

## Review questions for Senses lecture

### Multiple choice review questions:

- 1) The term \_\_\_\_\_ means the cells in a sense organ that convert sense stimuli into nerve signals and send those signals to the brain.
  - A) adapter
  - B) sensory receptor
  - C) generator
  - D) signal encoder
  
- 2) The receptors that produce pain are called
  - A) chemoreceptors
  - B) mechanoreceptors
  - C) proprioceptors
  - D) nociceptors
  
- 3) Receptors in the muscles, tendons, and joints that inform the brain of the position and movements of the body parts, are known as
  - A) nociceptors.
  - B) cutaneous receptors.
  - C) proprioceptors.
  - D) exteroceptors.
  
- 4) The cutaneous senses would include all of the following except
  - A) pressure.
  - B) temperature
  - C) light
  - D) pain
  
- 5) The hollow spaces of the eye (such as the large cavity between the lens and the retina) are filled with
  - A) plasma.
  - B) humors.
  - C) endolymph.
  - D) perilymph.
  
- 6) Rods and cones are sensory cells that respond to light. Together, they are called \_\_\_\_\_ cells.
  - A) mechanoreceptor
  - B) thermoreceptor
  - C) nociceptor
  - D) photoreceptor

- 7) The optic nerve is composed axons extending from the \_\_\_\_ cells in the retina.
- A) ganglion
  - B) bipolar
  - C) cone
  - D) photoreceptor (rods and cones)
- 8) The photoreceptors known as cones allow for
- A) vision at normal daylight intensities.
  - B) sharply detailed vision.
  - C) color vision.
  - D) a high degree of light sensitivity.
- 9) Within the retina
- A) the photoreceptors synapse directly with the bipolar cells.
  - B) the bipolar cells stimulate the photoreceptors.
  - C) the ganglion cells are directly coupled to the photoreceptors.
  - D) bipolar cell axons form the optic nerve
- 10) When light is absorbed by photoreceptor cells, which of the following events does **not** occur?
- A) Opsin pigment changes shape
  - B) The photoreceptor cells become has a nerve signal.
  - C) The photoreceptor cells release neurotransmitter
  - D) The ciliary body muscles conduct the signal.
- 11) The change in visual pigment molecules when stuck by light is called
- A) transduction
  - B) polarization
  - C) depolarization
  - D) bleaching
- 13) The function of the lens of the eye is to
- A) serve as the major site of focusing of light rays.
  - B) control the size of the pupil.
  - C) control the amount of light entering the eye.
  - D) All of these are functions of the lens.
- 14) The term \_\_\_\_ means when the ciliary body muscles contract to keep an image focused on the retina despite changes in the distance to the object.
- A) myopia.
  - B) hyperopia.
  - C) adaptation.
  - D) accommodation.

- 15) When a far object is sharply focused on the retina the
- A) lens is rotated by the iris
  - B) lens is rotated by the sclera
  - C) ciliary muscle is relaxed.
  - D) the retina is relaxed
- 16) Hair cells send a nerve signal when
- A) they are exposed to endolymph
  - B) they bind molecules
  - C) their cilia bend
  - D) Another neuron stimulates them
- 17) Which of the following is found in the inner ear?
- A) ossicles
  - B) otoliths
  - C) pinna
  - D) tympanic membrane
- 18) The sensory hair cells of the cochlea organ of Corti rest on the
- A) basilar membrane.
  - B) vestibular membrane.
  - C) tectorial membrane.
  - D) tympanic membrane.
- 19) The difference between low pitched sounds and high pitched sounds is the \_\_\_\_\_ of the vibrations.
- A) Amplitude
  - B) Speed
  - C) Wavelength
  - D) Frequency
- 20) The middle ear
- A) contains the cochlea and semicircular canals.
  - B) is responsible for transmitting sound waves from the outer ear to the inner ear.
  - C) contains the otolith organs.
  - D) has abundant hair cells.
- 21) Hair cells are the sense receptors in all of the following sense organs except
- A) the semicircular canals.
  - B) the cochlea.
  - C) the skin.
  - D) the otolith organs

