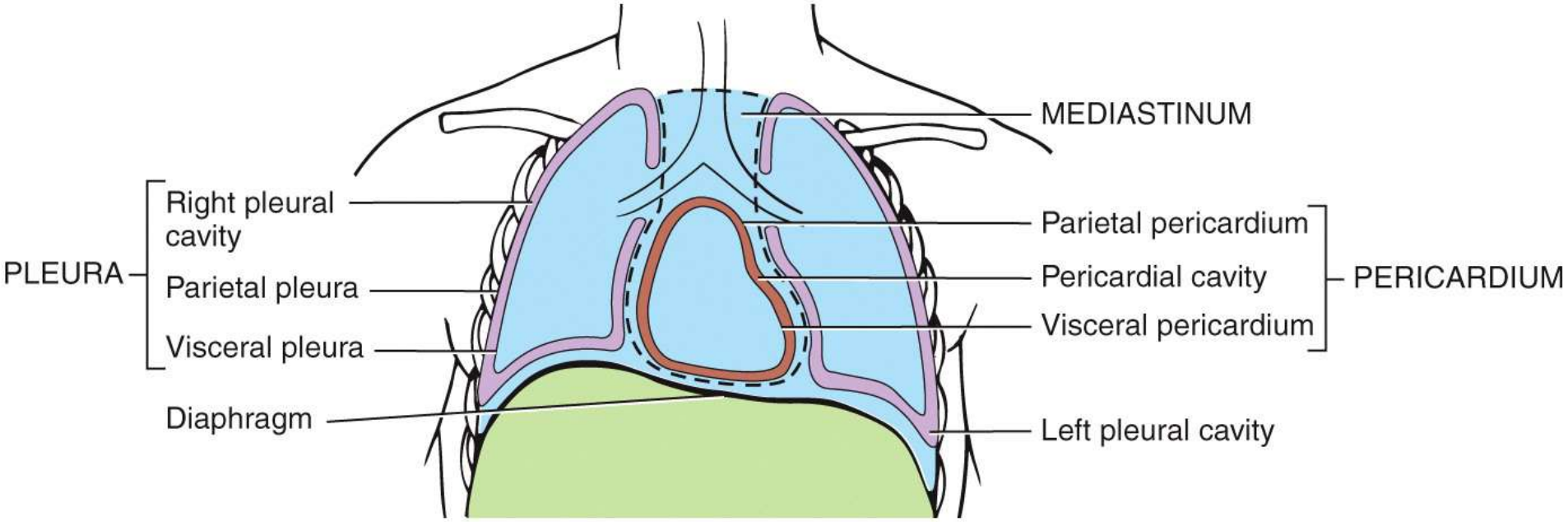
- **Cranial cavity**
  - contains brain
  - meninges membranes
- **Vertebral canal**
  - contains the spinal cord
  - meninges membranes

Thoracic Cavity

- **Mediastinum -** region between lungs // location for **heart, major blood vessels, esophagus, trachea, & thymus**
- **Pericardium –** around heart
  - **visceral pericardium**
  - **parietal pericardium**
  - **pericardial cavity**
  - **pericardial fluid**
- **Pleura –** around lungs
  - **visceral pleura**
  - **parietal pleura**
  - **peripleural cavity**
  - **peripleural fluid**

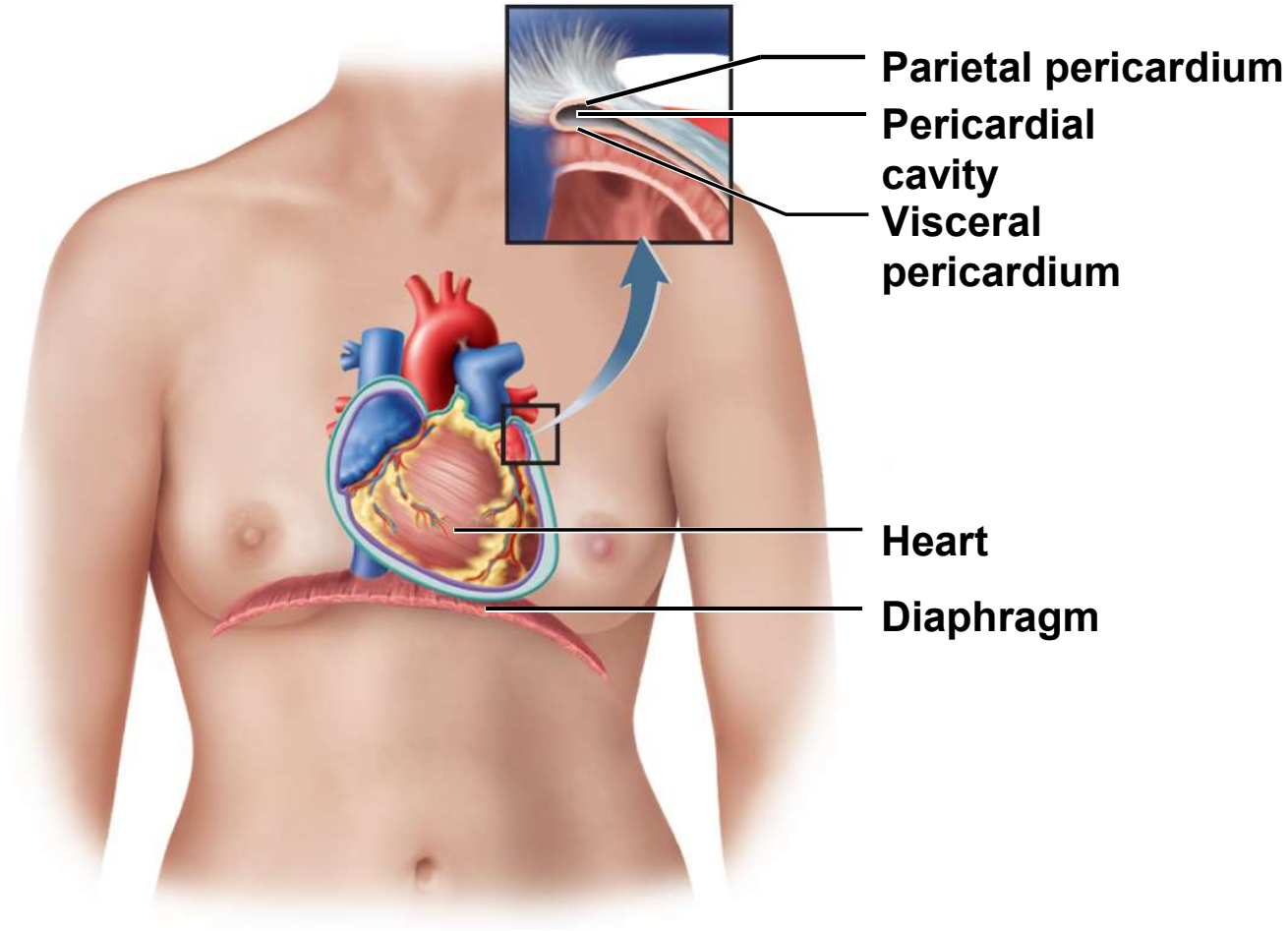


(b) Anterior view



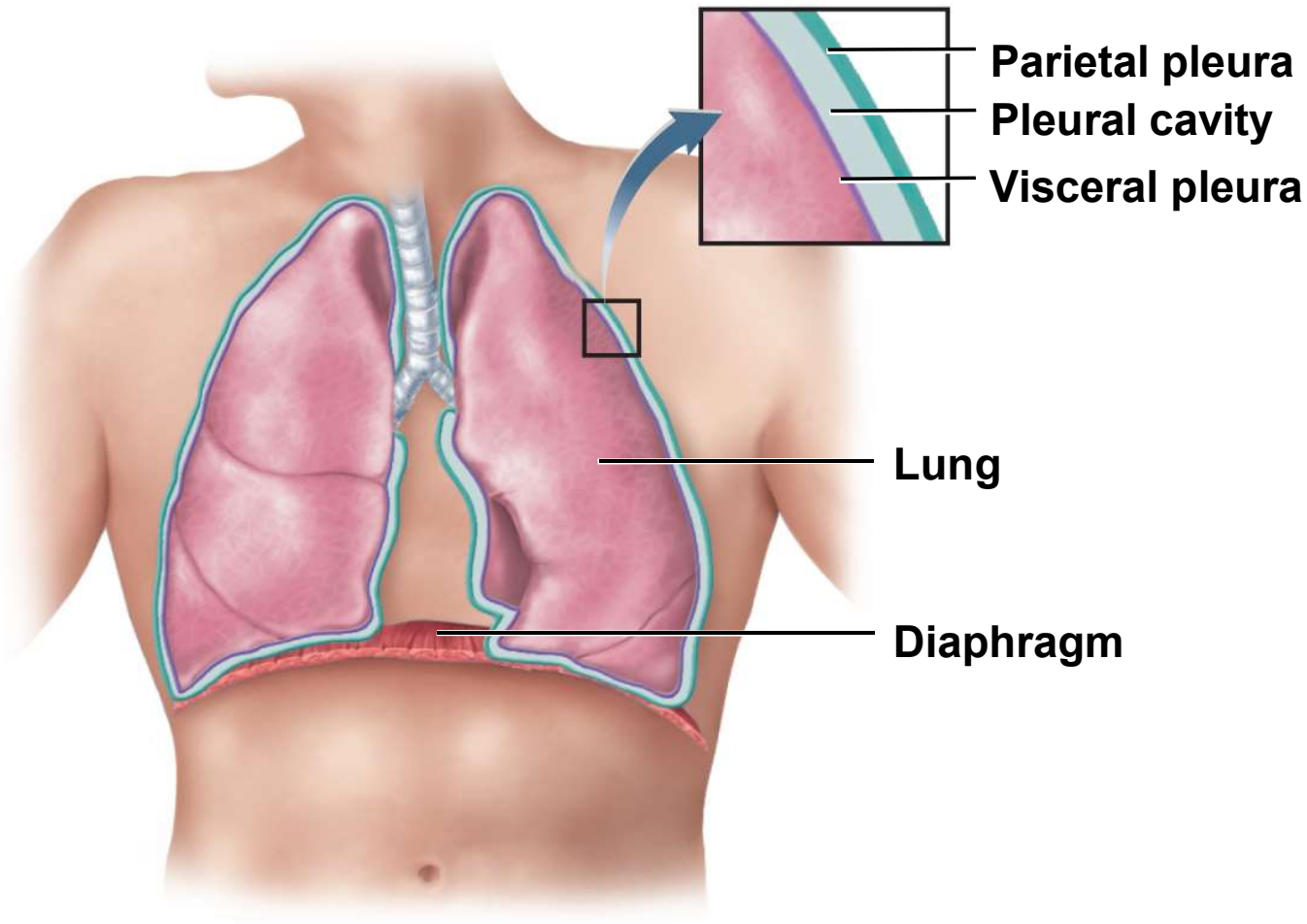
(a) Anterior view of thoracic cavity

Pericardial Membranes



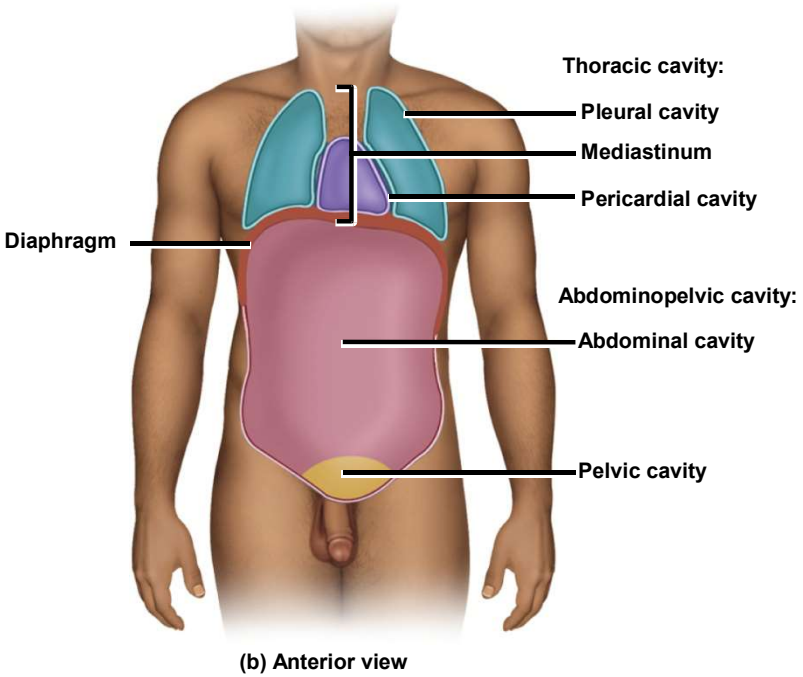
(a) Pericardium

Pleural Membranes



(b) Pleurae

Abdominopelvic Cavity



(b) Anterior view

- **Pelvic brim** separates abdominal & pelvic cavities
  - **abdominal cavity** contains most digestive organs, kidneys & ureters
  - **pelvic cavity** contains rectum, urinary bladder, urethra & reproductive organs

