

# CHAPTER 16

## The Sensory System

► OPHTHALMOLOGY,  
OTOLOGY

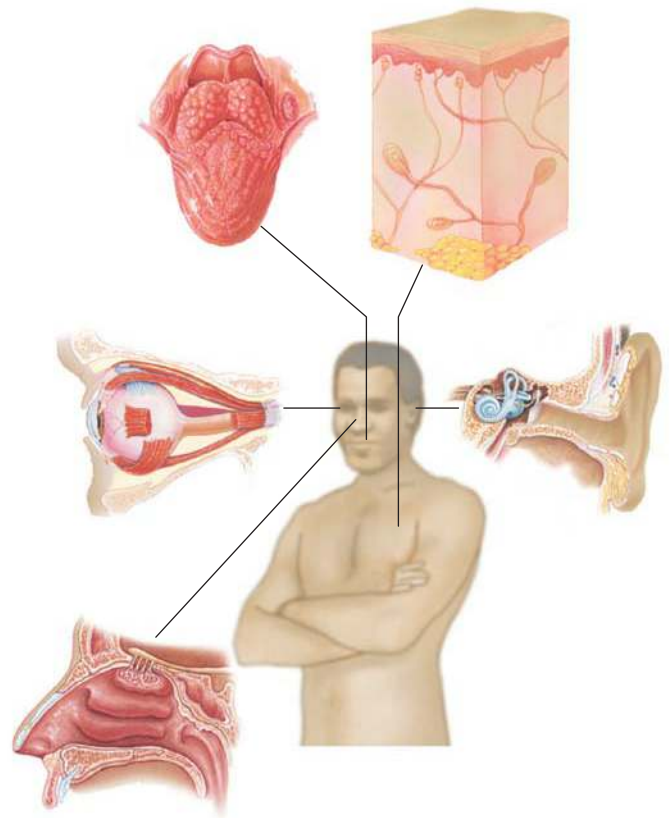
*After studying this chapter, you will be able to:*

- 16.1** Name the parts of the sensory system and discuss the function of each part
- 16.2** Define combining forms used in building words that relate to the sensory system
- 16.3** Identify the meaning of related abbreviations
- 16.4** Name the common diagnoses, clinical procedures, and laboratory tests used in treating disorders of the sensory system
- 16.5** List and define the major pathological conditions of the sensory system
- 16.6** Explain the meaning of surgical terms related to the sensory system
- 16.7** Recognize common pharmacological agents used in treating disorders of the sensory system

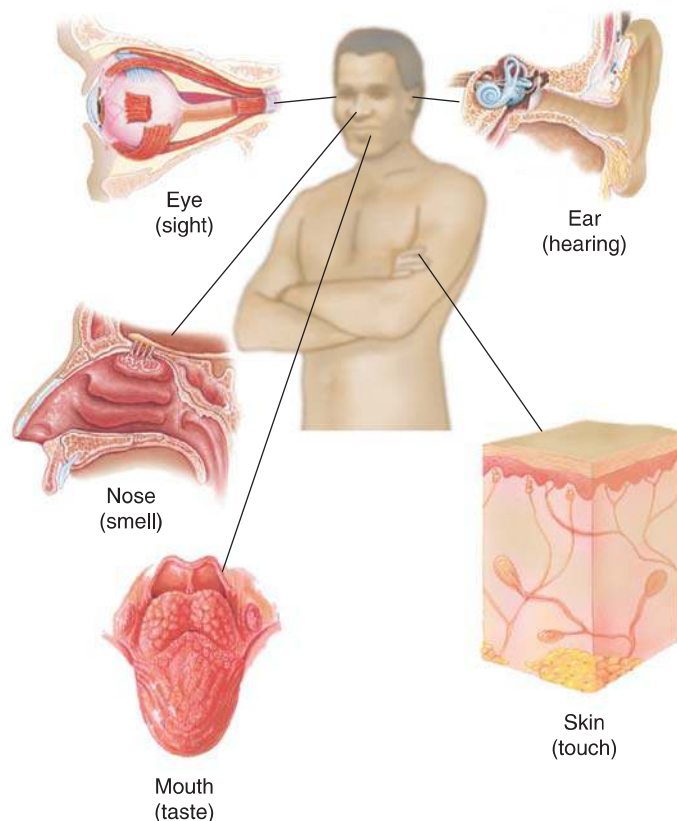
### Structure and Function

The **sensory system** includes any organ or part involved in the perceiving and receiving of stimuli from the outside world and from within our bodies. Aristotle, a Greek philosopher who lived more than 2000 years ago, identified the five senses—**sight, touch, hearing, smell, and taste**. These senses are popularly thought of as the sensory system even though most of the senses are based on stimulation of nerves in the nervous system. The specialized nerve endings of each of the senses are neurons with specialized dendrites that respond to only one sensation. When stimulated, the electrochemical signal progresses to the brain for interpretation as with any afferent signal of the nervous system. For example, the rods and cones of the retina are stimulated by light.

While all five senses are the main structures for reacting to environmental stimuli, there are other ways in which our bodies “sense” and react to stimuli. For example, the islets of Langerhans sense high blood sugar and are stimulated to release insulin. This is but one example of a type of sense response in the body; however, the major parts of the sensory system relate specifically to



The Howard Hughes Medical Institute (<http://www.hhmi.org/senses>) has an informational Web site called “Seeing, Hearing, and Smelling the World.”



**FIGURE 16-1a** The sensory system includes organs of the five senses.

Sense		Sensory Organ
Sight	→	Eyes
Touch	→	Skin
Hearing	→	Ears
Smell	→	Nose
Taste	→	Mouth

**FIGURE 16-1b** The locations where stimuli are sensed.

the organs of the five senses and related senses felt by those organs. Figure 16-1a shows the major organs of the sensory system. Figure 16-1b charts the location in the body where stimuli are sensed.

Sensory organs are also known as **sensory receptors**. All sensory receptors contain specialized receptor cells that are able to receive stimuli. They are designed to receive only certain stimuli (such as sound in the ear and light waves in the eye). Sensory receptor cells send impulses to the afferent (conductive) nerves in the central nervous system to interpret the stimuli.

## Sight—the Eye

The **eyes**, organs of sight, contain about 70 percent of all the receptors in the human body. Each eye is made up of three layers—the sclera, the choroids, and the retinal layer.

The outer layer is a smooth, firm, white posterior section called the **sclera**. It is made of a thick, tough membrane. The sclera supports the eyeball. The **cornea** is the transparent, anterior section, which is the first place where light is bent or refracted as it enters the eye. This section has a greater curvature to capture and direct light into the eye. The sclera has blood vessels that nourish the cornea (which has no blood supply). The cornea is transparent, has no blood vessels, and bends (or refracts) light rays in a process called **refraction**. The outer layer is covered by the **eyelid**. The anterior surface of the eye and the posterior surface of the eyelid are lined with a mucous membrane (the **conjunctiva**).

The choroid or middle layer is the vascular layer of blood vessels, consisting of a thin posterior membrane, the **choroid**. Anteriorly, this is continuous with the **ciliary body**, which contains the ciliary muscles, used for

focusing the eyes. Vision is the process that begins when light is refracted as it hits the cornea and again when it hits the *retina*. Light passes through the **pupil**, the black circular center of the eye, then passes through the **lens**, a colorless, flexible transparent body behind the **iris**, the colored part of the eye that expands and contracts in response to light, thereby opening and closing the pupil. From there it goes to the lens, which is suspended by ligaments that extend to the ciliary body. The ciliary body contracts to change the shape of the lens in a process called *accommodation*. Accommodation allows the eye to focus on objects at varying distances. This region of the eye which includes the iris, ciliary body, and choroid is known as the **uvea**.

The interior layer of the eye is called the *retinal layer*. It contains the **retina**, a light-sensitive membrane that can decode the light waves and send the information on to the brain, which interprets what we see. The retina itself has many layers. The thick layer of nervous tissue is called the **neuro-retina**. The neuro-retina consists of specialized nerve receptor cells called **rods**, sensors of black and white shades, and **cones**, sensors of color and the brightest light. There are three types of cones, one each for red, green, and blue. There are approximately 125 million rods and 7 million cones in each eye, along with other nerve cells, that convert the light images received to nerve impulses that are then transmitted through the **optic nerve** to the appropriate lobes of the brain.

The region where the retina connects to the optic nerve, where there are no rods or cones to receive images, is called the *optic disk* or *blind spot*. Light causes a chemical change in the rods and cones that allows them to convert the images to nerve impulses. The thin layer of the retina is made of pigmented epithelial tissue, which, along with the choroid, absorbs stray light that is not absorbed by the neuroretina and prevents reflections from the back of the retina. The center of the retina directly behind the lens has a small yellowish area called the **macula lutea**, which has a depression in the center called the **fovea centralis**, the area of sharpest vision.

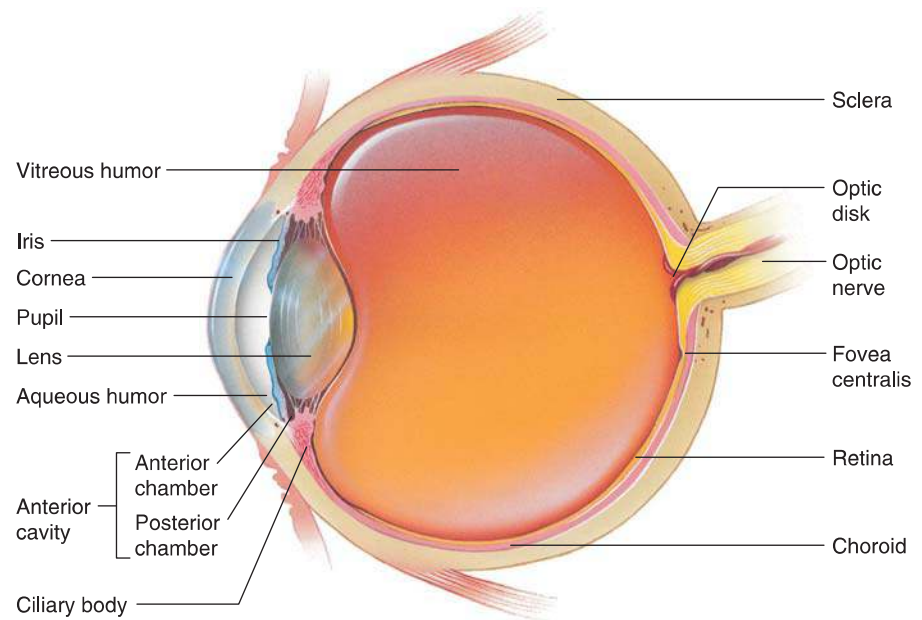
The eyeball is divided into three cavities called *chambers*. The *anterior chamber* lies between the cornea and iris. The *posterior chamber* lies between the iris and the lens. Both the anterior and posterior chambers are filled with *aqueous humor*, a thin, watery liquid that provides nourishment to the lens and cornea and maintains a constant pressure within the eyeball. The tissue that holds the aqueous humor in until it exits the eye is made up of *trabeculae*, bundles of supportive fiber. The *vitreous chamber*, located posterior to the lens, occupies about 80 percent of the space in the eyeball. It is filled with *vitreous humor*, a gelatinous substance that nourishes parts of the eyes and maintains a supportive structure to keep the eye from collapsing.