- 22) Horizontal acceleration in a straight line is detected primarily by the
- A) otolith organs
  - B) semicircular canals.
  - C) organ of Corti.
  - D) ossicles
- 23) The hair cells of a semicircular canal are located in the
- A) ampulla.
  - B) basilar membrane.
  - C) otolith membrane.
  - D) tectorial membrane.
- 24) The sensation that the room is spinning when one feels dizzy is due to
- A) after-discharge of the sensory neurons.
  - B) continued movement of the semicircular canals.
  - C) movement of the endolymph fluid.
  - D) movements of the otolith membrane.
- 25) The cupula is involved in the sensing \_\_\_\_\_.
- A) linear acceleration
  - B) rotational acceleration
  - C) gravity
  - D) vertical acceleration
- 26) The senses of smell and taste have all of the following in common except
- A) both sense 5 different types of molecules
  - B) both use chemoreceptors
  - C) the brain have specialized sense areas to receive their signals
  - D) both transmit nerve signals directly to the brain (not via the spine)
- 27) Which of the following is not a gustatory receptor type?
- A) salty
  - B) hot
  - C) bitter
  - D) sweet
- 28)  $H^+$  ions (acids) cause which taste sensation?
- A) sour
  - B) sweet
  - C) salty
  - D) bitter

29) The chemoreceptors on the tongue that are most sensitive to and respond to many types of plant toxins are the taste receptors for

- A) sweet.
- B) salty.
- C) bitter.
- D) sour.

**Answers to multiple choice questions:**

1 = B	11 = D	22 = A
2 = D	13 = A	23 = A
3 = C	14 = D	24 = C
4 = C	15 = C	25 = B
5 = B	16 = C	26 = A
6 = D	17 = B	27 = B
7 = A	18 = A	28 = A
8 = C	19 = D	29 = C
9 = A	20 = B	
10 = D	21 = C	

**Fill-in-the-blank review questions:**

- 1) In order for an event to be sensed, an appropriate sensory receptor must convert the stimulus to a(n) \_\_\_\_\_.
- 3) \_\_\_\_\_ are receptors that are dedicated to sensing pain.
- 4) Receptors in the skin that respond to pressure (touch), temperature, and tissue damage are called \_\_\_\_\_.
- 5) \_\_\_\_\_ are receptors which are found in skeletal muscles, tendons, joints, ligaments, etc., which allow us to sense the position of the body.

- 6) Each eye has extrinsic (external) muscles that are voluntary/involuntary (choose one word) muscles.
- 7) The eye has wall composed of three layers, or " \_\_\_\_\_."
- 8) The outermost layer of the eyeball has two regions: in the front, it is clear, forming the \_\_\_\_\_.  
The other areas are white, and forms the \_\_\_\_\_.
- 9) The middle tunic of the eye is called the \_\_\_\_\_
- 10) The \_\_\_\_\_ is the innermost layer of the three eye wall layers.
- 11) In the front of the eye, the \_\_\_\_\_ is the pigmented area surrounding the pupil. Its purpose is to \_\_\_\_\_.
- 12) The iris is made of \_\_\_\_\_ tissue.
- 13) In dimly lit areas, the pupil will dilate/contract (circle one).
- 14) The hollow areas of the eye are filled with fluid called \_\_\_\_\_.
- 16) The \_\_\_\_\_ is the clear part of the eye that focuses light images on the retina. Many patients benefit from having it re-shaped surgically to correct myopia, hyperopia, or astigmatism.
- 17) \_\_\_\_\_ are neurons that sense light; in humans, these are found in the retina.
- 18) The \_\_\_\_\_ are the photoreceptors that provide color vision and the \_\_\_\_\_ are the photoreceptors that provide black-and-white vision.
- 19) What are the two major types of photoreceptors called? \_\_\_\_\_ and \_\_\_\_\_.
- 20) What are the three types of color-sensing photoreceptors (what colors)? \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
- 21) The retina has three sub-layers. The cells of the three layers (from anterior-most to posterior-most) are called \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
- 22) In order to be absorbed by photoreceptors, light must actually pass through the \_\_\_\_\_ layer and the \_\_\_\_\_ layer of the retina.
- 23) The axons of the ganglion cells run along the surface of the retina then they become bundled together, pass through the back of the eye, and connect to the brain. This bundle of axons is called the \_\_\_\_\_.
- 24) The region of the retina where the axons of the ganglion cells leave the eye is called the \_\_\_\_\_ or \_\_\_\_\_, and lacks \_\_\_\_\_.

25) Color blindness is due to the genetic absence of one type of \_\_\_\_\_.