Peritoneum = Serous Membranes of Abdominopelvic cavity

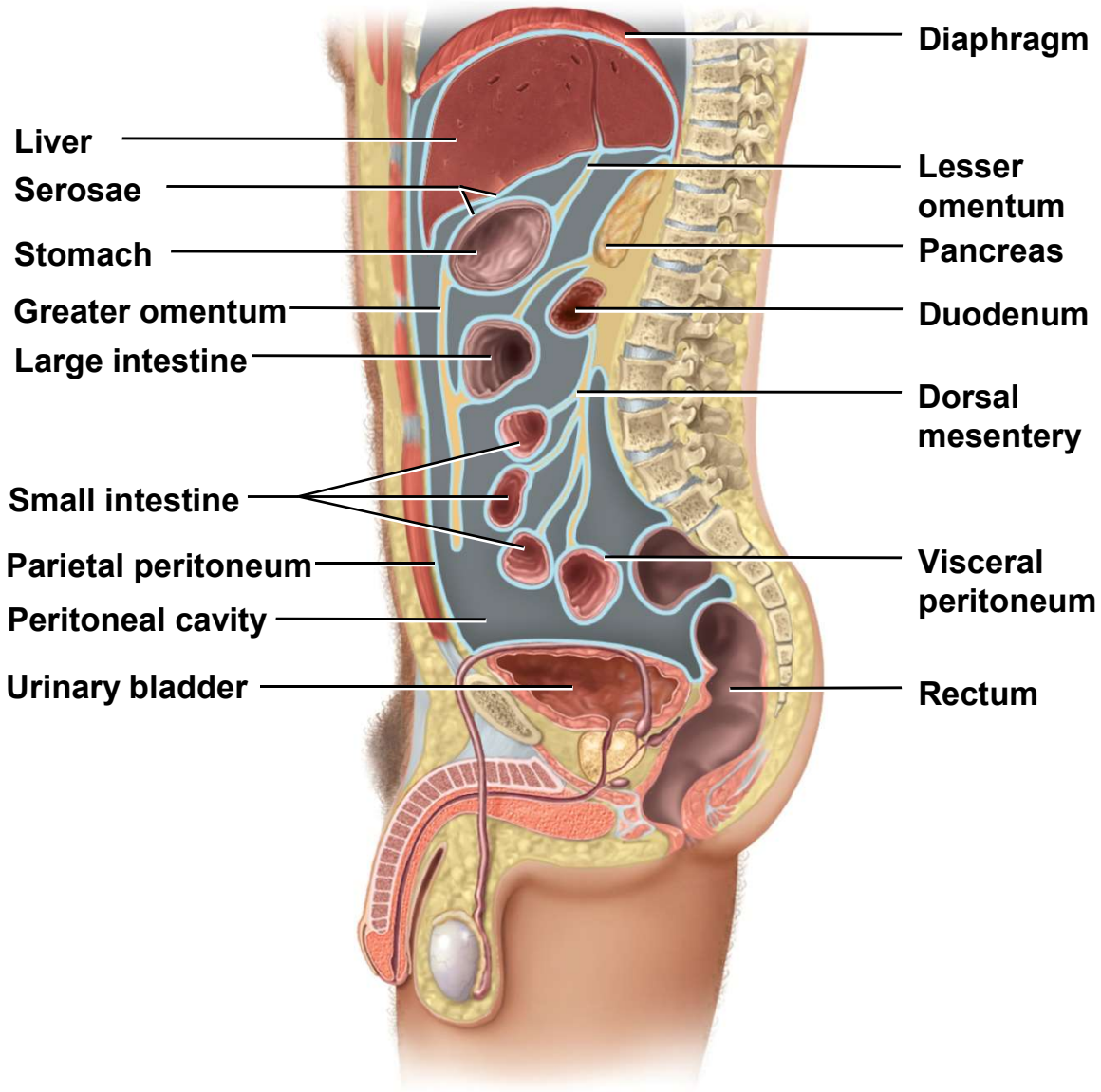
visceral peritoneum
parietal peritoneum
peritoneal cavity
peritoneal fluid

Intra-peritoneal Organs

Organs of the abdominal cavity are encircled by peritoneum and connected to posterior body wall by membranes

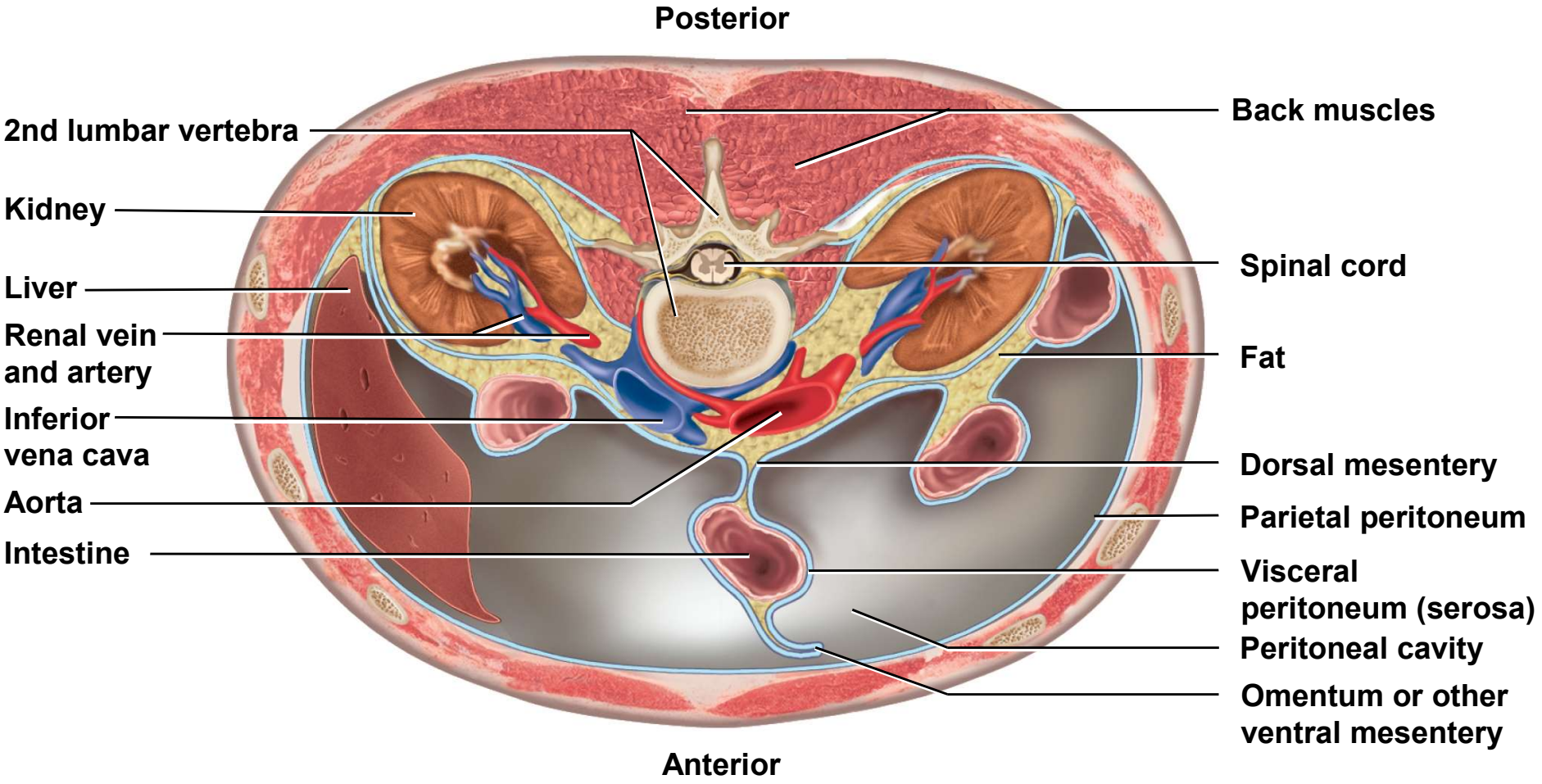
- **dorsal mesentery** – suspends intestines from posterior abdominal wall
- **mesocolon** – dorsal mesentery of large intestine
- **ventral mesentery** – suspends viscera from anterior abdominal wall // **greater omentum** – inferolateral border of stomach – overlies intestines - 'fatty apron' // **lesser omentum** – superomedial border of stomach to liver
- **serosa** – outer layer of an organ formed when the visceral peritoneum divides and wraps around the organ

Membranes of Abdominal Cavity



Retroperitoneal Organs

Describes position between muscles and parietal membranes.



Kidneys, Ureters, **Adrenal Glands,** most of **Pancreas**, Abdominal portions of **Aorta** and **Inferior Vena Cava**

Potential Spaces

- Found between two membranes normally pressed firmly together
  - not physically attached, may separate, and fill with fluid in unusual situations
- Examples
  - pleural cavity // air or fluid can accumulate between parietal and visceral pleura forming a space
  - uterus // in a non-pregnant uterus, mucous membranes of walls are in contact

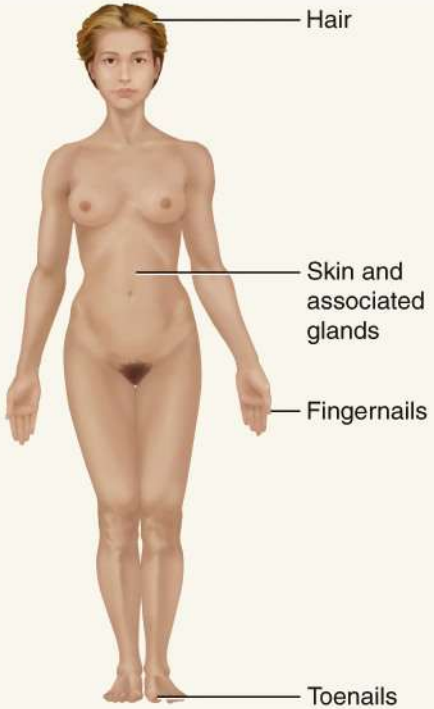
TABLE 1.2

The Eleven Systems of the Human Body

INTEGUMENTARY SYSTEM (CHAPTER 5)

Components: **Skin** and associated structures, such as **hair, fingernails** and **toenails, sweat glands**, and **oil glands**.

