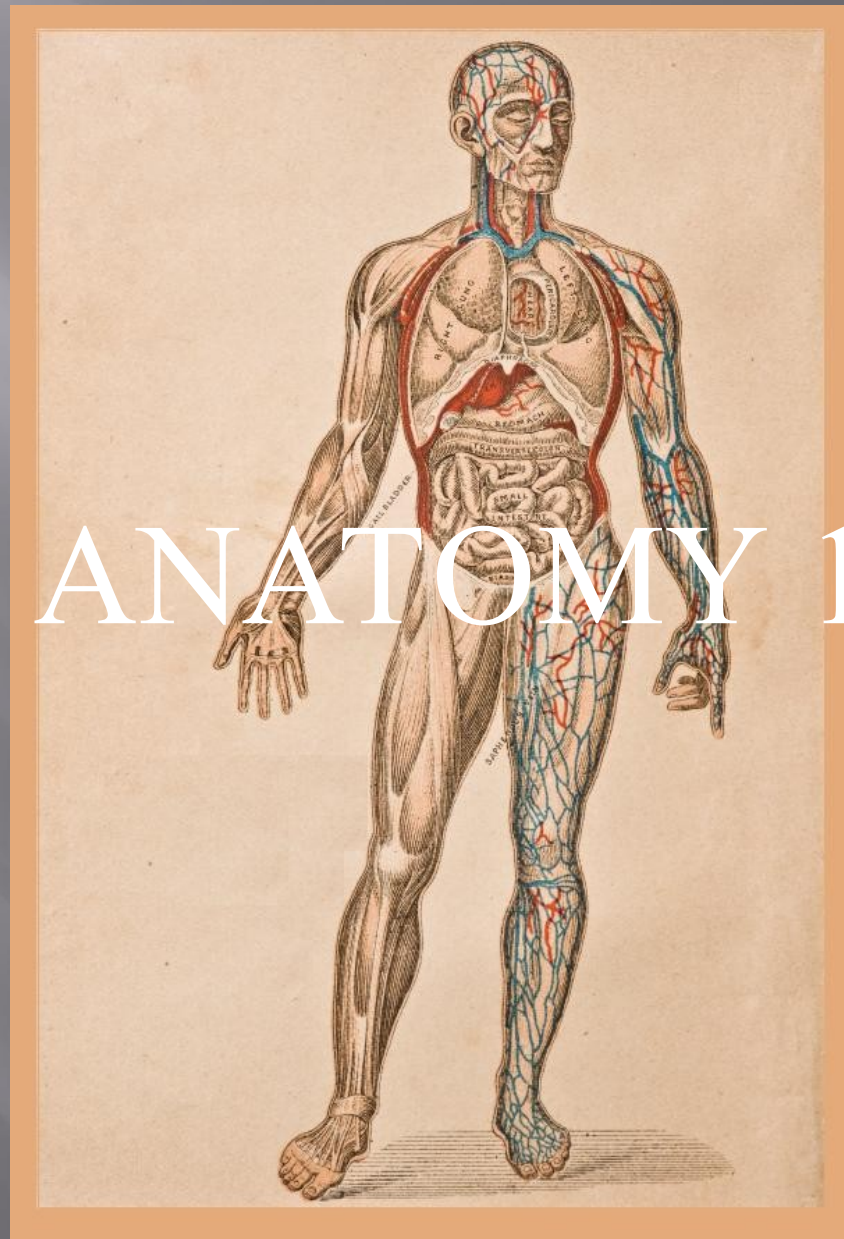




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COURSE OBJECTIVES:

- 1.To introduce the student to the **basic physical and chemical processes** as they apply to cellular structure and function manifested in organ systems and the entire human body.
- 2.To provide the student with a thorough understanding of the **structure of each system** of the human body.
- 3.To enable the student to **locate the structures** of the human body via a combination of visual, palpatory, and auscultatory skills.
- 4.To enable the student to **understand the anatomical and physiological basis of modern health care** by introducing abnormal or pathological conditions for consideration.

Wiley E-Text

Principles of Human Anatomy, 13th Edition

ISBN : 978-1-118-83380-3

984 pages October 2013, ©2014

Loose-leaf

Principles of Human Anatomy, 13th Edition Binder Ready Version

ISBN : 978-1-118-34441-5

984 pages October 2013, ©2014

Hardcover

Principles of Human Anatomy, 13th Edition

ISBN : 978-1-118-34499-6

984 pages October 2013, ©2014

You may also want to get a “colouring” atlas or cue cards.

OTHER HELPFUL TEXTS:

Netter, F. (2010). *Atlas of human anatomy* (5th ed.). Ciba-Geigy Corporation.

Sherwood, L. (2008). *Human physiology* (7th ed.). Brooks Cole.

Chaitow, L. (1997). *Palpations skills: Assessment and diagnosis through touch*. Churchill Livingstone.

Callison, Matt (2007) *The Motor Point Index: An Acupuncturist's Guide to Locating and Treating Motor Points*, AcuSport Seminar Series LLC. San Diego, CA.



1.1 Anatomy Defined

WHAT IS ANATOMY?

Anatomy is the study of the body **structures** and the **relationships** among these structures.

What is Physiology?

Physiology is the study of **functions** of body structures.

STRUCTURE



FUNCTION



YIN

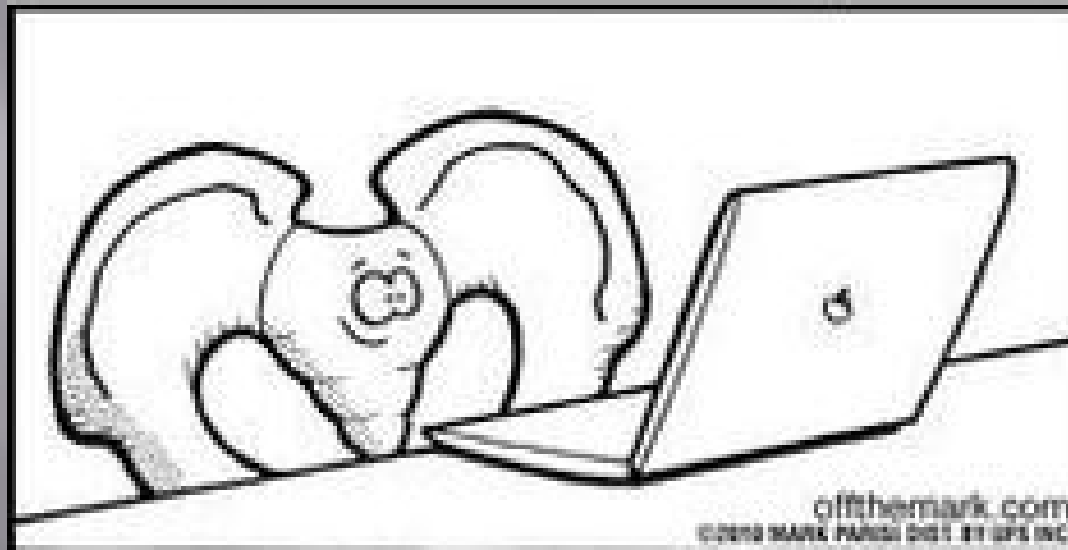
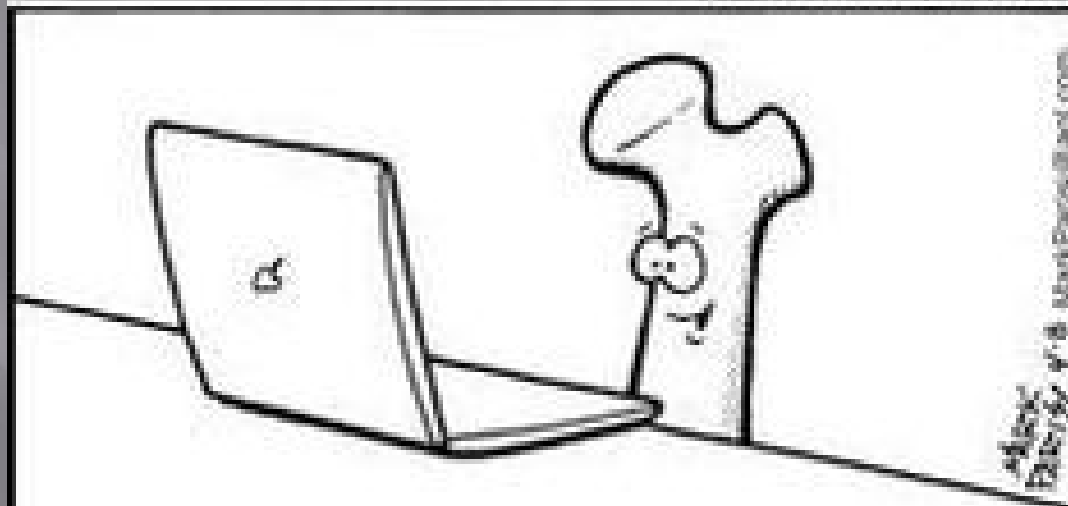


YANG

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Where do we start?

R.BISHAY



THE HIP BONE'S CONNECTED
TO THE THIGH BONE

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EVERYTHING IS CONNECTED!!!!!!

There are several ways to approach the study of
ANATOMY and PHYSIOLOGY.

- **Regional Anatomy (*Topographical*)**
- **Systemic Anatomy**
- **Clinical Anatomy (*Applied Anatomy*)**
- **Surface Anatomy**
- **Radiographic, Sectional, & Endoscopic Anatomy**

The anatomy of the human body can be studied at various levels of structural organization, ranging from

microscopic (visible only with the aid of a microscope)

to

macroscopic (visible without the use of a microscope).

These levels and the different methods used to study them provide the basis for the branches of anatomy, several of which are described in Table 1.1.

TABLE 1.1**Selected Branches of Anatomy**

BRANCH	STUDY OF
Embryology (em'-brē-OL-ō-jē; <i>embry</i> =embryo; <i>-logy</i> =study of)	In humans, the first eight weeks of development after fertilization of the egg
Developmental biology	The complete developmental history of an individual from fertilization to death
Cell biology	Cellular structure and function
Histology (his'-TOL-ō-jē-; <i>hist</i> =tissue)	Microscopic structure of tissues
Sectional anatomy	Internal structure and relationships of the body through the use of sections
Gross anatomy	Structures that can be examined without using 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 the relationships of deep or internal anatomy through visualization and palpation (gentle touch)
Imaging anatomy	Body structures that can be visualized with x-rays, CT scans, MRI, and so on
Pathological anatomy (path'-ō-LOJ-i-kal; <i>path</i> =disease)	Structural changes (from gross to microscopic) associated with disease

NON-INVASIVE DIAGNOSTIC TECHNIQUES



(A) Inspection of oral (mouth) cavity



(B) Palpation of lymph nodes in neck



(C) Auscultation of lungs



(D) Percussion of lungs

1.2 Levels of Body Organization

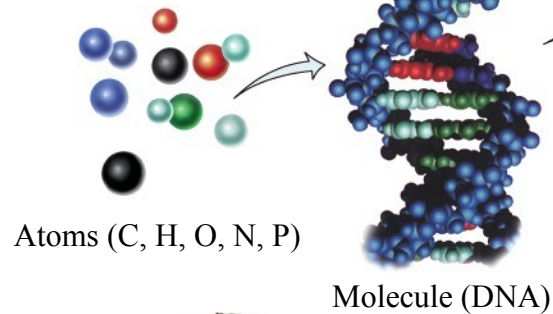
The human body consists of several interrelated levels of structural organization ranging from the least complex **chemical level** to the most complex **organismal level**.



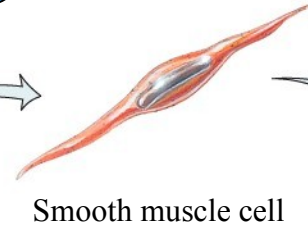
6 Levels of Structural Organization

LITERATURE	BODY
Letters/symbols	Chemicals
Words	Cells
Sentences	Tissues
Paragraphs	Organs
Chapters	Organ Systems
Book	Organism

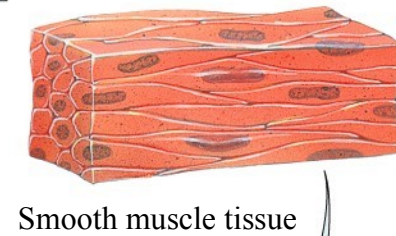
1 CHEMICAL LEVEL



2 CELLULAR LEVEL



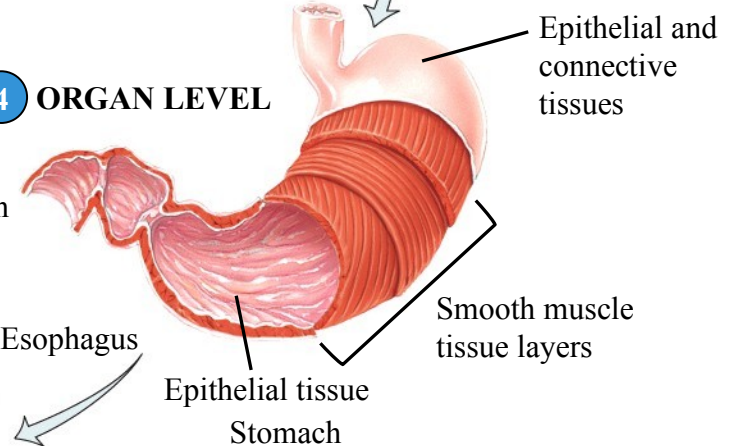
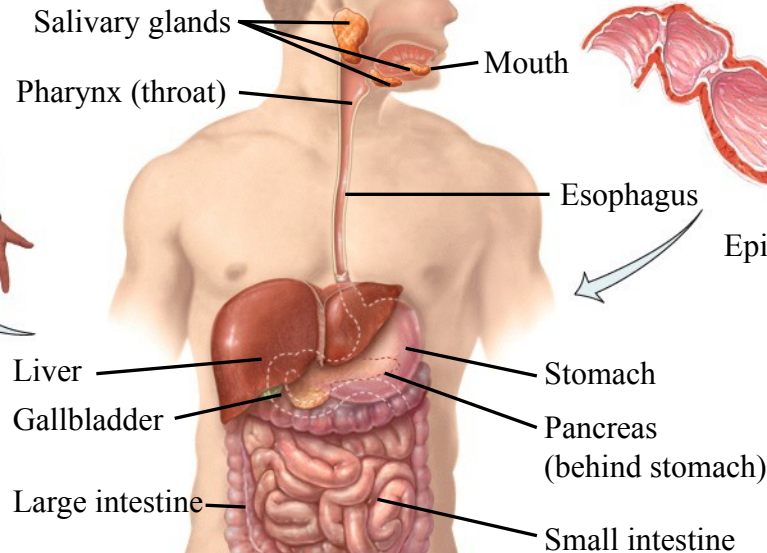
2 TISSUE LEVEL



5 SYSTEM LEVEL

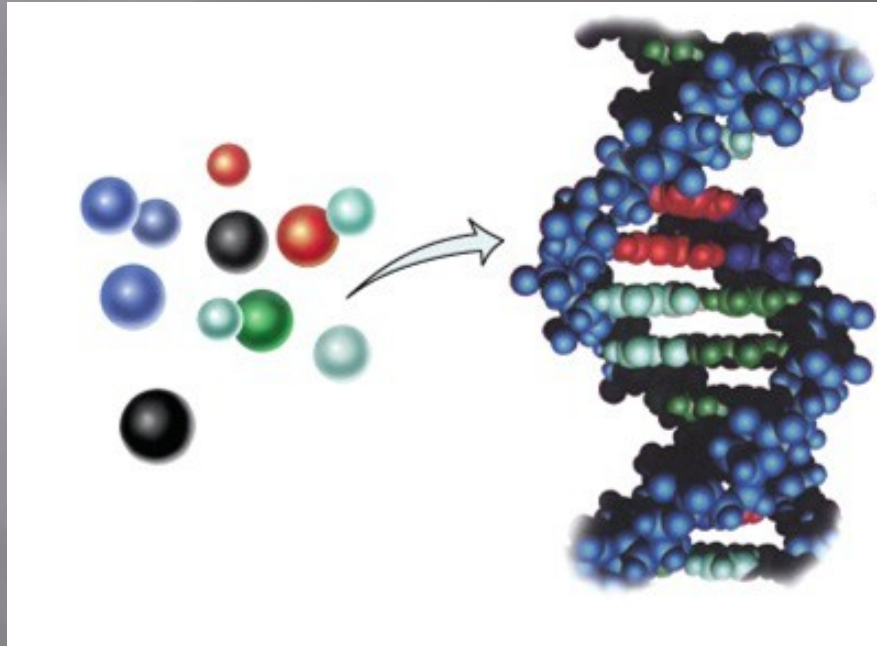


4 ORGAN LEVEL



6 ORGANISMAL LEVEL

Digestive system



At the **chemical** level,
atoms are organized into molecules.

Periodic Table of the Elements																		18 VIIIA 8A	
<div>Atomic Number</div> <div>Symbol</div> <div>Name</div> <div>Atomic Mass</div>																		2 He Helium 4.003	
1 H Hydrogen 1.008	2 IIA 2A												13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A		
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180		
11 Na Sodium 22.990	12 Mg Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8	10 VIII 8	11 IB 1B	12 IIB 2B	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948		
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.972	35 Br Bromine 79.904	36 Kr Krypton 84.798		
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294		
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018		
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown		
Lanthanide Series			57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.242	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967		
Actinide Series			89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]		
			Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide							

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At the **cellular** level,

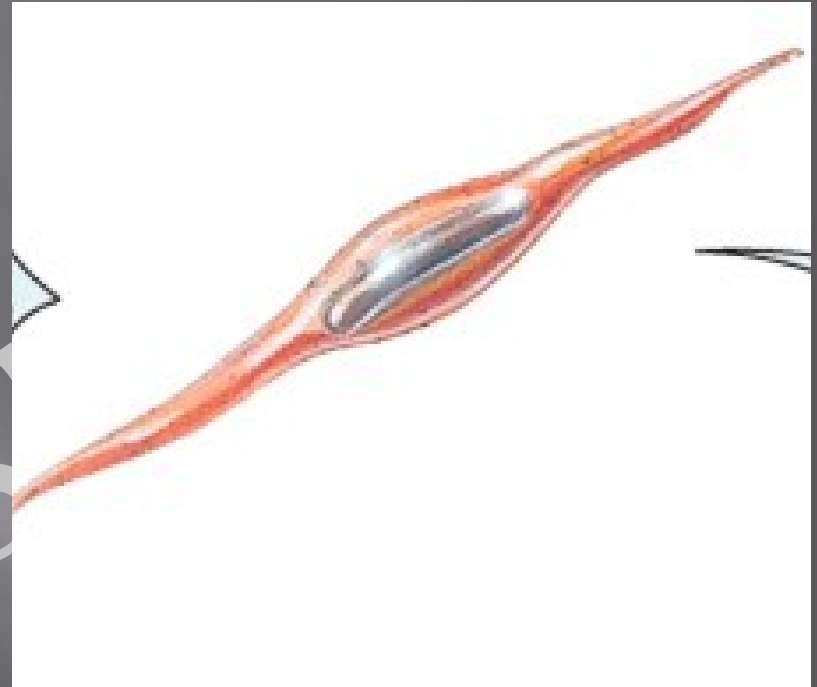
molecules are organized into cells.

Cells are the **basic structural and functional living units** of an organism

Cells are the **smallest living units** in the human body

Cells are made up of 3 main components:

- cell membrane
- cytoplasm
- organelles/nucleus.



At the **tissue** level,

cells are organized into tissues.



Tissues are **groups of similar cells** (and the materials surrounding them) that usually have similar embryological origins and **perform specialized functions**.

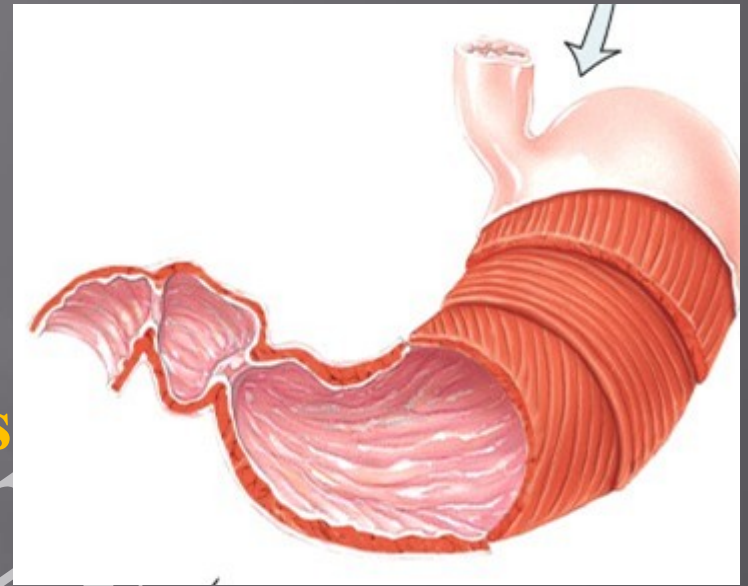
There are four major families of tissues:

- i. Epithelial tissue
- ii. Connective tissue
- iii. Muscular tissue
- iv. Nervous tissue

At the **organ** level,

two or more **different types of tissues** form **organs**.

Organs are structures that have **specific functions** and usually have **recognizable shapes**.

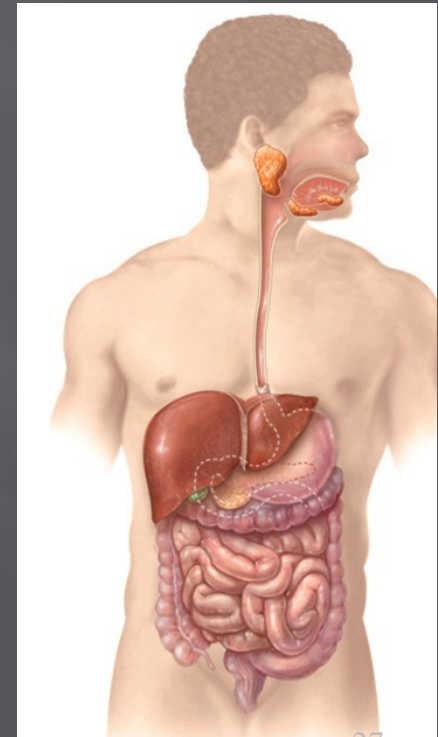


At the **system** level (or organ-system level),

related organs are organized into systems.