26) Color blindness is more common in which sex? \_\_\_\_\_

27) The retina generates a nerve signal when it is struck by light. Use the numbers 1 – 5 to indicate in what order the nerve signal passes through the following structures:

Optic nerve: \_\_\_\_\_

Ganglion cell: \_\_\_\_\_

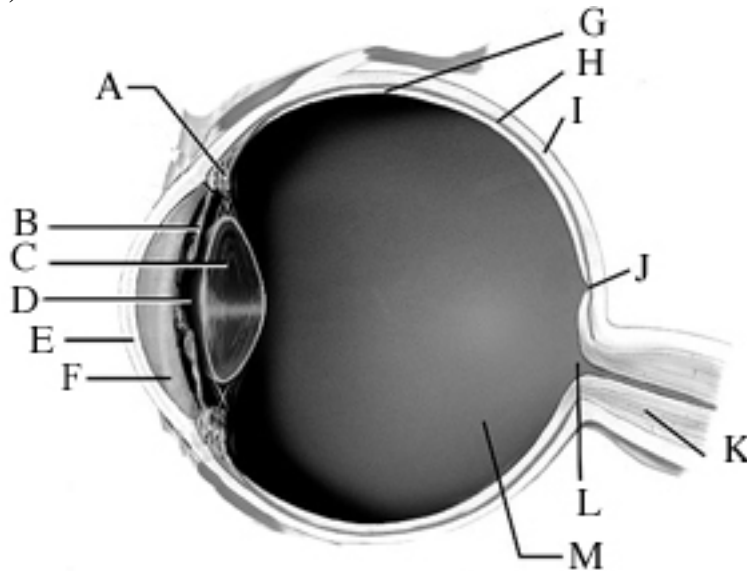
Visual area of cerebrum: \_\_\_\_\_

Photoreceptor cell: \_\_\_\_\_

Bipolar cell: \_\_\_\_\_

28) When a visual pigment molecule in a photoreceptor cell is hit by light, it \_\_\_\_\_, and this results in the photoreceptor cell generating a \_\_\_\_\_.

31) In the diagram below, name eye parts A – M. (Some hints: M is a fluid; skip F and J; L is a spot with no photoreceptors).



34) \_\_\_\_\_ is used by the eye to keep the image focused on the retina as the distance between the eyes and object is decreased.

35) The eye changes focus when the \_\_\_\_\_ bends the \_\_\_\_\_ into a different shape.

36) In a relaxed eye, the lens focuses far/near (circle one) objects on the retina.

37) Contracting the ciliary body of an eye results in focusing far/near (circle one) objects on the retina.

38) \_\_\_\_\_ is nearsightedness: All focal points are anterior/posterior (circle one) compared to where they normally are found.

39) \_\_\_\_\_ is farsightedness: all focal points are anterior/posterior (circle one) compared to where they normally are found.

40) Which disorder (hyperopia or myopia) is the one where the person can see far objects but not near objects? \_\_\_\_\_

41) The vision problem \_\_\_\_\_ occurs when the focal points are farther back in the eye than is normal.

42) If a person with myopia is looking at a near object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

43) If a person with myopia is looking at a near object and their ciliary body is contracted, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

44) If a person with myopia is looking at a far object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

45) If a person with hyperopia is looking at a far object and their ciliary body is contracted, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

46) If a person with hyperopia is looking at a far object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

51) The outer ear is composed of the visible portion of the ear, known as the \_\_\_\_\_.

52) The \_\_\_\_\_ is the outermost structure of the middle ear.

53) The three small bones of the middle ear are called the \_\_\_\_\_ (Hint: One word for all three bones)

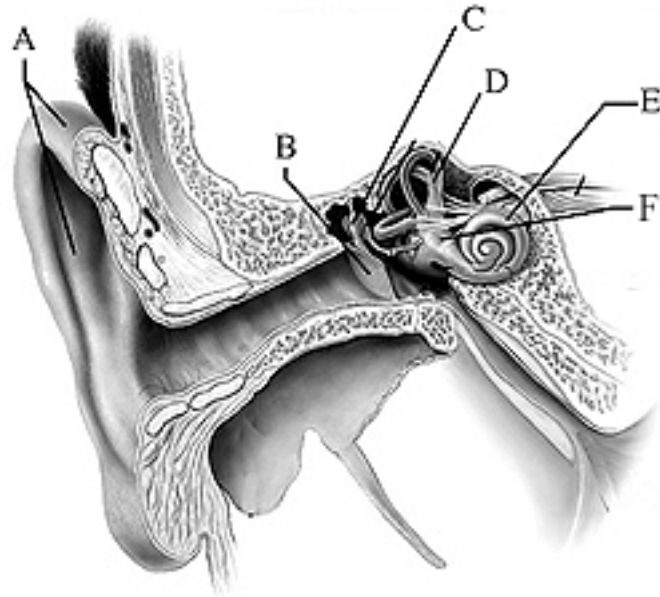
54) The small bones of the middle ear (from outermost to innermost) are the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

55) The inner ear contains fluids. The most abundant of the fluids is called \_\_\_\_\_.

