

The Special Senses

The Eye and Vision: Anatomy

1. Several accessory eye structures contribute to the formation of tears and/or help lubricate the eyeball. Match the described accessory structures with their secretion by choosing answers from the key.

Key: conjunctiva lacrimal glands tarsal glands

CONJUNCTIVA 1. mucus

TARSAL GLANDS 2. oil

LACRIMAL GLANDS 3. salt solution

2. The eyeball is wrapped in adipose tissue within the orbit. What is the function of the adipose tissue?

TO ACT AS A CUSHION

3. Why may it be necessary to blow one's nose after crying? BECAUSE THE TEARS DRAIN

INTO THE NASAL CAVITY

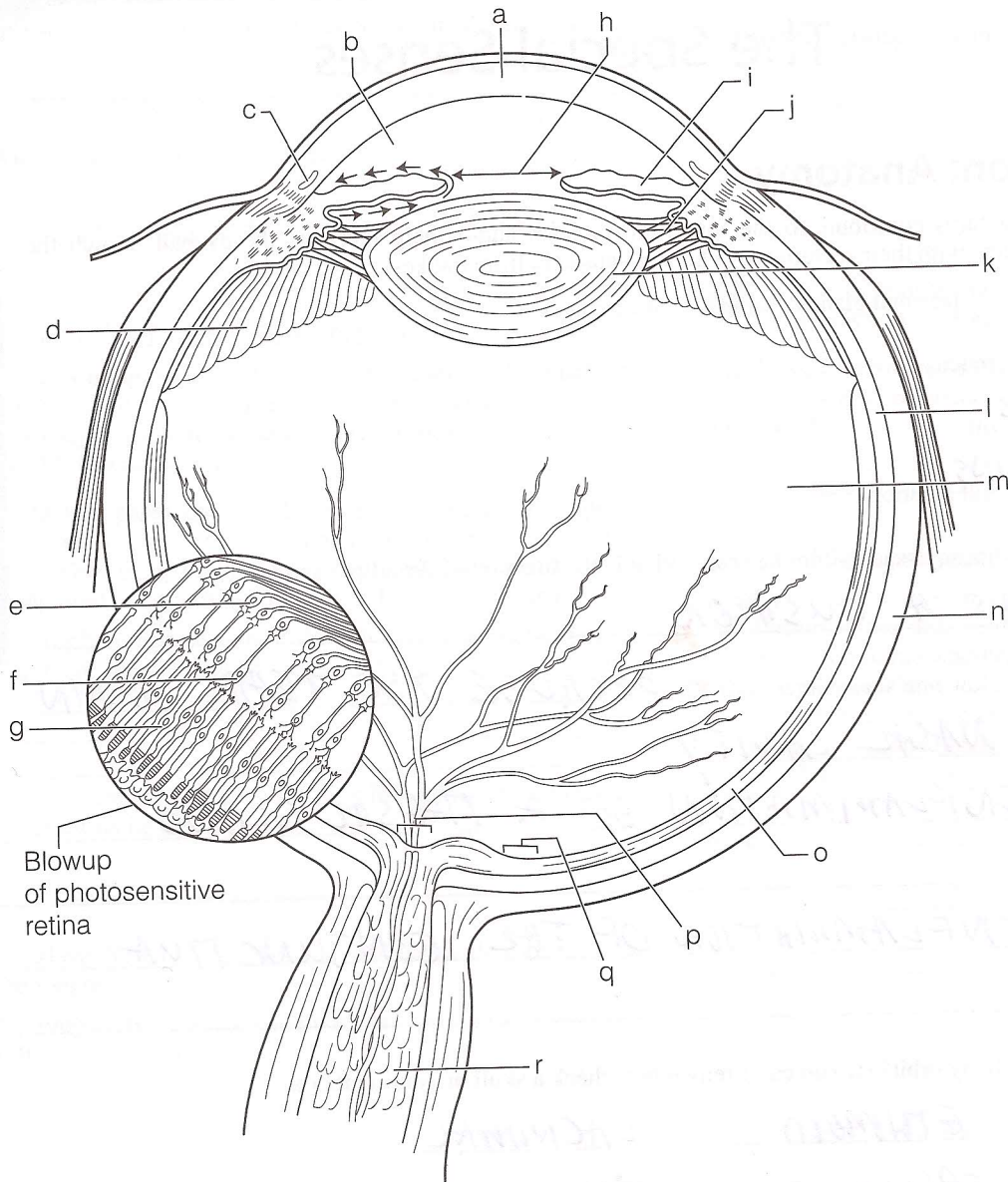
4. What is a sty? AN INFLAMMATION OF A TARSAL GLAND

