

CHAPTER 2

ANATOMIC STRUCTURES AND TERMS OF REFERENCE

OBJECTIVES

- 1 Identify anatomic terms common to the following body systems: integumentary, musculoskeletal, cardiovascular, blood and lymph, respiratory, nervous, endocrine, special senses of the eye and ear, gastrointestinal, urinary, and reproductive.
- 2 Describe the anatomic position.
- 3 Identify the body planes.
- 4 Define positional and directional terms, as well as terms related to body movement.
- 5 List the main body cavities.
- 6 Name the anatomic and clinical divisions of the abdomen.





MEET THE PATIENT Fourteen-year-old Raymond Hauck has been Dr. Spaulding's patient since he was a baby. Last evening, and persisting all night, he had a high fever, headache, and vomiting. In addition, his neck is stiff and painful, and he cannot touch his chin to his chest. Concerned for her son, Mrs. Hauck calls Dr. Spaulding's office the first thing in the morning and explains his symptoms over the telephone. Recognizing that Raymond is experiencing several signs and symptoms of **meningitis**, Dr. Spaulding makes an immediate referral to Dr. Migeon, a pediatric neurologist. The nature of a pediatric neurology practice requires last-minute adjustments to the schedule for patients who need to be seen immediately, and Jackie Smith, an experienced **Medical Assistant** who has worked for Dr. Migeon for several years, recognizes this urgency when she takes the call from Dr. Spaulding this morning. Jackie arranges for Raymond to be brought to the office immediately so that a **lumbar puncture** can be performed. Since Jackie performs a variety of administrative and clinical skills in the neurology office, she assists with the procedure by obtaining consent from Raymond's mother, preparing Raymond for the procedure, and assembling the necessary equipment. You will read about the procedure in **Medical Record Exercise 2-1**.

Now that you are familiar with the basic term components and understand the rules for forming and spelling medical terms, the next step in learning the language of health care is to analyze the term components that are used in forming terms related to structures of the body and anatomic reference points.

Term Components

Suffixes and prefixes that are used to form terms related to the anatomic structures of the body and anatomic reference points are listed below. Pertinent combining forms will be added as programmed learning segments are presented. Study the

suffixes and prefixes first, and then add the related combining forms as you work through the chapter.

| SUFFIX | MEANING | FLASH CARD ID |
|------------------------------------|---|---------------|
| -al, -ar, -ary, -eal, -ic, -ous | pertaining to | S-1 |
| -e | noun marker | |
| -genesis | origin or production | S-8 |
| -icle, -ole, -ule | small | S-16 |
| -ist | one who specializes in | S-17 |
| -ium | structure or tissue | S-19 |
| -logist | one who specializes in the study or treatment of | S-21 |
| -logy | study of | S-22 |
| -phil | attraction for | S-33 |
| -poiesis | formation | S-38 |
| -scope | instrument for examination | S-43 |
| -y | condition or process of | S-50 |

| PREFIX | MEANING | FLASH CARD ID |
|-------------------|--------------------------|---------------|
| a-, an- | without | P-1 |
| ab- | away from | P-2 |
| ad- | to, toward, or near | P-3 |
| ana- | up, apart | P-5 |
| ante-, pre-, pro- | before | P-6 |
| bi- | two or both | P-27 |
| e-, ex-, exo- | out or away | P-13 |
| endo- | within | P-14 |
| epi- | upon | P-15 |
| hyper-, super- | above or excessive | P-21 |
| hypo- | below or deficient | P-22 |
| inter- | between | P-23 |
| macro- | large | P-24 |
| micro- | small | P-26 |
| mono-, uni- | one | P-27 |
| pan- | all | P-30 |
| para- | alongside of or abnormal | P-31 |

(continued)

| PREFIX | MEANING | FLASH CARD ID |
|--------|-------------------|---------------|
| peri- | around | P-33 |
| post- | after | P-35 |
| semi- | half | P-18 |
| sub- | below or under | P-36 |
| trans- | across or through | P-11 |
| tri- | three | P-27 |

Anatomic Terms Related to Body Structures

Most anatomic terms stem from Latin because it was the language used during the period of the Roman Empire, when early scientific study of the form and structure of the body was conducted. It was common to use everyday terms to describe the structures of the body. For example, the patella (kneecap) was named for its resemblance to a pan, and the tympanic membrane (eardrum) got its name because of its likeness to a tambourine.

Some anatomic terms were named for the person who first discovered or described them. For example, the eustachian tube (also known as the auditory tube), which connects the middle ear to the throat, was named to honor Bartolomeo Eustachio, the anatomist who first discovered the structure. The female uterine tubes are also known as the fallopian tubes, in honor of Gabrielle Fallopius. He compared the ends of each tube to a trumpet (Latin, tuba). The use of proper names (eponyms) is fairly common, but their Latin synonyms were more often used when establishing standard anatomic nomenclature.

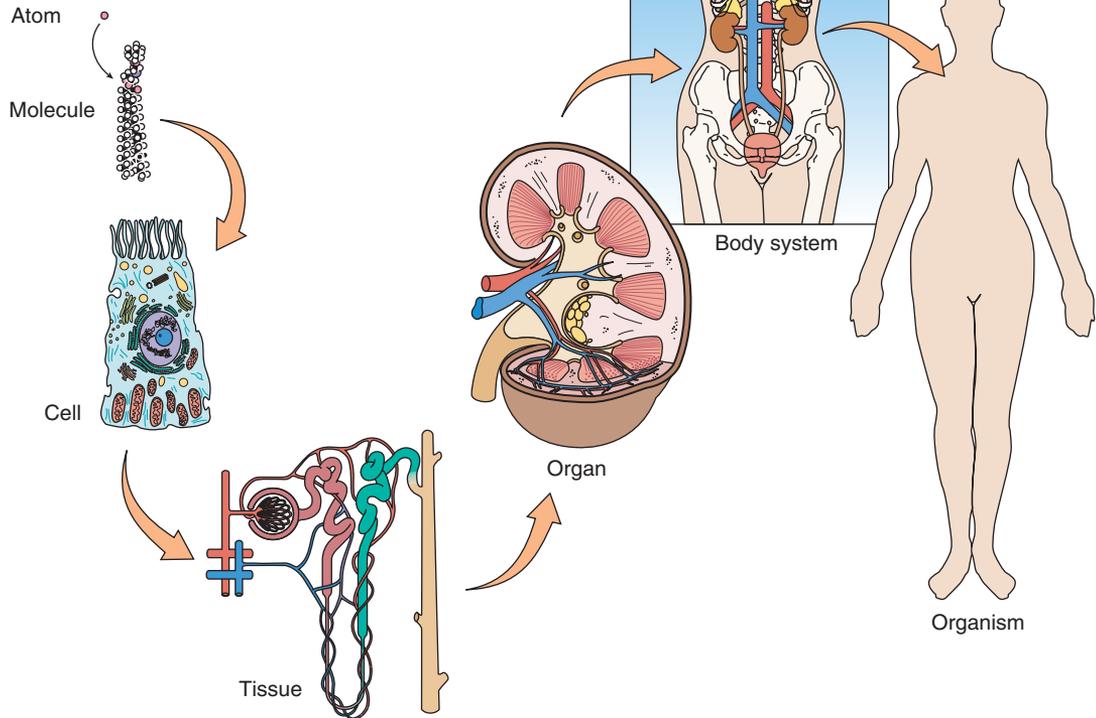
SELF-INSTRUCTION: Cells, Tissues, Organs, and Systems

Living things are organized from the simple level to the complex. The **cell** is the simplest living form and the basic unit of life. Cells are specialized and grouped into **tissues**, which are combined to form **organs**. Groups of organs form **body systems**, which work together to perform important functions in the body. The body systems include: integumentary, musculoskeletal, cardiovascular, blood and lymph, respiratory, nervous, endocrine, special senses of the eye and ear, gastrointestinal, urinary, and reproductive.

Study Fig. 2-1 and the following combining forms before starting the Programmed Review section.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------|---------|---------------|
| cyt/o | cell | CF-19 |
| hist/o | tissue | CF-30 |
| path/o | disease | CF-46 |
| tom/o | to cut | |
| ur/o, urin/o | urine | CF-67 |

Levels of organization

**FIGURE 2-1** Levels of organization in the body.**PROGRAMMED REVIEW: Cells, Tissues, Organs, and Systems**

| ANSWERS | REVIEW |
|---|--|
| <p>small</p> <p>cyto</p> <p>histology</p> | <p>2.1 The term cell, meaning small room, was used to describe the structures first observed in 1665 by Robert Hooke as he examined cork using a microscope, an instrument to examine something _____. He noted that the small cells were part of a larger web of woven tissue. The study of cells that comprise the human body became known as _____logy, and the study of tissue became known as _____.</p> |

| | |
|--|---|
| <p>systems organs urine pertaining to</p> | <p>2.2 Body cells combine to form tissues, and combinations of tissues compose the organs necessary for body functions. Organs act together as part of the larger body _____. For example, the kidneys are _____ that function to filter blood as part of the urinary system (<i>urin/o</i> means _____, and <i>-ary</i> means _____).</p> |
| <p>up or apart combining form to cut process of large</p> | <p>2.3 Human anatomy is defined as the scientific study of the form and structure of the body. The term was formed by the combination of <i>ana-</i>, a prefix meaning _____, with <i>tom/o</i>, a/an _____ meaning _____, and <i>-y</i>, a simple suffix referring to a condition or _____. Earliest anatomists performed gross or macroscopic anatomy. Gross refers to something large or visible to the naked eye. <i>macro-</i> also refers to something _____. Gross anatomy including dissection is a process of studying the body that has been used since ancient times.</p> |
| <p>cytology histology pathology pathologist</p> | <p>2.4 Cells and tissues too small to be viewed by the naked eye were analyzed once the microscope was invented. This study of cells, or _____, and study of tissue, or _____, is part of microscopic anatomy. Cytological and histological examinations are part of the medical specialty concerned with the study of disease, known as _____. The physician who is a specialist in the study of disease is called a/an _____.</p> |



ON CLOSER INSPECTION

Spelling Medical Terms

Correct spelling of medical terms is crucial for communication among health care professionals. Careless spelling can cause misunderstandings that have serious consequences. The following are some spelling pitfalls to avoid:

1. Some combining forms have the same meaning but different origins that compete for usage. For example, there are three combining forms that mean uterus:

hyster/o (Greek)

metr/o (Greek)

uter/o (Latin)

2. Other words sound similar but are spelled differently and have different meanings. For example:

abduction (to draw away from)

adduction (to draw toward)

3. Some words sound exactly the same but are spelled differently and have different meanings. Context is the clue to spelling. For example:

cytology (study of cells)

sitology (study of food)

ileum (part of the intestine)

ilium (part of the hip bone)

SELF-INSTRUCTION: Integumentary System

Study Fig. 2-2 and the following combining forms before starting the Programmed Review section.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------------------|---------|---------------|
| adip/o, lip/o | fat | CF-4 |
| derm/o, dermat/o, cutane/o | skin | CF-21 |
| melan/o | black | CF-39 |
| squam/o | scale | |



Rx for Success

Take care to note the placement of hyphens when studying the difference between e-, the prefix meaning out or away, and -e, the simple suffix used as a noun marker.

