

The Body as a Whole

The Essentials of the Language of Anatomy



CASE REPORT 2.1

You are

... a physical therapy assistant (PTA) employed in the Rehabilitation Unit at Fulwood Medical Center.

You are communicating with

... Mrs. Amy Vargas, a 70-year-old housewife, who is 2 weeks postop following an emergency right hip replacement for a hip fracture. Your task is to help her increase her walking ability and increase strength and mobility in her hip joint and upper arms.

You know that, in order to prevent her hip replacement from dislocating, she has been instructed to:

- Not bring the right leg or knee **medially** across the **sagittal** plane, for example, not to cross the right leg over the left leg.
- Not lift the right knee so that it is superior to the right hip.
- Not bend the trunk **anteriorly** so that it is at more than a 90-degree angle to the thigh.

Learning Outcomes

Effective medical treatment recognizes that each organ, tissue, and cell in your body, no matter where it is situated, functions in harmony with and affects every other organ, tissue, and cell. To understand these concepts, you need to be able to:

- 2.1 Describe the medical terms of the different anatomical planes, directions, and body regions.
- 2.2 Integrate individual body systems into the organization and function of the body as a whole.
- 2.3 Comprehend, spell, and write medical terms pertaining to the body as a whole so that you communicate and document accurately and precisely.
- 2.4 Recognize and pronounce medical terms pertaining to the body as a whole so that you communicate verbally with accuracy and precision.



LESSON 2.1

THE BODY AS A WHOLE

Anatomical Positions, Planes, and Directions

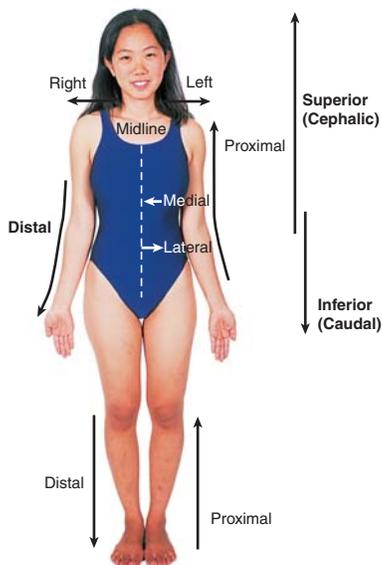
OBJECTIVES

Terms have been developed over the past several thousand years to enable you to describe clearly where different anatomical structures and lesions are in relation to each other. To do this, you need to be able to:

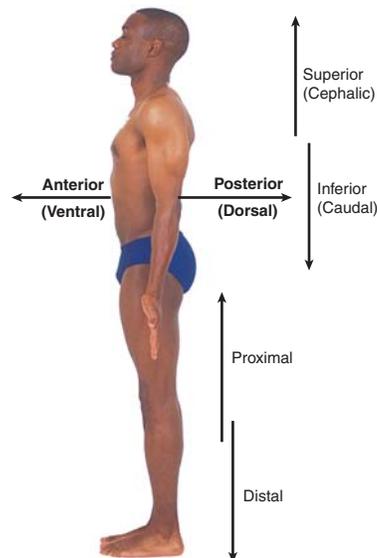
- Define the fundamental anatomical position on which all descriptions of anatomical locations are based.
- Describe the medical terminology of the different anatomical planes and directions.
- Relate these terms to physical sites on the body.
- Locate the body cavities.
- Identify the medical terminology of the four abdominal quadrants and nine regions.

Keynote

The transverse plane is the only horizontal body plane.



▲ FIGURE 2.1 Anatomical Position, with Directional Terms.



▲ FIGURE 2.2 Other Directional Terms.

FUNDAMENTAL ANATOMICAL POSITION

When all anatomical descriptions are used, it is assumed that the body is in the “anatomical position” (Figure 2.1). The body is standing erect with feet flat on the floor, face and eyes are facing forward, and arms are at the side with the palms facing forward.

When you lie down flat on your back, you are **supine**. When your palms face forward, the forearm is supine. When you lie down flat on your belly, you are **prone**. When your palms face backward, the forearm is prone.

ANATOMICAL DIRECTIONAL TERMS

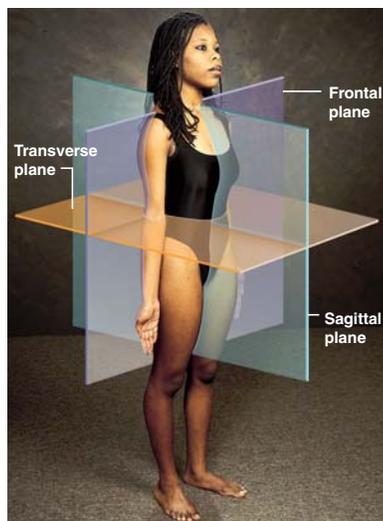
Directional terms describe the position of one structure or part of the body relative to another structure or part of the body. These directional terms are shown in Figures 2.1 and 2.2.

ANATOMICAL PLANES

Different views of the body are based on imaginary “slices” producing flat surfaces (planes) that pass through the body (Figure 2.3).

The three major anatomical planes are:

- **Transverse or horizontal:** A plane passing across the body parallel to the floor and perpendicular to the body’s long axis. It divides the body into an upper or superior portion and a lower or inferior portion.
- **Sagittal:** A vertical plane that divides the body into right and left portions.
- **Frontal (coronal):** A vertical plane that divides the body into front (**anterior**) and back (**posterior**) portions.



▲ FIGURE 2.3 Anatomical Planes.



Study Hint
Help your memory with little tricks of association for medical terms. *Example:* The medical term *supine* has the word *up* in it. The meaning of supine is *lying with the face and the anterior part of the body UP*. Associate *UP* with *sUPine*, and you will have no trouble remembering its definition. Then associate the opposite term, and you will know the meaning of *prone* as well.