## MORE ABOUT . . .

### Eye Color

Newborns with light skin are almost always born with blue eyes, even though their eyes may later turn brown or green. Eye color is determined by heredity. It takes several months for the melanocytes to be distributed to the anterior portion of the eye. Babies with darker skin normally have a higher concentration of melanocytes to begin with, and their eyes at birth are almost always dark. Albinos are born with no melanocytes in their body and they are, therefore, much more sensitive to light and have no pigment in the iris of their eyes.

**FIGURE 16-2** The eye is the organ of sight.



Several other structures are important to the eye. The eyelids close to protect the eyes or to allow rest and sleep. The **eyebrows** and **eyelashes** help keep foreign particles from entering the eye. The **lacrimal glands** secrete moisture into the *lacrimal ducts* or *tear ducts*. The resulting **tears** moisten the eyes, wash foreign particles off the eye, and distribute water and nutrients to parts of the eye. Tears may be secreted more heavily than necessary as a reaction to allergies, infections, or emotional upset. Figure 16-2 shows the eye.

## Hearing and Equilibrium—the Ear

The **ear** is an organ of hearing and **equilibrium** (balance). The three major divisions of the ear are the *external ear*, the *middle ear*, and the *inner ear*.

The external ear begins on the outside of the head with a funnel-like structure called the **auricle** or **pinna**. This structure leads through part of the skull known as the *temporal bone* (which itself has a bony projection called the *mastoid process*) to an S-shaped tube called the *external auditory meatus*. The external auditory meatus contains glands that secrete *cerumen* or earwax, a brownish yellow, waxy substance.

The middle ear includes the *tympanic cavity*, in which sits the **eardrum** (**tympanic membrane**) and the **auditory ossicles**, three small, specially shaped bones. The eardrum is an oval, semitransparent membrane with skin on its outer surface and a mucous membrane on the inside. Sound waves change the pressure on the eardrum, which moves back and forth, thereby producing vibrations. The three ossicles are the **malleus** (hammer), **incus** (anvil), and **stapes** (stirrup). They are all attached to the tympanic cavity by tiny ligaments. The malleus is attached to the eardrum to help it maintain its oval and conic shape. Vibrations are carried from the eardrum through the malleus to the incus. The incus passes the movement onto the stapes, which is connected to the wall near the *oval window*, an opening leading to the inner ear. The middle ear is connected to the pharynx through the **eustachian tube** (*auditory tube*). This tube helps equalize air pressure on both sides of the eardrum, which is essential to hearing. The eustachian tube is connected to the nasal cavity. This explains why children are more susceptible to ear infections following a head cold.



The inner ear is a system of two tubes—the **osseus labyrinth** and the **membranous labyrinth**. The osseus labyrinth is a bony canal in the temporal bone. The membranous labyrinth is a tube within the osseus labyrinth and separated from it by **perilymph**, a liquid secreted by the walls of the osseus labyrinth. Inside the membranous labyrinth is another fluid, **endolymph**. The labyrinths include three **semicircular canals**, structures important to equilibrium, and a **cochlea**, a snail-shaped structure important to hearing. The cochlea is further divided into the *scala vestibuli*, which leads from the oval window to the apex of the cochlea, and the *scala tympani*, which leads from the apex of the cochlea to a covered opening in the inner ear called the *round window*. The cochlea has a membrane called the *basilar membrane* that has hairlike receptor cells located in the **organ of Corti** on the membrane's surface. The hairs move back and forth in response to sound waves and eventually send messages via neurotransmitters through the eighth cranial nerve and to the brain for interpretation. Table 16-1 shows various **decibel** (intensity of sound) levels that can be heard by a normal human ear. The scale of decibels (dB) gives the intensity of sound in progressions multiplied by 10. So 10dB is 10 times greater than the lowest perceptible decibel, 20dB is 100 times as great as 10dB, and so on. The easy availability of electronic equipment and the sound generated by modern machines have raised the decibel levels to which each successive generation is exposed.

The sense of equilibrium is the ability to maintain steady balance either when still, *static equilibrium*, or when moving, *dynamic equilibrium*. The bony chamber between the semicircular canal and the cochlea is called the **vestibule**. The vestibule contains a membranous labyrinth divided into two chambers, the *utricle* and *sacculle*. Both of these chambers contain a **macula**, a structure with many hairlike sensory receptors that move forward, backward, or upward to move the gelatinous mass inside the inner ear. This mass contains **otoliths**, small calcifications that move to maintain gravitational balance. The semicircular canals also respond to movement and aid in maintaining balance. Figure 16-3 illustrates the structures of the ear.

## Touch, Pain, and Temperature—the Skin

The skin's layers sense different intensities of touch. Light touch is felt in the top layer of skin, whereas touch with harder pressure is felt in the middle

### MORE ABOUT . . .

#### Ears

Driving down a mountain sometimes causes you to feel and hear a popping sound. The eustachian tubes react quickly to equalize the pressure caused by exposure to a high altitude when the eardrum membrane is stretched. The eardrum “pops” back into place when pressure is equalized.

Dangerous Decibels (<http://www.dangerousdecibels.org>) is an organization dedicated to the prevention of noise-induced hearing loss.

### MORE ABOUT . . .

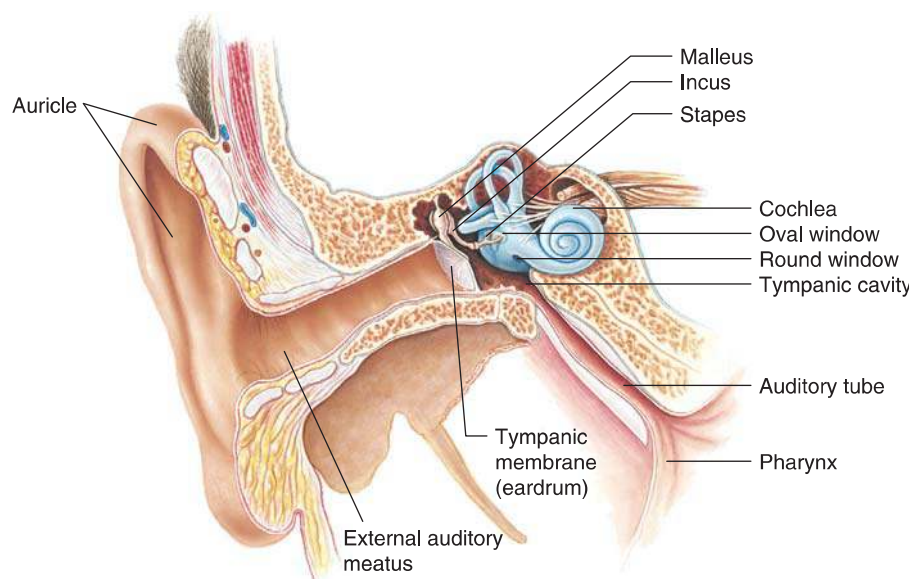
#### Equilibrium

Motion sickness in a vehicle or airplane is the result of many sudden changes in body motion that occur when the organs of equilibrium are disrupted. People experience motion sickness at different rates. Some medications relieve the feelings of dizziness and nausea that accompany motion sickness.

**TABLE 16-1** Decibel Levels

Decibel Level	Intensity of Sound	Effect on Hearing
40dB	10,000 times as great as 10dB	A whisper—perceptible to most people with normal hearing
60dB	1 million (1,000,000) times as great as 10dB	Regular conversational speech
80dB	100 million (100,000,000) times as great as 10dB	High noise such as in a crowded room or heavy traffic
130dB	10 trillion times as great as 10dB	Extremely loud rock concert; can cause ear damage.
140dB	100 trillion times as great as 10dB	Sound of a jet engine on takeoff. Hearing can be damaged.

**FIGURE 16-3** The ear is the organ of hearing.



## MORE ABOUT . . .

### Skin

One of the remarkable advances in genetic engineering is the ability to grow replacement skin. The new skin is grown from cells of skin from various parts of the body and can be used to replace burned or injured areas. If the skin is working once it is put in place, it will continue to grow and function like normal skin—helping to regulate body temperature, preventing foreign material from entering the body, and protecting inner organs from bruises.

or bottom layer. The skin's receptors can sense touch, pressure, pain, and hot and cold temperatures. Each type of receptor only senses one kind of sensation; for example, a heat receptor only senses heat; a pressure receptor only senses pressure. The skin also has pain receptors that sense any injury to skin tissue. Chapter 4 discusses the integumentary system, which is incorporated within the skin.

### Smell—the Nose

The sense of smell or *olfactory stimulation* is activated by *olfactory receptors* located at the top of the nasal cavity. The olfactory receptors are neurons covered with cilia that send smell messages to the brain. The receptors are located within the **olfactory organs**, yellowish-brown masses along the top of the nasal cavity. For the sense of smell to sense an object, the object must be dissolved in a liquid in the olfactory organs. The sense of smell is closely related to the sense of taste.

### Taste—the Tongue and Oral Cavity

**Taste buds** are organs that sense the taste of food. Most taste buds are on the surface of the tongue in small raised structures called **papillae**, but some also line the roof of the mouth and the walls of the pharynx. Each taste bud contains receptor cells, called **taste cells**. Nerve fibers wrapped around the taste cells transmit impulses to the brain. The taste buds are activated when the

item being tasted dissolves in the watery fluid surrounding the taste buds. The salivary glands secrete this fluid. There are at least four types of taste buds to match the primary taste sensations—sweet, sour, salty, and bitter. Different sections of the tongue contain concentrations of receptors for each of the taste sensations. There are also receptors that sense the texture, odor, and temperature of food. In the case of food that is too hot, too spicy, or too cold, some pain receptors are activated. The combination of the primary taste sensations and the aroma of food will be interpreted in the brain as the specific flavor of food. This explains why someone with a head cold does not have a good appetite.

## VOCABULARY REVIEW

In the previous section, you learned terms relating to the sensory system. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Meaning
<b>auditory ossicles</b> [ÄW-dī-tōr-ē ŌS-ī-klz]	Three specially shaped bones in the middle ear that anchor the eardrum to the tympanic cavity and that transmit vibrations to the inner ear.
<b>auricle</b> [ÄW-rī-kl] From Latin <i>auris</i> , ear	Funnel-like structure leading from the external ear to the external auditory meatus; also called pinna.
<b>choroid</b> [KŌ-rōyd] Greek <i>chorioeides</i> , like a membrane	Thin posterior membrane in the middle layer of the eye.
<b>ciliary</b> [SĪL-ē-är-ē] <b>body</b>	Thick anterior membrane in the middle layer of the eye.
<b>cochlea</b> [KŌK-lē-ä] Latin, snail shell	Snail-shaped structure in the inner ear that contains the organ of Corti.
<b>cones</b> [kōnz]	Specialized receptor cells in the retina that perceive color and bright light.
<b>conjunctiva</b> ( <i>pl.</i> , <i>conjunctivae</i> ) [kŏn-JŮNK-tī-vä (kŏn-JŮNK-tī-vē)] From Latin <i>conjungo</i> , to join together	Mucous membrane lining the eyelid.
<b>cornea</b> [KŌR-nē-ä] Latin, like a horn	Transparent anterior section of the eyeball that bends light in a process called refraction.
<b>decibel</b> [DĒS-ī-bēl] Latin <i>decimus</i> , tenth + <i>bel</i> , sound	Measure of the intensity of sound.
<b>ear</b> [ēr] Old English <i>eare</i>	Organ of hearing.
<b>eardrum</b> [ĒR-drŭm] ear + drum	Oval, semitransparent membrane that moves in response to sound waves and produces vibrations.
<b>endolymph</b> [ĒN-dō-lĭmf] endo-, within + lymph	Fluid inside the membranous labyrinth.