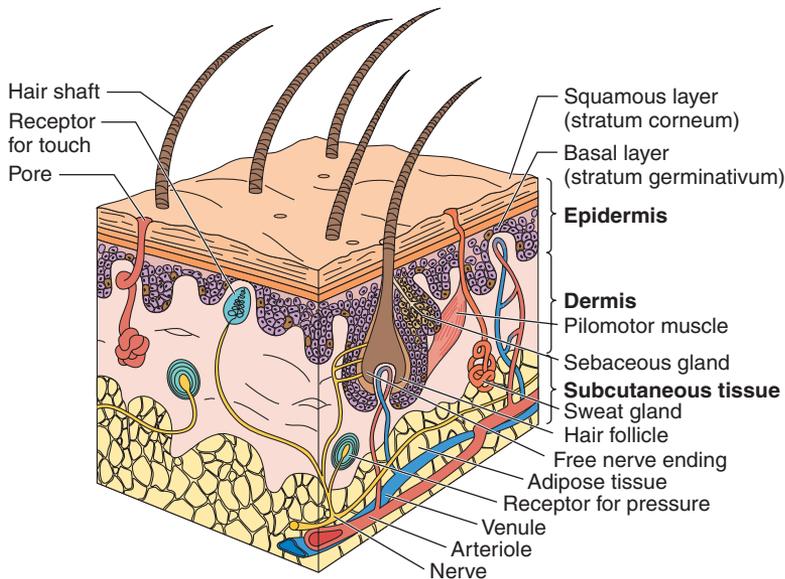


FIGURE 2-2 The skin.

PROGRAMMED REVIEW: Integumentary System

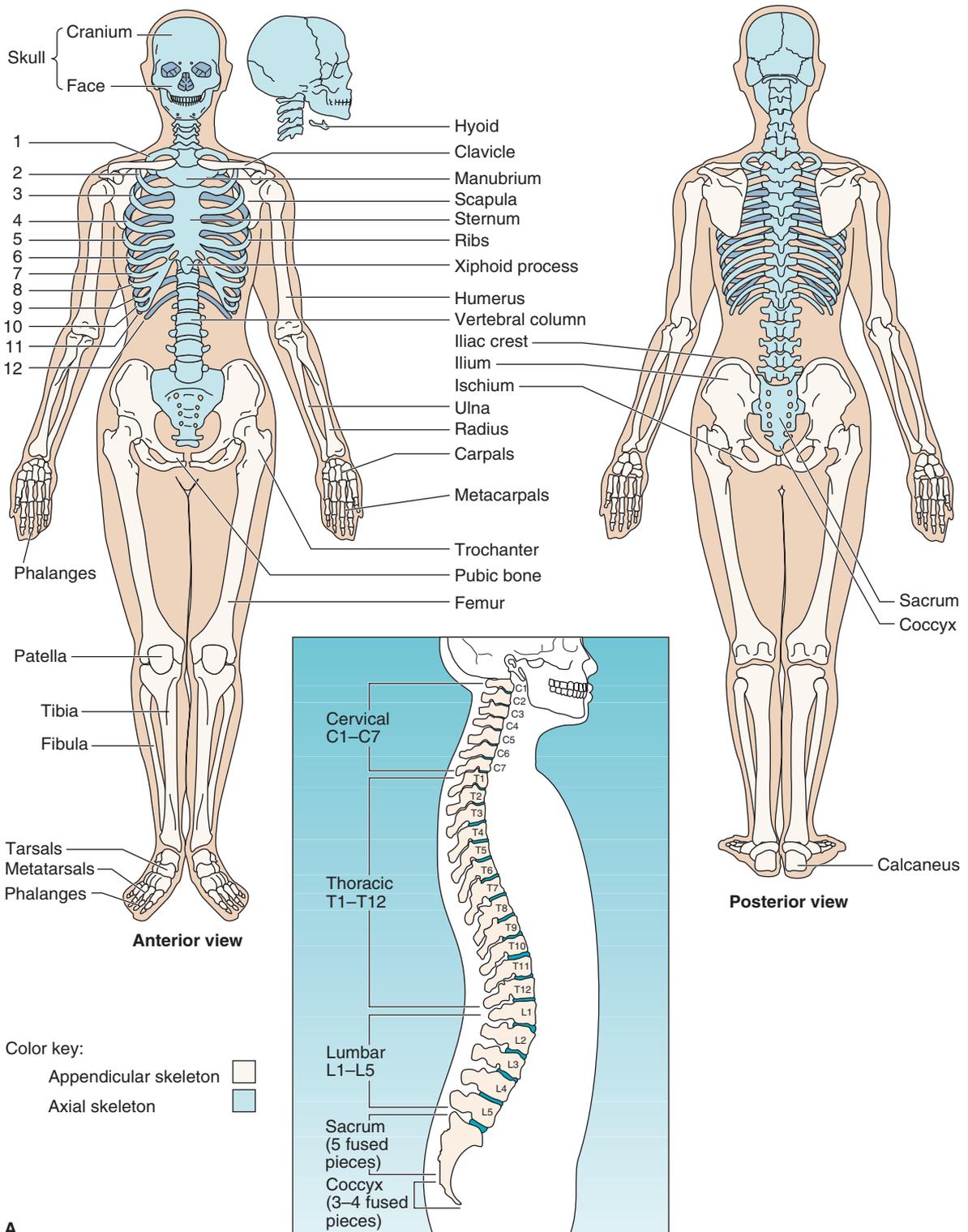
| ANSWERS | REVIEW |
|--------------------------------|---|
| skin upon below or under | <p>2.5 The largest organ of the body, the skin, is part of the integumentary system. Integument is Latin for skin, and <i>dermat/o</i> is Greek, meaning _____. The skin has three layers: the epidermis, dermis, and subcutaneous tissue. The epidermis is so named because it is _____ the dermis, and the subcutaneous tissue layer is named for its location _____ the dermis.</p> |
| black, cell noun marker | <p>2.6 The epidermis consists of many layers; the deepest is called the basal layer. Melanocytes are cells in the basal layer responsible for skin color. <i>melan/o</i> is a combining form meaning _____, <i>cyt/o</i> means _____, and <i>-e</i> is a/an _____. The outermost</p> |

| | |
|----------------------------------|---|
| scale pertaining to | layer of the epidermis is known as the squamous cell layer. <i>squam/o</i> means _____, and <i>-ous</i> means _____. |
| fat | 2.7 The dermis is the connective tissue layer that contains blood vessels, nerves, glands, and hair follicles. The subcutaneous layer contains adipose tissue. <i>adip/o</i> and <i>lip/o</i> are combining forms meaning _____. |
| dermatology dermatologist | 2.8 The specialty field involved with the study and treatment of skin diseases is called _____. The specialist in the study and treatment of the skin is called a/an _____. |