Abbreviation

PTA physical therapy assistant

WORD ANALYSIS AND DEFINITION

S/ = Suffix P/ = Prefix R/ = Root R/CF = Combining Form

WORD	PRONUNCIATION	ELEMENTS		DEFINITION
abdomen abdominal (adj)	AB -doh-men ab- DOM -in-al	S/ R/	Latin <i>abdomen</i> -al <i>pertaining to</i> abdomin- <i>abdomen</i>	Part of the trunk between thorax and pelvis. Pertaining to the abdomen.
anterior (opposite of <i>posterior</i>)	an- TEER -ee-or	S/ R/	-ior <i>pertaining to</i> anter- <i>before, front part</i>	The front surface of the body; situated in front.
caudal (opposite of <i>cephalic</i> , same as <i>inferior</i>)	KAW -dal	S/ R/	-al <i>pertaining to</i> caud- <i>tail</i>	Pertaining to or nearer to the tailbone.
cephalic (opposite of <i>caudal</i> , same as <i>superior</i>)	seh- FAL -ik	S/ R/	-ic <i>pertaining to</i> cephal- <i>head</i>	Pertaining to or nearer to the head.
coronal (same as <i>frontal</i>)	KOR -oh-nal	S/ R/	-al <i>pertaining to</i> coron- <i>crown</i>	Pertaining to the vertical plane dividing the body into anterior and posterior portions.
distal (opposite of <i>proximal</i>)	DISS -tal	S/ R/	-al <i>pertaining to</i> dist- <i>away from the center</i>	Situated away from the center of the body.
dorsal (same as <i>posterior</i>)	DOOR -sal	S/ R/	-al <i>pertaining to</i> dors- <i>back</i>	Pertaining to the back or situated behind.
lateral (opposite of <i>medial</i>)	LAT -er-al	S/ R/	-al <i>pertaining to</i> later- <i>side</i>	Situated at the side of a structure.
medial (opposite of <i>lateral</i>)	ME -dee-al	S/ R/	-al <i>pertaining to</i> medi- <i>middle</i>	Nearer to the middle of the body.
posterior (opposite of <i>anterior</i>)	pohs- TEER -ee-or	S/ R/	-ior <i>pertaining to</i> poster- <i>back part</i>	Pertaining to the back surface of the body; situated behind.
prone (opposite of <i>supine</i>)	PROHN		Latin <i>bending forward</i>	Lying face down, flat on your belly.
proximal (opposite of <i>distal</i>)	PROK -sih-mal	S/ R/	-al <i>pertaining to</i> proxim- <i>nearest to the center</i>	Situated nearest to the center of the body.
sagittal	SAJ -ih-tal	S/ R/	-al <i>pertaining to</i> sagitt- <i>arrow</i>	Vertical plane through the body dividing it into right and left portions.
supine (opposite of <i>prone</i>)	soo- PINE		Latin <i>lying on the back</i>	Lying face up, flat on your spine.
transverse	trans- VERS		Latin <i>crosswise</i>	Horizontal plane dividing the body into upper and lower portions.
ventral (same as <i>anterior</i>)	VEN -tral	S/ R/	-al <i>pertaining to</i> ventr- <i>belly</i>	Pertaining to the belly or situated nearer the surface of the belly.

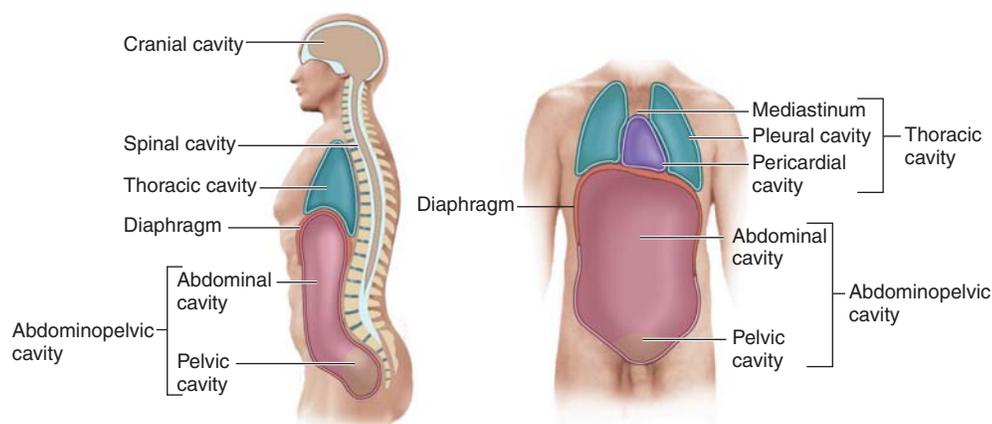
EXERCISES

Group the opposites in the WAD above for ease of study. Fill in the chart.

Term	Meaning of Term	Opposite Term	Meaning of Opposite Term
Anterior			
Caudal			
Distal			
Prone			

BODY CAVITIES

FIGURE 2.4 Major Body Cavities.



The body contains many **cavities**. Some, like the nasal cavity, open to the outside. Five **cavities** do not open to the outside; they are shown in *Figure 2.4* and listed below.

1. **Cranial cavity:** Contains the brain within the skull.
2. **Thoracic cavity:** Contains the heart, lungs, thymus gland, trachea and esophagus, and numerous blood vessels and nerves.
3. **Abdominal cavity:** Is separated from the thoracic cavity by the **diaphragm** and contains the stomach, intestines, liver, spleen, pancreas, and kidneys.
4. **Pelvic cavity:** Is surrounded by the pelvic bones and contains the urinary bladder, part of the large intestine, the rectum and anus, and the internal reproductive organs.
5. **Spinal cavity:** Contains the spinal cord.

The abdominal cavity and pelvic cavity can be combined as the **abdominopelvic cavity**.

ABDOMINAL QUADRANTS

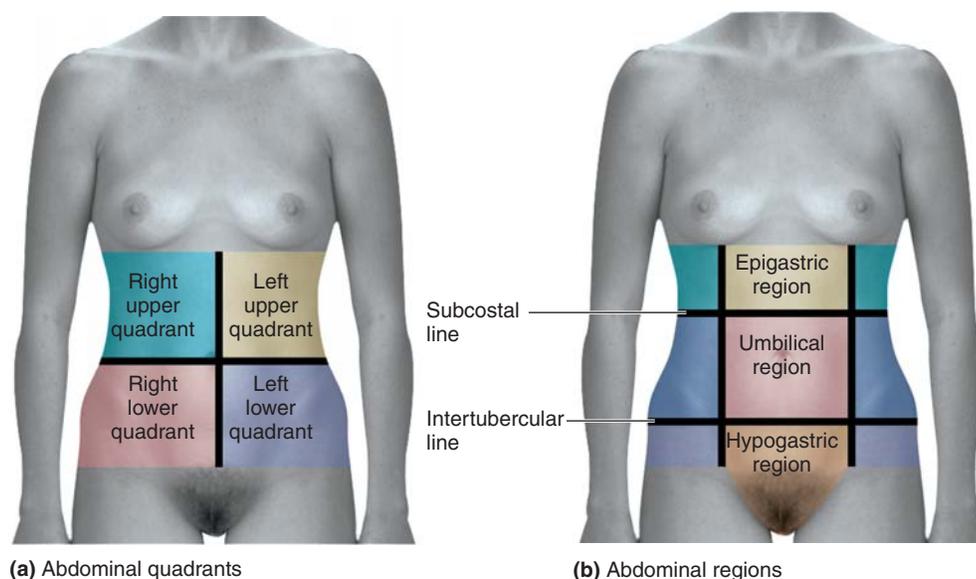
One way of referring to the locations of abdominal structures and to the site of abdominal pain and other abnormalities is to divide the abdomen into **quadrants**, as shown in *Figure 2.5a*. The locations are right upper quadrant (**RUQ**), left upper quadrant (**LUQ**), right lower quadrant (**RLQ**), and left lower quadrant (**LLQ**).

In addition, there are nine regions in the abdomen, as shown in *Figure 2.5b*.

Abbreviations

LLQ	left lower quadrant
LUQ	left upper quadrant
RLQ	right lower quadrant
RUQ	right upper quadrant

FIGURE 2.5 Regional Anatomy.