What is conjunctivitis? INFLAMMATION OF THE CONJUNCTIVA

5. Which seven bones form the bony orbit? (If you can't remember, check a skull or your textbook.)

FRONTAL ETHMOID LACRIMAL
ZYGOMATIC SPHENOID MAXILLA
PALATINE

6. Identify the lettered structures on the diagram by matching each letter with one of the terms to the right.



- B anterior segment containing aqueous humor
- F bipolar cells
- C scleral venous sinus
- D ciliary body
- L choroid
- A cornea
- Q fovea centralis
- E ganglion cells
- I iris
- K lens
- P optic disc
- R optic nerve
- G photoreceptors
- H pupil
- O retina
- N sclera
- J ciliary zonule (suspensory ligaments)
- M vitreous body in posterior segment

Notice the arrows drawn close to the left side of the iris in the diagram above. What do they indicate?

PRODUCTION + DRAINAGE OF THE AQUEOUS HUMOR INTO THE CANAL OF SCHLEMM

7. Match the key responses with the descriptive statements that follow.

- | | | | | |
|------|----------------------|-----------------|------------|--------------------------------------|
| Key: | aqueous humor | cornea | lens | sclera |
| | scleral venous sinus | fovea centralis | optic disc | ciliary zonule (suspensory ligament) |
| | choroid | iris | retina | vitreous humor |
| | ciliary body | | | |

CILIARY ZONULE attaches the lens to the ciliary body

- AQUEOUS HUMOR 2. fluid filling the anterior segment of the eye
- OPTIC DISC 3. the blind spot
- IRIS 4. contains muscle that controls the size of the pupil
- SCLERAL VENOUS SINUS 5. drains the aqueous humor from the eye
- RETINA 6. "sensory" layer
- VITREOUS HUMOR 7. substance occupying the posterior segment of the eyeball
- CHOROID 8. forms most of the pigmented vascular tunic
- FOVEA CENTRALIS 9. tiny pit in the macula lutea; contains only cones
- LENS 10. important light-bending structure of the eye; shape can be modified
- CORNEA 11. anterior transparent part of the fibrous tunic—your "window on the world"
- SCLERA 12. the white of the eye

8. The intrinsic eye muscles are under the control of which of the following? (Circle the correct response.)

autonomic nervous system

somatic nervous system

Dissection of the Cow (Sheep) Eye

9. What modification of the choroid that is *not* present in humans is found in the cow eye?

TAPETUM LUCIDUM

What is its function? TO REFLECT LIGHT TO ALLOW COW TO SEE BETTER IN LOW LIGHT CONDITIONS

10. Describe the appearance of the retina. DELICATE, WHITE CRUMPLED MEMBRANE-LIKE

At what point is it attached to the posterior aspect of the eyeball? AT THE OPTIC NERVE

Visual Tests and Experiments

11. Use terms from the key to complete the statements concerning near and distance vision. (Some terms may be used more than once.)

Key: contracted decreased increased relaxed taut lax

During distance vision: The ciliary muscle is RELAXED, the ciliary zonule (suspensory ligament) is TAUT, the convexity of the lens is DECREASED, and light refraction is DECREASED. During close vision: The ciliary muscle is CONTRACTED, the ciliary zonule (suspensory ligament) is LAX, lens convexity is INCREASED, and light refraction is INCREASED.

12. Explain why the part of the image hitting the blind spot is not seen. NO PHOTORECEPTORS

13. Match the terms in column B with the descriptions in column A:

Column A	Column B
<u>REFRACTION</u> 1. light bending	accommodation
<u>ACCOMMODATION</u> 2. ability to focus for close (under 20 ft) vision	astigmatism
<u>EMMETROPIA</u> 3. normal vision	convergence
<u>HYPEROPIA</u> 4. inability to focus well on close objects (farsightedness)	emmetropia
<u>MYOPIA</u> 5. nearsightedness	hyperopia
<u>ASTIGMATISM</u> 6. blurred vision due to unequal curvatures of the lens or cornea	myopia
<u>CONVERGENCE</u> 7. medial movement of the eyes during focusing on close objects	refraction

14. Record your Snellen eye test results below:

Left eye (without glasses) _____ (with glasses) _____

Right eye (without glasses) _____ (with glasses) _____

Is your visual acuity normal, less than normal, or better than normal? _____

Explain. _____

Explain why each eye is tested separately when the Snellen eye chart is used. TO UNDERSTAND