Systems are functionally related groups of organs that cooperate to perform a **common general function**.

There are eleven systems in the body.



11 SYSTEMS OF THE HUMAN BODY

The Integumentary System

The Skeletal System

The Muscular System

The Nervous System

The Endocrine System

The Cardiovascular System

The Lymphatic and Immune Systems

The Respiratory System

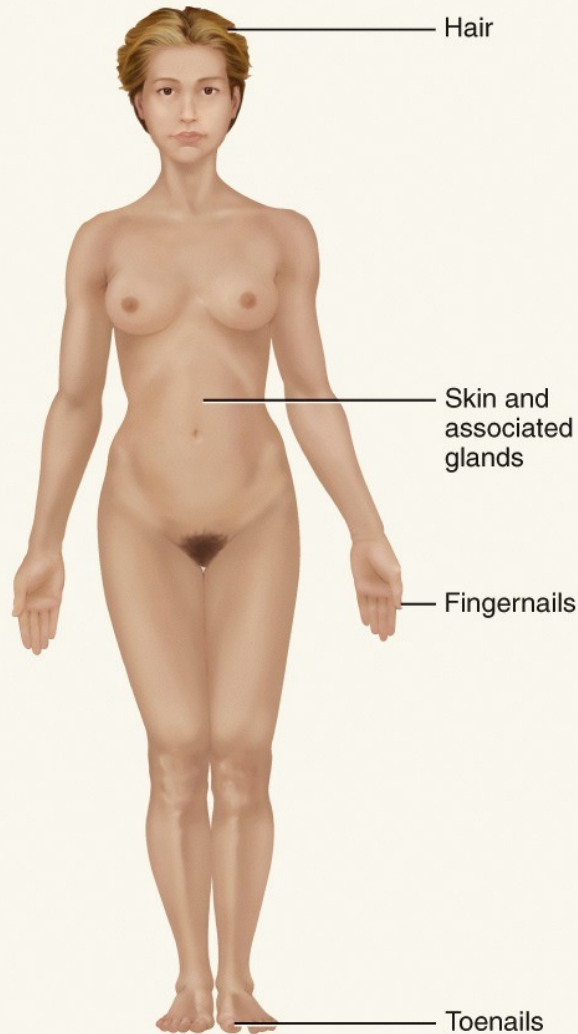
The Digestive System

The Urinary System

The Reproductive Systems

TABLE 1.2

The Eleven Systems of the Human Body



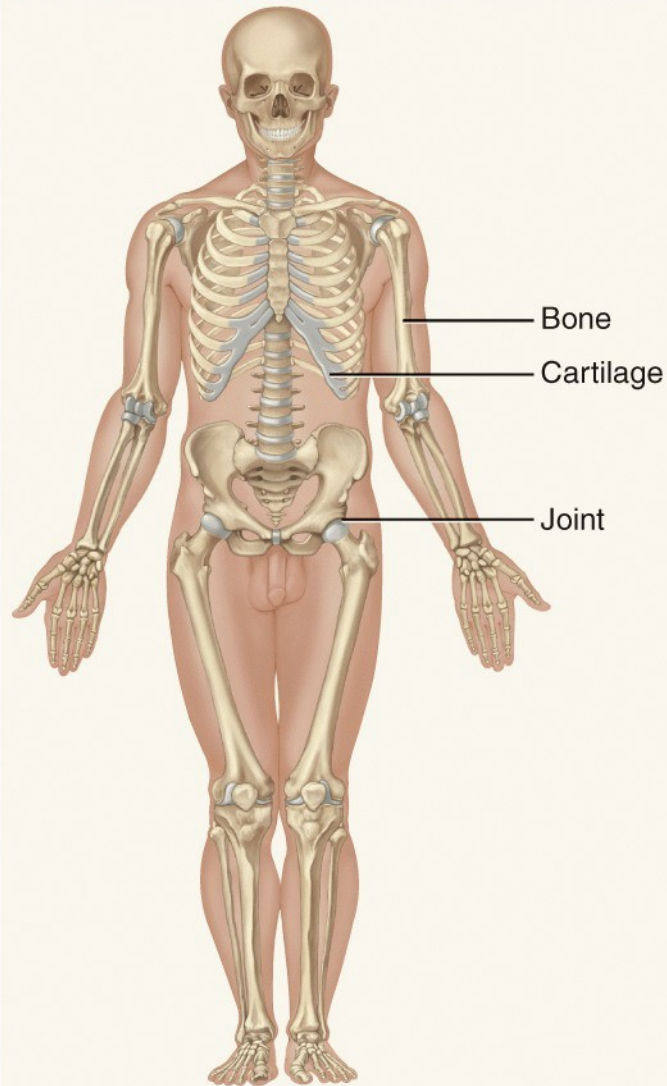
INTEGUMENTARY SYSTEM (CHAPTER 5)

Components: Skin, and structures associated with it, such as hair, fingernails and toenails, sweat glands, and oil glands and the subcutaneous layer.

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

TABLE 1.2

The Eleven Systems of the Human Body



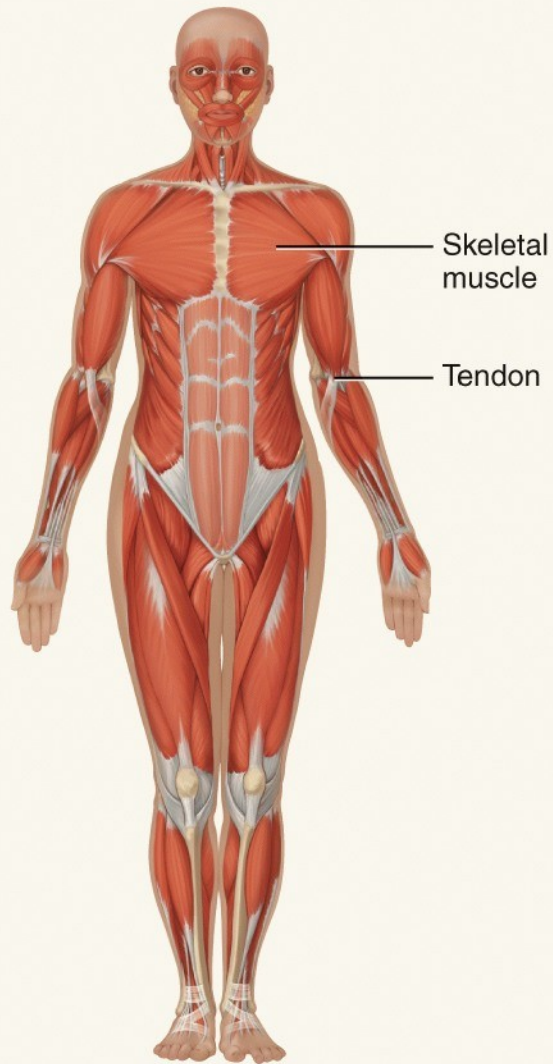
SKELETAL SYSTEM (CHAPTERS 6–9)

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

Functions: Supports and protects the body; provides a 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



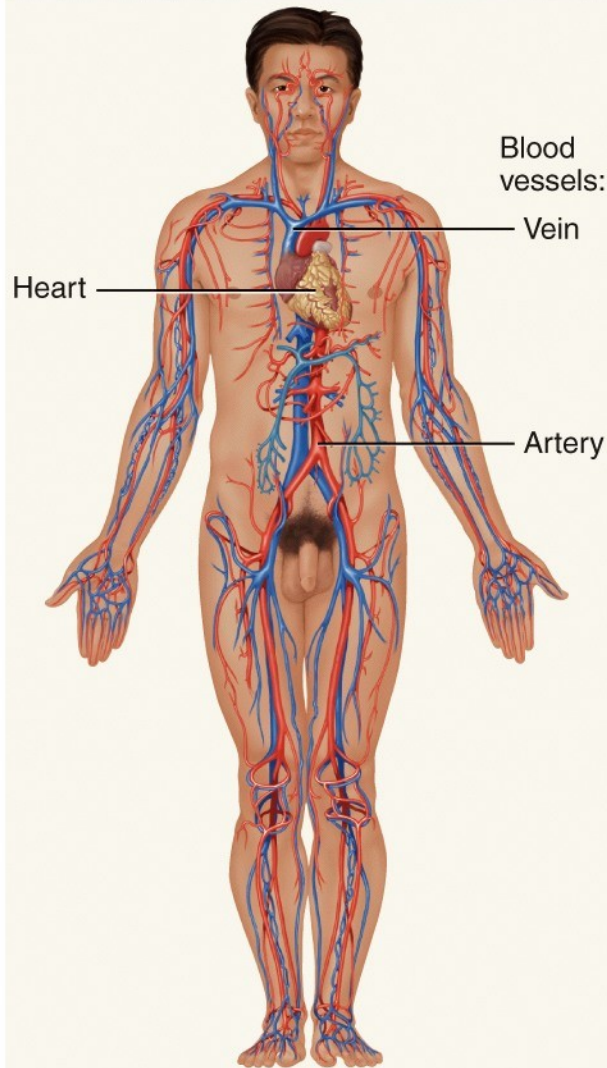
MUSCULAR SYSTEM (CHAPTERS 10, 11)

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

Functions: Participates in bringing about body movements, such as walking, maintains posture, and produces heat.

TABLE 1.2

The Eleven Systems of the Human Body



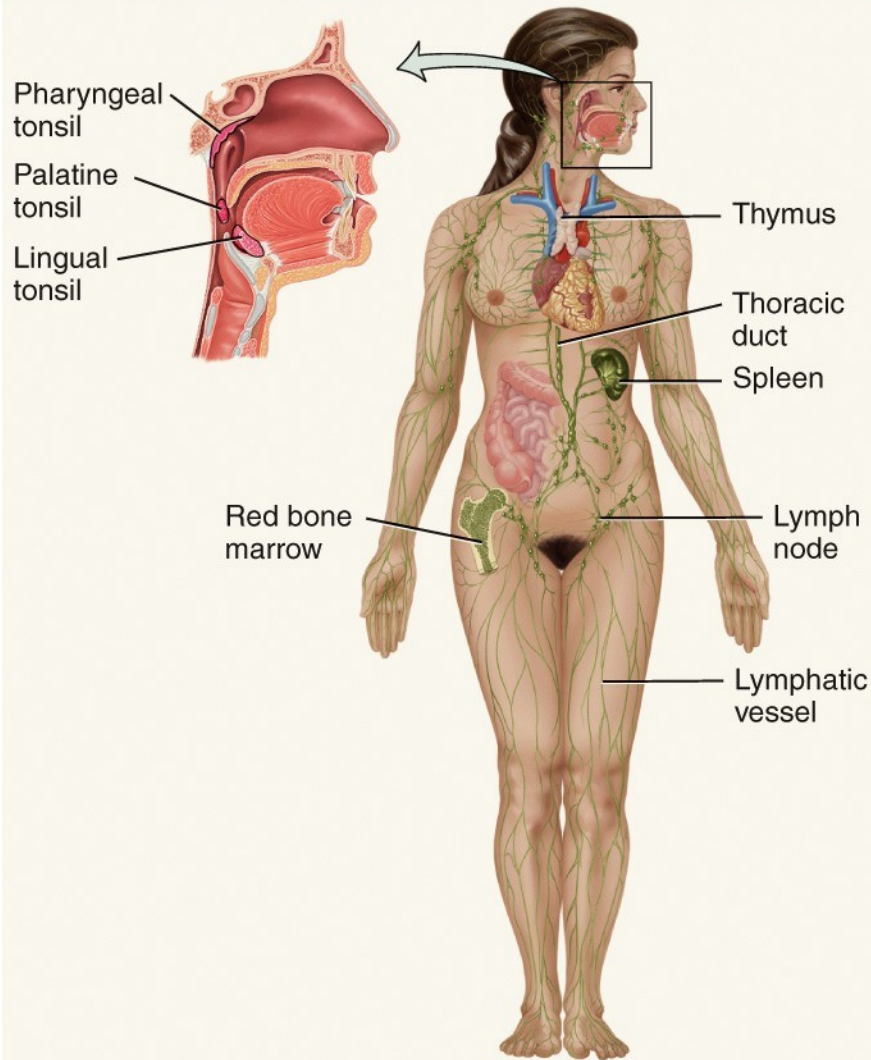
CARDIOVASCULAR SYSTEM (CHAPTERS 12–14)

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

The Eleven Systems of the Human Body



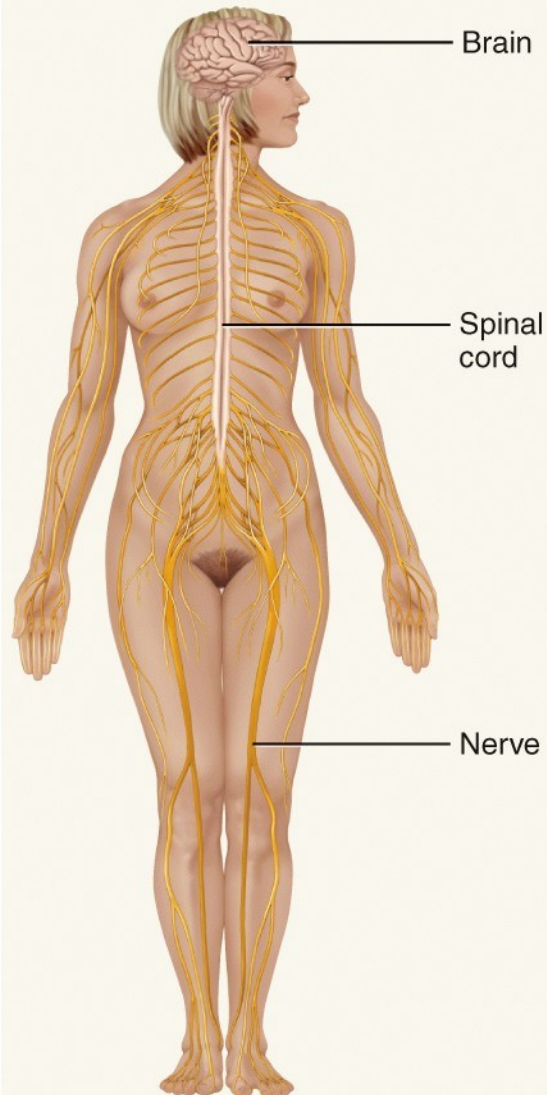
LYMPHATIC SYSTEM AND IMMUNITY (CHAPTER 15)

Components: Lymphatic fluid, lymphatic 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.

TABLE 1.2

The Eleven Systems of the Human Body



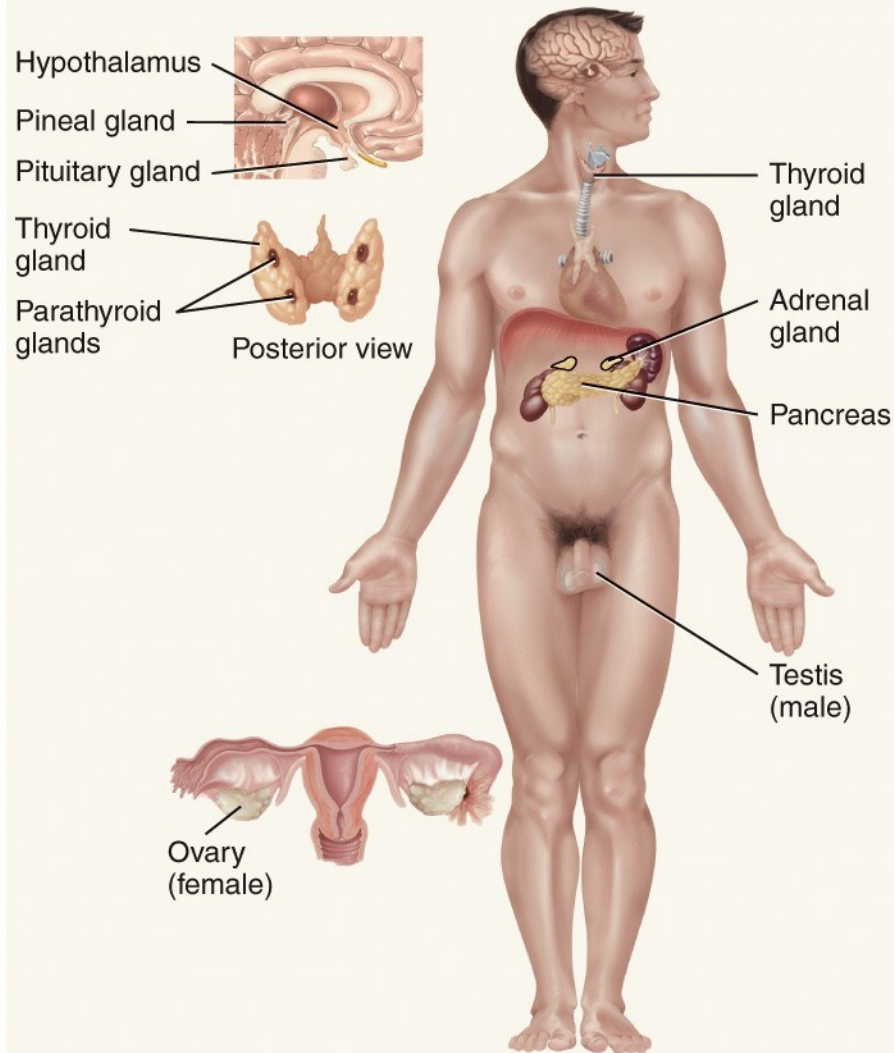
NERVOUS SYSTEM (CHAPTERS 16–21)

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

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

TABLE 1.2

The Eleven Systems of the Human Body



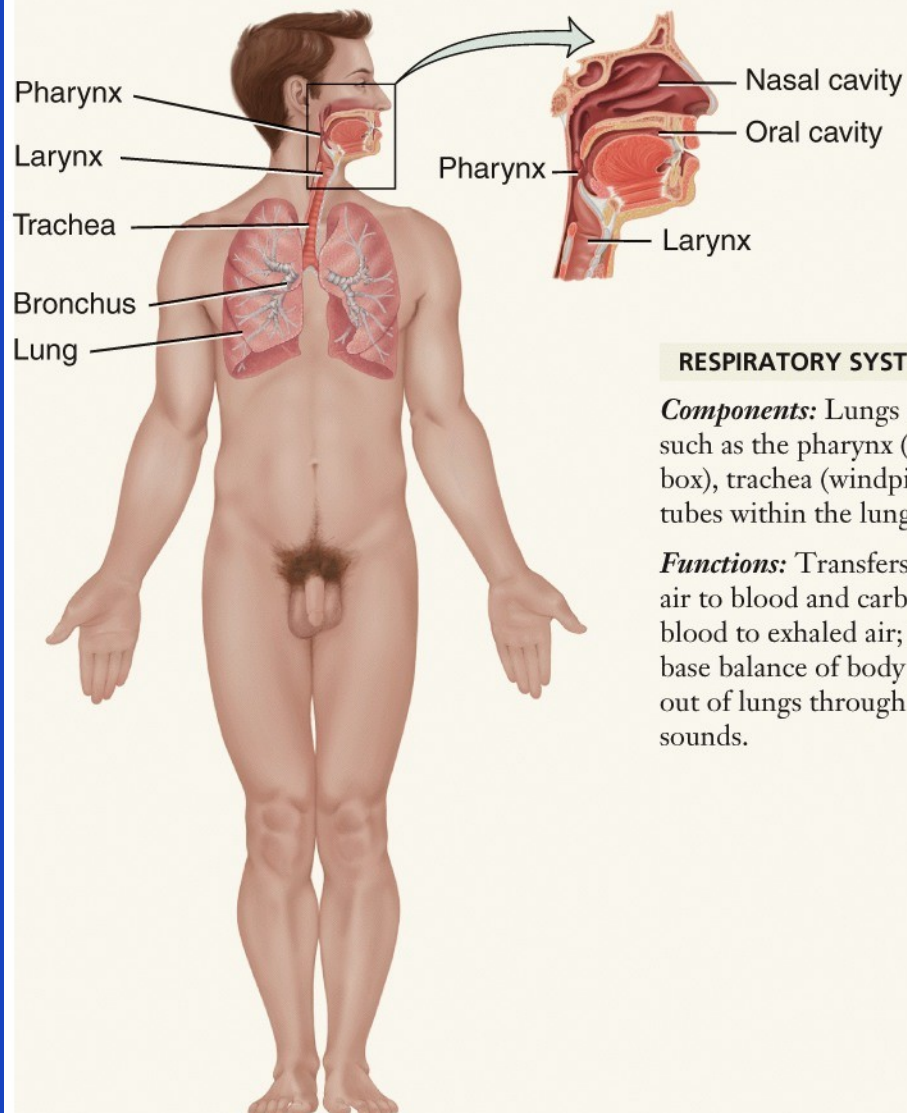
ENDOCRINE SYSTEM (CHAPTER 22)

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, which are chemical messengers transported in blood from an endocrine gland or tissue to a target organ.