LESSON 2.2

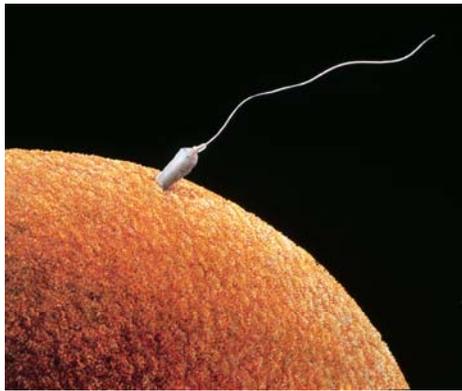
Organization of the Body

THE BODY AS A WHOLE

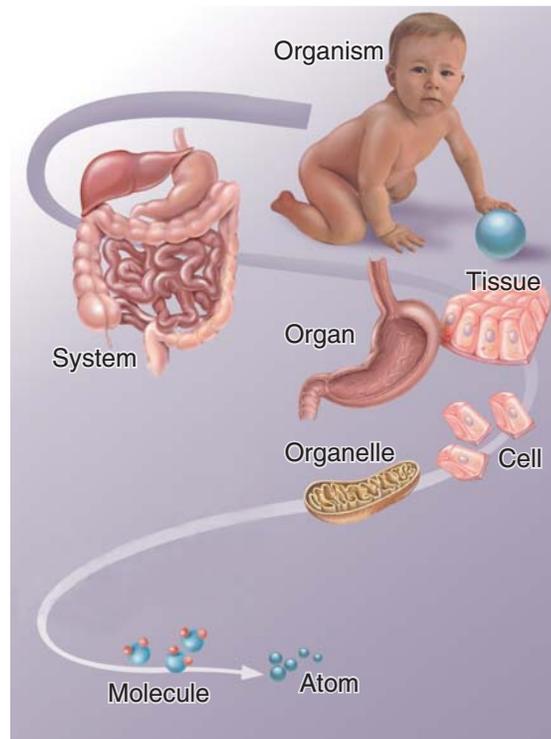
OBJECTIVES

All the different elements of your body interact with each other to enable your body to be in constant change as it reacts to your environment and to the nourishment you give it. To understand the structure and function of the elements of your body, you need to be able to:

- Name the medical terms associated with cells, tissues, and organs.
- Discuss the medical terminology for the major structures and functions of a cell.
- Describe the structures and functions of the nucleus and mitochondria.



▲ FIGURE 2.6 Fertilization of Egg by Single Sperm.



COMPOSITION OF THE BODY

- The whole body or organism is composed of *organ* systems.
 - Organ systems are composed of *organs*.
 - Organs are composed of *tissues*.
 - Tissues are composed of *cells*.
 - Cells are composed in part of *organelles*.
 - Organelles are composed of *molecules*.
 - Molecules are composed of *atoms*.

THE CELL

The result of the **fertilization** of an egg by a sperm is a single fertilized cell, the **zygote** (Figure 2.6). This cell is the origin of every cell in your body. It divides and multiplies into millions of cells that are the basic unit of every tissue and organ. The structure and all the functions of your tissues and organs are due to their cells. **Cytology** is the study of cell structure and function.

WORD ANALYSIS AND DEFINITION

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WORD	PRONUNCIATION	ELEMENTS		DEFINITION
cell	SELL		Latin <i>a storeroom</i>	The smallest unit of the body capable of independent existence.
cytology	SIGH-tol-oh-jee	S/ R/CF S/	-logy <i>study of</i>	Study of the cell.
cytologist	SIGH-tol-oh-jist		cyt/o- <i>cell</i> -logist <i>one who studies, a specialist</i>	Specialist in the structure, chemistry, and pathology of the cell.
fertilization (noun)	FER-til-eye-ZAY-shun	S/ R/	-ation <i>process</i>	Union of a male sperm and a female egg.
fertilize (verb)	FER-til-ize		fertiliz- <i>to make fruitful</i> Greek <i>to bear</i>	Penetration of the egg by sperm.
organ	OR-gan		Latin <i>instrument, tool</i>	Structure with specific functions in a body system.
organelle	OR-gah-nell	S/ R/ S/	-elle <i>small</i>	Part of a cell having specialized function(s).
organism	OR-gan-izm		organ- <i>organ</i> -ism <i>condition, process</i>	Any whole living, individual plant or animal.
tissue	TISH-you		Latin <i>to weave</i>	Collection of similar cells.
zygote	ZYE-goat		Greek <i>yolk</i>	Cell resulting from the union of sperm and egg.

EXERCISES

Review the terms in the WAD box above and the text on the opposite page before answering the questions. Pay careful attention to word elements and meanings. Fill in the blanks.

1. Put the following terms in the ascending order of their size:

organism cells molecules organs
organ systems organelles atoms tissues

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

2. The suffix _____ means *study of*. The suffix that means *specialist (in the study of)* is _____.

3. What part of *cyt/o* makes it a combining form rather than a root? _____

4. Write two definitions of any two terms in question 1.

- _____
- _____

STRUCTURE AND FUNCTION OF CELLS

As the zygote divides, every cell derived from it becomes a small, complex factory that carries out these basic functions of life:

- **Manufacture** of proteins and **lipids**.
- **Production** and use of energy.
- **Communication** with other cells.
- **Replication** of deoxyribonucleic acid (DNA).
- **Reproduction** of itself.

Abbreviation

DNA deoxyribonucleic acid

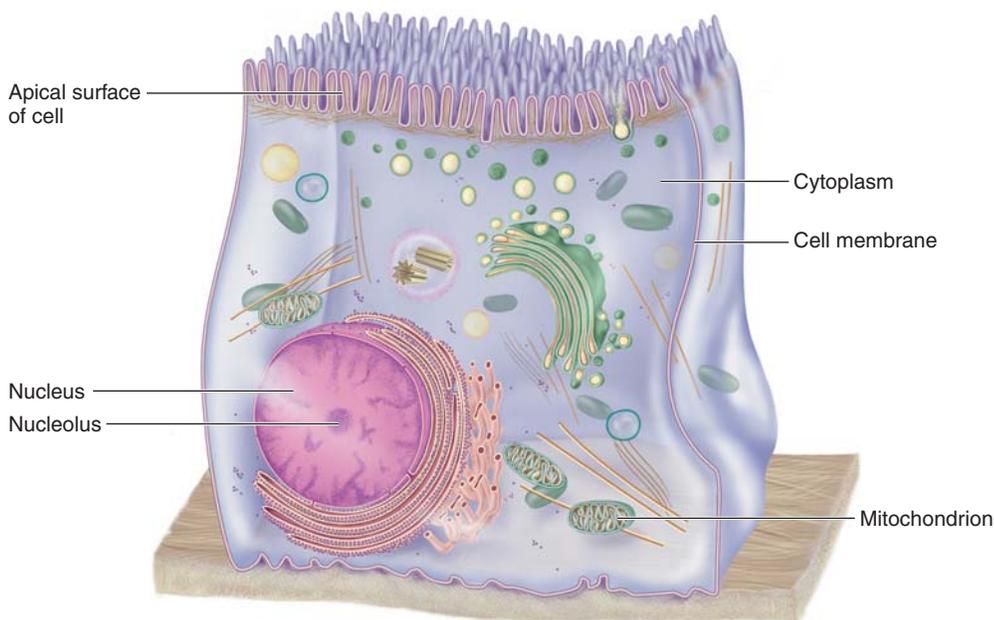
All your cells contain a fluid called **cytoplasm** (intracellular fluid) surrounded by a cell **membrane** (Figure 2.7).