SELF-INSTRUCTION: Musculoskeletal System

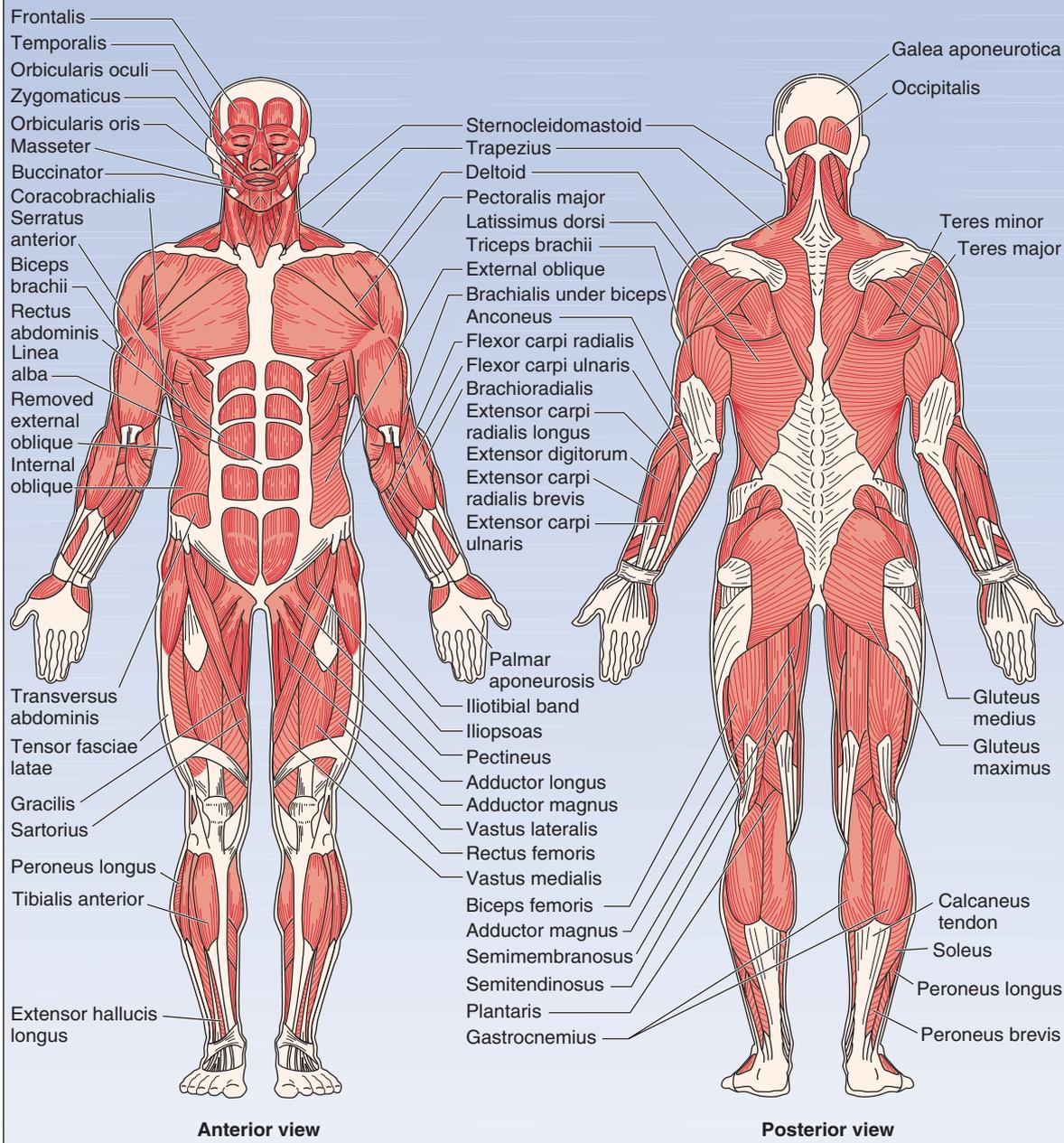
Study Fig. 2-3 and the following combining forms before starting the Programmed Review section.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------------|-------------------------------|---------------|
| acr/o | extremity or topmost | CF-2 |
| arthr/o | joint | CF-6 |
| cervic/o | neck | CF-13 |
| chondr/o | cartilage | |
| cost/o | rib | CF-15 |
| crani/o | skull | CF-16 |
| lumb/o | loin (lower back) | |
| my/o, muscul/o | muscle | CF-40 |
| myell/o | bone marrow or spinal cord | CF-41 |
| oste/o | bone | |
| spin/o | thorn | |
| thorac/o, pector/o | chest | CF-63 |
| vertebr/o, spondyl/o | vertebra | CF-69 |



A

FIGURE 2-3 The musculoskeletal system. **A.** The skeleton. Inset shows numbering of the vertebrae. **B.** Skeletal muscles.



B

FIGURE 2-3 Continued.

PROGRAMMED REVIEW: Musculoskeletal System

| ANSWERS | REVIEW |
|---|--|
| oste/o joint my/o | <p>2.9 The musculoskeletal system provides support and gives shape to the body. Bones, which form the skeleton, are covered with muscle to supply the forces that make movement possible. _____ is the combining form for bone, and <i>arthr/o</i> is the combining form meaning _____ or articulation, the hinge between bones. <i>muscul/o</i> and _____ are combining forms meaning muscle. There are 206 bones and 600 skeletal muscles in the adult body. The major bones comprise the skull, spine, chest, and upper and lower limbs.</p> |
| structure or tissue skull | <p>2.10 The anatomic term for the skull, the collection of bones of the head, is the cranium. This term is formed by joining the suffix <i>-ium</i>, meaning _____, with <i>crani/o</i>, meaning _____.</p> |
| chest cost/o chondr/o rib cartilage | <p>2.11 <i>thorac/o</i>, a combining form meaning _____, was used to name the thorax, the chest area of the body between the neck and abdomen. The bones of the thorax include the sternum (breastbone) and 12 pairs of ribs. The combining form for rib is _____. Covering the ribs and lining joints is a substance called cartilage. The combining form for cartilage is _____. Costochondral means pertaining to _____ and _____.</p> |
| | <p>2.12 The ribs connect at the back with the bones of the vertebral column, also referred to as the spine. <i>spin/o</i>,</p> |

| | |
|--|--|
| <p>vertebr/o, spondyl/o</p> <p>vertebra</p> <p>vertebrae</p> | <p>which is Latin for thorn, refers to the thorn-like bony processes of the vertebra. There are two combining forms for vertebra: _____ and _____. <i>vertebr/o</i>, from Latin, is used in anatomic terms. <i>spondyl/o</i>, meaning _____, is Greek in origin and is used in diagnostic and surgical terms that will be covered in upcoming chapters. Note that the plural of vertebra is _____.</p> |
| <p>cervic/o</p> <p>neck</p> <p>chest</p> <p>loin (lower back)</p> <p>pertaining to</p> | <p>2.13 Each vertebra is named and numbered according to its region and position. The anatomic term for neck is cervix, from the combining form _____. There are 7 cervical vertebrae (C1 to C7), located in the _____. There are 12 thoracic vertebrae (T1 to T12), located in the _____ region. The bones of the spine in the lower back are called lumbar vertebrae (L1 to L5). <i>lumb/o</i> means _____, and <i>-ar</i> means _____.</p> |
| <p>myel/o</p> | <p>2.14 The vertebrae provide protection for the spinal cord and nerves. The combining form for spinal cord (also meaning bone marrow) is _____.</p> |
| <p>extremity</p> <p>pertaining to, acr/o</p> | <p>2.15 The bones of the extremities include the arms and legs. <i>acr/o</i> is a combining form meaning _____. Acral is a term referring to the peripheral parts of the body limbs, such as the fingers. It was formed by the combination of <i>-al</i>, meaning _____, and _____, the combining form that means extremity.</p> |



Rx for Success

As you learn medical terms, you can have fun experimenting with creating words, such as glyco (sweet) + cardio (heart) = sweetheart! However, in the real medical world, the word must be accepted by the medical community to be considered a legitimate term. Often there seems to be no reason why a particular word form became acceptable. That is why you should check your medical dictionary when in doubt of the spelling, formation, or precise meaning of a term.

SELF-INSTRUCTION: Cardiovascular System

Study Fig. 2-4 and the following combining forms before starting the Programmed Review below.

| COMBINING FORM | MEANING | FLASH CARD ID |
|-------------------------|----------------------------|---------------|
| angi/o, vas/o, vascul/o | vessel | CF-5 |
| aort/o | aorta | |
| arteri/o | artery | |
| atri/o | atrium | |
| cardi/o | heart | CF-11 |
| coron/o | circle or crown | |
| ven/o, phleb/o | vein | CF-68 |
| ventricul/o | ventricle (belly or pouch) | |

PROGRAMMED REVIEW: Cardiovascular System

| ANSWERS | REVIEW |
|----------------|---|
| angi/o | 2.16 <i>vas/o, vascul/o,</i> and _____ are combining forms referring to vessel. The cardiovascular system consists of the _____ and _____, which transport blood throughout the body. The heart is a hollow muscular |
| heart, vessels | |

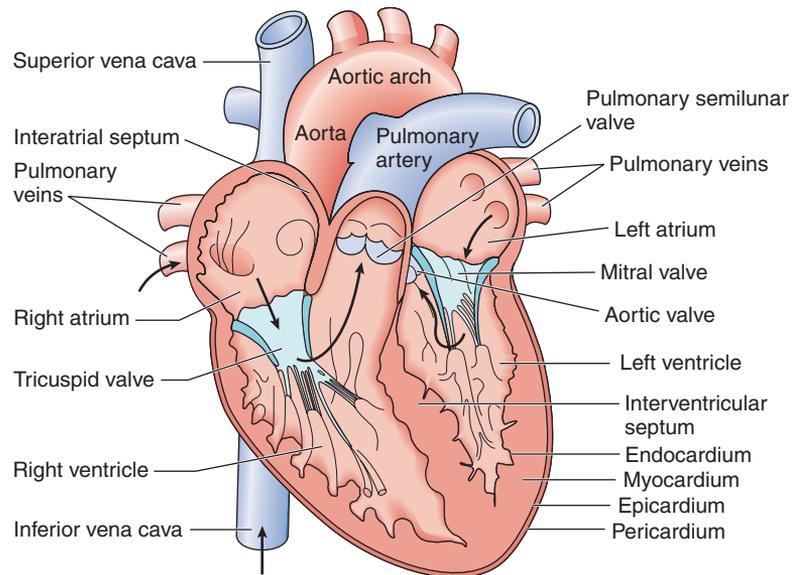


FIGURE 2-4 Structures of the heart.

atrium

atria

ventricul/o

belly, pouch

small

organ that has four chambers. *atri/o* is the combining form for _____, stemming from the Latin word for an entrance hall. The plural form of the word is _____. The right and left atria are the upper chambers of the heart. The ventricles of the heart are the lower chambers, named from the combining form _____, meaning _____ or _____. The suffix in ventricle refers to something _____.

aorta

pertaining to

2.17 The one-way blood flow from one heart chamber to another, or from a heart chamber to an artery, is regulated by heart valves that open and close as the heart beats. The names of the valves give clues to their structure or function. The valve between the left ventricle and the aorta is the aortic valve; *aort/o* means _____ and *-ic* means _____.

