

ANSWERS TO CHAPTER 9

CONTENT LEARNING ACTIVITY

Introduction

1. Stimulus; 2. Sensation; 3. Projection; 4. Special senses; 5. General senses

General Senses

1. Free nerve endings; 2. Merkel's disks; 3. Meissner's corpuscles; 4. Ruffini's end-organs; 5. Pacinian corpuscles

Pain

1. Localized; 2. Diffuse; 3. Nerve; 4. Reticular formation; 5. Lateral spinothalamic tract; 6. Dorsal columns; 7. Referred pain; 8. Phantom pain

Olfaction

1. Olfactory neurons; 2. Olfactory nerve; 3. Olfactory bulb; 4. Olfactory tract; 5. Olfactory cortex

Taste

1. Taste bud; 2. Papillae; 3. Taste cell; 4. Facial nerve; 5. Tip of tongue; 6. Back of tongue; 7. Side of tongue

Vision: Accessory Structures

1. Eyebrows; 2. Eyelids; 3. Conjunctiva; 4. Lacrimal gland; 5. Lacrimal canaliculi; 6. Nasolacrimal duct; 7. Extrinsic eye muscles

Anatomy of the Eye

1. Fibrous tunic; 2. Vascular tunic; 3. Nervous tunic; 4. Sclera; 5. Cornea
1. Choroid; 2. Ciliary body; 3. Lens; 4. Iris; 5. Pupil
1. Pigmented retina; 2. Sensory retina; 3. Rods; 4. Cones; 5. Rhodopsin
1. Macula lutea; 2. Fovea centralis; 3. Optic disc; 4. Aqueous humor; 5. Vitreous humor
1. Conjunctiva; 2. Cornea; 3. Anterior compartment; 4. Iris; 5. Pupil; 6. Lens; 7. Suspensory ligaments; 8. Ciliary body; 9. Sclera; 10. Choroid; 11. Retina; 12. Vitreous humor; 13. Optic nerve; 14. Posterior compartment

Functions of the Complete Eye

1. Refraction; 2. Concave lens; 3. Convex lens; 4. Focal point; 5. Focusing

1. Cornea; 2. Lens; 3. Accommodation; 4. Contracted; 5. Relaxed

1. Optic nerve; 2. Optic chiasma; 3. Optic tract; 4. Optic radiations; 5. Visual cortex; 6. Visual field

The Ear and Its Functions

1. Auricle; 2. External auditory meatus; 3. Cerumen; 4. Tympanic membrane

1. Oval window; 2. Round window; 3. Auditory ossicles; 4. Mastoid air cells; 5. Auditory tube

1. Osseous labyrinth; 2. Membranous labyrinth; 3. Endolymph; 4. Perilymph; 5. Cochlea; 6. Semicircular canals and vestibule

1. External ear; 2. Auricle; 3. External auditory meatus; 4. Tympanic membrane; 5. Auditory ossicles; 6. Malleus; 7. Incus; 8. Stapes; 9. Auditory tube; 10. Inner ear; 11. Round window; 12. Cochlea; 13. Vestibule; 14. Oval window; 15. Semicircular canals

Hearing

1. Vestibular membrane; 2. Basilar membrane; 3. Scala vestibuli;

1. Auricle; 2. Tympanic membrane; 3. Malleus; 4. Incus; 5. Stapes; 6. Oval window; 7. Perilymph; 8. Round window

1. Vestibular; 2. Endolymph; 3. Basilar; 4. Hair cells; 5. Tectorial; 6. Action potentials; 7. Pitch; 8. Volume

1. Oval window; 2. Scala vestibuli; 3. Scala tympani; 4. Cochlear duct; 5. Membranous labyrinth; 6. Vestibular membrane; 7. Basilar membrane; 8. Tectorial membrane; 9. Spiral organ; 10. Round window

Equilibrium

1. Static equilibrium; 2. Kinetic equilibrium; 3. Saccule and utricle; 4. Macula; 5. Crista ampullaris

QUICK RECALL

1. General senses: touch, pressure, pain, temperature, vibration, itch, and proprioception (sense of position); Special senses: smell, taste, sight, hearing, and balance (equilibrium)
2. Free nerve endings, Merkel's disks, hair follicle receptors, Meissner's corpuscles, Ruffini's end-organs, and Pacinian corpuscles
3. Sour, salty, bitter, and sweet.
4. Fibrous, vascular, and nervous tunics
5. Anterior compartment filled with aqueous humor and posterior compartment filled with vitreous humor
6. Rods: very sensitive to light and function in dim light; Cones: less sensitive to light (require more light to operate than rods), and are responsible for color vision
7. Cochlea: hearing; Vestibule: static balance; Semicircular canals: kinetic balance
8. Middle ear: auditory tube; Inner ear: round window
9. Static equilibrium (evaluates the position of the head relative to gravity) by the vestibule; kinetic equilibrium (evaluates head movements) by the semicircular canals