Functions: Protects body; helps regulate body temperature; eliminates some wastes; helps make vitamin D; detects sensations such as touch, pain, warmth, and cold; stores fat and provides insulation.



SKELETAL SYSTEM (CHAPTERS 6–9)

Components: **Bones** and **joints** of the body and their associated **cartilages.**

Functions: Supports and protects body; provides surface area for muscle attachments; aids body movements; houses cells that produce blood cells; stores minerals and lipids (fats).

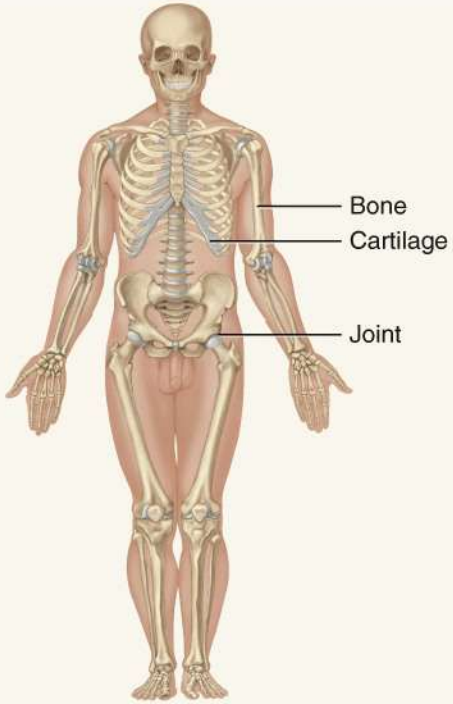


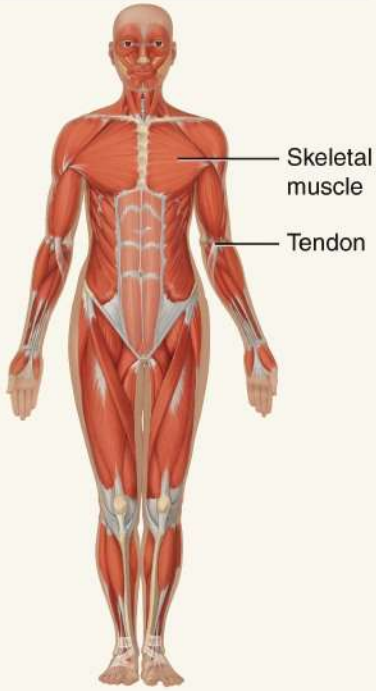
TABLE 1.2

The Eleven Systems of the Human Body

MUSCULAR SYSTEM (CHAPTERS 10, 11)

Components: Specifically, **skeletal muscle** tissue—muscle usually attached to bones (other muscle tissues include smooth and cardiac).

Functions: Participates in body movements, such as walking; maintains posture; produces heat.



NERVOUS SYSTEM (CHAPTERS 12–17)

Components: **Brain, spinal cord, nerves**, and special sense organs, such as **eyes** and **ears**.

Functions: Generates action potentials (nerve impulses) to regulate body activities; detects changes in body's internal and external environments, interprets changes, and responds by causing muscular contractions or glandular secretions.

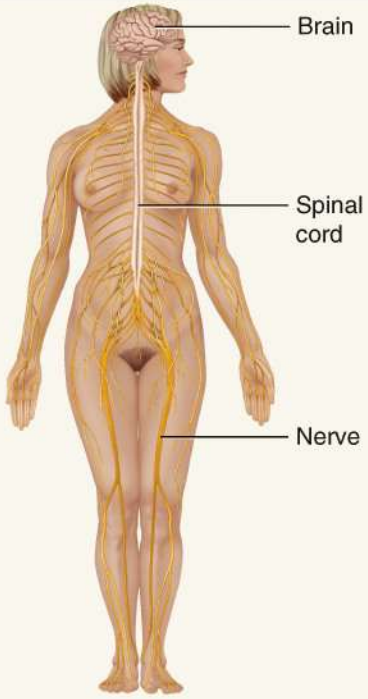


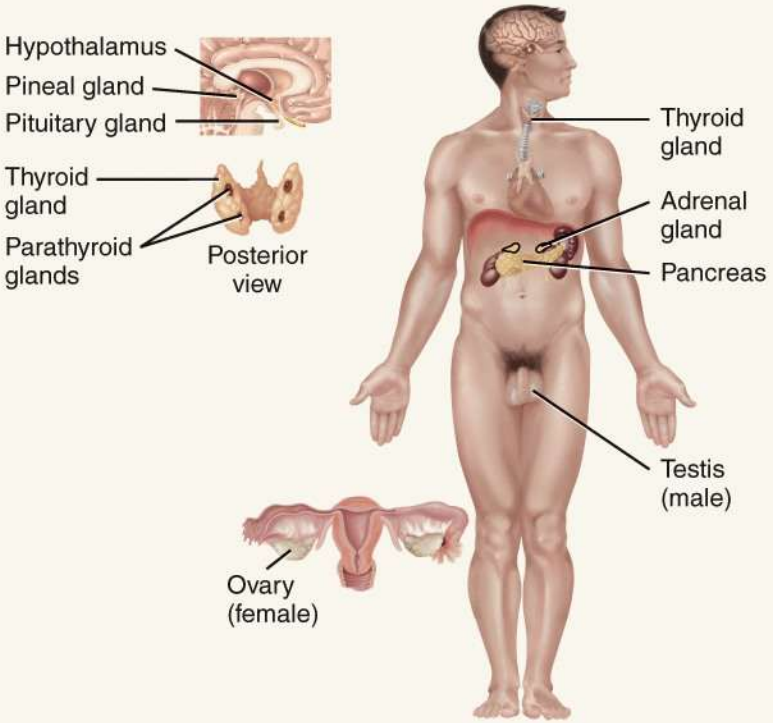
TABLE 1.2 CONTINUED

The Eleven Systems of the Human Body

ENDOCRINE SYSTEM (CHAPTER 18)

Components: Hormone-producing glands **(pineal gland, hypothalamus, pituitary gland, thymus, thyroid gland, parathyroid glands, adrenal glands, pancreas, ovaries**, and **testes)** and hormone-producing cells in several other organs.

Functions: Regulates body activities by releasing hormones (chemical messengers transported in blood from endocrine gland or tissue to target organ).



CARDIOVASCULAR SYSTEM (CHAPTERS 19–21)

Components: **Blood, heart**, and **blood vessels**.

Functions: Heart pumps blood through blood vessels; blood carries oxygen and nutrients to cells and carbon dioxide and wastes away from cells and helps regulate acid–base balance, temperature, and water content of body fluids; blood components help defend against disease and repair damaged blood vessels.

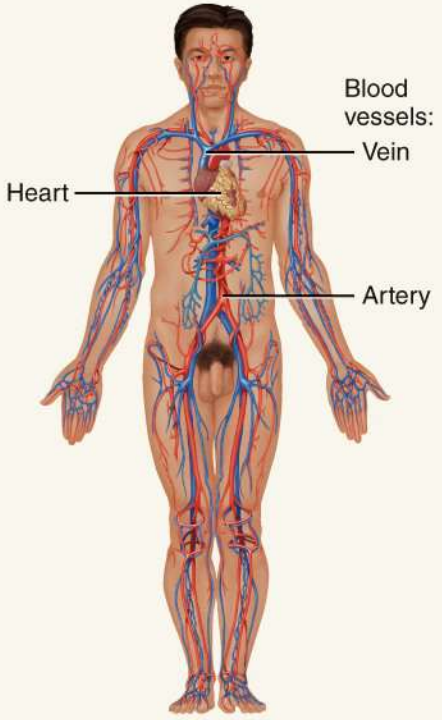


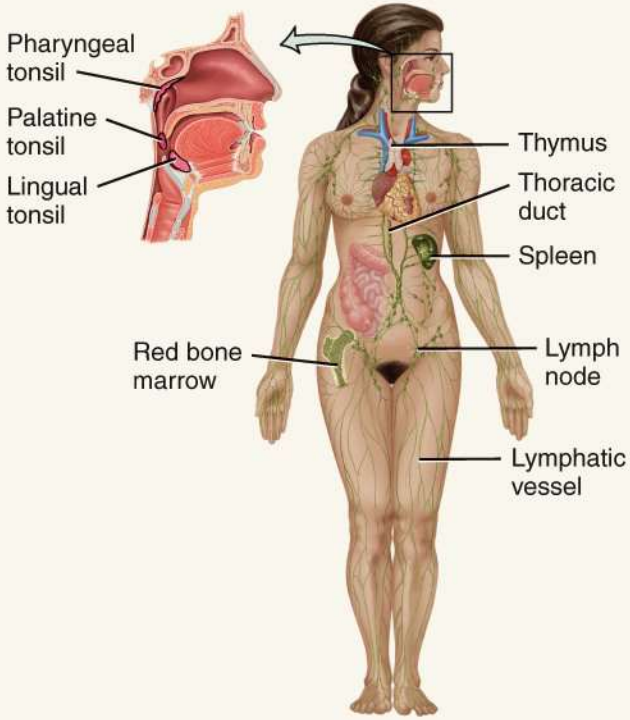
TABLE 1.2 CONTINUED

The Eleven Systems of the Human Body

LYMPHATIC SYSTEM AND IMMUNITY (CHAPTER 22)

Components: **Lymphatic fluid** and **vessels; spleen, thymus, lymph nodes,** and **tonsils**; cells that carry out immune responses (**B cells, T cells**, and others).

Functions: Returns proteins and fluid to blood; carries lipids from gastrointestinal tract to blood; contains sites of maturation and proliferation of B cells and T cells that protect against disease-causing microbes.



RESPIRATORY SYSTEM (CHAPTER 23)

Components: **Lungs** and air passageways such as the **pharynx** (throat), **larynx** (voice box), **trachea** (windpipe), and **bronchial tubes** leading into and out of lungs.

Functions: Transfers oxygen from inhaled air to blood and carbon dioxide from blood to exhaled air; helps regulate acid–base balance of body fluids; air flowing out of lungs through vocal cords produces sounds.