| | |
|--|---|
| <p>three</p> <p>two</p> <p>half</p> | <p>2.18 Cuspid refers to a tooth-like point. The tricuspid valve, located between the right atrium and right ventricle, was named for its _____ cusps. The bicuspid valve, located between the left atrium and left ventricle, has _____ cusps. It is also known as the mitral valve because its two parallel cusps resemble the shape of a bishop's mitre (headdress of Christian bishops). The pulmonary semilunar valve is between the right ventricle and the pulmonary artery. Semilunar gives clues to its _____-moon shape.</p> |
| <p>between</p> <p>atria</p> <p>interventricular</p> | <p>2.19 The term septum refers to an anatomic partition. The interatrial septum is the partition _____ the right and left _____. Between the right and left ventricles is the _____ septum.</p> |
| <p>within</p> <p>heart</p> <p>tissue</p> <p>-ium</p> | <p>2.20 You'll recall that the prefix <i>endo-</i> means _____. Combined with <i>cardi/o</i>, it refers to something within the _____. The endocardium is the structure or _____ lining the cavities of the heart. The suffix denoting structure or tissue is _____.</p> |
| <p>epi-</p> <p>suffix</p> <p>structure</p> <p>tissue</p> | <p>2.21 A common prefix that means upon is _____. Combined with <i>cardi/o</i> and the _____ -<i>ium</i>, it forms the term epicardium, which is the _____ or _____ forming the outer layer of the heart.</p> |
| <p>muscle</p> <p>myocardium</p> | <p>2.22 <i>my/o</i> is a combining form meaning _____. The term for heart muscle tissue is _____.</p> |
| <p>around</p> <p>heart</p> | <p>2.23 <i>peri-</i> is a prefix that means _____. The pericardium is a protective sac that encloses the _____.</p> |

| | |
|---|---|
| <p>arteries</p> <p>ven/o</p> <p>vein</p> <p>small</p> | <p>2.24 The names of blood vessels are easy to remember because they are similar to the combining forms. The _____, which carry blood from the heart, are named from <i>arteri/o</i>. The veins, which carry blood to the heart, are named from _____. <i>phleb/o</i>, the second combining form meaning _____, is Greek in origin. The arterioles, also from <i>arteri/o</i>, are the small vessels that receive blood from the arteries. The blood then flows to the capillaries, the tiniest vessels. The blood is then gathered from the capillaries into the venules, which are small vessels that connect to the veins. The suffixes <i>-ole</i> and <i>-ule</i> are used to indicate something _____.</p> |
| <p>lungs</p> <p>circle or crown, coronary</p> | <p>2.25 Circulation refers to the flow of the blood through the vessels. The blood flow through the body (except the lungs) is called the systemic circulation. The pulmonary circulation is the blood flow through the _____. The blood flow to the heart muscle, based on the combining form <i>coron/o</i>, meaning _____, is the _____ circulation.</p> |

SELF-INSTRUCTION: Blood and Lymph Systems

Study Figs. 2-5 and 2-6 and the following combining forms before starting the Programmed Review below.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------|----------------------|---------------|
| cyt/o | cell | CF-19 |
| erythr/o | red | CF-24 |
| hem/o, hemat/o | blood | CF-28 |
| immun/o | safe | |
| leuk/o | white | CF-35 |
| lymph/o | clear fluid | |
| splen/o | spleen | |
| thromb/o | clot | CF-64 |
| thym/o | thymus gland or mind | |

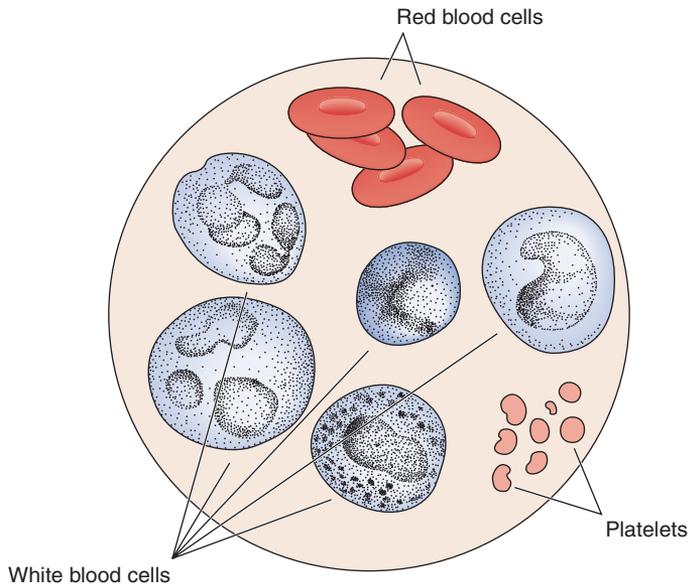


FIGURE 2-5 Components of the blood.

PROGRAMMED REVIEW: Blood and Lymph Systems

| ANSWERS | REVIEW |
|--|---|
| hemat/o blood, hematology formation, blood | <p>2.26 Blood provides transport for oxygen, nutrients, and waste. <i>hem/o</i> and _____ are combining forms meaning _____. The study of blood is _____. Hemopoiesis refers to the _____ of _____. Plasma, the liquid part of the blood, has three cellular components: red cells, white cells, and platelets.</p> |
| cell red suffix noun, erythrocyte | <p>2.27 <i>cyt/o</i> is the combining form meaning _____, and <i>erythr/o</i> is the combining form meaning _____. When combined and modified by <i>-e</i>, the _____ used as a/an _____ marker, the term _____ is formed. Erythrocytes, also known as red blood cells (RBC), are responsible for the transport of oxygen and carbon dioxide in the blood.</p> |

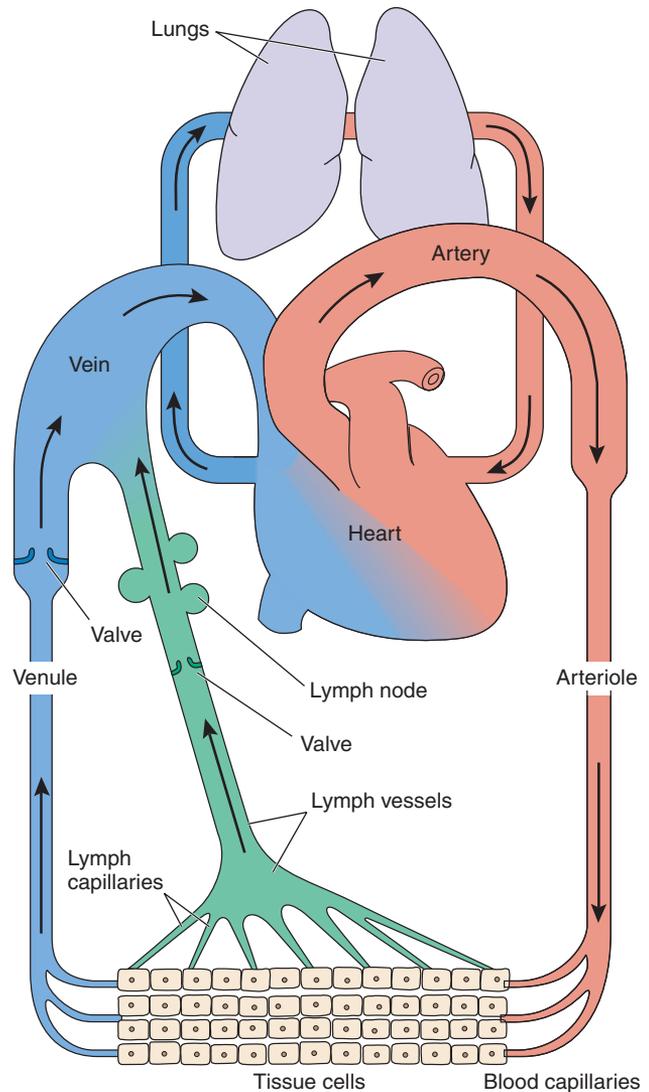


FIGURE 2-6 Blood and lymph circulation. Deoxygenated blood ■ Oxygenated blood ■

white
leukocyte

white blood
cells

2.28 The combining form *leuk/o* means _____; thus a white blood cell (WBC) is a/an _____. Leukocytes are the cells that fight infection and protect the body from invasion of harmful substances. There are five types of leukocytes or _____. Three types, classified as granulocytes because

| | |
|---|---|
| <p>suffix attraction for</p> <p>combining form</p> <p>phil</p> <p>phil</p> | <p>they contain granules in their cytoplasm, were named for the distinct attraction each had for the dye used to stain them for microscopic examination. Using the _____ <i>-phil</i>, meaning _____, the basophil was named for its granules' attraction for the dark base color in the stain. The leukocyte with granules that took to a neutral stain uses the _____ <i>neutr/o</i>, meaning neither, modified by <i>-phil</i> to make the term neutro_____. Similarly, <i>eosin/o</i>, a combining form meaning rose-colored, was used to name the eosino_____, due to the attraction of its granules to the rose color in the dye.</p> |
| <p>without leukocytes without</p> <p>one cell noun marker clear fluid</p> | <p>2.29 Using the prefix <i>a-</i>, meaning _____, the other two types of white blood cells, or _____, are known as agranulocytes because they are _____ granules: monocytes and lymphocytes. The name monocyte was formed by linking <i>mono-</i>, a prefix meaning _____, with <i>cyt/o</i>, a combining form meaning _____, and <i>-e</i>, a suffix referring to a/an _____. <i>lymph/o</i> is a combining form meaning _____.</p> |
| <p>clot, cell</p> | <p>2.30 Platelets were named for their plate-like, fragmented structure. They are also known as thrombocytes because of their function in the clotting process; <i>thromb/o</i> means _____, and <i>cyte</i> refers to a/an _____.</p> |
| | <p>2.31 The lymph system protects the body by filtering microorganisms and foreign particles from the lymph and supporting the activities of the lymphocytes in the immune response. Immune is a term formed from <i>immun/o</i>, a</p> |

| | |
|--------------------------------|---|
| safe noun | combining form meaning _____, and <i>-e</i> , a suffix used as a/an _____ marker. |
| thym/o, splen/o lymph/o | 2.32 The two organs of the lymph system are the thymus and the spleen. The combining form for thymus is _____; _____ is the combining form for spleen. Lymph, the fluid that is circulated by lymph vessels, is filtered by lymph nodes. The combining form for lymph is _____, meaning clear fluid. |

SELF-INSTRUCTION: Respiratory System

Study Fig. 2-7 and the following combining forms before starting the Programmed Review below.

| COMBINING FORM | MEANING | FLASH CARD ID |
|--------------------|--------------------|---------------|
| alveol/o | alveolus (air sac) | |
| bronch/o | bronchus (airway) | |
| laryng/o | larynx (voice box) | |
| nas/o, rhin/o | nose | CF-43 |
| pharyng/o | pharynx or throat | |
| pneum/o, pneumon/o | air or lung | CF-51 |
| pulmon/o | lung | CF-54 |
| trache/o | trachea (windpipe) | |

PROGRAMMED REVIEW: Respiratory System

| ANSWERS | REVIEW |
|-------------|--|
| air lung | 2.33 <i>pneum/o</i> and <i>pneumon/o</i> , meaning _____ or _____, are the key combining forms of the respiratory system, which is responsible for the exchange of gases (oxygen and carbon dioxide) within the body. |