THE ACUITY OF EACH EYE

Explain 20/40 vision. MEANS LESS THAN NORMAL VISION + SPECIFICALLY THAT THEY SEE BETTER CLOSE UP; MYOPIC

Explain 20/10 vision. MEANS BETTER THAN NORMAL VISION + SPECIFICALLY THAT THEY SEE BETTER FAR AWAY; HYPEROPIC

15. Define astigmatism: BLURRED VISION DUE TO UNEQUAL CURVATURES OF THE CORNEA

16. Record the distance of your near point of accommodation as tested in the laboratory:

right eye _____ left eye _____

Is your near point within the normal range for your age? _____

17. How can you explain the fact that we see a great range of colors even though only three cone types exist?

RANGE OF COLOR COMES FROM WEIGHTED AVERAGE OF OVERLAPPING SIGHT WAVELENGTH SENSITIVITIES OF THE THREE CONE TYPES

18. In the experiment on the convergence reflex, what happened to the position of the eyeballs as the object was moved closer to the subject's eyes? _____

What extrinsic eye muscles control the movement of the eyes during this reflex? _____

What is the value of this reflex? _____

If these muscles were unable to function, what would be the visual result?

19. Many college students struggling through mountainous reading assignments are told that they need glasses for "eyestrain." Why does looking at close objects cause more strain on the extrinsic and intrinsic eye muscles than does looking at far objects?

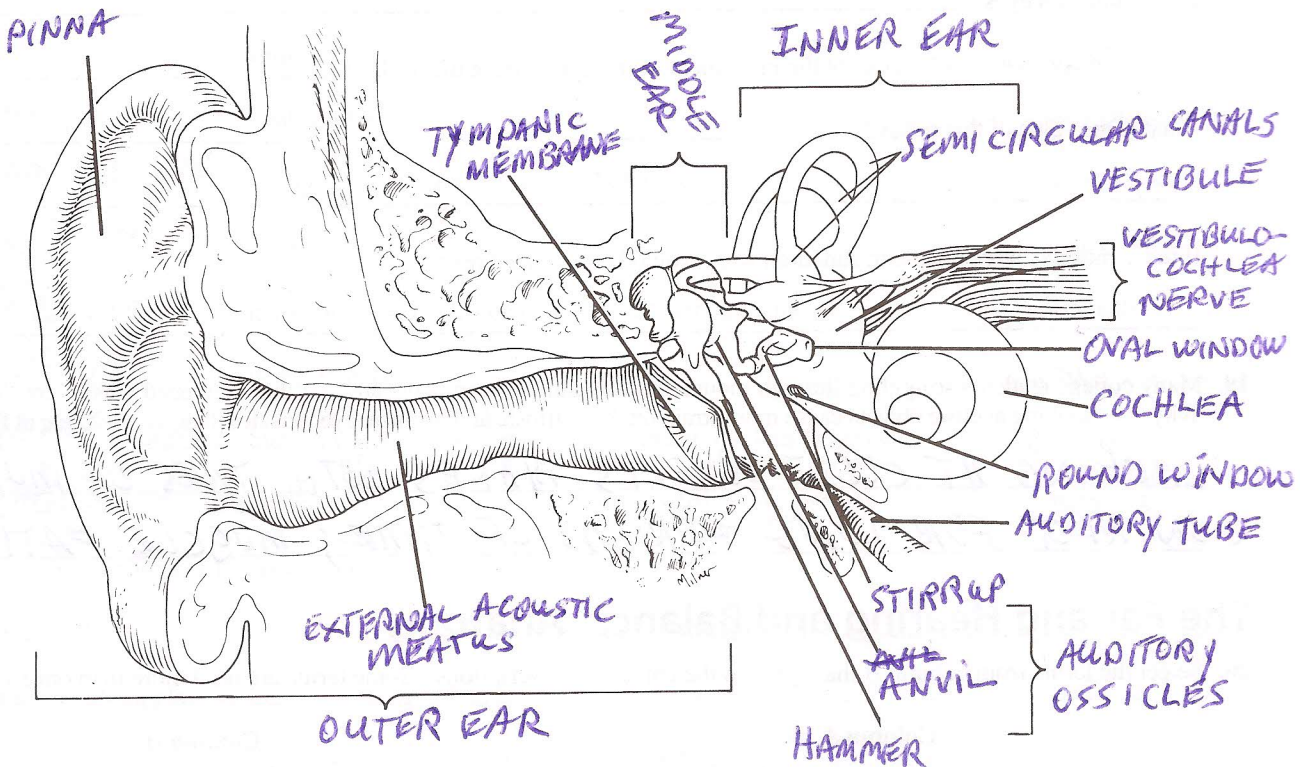
LOOKING AT CLOSE OBJECTS MAKES BOTH TYPES OF MUSCLES CONTRACT FOR LONG PERIODS OF TIME; MUSCLE FATIGUE