Term	Meaning
<b>equilibrium</b> [ē-kwī-LĬB-rē-ŭm] Latin <i>aequilibrium</i> , horizontal position	Sense of balance.
<b>eustachian</b> [yū-STĀ-shŭn, yū-STĀ-kē-ăn] <b>tube</b> After Bartolommeo Eustachio (1524–1574), Italian anatomist	Tube that connects the middle ear to the pharynx.
<b>eye</b> [ī] Old English <i>eage</i>	Organ of sight.
<b>eyebrow</b> [Ī-brŏw] eye + brow	Clump of hair, usually about a half an inch above the eye, that helps to keep foreign particles from entering the eye.
<b>eyelashes</b> [Ī-lăsh-ěz] eye + lashes	Group of hairs protruding from the end of the eyelid; helps to keep foreign particles from entering the eye.
<b>eyelid</b> [Ī-lĭd] eye + lid	Moveable covering over the eye.
<b>fovea centralis</b> [FŌ-vē-ă sĕn-TRĀL-ĭs]	Depression in the center of the macula lutea; perceives sharpest images.
<b>hearing</b>	Ability to perceive sound.
<b>incus</b> [ĬN-kŭs] Latin, anvil	One of the three auditory ossicles; the anvil.
<b>iris</b> [Ī-rĭs] Greek, iris, rainbow	Colored part of the eye; contains muscles that expand and contract in response to light.
<b>lacrimal</b> [LĀK-rĭ-măl] <b>glands</b>	Glands that secrete liquid to moisten the eyes and produce tears.
<b>lens</b> [lĕnz] Latin, lentil	Colorless, flexible transparent body behind the iris.
<b>macula</b> [MĀK-yū-lă] Latin, spot	Inner ear structure containing hairlike sensors that move to maintain equilibrium.
<b>macula lutea</b> [lū-TĒ-ă]	Small, yellowish area located in the center of the retina, which has a depression called the fovea centralis.
<b>malleus</b> [MĀL-ē-ŭs] Latin, hammer	One of the three auditory ossicles; the hammer.
<b>membranous labyrinth</b> [LĀB-ĭ-rĭnth]	One of the two tubes that make up the semicircular canals.
<b>neuroretina</b> [nūr-ŏ-RĒT-ĭ-nă] neuro-, nerve + retina	Thick layer of nervous tissue in the retina.
<b>olfactory</b> [ŏl-FĀK-tŏ-rē] <b>organs</b>	Organs at the top of the nasal cavity containing olfactory receptors.
<b>optic nerve</b>	Nerve that transmits nerve impulses from the eye to the brain.



Term	Meaning
<b>organ of Corti</b> [KŌR-tī]	Structure on the basilar membrane with hairlike receptors that receive and transmit sound waves.
<b>osseus</b> [ŌS-sē-ŭs] <b>labyrinth</b>	One of the two tubes that make up the semicircular canals.
<b>otoliths</b> [Ō-tō-līths] oto-, ear + -lith, stone	Small calcifications in the inner ear that help to maintain balance.
<b>papillae</b> [pă-PĪL-ē] Latin <i>papilla</i> , small pimple	Small, raised structures that contain the taste buds.
<b>perilymph</b> [PĒR-ī-līmf] peri-, around + lymph	Liquid secreted by the walls of the osseus labyrinth.
<b>pinna</b> [PĪN-ă] Latin, feather	Auricle.
<b>pupil</b> [PYŪ-pīl] Latin <i>pupilla</i>	Black circular center of the eye; opens and closes when muscles in the iris expand and contract in response to light.
<b>refraction</b> [rē-FRĀK-shŭn] From Latin <i>refractus</i> , broken up	Process of bending light rays.
<b>retina</b> [RĒT-ī-nă]	Oval, light-sensitive membrane in the interior layer of the eye; decodes light waves and transmits information to the brain.
<b>rods</b> [rōdz]	Specialized receptor cells in the retina that perceive black to white shades.
<b>sclera</b> ( <i>pl.</i> , <i>sclerae</i> ) [SKLĒR-ă (SKLĒR-ē)] Greek <i>skleros</i> , hard	Thick, tough membrane in the outer eye layer; supports eyeball structure.
<b>semicircular canals</b>	Structures in the inner ear important to equilibrium.
<b>sensory receptors</b>	Specialized tissue containing cells that can receive stimuli.
<b>sensory system</b>	Organs or tissue that perceive and receive stimuli from outside or within the body.
<b>sight</b>	Ability to see.
<b>smell</b>	Ability to perceive odors.
<b>stapes</b> ( <i>pl.</i> , <i>stapes</i> , <i>stapedes</i> ) [STĀ-pēz (STĀ-pē-dēz)]	One of the three auditory ossicles; the stirrup.
<b>taste</b>	Ability to perceive the qualities of ingested matter.
<b>taste buds</b>	Organs that sense the taste of food.
<b>taste cells</b>	Specialized receptor cells within the taste buds.
<b>tears</b> [tērz]	Moisture secreted from the lacrimal glands.
<b>touch</b>	Ability to perceive sensation on the skin.

Term	Meaning
<b>tympanic</b> [tĭm-PĂN-ĭk] <b>membrane</b>	Eardrum.
<b>uvea</b> [YŪ-vē-ă] Latin <i>uva</i> , grape	Region of the eye containing the iris, choroid membrane, and ciliary bodies.
<b>vestibule</b> [VĚS-tĭ-bŭl] Latin <i>vestibulum</i> , space	Bony chamber between the semicircular canal and the cochlea.

## CASE STUDY

### Checking Symptoms

John James, a 67-year-old male, presented at his family doctor's office very nervous and upset. His general health is excellent and, although he was widowed one year ago, he is proud of the way he has maintained his independence. His only complaint is diminished vision. He says his night vision is so bad that he has given up night driving. His family doctor gives him a general physical including laboratory tests. All of the

test results prove normal. Mr. James is then referred to an ophthalmologist (eye specialist).

### Critical Thinking

1. In addition to the general physical, why did the family doctor refer Mr. James to an ophthalmologist?
2. Why is a general physical necessary?

## STRUCTURE AND FUNCTION EXERCISES

### Find a Match

Match the terms in the left-hand column with the definitions in the right-hand column.

- |                            |  |
|----------------------------|--|
| 3. ____ iris               | a. tough, white, outer coating of eyeball          |
| 4. ____ sclera             | b. dark opening of the eye, surrounded by the iris |
| 5. ____ pupil              | c. earwax  |
| 6. ____ optic disc         | d. hammer  |
| 7. ____ eustachian         | e. eardrum   |
| 8. ____ incus              | f. anvil   |
| 9. ____ malleus            | g. stirrup   |
| 10. ____ stapes            | h. auditory tube                                   |
| 11. ____ tympanic membrane | i. pinna   |
| 12. ____ auricle           | j. blind spot of the eye                           |
| 13. ____ cerumen           | k. colored portion of the eye                      |

### Check Your Knowledge

Circle T for true or F for false.

14. The aqueous humor is a thick, gelatinous substance. T F
15. The sharpest images are perceived in the optic disk. T F

16. Rods and cones are receptor cells that sense light and color. T F
17. Olfactory receptors perceive light rays. T F
18. Semicircular canals in the ears are important to equilibrium. T F
19. Refraction is the focusing on distant objects. T F
20. The papillae house the taste buds. T F

## Combining Forms and Abbreviations

The lists below include combining forms and abbreviations that relate specifically to the sensory system. Pronunciations are provided for the examples.

COMBINING FORM	MEANING	EXAMPLE
audi(o), audit(o)	hearing	<i>audiometer</i> [ăw-dē-ŌM-ě-těr], instrument for measuring hearing
aur(o), auricul(o)	hearing	<i>auriculocranial</i> [ăw-RĪK-yū-lō-KRĀ-nē-ăl], pertaining to the auricle of the ear and the cranium
blephar(o)	eyelid	<i>blepharitis</i> [blěf-ă-RĪ-tīs], inflammation of the eyelid
cerumin(o)	wax	<i>ceruminolytic</i> [sě-rū-mĭ-nō-LĪT-ĭk], agent for softening earwax
cochle(o)	cochlea	<i>cochleovestibular</i> [kōk-lē-ō-vēs-TĪB-yū-lăr], pertaining to the cochlea and the vestibule of the ear
conjunctiv(o)	conjunctiva	<i>conjunctivoplasty</i> [kōn-JŮNK-tĭ-vō-plăs-tē], plastic surgery on the conjunctiva
cor(o), core(o)	pupil	<i>coreoplasty</i> [KŌR-ē-ō-plăs-tē], surgical correction of the size and shape of a pupil
corne(o)	cornea	<i>corneoscleral</i> [kōr-nē-ō-SKLĚR-ăl], pertaining to the cornea and sclera
cycl(o)	ciliary body	<i>cyclodialysis</i> [sĭ-klō-dĭ-ĀL-ĭ-sĭs], method of relieving intraocular pressure in glaucoma
dacry(o)	tears	<i>dacryolith</i> [DĂK-rē-ō-lĭth], calculus in the tear duct
ir(o), irid(o)	iris	<i>iridoptosis</i> [ĭr-ĭ-dŏp-TŌ-sĭs], prolapse of the iris
kerat(o)	cornea	<i>keratoconus</i> [kěr-ă-tō-KŌ-nŭs], abnormal protrusion of the cornea
lacrim(o)	tears	<i>lacrimotomy</i> [LĂK-rĭ-mŏ-tō-mē], incision into the lacrimal duct
mastoid(o)	mastoid process	<i>mastoiditis</i> [măs-tŏy-DĪ-tīs], inflammation of the mastoid process

COMBINING FORM	MEANING	EXAMPLE
myring(o)	eardrum, middle ear	<i>myringitis</i> [mĭr-ĭn-JĬ-tĭs], inflammation of the tympanic membrane
nas(o)	nose	<i>nasosinusitis</i> [nās-zō-sĭ-nŭ-SĬ-tĭs], inflammation of the nasal and sinus cavities
ocul(o)	eye	<i>oculodynia</i> [ŏk-yŭ-lō-DĬN-ē-ă], pain in the eyeball
ophthalm(o)	eye	<i>ophthalmoscope</i> [ŏf-THĀL-mō-skōp], instrument for studying the interior of the eyeball
opt(o), optic(o)	eye	<i>optometer</i> [ŏp-TŌM-ē-tēr], instrument for determining eye refraction
ossicul(o)	ossicle	<i>ossiculectomy</i> [ŎS-ĭ-kyŭ-LĚK-tō-mē], removal of one of the ossicles of the middle ear
phac(o), phak(o)	lens	<i>phacoma</i> [fā-KŌ-mă], tumor of the lens
pupill(o)	pupil	<i>pupillometer</i> [pyŭ-pĭ-LŌM-ē-tēr], instrument for measuring the diameter of the pupil
retin(o)	retina	<i>retinitis</i> [rēt-ĭ-NĬ-tĭs], inflammation of the retina
scler(o)	white of the eye	<i>sclerectasia</i> [sklēr-ĕk-TĀ-zhē-ă], bulging of the sclera
scot(o)	darkness	<i>scotometer</i> [skō-TŌM-ē-tēr], instrument for evaluating a scotoma or blind spot
tympan(o)	eardrum, middle ear	<i>tympanoplasty</i> [tĭm-pă-nō-PLĀS-tē], repair of a damaged middle ear
uve(o)	uvea	<i>uveitis</i> [yŭ-vē-Ĭ-tĭs], inflammation of the uvea