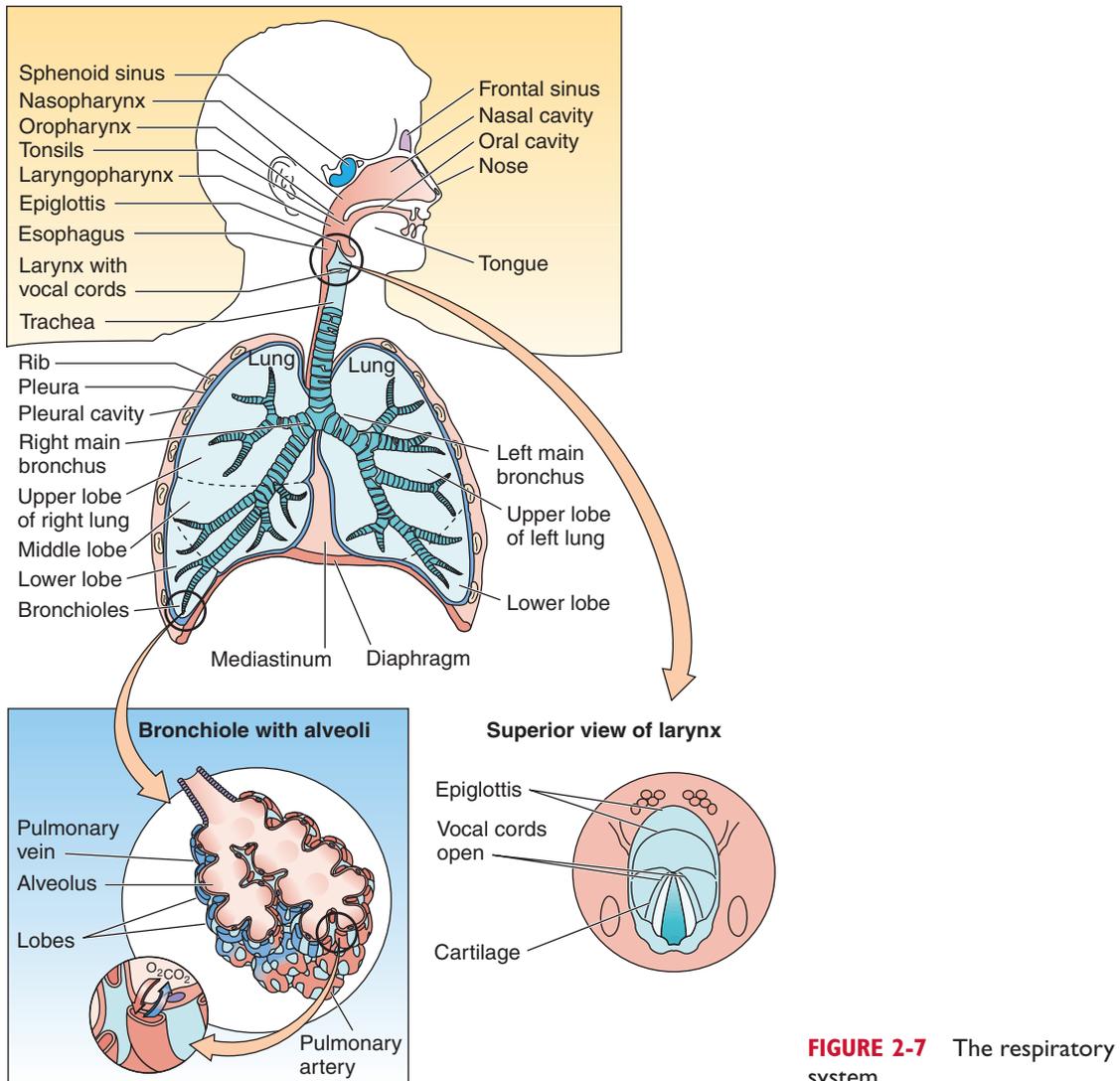


FIGURE 2-7 The respiratory system.

nose

rhin/o

pharynx, throat

laryng/o

2.34 The nose is the first structure to receive oxygen. *nas/o* is the Latin combining form meaning _____. The other combining form that means nose is Greek in origin: _____. *pharyng/o* is the combining form for _____ or _____, the next structure to receive air. Beneath the pharynx is the larynx (voice box), from the combining form _____. The windpipe,

| | |
|--|--|
| trachea, trache/o | or _____, from the combining form _____, is the structure that connects with two main airways into the lungs: the right bronchus and the left bronchus. |
| bronch/o, bronchi small singular alveol/o | 2.35 The combining form for bronchus (airway) is _____. The plural of bronchus is _____. These airways split into smaller branches, the smallest of which are the bronchioles. The suffix <i>-ole</i> means _____. At the ends of the bronchioles are thin-walled microscopic sacs known as alveoli. Alveolus is the _____ term, the combining form for which is _____. |
| lung, study of | 2.36 Pulmonology, the medical specialty concerned with the study and treatment of the lungs, is formed by <i>pulmon/o</i> , meaning _____, and <i>-logy</i> , meaning _____. |

SELF-INSTRUCTION: Nervous System

Study Fig. 2-8 and the following combining forms before starting the Programmed Review below.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------|----------------------------|---------------|
| cerebr/o | largest part of the brain | |
| encephal/o | entire brain | CF-22 |
| mening/o | membrane (meninges) | |
| myel/o | bone marrow or spinal cord | CF-41 |
| neur/o | nerve | |

PROGRAMMED REVIEW: Nervous System

| ANSWERS | REVIEW |
|---------|---|
| nerve | 2.37 The nervous system is a complicated network of nerves and fibers that control all functions of the body. <i>neur/o</i> is the combining form for _____. |

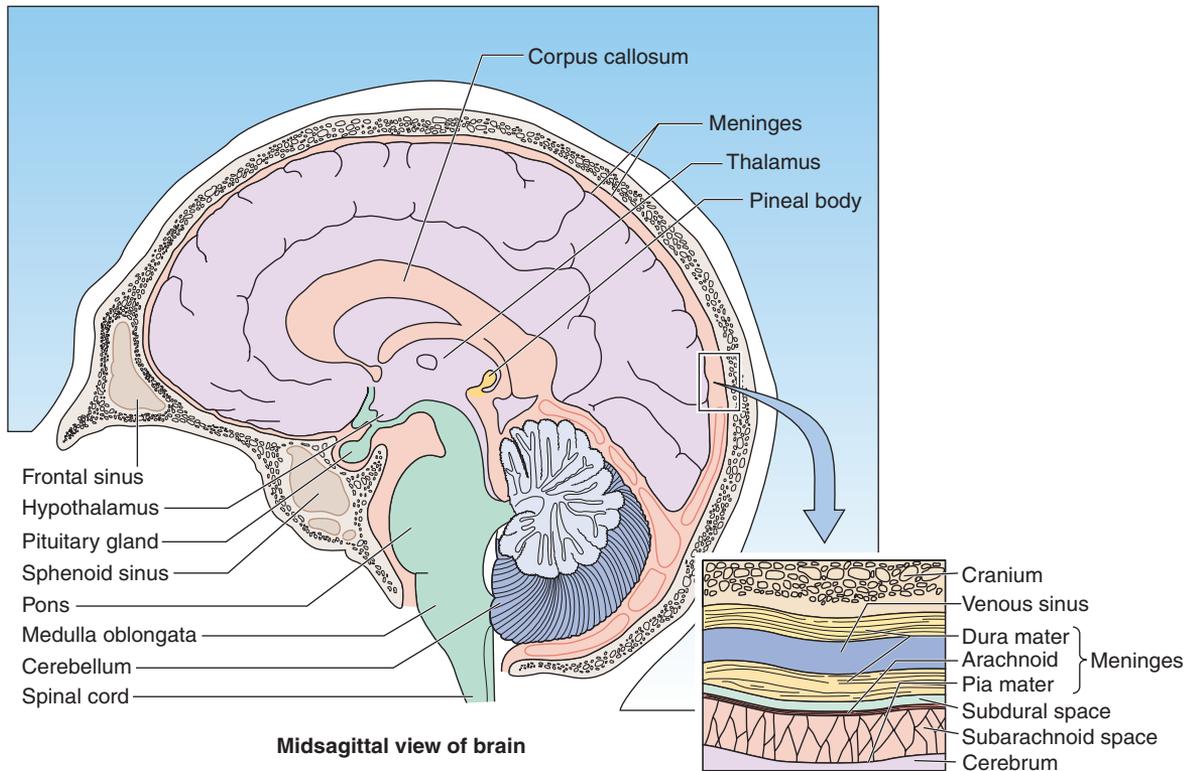


FIGURE 2-8 Midsagittal view of the brain.

2.38 The central nervous system (CNS) is composed of the brain and spinal cord. *cerebr/o* is the Greek combining form for _____, the largest part of the brain. *encephal/o* is another Greek _____ referring to the entire _____. The vertebrae house the spinal cord, a bundle of nerves coming from the brain and ultimately connecting to all areas of the body. *mening/o*, a combining form meaning _____, is used to name the protective coverings around the brain and spinal cord known as the _____. *myel/o* is the combining form referring to either bone marrow or _____.

cerebrum
 combining form
 brain
 membrane
 meninges
 spinal cord

neurology
neur/o
suffix, study of

2.39 The study of the nervous system is _____, from _____, the combining form for nerve, and *-logy*, the _____ meaning _____.



Vital Statistics **MENINGITIS** (*men-in-jī'tis*)

Origin: *mening/o* (membrane) + *G. -itis* (inflammation)

Our patient at the beginning of this chapter had classic symptoms of meningitis. Meningitis is an infection of the meninges, which are the coverings around the brain and spinal cord (see Fig. 2-8). The infection occurs most often in children, teens, and young adults. Also at risk are older adults and people who have long-term health problems, such as a weakened immune system.

There are two main kinds of meningitis, both of which share the same symptoms:

- Viral meningitis is fairly common. It usually does not cause serious illness.
- Bacterial meningitis is not as common but is very serious. It needs to be treated right away to prevent brain damage and death.