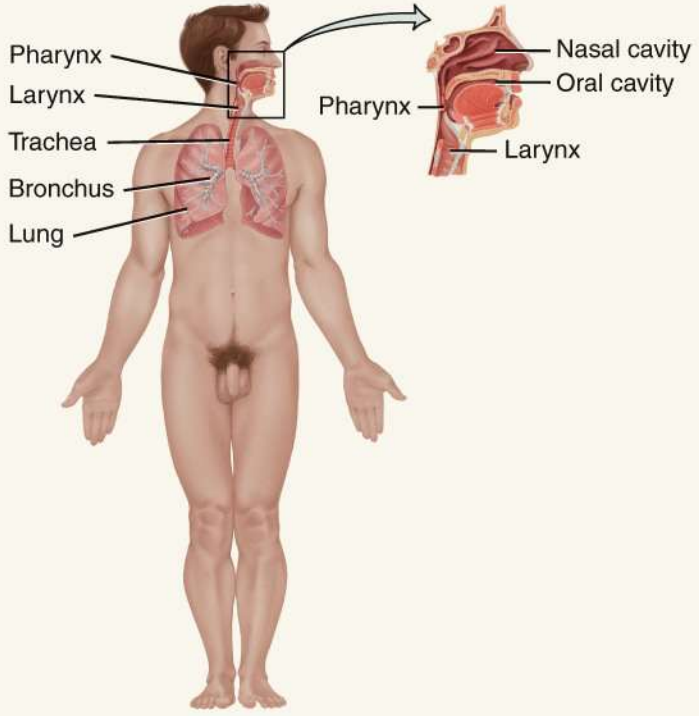


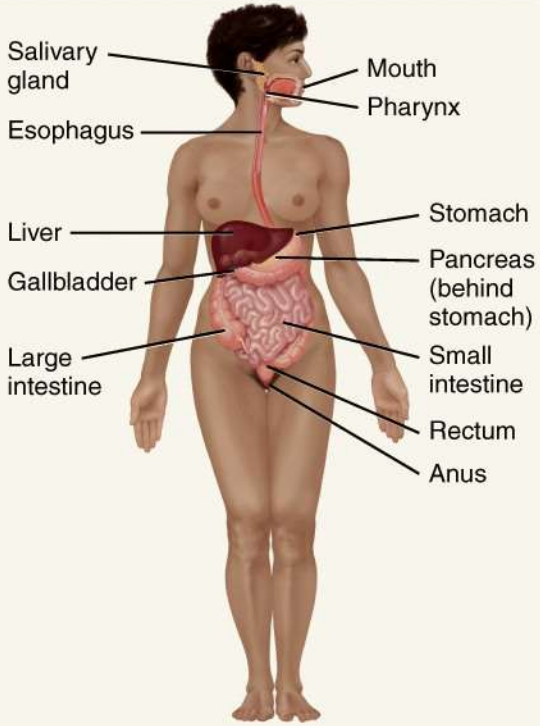
TABLE 1.2 CONTINUED

The Eleven Systems of the Human Body

DIGESTIVE SYSTEM (CHAPTER 24)

Components: Organs of gastrointestinal tract, a long tube that includes the **mouth, pharynx** (throat), **esophagus** (food tube), **stomach, small** and **large intestines**, and **anus**; also includes accessory organs that assist in digestive processes, such as **salivary glands, liver, gallbladder**, and **pancreas**.

Functions: Achieves physical and chemical breakdown of food; absorbs nutrients; eliminates solid wastes.



URINARY SYSTEM (CHAPTER 26)

Components: **Kidneys, ureters, urinary bladder**, and **urethra**.

Functions: Produces, stores, and eliminates urine; eliminates wastes and regulates volume and chemical composition of blood; helps maintain the acid–base balance of body fluids; maintains body's mineral balance; helps regulate production of red blood cells.

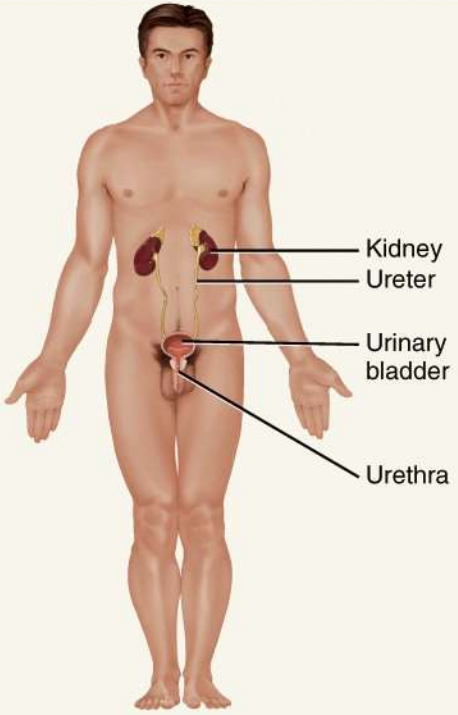


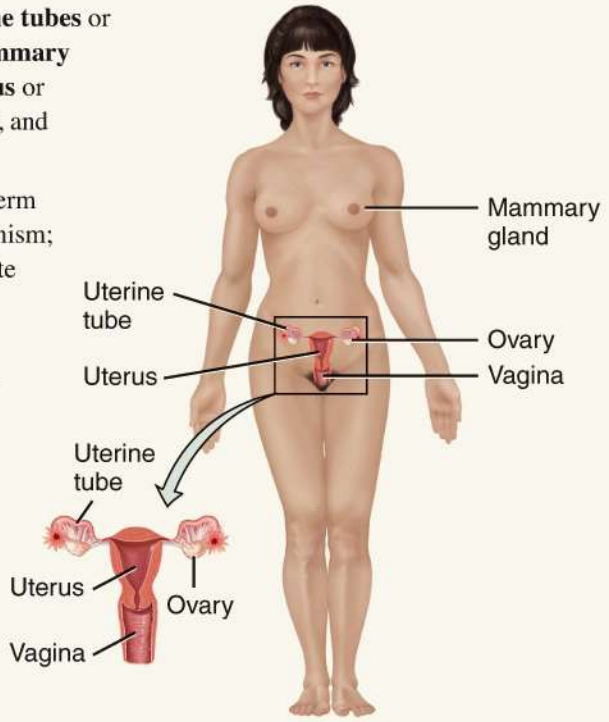
TABLE 1.2 CONTINUED

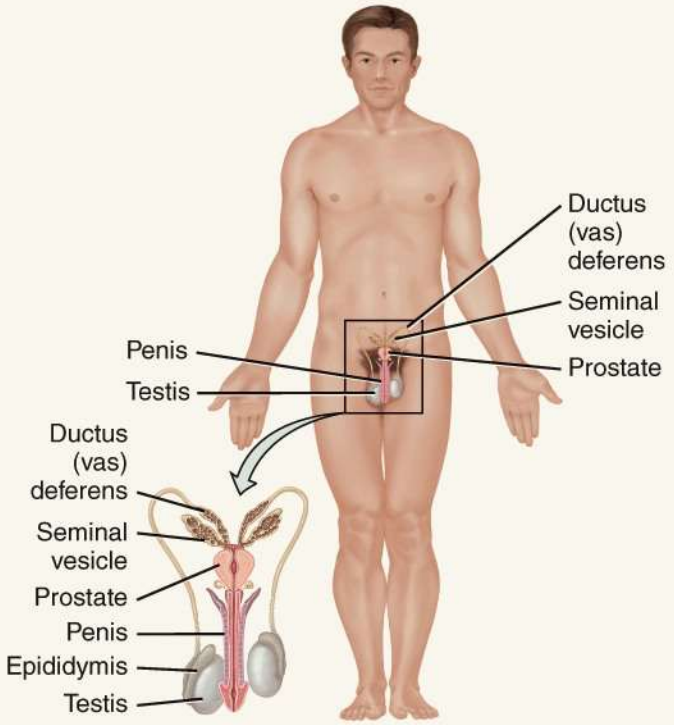
The Eleven Systems of the Human Body

REPRODUCTIVE SYSTEMS (CHAPTER 28)

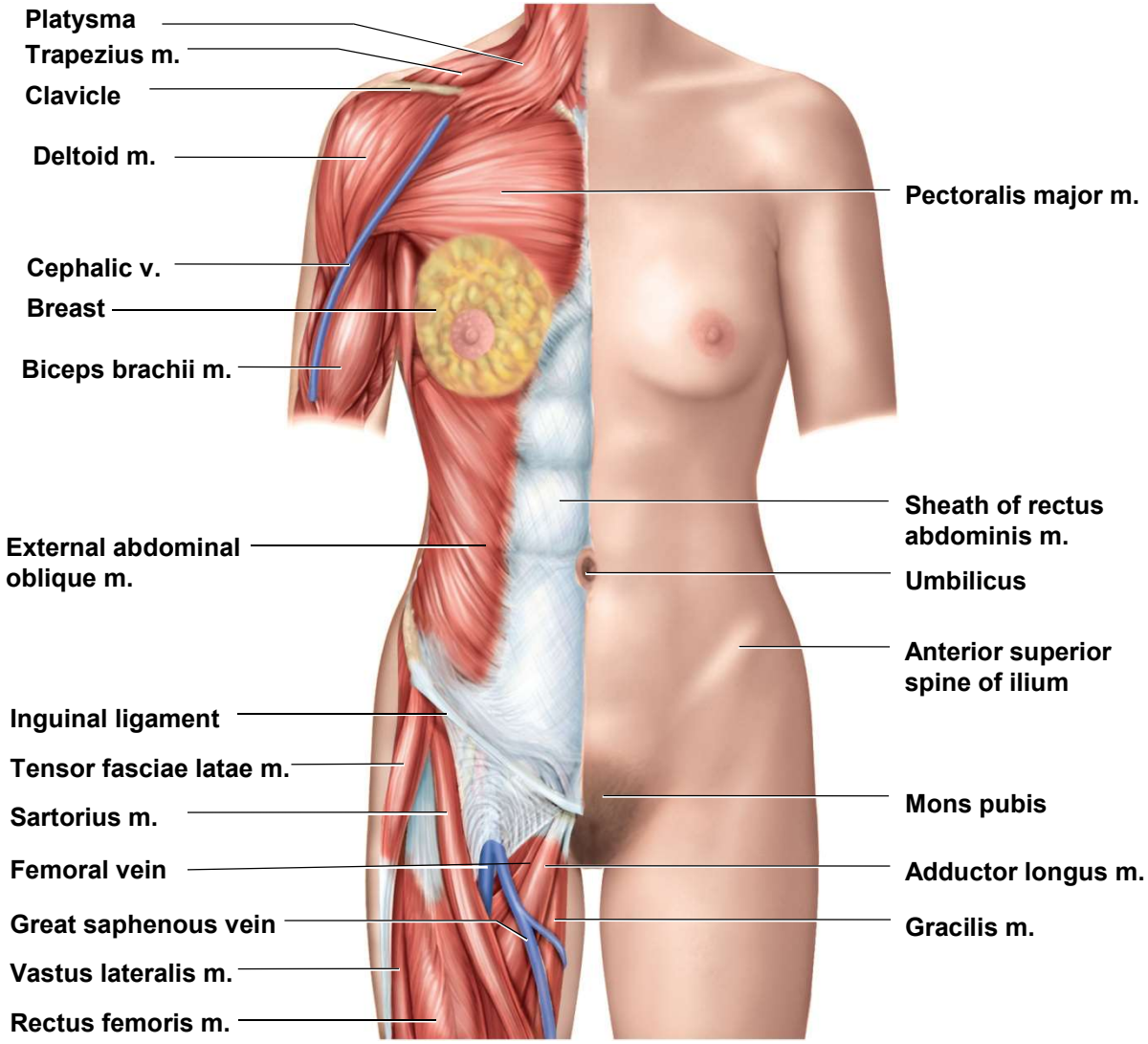
Components: **Gonads** (**testes** in males and **ovaries** in females) and associated organs (**uterine tubes** or *fallopian tubes*, **uterus, vagina**, and **mammary glands** in females and **epididymis, ductus** or **vas deferens, seminal vesicles, prostate**, and **penis** in males).

Functions: Gonads produce gametes (sperm or oocytes) that unite to form a new organism; gonads also release hormones that regulate reproduction and other body processes; associated organs transport and store gametes; mammary glands produce milk.