ABBREVIATION	MEANING	ABBREVIATION	MEANING
acc.	accommodation	D	diopter
AD	right ear	dB	decibel
ARMD	age-related macular degeneration	DVA	distance visual acuity
AS	left ear	ECCE	extracapsular cataract extraction
AU	both ears	EENT	eye, ear, nose, and throat
ENT	ear, nose, and throat	OU	each eye
ICCE	intracapsular cataract cryoextraction	PERRL, PERRLA	pupils equal, round, reactive to light (and accommodation)
IOL	intraocular lens	PE tube	polyethylene ventilating tube (placed in the eardrum)
IOP	intraocular pressure	SOM	serous otitis media
NVA	near visual acuity	VA	visual acuity



ABBREVIATION	MEANING	ABBREVIATION	MEANING
OD	right eye	VF	visual field
OM	otitis media	+	plus/convex
OS	left eye	—	minus/concave

## CASE STUDY

### Seeing a Specialist

Mr. James was next referred to an ophthalmologist who discovered that Mr. James had a cataract in his right eye that should be removed. He also had one in the left eye that did not need treatment at this time. During surgery, an IOL implant was placed in the right eye. After surgery, the ophthalmologist prescribed eyeglasses. The prescription form is used to instruct the optometrist or optician as to what corrective powers are necessary.

### Critical Thinking

21. Through which eye can Mr. James see distant objects more clearly?
22. Did Mr. James need a corrective lens for his left eye?

<b>Dr. Janet Maitland</b> 3000 Blue Willow Lane Forest Park, IL 99999 999-000-5555					
NAME <u>John James</u>				DATE <u>2/3/XXXX</u>	
<b>Rx</b>					
	SPH.	CYL.	AXIS	PRISM	Remarks
R	-.75	+.75	180	20/20	1st Rx after cataract Sx OD
L	-2.00	+.75	005	20/50	
ADD		P.D.			
R	+2.50	DIST 64		60 NEAR	
L	+2.50				
EXPIRES <u>2/XXXX</u>				<input checked="" type="checkbox"/> Janet Maitland, M.D. <u>Janet Maitland, M.D.</u> <small>IL, LIC. NO. 7yyt18</small>	

## COMBINING FORMS AND ABBREVIATIONS EXERCISES

### Find the Roots

From the following list of combining forms and from the list of suffixes in Chapter 2, write the word that matches the definition.

audi(o) blephar(o) core(o) dacryocyst(o) irid(o) kerat(o) opt(o) ot(o) retin(o) scler(o)

- |   |   |
|---|---|
| 23. _____ inflammation of the ear                   | 30. _____ repair of the pupil                   |
| 24. _____ instrument for determining eye refraction | 31. _____ softening of the sclera               |
| 25. _____ study of the ear                          | 32. _____ inflammation of the sclera and cornea |
| 26. _____ inflammation of the cornea                | 33. _____ swelling in the eyelid                |
| 27. _____ instrument to examine the cornea          | 34. _____ pertaining to the retina              |
| 28. _____ disease of the iris                       | 35. _____ paralysis of the iris                 |
| 29. _____ pain in the tear sac                      | 36. _____ earache                               |

37. \_\_\_\_\_ study of hearing (disorders)

38. \_\_\_\_\_ inflammation of the eyelid

39. \_\_\_\_\_ hemorrhage from the ear

40. \_\_\_\_\_ instrument to measure hearing

## Diagnostic, Procedural, and Laboratory Terms

---

Diagnosis of the sensory system usually includes testing of the sense in question and examination of the sensory structures. Loss of a sense can cause serious problems for an individual. In some cases, senses can be partially or totally restored through the use of prosthetic devices, transplants, or medication. In other cases, patients must adapt to the loss of a sense.

### Diagnosing the Eye

An **ophthalmologist** (medical doctor who specializes in treatment and surgeries of the eye) and an **optometrist** (a trained nonmedical specialist who can examine patients for vision problems and prescribe lenses) both perform routine eye examinations. The most common diagnostic test of the eye is the visual acuity test, which measures the ability to see objects clearly at measured distances. The most common chart is the *Snellen Chart*. Perfect vision measures 20/20 on such a test. The first number, 20, is the distance (typically 20 feet) from which the person being tested reads a chart with black letters of different size. The second number is the distance from which the person being tested can read the size of the letters in relation to someone with normal vision. If the test shows that the subject can read only the letters on the 400 line, then the vision would be measured as 20/400. The 400 line means that someone with normal vision would be able to see from 400 feet away what the person being tested can see without corrective lenses at only 20 feet. A reading that shows less than 20/20 (for example 20/13) means that a person can read something at 20 feet that most people with 20/20 vision would only be able to read at 13 feet.

The next step in a routine eye examination is to examine peripheral vision, the area one is able to see to the side with the eyes looking straight ahead. This is usually done by telling a patient to follow a finger placed in front of their eyes while facing straight ahead. (In diagnosing some diseases, peripheral vision is tested in an examination called a *visual field examination*.) Depending on the patient's age, most routine eye examinations also include **tonometry**, a measurement of pressure within the eye (a test for glaucoma) and **ophthalmoscopy** (visual examination of the interior of the eye). If the patient needs corrective lenses, an **optician** (trained technician who makes and fits corrective lenses) can fill the prescription written by an ophthalmologist or an optometrist. Most optometrists and some ophthalmologists also fill prescriptions for lenses. A prescription includes the **diopter**, the unit of refracting power needed in a lens.

For further diagnosis of the eye, a *slit lamp ocular device* is used to view the interior of the eye magnified through a microscope (Figure 16-4). *Fluorescein angiography* is the injection of a contrast medium into the blood vessels to observe the movement of blood throughout the eye. This test is for people with diabetes and other diseases that may manifest lesions on various parts of the eye.

## Diagnosing the Ear

Hearing tests are routinely given to young children to see if they have any hearing deficit. Later, hearing is checked when a person notices hearing loss or when that person's friends and family suspect it. An **otologist** is an ear specialist, and an **audiologist** is a nonmedical hearing specialist. **Otorhinolaryngologists** are specialists who practice *otorhinolaryngology*, the medical specialty covering the ear, nose, and throat. They all perform thorough examinations that include **otoscopy**, visual examination of the ear using an *otoscope*, a lighted viewing device (Figure 16-5). Such an examination might also include **audiometry**, the measurement of various acoustic frequencies to determine what frequencies the patient can or cannot hear. The device used is an *audiometer*, and the results of the test are plotted on a graph, an **audiogram**. The inside of the ear may be tested using a *pneumatic otoscope*, an otoscope that allows air to be blown into the ear to view the movement of the eardrum. A *tuning fork* compares the conduction of sound in one ear or between the two ears. The *Rinne test* and the *Weber test* are two tuning fork tests.

Hearing aids have improved both in the sound they provide and in the way they have been made so small as to be almost unnoticeable. Cochlear implants are another method of improving hearing.

## Diagnosing Other Senses

The nose is usually observed as part of a general examination or, more specifically, a respiratory examination. Loss of the sense of smell is often the result of a disease process or of aging. The tongue and other parts of the mouth and the skin are also observed during a general examination. Loss of taste or touch may also be part of a disease process or of aging.



**FIGURE 16-4** A slit lamp ocular device is a viewing device that uses a microscope to magnify the interior of the eye.

**FIGURE 16-5** An otoscope is used to perform a visual examination of the ear. The family doctor here is examining a young patient with an earache.

## VOCABULARY REVIEW

In the previous section, you learned diagnostic, procedural, and laboratory terms. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Meaning
<b>audiogram</b> [ÄW-dē-ō-grām] audio- + -gram, a recording	Graph that plots the acoustic frequencies being tested.
<b>audiologist</b> [äw-dē-ÖL-ō-jīst] audio- + -logist, one who specializes	Specialist in evaluating hearing function.
<b>audiometry</b> [äw-dē-ÖM-ē-trē] audio- + -metry, measurement	Measurement of acoustic frequencies using an audiometer.
<b>diopter</b> [dī-ÖP-tēr] Greek <i>dioptra</i> , leveling instrument	Unit of refracting power of a lens.
<b>ophthalmologist</b> [öf-thäl-MÖL-ō-jīst] ophthalmo-, eye + -logist	Medical specialist who diagnoses and treats eye disorders.
<b>ophthalmoscopy</b> [öf-thäl-MÖS-kō-pē] ophthalmo- + -scopy, viewing	Visual examination of the interior of the eye.
<b>optician</b> [öp-TİSH-ün]	Technician who makes and fits corrective lenses.
<b>optometrist</b> [öp-TÖM-ē-trīst] opto-, eye + Greek <i>metron</i> , measure	Nonmedical specialist who examines the eyes and prescribes lenses.
<b>otologist</b> [ō-TÖL-ō-jīst] oto-, ear + -logist	Medical specialist in ear disorders.
<b>otorhinolaryngologist</b> [ō-tō-rī-nō-lär-īng-GÖL-ō-jīst] oto-, ear + rhino-, nose + laryngo-, throat + -ologist	Medical specialist who treats ear, nose, and throat disorders.
<b>otoscopy</b> [ō-TÖS-kō-pē] oto- + -scopy	Inspection of the ear using an otoscope.
<b>tonometry</b> [tō-NÖM-ē-trē] tono-, tension + -metry	Measurement of tension or pressure within the eye.

## CASE STUDY

### Another Problem Arises

Mr. James returned to the ophthalmologist in four months complaining of cloudy vision in his left eye. The ophthalmologist determined that it was time to remove the cataract in the left eye and replace it with an artificial lens or IOL. After a few weeks, Mr. James had regained night vision, even proclaiming that he could see better now than he had years before. His eyeglass prescription was changed. He only really needed his glasses for reading.

The ophthalmologist also recommended sunglasses for most outdoor daytime activities, because ultraviolet rays can harm the eyes.

### Critical Thinking

41. An artificial lens replaces what part of the eye?
42. Does a lens implant change eye color?



## DIAGNOSTIC, PROCEDURAL, AND LABORATORY TERMS EXERCISES

### Know Your Senses

For each of the following diagnostic tests or devices, write A for eye, B for ear, or C for both eye and ear.