The cell membrane is made of **proteins** and **lipids** and allows water, oxygen, glucose, **electrolytes**, **steroids**, and alcohol to pass through it. On the outside of the cell membrane are receptors that bind to chemical messengers such as **hormones** sent by other cells. These are the chemical signals by which your cells communicate with each other.

Organelles are small structures in the cytoplasm of the cell that carry out special **metabolic** tasks, the chemical processes that occur in the cell. They include the nucleus, nucleolus, and **mitochondria**. These organelles are defined, and their functions detailed, in the succeeding pages.

Keynote

The cytoplasm is a clear, gelatinous substance crowded with different organelles.



▲ **FIGURE 2.7** Structure of a Representative Cell.

WORD ANALYSIS AND DEFINITION

S/ = Suffix P/ = Prefix R/ = Root R/CF = Combining Form

WORD	PRONUNCIATION	ELEMENTS		DEFINITION
cytoplasm	SIGH-toh-plazm	S/ R/CF	-plasm <i>something formed</i> cyt/o- <i>cell</i>	Clear, gelatinous substance that forms the substance of a cell, except for the nucleus.
deoxyribonucleic acid (DNA)	dee-OCK-see-rye boh-noo-KLEE-ik ASS-id		deoxyribose (a sugar) nucleic acid (a protein)	Source of hereditary characteristics found in chromosomes.
electrolyte	ee-LEK-troh-lite	S/ R/CF	-lyte <i>soluble</i> electr/o- <i>electricity</i>	Substance that, when dissolved in a suitable medium, forms electrically charged particles.
hormone	HOR-mohn		Greek <i>set in motion</i>	Chemical formed in one tissue or organ and carried by the blood to stimulate or inhibit a function of another tissue or organ.
hormonal (adj)	hor-MOHN-al	S/ R/	-al <i>pertaining to</i> hormon- <i>hormone</i>	Pertaining to a hormone.
lipid	LIP-id		Greek <i>fat</i>	General term for all types of fatty compounds; for example, cholesterol, triglycerides and fatty acids.
membrane	MEM-brain		Latin <i>parchment</i>	Thin layer of tissue covering a structure or cavity.
membranous (adj)	MEM-brah-nus	S/ R/	-ous <i>pertaining to</i> membran- <i>cover, skin</i>	Pertaining to a membrane.
metabolism	meh-TAB-oh-lizm	S/ R/	-ism <i>condition, process</i> metabol- <i>change</i>	The constantly changing physical and chemical processes occurring in the cell that are the sum of anabolism and catabolism.
metabolic (adj)	met-ah-BOL-ik	S/	-ic <i>pertaining to</i>	Pertaining to metabolism.
mitochondria (pl)	my-toe-KON-dree-ah	S/ R/CF	-ia <i>condition</i> mit/o- <i>thread</i>	Organelles that generate, store, and release energy for cell activities.
mitochondrion (singular)	my-toe-KON-dree-on	R/ S/	-chondr- <i>granule</i> -ion <i>condition</i>	
protein	PRO-teen		Greek <i>protein</i>	Class of food substances based on amino acids.
steroid	STER-oyd	S/ R/	-oid <i>resembling</i> ster- <i>solid</i>	Large family of chemical substances found in many drugs, hormones, and body components.

EXERCISES

Elements: Knowledge of elements is your best clue to determining the meaning of medical terminology. Analyze the elements in these questions to find your answers. Fill in the blanks.

1. What do the terms *metabolism* and *mitochondria* have in common?

(Hint: They both lack the same thing.)

Use either term in a sentence of your choice that is not a definition.

2. Which term relates to electrically charged particles? (Circle the best answer.)

protein membrane electrolyte

3. Which term relates to change?

steroid metabolic lipid

4. Which term is a condition?

metabolism cytoplasm hormone

STRUCTURE AND FUNCTION OF CELLS (continued)

Organelles

The **nucleus** is the largest organelle (Figure 2.8). It directs all the activities of the cell. The nucleus is surrounded by its own membrane. The 46 molecules of DNA in the nucleus form 46 **chromosomes** (Figure 2.9).

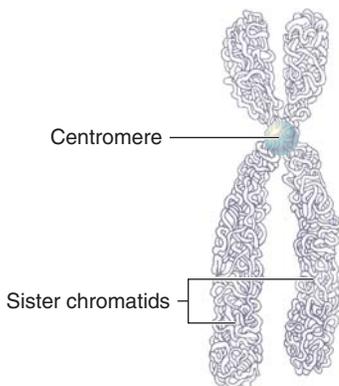
Each nucleus contains a **nucleolus**, a small dense body composed of **ribonucleic acid (RNA)** and protein. It is involved in the manufacture of proteins from simple materials—a process called **anabolism**.

Mitochondria are the powerhouses of the cell. They produce energy by breaking down compounds such as glucose and fat—a process called **catabolism**.

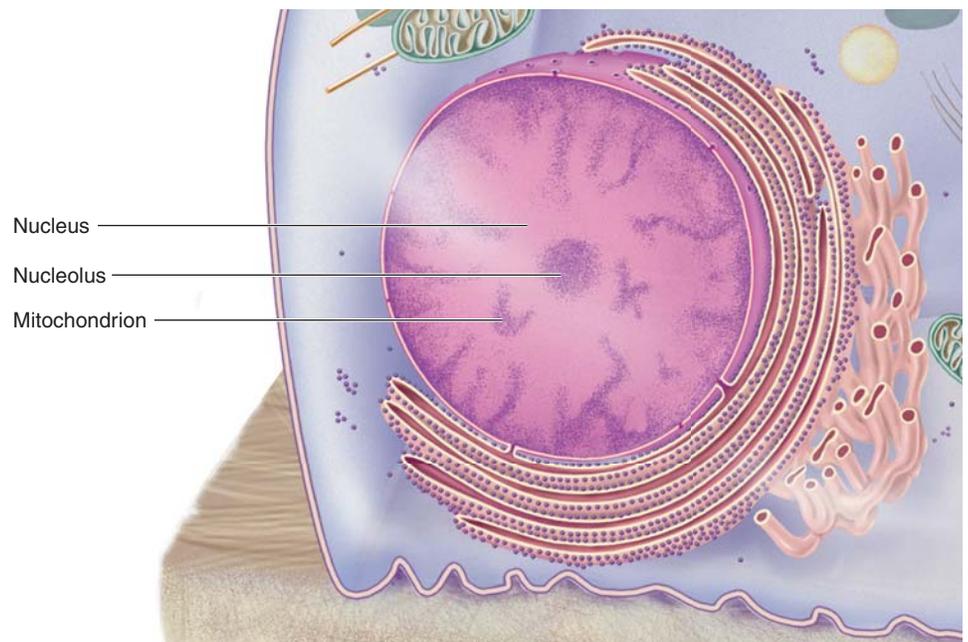
Metabolism is the sum of the constructive processes of anabolism and the destructive processes of catabolism within a cell (**intracellular**).