TABLE 1.2

The Eleven Systems of the Human Body



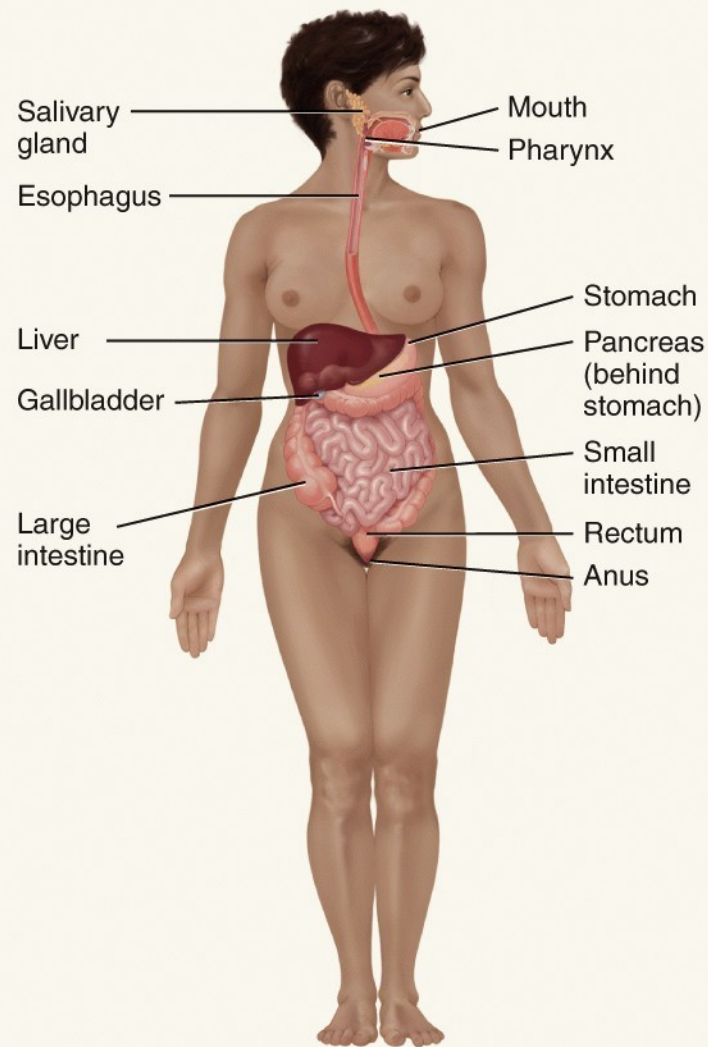
RESPIRATORY SYSTEM (CHAPTER 23)

Components: Lungs and air passageways such as the pharynx (throat), larynx (voice box), trachea (windpipe), and bronchial tubes within the 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

The Eleven Systems of the Human Body



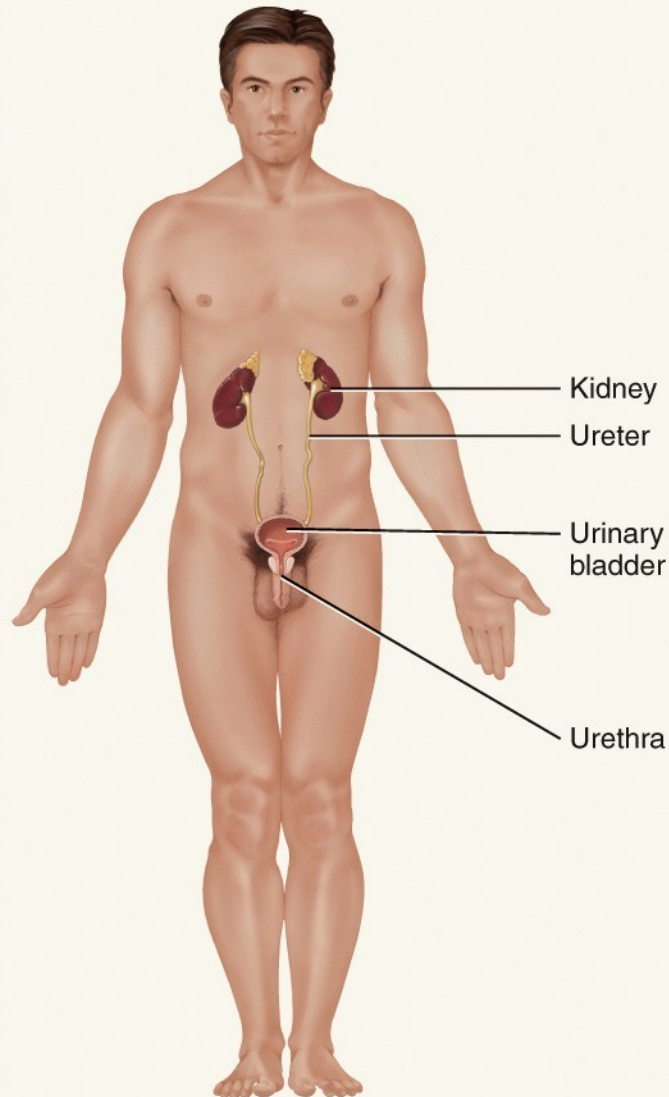
DIGESTIVE SYSTEM (CHAPTER 24)

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

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

TABLE 1.2

The Eleven Systems of the Human Body



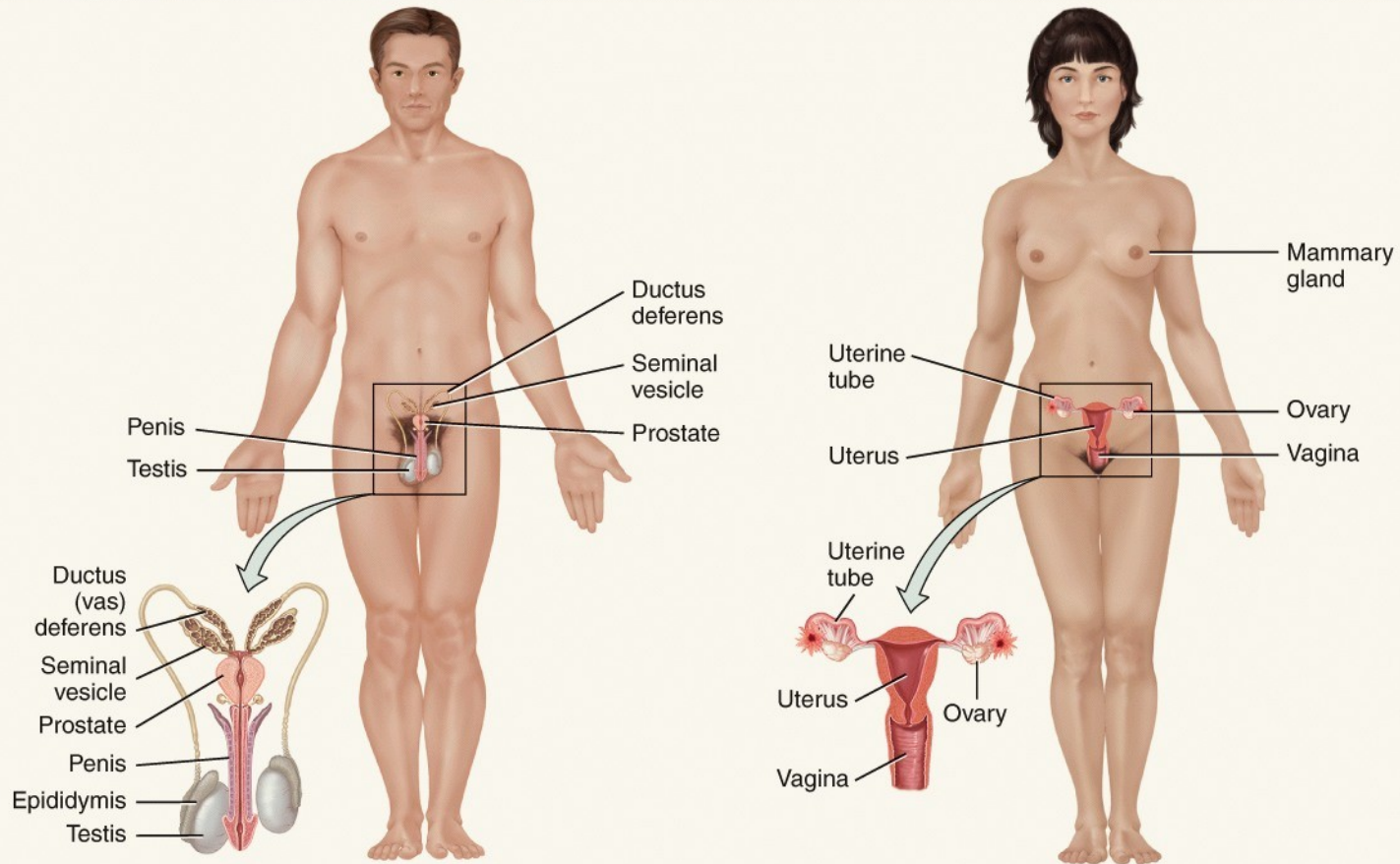
URINARY SYSTEM (CHAPTER 25)

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

The Eleven Systems of the Human Body



REPRODUCTIVE SYSTEMS (CHAPTER 26)

Components: Gonads (testes in males and ovaries in females) and associated organs (such as the uterine or fallopian tubes, uterus, and vagina in females and epididymides, seminal vesicles, prostate, ductus deferenses, 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.

AND FINALLY...

At the **organismal** level,

all the systems are structurally integrated and function cooperatively to constitute the total organism.



1.3 Life Processes

All living organisms have certain characteristics that set them apart from non-living things.



Life Processes

Metabolism: Sum of all the chemical processes that occur in the body.

Responsiveness: The body's ability to detect and respond to changes in its internal (inside the body) or external (outside the body) environment.

Movement: Includes motion of the whole body, individual organs, single cells, and even structures inside cells.

Growth: Increase in body size due to an increase in (1) size of existing cells, (2) number of cells, or (3) amount of material surrounding cells.

Differentiation: When unspecialized cells become specialized. Such precursor cells, which can divide and give rise to cells that undergo differentiation, are called stem cells.

Reproduction: Is (1) the formation of new cells for growth, repair, or replacement or (2) the production of a new individual.

Requirements of Life

- **Water** - required for metabolism, transport, regulation
- **Food** - substances that provide nutrients
- **Oxygen** - used in the release of energy
- **Heat** - form of energy which helps control metabolic reactions
- **Pressure** - application of force on an object

Cellular Metabolic Processes

- Respiration
- Digestion
- Absorption
- Circulation
- Assimilation
- Excretion

Although not all of these processes occur in cells throughout the body all of the time, when any one of them ceases to occur properly, **cell death** may occur. When cell death is extensive and leads to **organ failure**, the result is **death of the organism**.

1.4 Basic Anatomical Terminology

Why do we need to know this?

1.4 Basic Anatomical Terminology

- Anatomical Position
- Regional Names
- Planes and Sections
- Directional Terms
- Body Cavities
- Abdominopelvic Regions and Quadrants



Freeze! It's Anatomical Position Time

Anatomical Position



STANDING POSTURE

- The body is erect
- Feet flat on the floor
- Upper limbs are at the sides with the palms facing forward.

LYING POSTURE

- Lying face down = prone position
- Lying face up = supine position.

*** ALWAYS GET YOUR BEARINGS FIRST

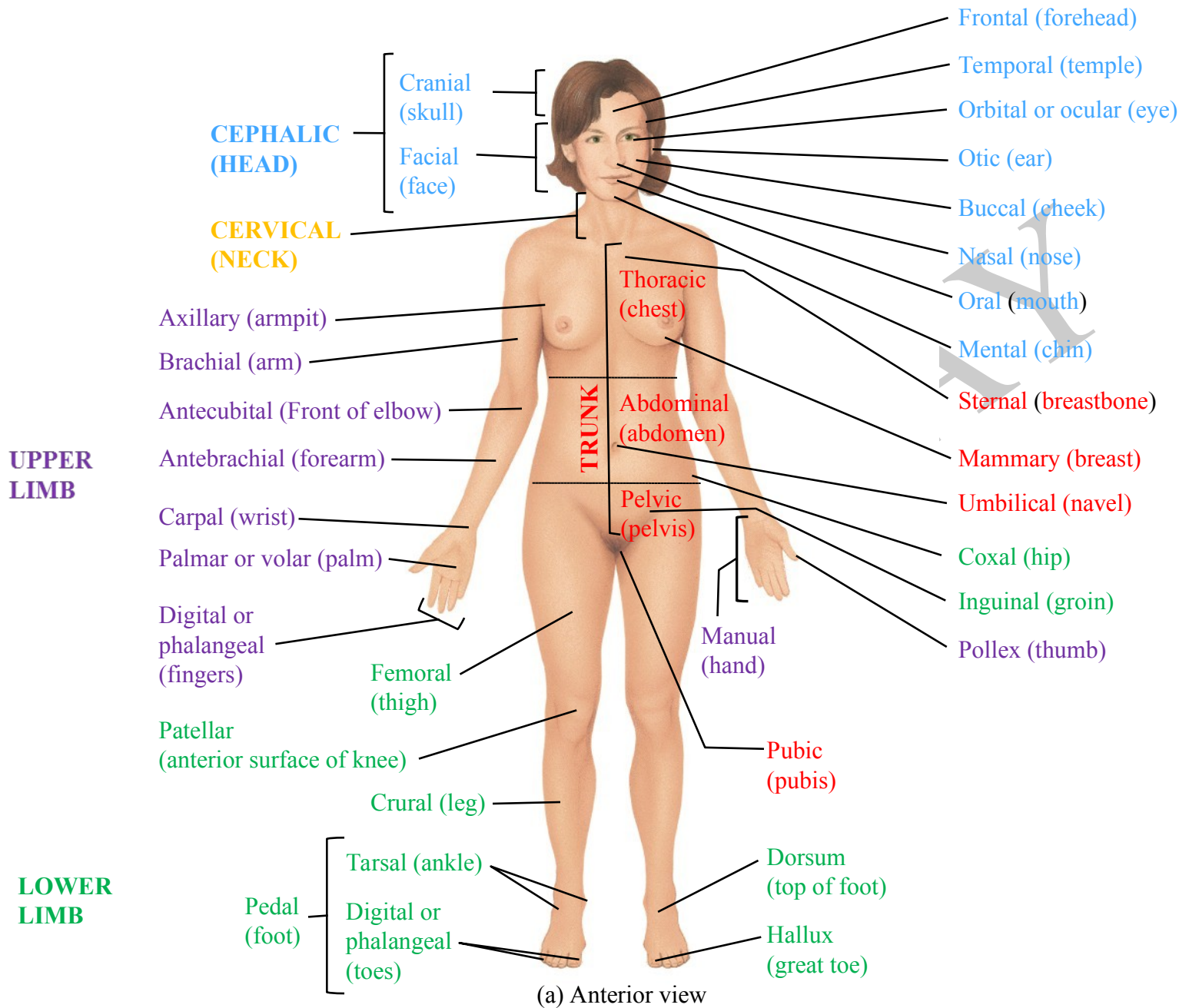
when viewing an picture or diagram of the human body.

Regional Names

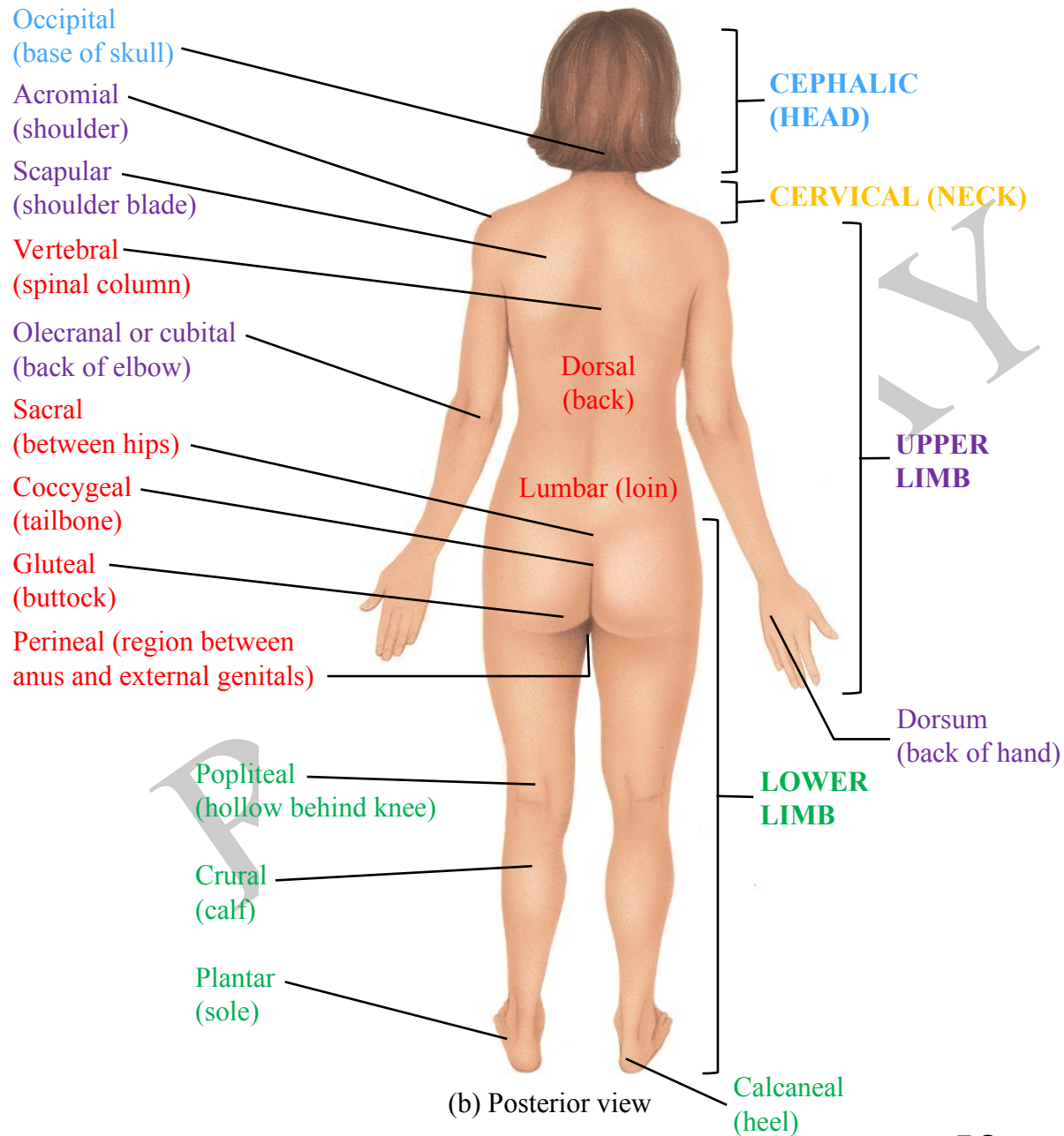
The human body is divided into five major regions that can be identified externally.

- Head (cephalic)
- Neck (cervical)
- Trunk
- Upper Limb (extremity)
- Lower Limb (extremity)





TRUNK

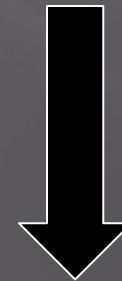




Directional Terms

Used to improve communication when discussing the basic parts of the body and their **relative** positions to one another.

Typically grouped into pairs that have opposite meanings.