- |                         |                          |
|-------------------------|--------------------------|
| 43. audiogram _____     | 47. tuning fork _____    |
| 44. otoscope _____      | 48. Snellen chart _____  |
| 45. Rinne test _____    | 49. tonometer _____      |
| 46. visual acuity _____ | 50. ophthalmoscope _____ |

### Pathological Terms

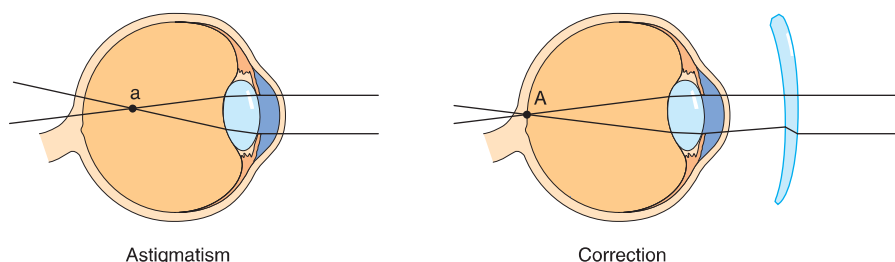
Lost or damaged senses are illnesses in themselves. The disruption of losing or damaging a sense organ can lead to related illnesses. Much of the pathology of the sensory system results from age-related disorders or just age-related wear and tear on the sensory organs.

### Eye Disorders

The most common eye disorders involve defects in the curvature of the cornea and/or lens or defects in the refractive ability of the eye due to an abnormally short or long eyeball. Such disorders are usually managed with corrective lenses. Corrective lenses may be placed in frames to be worn on the face or may be in the form of **contact lenses**, which are placed directly over the cornea of the eye centered on the pupil. Contact lenses come in a variety of types, including disposable, hard, soft, and long-term wear. The degree of correction of the lenses depends on the results of a visual acuity examination.

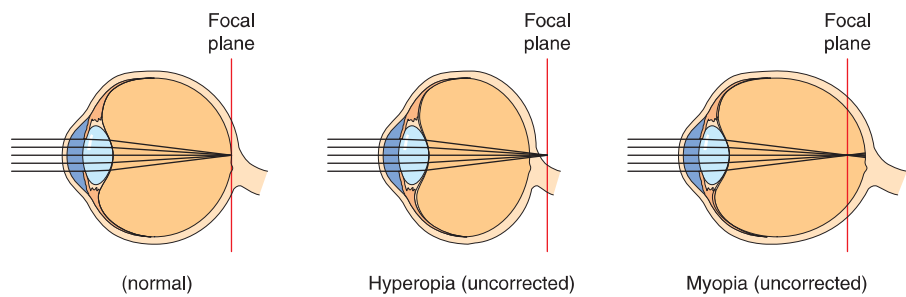
An eye examination may reveal an **astigmatism**, distortion of sight because light rays do not come to a single focus on the retina (Figure 16-6). It may also reveal **hyperopia** (farsightedness) or **myopia** (nearsightedness). All three are errors of refraction, the bending of light that causes light rays to fall at one point on the retina. Hyperopia is the focusing of light rays behind the retina, and myopia is the focusing of light rays in front of the retina. Figure 16-7 shows hyperopia and myopia. **Presbyopia** is loss of close reading vision due to lessened ability to focus and accommodate, a common disorder after age 40 and another refractive disorder.

**Strabismus** is eye misalignment (sometimes called “cross-eyed”). Two types of strabismus are **esotropia**, deviation of one eye inward, and **exotropia**, deviation of one eye outward. **Asthenopia** or **eyestrain** is a condition in



**FIGURE 16-6** An astigmatism distorts light rays.

**FIGURE 16-7** Hyperopia and myopia are errors of refraction.



which the eyes tire easily because of weakness of the ocular or ciliary muscles. Symptoms may include pain in or around the eyes, headache, dimness of vision, dizziness, and light nausea. **Diplopia** is double vision. **Photophobia** is extreme sensitivity to light, sometimes as a result of a disease.

**Cataracts** are cloudiness of the lens of the eye. They are usually a result of the aging process, but can be congenital or the result of a disease process or injury. Also, some types of medication may hasten the clouding of the lens. Removal of a cataract results in **aphakia**, absence of a lens. A **pseudophakia** is an implanted lens used to replace one that has been removed. A **scotoma** is a blind spot in vision.

**Glaucoma** is any disease caused by increased intraocular pressure of the aqueous humor. The pressure misaligns the lens and cornea and causes damage to the ciliary body. It can be treated in most cases by the use of special eye medications or surgical procedures (including laser treatments) to relieve the pressure. If not treatable, it can lead to **blindness**, loss of vision.

There are many other causes of blindness, such as congenital defects, trauma to the eyes, and **macular degeneration**. Macular degeneration is the breakdown of macular tissue, which leads to loss of central vision, the vision we use for reading, driving, and watching television. Some specific conditions within the eye may affect vision. One such is *papilledema* or *edema* of the optic disk. Diseases of other body systems can affect the senses. *Diabetic retinopathy* is a complication of diabetes mellitus that can result in vision loss. **Retinitis pigmentosa** is a progressive, inherited disorder, usually accompanied by scarring on the retina and **nyctalopia**, night blindness. The retina can tear or become detached and need surgical repair. Many of these conditions and other situations can lead to a form of partial blindness known as *legal blindness*. Legal blindness is a range of sight set by states. For example, someone whose vision can only be corrected to 20/400 may be considered legally blind.

The eyeball can protrude abnormally, as in **exophthalmus** or **exophthalmos**, usually caused by hyperthyroidism. **Lacrimation** or **epiphora** is excessive tearing, and **nystagmus** is excessive eyeball movement.

Inflammations and conditions of the eyelid include **blepharospasm**, involuntary eyelid movement causing excessive blinking; **blepharitis**, inflammation of the eyelid; **conjunctivitis** or **pinkeye**, a highly infectious inflammation of the conjunctiva; **blepharochalasis** or **dermatochalasis**, loss of elasticity of the eyelid; and **blepharoptosis**, paralysis of the eyelid causing drooping. A **chalazion** is a nodular inflammation that usually forms on the eyelid. **Trichiasis** is abnormal growth of eyelashes in a direction that causes them to rub on the eye. A **hordeolum** or **sty** is an infection of a sebaceous gland in the eyelid.

Inflammations of other parts of the eye include **dacryoadenitis**, inflammation of a lacrimal gland; **dacryocystitis**, inflammation of a tear duct; **iritis**,

inflammation of the iris; **keratitis**, inflammation of the cornea; **retinitis**, inflammation of the retina; and **scleritis**, inflammation of the sclera.

## Ear Disorders

The sense of hearing can be diminished or lost in a number of situations. **Anacusis** is total loss of hearing. **Paracusis** is impaired hearing. **Deafness** is either partial or total hearing loss. **Presbycusis** or *presbycusis* is age-related hearing loss. *Conductive hearing loss* is caused by lessening of vibrations of the ear. *Sensorineural hearing loss* (also known as nerve deafness) is caused by lesions or dysfunction of those parts of the ear necessary to hearing. *Cerumen impaction*, abnormal wax buildup, can diminish hearing. **Otosclerosis** is the hardening of bone within the ear. **Tinnitus** is a constant ringing or buzzing in the ear. **Otalgia** or *earache* can interfere with hearing. **Otorrhagia**, bleeding in the ear, and **otorrhea**, purulent matter draining from the ear, can also impair hearing, usually temporarily. The sense of equilibrium is disturbed in **vertigo**, dizziness.

Various ear inflammations can diminish hearing or cause pain. **Otitis media** is inflammation of the middle ear. *Suppurative otitis media* is bacterial in nature and is often found in children. *Serous otitis media* is fluid contained in the middle ear, preventing free movement of the tympanic membrane. **Otitis externa**, also known as *swimmer's ear*, is a fungal infection of the external ear canal often occurring in hot weather. **Labyrinthitis** is inflammation of the labyrinth. **Myringitis** or **tympanitis** is inflammation of the eardrum. **Mastoiditis** is inflammation of the mastoid process. Changes in atmospheric pressure, as in air travel, can result in **aerotitis media**, inflammation of the middle ear.

An *acoustic neuroma* is a benign tumor of the eighth cranial nerve that can affect hearing. A **cholesteatoma** is a fatty cyst within the middle ear. **Meniere's disease** is elevated fluid pressure within the cochlea, causing disturbances of the equilibrium and vertigo.

There are a number of organizations dedicated to fighting blindness or providing services for the blind. Prevent Blindness ([www.preventblindness.org](http://www.preventblindness.org)) is one example.

The Deafness Research Foundation ([www.drf.org](http://www.drf.org)) provides research grants and disseminates information about deafness.

## VOCABULARY REVIEW

In the previous section, you learned terms relating to pathology. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

TERM	MEANING
<b>aerotitis media</b> [ār-ō-TĪ-tis MĒ-dē-ă] an-, without + Greek <i>akousis</i> , hearing	Inflammation of the middle ear caused by air pressure changes, as in air travel.
<b>anacusis</b> [ăn-ă-KŪ-sis] an-, without + Greek <i>akousis</i> , hearing	Loss of hearing.
<b>aphakia</b> [ă-FĀ-kē-ă] a-, without + Greek <i>phakos</i> , lentil-shaped	Absence of a lens.
<b>asthenopia</b> [ăs-thĕ-NŌ-pē-ă] Greek <i>astheneia</i> , weakness + ops, eye	Weakness of the ocular or ciliary muscles that causes the eyes to tire easily.

TERM	MEANING
<b>astigmatism</b> [ă-STĪG-mă-tĭzm] a-, without + Greek <i>stigma</i> , point + -ism, state	Distortion of sight because of lack of focus of light rays at one point on the retina.
<b>blepharitis</b> [blĕf-ă-RĪ-tĭs] blephar-, eyelid + -itis, inflammation	Inflammation of the eyelid.
<b>blepharochalasis</b> [blĕf-ă-rō-KĀL-ă-sĭs] blepharo-, eyelid + Greek <i>chalasis</i> , a slackening	Loss of elasticity of the eyelid.
<b>blepharoptosis</b> [blĕf-ă-RŌP-tō-sĭs] blepharo- + Greek <i>ptosis</i> , a falling	Drooping of the eyelid.
<b>blepharospasm</b> [BLĒF-ă-rō-spāzm] blepharo- + spasm	Involuntary eyelid movement; excessive blinking.
<b>blindness</b>	Loss or absence of vision.
<b>cataract</b> [CĀT-ă-răkt] Latin <i>cataracta</i>	Cloudiness of the lens of the eye.
<b>chalazion</b> [kă-LĀ-zē-ŏn] Greek, little sty	Nodular inflammation that usually forms on the eyelid.
<b>cholesteatoma</b> [kō-lēs-tē-ă-TŌ-mă] chole(sterol) + steato-, fat + -oma, tumor	Fatty cyst within the middle ear.
<b>conjunctivitis</b> [kŏn-jŭnk-tĭ-VĪ-tĭs] conjunctiv-, conjunctiva + -itis	Inflammation of the conjunctiva of the eyelid.
<b>contact lenses</b>	Corrective lenses worn on the surface of the eye.
<b>dacryoadenitis</b> [DĀK-rē-ŏ-ăd-ĕ-NĪ-tĭs] dacryo-, lacrimal gland + aden, gland + -itis	Inflammation of the lacrimal glands.
<b>dacryocystitis</b> [DĀK-rē-ŏ-sĭs-TĪ-tĭs] dacryo- + cyst + -itis	Inflammation of a tear duct.
<b>deafness</b>	Loss or absence of hearing.
<b>dermatochalasis</b> [DĒR-mă-tō-kă-LĀ-sĭs] dermato-, skin + Greek <i>chalasis</i> , a slackening	Loss of elasticity of the eyelid.
<b>diplopia</b> [dĭ-PLŌ-pē-ă] diplo-, double + -opia, vision	Double vision.
<b>epiphora</b> [ĕ-PĪF-ŏ-ră] Greek, a sudden flow	Excessive tearing.
<b>esotropia</b> [ĕs-ŏ-TRŌ-pē-ă] Greek <i>eso</i> , inward + -tropia, a turning	Deviation of one eye inward.
<b>exophthalmos, exophthalmus</b> [ĕk-sŏf-THĀL-mŏs] ex-, out of + Greek <i>ophthalmos</i> , eye	Abnormal protrusion of the eyeballs.
<b>exotropia</b> [ĕk-sŏ-TRŌ-pē-ă] exo-, outward + -tropia	Deviation of one eye outward.
<b>eyestrain</b> eye + strain	Asthenopia.
<b>farsightedness</b>	Hyperopia.