Abbreviation

RNA ribonucleic acid



▲ **FIGURE 2.9**
Chromosome Structure.



▲ **FIGURE 2.8** The Nucleus.

WORD ANALYSIS AND DEFINITION

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WORD	PRONUNCIATION	ELEMENTS	DEFINITION
anabolism	an- AB -oh-lizm	S/ R/ -ism <i>process, condition</i> anabol- <i>build up</i>	The buildup of complex substances in the cell from simpler ones as a part of metabolism.
catabolism	kah- TAB -oh-lizm	S/ R/ -ism <i>process, condition</i> catabol- <i>break down</i>	The breakdown of complex substances into simpler ones as a part of metabolism.
chromosome	KROH -moh-sohm	S/ R/CF -some <i>body</i> chrom/o- <i>color</i>	Body in the nucleus that contains DNA and genes.
intracellular	in-trah- SELL -you-lar	S/ P/ R/ -ar <i>pertaining to</i> intra- <i>within</i> -cellul- <i>small cell</i>	Within the cell.
nucleolus	nyu- KLEE -oh-lus	S/ R/CF -lus <i>small</i> nucle/o- <i>nucleus</i>	Small mass within the nucleus.
nucleus	NYU -klee-us	R/ Latin <i>command center</i> nucle- <i>nucleus</i>	Functional center of a cell or structure.
nuclear (adj)	NYU -klee-ar	S/ -ar <i>pertaining to</i>	Pertaining to a nucleus.
ribonucleic acid (RNA)	RYE -boh-nyu- KLEE -ik ASS-id	S/ P/ R/ -ic <i>pertaining to</i> ribo- <i>from ribose, a sugar</i> -nucle- <i>nucleus</i>	The information carrier from DNA in the nucleus to an organelle to produce protein molecules.

EXERCISES

Match the definition in column 1 with the correct medical term in column 2. (Note: Several terms are very similar in appearance, but their elements make them different.)

Definition	Medical Term
_____ 1. part of nucleus with DNA and genes	A. nuclear
_____ 2. destructive process in the cell	B. intracellular
_____ 3. functional center of the cell	C. chromosome
_____ 4. pertaining to the nucleus	D. catabolism
_____ 5. constructive process in the cell	E. nucleus
_____ 6. small mass within the nucleus	F. nucleolus
_____ 7. within the cell	G. RNA
_____ 8. information carrier for DNA	H. anabolism



OBJECTIVES

The information in this lesson will enable you to:

- Define the four primary tissue groups.
- Discuss the medical terminology for the structure and functions of each tissue group.
- Name the organ systems.
- Describe the medical terminology for the functions of each organ system.

CASE REPORT 2.2

You are

... a physical therapy assistant employed in the Rehabilitation Unit in Fulwood Medical Center.

You are

communicating with

... Mr. Richard Josen, a 22-year-old man who injured tissues in his left knee while playing football (Figure 2.10). Using *arthroscopy*, the orthopedic surgeon removed his torn anterior *cruciate ligament* (ACL) and replaced it with a *graft* from his *patellar tendon*. The torn medial collateral ligament was sutured together. The tear in his medial *meniscus* was repaired. Rehabilitation focused on strengthening the *muscles* around his knee joint and regaining joint mobility and stability.

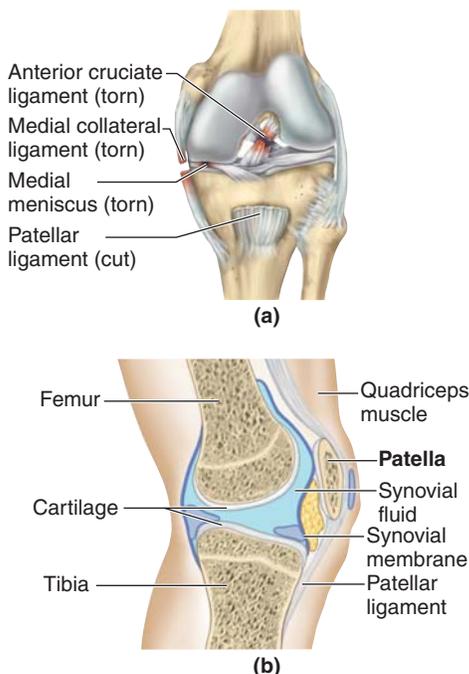
TISSUES

Tissues hold your body together. The many tissues of your body have different structures for specialized functions. Each different tissue is made of similar cells with unique materials around them that are manufactured by the cells. **Histology** is the study of the structure and function of tissues. The four primary tissue groups are outlined in Table 2.1.

TABLE 2.1 The Four Primary Tissue Groups

Type	Function	Location
Connective	Bind, support, protect, fill spaces, store fat	Widely distributed throughout the body, e.g., in blood, bone cartilage, and fat
Epithelial	Protect, secrete, absorb, excrete	Cover body surface, cover and line internal organs, compose glands
Muscle	Movement	Attached to bones, in the walls of hollow internal organs, in the heart
Nervous	Transmit impulses for coordination, sensory reception, motor actions	Brain, spinal cord, nerves

Adapted from Shier, Butler, and Lewis, *Hole's Human Anatomy and Physiology*, 10th ed. Copyright © 2004 The McGraw-Hill Companies, Inc. Adapted with permission.



◀ **FIGURE 2.10** Knee Anatomy.
 (a) Injury to left knee. (b) Normal knee.

WORD ANALYSIS AND DEFINITION

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WORD	PRONUNCIATION	ELEMENTS		DEFINITION
arthros-copy	ar- THROS -koh-pee	S/ R/CF	- s-copy to examine, to view arthr/o- joint	Visual examination of the interior of a joint.
connective tissue	koh- NECK -tiv TISH -you	S/ R/	- ive pertaining to connect- join together tissue Latin to weave	The supporting tissue of the body.
cruciate	KRU -she-ate		Latin <i>cross</i>	Shaped like a cross.
graft	GRAFT		French <i>transplant</i>	Transplantation of living tissue.
histology	his- TOL -oh-jee	S/ R/CF	- logy study of hist/o- tissue	Study of the structure and function of cells, tissues, and organs.
histologist	his- TOL -oh-jist	S/	- logist one who studies, specialist	Specialist in histology.
ligament	LIG -ah-ment		Latin <i>band</i>	Band of fibrous tissue connecting two structures.
meniscus	meh- NISS -kuss		Greek <i>crescent</i>	Disc of cartilage between the bones of a joint.
muscle	MUSS -el		Latin <i>muscle</i>	A tissue consisting of contractile cells.
patella (singular) patellae (pl)	pah- TELL -ah pah- TELL -ee		Latin <i>small plate</i>	Thin, circular bone embedded in the patellar tendon in front of the knee joint; also called the <i>kneecap</i> .
patellar (adj)	pah- TELL -ar	S/ R/	- ar pertaining to patell- <i>patella</i>	Pertaining to the patella.

Abbreviation

ACL anterior cruciate ligament

EXERCISES

Dictionary exercise: When you are working in the medical field, you will be exposed to medical terms you may not recognize. Learn to use a good medical dictionary, or practice going online to find the definitions you need. The Case Report on the opposite page contains some terms that are not defined in the WAD above.