The Ear and Hearing and Balance: Anatomy

20. Select the terms from column B that apply to the column A descriptions. (Some terms are used more than once.)

Column A		Column B
<u>ANVIL</u>	<u>HAMMER</u>	auditory (pharyngotympanic) tube
<u>STIRRUP</u>	1. collectively called the auditory ossicles	anvil (incus)
<u>VESTIBULE</u>	<u>SEMICIRCULAR CANALS</u>	cochlea
_____	2. ear structures involved with balance	endolymph
<u>TYMPANIC MEMBRANE</u>	3. transmits sound vibrations to the ossicles	external acoustic meatus
<u>SEMICIRCULAR CANALS</u>	4. three circular passages, each in a different plane of space	hammer (malleus)
<u>OVAL WINDOW</u>	5. transmits the vibratory motion of the stirrup to the fluid in the inner ear	oval window
<u>AUDITORY TUBE</u>	6. passage between the throat and the tympanic cavity	perilymph
<u>ENDOLYMPH</u>	7. fluid contained within the membranous labyrinth	pinna
<u>AUDITORY TUBE</u>	8. involved in equalizing pressure in the middle ear with atmospheric pressure	round window
		semicircular canals
		stirrup (stapes)
		tympanic membrane
		vestibule

21. Identify all indicated structures and ear regions that are provided with leader lines or brackets in the following diagram.



22. Match the membranous labyrinth structures listed in column B with the descriptive statements in column A

Column A		Column B
<u>COCHLEAR DUCT</u>	1. contains the spiral organ of Corti	ampulla
<u>SACCLE</u> , <u>UTRICLE</u>	2. sites of the maculae	basilar membrane
<u>BASILAR MEMBRANE</u>	3. hair cells of the spiral organ of Corti rest on this membrane	cochlear duct
<u>TECTORIAL MEMBRANE</u>	4. gel-like membrane overlying the hair cells of the spiral organ of Corti	cochlear nerve
<u>AMPULLA</u>	5. contains the crista ampullaris	cupula
<u>SACCLE</u> , <u>UTRICLE</u>		otoliths
<u>OTOLITHS</u>	6. function in static equilibrium	sacculle
<u>AMPULLA</u> , <u>CUPULA</u> , <u>SEMI CIRCULAR DUCTS</u>		semicircular ducts
<u>VESTIBULAR NERVE</u>	7. function in dynamic equilibrium	tectorial membrane
<u>COCHLEAR NERVE</u>	8. carries auditory information to the brain	utricle
<u>CUPULA</u>	9. gelatinous cap overlying hair cells of the crista ampullaris	vestibular nerve
<u>OTOLITHS</u>	10. grains of calcium carbonate in the maculae	

23. Describe how sounds of different frequency (pitch) are differentiated in the cochlea. DIFFERENT PITCH SOUNDS STIMULATE DIFFERENT AREAS OF THE SPIRAL ORGAN
24. Explain the role of the endolymph of the semicircular canals in activating the receptors during angular motion. THE ENDOLYMPH MOVES MORE SLOWLY THAN THE CUPULA AND THUS CAUSES IT TO BEND WHICH ACTIVATES THE RECEPTORS
25. Explain the role of the otoliths in perception of static equilibrium (head position). OTOLITHS PROVIDE WEIGHT AND UNDER THE INFLUENCE OF GRAVITY PULL ON THE OTOLITH MEMBRANE WHICH THEN MOVES THE HAIR CELLS HAIR CAUSING ACTION POTENTIALS

Hearing and Balance Tests

26. Was the auditory acuity measurement made during the experiment on page 209 the same or different for both ears?
 _____ What factors might account for a difference in the acuity of the two ears?

27. During the sound localization experiment on page 209, in which position(s) was the sound least easily located?

 How can this observation be explained? _____

28. When the tuning fork handle was pressed to your forehead during the Weber test, where did the sound seem to originate?

 Where did it seem to originate when one ear was plugged with cotton? _____
 How do sound waves reach the cochlea when conduction deafness is present? _____

29. The Rinne test evaluates an individual's ability to hear sounds conducted by air or bone. Which is typical of normal hearing? _____
30. Define *nystagmus*: IS THE INVOLUNTARY ROLLING OF THE EYES IN ANY DIRECTION OR THE TRAILING OF THE EYES SLOWLY IN ONE DIRECTION