TERM	MEANING
<b>glaucoma</b> [glăw-KŌ-mă] Greek <i>glaukoma</i> , opacity	Any of various diseases caused by abnormally high eye pressure.
<b>hordeolum</b> [hōr-DE-ō-lŭm]	Infection of a sebaceous gland of the eyelid; sty.
<b>hyperopia</b> [hī-pēr-Ō-pē-ă] hyper-, excessive + -opia, vision	Focusing behind the retina causing vision distortion; farsightedness.
<b>iritis</b> [ī-RĪ-tis] ir-, iris + -itis	Inflammation of the iris.
<b>keratitis</b> [kēr-ă-TĪ-tis] kerat-, cornea + -itis	Inflammation of the cornea.
<b>labyrinthitis</b> [LĂB-ĭ-rĭn-THĪ-tis] labyrinth + -itis	Inflammation of the labyrinth.
<b>lacrimation</b> [lăk-rĭ-MĂ-shŭn]	Secretion of tears, usually excessively.
<b>macular</b> [MĂK-yŭ-lăr] <b>degeneration</b>	Gradual loss of vision caused by degeneration of tissue in the macula.
<b>mastoiditis</b> [măs-töy-DĪ-tis] mastoid + -itis	Inflammation of the mastoid process.
<b>Meniere's disease</b> [mĕn-YĒRZ] After Prosper Meniere (1799–1862), French physician	Elevated pressure within the cochlea.
<b>myopia</b> [mī-Ō-pē-ă] Greek, from <i>my-</i> , muscle + -opia, vision	Focusing in front of the retina causing vision distortion; nearsightedness.
<b>myringitis</b> [mĭr-ĭn-JĪ-tis] myring-, eardrum + -itis	Inflammation of the eardrum.
<b>nearsightedness</b>	Myopia.
<b>nyctalopia</b> [nĭk-tă-LŌ-pē-ă] nyct-, night + Greek <i>alaos</i> , obscure + -opia, vision	Night blindness.
<b>nystagmus</b> [nĭs-STĂG-mŭs] Greek <i>nystagmos</i> , a nodding	Excessive involuntary eyeball movement.
<b>otalgia</b> [ō-TĂL-jē-ă] ot-, ear + -algia, pain	Pain in the ear.
<b>otitis externa</b> [ō-TĪ-tis ěks-TĚR-nă]	Fungal infection of the external ear canal.
<b>otitis media</b> [MĒ-dē-ă]	Inflammation of the middle ear.
<b>otorrhagia</b> [ō-tō-RĂ-jē-ă] oto-, ear + -rrhagia, hemorrhage	Bleeding from the ear.
<b>otorrhea</b> [ō-tō-RĒ-ă] oto- + -rrhea, flow	Purulent discharge from the ear.
<b>otosclerosis</b> [ō-tō-sklĕ-RŌ-sis] oto- + sclerosis	Hardening of bones of the ear.
<b>paracusis</b> [PĂR-ă-KŪ-sis] para-, beyond + Greek <i>akousis</i> , hearing	Impaired hearing.

TERM	MEANING
<b>photophobia</b> [fō-tō-FŌ-bē-ă] photo-, light + -phobia, fear	Extreme sensitivity to light.
<b>pinkeye</b>	Conjunctivitis.
<b>presbycusis</b> [prēz-bē-ă-KŪ-sīs] presby-, old age + Greek <i>akousis</i> , hearing	Age-related hearing loss.
<b>presbyopia</b> [prēz-bē-Ō-pē-ă] presby- + -opia	Age-related diminished ability to focus or accommodate.
<b>pseudophakia</b> [sū-dō-FĀ-kē-ă] pseudo-, fake + Greek <i>phakos</i> , lentil	Eye with an implanted lens after cataract surgery.
<b>retinitis</b> [rēt-ī-NĪ-tīs] retin-, retina + -itis	Inflammation of the retina.
<b>retinitis pigmentosa</b> [pīg-mēn-TŌ-să]	Progressive, inherited disease with a pigmented spot on the retina and poor night vision.
<b>scleritis</b> [sklē-RĪ-tīs]	Inflammation of the sclera.
<b>scotoma</b> [skō-TŌ-mă] Greek <i>skotoma</i> , vertigo	Blind spot in vision.
<b>strabismus</b> [stră-BĪZ-mūs] Greek <i>strabismos</i> , a squinting	Eye misalignment.
<b>sty, stye</b> [stī] Old English <i>stigan</i> , to rise	Hordeolum.
<b>tinnitus</b> [tī-NĪ-tūs, TĪ-nī-tūs] Latin, a jingling	Constant ringing or buzzing in the ear.
<b>trichiasis</b> [tri-KĪ-ă-sīs] trich-, hair + -iasis, condition	Abnormal growth of eyelashes in a direction that causes them to rub on the eye.
<b>tympanitis</b> [tīm-pă-NĪ-tīs] tympan-, eardrum + -itis	Inflammation of the eardrum.
<b>vertigo</b> [VĒR-tī-gō, vēr-TĪ-gō] Latin	Dizziness.

## CASE STUDY

### Getting Treatment

After his 69th birthday, Mr. James noticed that his hearing had seriously diminished in the last year. His physician referred him to a specialist. It was found that Mr. James had a buildup of wax in his ear. After treatment, his hearing improved slightly, but not enough for Mr. James to feel comfortable.

### Critical Thinking

51. What other condition might explain this patient's hearing loss?
52. What type of specialist should Mr. James be referred to?

## PATHOLOGICAL TERMS EXERCISES

### Sense the Diseases

For each of the diseases listed below, write A for eye, B for ear, or C for nose to indicate the organ associated with that disease.

- |                           |                             |
|---------------------------|-----------------------------|
| 53. conjunctivitis _____  | 58. allergic rhinitis _____ |
| 54. cataract _____        | 59. scotoma _____           |
| 55. nyctalopia _____      | 60. nasosinusitis _____     |
| 56. aerotitis media _____ | 61. Meniere's disease _____ |
| 57. presbyopia _____      |                             |

### Check Your Knowledge

Circle T for true or F for false.

- 62. A hordeolum is a sty. T F
- 63. The focusing of light rays behind the retina is myopia. T F
- 64. Myringitis is an inflammation of the tympanic membrane. T F
- 65. A chalazion is a nodular inflammation typically occurring in the nose. T F
- 66. Labyrinthitis occurs in the labyrinth of the eye. T F

### Surgical Terms

Some of the sense organs require surgery at various times. Corneal transplants or **keratoplasty** may give or restore sight. Implantation of new sound wave devices may give or restore hearing. The eye, ear, and the nose are also the site of plastic surgery to correct congenital defects or the signs of aging. Microscopic laser surgery or microsurgery is often used to operate on the small, delicate sensory organs. Vision correction surgery is becoming quite common as advances in laser surgery make this possible.

Plastic surgery is used in **blepharoplasty**, eyelid repair; **otoplasty**, surgical repair of the outer ear; and **tympanoplasty**, eardrum repair. In some cases, removal of part of a sensory organ becomes necessary to treat a disorder or because a part has become damaged or cancerous.

*Cataract extraction* is the removal of a cloudy lens from the eye. It is usually followed by an *intraocular lens (IOL) implant*, during which an artificial lens is implanted to replace the natural lens of the eye that was removed. It is unusual for patients to be unable to tolerate the implant. When they do, however, special glasses are prescribed that allow the patient some, usually limited, sight. Ultrasound can be used to break up and remove cataracts in **phacoemulsification**. A **dacryocystectomy** is the removal of a lacrimal sac. **Enucleation** is the removal of an eyeball. **Iridectomy** is removal of part of the iris. A **trabeculectomy** is an incision into and removal of part of the trabeculae to allow aqueous humor to flow freely around the eye. An **iridotomy** is an incision into the iris to allow aqueous humor to flow from the posterior to the anterior chambers. Correction of nearsightedness is also available with a laser procedure that changes the curvature of the cornea by making spokelike incisions around it. A retina can tear or become detached due to a

trauma. **Cryoretinopexy** or *cryopexy* is the use of extreme cold to repair the damage to the retina, which can also be repaired using laser surgery.

In the ear, hearing can sometimes be aided by a **stapedectomy**, removal of the stapes to correct otosclerosis and insertion of tissue to substitute for a damaged stapes. A **myringotomy** is the insertion of a small, polyethylene (PE or pressure-equalizing) tube to help drain fluid, thereby relieving some of the symptoms of otitis media. This operation is done frequently on infants and children with recurring ear infections. In addition, cochlear implants can now help deaf people hear and are used increasingly for deaf children.

## VOCABULARY REVIEW

In the previous section, you learned terms relating to surgery. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Meaning
<b>blepharoplasty</b> [BLĚF-ă-rō-plăst-ē] blepharo-, eyelid + -plasty, repair	Surgical repair of the eyelid.
<b>cryoretinopexy</b> [krī-ō-rĕ-tĭn-nō-PĚKS-ē] cryo-, cold + retino-, retina + -pexy, a fixing	Fixing of a torn retina using extreme cold.
<b>dacryocystectomy</b> [dăk-rĕ-ō-sĭs-TĚK-tō-mē] dacryo-, lacrimal gland + cyst + -ectomy, removal	Removal of a lacrimal sac.
<b>enucleation</b> [ē-nū-klĕ-Ā-shŭn] From Latin <i>enucleo</i> , to remove the kernel	Removal of an eyeball.
<b>iridectomy</b> [ĭr-ĭ-DEK-tō-mē] irid-, iris + -ectomy	Removal of part of the iris.
<b>iridotomy</b> [ĭr-ĭ-DŌT-ō-mē] irido-, iris + -tomy, a cutting	Incision into the iris to relieve pressure.
<b>keratoplasty</b> [KĚR-ă-tō-plăs-tē] kerato-, cornea + -plasty	Corneal transplant.
<b>myringotomy</b> [mĭr-ĭng-GŌT-ō-mē] myringo-, middle ear + -tomy	Insertion of a small tube to help drain fluid from the ears (particularly of children).
<b>otoplasty</b> [Ō-tō-plăs-tē] oto-, ear + -plasty	Surgical repair of the outer ear.
<b>phacoemulsification</b> [FĀ-kō-ē-mŭls-ĭ-fĭ-KĀ-shŭn] phaco-, lens + emulsification	Use of ultrasound to break up and remove cataracts.
<b>stapedectomy</b> [stā-pĕ-DEK-tō-mē] stapes + -ectomy	Removal of the stapes to cure otosclerosis.
<b>trabeculectomy</b> [tră-BĚK-yŭ-LĚK-tō-mē] trabecul(um) + -ectomy	Removal of part of the trabeculum to allow aqueous humor to flow freely around the eye.
<b>tympanoplasty</b> [TĪM-pă-nō-plăs-tē] tympano- + -plasty	Repair of an eardrum.