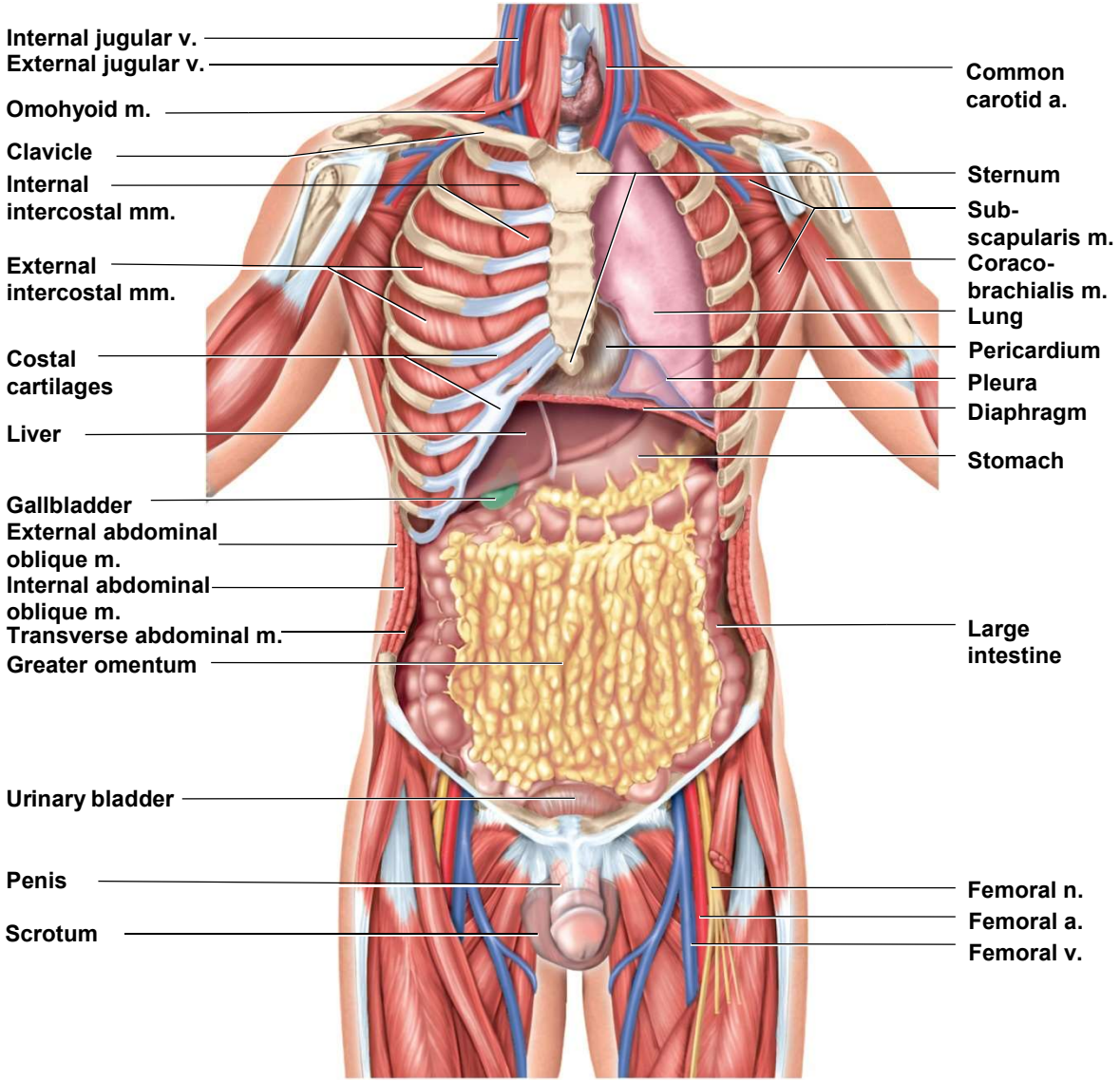




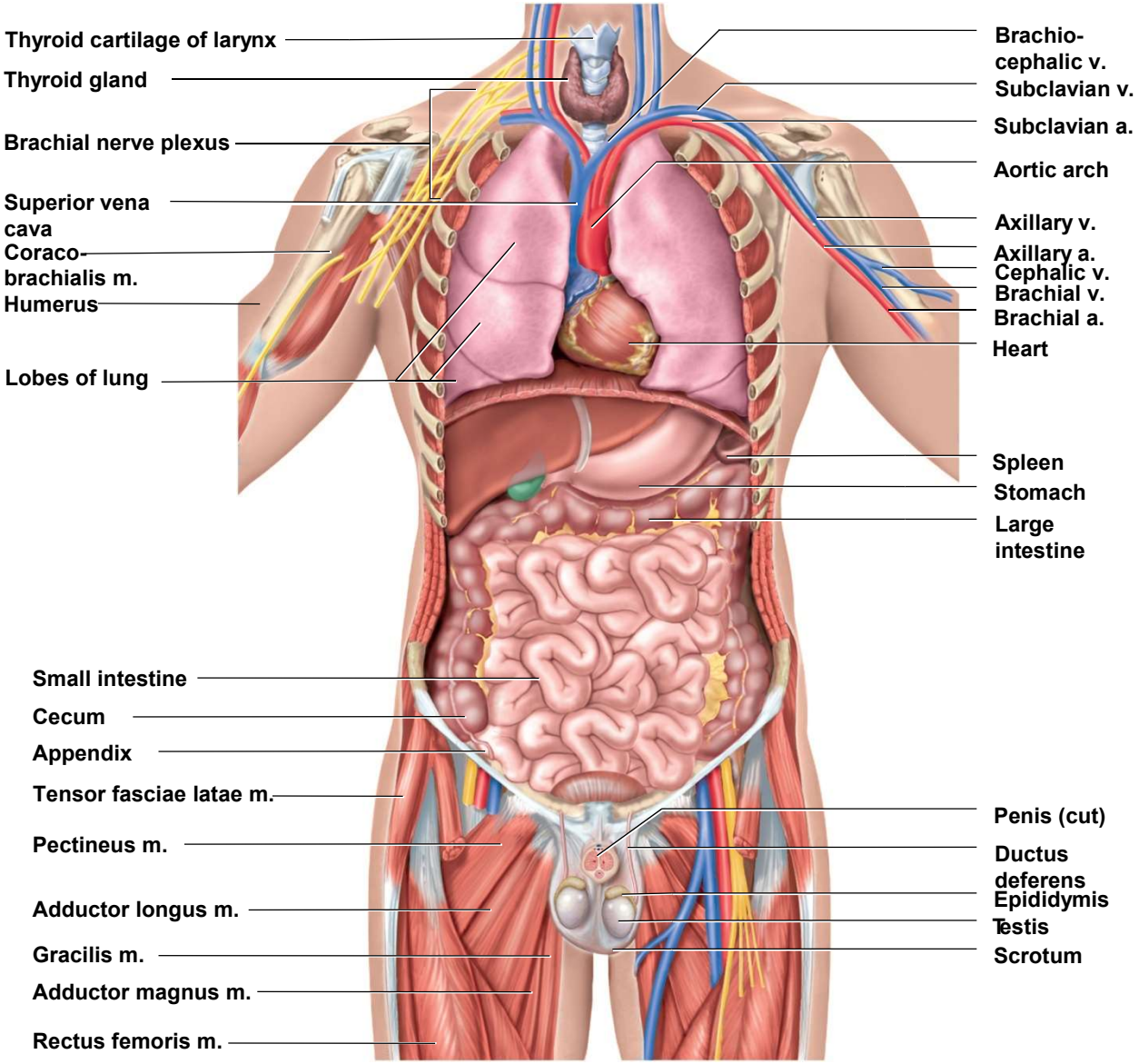
Superficial Anatomy (female)