Use a dictionary (or go online) to define each of the following terms and identify it as noun, verb, or adjective.

1. *orthopedic* (noun, verb, adjective) _____

Definition:

2. *rehabilitation* (noun, verb, adjective) _____

Definition:

3. *collateral* (noun, verb, adjective) _____

Definition:

4. *sutured* (noun, verb, adjective) _____

Definition:

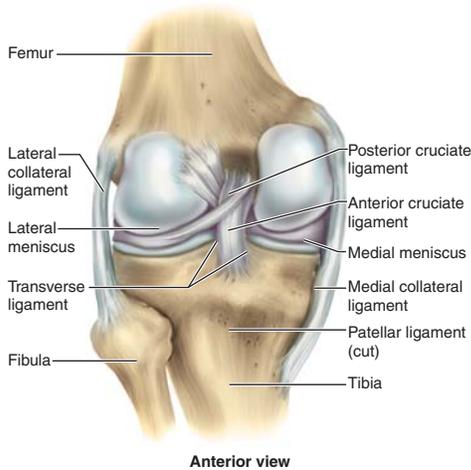
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CONNECTIVE TISSUES

To understand the relation of structure to function in the different tissues, the knee joint is used in this lesson to illustrate the structures and functions of the different tissues found in the joint.

Connective Tissues in the Knee Joint

- The **bones** of the knee joint are the **femur**, **tibia**, and **patella** (see Chapter 9). Bone is the hardest connective tissue due to the presence of calcium mineral salts, mostly calcium phosphate. Bones have a good blood supply that enables them to heal after a fracture. Bones as a whole are covered with a thick fibrous tissue called the **periosteum**.
- **Cartilage** has a flexible, rubbery **matrix** that allows it to function as a shock absorber (in the knee, as a **meniscus**) and a gliding surface where two bones meet to form a joint. Cartilage has very few blood vessels and heals poorly or not at all. When it is injured or torn, surgical repair is usually necessary. Cartilage also forms the shape of your ear, the tip of your nose, and your larynx.
- **Ligaments** are strips or bands of fibrous connective tissue made of **collagen** fibers. The knee joint has a complex array of 11 ligaments that hold it together. The blood supply to ligaments is poor, so they do not heal well without surgery (Figure 2.11).
- **Tendons** are thick, strong ligaments that attach muscles to bone.
- The **joint capsule** of the knee joint encloses the joint cavity and is made of thin, fibrous connective tissue. It is strengthened by fibers that extend over it from the ligaments and muscles surrounding the knee joint. These features are common to most joints.
- The **synovial membrane** lines many joint capsules and secretes **synovial fluid**. This fluid is a slippery lubricant retained in the joint cavity by the capsule. It makes joint movement almost friction-free and distributes **nutrients** to the cartilage on the joint surfaces of bone.
- **Muscle tissue** stabilizes the joint. Extensions of the tendons of the large muscles in front of, and in the rear of, the thigh are major stabilizers of the knee joint. The muscles themselves respectively extend and flex the joint (see Chapter 9).
- **Nervous tissue** carries messages between the brain and the knee structures. All the knee structures are well supplied with nerves, which is why a knee injury is excruciatingly painful.



▲ **FIGURE 2.11** Ligaments of Knee Joint.

WORD ANALYSIS AND DEFINITION

S/ = Suffix P/ = Prefix R/ = Root R/CF = Combining Form

WORD	PRONUNCIATION	ELEMENTS		DEFINITION
capsule	KAP-syul		Latin <i>little box</i>	Fibrous tissue layer surrounding a joint or other structure.
capsular (adj)	KAP-syu-lar	S/ R/	-ar <i>pertaining to</i> capsul- <i>box</i>	Pertaining to a capsule.
cartilage	KAR-tih-lage		Latin <i>gristle</i>	Nonvascular, firm connective tissue found mostly in joints.
collagen	KOLL-ah-jen	S/ R/CF	-gen <i>produce, form</i> coll/a- <i>glue</i>	Major protein of connective tissue, cartilage, and bone.
matrix	MAY-triks		Latin <i>mater mother</i>	Substance that surrounds and protects cells, is manufactured by the cells, and holds them together.
nutrient	NYU-tree-ent	S/ R/	-ent <i>end result</i> nutri- <i>nourish</i>	A substance in food required for normal physiologic function.
periosteum	PER-ee-OSS-tee-um	S/ P/ R/	-um <i>tissue</i> peri- <i>around</i> -oste- <i>bone</i>	Fibrous membrane covering a bone.
synovial	si-NOH-vee-al	S/ P/ R/CF	-al <i>pertaining to</i> syn- <i>together</i> -ov/i- <i>egg</i>	Pertaining to the synovial membrane or fluid.
tendon	TEN-dun		Latin <i>sinew</i>	Fibrous band that connects muscle to bone.

EXERCISES

Match the element in column 1 with the meaning in column 2. Give an example of a medical term containing that element in column 3. Some terms in the third column will appear more than once.

Element	Meaning	Medical Term
_____ 1. colla	A. box	_____
_____ 2. peri	B. together	_____
_____ 3. al	C. around	_____
_____ 4. oste	D. nourish	_____
_____ 5. nutri	E. tissue	_____
_____ 6. um	F. form	_____
_____ 7. capsul	G. pertaining to	_____
_____ 8. syn	H. egg	_____
_____ 9. ovi	I. bone	_____
_____ 10. gen	J. glue	_____
_____ 11. ent	K. pertaining to	_____
_____ 12. ar	L. end result	_____



ORGANS AND ORGAN SYSTEMS

An **organ** is a structure composed of several tissues that work together to carry out specific functions. For example, the skin is an organ that has different tissues in it such as epithelial cells, hair, nails, and glands (see Chapter 3).

An **organ system** is a group of organs with a specific collective function such as digestion, circulation, or respiration. For example, the nose, pharynx, larynx, trachea, bronchi, and lungs work together to achieve the total function of respiration (see Chapter 7).

The different organs in an organ system are usually interconnected. For example, in the **urinary organ system** (Figure 2.12), the organs are the kidneys, ureters, bladder, and urethra, and they are all connected (see Chapter 9).

All your **organ systems** work together to ensure that your body's internal environment remains relatively constant. This process is called **homeostasis**. It ensures that cells receive adequate nutrients and oxygen and that their waste products are removed. Your cells can then function normally. Disease affecting an organ or organ system disrupts this game plan of homeostasis.

The body has 11 organ systems, shown in Table 2.2. Muscular and skeletal are considered one organ system, the musculoskeletal system (see Chapter 9). Each body system has a chapter in this book where the terms associated with it are defined.

▲ FIGURE 2.12 The Urinary System.

Keynote

Homeostasis is the coordinated response of all the organs to maintain the internal physiologic stability of an organism.