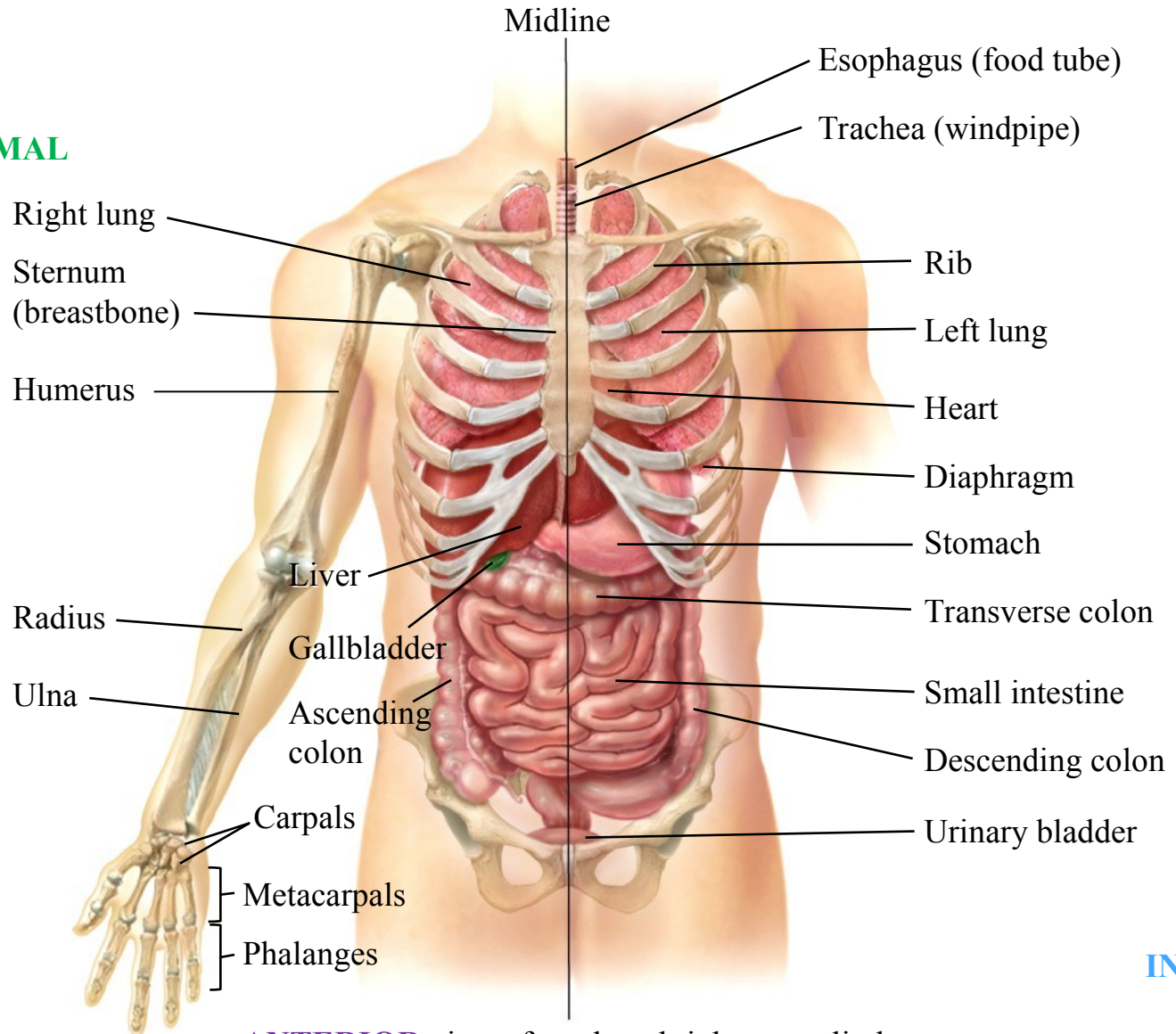
LATERAL ↔ **MEDIAL** ↔ **LATERAL**

SUPERIOR

PROXIMAL

DISTAL

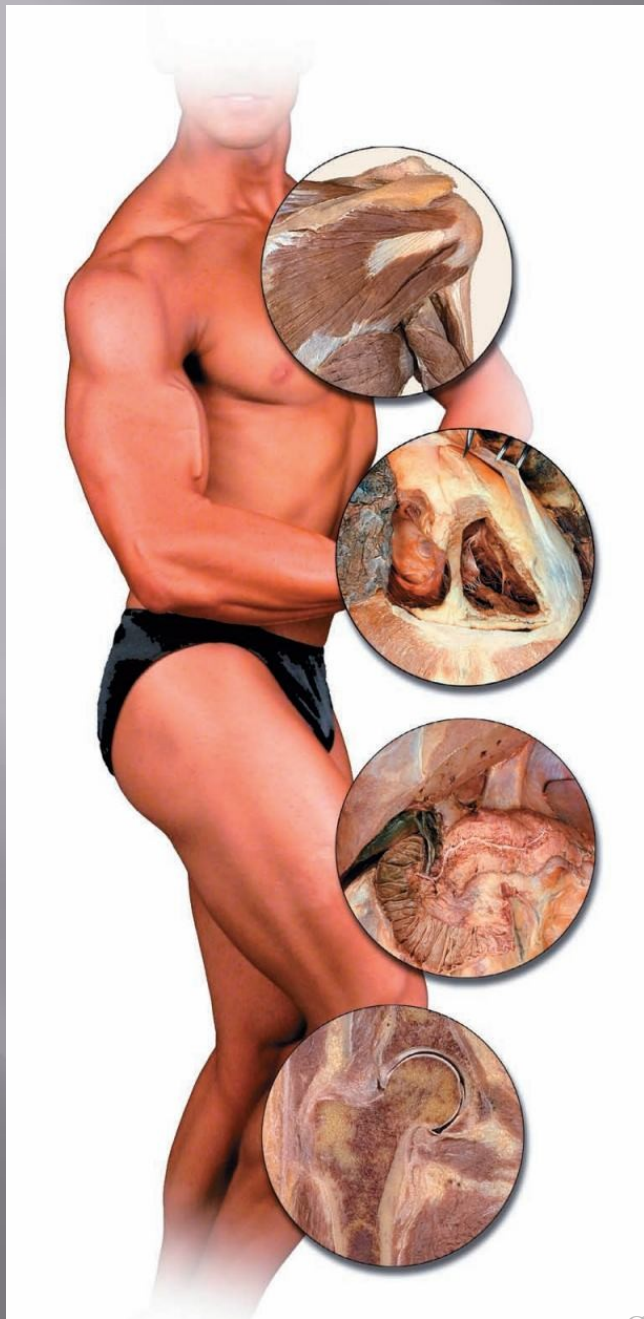
INFERIOR



ANTERIOR view of trunk and right upper limb

DIRECTIONAL TERM	DEFINITION	EXAMPLE OF USE
Superior (soo'-PĒR-ē-or)	Above or higher in position; toward the head. (Not used in reference to the limbs.)	The heart is superior to the liver.
Cranial (KRĀN-ē-al) or cephalic (se-FAL-ik)	Relating to the skull or head; toward the head. (This is a more flexible term than superior because it can be applied to all animals, whether they stand upright on two limbs or on all four limbs.)	The stomach is more cranial than the urinary bladder.
Inferior (in'-FĒR-ē-or)	Below or lower in position; toward the feet. (Not used in reference to the limbs.)	The stomach is inferior to the lungs.
Rostral (ROS'-tral)	Relating to the nose and mouth region; toward the face.	The frontal lobe of the brain is rostral to the occipital lobe (see Figure 18.12b).
Caudal (KAUD-al)	Relating to the tail; at or near the tail or posterior part of the body.	The lumbar vertebrae are caudal to the cervical vertebrae (see Figure 7.15a).
Anterior (an-TĒR-ē-or)	Nearer to or at the front of the body.	The sternum (breastbone) is anterior to the heart.
Posterior (pos-TĒR-ē-or)	Nearer to or at the back of the body.	The esophagus (food tube) is posterior to the trachea (windpipe).
Ventral (VEN-tral)	Relating to the belly side of the body; toward the belly. (Used synonymously with anterior in human anatomy.)	The intestines are ventral to the vertebral column.
Dorsal (DORS-al)	Relating to the back side of the body; toward the back. (Used synonymously with posterior in human anatomy.)	The kidneys are dorsal to the stomach.

DIRECTIONAL TERM	DEFINITION	EXAMPLE OF USE
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 colon and descending colon.
Ipsilateral (ip-si-LAT-er-al)	On the same side of the body's midline as another structure.	The gallbladder and ascending colon are ipsilateral.
Contralateral (CON-tra-lat-er-al)	On the opposite side of the body's midline 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)	Toward or on the surface of the body.	The ribs are superficial to the lungs.
Deep	Away from the surface of the body.	The ribs are deep to the skin of the chest and back.
External (ex-STERN-al)	Toward the outside of a structure. (Is typically used when describing relationships of individual organs.)	The visceral pleura is on the external surface of the lungs (see Figure 1.7a).
Internal (in-TERN-al)	Toward the inside of a structure. (Is typically used when describing relationships of individual organs.)	The mucosa forms the internal lining of the stomach (see Figure 24.11a).

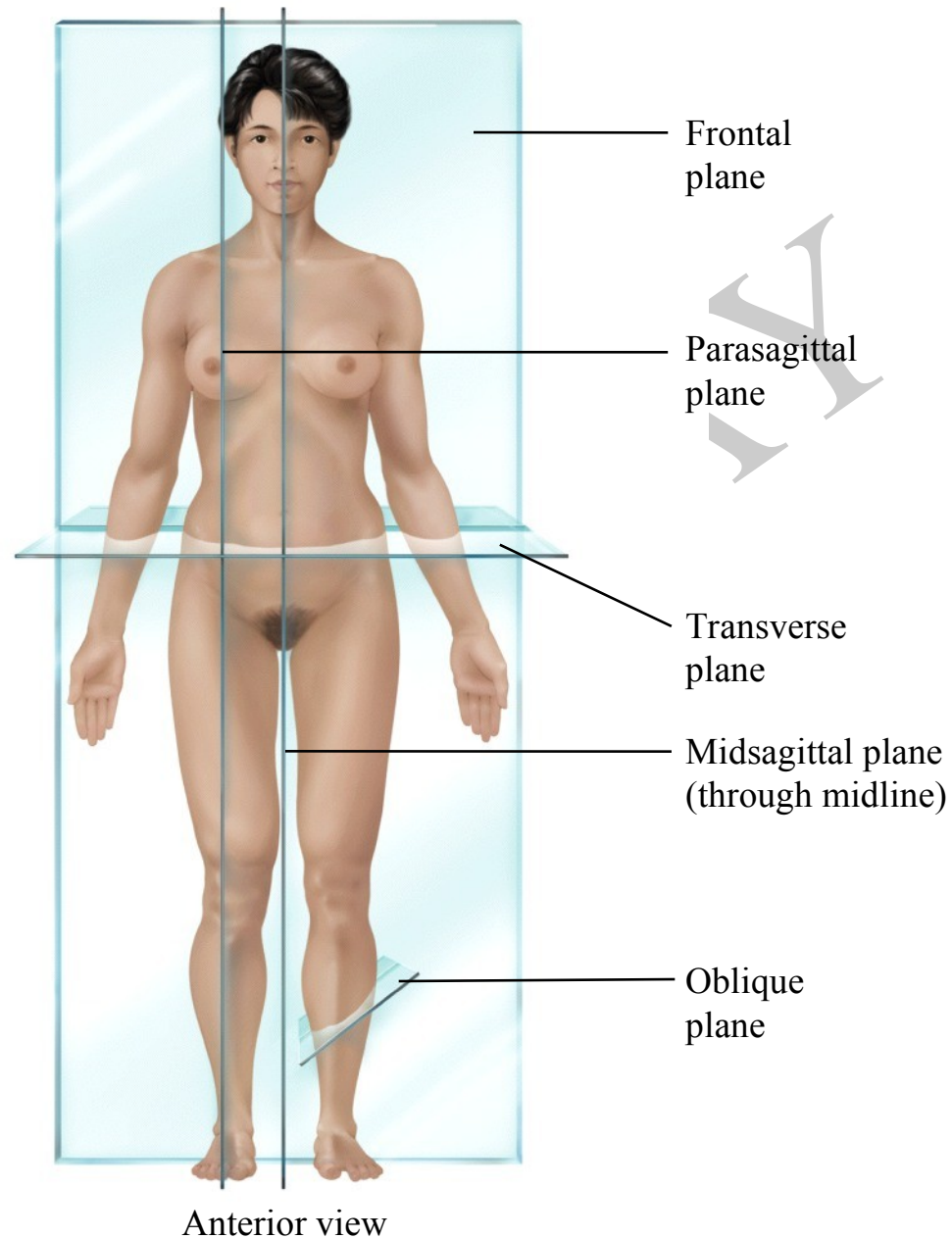


Planes and Sections

Planes are imaginary flat surfaces that pass through the body in order to provide an informative view of a specific region of the body.

Sections are flat surfaces of the body that may be studied after the body has been cut along a specific plane.

Planes through the human body.



Planes through the human body.

Sagittal plane (sagitta = arrow):

Vertical plane that divides the body or organ into right and left sides.

Midsagittal plane, or Median plane:

Sagittal plane that passes through the midline of the body and divides it into equal right and left sides.

Parasagittal plane (para = beside):

Sagittal plane that divides the body into unequal right and left sides.

Frontal, or Coronal plane (corona = crown):

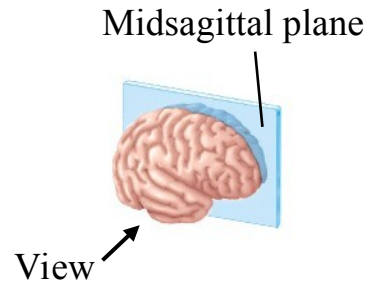
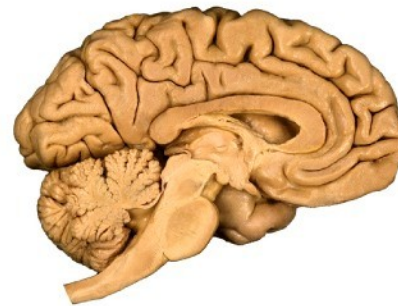
Divides the body or an organ into front and back portions.

Transverse plane or cross-sectional plane or horizontal plane:

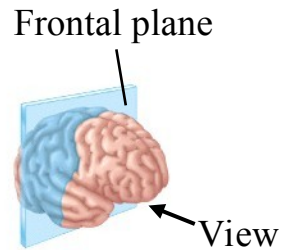
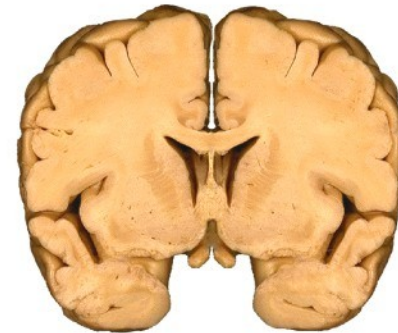
Divides the body or an organ into upper and lower portions.

Sagittal, frontal, and transverse planes are all at right angles to one another.

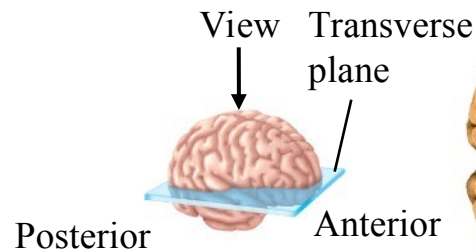
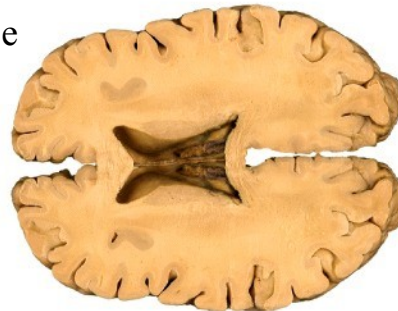
Planes and sections through different parts of the brain.



(a) Midsagittal section



(b) Frontal section



(c) Transverse section

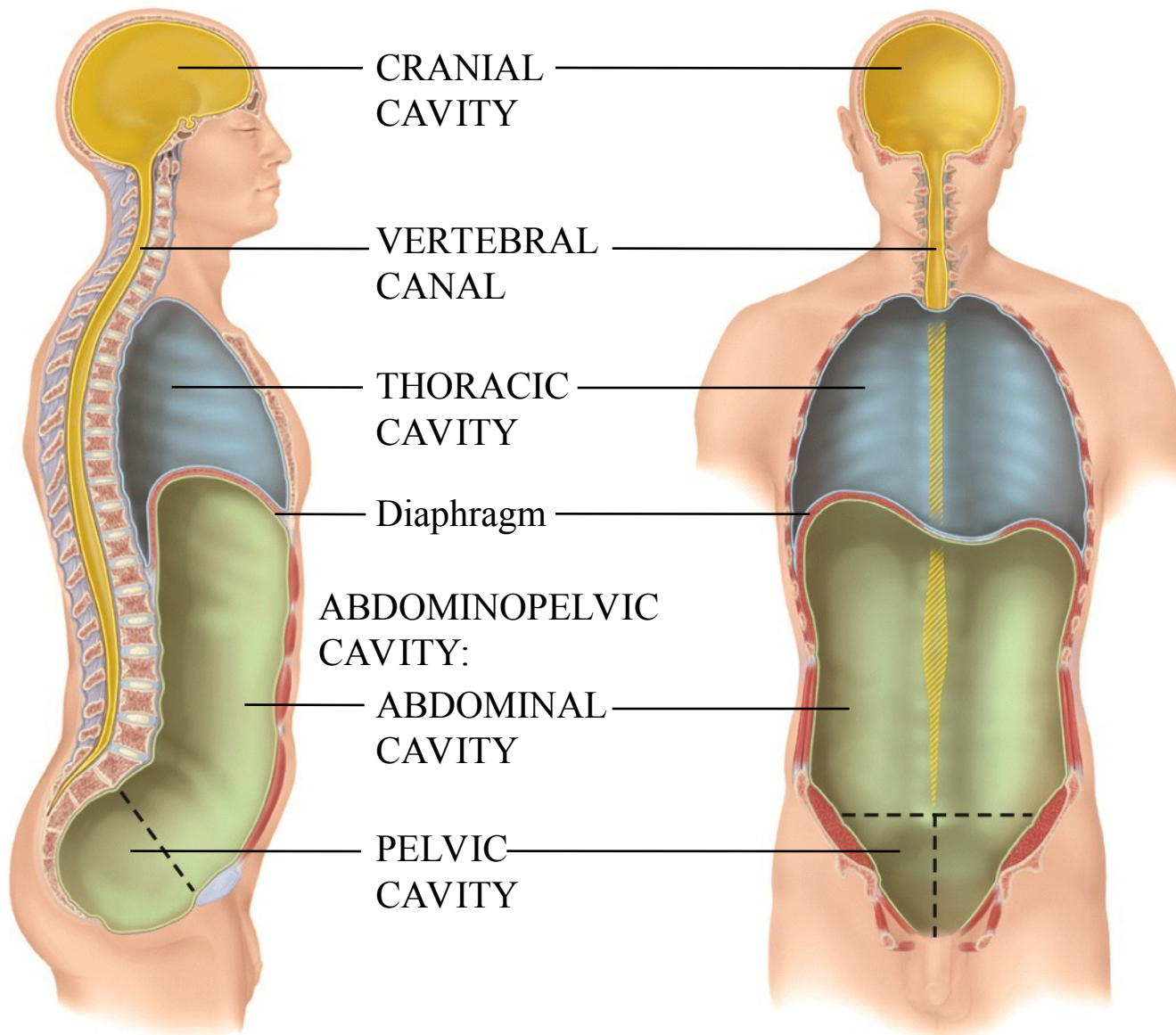
Dissection Shawn Miller; Photograph Mark Nielsen

Body Cavities

Enclosed spaces within the body that help protect, separate, and support internal organs that are located inside them.

Bones, muscles, and ligaments separate the various body cavities from one another.



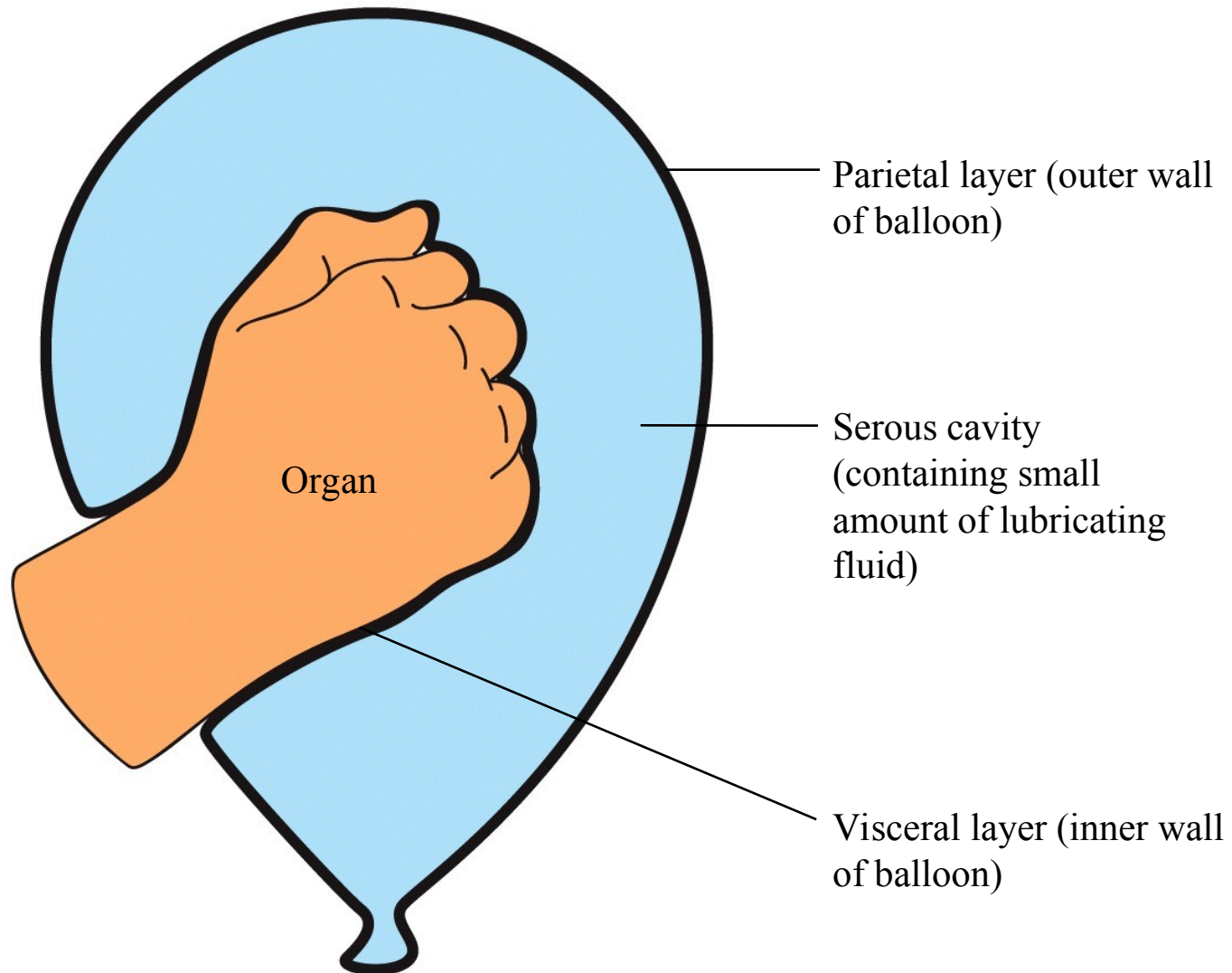


(a) Right lateral view

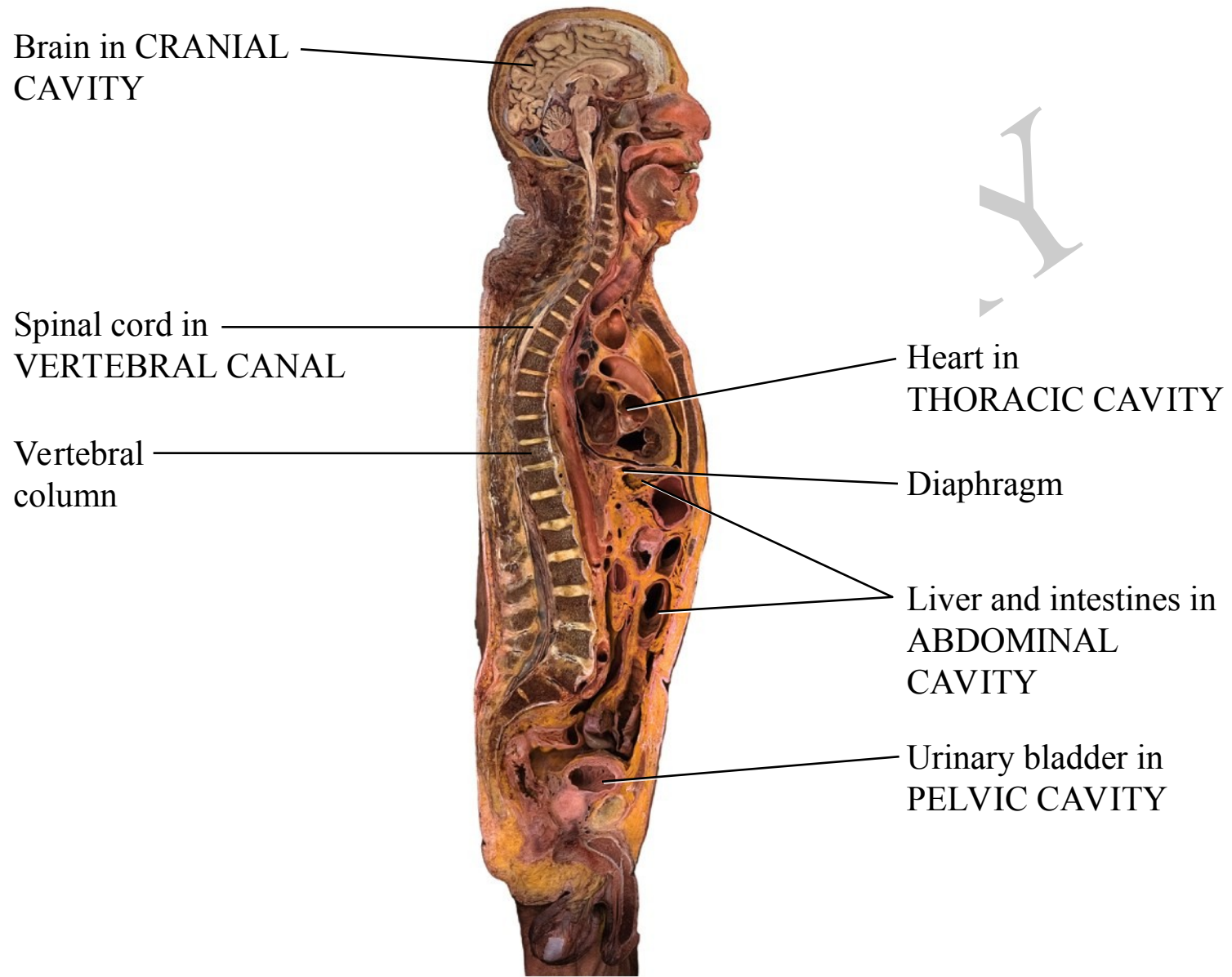
(b) Anterior view

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 sacs and the mediastinum.
<i>Pleural cavity</i>	A potential space between the layers of the pleura that surrounds a lung.
<i>Pericardial cavity</i>	A potential space between the layers of the pericardium that surrounds the heart.
<i>Mediastinum</i>	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.
<i>Abdominal cavity</i>	Contains stomach, spleen, liver, gallbladder, small intestine, and most of large intestine.
<i>Pelvic cavity</i>	Contains urinary bladder, portions of large intestine, and internal organs of reproduction.