Viral meningitis is caused by viruses, and bacterial meningitis is caused by bacteria. Meningitis can also be caused by other organisms and some medicines, but this is rare.

Meningitis is contagious. The germs that cause it can be passed from one person to another through coughing and sneezing and through close contact.

The most common symptoms are:

- A stiff and painful neck
- Fever
- Headache
- Vomiting
- Trouble staying awake
- Seizures

Lumbar puncture, or spinal tap, is the most important lab test for meningitis (see **Vital Statistics: Lumbar Puncture** and **Medical Record Exercise 2-1**).

Treatment depends on the cause. Bacterial meningitis is treated in a hospital with antibiotics and close observation to prevent serious problems such as hearing loss, seizures, or brain damage. Individuals with viral meningitis most commonly receive home treatment and typically get better within a few weeks.



Health Care Professionals

MEET THE MEDICAL ASSISTANT

The medical assistant who assisted with Raymond Hauck's lumbar puncture worked for a neurologist, but medical assistants can work in a variety of settings. Following is a brief description of this health care profession.

Medical assistants are multiskilled health professionals who perform administrative and clinical procedures in medical offices, clinics, and outpatient care facilities. Examples of administrative duties include scheduling appointments and filing insurance forms. Clinical duties typically involve direct patient care, such as obtaining vital signs and assisting physicians and other health care providers with examinations and treatments. Some medical assistants are trained on the job, but many complete one-year or two-year education programs.



A more detailed description of medical assisting as a health care career can be found in the Audio Glossary on this text's online site and at www.thePoint.lww.com/WillisQC.



SELF-INSTRUCTION: Endocrine System

Study Fig. 2-9 and the following combining forms before starting the Programmed Review section.

| COMBINING FORM | MEANING | FLASH CARD ID |
|---------------------------|------------------------|---------------|
| aden/o | gland | CF-3 |
| adren/o, adrenal/o | adrenal gland | |
| crin/o | to secrete | CF-17 |
| hormon/o | hormone | |
| ovari/o | ovary | |
| pancreat/o | pancreas | |
| test/o, orchi/o, orchid/o | testis or testicle | CF-61 |
| thym/o | thymus gland or mind | |
| thyr/o, thyroid/o | thyroid gland (shield) | |

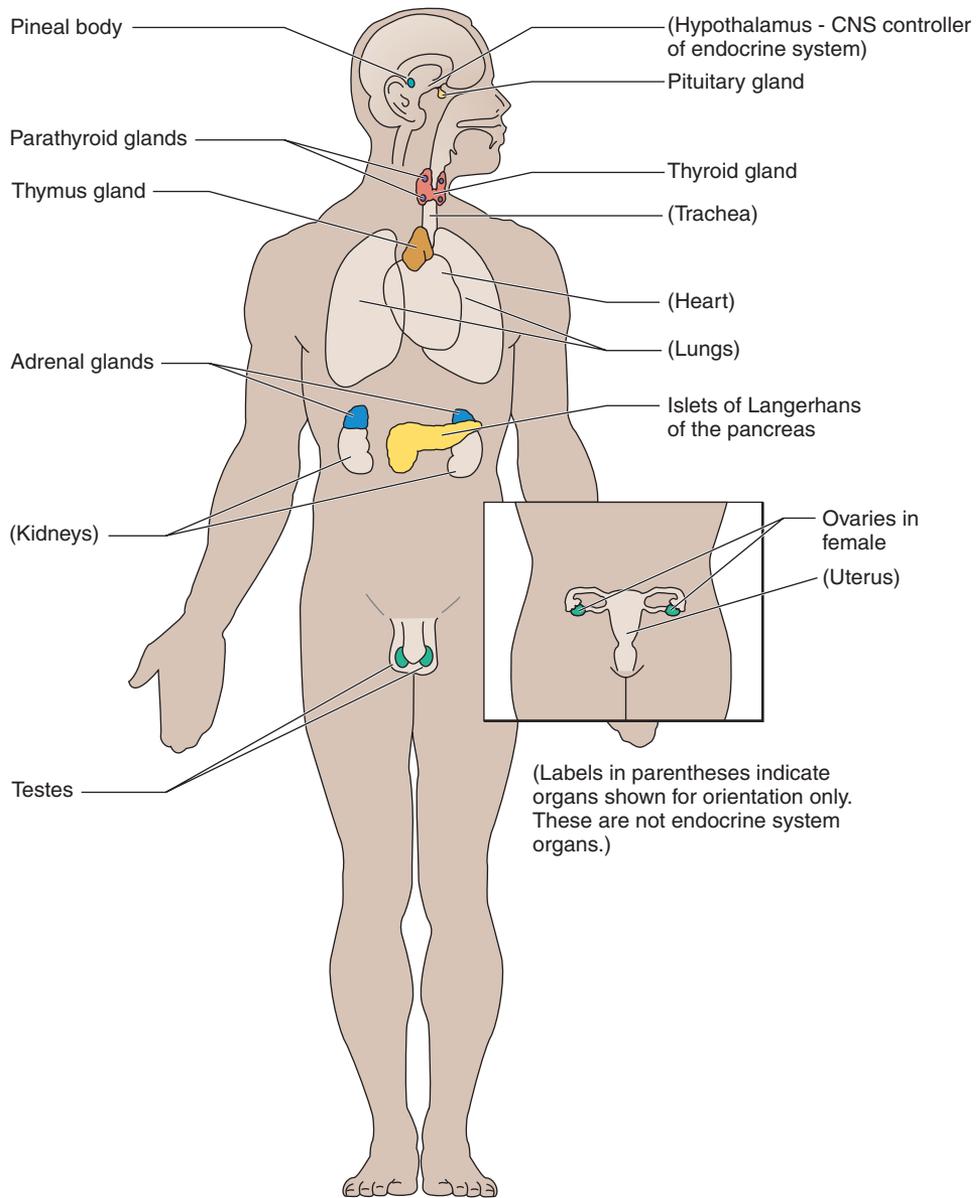


FIGURE 2-9 The endocrine system.

PROGRAMMED REVIEW: Endocrine System

| ANSWERS | REVIEW |
|--|--|
| secrete within endocrine gland hormon/o adjective | 2.40 The combining form <i>crin/o</i> , meaning to _____, plus the prefix <i>endo-</i> , meaning _____, and <i>-e</i> (the suffix used as a noun marker) form the term for the system of glands that secretes hormones within the body known as the _____ system. The endocrine system helps regulate and maintain various body functions by secreting hormones and other substances from ductless glands. <i>aden/o</i> is a combining form meaning _____. The combining form for hormone is _____, from a Greek word meaning "an urging on" (a hormone is a substance that urges an action to occur). Hormonal is the _____ form. |
| adrenal near | 2.41 The combining forms <i>adren/o</i> and <i>adrenal/o</i> mean _____ gland. The prefix <i>ad-</i> used in these combining forms gives a clue that the gland is to, toward, or _____ the kidney. |
| thymus | 2.42 The combining form <i>thym/o</i> means _____ gland. It was named for its resemblance to a bunch of the herb thyme. |
| thyr/o, thyroid/o shield | 2.43 The two combining forms meaning thyroid gland are _____ and _____. The Greek term at the origin of these combining forms means shield, and the thyroid gland is so named because it resembles a/an _____. |
| all | 2.44 The prefix <i>pan-</i> , meaning _____, and <i>creas</i> , a root meaning flesh, were combined to name the pancreas |

| | |
|---|--|
| | because of its “all flesh” appearance when first examined. The pancreas performs an endocrine function by secreting insulin. |
| alongside of parathyroid | 2.45 Recall that the prefix <i>para-</i> means _____ or abnormal. Located alongside of the thyroid glands in the neck are the _____ glands. |
| below | 2.46 The pituitary gland, located at the base of the brain, secretes a long list of hormones. It is also called the hypophysis, a term using the prefix <i>hypo-</i> , meaning _____ (or deficient), because it hangs below the hypothalamus part of the brain. |
| testis testicle testes, testicles testis testicle | 2.47 <i>test/o</i> , a Latin combining form meaning _____ or _____, is used to name the glands in males that are located on both sides within the scrotum and secrete testosterone, a hormone that affects masculinization and reproduction. These glands are called the _____ or _____. <i>orchi/o</i> and <i>orchid/o</i> are Greek combining forms meaning _____ or _____. |
| ovary ovaries | 2.48 <i>ovari/o</i> , a combining form meaning _____, was used to name the female glands responsible for regulation of reproduction by secretion of estrogen and progesterone. These glands are called the _____. |

SELF-INSTRUCTION: The Special Senses: Eye and Ear

Study Fig. 2-10 and the following combining forms before starting the Programmed Review section.

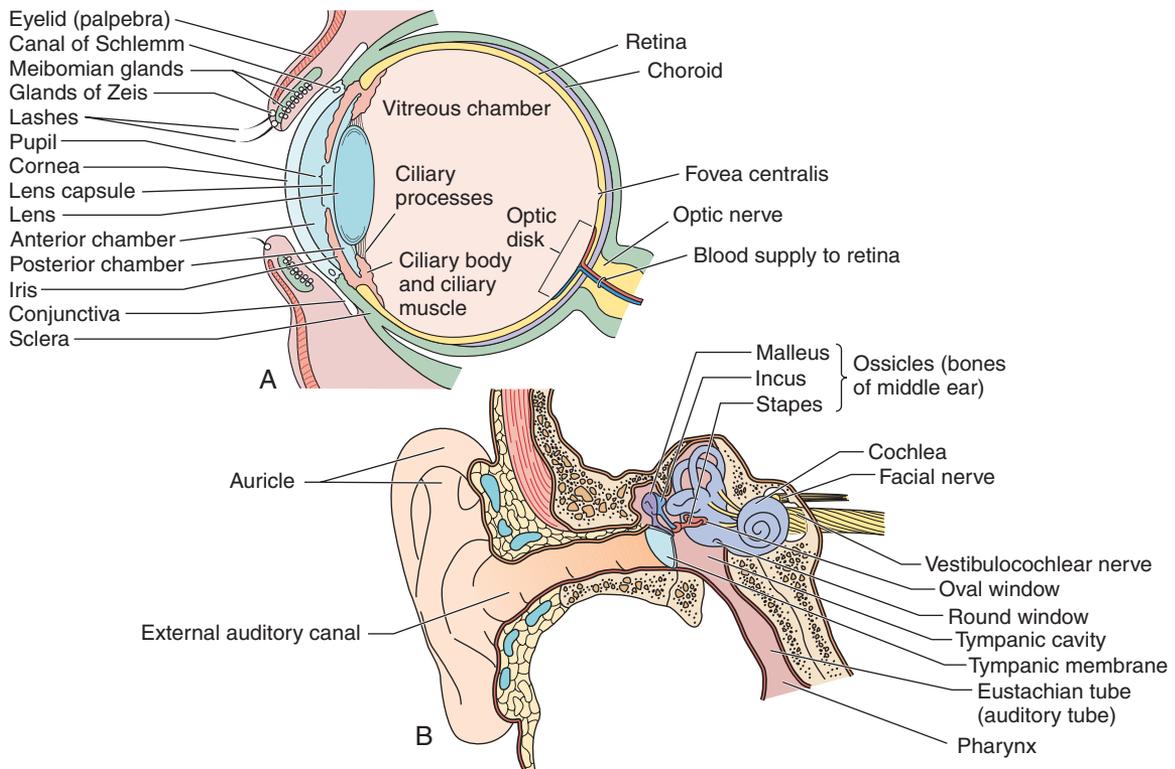


FIGURE 2-10 The special senses. **A.** The eye. **B.** The ear.

