Head: Special Senses

Taste
Smell
Vision
Hearing/Balance

www.fisiokinesiterapia.biz

TASTE: how does it work?

- Taste buds on tongue on fungiform papillae ("mushroom-like projections)
- Each "bud" contains several cell types in microvilli that project through pore and chemically sense food
- Gustatory receptor cells communicate with cranial nerve axon endings to transmit sensation to brain



M&M, Fig. 16.1



Copyright @ Pearson Education, Inc., publishing as Benjamin Cummings.

Five taste sensations

Sweet—front middle ♦ Sour—middle sides Salty—front side/tip ♦ Bitter —back ♦ "umami" posterior pharynx M&M, Fig. 16.1



Int



Copyright @ Pearson Education, Inc., publishing as Benjamin Cummings.

Smell: How does it work?

- Olfactory epithelium in nasal cavity with special olfactory receptor cells
- Receptor cells have endings that respond to unique proteins
- Every odor has particular signature that triggers a certain combination of cells
- Axons of receptor cells carry message back to brain
- Basal cells continually replace receptor cells—they are only neurons that are continuously replaced throughout life.



Vision

- 1. Movement of eye—extrinsic eye muscles and location in orbit
- 2. Support of eye—lids, brows, lashes, tears, conjunctiva
- 3. Lens and focusing—structures of eyeball and eye as optical device
- 4. Retina and photoreceptors



Movement of eye

Eye movement simulator (<u>http://cim.ucdavis.edu/ey</u> <u>es/version1/eyesim.htm</u>)

Extrinsic eye muscles

Muscle	Movement	Nerve
Superior	Depresses eye, turns laterally	IV (Trochlear)
Lateral rectus	Turns laterally	VI (Abducens)
Medial rectus	Turns medially	
Superior	Elevates	(Aculomotor)
Thetus	Depresses eye	(Aculomotor)
Thetus	Elevates eye,	(Presignation)
oblique	turns laterally	
	isiokinesiter	ania hiz

 $\mathbf{U}\mathbf{U}$



Support/Maintenance of Eye Eyebrows: shade, shield for perspiration Eyelids (palpebrae): skin-covered folds with "tarsal plates" connective tissue inside - Levator palpebrae superioris muscle opens eye (superior portion is smooth muscle—why?) Canthus (plural canthi): corner of eye - Lacrimal caruncle makes eye "sand" at medial corner - Epicanthal folds in many Asian people cover caruncle

- Tarsal glands make oil to slow drying

Eyelash—ciliary gland at hair follicle—infection

Support of Eye--conjunctiva

Mucous membrane that coats inner surface of eyelid (palpebral part) and then folds back onto surface of eye (ocular part)

- Thin layer of connective tissue covered with stratified columnar epithelium
- Very thin and transparent, showing blood vessels underneath (blood-shot eyes)
- Goblet cells in epithelium secrete mucous to keep eyes moist



 Vitamin A necessary for all epithelial secretions—lack leads



Support of eye--tears

 Lacrimal glands superficial/lateral in orbit, produce tears

 Lacrimal duct (nasolacrimal duct)

medial corner of eye carries tears to nasal cavity (frequently closed in newbornsopens by 1 yr usually)

 Tears contain mucous, antibodies, lysozyme (anti-



Copyright @ Pearson Education, Inc., publishing as Benjamin Cummings.

Eye as lens/optical device



M&M, fig. 16.7

(a)

Copyright @ Pearson Education, Inc., publishing as Benjamin Cummings.

Light path: Cornea \rightarrow Anterior segment \rightarrow Pupil \rightarrow Lens \rightarrow Posterior segment \rightarrow Neural layer of retina \rightarrow Pigmented retina

Eye as optical device--structures

- Sclera (fibrous tunic): is tough connective tissue ball that forms outside of eyeball
 - like box/case of camera
 - Corresponds to dura mater of brain
- Cornea: anterior transparent part of sclera (scratched cornea is typical sports injury); begins focusing light
- Choroid Internal to sclera/cornea
 - Highly vascularized
 - Darkly pigmented (for light absorption inside box)
- Ciliary body: thick ring of tissue that encircles and holds lens
- Iris: colored part of eye between lens and cornea, attached at base to ciliary body
- Pupil: opening in middle of iris
- Retina: sensory layer that responds to light and transmits visual signal to brain



Detail: Aperture and focus



 APERTURE
 Pupil changes shape due to intrinsic autonomic muscles
 Sympathetic: Dilator pupilla

Dilator pupillae (radial fibers)

- Parasympathetic:

Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

(animation of lens

http://artsci.shu.edu/biology/Student%20Pages/Kyle%20Keenan/eye/lensmovementnrve.html

FOCUS

- Ciliary muscles in ciliary body pull on lens to focus far away
- Elasticity of lens brings back to close focus
- Thus, with age, less elasticity, no close focus \rightarrow far-sighted

Detail: eye color

 Posterior part of iris always brown in color

 People with brown/black eyes with pigment throughout iris
 People with blue eyes—rest of iris clear, brown pigment at back appears blue after passing through iris/cornea

Details: Retina and photoreceptors

- Retina is outgrowth of brain
 - Neurons have specialized receptors at end with "photo pigment" proteins (rhodopsins)
 - Rod cells function in dim light, not color-tuned
 - Cone cells have three types: blue, red, green
 - In color blindness, gene for one type of rhodopsin is deficient, usually red or green
- Photoreceptors sit on pigmented layer of choroid. Pigment from melanocytes--melanoma possible in retina!!
- Axons of photoreceptors pass on top or superficial to photoreceptor region
- Axons congregate and leave retina at optic disc (blind spot)
- Fovea centralis is in direct line with lens, where light is focused most directly, and has intense cone cell population (low light night vision best from side of eye)
- Blood vessels superficial to photoreceptors (retina is good sight to check for small vessel disease in diabetes)





Middle Ear

External auditory canal ends at tympanic membrane which vibrates against malleus on other side

- Inside middle ear chamber
 - malleus→incus →stapes which vibrates on oval window of inner ear
- Muscles that inhibit vibration when sound is too loud
 - Tensor tympani m. (inserts on malleus)
 - Stapedius m. (inserts on stapes)



Copyright @ Pearson Education, Inc., publishing as Benjamin Cummings.

M&M, fig. 16.19



Static equilibrium, linear motion

- Utricle, saccule are egg-shaped sacs in center (vestibule) of labyrinth
- 3-D motion, angular acceleration
 - 3 semicircular canals for X,Y,Z planes
- Sound vibrations

Auditory Nerve (Acoustic) VIII receives stimulus from all to brain Vestibular n.—equilibrium Cochlear n.—hearing