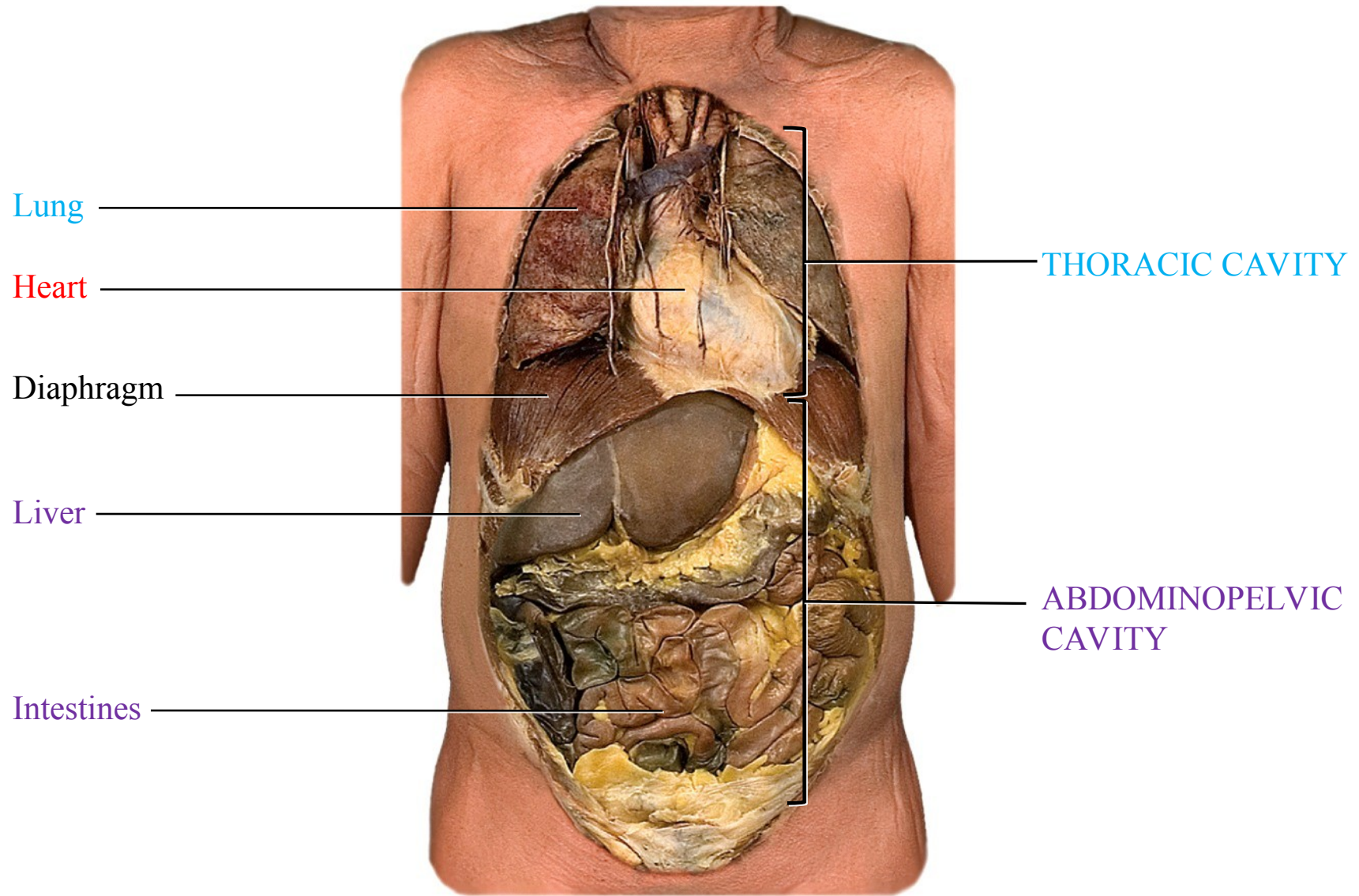
* See **Figure 1.7** for details of the thoracic cavity.



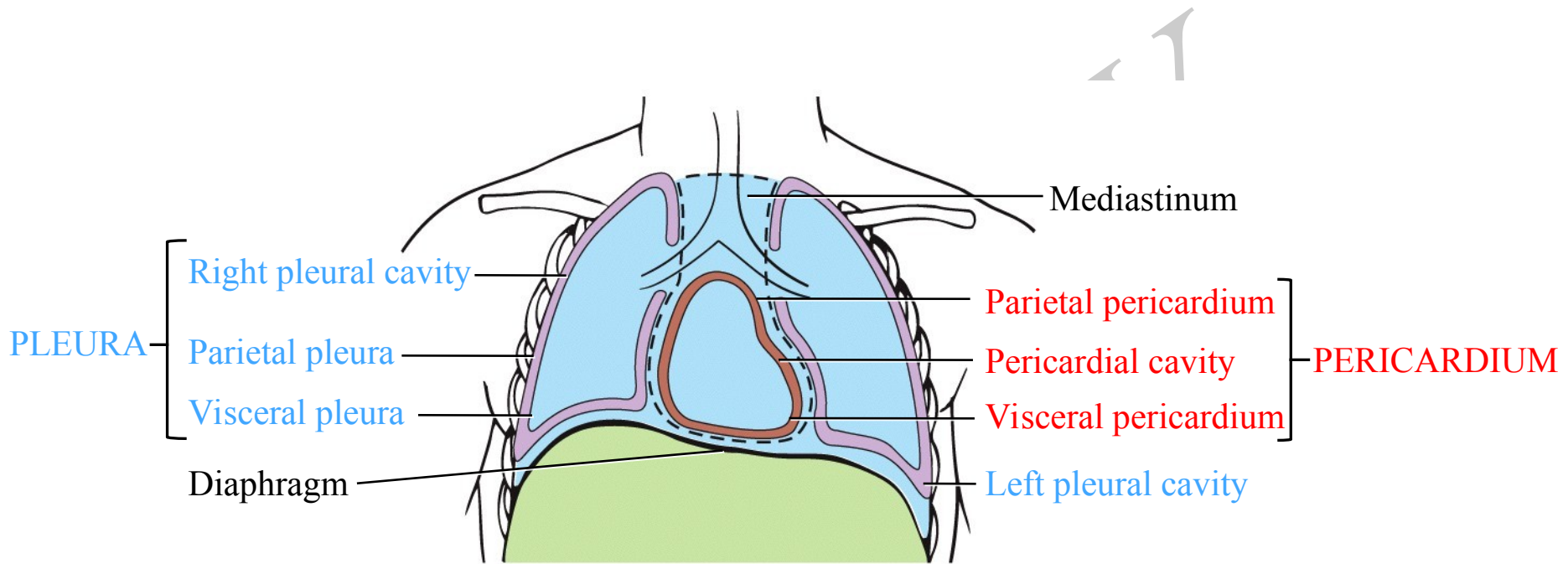
(e) The concept of a serous sac



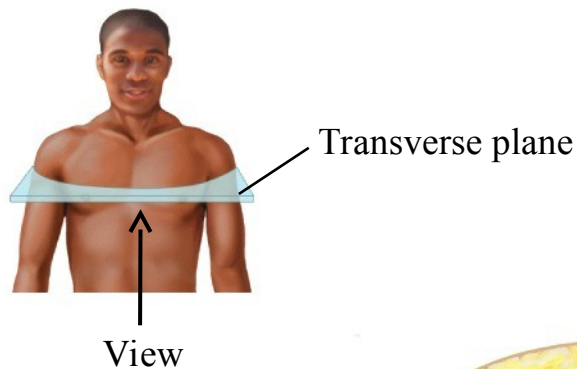
(c) Sagittal section



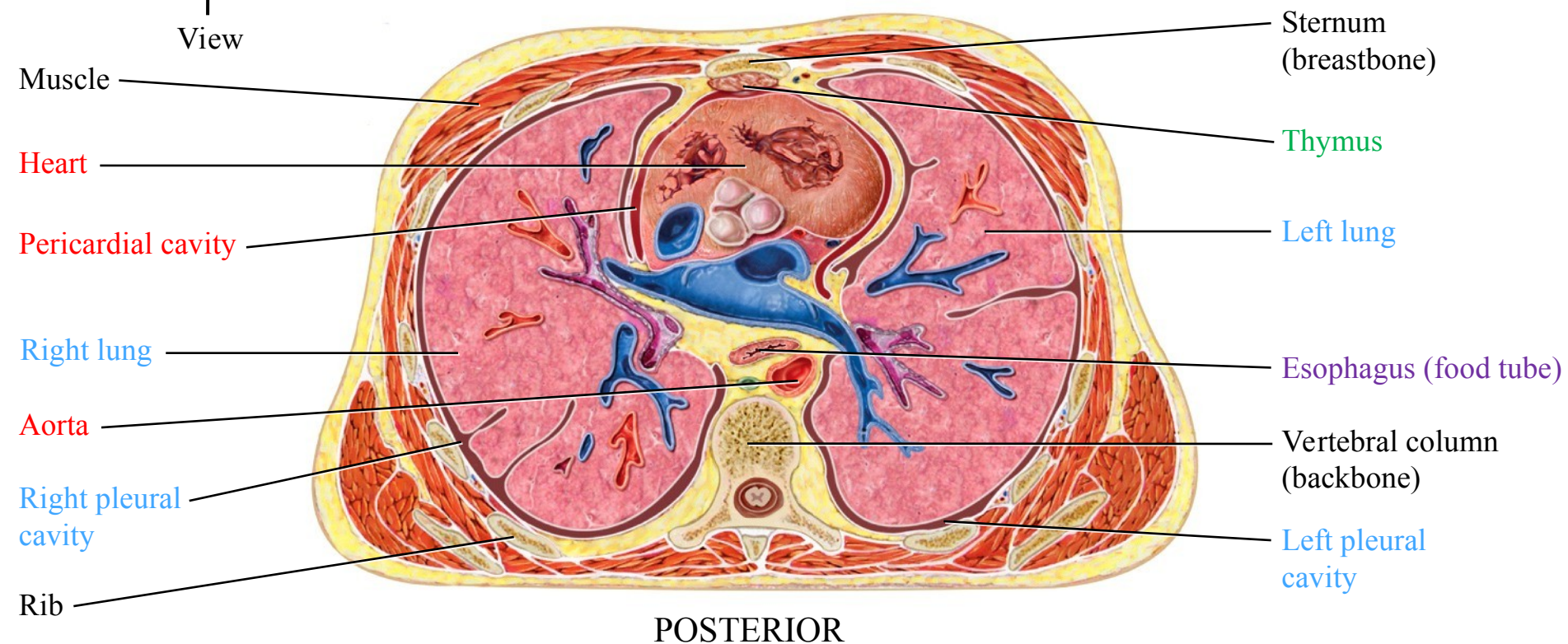
(d) Anterior view



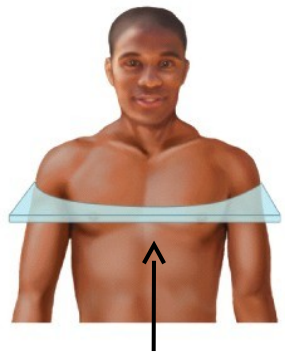
(a) Anterior view of thoracic cavity



ANTERIOR



(b) Inferior view of transverse section of thoracic cavity



View

PLEURA

Parietal pleura

Right pleural cavity

Visceral pleura

Skin

Right lung

Rib

ANTERIOR

Sternum

Parietal pericardium

Pericardial cavity

Visceral pericardium

Heart

Esophagus

Aorta

Vertebral column (backbone)

Spinal cord

PERICARDIUM

Mark Nielsen

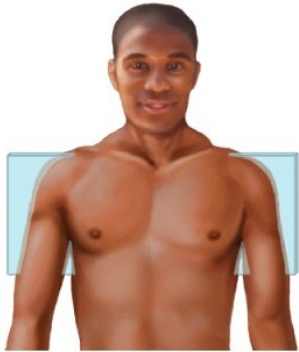
LATERAL

POSTERIOR

MEDIAL

(c) Inferior view of transverse section of thoracic cavity

69

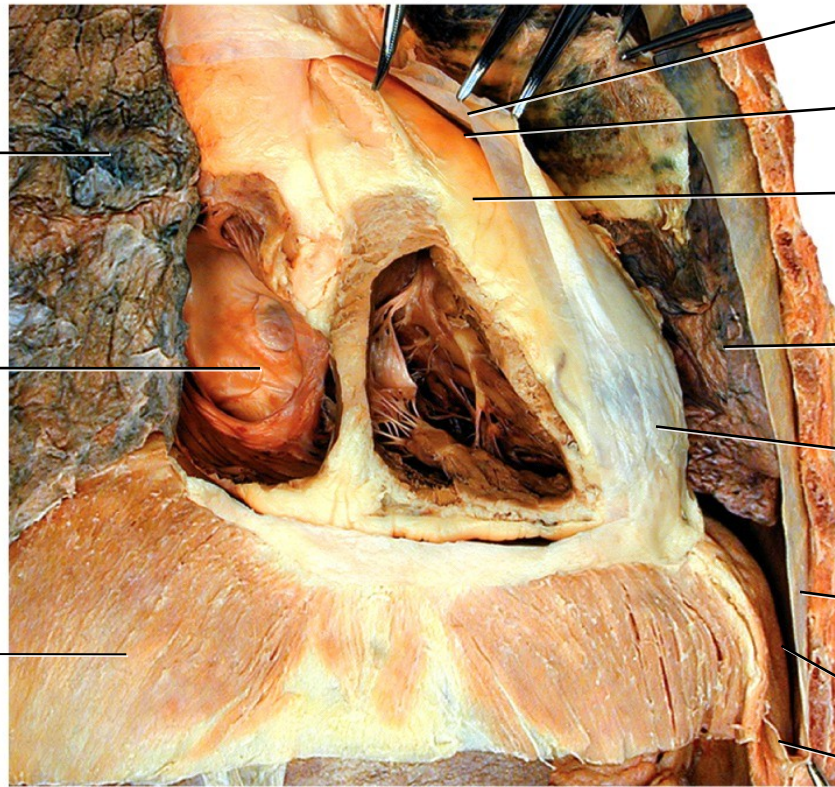


Dissection Shawn Miller; Photograph Mark Nielsen

Right lung

Heart

Diaphragm



Parietal pericardium

Pericardial cavity

Visceral pericardium

PERICARDIUM

Visceral pleura (covering lung)

Parietal pleura (covering fibrous pericardium)

Parietal pleura (lining rib cage)

Pleural cavity

Parietal pleura (covering diaphragm)

PLEURA

(d) Layers of the pericardium and pleura

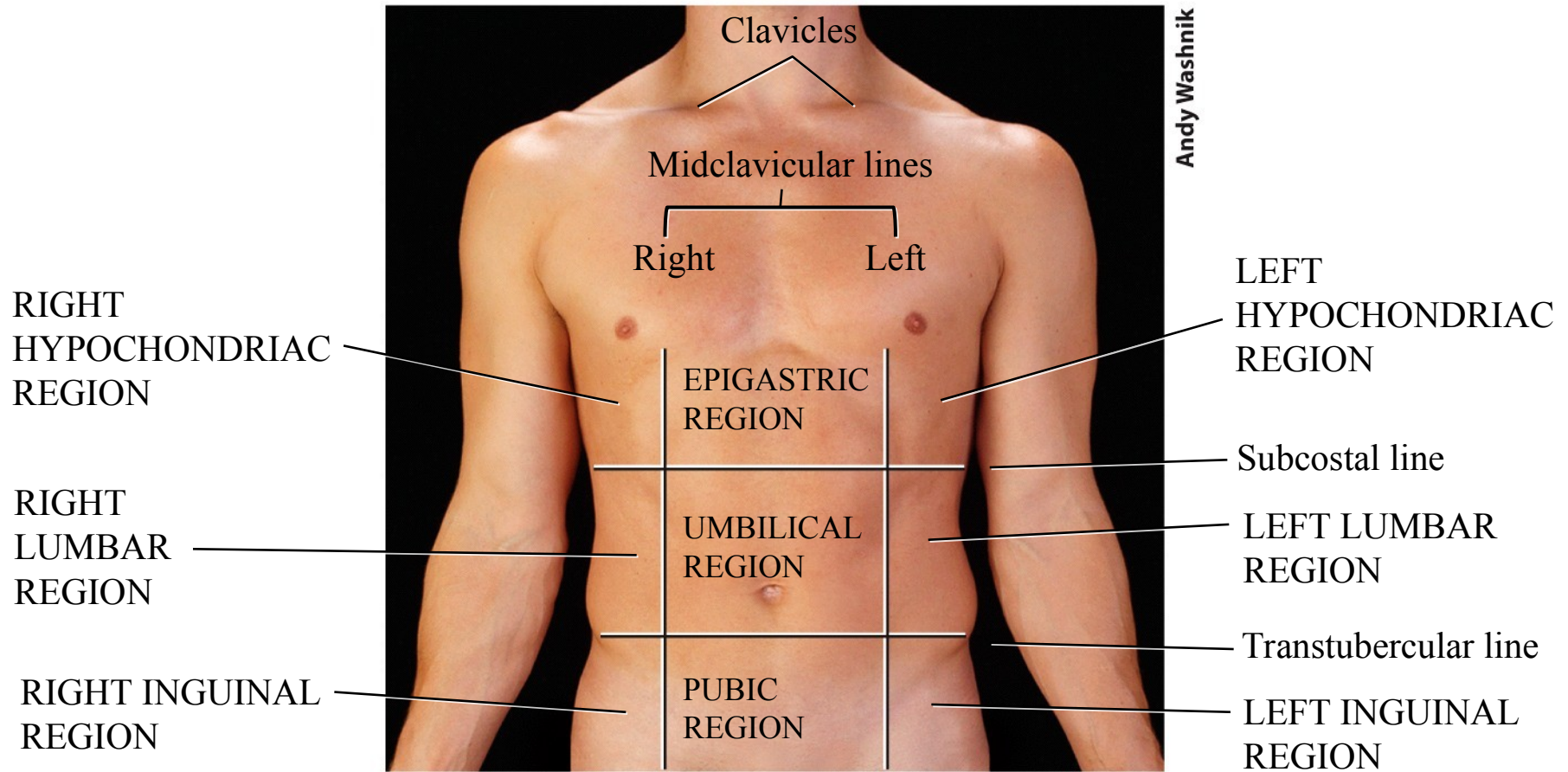
Abdominopelvic Regions and Quadrants

For precise locations of internal organs, the abdominopelvic cavity is divided into nine abdominopelvic regions.

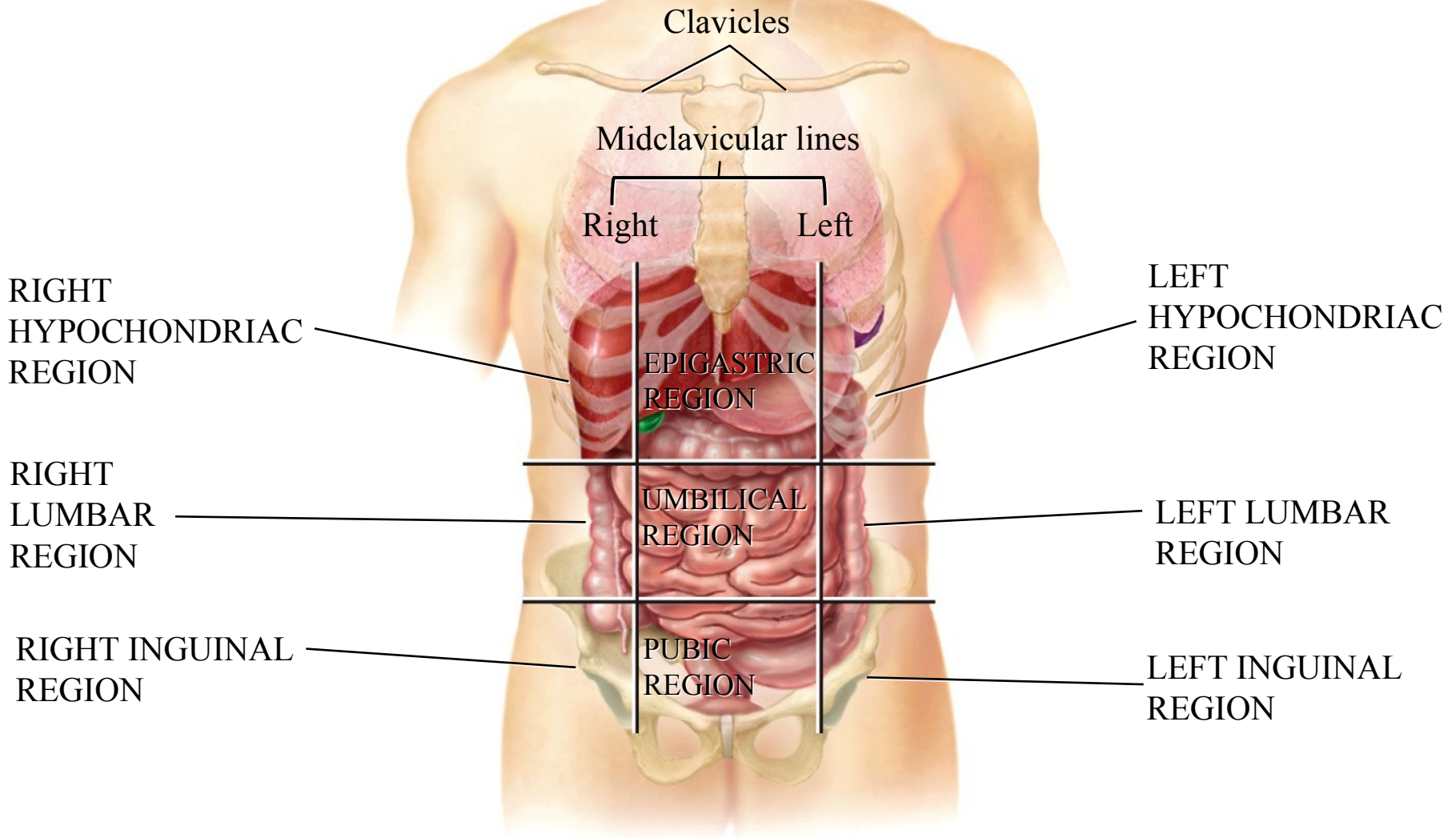
For clinical purposes, abdominopelvic cavity is divided into four quadrants.