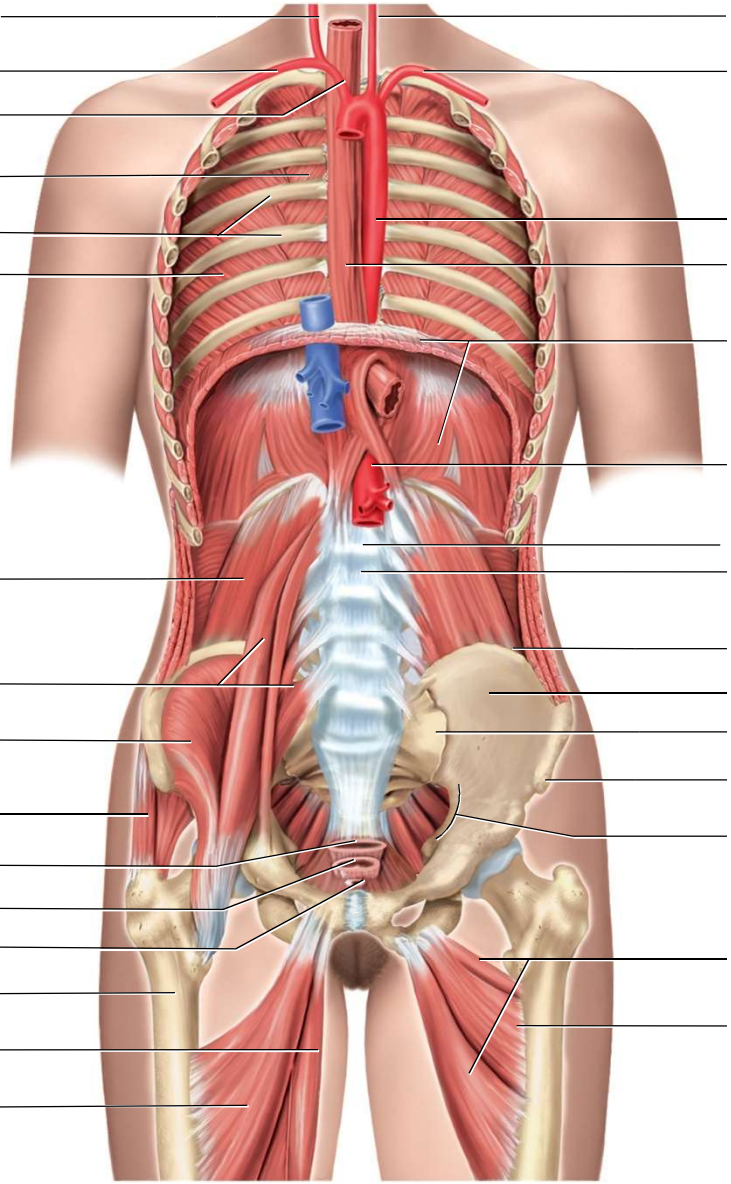
Visceral Anatomy (male) 1



Visceral Anatomy (male) 2



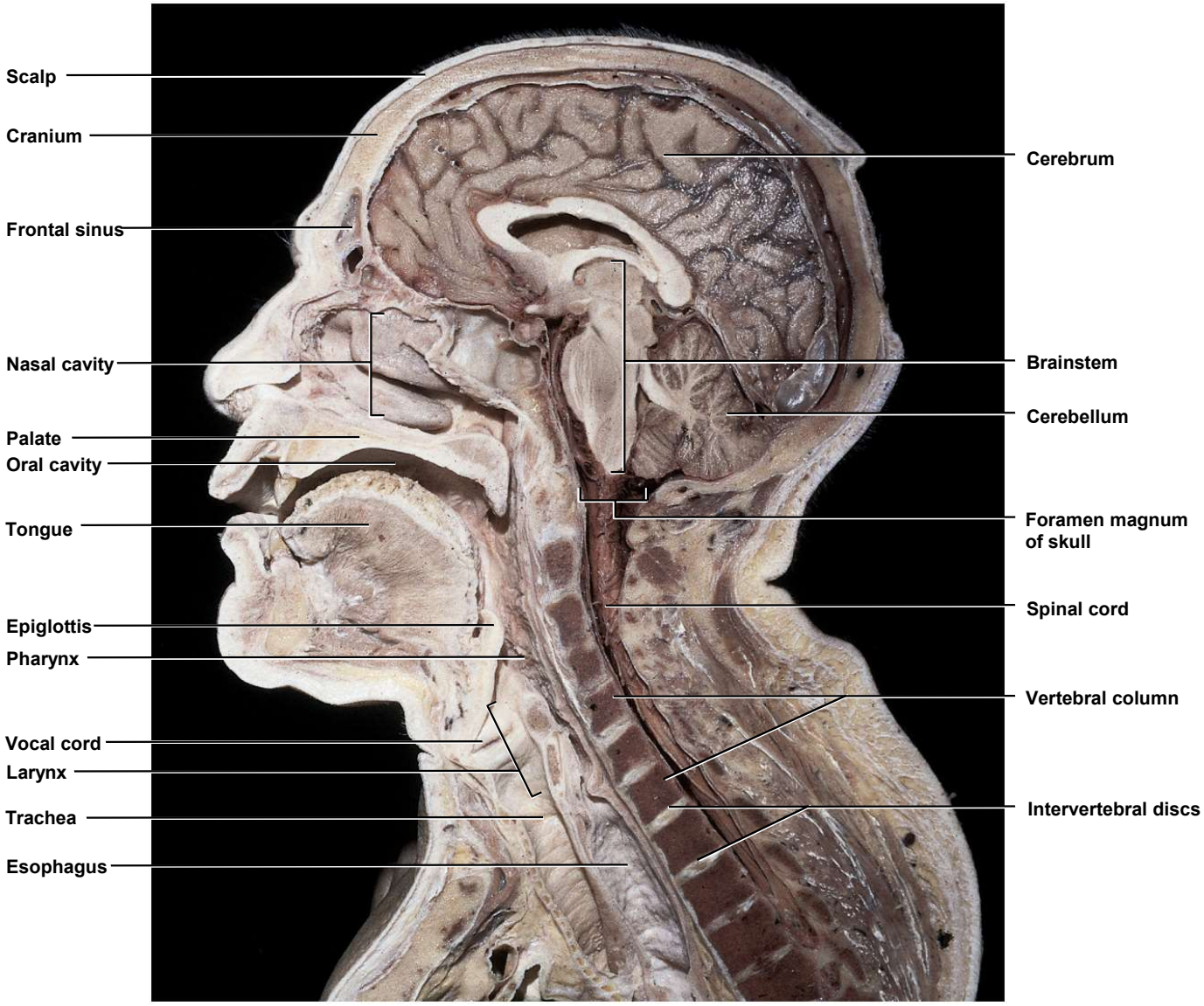
Dorsal Body Wall (female)



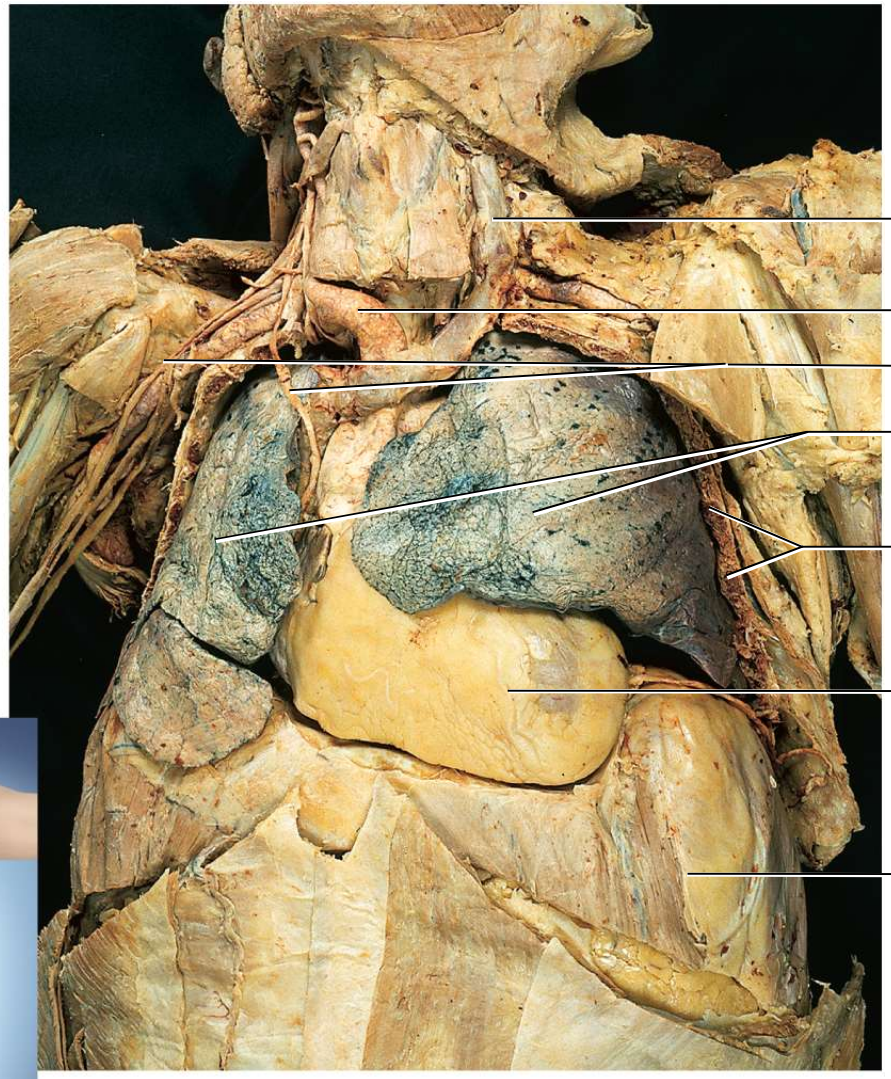
Right common carotid a.
Right subclavian a.
Brachiocephalic trunk
External intercostal m.
Ribs
Internal intercostal m.
Quadratus lumborum m.
Psoas major m.
Iliacus m.
Gluteus medius m.
Rectum
Vagina
Urethra
Femur
Gracilis m.
Adductor longus m.

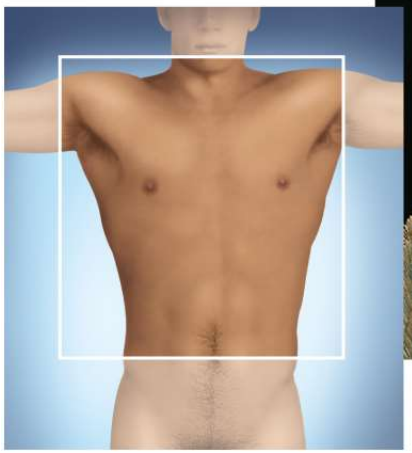
Left common carotid a.
Left subclavian a.
Thoracic aorta
Esophagus
Diaphragm
Abdominal aorta
Intervertebral disc
Lumbar vertebra
Iliac crest
Ilium
Sacrum
Anterior superior spine of ilium
Brim of pelvis
Adductor magnus m.
Adductor brevis m.