## SURGICAL TERMS EXERCISES

### Check Your Knowledge

Fill in the blanks.

67. A patient sustaining a third-degree burn to the pinna would likely require \_\_\_\_\_.
68. A stapedectomy would be performed to correct \_\_\_\_\_.
69. Cryoretinopexy would be performed to correct a \_\_\_\_\_ retina.
70. A corneal \_\_\_\_\_ may restore sight.
71. A child with chronic otitis media may need a \_\_\_\_\_.

## CASE STUDY

### Getting Help

Mr. James's great grandson came for a few days' visit with his mother. The two-year-old had had fairly frequent ear infections, but they seemed to have subsided for a month or two, so his mother decided to risk the overnight stay. The boy woke up screaming and clutching his ear. A local 24-hour clinic diagnosed severe otitis media and prescribed medication. When the boy

returned home, his pediatrician wrote the note below in his medical record.

### Critical Thinking

72. Is the child's otitis media infectious for Mr. James?
73. Why did the doctor suggest a myringotomy?

Patient name <u>Everett James</u> Age <u>2</u> Current Diagnosis _____	
DATE/TIME 3/3/XXXX	Notes: Frequent otitis media (7 times in the last 11 months). Suggest myringotomy. (Note: schedule during mother's work vacation 5/4–5/11.)
	J. Redpine, M.D.

## Pharmacological Terms

Eyes and ears can both be treated with the *instillation* of drops. Antibiotic *ophthalmic solution* is an antibacterial agent used to treat eye infections, such as conjunctivitis. A **mydriatic** solution dilates the pupil during an eye examination. A **miotic** solution causes the pupil to contract. The eye and the ear can both be *irrigated*, flushed with water or solution to remove foreign objects. *Ear irrigation (lavage)* is the irrigation of the ear canal to remove excessive cerumen buildup. Antibiotics, antihistamines, anti-inflammatories, and decongestants are used to relieve ear infections, allergies, inflammations, and congestion. Table 16-2 lists various medications used for disorders of the senses.



**TABLE 16-2 Medications Used to Treat Disorders of the Senses**

Drug Class	Purpose	Generic	Trade Name
antiseptic ear drops	to cleanse ears by dispelling earwax	isopropyl alcohol carbamide peroxide	Aqua Ear, Swim Ear Murine Ear Drops
anti-inflammatory ear drops	to reduce ear inflammation	hydrocortisone	Cortane-B, VoSol
eye drops	to reduce eye congestion	tetrahydrozoline	Murine, Visine
eye moisturizer	to moisten eyes	cyclosporine carboxymethylcellulose	Restasis Refresh Plus
miiotic	contraction of the pupil	carbachol	Isopto Carbachol, Miostat
mydriatic	dilation of the pupil	atropine tropicamide	Atropisol Mydriacil
nasal decongestant	to reduce nasal congestion	pseudoephedrine xylometazoline	Drixoral, Sudafed Otrivin

## VOCABULARY REVIEW

In the previous section, you learned terms relating to pharmacology. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Meaning
<b>miotic</b> [mī-ŌT-īk] From Greek <i>meion</i> , less	Agent that causes the pupil to contract.
<b>mydriatic</b> [mī-drē-ĀT-īk] Greek <i>mydriasis</i> , excessive pupil dilation	Agent that causes the pupil to dilate.

## CASE STUDY

### Making Progress

When his great grandson came to visit the following year, Mr. James was hearing better with the help of a hearing aid. His eyesight was nearly perfect, and at age 70, he was happy to remain independent. His great-grandson's operation had proved effective. The boy had gone for about 10 months without any ear inflammations. On the second day of the visit, however, the boy started rubbing his eyes and complained of itching. His mother noticed a reddish area around the edge of his eyelid.

### Critical Thinking

74. What was the likely cause of the child's itchy eyelids?
75. Is it surprising that Mr. James, who played with his great grandson frequently, developed the same condition five days later?

## PHARMACOLOGICAL TERMS EXERCISES

### Check Your Knowledge

Fill in the blanks.

76. What medication might be prescribed for conjunctivitis? \_\_\_\_\_
77. During an eye exam, what agent helps to open a part of the eye for better viewing? \_\_\_\_\_
78. What medication might be prescribed for otitis media? \_\_\_\_\_

### CHALLENGE SECTION

Look at the letter below.

#### Critical Thinking

79. What eye conditions does this diabetic patient have?
80. What condition does he have that is probably not caused by diabetes?

**Dr. Janet Maitland**

3000 Blue Willow Lane  
Forest Park, IL 99999  
999-000-5555

5/6/XXXX

William Gonzalez, M.D.  
7 Steele Drive  
Forest Park, IL 99999  
999-000-5444

Dear Dr. Gonzalez:

I was happy to evaluate our mutual patient, Joseph Consalvo, with regards to his recent Plaquenil prescription.

IMPRESSION: I do not see any evidence of Plaquenil toxicity on his examination, although there is a fair amount of macular disease due to previous diabetic retinopathy and subsequent laser therapy. He has recovered well from his cataract surgery, and his vision has returned to the expected level.

RECOMMENDATION: I think that I would continue to monitor him for problems every four to six months, both in regard to Plaquenil and with regard to his history of relatively severe nonproliferative diabetic retinopathy. We made an appointment for an examination after this period of time and he is to report any sudden changes in his vision to me directly.

I hope this information is helpful. Please let me know if I can be of any further help.

Sincerely,

*Janet Maitland, M.D.*

Janet Maitland, M.D.

JM/lrc

## TERMINOLOGY IN ACTION

This prescription is for eyeglasses for a 55-year-old woman. What condition or conditions are being corrected?

**Dr. Arif Namoun**  
North Street Eye Center  
Greenville, OK 99999  
999 000-5555

NAME Susan Carver DATE 1/16/XXXX

**R**

	SPH.	CYL.	AXIS	PRISM	Remarks
R	300	-100	180	20/200	
L	-2.00	+.75	005	20/50	

**ADD**

R	+2.50
L	+2.50

EXPIRES 6/XXXX

☒ Arif Namoun, M.D.  
Arif Namoun, M.D.  
IL. LIC. NO. 799118

## USING THE INTERNET

Go to the site of the American Society of Cataract and Refractive Surgery (<http://www.ascrs.org>). Write a brief description of any discussion of cataracts, including what type of surgery is available.

# CHAPTER REVIEW

The material that follows is to help you review all the material in this chapter.

## Build Your Medical Vocabulary

Divide each of the following terms into words parts and define them; then define the term. Use the information from Chapters 2 and 3 to help you.

- |                         |                                |
|-------------------------|--------------------------------|
| 81. corectopia: _____   | 94. uveoscleritis: _____       |
| 82. keratoscope: _____  | 95. myringoplasty: _____       |
| 83. tympanitis: _____   | 96. ophthalmalgia: _____       |
| 84. blepharedema: _____ | 97. mastoidectomy: _____       |
| 85. dacryolith: _____   | 98. retinopexy: _____          |
| 86. optometry: _____    | 99. audiology: _____           |
| 87. ossiculotomy: _____ | 100. iridopathy: _____         |
| 88. scotoma: _____      | 101. scleroconjunctival: _____ |
| 89. auricular: _____    | 102. nasolacrimal: _____       |
| 90. phacomalacia: _____ | 103. cochleitis: _____         |
| 91. lacrimonasal: _____ | 104. pupilloscope: _____       |
| 92. cerumenosis: _____  | 105. conjunctivitis: _____     |
| 93. cycloplegia: _____  | 106. iritis: _____             |

## DEFINITIONS

Define and pronounce the following terms. The blue words in curly brackets are references to the Spanish glossary available online at [www.mhhe.com/medterm3e](http://www.mhhe.com/medterm3e).

### WORD

- |   |  |   |
|---|--|---|
| 107. aerotitis media [ār-ō-TĪ-tīs<br>MĒ-dē-ă]       | 116. auditory ossicles<br>[ĂW-dī-tōr-ē ŌS-ī-klz] | 125. blindness {ceguera}                    |
| 108. anacusis [ăn-ă-KŪ-sīs] {anacusia}              | 117. aur(o), auricul(o)                          | 126. cataract [CĂT-ă-răkt]<br>{catarata}    |
| 109. aphakia [ă-FĂ-kē-ă] {afaquia}                  | 118. auricle [ĂW-rī-kl] {auricular}              | 127. cerumin(o)                             |
| 110. asthenopia [ăs-thē-NŌ-pē-ă]<br>{astenopía}     | 119. blephar(o)                                  | 128. chalazion [kă-LĂ-zē-ŏn]<br>{chalazión} |
| 111. astigmatism [ă-STĪG-mă-tĭzm]<br>{astimagtismo} | 120. blepharitis [blĕf-ă-RĪ-tīs]<br>{blefaritis} | 129. cholesteatoma<br>[kō-lēs-tē-ă-TŌ-mă]   |
| 112. audi(o), audit(o)                              | 121. blepharochalasis<br>[blĕf-ă-rō-KĂL-ă-sīs]   | 130. choroid [KŌ-rōyd] {coroides}           |
| 113. audiogram [ĂW-dē-ō-grăm]<br>{audiograma}       | 122. blepharoplasty<br>[BLĕF-ă-rō-plăst-ē]       | 131. ciliary [SĪL-ē-ăr-ē] body              |
| 114. audiologist [ăw-dē-ŌL-ō-jĭst]<br>{audiólogo}   | 123. blepharoptosis<br>[blĕf-ă-RŌP-tō-sīs]       | 132. cochle(o)                              |
| 115. audiometry [ăw-dē-ŌM-ē-trē]<br>{audiometría}   | 124. blepharospasm<br>[BLĕF-ă-rō-spăzm]          | 133. cochlea [KŌK-lē-ă] {caracol}           |
|   |  | 134. cones [kŏnz] {conos}                   |
|   |  | 135. conjunctiv(o)                          |