WORD PARTS

1. cochlea
2. sclera
3. vitreous humor
4. fovea centralis
5. otoliths
6. otoliths

MASTERY LEARNING ACTIVITY

1. D. Free nerve endings detect pain, itch, temperature, and movement. Merkel's disks detect light touch and superficial pressure; Pacinian corpuscles detect deep pressure, vibration, and position (proprioception); and Meissner's corpuscles detect fine, discriminative touch.
2. D. Localized, sharp pain is transmitted rapidly, whereas diffuse, aching, burning pain is transmitted slowly. According to the "gate" theory, the dorsal columns can inhibit pain transmission in the lateral spinothalamic tracts. Referred pain is pain felt at a location that is not the source of the pain stimulus.
3. E. Olfactory neurons have cilia with receptors that react to molecules dissolved in fluid. Action potentials generated as a result travel through the olfactory nerves, olfactory bulbs, and olfactory tracts to the olfactory cortex of the brain.
4. C. There are four basic tastes: sour, salty, bitter, and sweet. Taste buds on papillae detect taste. Taste from the posterior one third of the tongue is carried by the glossopharyngeal nerve. The facial nerve carries taste from the anterior two thirds of the tongue.
5. D. Tears lubricate and clean the eye, and protect against eye infections. Tears are released from the lacrimal gland located in the superior, lateral corner of the eye and are collected in the medial corner by the lacrimal canaliculi and conducted to the nasal cavity.
6. D. The correct order is sclera, choroid, retina.
7. E. Aqueous humor keeps the eye inflated. It is produced by the ciliary body and returns to the blood through a venous ring at the base of the cornea. Excess aqueous humor causes glaucoma. The choroid is black because of melanin, the same pigment that colors the skin.
8. D. Light passes through the cornea, aqueous humor, lens, and vitreous humor.
9. C. Light striking retinal causes it to change shape and separate from opsin. These events eventually result in action potentials that go to the brain where the action potentials are interpreted as vision. Meanwhile the retinal and opsin (with the expenditure of ATP) recombine and are ready to be stimulated again by light.
10. B. These are the events of accommodation. The ciliary muscles contract and the lens becomes more spherical when we look at objects that are closer than 20 feet to us.
11. D. The auricle is part of the external ear; the auditory tube and auditory ossicles are part of the middle ear; and the cochlea is part of the inner ear.
12. A. Movement of the stapes (auditory ossicle) produces vibrations in the perilymph of the scala vestibuli. These vibrations cause the vestibular membrane to vibrate, which produces vibrations in the endolymph of the cochlear duct. Vibration of the endolymph cause the basilar membrane to vibrate.
13. D. Sound waves cause the tympanic membrane to vibrate. These vibrations are transmitted by the auditory ossicles to the oval window. Movement of the stapes within the oval window produces vibrations in the perilymph of the scala vestibuli. These vibrations can travel to the end of the cochlea, into the scala tympani, and to the round window, causing the membrane of the round window to move.
14. B. The spiral organ has hair cells that are embedded in the tectorial membrane. The spiral organ rests upon the basilar membrane and is found in the cochlear duct.
15. D. The cristae ampullaris in the semicircular canals are responsible for detecting movements of the head. The maculae in the utricle and saccule detect the position of the head relative to the ground. The spiral organ is responsible for hearing.



FINAL CHALLENGES



1. Pain from visceral organs is not well localized because of the absence of tactile receptors. Pain from visceral organs is normally perceived as a diffuse pain. The pain from the colon would also probably be referred to the anterior, inferior surface of the abdomen (see figure 9.2 in the text). This referred pain could be quite intense.
2. The tip of the tongue has taste buds that react strongly to sugar and salt, so it is likely that the volunteer will correctly identify the sugar solution. The back of the tongue is better at identifying bitter tastes such as unsweetened tea. The volunteer probably will not correctly identify the tea. Because taste buds are stimulated by dissolved substances, drying the tongue should prevent correct identification of the sugar crystals.
3. When a contaminated hand rubs the eyes, the virus can be introduced into tears on the conjunctiva. From there the virus can spread into the lacrimal canaliculi, and pass through the nasolacrimal duct into the nasal cavity.
4. A cataract clouds the lens so that light can not enter the eye to produce an image on the retina. Removal of the lens lets light in, but it is no longer properly focused. Without the refracting ability of the lens, light rays do not converge enough and the focal point is too far behind the retina. The woman is hyperopic or farsighted in the right eye and a convex lens would be recommended.
5. If the hair cells of the macula are stretched (not bent), a person is upside down. Gravity acts on the otoliths in the macula and causes the hair cells to stretch. If the hair cells are bent, it could indicate that the person is lying on his side.