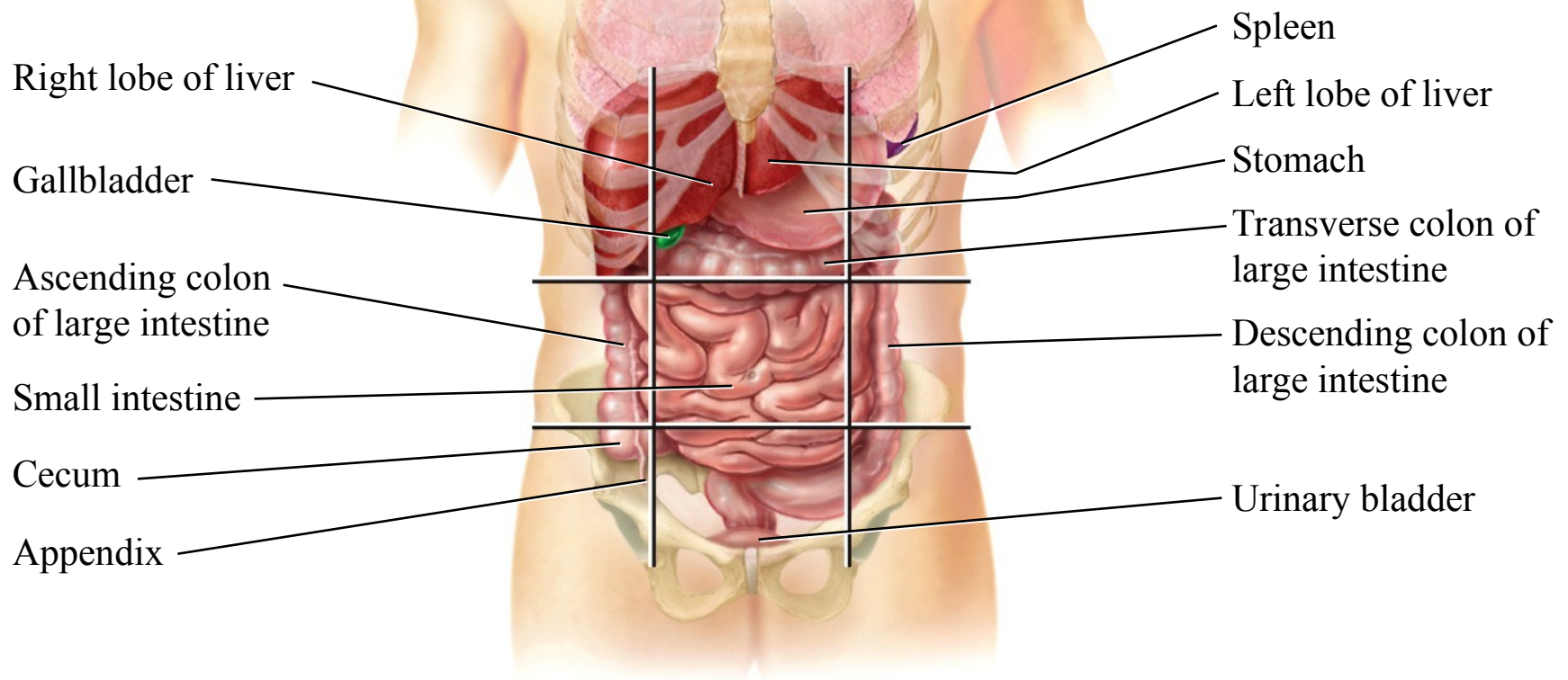
Anterior view showing 9 abdominopelvic regions



TIC TAC TOE

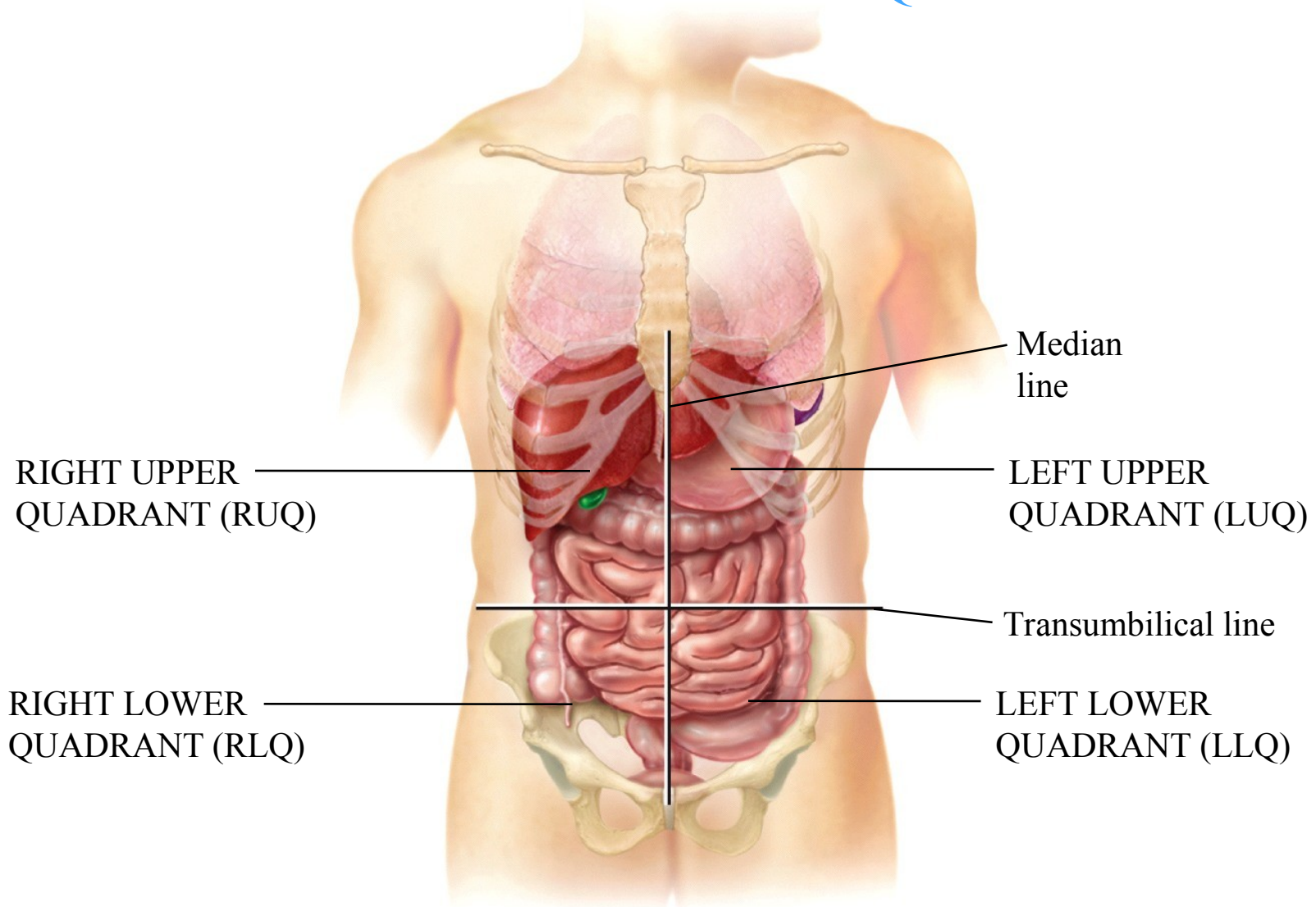


(a) Anterior view showing 9 abdominopelvic regions

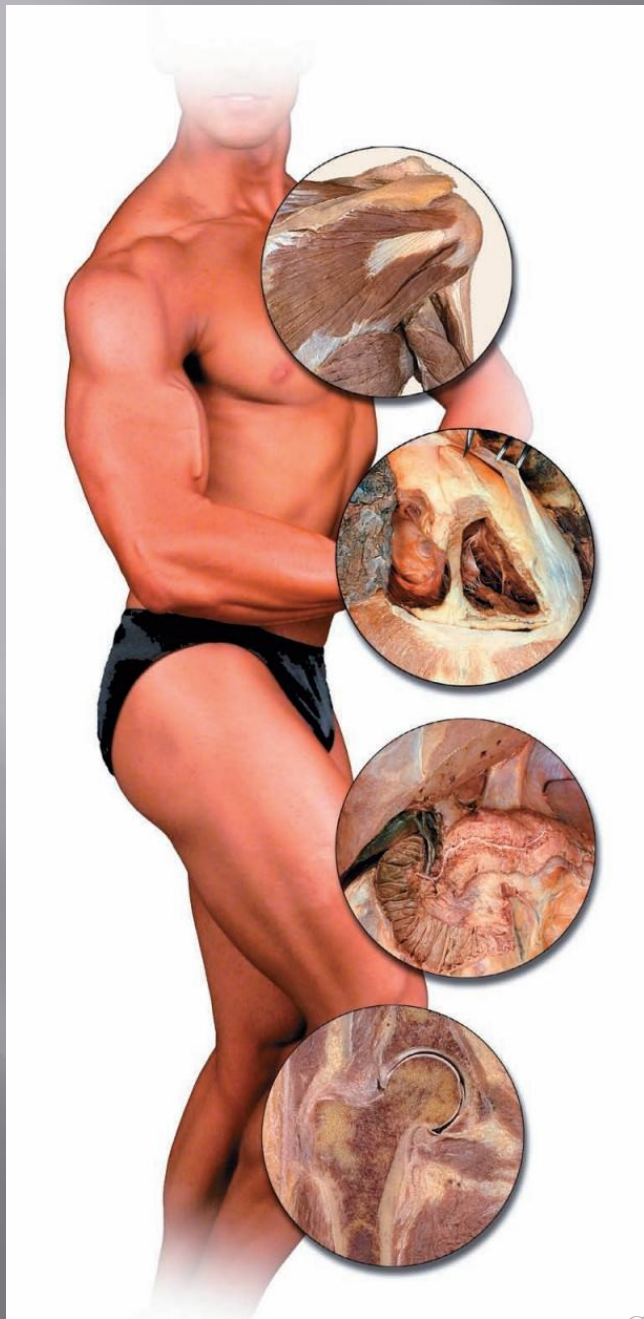


(c) Anterior superficial view of organs in 9 abdominopelvic regions

FOUR ABDOMINOPELVIC QUADRANTS



Anterior view



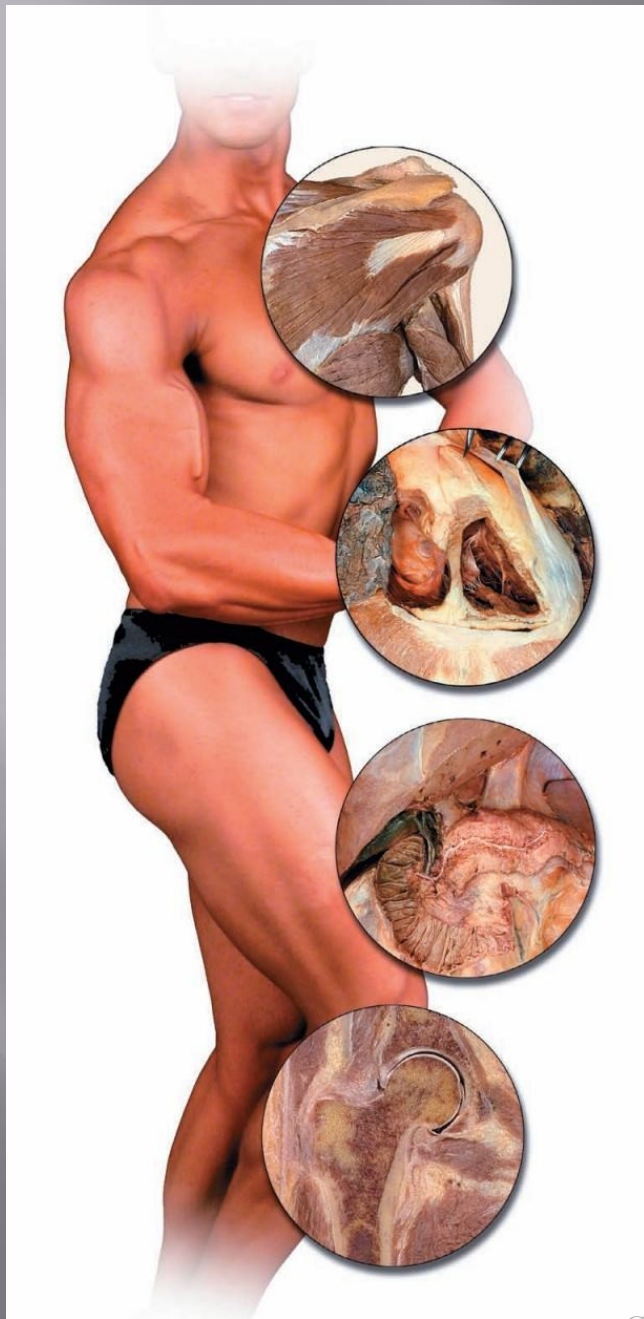
1.5 The Human Body and Disease

1. A **disorder** is any abnormality of structure and/or function.
2. A **disease** is a more specific term for an illness characterized by a recognizable set of
symptoms = *subjective changes in body function*
and
signs = *objective changes that can be observed and measured.*

1.5 The Human Body and Disease

3.Epidemiology is the study of how diseases are transmitted among individuals in a community.

4.Diagnosis is the science and skill of distinguishing one disorder or disease from another.



1.6 Medical Imaging

Techniques and processes used to create images of the human body.

Allow visualization of structures inside our bodies

Increase the precision of diagnosis of a wide range of anatomical and physiological disorders.

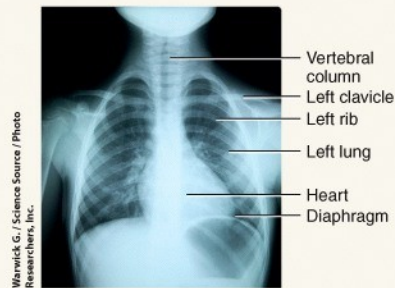
TABLE 1.3**Common Medical Imaging Procedures****RADIOGRAPHY**

Procedure: A single barrage of x-rays passes through the body, producing an image of interior structures on x-ray-sensitive film. The resulting two-dimensional image is a *radiograph* (RĀ-dē-o-graf'), commonly called an *x-ray*.

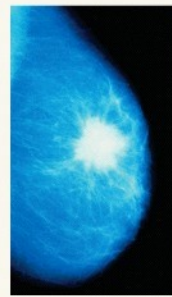
Comments: Radiographs are relatively inexpensive, quick, and simple to perform, and usually provide sufficient information for diagnosis. X-rays do not easily pass through dense structures so bones appear white. Hollow structures, such as the lungs, appear black. Structures of intermediate density, such as skin, fat, and muscle, appear as

varying shades of gray. At low doses, x-rays are useful for examining soft tissues such as the breast (**mammography**) and for determining bone density (**bone densitometry**).

It is necessary to use a substance called a contrast medium to make hollow or fluid-filled structures visible in radiographs. X-rays make structures that contain contrast media appear white. The medium may be introduced by injection, orally, or rectally, depending on the structure to be imaged.



Radiograph of thorax in anterior view

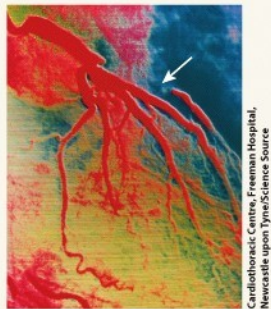


Mammogram of female breast showing cancerous tumor (white mass with uneven border)



Bone densitometry scan of lumbar spine in anterior view

Contrast x-rays are used to image blood vessels (**angiography**), the urinary system (**intravenous urography**), and the gastrointestinal tract (**barium contrast x-ray**).



Angiogram of adult human heart showing blockage in coronary artery (arrow)



Intravenous urogram showing kidney stone (arrow) in right kidney



Barium contrast x-ray showing cancer of the ascending colon (arrow)



Vertebral column

Left clavicle

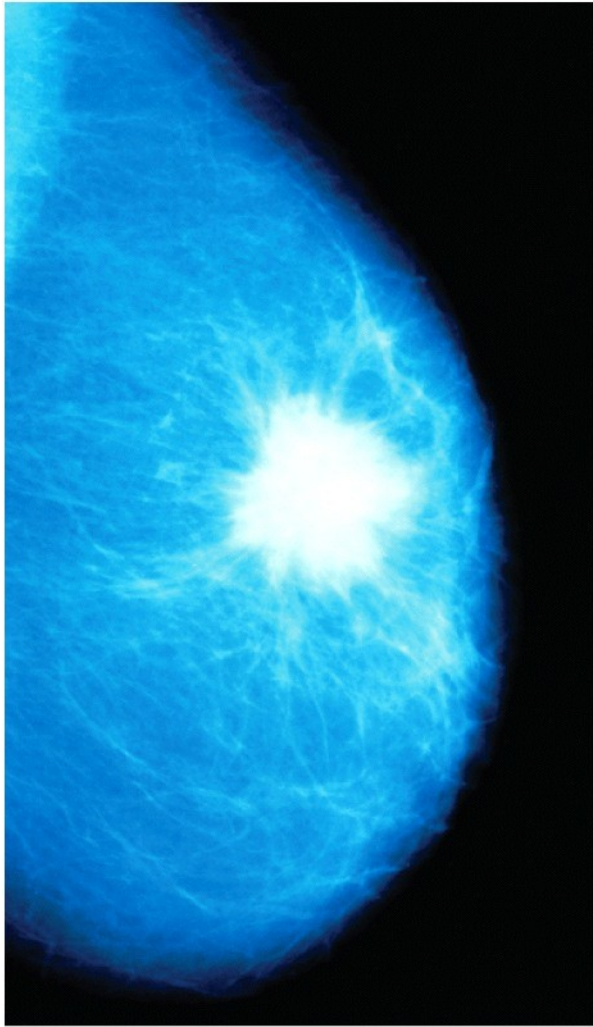
Left rib

Left lung

Heart

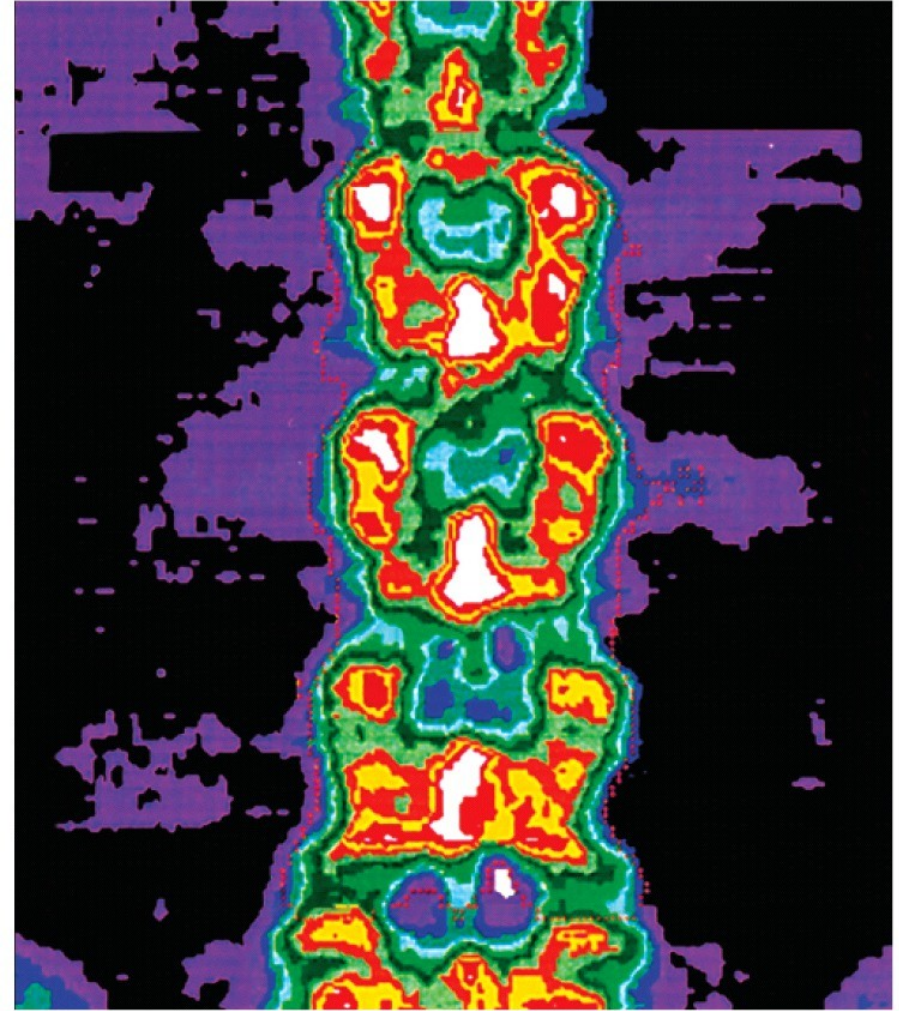
Diaphragm

Radiograph of thorax in anterior view



Breast Cancer Unit, Kings College Hospital,
London/Photo Researchers, Inc.