Median Section of the Head

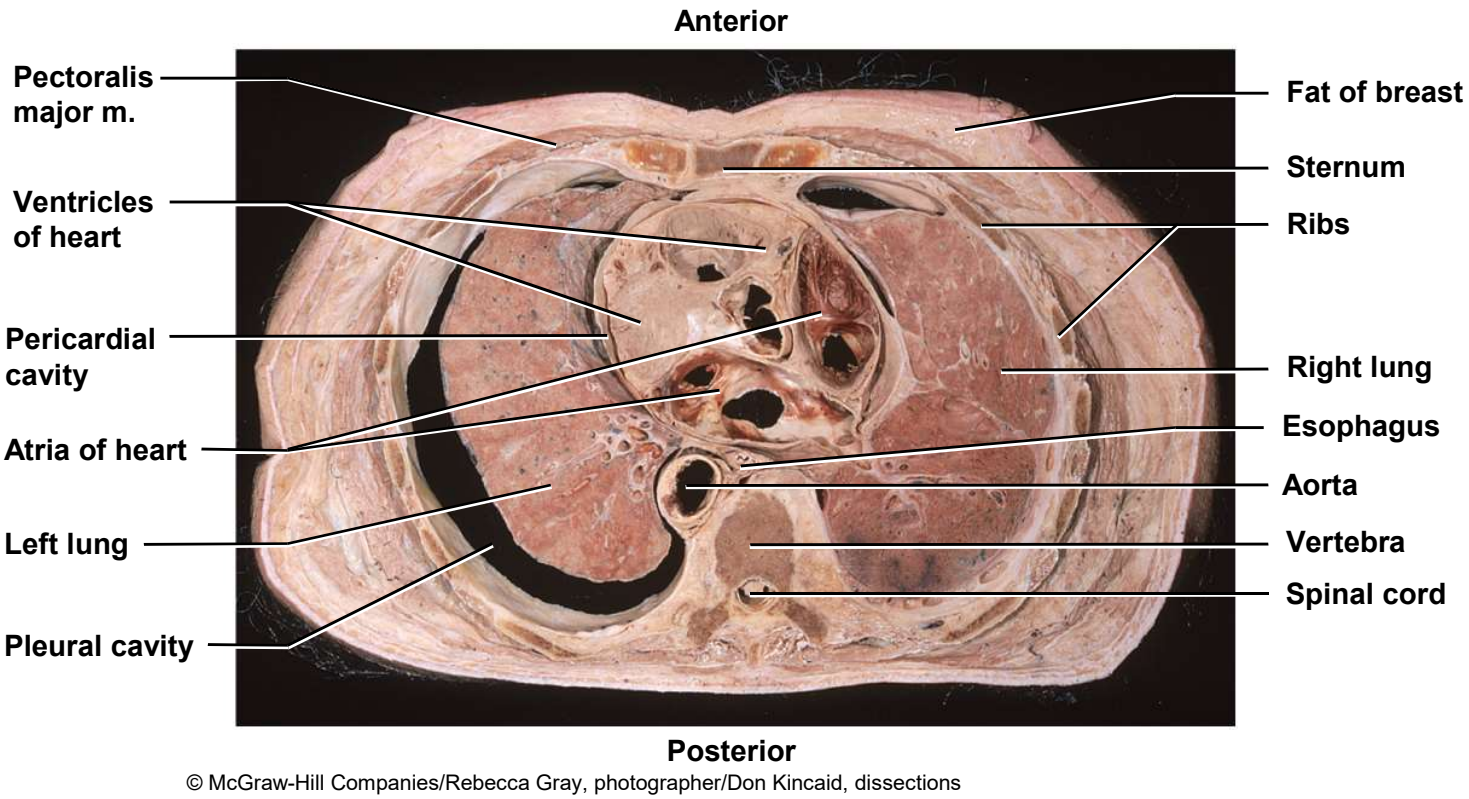


Dissection of Thoracic Cavity

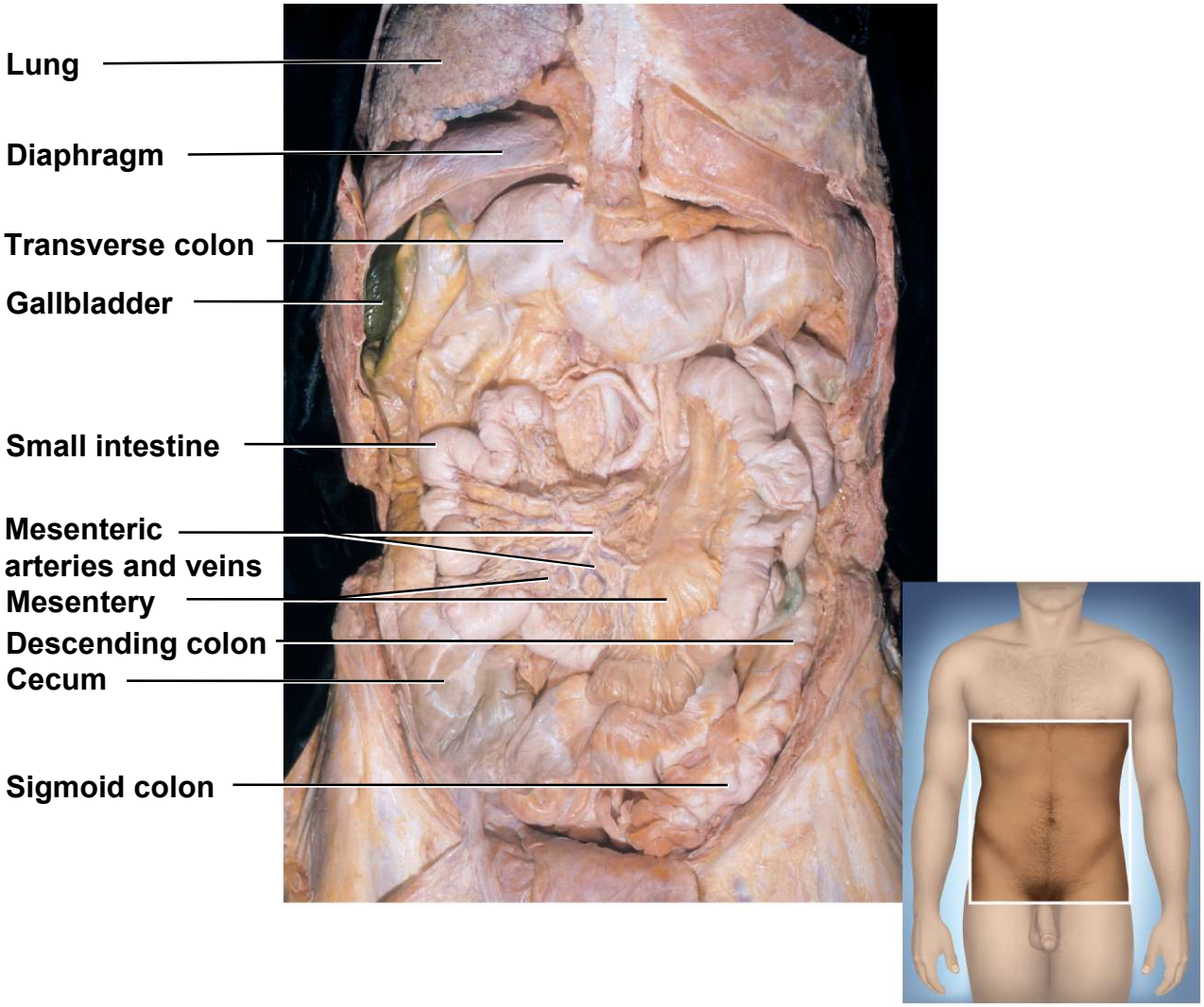




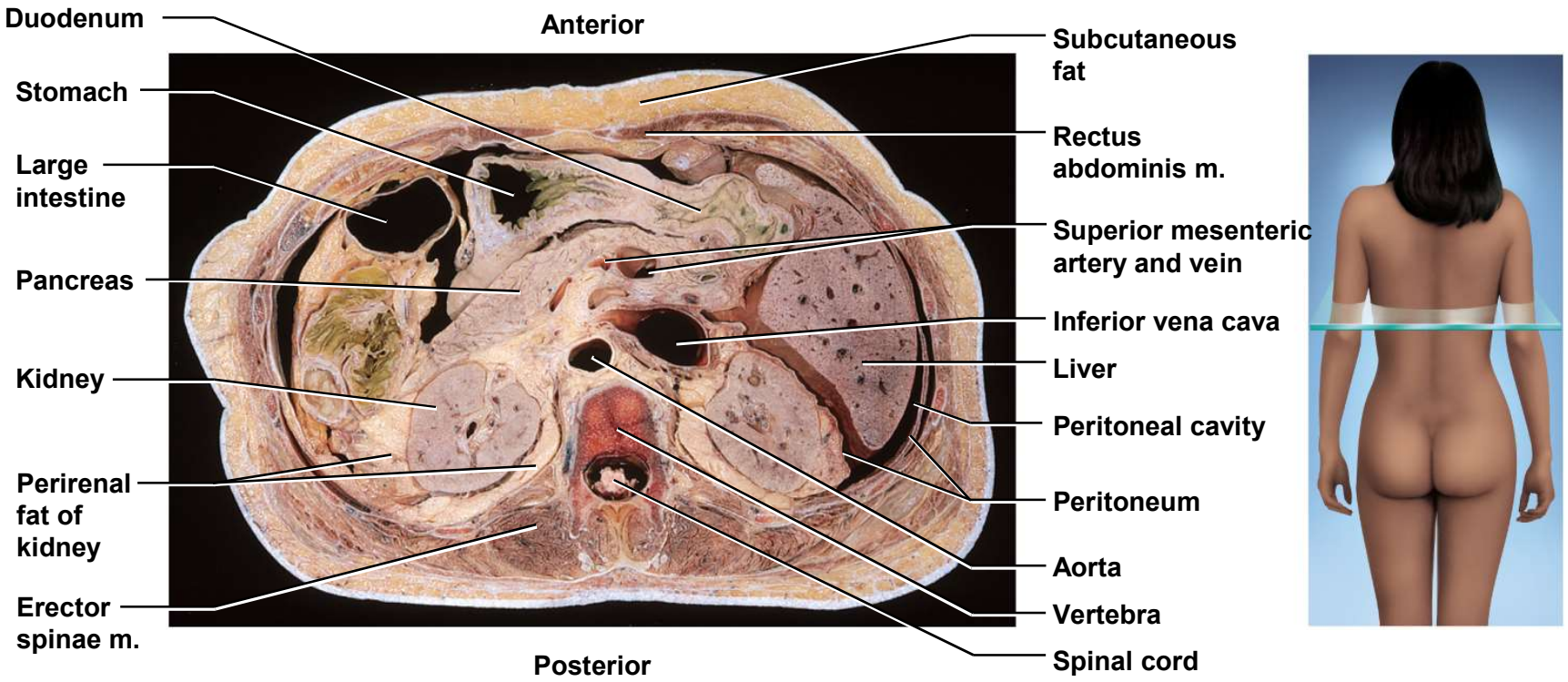
Transverse Section of Thorax



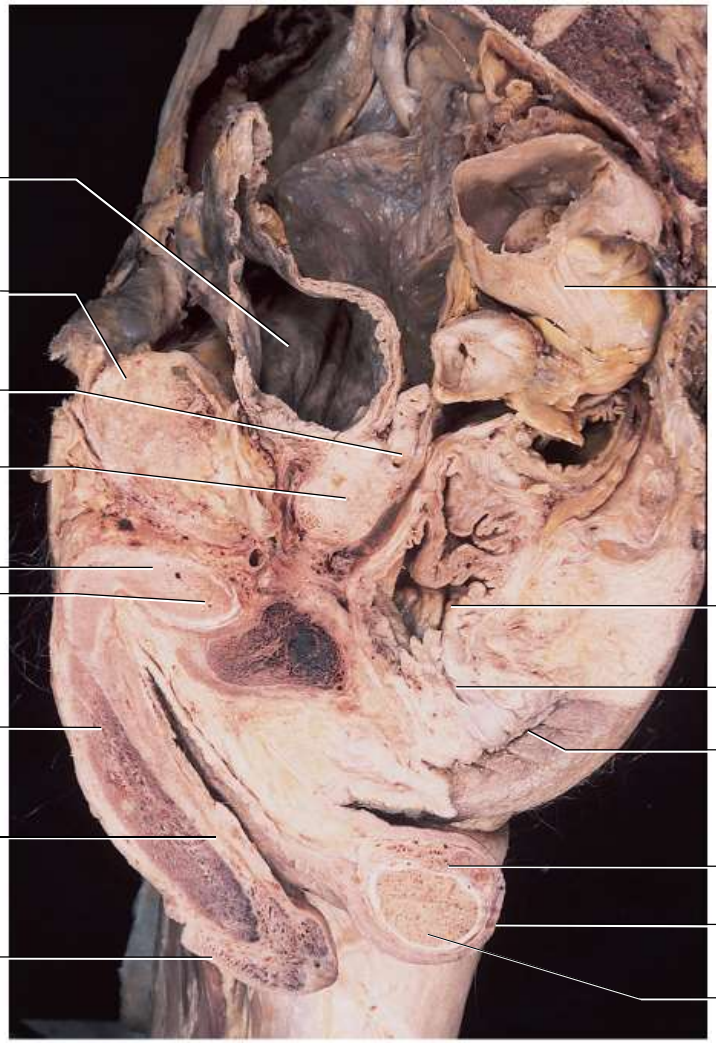
Dissection of Abdomen



Transverse Section of Abdomen

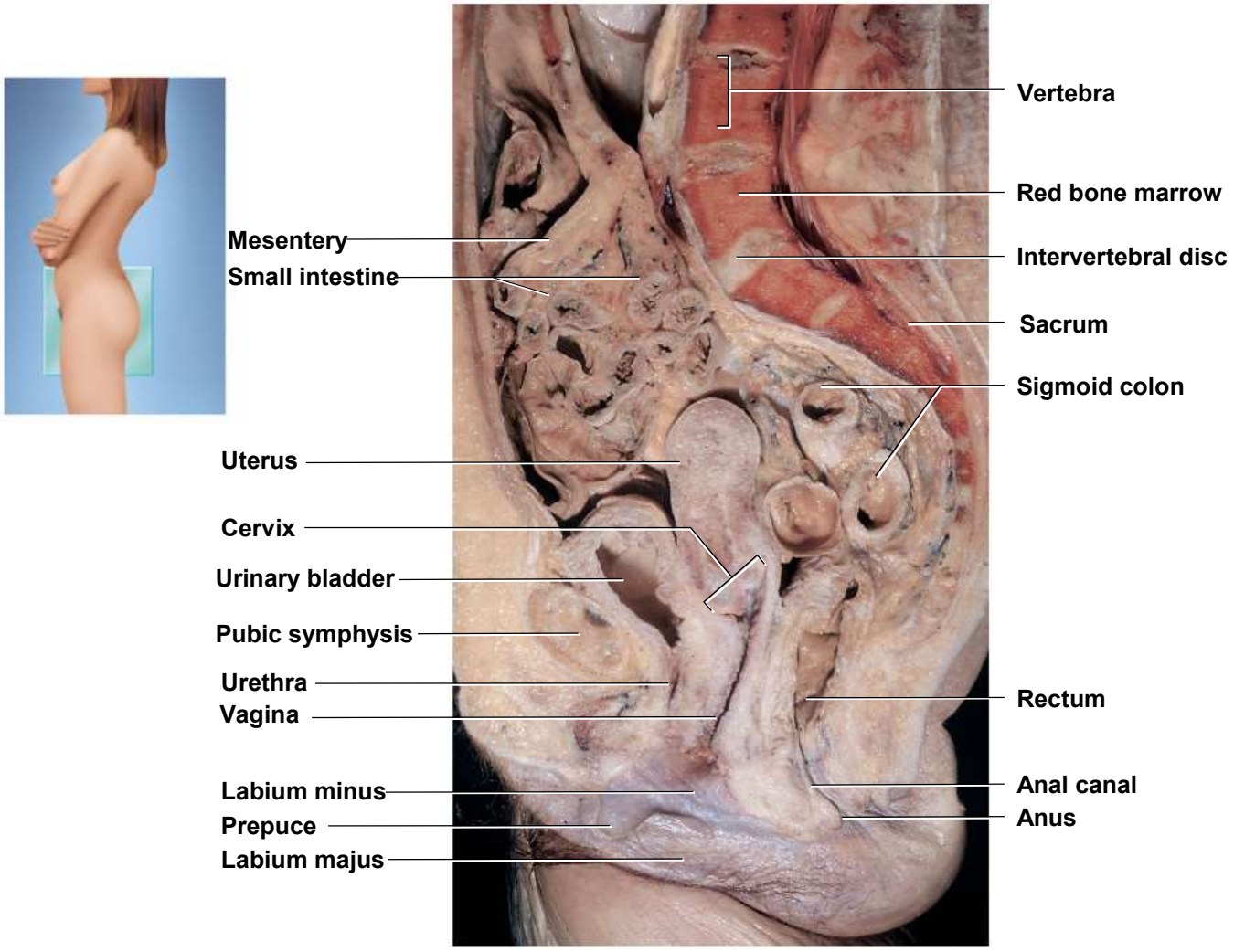


Median Section of Male Pelvic Region



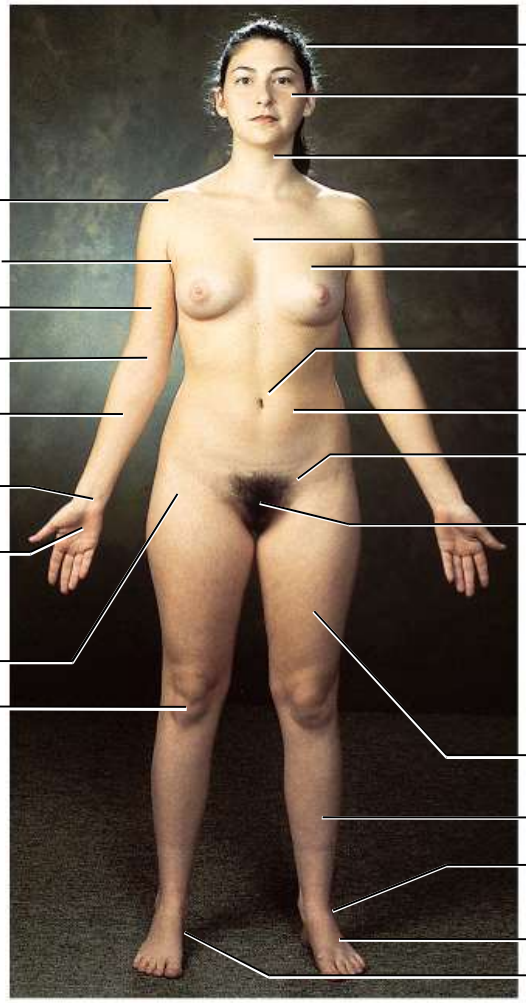
(a) Male

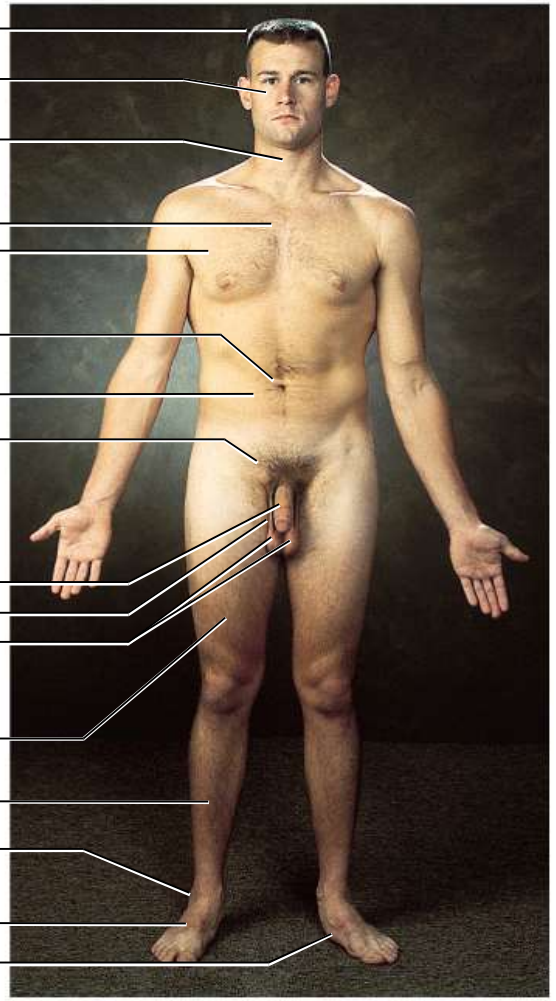
Median Section of Female Pelvic Region



(b) Female

Anatomical Terminology (ventral)





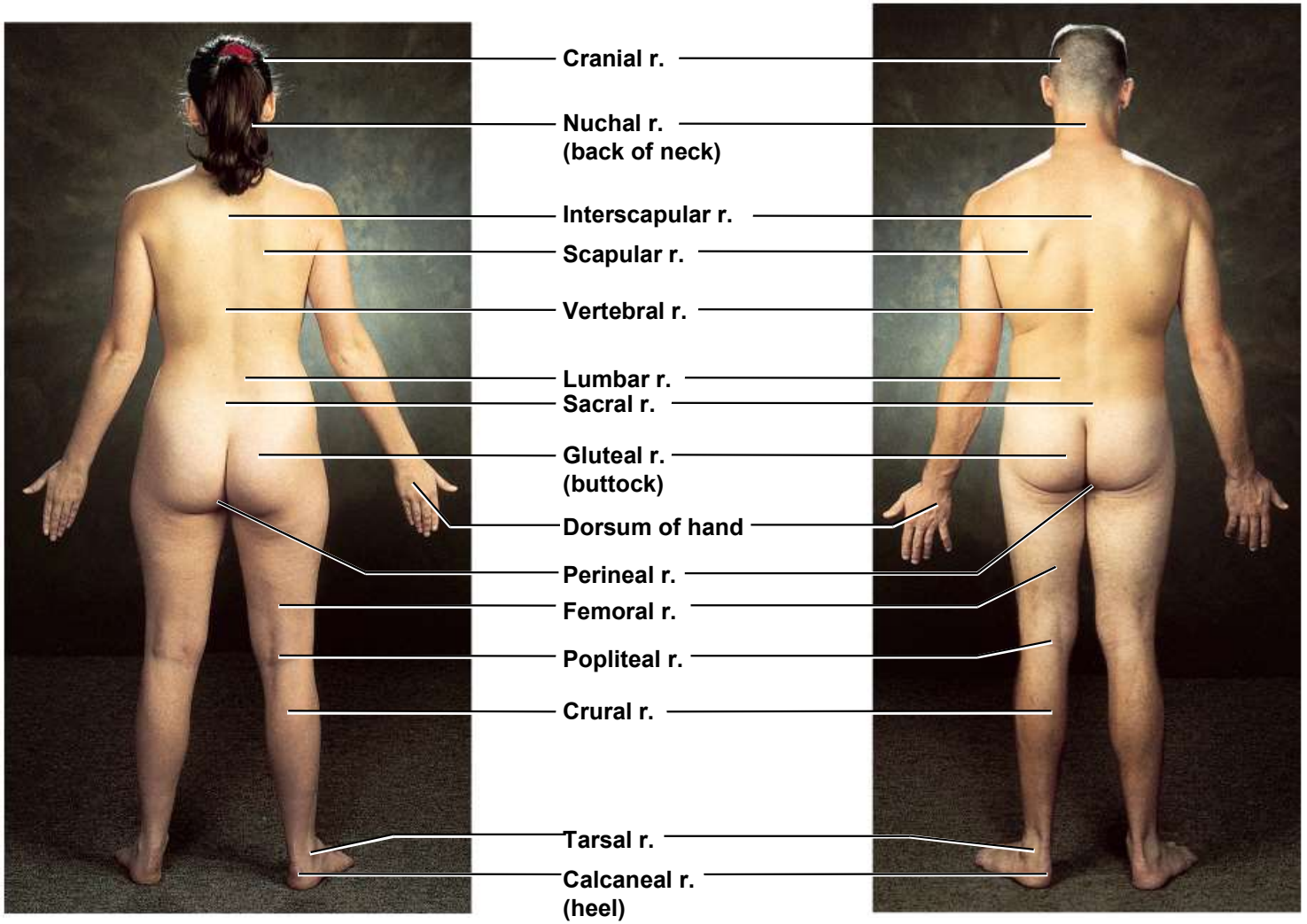
Upper limb:
Acromial r. (shoulder)
Axillary r. (armpit)
Brachial r. (arm)
Cubital r. (elbow)
Antebrachial r. (forearm)
Carpal r. (wrist)
Palmar r. (palm)
Lower limb:
Coxal r. (hip)
Patellar r. (knee)

Cephalic r. (head)
Facial r. (face)
Cervical r. (neck)
Thoracic r. (chest):
Sternal r.
Pectoral r.
Umbilical r.
Abdominal r.
Inguinal r. (groin)
Pubic r.:
Mons pubis
External genitalia:
Penis
Scrotum
Testes
Lower limb:
Femoral r. (thigh)
Crural r. (leg)
Tarsal r. (ankle)
Pedal r. (foot):
Dorsum
Plantar surface (sole)

(a) Anterior (ventral)

(b) Anterior (ventral)

Anatomical Terminology (dorsal)



(c) Posterior (dorsal)

(d) Posterior (dorsal)

TABLE 1.1

Selected Branches of Anatomy and Physiology

BRANCH OF ANATOMY	STUDY OF
Embryology (em′-brē-OL-ō-jē; *embry-* = embryo; *-logy* = study of)	The first eight weeks of development after fertilization of a human egg.
Developmental biology	The complete development of an individual from fertilization to death.