| COMBINING FORM | MEANING | FLASH CARD ID |
|---------------------------|------------------------------|---------------|
| ocul/o, opt/o, ophthalm/o | eye | |
| aur/i, ot/o | ear | CF-8 |
| conjunctiv/o | conjunctiva | |
| corne/o, kerat/o | cornea | |
| ir/o, irid/o | iris (colored circle) | |
| lacrim/o, dacry/o | tear | CF-34 |
| retin/o | retina | |
| scler/o | hard or sclera | CF-58 |
| tympan/o, myring/o | eardrum or tympanic membrane | CF-66 |

PROGRAMMED REVIEW: The Special Senses: Eye and Ear

| ANSWERS | REVIEW |
|---|---|
| ocul/o, opt/o, ophthalm/o eye pertaining to | 2.49 There are three combining forms meaning eye: _____, _____, and _____. Ophthalmic, optic, and ocular are examples of adjectives referring to the _____. They are modified by suffixes meaning _____. |
| cornea kerat/o | 2.50 <i>corne/o</i> is the Latin combining form used to name the transparent outer covering of the eye called the _____. The second combining form meaning cornea, from the Greek word <i>kera</i> meaning horn or hard tissue, is _____. |
| lacrim/o dacry/o | 2.51 There are two combining forms for tears, one based on a Latin word and one from Greek. The lacrimal gland (tear gland) comes from the combining form _____. The term dacryocyst means the lacrimal sac (cyst = sac), where tears are collected before they flow to the nose. The second combining form for tears is _____. |
| conjunctiv/o scler/o retin/o ir/o | 2.52 Many combining forms are very similar to the terms that express their meaning. For example, the combining form meaning the conjunctiva, the mucous membrane that lines the eyelids and outer surface of the eyeball, is _____. The combining form for the sclera, the tough, white outer layer of the eye, is _____. The combining form for retina, the innermost, light-sensitive layer at the back of the eye, is _____. Similarly, the two combining forms for the iris, the colored circle of the eye that surrounds the pupil, are <i>irid/o</i> and _____. |

| | |
|---|--|
| <p>ot/o</p> <p>otologist</p> <p>ear</p> | <p>2.53 The two combining forms for ear are <i>aur/i</i> and _____. Medical study of the ear is called otology. The physician who specializes in the study and treatment of the ear is a/an _____. Otology is a subspecialty of otorhinolaryngology (otolaryngology), involving study and treatment of the _____, nose, and throat, more commonly known as ENT.</p> |
| <p>aur/i</p> | <p>2.54 The other combining form meaning ear is _____. The auricle, for example, is the outer, visible part of the ear.</p> |
| <p>tympan/o</p> <p>myring/o</p> | <p>2.55 A kind of drum used in symphony orchestras is called a tympany, from the Greek word for drum. The combining form for the eardrum is _____. A second combining form for eardrum comes from the Latin word for drum membrane, myringa. That combining form is _____.</p> |



MEET THE PATIENT Tenille Jovian has been a candy lover for as long as she can remember. She blames this affinity, along with the fact that she grew up in an area where fluoride was not added to drinking water, for the multiple dental cavities she had as a child and young adult. Over the years, she has learned a great deal about dental health and the importance of seeing the dentist every six months for a check up and teeth cleaning. Her **Dental Hygienist**, Jacob Kaplan, spends time during each of her visits educating her about healthy dental practices and disease prevention. Tenille has called the office for an earlier appointment because she is experiencing some tooth sensitivity.

SELF-INSTRUCTION: Gastrointestinal System

Study Fig. 2-11 and the following combining forms before starting the Programmed Review section.

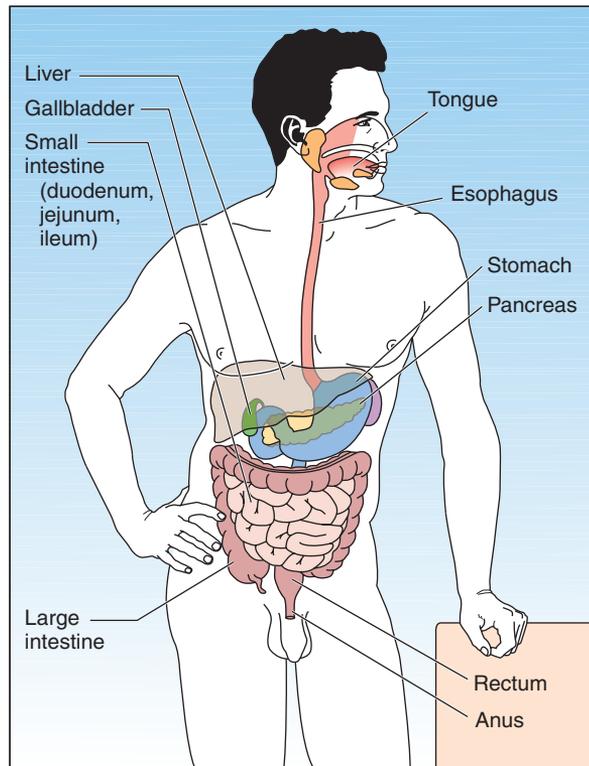


FIGURE 2-11 The gastrointestinal system.

| COMBINING FORM | MEANING | FLASH CARD ID |
|------------------|-------------------------|---------------|
| an/o | anus | |
| chol/e, bil/i | bile | CF-14 |
| col/o, colon/o | colon (large intestine) | |
| dent/i, odont/o | teeth | CF-20 |
| enter/o | small intestine | CF-23 |
| esophag/o | esophagus | |
| gastr/o | stomach | CF-26 |
| hepat/o | liver | CF-29 |
| lingu/o, gloss/o | tongue | CF-36 |
| or/o, stomat/o | mouth | |
| pancreat/o | pancreas | |
| rect/o | rectum | |

PROGRAMMED REVIEW: Gastrointestinal System

| ANSWERS | REVIEW |
|--|--|
| mouth teeth tongue, esophagus stomach small large, anus rectum | <p>2.56 The gastrointestinal (GI) system provides for digestion and elimination. Combining forms related to key structures of the digestive tract are: <i>or/o</i> and <i>stomat/o</i>, meaning _____; <i>dent/i</i> and <i>odont/o</i>, meaning _____, <i>gloss/o</i> and <i>ling/o</i>, meaning _____; <i>esophag/o</i>, meaning _____; <i>gastr/o</i>, meaning _____; <i>enter/o</i>, meaning _____ intestine; <i>col/o</i> and <i>colon/o</i>, meaning _____ intestine; <i>an/o</i>, meaning _____; and <i>rect/o</i>, meaning _____.</p> |
| liver bil/i, bile bile | <p>2.57 <i>hepat/o</i> is the combining form for _____, the organ that produces bile necessary for digestion. <i>chol/e</i> and _____ are combining forms meaning _____. Cholecyst is a term used to refer to the gallbladder, the sac-like structure that stores _____.</p> |
| pancreas, within out, away | <p>2.58 <i>pancreat/o</i> is the combining form meaning _____. <i>endo-</i>, the prefix meaning _____, and <i>exo-</i>, the prefix meaning _____ or _____, are used to explain the complex functions of the pancreas. As noted earlier in this chapter, the endocrine function of the pancreas is to secrete insulin. Its exocrine function is to secrete pancreatic enzymes delivered out through ducts into the small intestine during digestion.</p> |



Health Care Professionals

MEET THE DENTAL HYGIENIST

Dental hygienists are licensed dental professionals who perform routine teeth cleaning, which is referred to as “oral prophylaxis.” Dental hygienists are also trained to take dental x-rays, place dental sealants, take alginate impressions, administer local anesthesia, and, in some states, place and carve dental amalgam (fillings). As you learned in Tenille Jovian’s story earlier, dental hygienists also play an important role in providing patient education about dental health and preventing oral disease.



 A more detailed description of dental hygiene as a health care career can be found in the Audio Glossary on this text’s online site and at www.thePoint.lww.com/WillisQC.

SELF-INSTRUCTION: Urinary System

Study Fig. 2-12 and the following combining forms before starting the Programmed Review section.