TABLE 2.2 Organ Systems

Organ System	Major Organs	Major Functions
Integumentary	Skin, hair, nails, sweat glands, sebaceous glands	Protect tissues, regulate body temperature, support sensory receptors
Skeletal	Bones, ligaments, cartilages	Provide framework, protect soft tissues, provide attachments for muscles, produce blood cells, store inorganic salts
Muscular	Muscles	Cause movements, maintain posture, produce body heat
Nervous	Brain, spinal cord, nerves, sense organs	Receive and interpret sensory information, stimulate muscles and glands
Endocrine	Glands that secrete hormones: pituitary, thyroid, parathyroid, adrenal, pancreas, ovaries, testes, pineal, thymus	Control metabolic activities of organs
Cardiovascular	Heart, blood vessels	Move blood and transport substances throughout body
Lymphatic	Lymph vessels and nodes, thymus, spleen	Defend body against infection, return tissue fluid to blood, carry certain absorbed food molecules
Digestive	Mouth, tongue, teeth, salivary glands, pharynx, esophagus, stomach, liver, gallbladder, pancreas, small and large intestines	Receive, break down, and absorb food; eliminate unabsorbed material
Respiratory	Nasal cavity, pharynx, larynx, trachea, bronchi, lungs	Intake and output air, exchange gases between air and blood
Urinary	Kidneys, ureters, urinary bladder, and urethra	Remove wastes from blood, maintain water and electrolyte balance, store and transport urine
Reproductive	<i>Male:</i> scrotum, testes, epididymides, vasa deferentia, seminal vesicles, prostate, bulbourethral glands, urethra, penis <i>Female:</i> ovaries, fallopian tubes, uterus, vagina, vulva	Produce and maintain sperm cells, transfer sperm cells into female reproductive tract Produce and maintain egg cells, receive sperm cells, support development of an embryo, function in birth process

Adapted from Shier, Butler, and Lewis, *Hole's Human Anatomy and Physiology*, 10th ed. Copyright © 2004 The McGraw-Hill Companies, Inc. Adapted with permission.



CHAPTER 2 REVIEW

THE BODY AS A WHOLE

CHALLENGE YOUR KNOWLEDGE

A. **Construct** the following medical terminology, using the elements as your guide. The word in capitals will be your clue to the missing element. Fill in the blanks.

1. RESEMBLING a solid _____ /oid
2. SMALL organ _____ /elle
3. pertaining to CHANGE _____ /ic
4. process of BREAKING DOWN _____ /ism
5. use of an instrument to examine a JOINT _____ /scopy
6. one who studies TISSUE _____ /logist
7. tissue AROUND bone _____ /oste/ um
8. standing THE SAME _____ / stasis
9. pertaining to THE BACK _____ /al
10. pertaining to a NERVE _____ /ous

B. **Word attack exercise:** This exercise will help you develop a method of analyzing medical terminology questions to determine the correct answer. Work the exercise step-by-step.

Question:

Which of the following terms means fibrous membrane covering a bone?

- | | |
|------------------|---------------|
| a. collagen | d. endocrine |
| b. synovial | e. periosteum |
| c. integumentary | |

1. The question concerns a "fibrous membrane covering a bone." Do you recognize any of these words in the question as having an element that matches an answer? Write them here:

2. Read the answer choices again, and cross off any that you know are not correct.

The incorrect ones are _____.

3. Of the remaining answer choices, look for one that contains any element that matches any of the words in the question.

(See answer 1 above.) _____.

4. The correct answer to this question is _____.

because it contains the element(s) _____.

C. **Spelling correctly** is *always important* and is the mark of an educated professional. Choose the correct spelling to complete the patient's documentation. Circle the best choice.

1. This patient's (electrolite/electrolyte) balance should be checked once a day.
2. Mr. Josen has torn his anterior (cruxiate/cruciate) ligament and will require a surgical repair.
3. The medial (meniscus/menniscus) will be repaired at the same time.
4. The patient has worn away the (cartiledge/cartilage) in his kneecap.
5. This injectable drug should help replace the loss of (sinovial/synovial) fluid in the patient's knee.
6. Mr. Rose's (umbilical/umbellical) hernia surgery should be scheduled as soon as possible.
7. The patient's broken ribs have punctured his (thoracic/thorascic) cavity.
8. The doctor has ordered an x-ray of the patient's left (patella/patela).
9. Because she is bedridden, the patient's (integemetary/integumentary) system is severely compromised.
10. Her (resperation/respiration) is shallow and labored.

D. **Roots/combining forms** are the foundation of every medical term. List here the 10 roots/combining forms in this chapter that you have the most difficulty remembering. Be sure to include their meanings, and provide an example of each in a medical term.



Study Hint

Use this list for study review.

Root/Combining Form	Meaning of R/CF	Example of a Medical Term



CHAPTER 2 REVIEW

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E. **Difference between:** If you know the meaning of the term, you can briefly explain it to someone else. Write your explanations below.

1. organ

2. organelle

3. The difference in these two terms is the element _____,
which means _____.

F. **Partner exercise:** Ask your study partner to close his or her text. Dictate the following sentences to your partner, and then ask him or her to spell the sentences back to you. Check your partner's sentences against the text below. The sentence is not correct unless every word is present and *everything* is spelled correctly. When you have finished checking your partner's answers, close your book, ask your partner to dictate the sentences to you, and you write them down and then check them.

1. In order to prevent her hip replacement from dislocating, she has been instructed to not bring the right leg or knee medially across the sagittal plane.
2. The transverse, or horizontal, plane divides the body into an upper or superior portion and a lower or inferior portion.
3. The abdominal cavity is separated from the thoracic cavity by the diaphragm and contains the stomach, intestines, liver, spleen, pancreas, and kidneys.

G. **Layperson's language:** Translate the following sentences into language your patient can understand. Be brief, but be sure you are conveying the complete information. Rewrite the sentences on the lines below.

1. The doctor has told the patient her patellar joint lacks synovial fluid and this is the cause of her severe pain.

2. The orthopedic surgeon has recommended an arthroscopy to repair the torn ACL ligament and the torn medial meniscus.

H. **Group the elements** to make studying easier. Fill in the chart below with the meaning of the given element, and list a medical term containing that element. Remember to answer the question at the end of the exercise.

Element	Meaning of Element	Medical Term with This Element
al		
ar		
ation		
elle		
ia		
ic		
ior		
ity		
logist		
logy		
lus		
oid		
um		

1. These elements are all _____.

I. **What am I?** A brief clue is given as to the identity of the term. Can you name them all? Fill in the blanks.

1. largest organelle _____
2. part of the trunk between abdomen and neck _____
3. powerhouse of the cell _____
4. stable internal environment of the body _____
5. the skin _____
6. belly button (navel) _____
7. fertilized egg _____
8. smallest unit of the body capable of independent existence _____
9. clear fluid collected from body tissues _____
10. chemical messenger _____



CHAPTER 2 REVIEW

THE BODY AS A WHOLE

J. Terminology challenge: More than one element can have the same meaning. For example, there are many elements that all mean *pertaining to*. Find more pairs of elements in this chapter that both mean the same thing. Do *not* use any examples of *pertaining to*.