Mammogram of female breast showing cancerous tumor (white mass with uneven border)



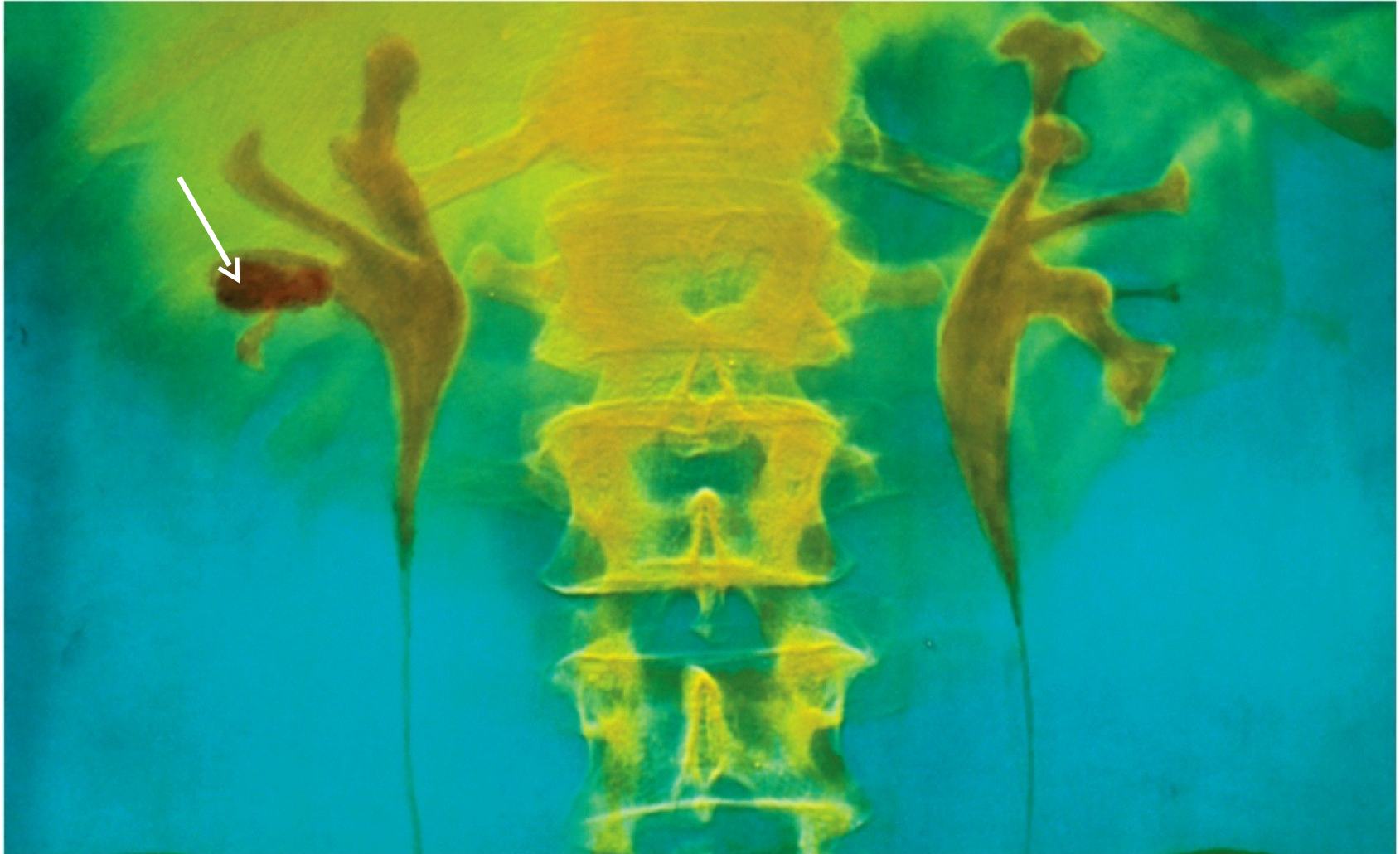
Zephyr/Photo Researchers, Inc.

Bone densitometry scan of lumbar spine in anterior view



Cardiothoracic Centre, Freeman Hospital,
Newcastle upon Tyne/Science Source

Angiogram of adult human heart showing a
blockage in coronary artery (arrow) 82



Intravenous urogram showing kidney stone (arrow) in right kidney



Science Photo Library/Photo Researchers, Inc.

Barium contrast x-ray showing cancer of the ascending colon (arrow)

TABLE 1.3

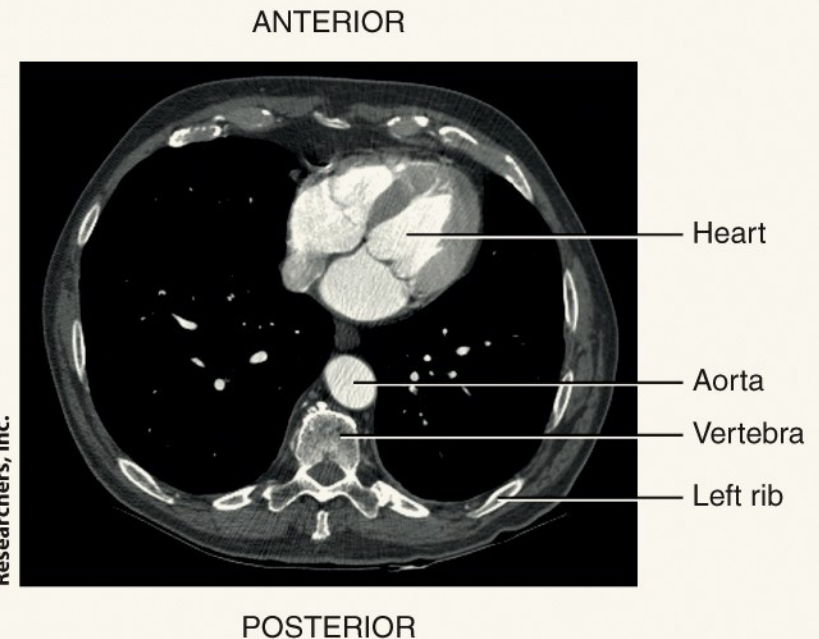
Common Medical Imaging Procedures

COMPUTED TOMOGRAPHY (CT) [formerly called computerized axial tomography (CAT) scanning]

Procedure: Computer-assisted radiography in which an x-ray beam traces an arc at multiple angles around a section of the body. The resulting transverse section of the body, called a *CT scan*, is shown on a video monitor.

Comments: Visualizes soft tissues and organs with much more detail than conventional radiographs. Differing tissue densities show up as various shades of gray. Multiple scans can be assembled to build three-dimensional views of structures (described next). Whole-body CT scanning is also used. Typically, such scans actually target the torso. Whole-body CT scanning appears to provide the most benefit in screening for lung cancers, coronary artery disease, and kidney cancers.

Living Art Enterprises/Science Source/Photo Researchers, Inc.



ANTERIOR



Heart

Aorta

Vertebra

Left rib

POSTERIOR

Computed tomography scan of thorax in inferior view

TABLE 1.3

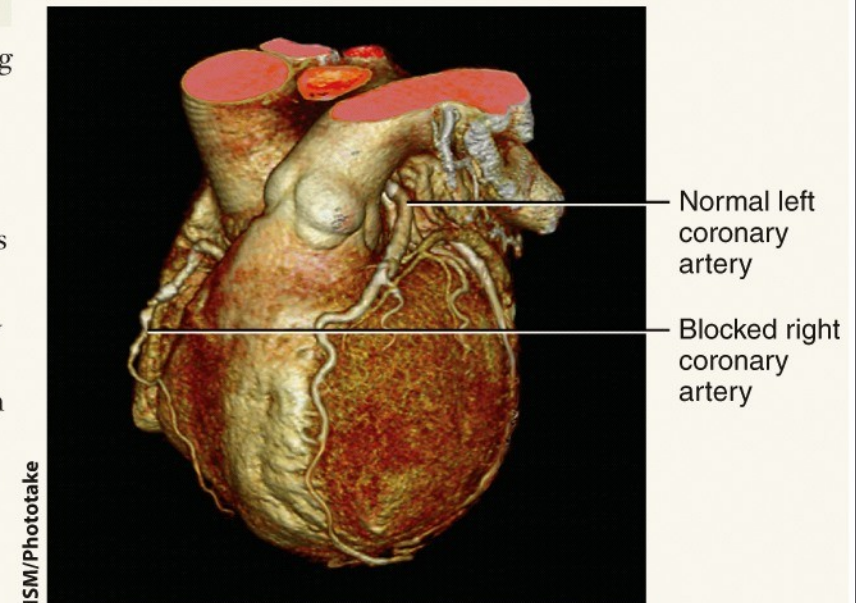
Common Medical Imaging Procedures

CORONARY (CARDIAC) COMPUTED TOMOGRAPHY ANGIOGRAPHY (CCTA)

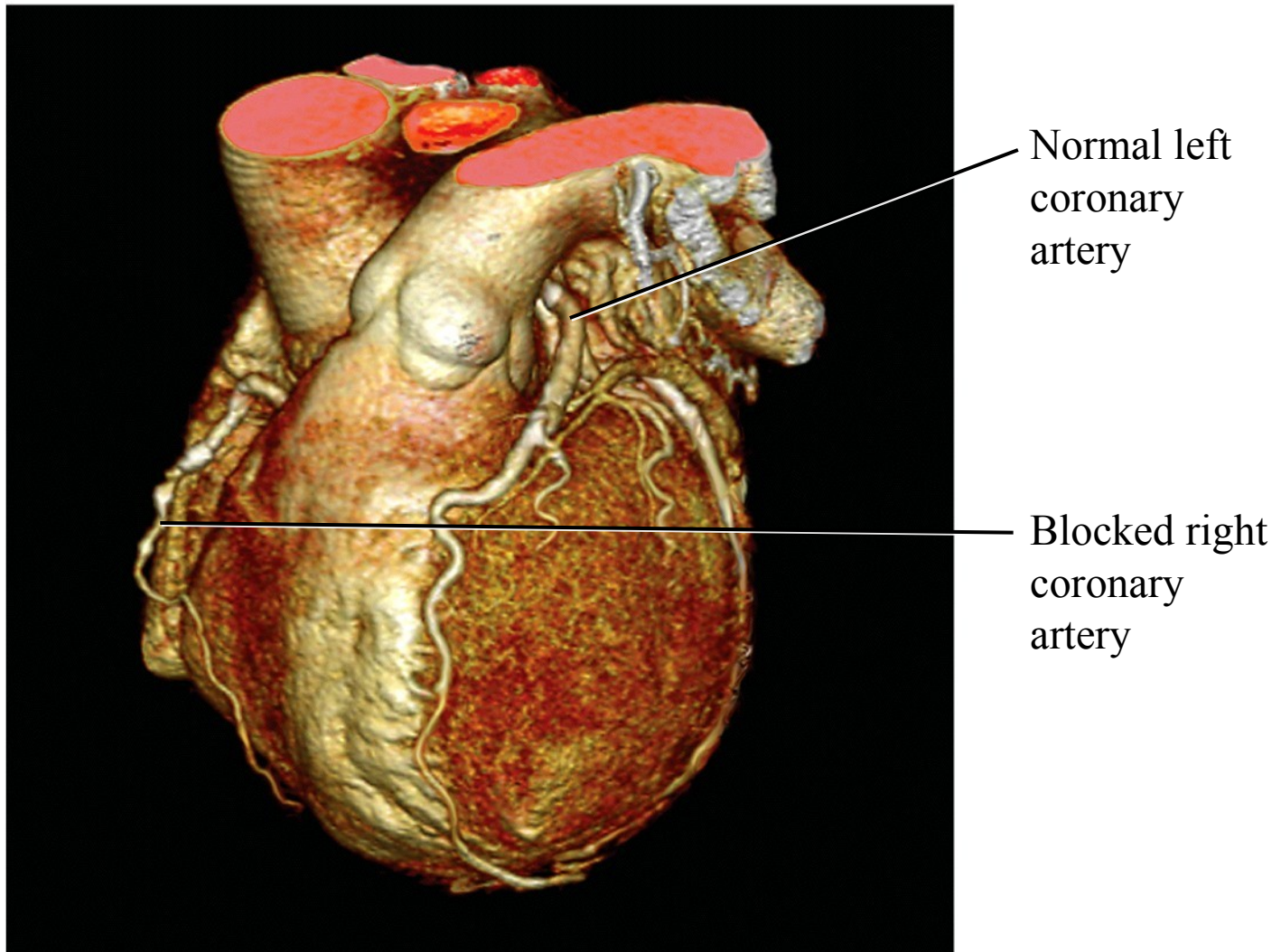
Procedure: Computer-assisted radiography in which an iodine-containing contrast medium is injected into a vein and a beta-blocker is given to decrease heart rate. Then, numerous x-ray beams trace an arc around the heart and a scanner detects the x-ray beams and transmits them to a computer, which transforms the information into a three-dimensional image of the coronary blood vessels on a monitor. The image procured is called a *CCTA scan* and can be generated in less than 20 seconds.

Comments: Used primarily to determine whether there are any coronary artery blockages (for example, atherosclerotic plaque or calcium) that may require an intervention such as angioplasty or stent. The CCTA can be rotated, enlarged, and moved at any angle. Since the procedure can take thousands of images of the heart within the time of a single heartbeat, it provides a great amount of detail about the heart's structure and function.

Computed tomography scan of thorax in inferior view



CCTA scan of coronary arteries



CCTA scan of coronary arteries

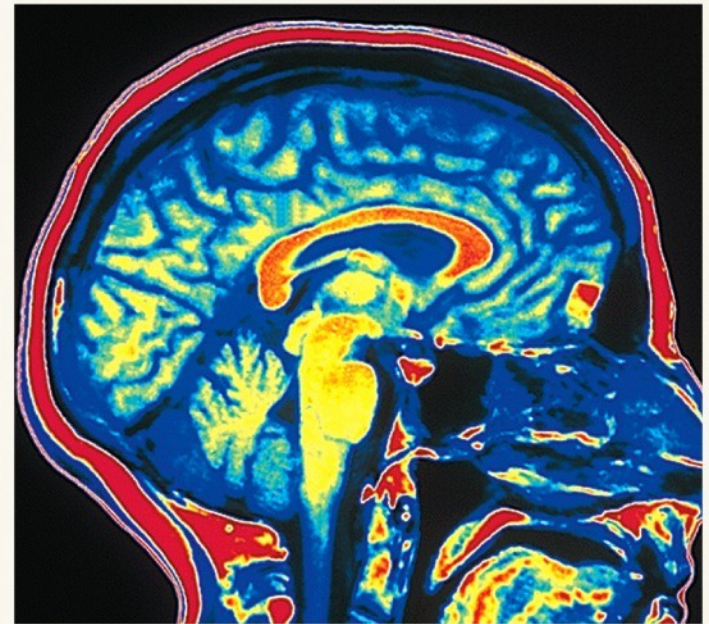
TABLE 1.3

Common Medical Imaging Procedures

MAGNETIC RESONANCE IMAGING (MRI)

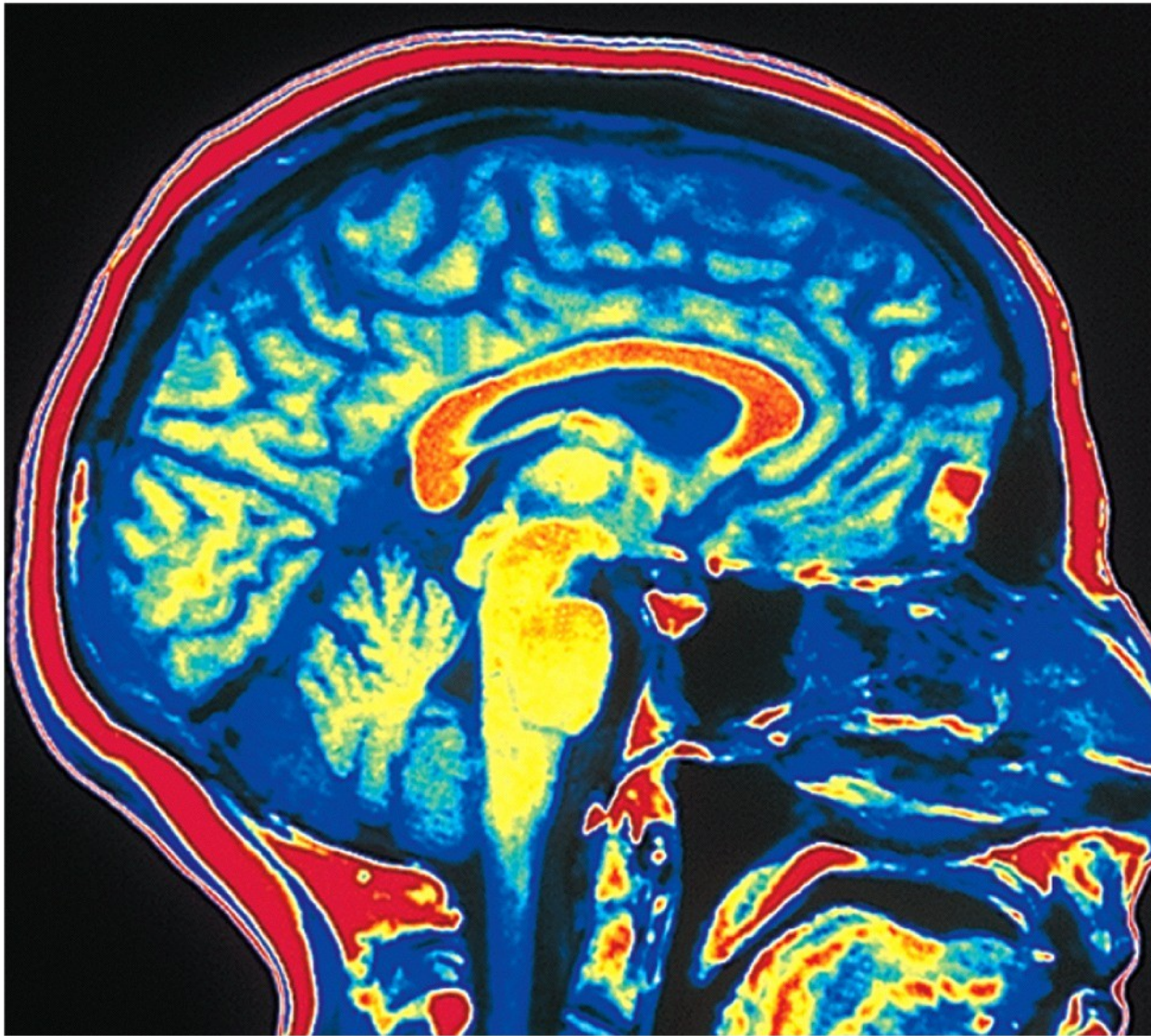
Procedure: The body is exposed to a high-energy magnetic field, which causes protons (small positive particles within atoms, such as hydrogen) in body fluids and tissues to arrange themselves in relation to the field. Then a pulse of radio waves “reads” these ion patterns, and a color-coded image is assembled on a video monitor. The result is a two- or three-dimensional blueprint of cellular chemistry.

Comments: Relatively safe, but can’t be used on patients with metal in their bodies. Shows fine details for soft tissues but not for bones. Most useful for differentiating between normal and abnormal tissues. Used to detect tumors and artery-clogging fatty plaques, reveal brain abnormalities, measure blood flow, and detect a variety of musculo-skeletal, liver, and kidney disorders.



Scott Camazine/Photo Researchers, Inc.

Magnetic resonance image of brain in sagittal section



Scott Camazine/Photo Researchers, Inc.

Magnetic resonance image of brain in sagittal section

TABLE 1.3

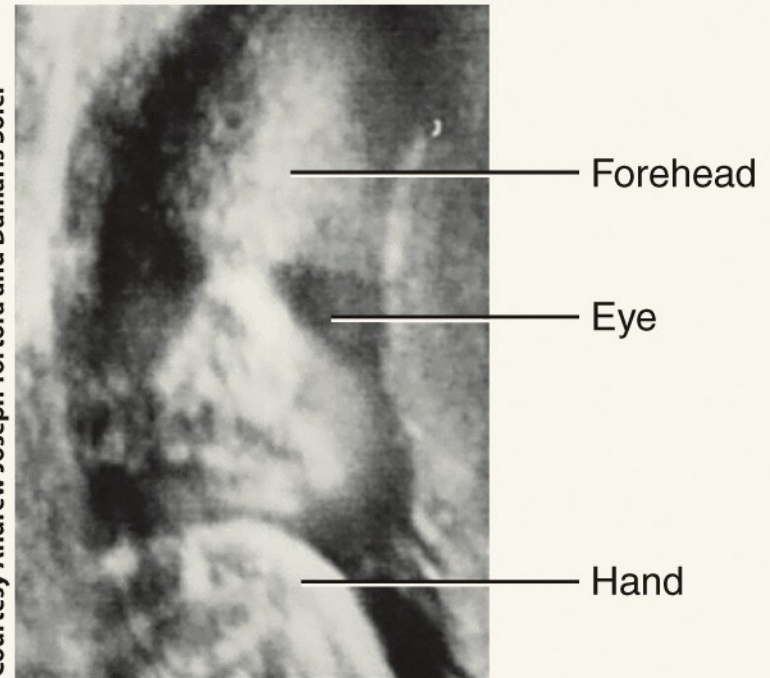
Common Medical Imaging Procedures

ULTRASOUND SCANNING

Procedure: High-frequency sound waves produced by a handheld wand reflect off body tissues and are detected by the same instrument. The image, which may be still or moving, is called a *sonogram* (SON-ō-gram) and is shown on a video monitor.