Cell biology	Cellular structure and functions.
Histology (his-TOL-ō -jē; *hist-* = tissue)	Microscopic structure of tissues.
Gross anatomy	Structures that can be examined without a microscope.
Systemic anatomy	Structure of specific systems of the body such as the nervous or respiratory systems.
Regional anatomy	Specific regions of the body such as the head or chest.
Surface anatomy	Surface markings of the body to understand internal anatomy through visualization and palpation (gentle touch).
Imaging anatomy	Body structures that can be visualized with techniques such as x-rays, MRI, and CT scans.
Pathological anatomy (path′-ō-LOJ-i-kal; *path-* = disease)	Structural changes (gross to microscopic) associated with disease.

BRANCH OF PHYSIOLOGY	STUDY OF
Neurophysiology (NOOR-ō-fiz-ē-ol′-ō-jē; *neuro-* = nerve)	Functional properties of nerve cells.
Endocrinology (en′-dō-kri-NOL-ō-jē; *endo-* = within; *-crin* = secretion)	Hormones (chemical regulators in the blood) and how they control body functions.
Cardiovascular physiology (kar-dē-ō-VAS-kū-lar; *cardi-* = heart; *vascular* = blood vessels)	Functions of the heart and blood vessels.
Immunology (im′-ū-NOL-ō-jē; *immun-* = not susceptible)	The body's defenses against disease-causing agents.
Respiratory physiology (RES-pi-ra-tōr-ē; *respira-* = to breathe)	Functions of the air passageways and lungs.
Renal physiology (RĒ-nal; *ren-* = kidney)	Functions of the kidneys.
Exercise physiology	Changes in cell and organ functions due to muscular activity.
Pathophysiology (Path-ō-fiz-ē-ol′-ō-jē)	Functional changes associated with disease and aging.