1. _____ and _____ both mean _____
2. _____ and _____ both mean _____
3. _____ and _____ both mean _____
4. _____ and _____ both mean _____

K. Recall and review: There is a large volume of medical terminology to learn. This exercise reviews terms that appear in this chapter and the previous one. S-t-r-e-t-c-h your memory—try to answer the questions without turning back in your book. Your knowledge of roots and two different suffixes will help you fill in the blanks and the chart.

Suffix for *study of* = _____

Suffix for *specialist* = _____

Base of Term	Medical term for the <i>Study of This Field</i>	Medical Term for a <i>Specialist in This Field</i>
the lungs		
the heart		
the nervous system		
cells		
the urinary system		
tissues		

L. Identification of elements, and knowledge of their meaning, will aid your understanding of the meaning of a term. Know your elements to increase your medical vocabulary! Fill in the chart.

Element	Meaning of Element	Medical Term Example	Meaning of Medical Term
caud			
cephal			
colla			
electro			
endo			
metabol			
oste			
poster			
scopy			
vascul			

M. **Latin and Greek terms** cannot be further deconstructed into prefix, root, or suffix. You must know them for what they are. Test your knowledge of these terms with this exercise. Match the meaning in column 1 with the correct medical term in column 2.

	Meaning	Medical Term
_____	1. yolk	A. lipid
_____	2. sinew	B. supine
_____	3. band	C. patella
_____	4. fence	D. membrane
_____	5. fat	E. prone
_____	6. bending forward	F. zygote
_____	7. small plate	G. tendon
_____	8. parchment	H. medial
_____	9. lying on the back	I. diaphragm
_____	10. middle	J. ligament

N. **Brain teaser:** From the description given, can you determine what the medical term is?

1. "The body is standing erect with feet flat on the floor, face and eyes are facing forward, and the arms are at the side with the palms facing forward."

Medical term: _____

2. "Opposite of 'caudal,' same as 'superior':"

Medical term: _____

3. "Contains the heart, lungs, thymus gland, trachea, esophagus, and numerous blood vessels and nerves."

Medical term: _____



CHAPTER 2 REVIEW

THE BODY AS A WHOLE

Q. **Chapter challenge:** Circle the correct answer.

- Which statement is most correct?
 - Another name for cytoplasm is *intracellular fluid*.
 - Organelles have no specific functions.
 - The cell membrane is made of cartilage and lipids.
 - The nucleus, nucleolus, and electrolytes are organelles.
 - The cell membrane does not allow alcohol to pass through.
- Patella* is the correct medical term for:
 - the thigh
 - the muscle between two body cavities
 - the kneecap
 - the membrane covering a bone
 - the disc of connective tissue in the knee
- In the abbreviation *LLQ*, the first "L" stands for:
 - lower
 - left
 - limp
 - ligament
 - lateral
- Circle the pair of correct opposites:
 - superior and lateral
 - transverse and horizontal
 - coronal and frontal
 - distal and proximal
 - cephalic and caudal
- The diaphragm separates:
 - the pelvic cavity and the spinal cavity
 - the lungs and the heart
 - the cranial cavity and the thoracic cavity
 - the stomach and the intestines
 - the thoracic cavity and the abdominopelvic cavity
- Choose the correct body system and the organ it contains:

a. integumentary	eyelash
b. endocrine	pineal
c. urinary	pancreas
d. digestive	uterus
e. reproductive	urethra
- Circle the term with a combining form meaning *egg*:
 - synovial
 - metabolism
 - homeostasis
 - urinary
 - cranial
- Maintaining the body's internal environment is:
 - hemostasis
 - metabolism
 - anabolism
 - homeostasis
 - catabolism



Study Hint

Immediately cross off any answer you know is not correct. In your remaining choices, there is only *one best answer*.

9. *Epigastric, hypogastric, and umbilical* describe:
- a. body planes
 - b. directional terms
 - c. body cavities
 - d. anatomical positions
 - e. body regions
10. Which term is the opposite of *caudal* and the same as *superior*:
- a. anterior
 - b. cephalic
 - c. coronal
 - d. distal
 - e. sagittal
11. Circle the term that has a root that means *chest*:
- a. umbilicus
 - b. cranial
 - c. thoracic
 - d. nucleolus
 - e. collagen
12. What does a histologist specialize in studying?
- a. blood
 - b. cells
 - c. tissues
 - d. heart
 - e. skin
13. "A chemical formed in one tissue or organ and carried by the blood to stimulate or inhibit a function of another tissue or organ" is the definition of:
- a. lipid
 - b. electrolyte
 - c. protein
 - d. hormone
 - e. steroid
14. Which term has an element that means *color*?
- a. metabolism
 - b. chromosome
 - c. intracellular
 - d. collagen
 - e. endocrine
15. Which of the following is the only horizontal plane?
- a. posterior
 - b. anterior
 - c. superior
 - d. transverse
 - e. coronal
16. Find the only pair of incorrectly spelled medical terms:
- a. mitochondria organelle
 - b. membranous chromosone
 - c. muscle cruciate
 - d. patellar cartilage
 - e. synovial cytology



CHAPTER 2 REVIEW

THE BODY AS A WHOLE

R. **Case Report challenge:** Now that you are more comfortable with the terms in this chapter, you can apply that knowledge and briefly answer the questions about the case report. If you read the report through once and then go back and underline all the medical terminology, this will make it easier to answer the questions. Fill in the blanks.

CASE REPORT 2.2

You are

... a physical therapy assistant employed in the Rehabilitation Unit in Fulwood Medical Center.

You are communicating with

... Mr. Richard Josen, a 22-year-old man who injured tissues in his left knee while playing football. Using **arthroscopy**, the orthopedic surgeon removed his torn anterior **cruciate ligament** (ACL) and replaced it with a **graft** from his **patellar** tendon. The torn medial collateral ligament was sutured together. The tear in his medial **meniscus** was repaired. Rehabilitation focused on strengthening the **muscles** around his knee joint and regaining joint mobility and stability.

1. What type of procedure is an *arthroscopy*?

2. What is the function of a *ligament*?

3. A *cruciate* ligament forms what shape?

4. What was removed from this patient? _____

5. What is *transplanted*, and where did it come from?

6. Describe the location of *medial*:

7. What two parts of this patient's knee were repaired?

8. What is the function of a *meniscus*?

9. What is the meaning of the term "*rehabilitation*"?

10. Describe "joint mobility and stability":

S. Chapter challenge: Circle the correct answer.

1. Circle the pair of terms that relate to the knee joint:

- | | |
|------------------|-----------|
| a. skeleton | lymphatic |
| b. integumentary | ligament |
| c. coronal | quadrant |
| d. diaphragm | zygote |
| e. cruciate | meniscus |

2. The suffix *stasis* means:

- | | |
|-------------------------|---------------------|
| a. breaking down | d. something formed |
| b. stand still, control | e. producing |
| c. to secrete | |

3. Choose the term that has a root meaning *blood vessel*:

- | | |
|-------------------|-----------|
| a. integument | d. lymph |
| b. cardiovascular | e. dorsal |
| c. respiratory | |

4. **Brain teaser:** Which term functions as a "shock absorber"?

- | | |
|-------------|-------------|
| a. ligament | d. meniscus |
| b. membrane | e. muscle |
| c. tendon | |