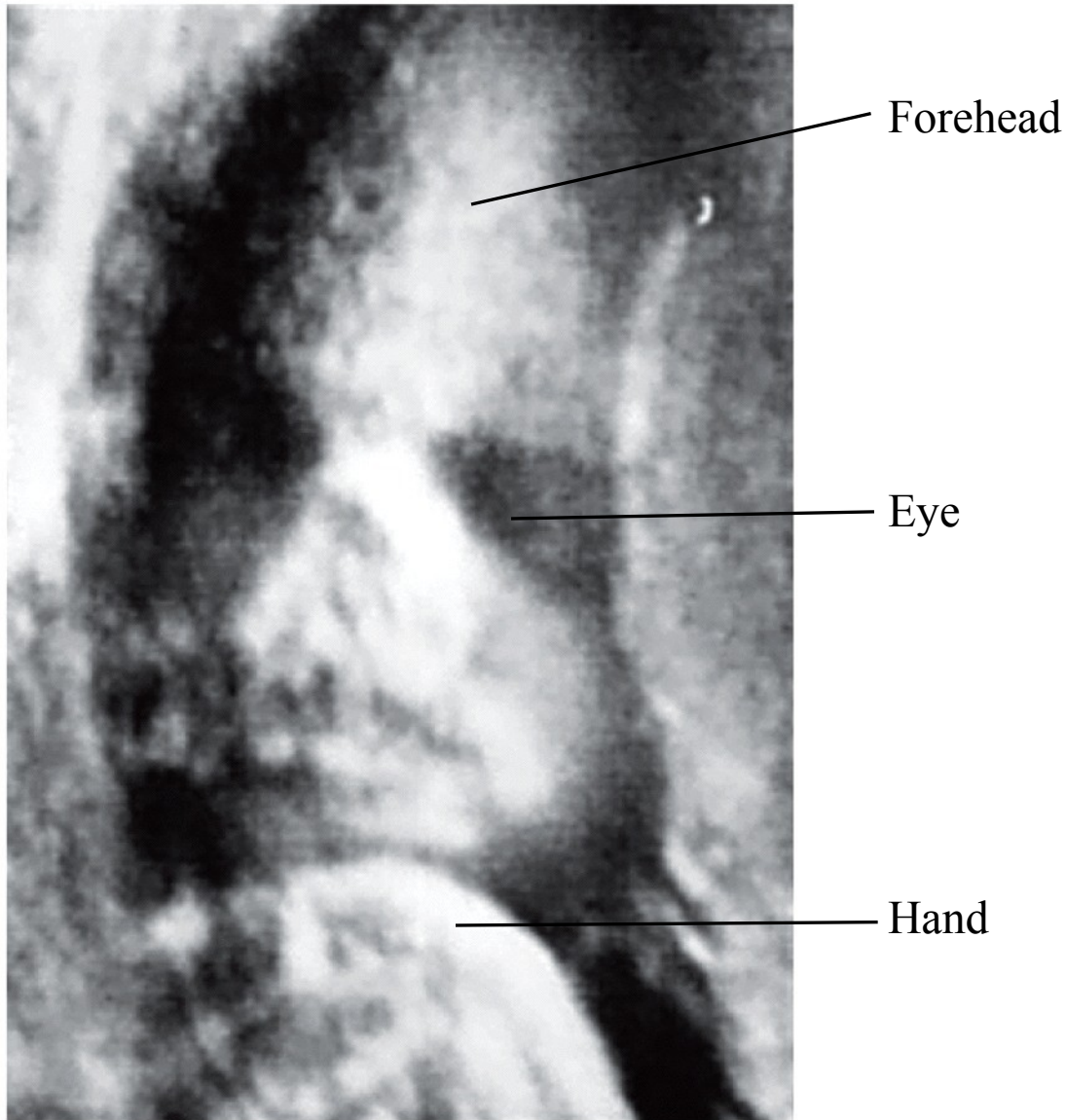
Comments: Safe, noninvasive, painless, and uses no dyes. Most commonly used to visualize the fetus during pregnancy. Also used to observe the size, location, and actions of organs and blood flow through blood vessels (**doppler ultrasound**).

Courtesy Andrew Joseph Tortora and Damaris Soler



Sonogram of fetus

Courtesy Andrew Joseph Tortora and Damaris Soler



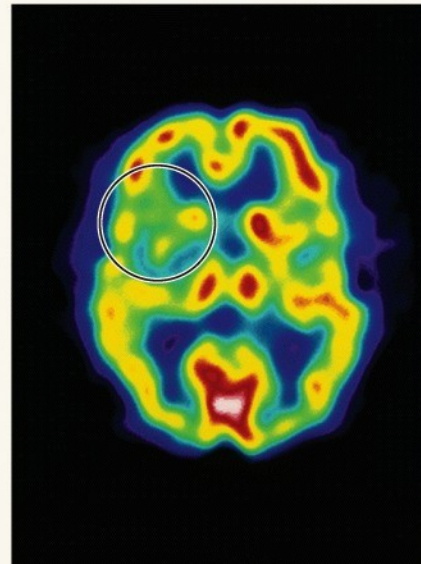
Sonogram of fetus (Courtesy of Andrew Joseph Tortora and Damaris Soler)

TABLE 1.3**Common Medical Imaging Procedures****POSITRON EMISSION TOMOGRAPHY (PET)**

Procedure: A substance that emits positrons (positively charged particles) is injected into the body, where it is taken up by tissues. The collision of positrons with negatively charged electrons in body tissues produces gamma rays (similar to x-rays) that are detected by gamma cameras positioned around the subject. A computer receives signals from the gamma cameras and constructs a *PET scan* image, displayed in color on a video monitor. The PET scan shows where the injected substance is being used in the body. In the PET scan image shown here, the black and blue colors indicate minimal activity; the red, orange, yellow, and white colors indicate areas of increasingly greater activity.

Comments: Used to study the physiology of body structures, such as metabolism in the brain or heart.

ANTERIOR

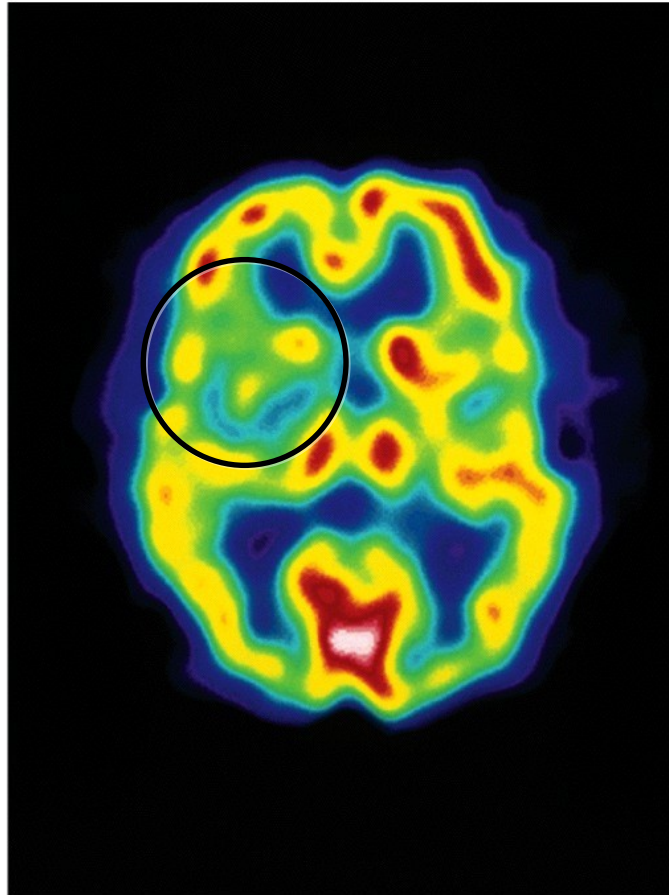


POSTERIOR

Positron emission tomography scan of transverse section of brain (circled area at upper left indicates where a stroke has occurred)

Department of Nuclear Medicine, Charing Cross
Hospital / Photo Researchers, Inc.

ANTERIOR



Department of Nuclear Medicine, Charing Cross
Hospital /Photo Researchers, Inc.

POSTERIOR

Positron emission tomography scan of transverse section of brain (circled area at upper left indicates where a stroke has occurred)

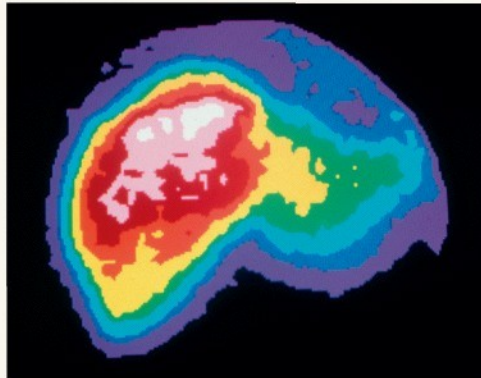
TABLE 1.3

Common Medical Imaging Procedures

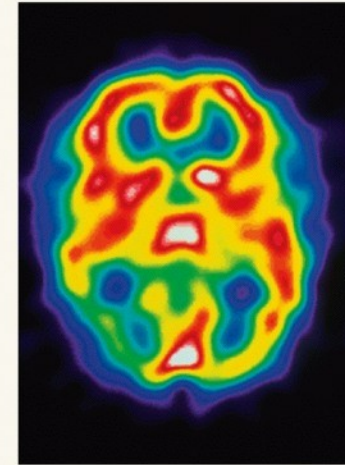
RADIONUCLIDE SCANNING

Procedure: A *radionuclide* (radioactive substance) is introduced intravenously into the body and carried by the blood to the tissue to be imaged. Gamma rays emitted by the radionuclide are detected by a gamma camera outside the subject and fed into a computer. The computer constructs a *radionuclide scan* and displays it in color on a video monitor. Areas of intense color take up a lot of the radionuclide and represent high tissue activity; areas of less intense color take up smaller amounts of the radionuclide and represent low tissue activity. **Single-photon-emission computed tomography (SPECT)** scanning is a specialized type of radionuclide scanning that is especially useful for studying the brain, heart, lungs, and liver.

Comments: Used to study activity of a tissue or organ, such as searching for malignant tumors in body tissues or scars that may interfere with heart muscle function.

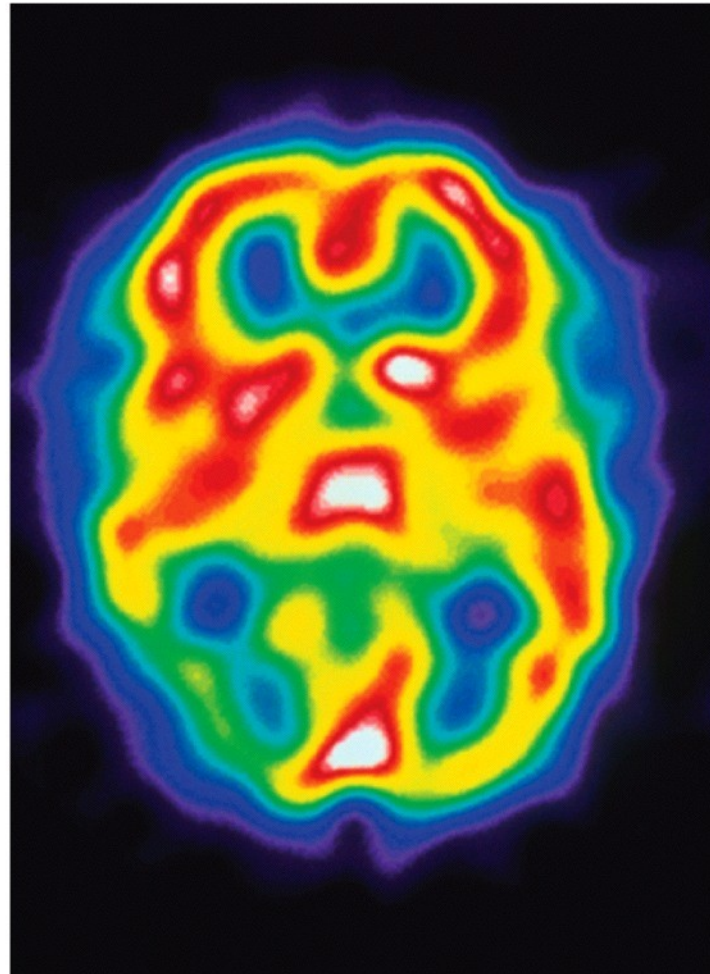


Radionuclide (nuclear) scan of normal human liver



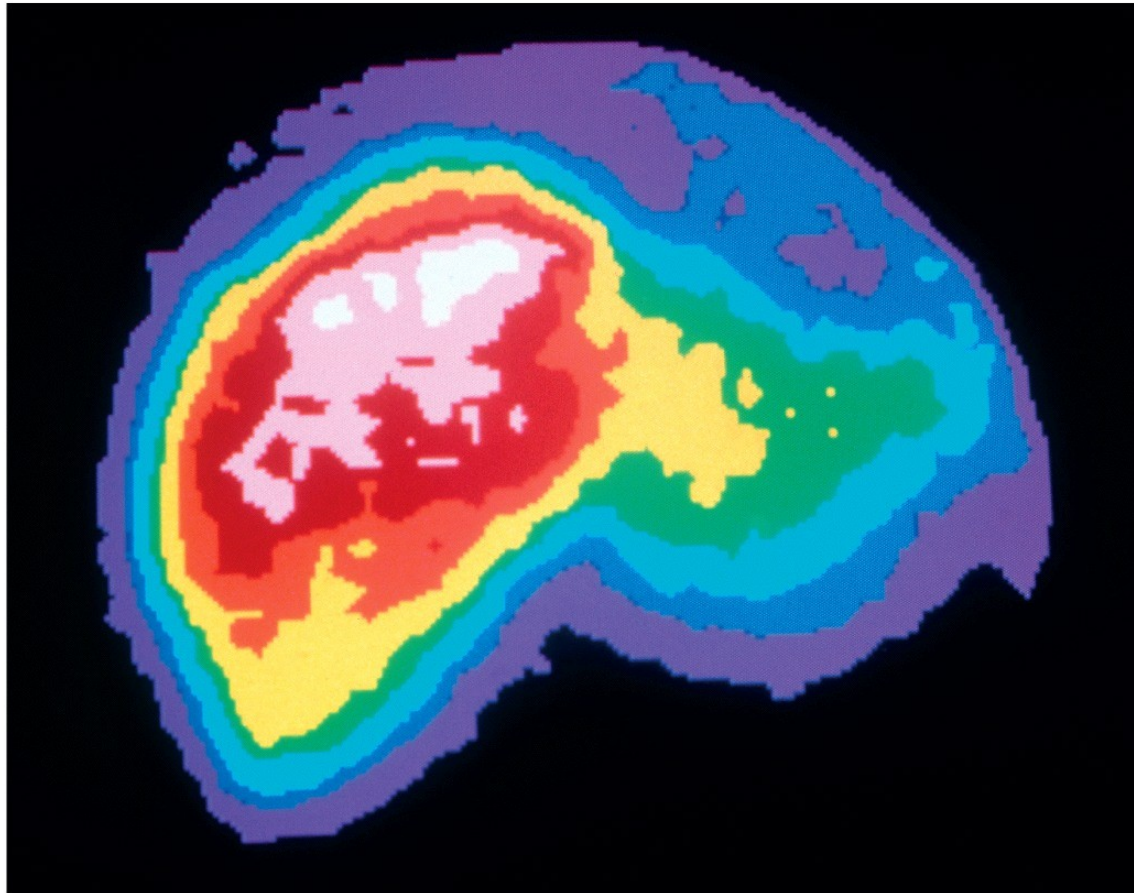
Dept. of Nuclear Medicine, Charing Cross Hospital / Photo Researchers, Inc.

Single-photon-emission computerized tomography (SPECT) scan of transverse section of brain (green area at lower left indicates a migraine attack)



Dept. of Nuclear Medicine, Charing Cross
Hospital/Photo Researchers, Inc.

Single-photon-emission computerized tomography (SPECT) scan of transverse section of brain (green area at lower left indicates a migraine attack)



Publiphoto/Photo Researchers, Inc.

Radionuclide (nuclear) scan of normal human heart

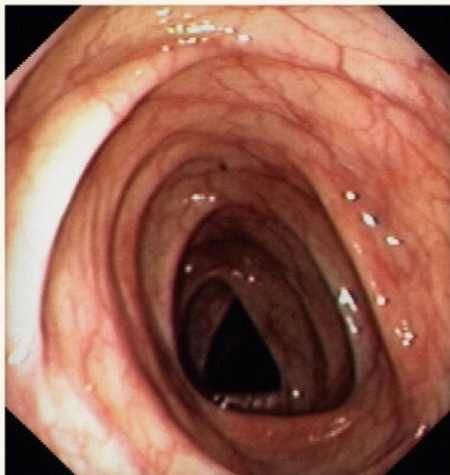
TABLE 1.3

Common Medical Imaging Procedures

ENDOSCOPY

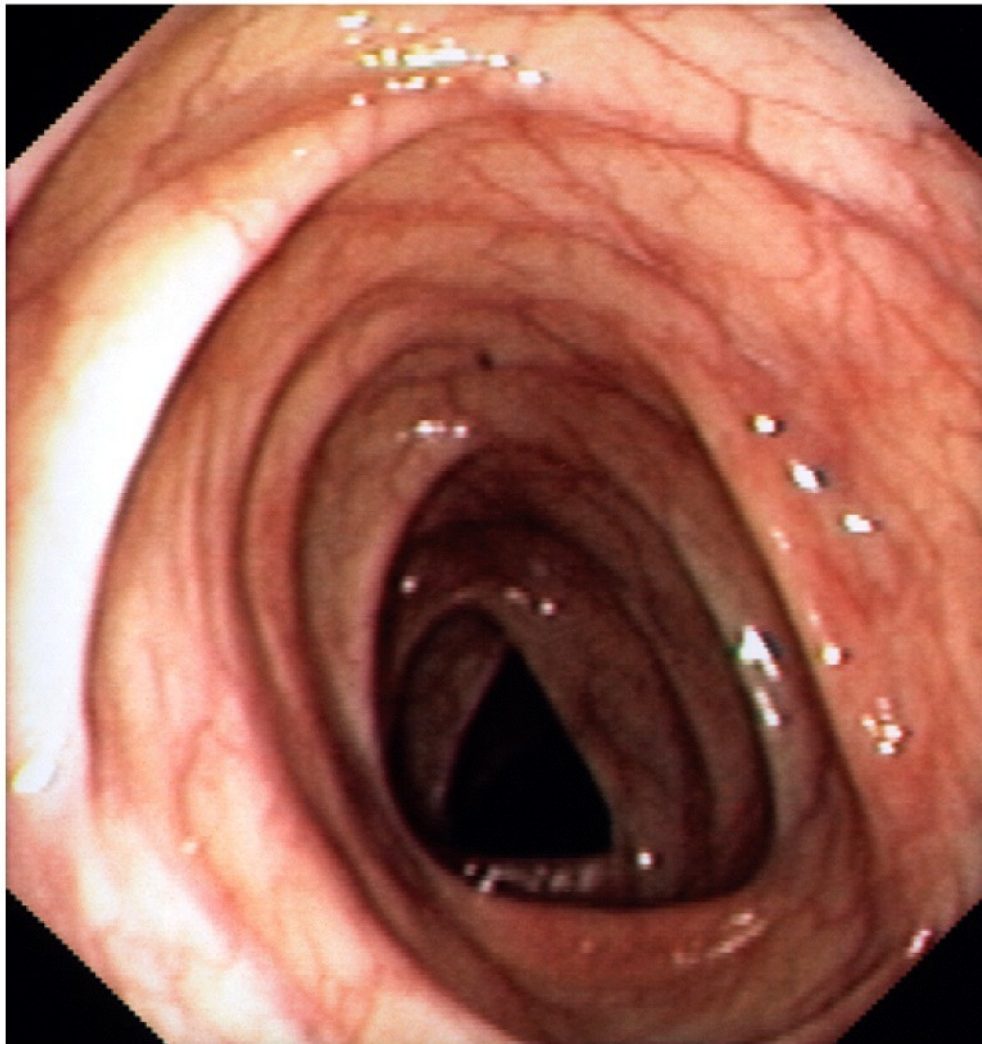
Procedure: The visual examination of the inside of body organs or cavities using a lighted instrument with lenses called an *endoscope*. The image is viewed through an eyepiece on the endoscope or projected onto a monitor.

Comments: Examples of endoscopy include colonoscopy, laparoscopy, and arthroscopy. *Colonoscopy* is used to examine the interior of the colon, which is part of the large intestine. *Laparoscopy* is used to examine the organs within the abdominopelvic cavity. *Arthroscopy* is used to examine the interior of a joint, usually the knee.



Camal/Phototake

Interior view of colon as shown
by colonoscopy



Camal/Phototake

Interior view of colon as shown by
colonoscopy

Measuring the Human Body

Measurements (such as dimensions, weight, volume, etc.) of parts of the body are expressed by scientists in metric units.



MEASUREMENTS

U.S. Customary System

PARAMETER	UNIT	RELATION TO OTHER U.S. UNITS	SI (METRIC) EQUIVALENT
Length	inch	1/12 foot	2.54 centimeters
	foot	12 inches	0.305 meter
	yard	36 inches	0.914 meters
	mile	5,280 feet	1.609 kilometers
Mass	grain	1/1000 pound	64.799 milligrams
	dram	1/16 ounce	1.772 grams
	ounce	16 dram	28.350 grams
	pound	16 ounces	453.6 grams
	ton	2,000 pounds	907.18 kilograms
Volume (Liquid)	ounce	1/16 pint	29.574 milliliters
	pint	16 ounces	0.473 liter
	quart	2 pints	0.946 liter
	gallon	4 quarts	3.785 liters
Volume (Dry)	pint	1/2 quart	0.551 liter
	quart	2 pints	1.101 liters
	peck	8 quarts	8.810 liters
	bushel	4 pecks	35.239 liters

International System (SI)

BASE UNITS

UNIT	QUANTITY	SYMBOL
meter	length	m
kilogram	mass	kg
second	time	s
liter	volume	L
Mole	amount of matter	mol

PREFIXES

PREFIX	MULTIPLIER	SYMBOL
tera-	10^{12} = 1,000,000,000,000	T
giga-	10^9 = 1,000,000,000	G
mega-	10^6 = 1,000,000	M
kilo-	10^3 = 1,000	k
hecto-	10^2 = 100	h
deca-	10^1 = 10	da
deci-	10^{-1} = 0.1	d
centi-	10^{-2} = 0.01	c
milli-	10^{-3} = 0.001	m
micro-	10^{-6} = 0.000,001	μ
nano-	10^{-9} = 0.000,000,001	n
pico-	10^{-12} = 0.000,000,000,001	p