## WORD

136. conjunctiva (pl., conjunctivae) [kõn-JŮNK-tĩ-vă (-vĕ)] {conjuntiva}
137. conjunctivitis [kõn-jũnk-tĩ-VĪ-tis] {conjunctivitis}
138. contact lenses
139. cor(o), core(o)
140. corne(o)
141. cornea [KÕR-nĕ-ă] {cornea}
142. cryoretinopexy [krĩ-õ-rĕ-tĩn-nõ-PĚKS-ĕ]
143. cycl(o)
144. dacry(o)
145. dacryoadenitis [DĂK-rĕ-õ-ăd-ĕ-NĪ-tis]
146. dacryocystectomy [dăk-rĕ-õ-sis-TĚK-tõ-mĕ]
147. dacryocystitis [DĂK-rĕ-õ-sis-TĪ-tis]
148. deafness {sordera}
149. decibel [DĚS-ĩ-bĕl] {decibel}
150. dermatochalasis [DĚR-mă-tõ-kă-LĂ-sis] {dermatocalasia}
151. diopter [dĩ-ÕP-tĕr]
152. diplopia [dĩ-PLÕ-pĕ-ă] {diplopía}
153. ear [ĕr] {oreja, oído}
154. eardrum [ĚR-drũm] {tambor de oído}
155. endolymph [ĚN-dõ-lĩmf] {endolinfă}
156. enucleation [ĕ-nũ-klĕ-Ā-shũn] {enucleación}
157. epiphora [ĕ-PĪF-õ-ră] {epífora}
158. equilibrium [ĕ-kwĩ-LĪB-rĕ-ũm] {equilibrio}
159. esotropia [ĕs-õ-TRÕ-pĕ-ă] {esotropía}
160. eustachian [yũ-STĀ-shũn, yũ-STĀ-kĕ-ăn] tube
161. exophthalmos, exophthalmus [ĕk-sõf-THĀL-mõs]
162. exotropia [ĕk-sõ-TRÕ-pĕ-ă]
163. eye [ĩ] {ojo}
164. eyebrow [Ī-brõw] {ceja}
165. eyelashes [Ī-lăsh-ĕz] {pestañas}
166. eyelid [Ī-lĩd] {párpado}
167. eyestrain {vista fatigada}
168. farsightedness {hiperopía}
169. fovea centralis [FÕ-vĕ-ă sĕn-TRĀL-ĩs]
170. glaucoma [glăw-KÕ-mă] {glaucoma}
171. hearing {audición}
172. hordeolum [hõr-DĚ-õ-lũm] {orzuelo}
173. hyperopia [hĩ-pĕr-Õ-pĕ-ă]
174. incus [ĪN-kũs] {incus}
175. ir(o), irid(o)
176. iridectomy [ĩr-ĩ-DĚK-tõ-mĕ] {iridectomía}
177. iridotomy [ĩr-ĩ-DÕT-õ-mĕ]
178. iris [Ī-rĩs] {iris}
179. iritis [ĩ-RĪ-tis] {iritis}
180. kerat(o)
181. keratitis [kĕr-ă-TĪ-tis] {queratitis}
182. keratoplasty [KĚR-ă-tõ-plăs-tĕ] {queratoplastia}
183. labyrinthitis [LĂB-ĩ-rĩn-THĪ-tis] {laberintitis}
184. lacrim(o)
185. lacrimal [LĂK-rĩ-măl] glands
186. lacrimation [lăk-rĩ-MĀ-shũn] {lagrimeo}
187. lens [lĕnz] {lens, lente}
188. macula [MĂK-yũ-lă] {macula}
189. macula lutea [lũ-TĚ-ă]
190. macular [MĂK-yũ-lăr] degeneration
191. malleus [MĂL-ĕ-ũs] {malleus}
192. mastoid(o)
193. mastoiditis [măs-tõy-DĪ-tis]
194. membranous labyrinth [LĂB-ĩ-rĩn]
195. Meniere's [mĕn-YĚRZ] disease
196. miotic [mĩ-ÕT-ĩk]
197. mydriatic [mĩ-drĕ-ĀT-ĩk]
198. myopia [mĩ-Õ-pĕ-ă] {miopía}
199. myring(o)
200. myringitis [mĩr-ĩn-JĪ-tis] {miringitis}
201. myringotomy [mĩr-ĩng-GÕT-õ-mĕ]
202. nas(o)
203. nearsightedness {miopía}
204. neuroretina [nũr-õ-RĚT-ĩ-nă]
205. nyctalopia [nĩk-tă-LÕ-pĕ-ă] {nictalopía}
206. nystagmus [nĩs-STĀG-mũs] {nistagmo}
207. ocul(o)
208. olfactory [õl-FĂK-tõ-rĕ] organs
209. ophthalm(o)
210. ophthalmologist [õf-thăl-MÕL-õ-jĩst] {oftalmólogo}
211. ophthalmoscopy [õf-thăl-MÕS-kõ-pĕ] {oftalmoscopia}
212. opt(o), optic(o)
213. optician [õp-TĪSH-ũn]
214. optic nerve
215. optometrist [õp-TÕM-ĕ-trĩst] {optometrista}
216. organ of Corti [KÕR-tĩ]
217. osseus [ÕS-sĕ-ũs] labyrinth
218. ossicul(o)
219. otalgia [õ-TĂL-jĕ-ă] {otalgia}
220. otitis externa [õ-TĪ-tis ĕks-TĚR-nă] {otitis externa}
221. otitis media [MĚ-dĕ-ă] {otitis media}
222. otoliths [Õ-tõ-lĩths] {otolitos}
223. otologist [õ-TÕL-õ-jĩst] {otólogo}
224. otoplasty [Õ-tõ-plăs-tĕ] {otoplastia}



## WORD

225. otorhinolaryngologist  
[ō-tō-rī-nō-lār-īng-GŎL-ō-jĭst]
226. otorrhagia [ō-tō-RĀ-jē-ă]  
{**otorragia**}
227. otorrhea [ō-tō-RĒ-ă] {**otorrea**}
228. otosclerosis [ō-tō-sklĕ-RŎ-sĭs]  
{**otosclerosis**}
229. otoscopy [ō-TŎS-kō-pē]  
{**otoscopia**}
230. papillae [pă-PĪL-ē] {**papilas**}
231. paracusis [PĀR-ă-KŪ-sĭs]  
{**paracusia**}
232. perilymph [PĒR-ĭ-lĭmf]
233. phac(o), phak(o)
234. phacoemulsification  
[FĀ-kō-ē-mŭls-ĭ-fĭ-KĀ-shŭn]
235. photophobia [fō-tō-FŎ-bē-ă]  
{**fotofobia**}
236. pinkeye [PĪNK-Ī]
237. pinna [PĪN-ă]
238. presbycusis [prĕz-bē-ă-KŪ-sĭs] {**presbiacusia**}
239. presbyopia [prĕz-bē-Ŏ-pē-ă]  
{**presbiopía**}
240. pseudophakia [sŭ-dō-FĀ-kē-ă]  
{**seudofaquia**}
241. pupil [PYŪ-pĭl] {**pupila**}
242. pupill(o)
243. refraction [rē-FRĀK-shŭn]  
{**refracci3n**}
244. retin(o)
245. retina [RĚT-ĭ-nă] {**retina**}
246. retinitis [rĕt-ĭ-NĪ-tĭs] {**retinitis**}
247. retinitis pigmentosa  
[pĭg-mĕn-TŎ-să]
248. rods [r3dz] {**bastoncillos**}
249. scler(o)
250. sclera (pl., sclerae) [SKLĒR-ă  
(SKLĒR-ē)] {**sclera**}
251. scleritis [sklĕ-RĪ-tĭs] {**escleritis**}
252. scot(o)
253. scotoma [skō-TŎ-mă]  
{**escotoma**}
254. semicircular canals
255. sensory receptors
256. sensory system
257. sight {**vista**}
258. smell {**olfacci3n, oler**}
259. stapedectomy  
[stă-pē-DĚK-tō-mē]
260. stapes (pl., stapes, stapedes)  
[STĀ-pēz (STĀ-pē-dēz)]  
{**estribo**}
261. strabismus [stră-BĪZ-mŭs]  
{**estrabismo**}
262. sty, styte [stĭ] {**orzuelo**}
263. taste
264. taste buds
265. taste cells
266. tears [tĕrz] {**lágrimas**}
267. tinnitus [tĭ-NĪ-tŭs, TĪ-nĭ-tŭs]  
{**tinnitus**}
268. tonometry [tō-NŎM-ĕ-trĕ]  
{**tonometría**}
269. touch {**tacto**}
270. trabeculectomy  
[tră-BĚK-yŭ-LĚK-tō-mē]
271. trichiasis [trĭ-KĪ-ă-sĭs]
272. tympan(o)
273. tympanic [tĭm-PĀN-ĭk]  
membrane
274. tympanitis [tĭm-pă-NĪ-tĭs]
275. tympanoplasty  
[TĪM-pă-nō-plăs-tĕ]
276. uve(o)
277. uvea [YŪ-vē-ă] {**úvea**}
278. vertigo [VĚR-tĭ-gō, vĕr-TĪ-gō]  
{**vértigo**}
279. vestibule [VĚS-tĭ-bŭl]  
{**vestíbulo**}

## Abbreviations

Write the full meaning of each abbreviation.

### ABBREVIATION

- |           |           |                    |
|-----------|-----------|--------------------|
| 280. acc. | 289. EENT | 298. OU            |
| 281. AD   | 290. ENT  | 299. PERRL, PERRLA |
| 282. ARMD | 291. ICCE | 300. PE tube       |
| 283. AS   | 292. IOL  | 301. SOM           |
| 284. AU   | 293. IOP  | 302. VA            |
| 285. D    | 294. NVA  | 303. VF            |
| 286. dB   | 295. OD   | 304. +             |
| 287. DVA  | 296. OM   | 305. —             |
| 288. ECCE | 297. OS   |                    |

Name \_\_\_\_\_ Date \_\_\_\_\_

## Chapter 16: Word- Building (20 questions—1 pts. each)

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Using the following combining forms, complete the word that best fits the definition of each word relating to the sensory system listed below. Combining forms may be used more than once.

audi(o)	cor(o)	myring(o)	pupill(o)
blephar(o)	corne(o)	nas(o)	retin(o)
cerumin(o)	dacry(o)	ophthalm(o)	scler(o)
cochle(o)	ir(o)	ossicul(o)	scot(o)
conjunctiv(o)	lacrim(o)	phac(o)	uve(o)

1. Abnormal positioning of the pupil: \_\_\_\_\_ ectopia
2. Incision into the eardrum: \_\_\_\_\_ tomy
3. Hernia of the lens: \_\_\_\_\_ cele
4. Caused by sound: \_\_\_\_\_ genic
5. Relating to the cochlea: \_\_\_\_\_ ar
6. Involving the nose and stomach: \_\_\_\_\_ gastric
7. Excessive tearing: \_\_\_\_\_ rrhea
8. Inflammation of the conjunctiva: \_\_\_\_\_ itis
9. Repositioning of a detached retina: \_\_\_\_\_ piesis
10. Swelling of the eyelids: \_\_\_\_\_ edema
11. Surgical repair of the sclera: \_\_\_\_\_ plasty
12. Softening of the lens: \_\_\_\_\_ malacia
13. Inflammation of the nose and sinuses: \_\_\_\_\_ sinusitis
14. Substance that softens wax: \_\_\_\_\_ lytic
15. Inflammation of the uvea: \_\_\_\_\_ itis
16. Inflammation of the iris: \_\_\_\_\_ itis
17. Fungal disease of the eye: \_\_\_\_\_ mycosis
18. Narrowing of the tear duct: \_\_\_\_\_ stenosis
19. Of low illumination: \_\_\_\_\_ opic
20. Removal of the ossicle: \_\_\_\_\_ ectomy