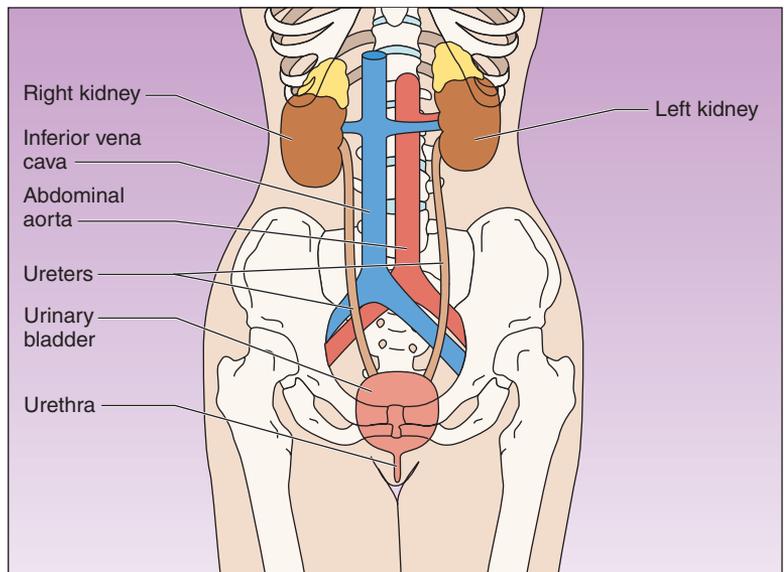


FIGURE 2-12 The urinary system.

| COMBINING FORM | MEANING | FLASH CARD ID |
|-----------------|----------------|---------------|
| abdomin/o | abdomen | CF-1 |
| cyst/o, vesic/o | bladder or sac | CF-18 |
| ren/o, nephro | kidney | CF-45 |
| ur/o, urin/o | urine | CF-67 |
| ureter/o | ureter | |
| urethr/o | urethra | |

PROGRAMMED REVIEW: Urinary System

| ANSWERS | REVIEW |
|---|---|
| abdomen urine, noun kidney nephro pertaining to kidney | <p>2.59 <i>abdomin/o</i> is a combining form meaning _____. The abdominal cavity houses several organs in the body. Among the most vital are the kidneys, the two structures on each side of the lumbar (lower back) region of the abdomen that filter blood and secrete impurities, forming urine (<i>urin/o</i> means _____ and <i>-e</i> is a/an _____ marker). <i>ren/o</i> is the Latin combining form for _____ and _____ is the Greek combining form. Renal is a common adjective, meaning _____ the _____.</p> |
| bladder vesic/o urinary pertaining to | <p>2.60 The combining form <i>cyst/o</i> means sac or _____. Another combining form meaning bladder or sac is _____ (from the Latin word <i>vesica</i>, meaning bladder). The sac that holds urine is called the _____ bladder (combining <i>urin/o</i> with <i>-ary</i>, another adjective ending meaning _____).</p> |
| | <p>2.61 Two similar words refer to different urinary system structures that carry urine. The ureters carry urine from the kidney to the bladder. The urethra carries urine from the bladder to the outside of the body. The combining form for</p> |

ureter/o
urethr/o

ureter is _____. The combining form for urethra is _____.

urine

2.62 *ur/o* is another combining form meaning _____.

urology

The medical specialty concerned with study of the urinary tract is _____.

urologist

The physician who specializes in the study and treatment of the urinary system is called a/an _____.

nephro

The physician who particularly specializes in the study and treatment of the kidneys is known as a/an _____ologist.

SELF-INSTRUCTION: Male Reproductive System

Study Fig. 2-13 and the following combining forms before starting the Programmed Review section.

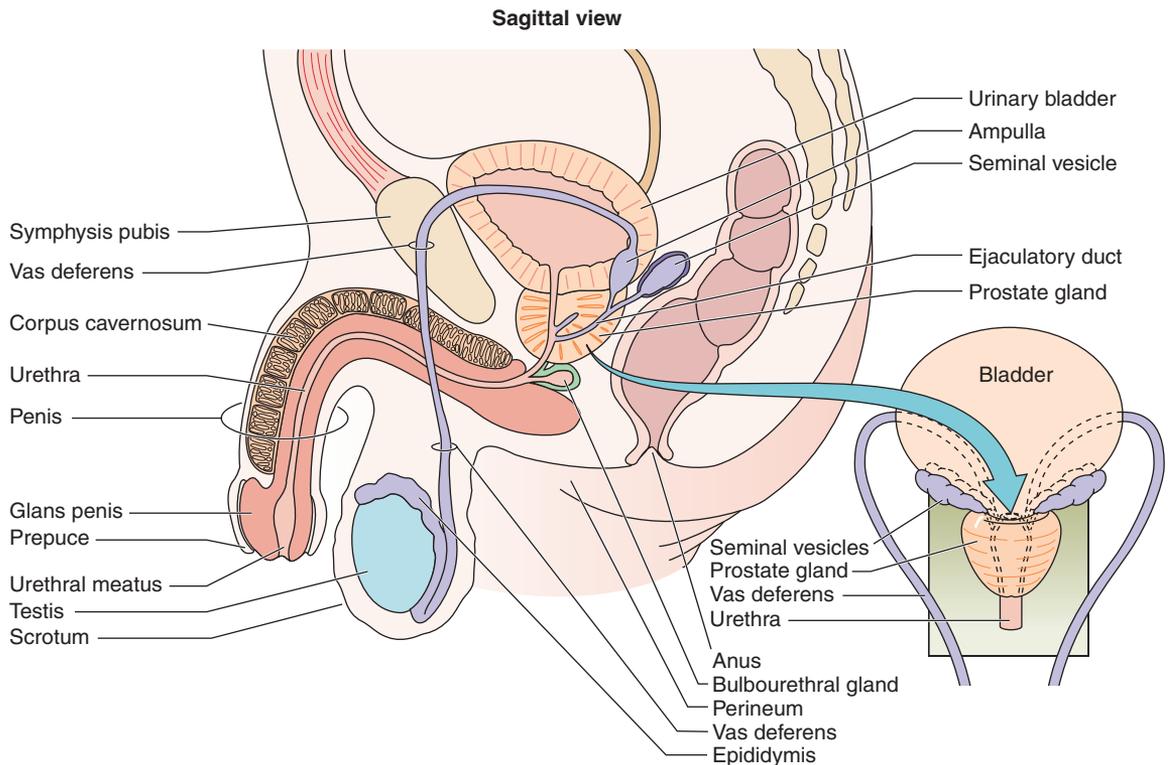


FIGURE 2-13 The male reproductive system.

| COMBINING FORM | MEANING | FLASH CARD ID |
|----------------------------------|--------------------|---------------|
| prostat/o | prostate gland | |
| sperm/o, spermat/o | sperm | |
| test/o, orch/o, orch/o, orchid/o | testis or testicle | CF-61 |
| vas/o | vessel | CF-5 |

PROGRAMMED REVIEW: Male Reproductive System

| ANSWERS | REVIEW |
|--|---|
| testicles orch/o orchid/o, orchid/o | 2.63 Stemming from <i>test/o</i> , a Latin combining form, the testis, or testicle, is one of the two glands that produce sperm and the male hormone testosterone. The plural forms are testes and _____. There are three different Greek combining forms meaning testis (the names are due to the resemblance of the gland to an orchid bulb): _____, _____, and _____. |
| sperm/o, spermat/o sperm pertaining to | 2.64 The Greek word sperma means seed, and thus, sperm is the male's reproductive "seed." The two combining forms for sperm are _____ and _____. Spermatic is an adjective formed by combining <i>spermat/o</i> , meaning _____, and <i>-ic</i> , meaning _____. |
| vas/o | 2.65 The Latin word vas refers to vessel, which includes ducts and blood vessels. The combining form for vessel is _____. The vas deferens is the vessel (duct) that carries sperm from the testicle. |
| | 2.66 The Latin term prostata has its origins in a Greek word meaning one who stands before. Perhaps the prostate gland |

prostat/o

was so named because it stands before the opening for sperm leaving the body to exit through the penis. The combining form for prostate gland is _____.

SELF-INSTRUCTION: Female Reproductive System

Study Fig. 2-14 and the following combining forms before starting the Programmed Review section.

| COMBINING FORM | MEANING | FLASH CARD ID |
|--------------------------|---------------------------|---------------|
| gynec/o | female | CF-27 |
| mast/o, mamm/o | breast | CF-38 |
| ovari/o, oophor/o | ovary | |
| ov/i, ov/o | egg | |
| salping/o | uterine or fallopian tube | CF-56 |
| uter/o, hyster/o, metr/o | uterus | |
| vagin/o, colp/o | vagina | |
| vulv/o, episi/o | vulva | CF-70 |

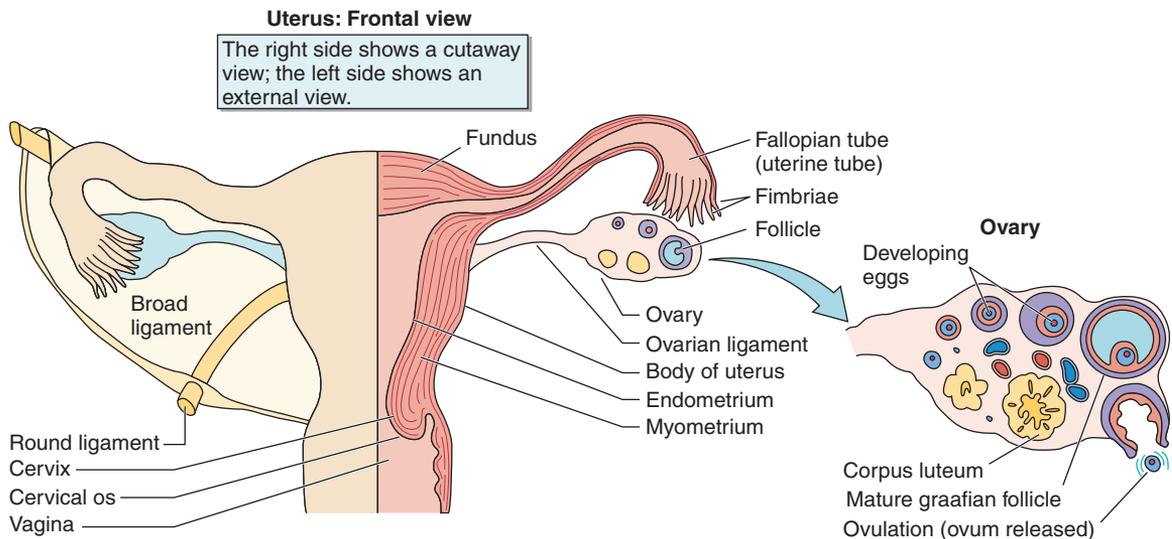


FIGURE 2-14 The female reproductive system.