56) The correct anatomical term for the eardrum is the \_\_\_\_\_.



57) In the diagram below, identify ear structures A – F. (Hint: C is a term for all the bones in the middle ear). Also, use the letters in the diagram to answer the questions below.



- 58) As vibrations in the air cause the eardrum to vibrate, the eardrum pushes against the \_\_\_\_\_ bone.
- 59) The ossicles initially transmit vibrations to the \_\_\_\_\_ region of the inner ear.
- 60) As the ossicles move, their movement is converted to vibrations of the \_\_\_\_\_ fluid in the inner ear .
- 61) The cochlea is a snail shaped organ in the inner ear which is responsible for \_\_\_\_\_.
- 62) The actual organ within the cochlea which is responsible for hearing is the \_\_\_\_\_. (Hint: It is made of hair cells sandwiched between two membranes).
- 63) Movement of fluid in the inner ear causes movement of the \_\_\_\_\_ membrane, which results in movement cilia of the \_\_\_\_\_, which are the sensory receptors located in the cochlea.
- 64) The \_\_\_\_\_ membrane is an inflexible membrane that attaches to the cilia of hair cells within the cochlea.
- 71) The vestibule is a compartment of the inner ear which is the major region involved in the sense of \_\_\_\_\_.
- 73) The semicircular canals are compartments of the inner ear which sense \_\_\_\_\_.
- 74) The \_\_\_\_\_ organs are structures in the vestibule which sense linear (vertical and horizontal) movement.

75) There are two otolith organs in the vestibule: the \_\_\_\_\_ and the \_\_\_\_\_.

76) The otolith organs contain \_\_\_\_\_, which are hair cells whose cilia are imbedded in a gel that also contains \_\_\_\_\_, which are dense granules of calcium.

77) The otolith organs provide a sense of \_\_\_\_\_ movement; while the semicircular canals provide a sense of \_\_\_\_\_ movement.

78) The otoliths are composed of microscopic crystals of \_\_\_\_\_

79) The sensory hair cells of the semicircular canals are located within a bulge called the \_\_\_\_\_

80) Using the letters from question 57 as answers, which part of the ear...

- a) Contains the organ of Corti? \_\_\_\_\_
- b) Is where spinning motion is detected? \_\_\_\_\_
- c) Are the smallest bones in the body? \_\_\_\_\_
- d) Contains a structure called the ampulla? \_\_\_\_\_
- e) Contains structures called the utricle and saccule? \_\_\_\_\_
- f) Contains otoliths? \_\_\_\_\_
- g) Is where moving forward is detected? \_\_\_\_\_
- h) Contains hair cells that are used in sensing? \_\_\_\_\_

81) The enlarged regions at the entrance to each semicircular canal are the \_\_\_\_\_, each of which houses a gel structure called a(n) \_\_\_\_\_. There are hair cells within this gel structure.

82) As endolymph flows through the semicircular canals in response to rotation of the head, the cupula \_\_\_\_\_, thus bending the hair cells' cilia, which causes the hair cells to \_\_\_\_\_.

83) \_\_\_\_\_ are sensory neurons that detect molecules (chemicals) for senses of smell and taste.

85) \_\_\_\_\_ is the correct term for the sense of smell.

86) The five kinds of gustatory receptors are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

87) If you drank NaOH (the active chemical in Drano and oven cleaner...not a good idea), which of the taste sensations would you experience? Give all answers. (Hint: NaOH turns into  $\text{Na}^+$  and  $\text{OH}^-$  in your saliva. Review the  $\text{OH}^-$  ion in the chapter on water chemistry).

- 88) If you drank HCl (a strong acid...not a good idea), which of the taste sensations would you experience? \_\_\_\_\_
- 89) Gustatory receptors in the mouth are located in clusters called \_\_\_\_\_.
- 90) The olfactory receptors are located on the \_\_\_\_\_.
- 91) Unlike taste, there are \_\_\_\_\_ (roughly how many?) of different types of olfactory receptors.

**Answers to fill-in-the-blank review questions:**

- |                            |                            |
|----------------------------|----------------------------|
| 1) Nerve signal            | 26) Males                  |
| 3) Nociceptors             | 27) 4                      |
| 4) Cutaneous receptors     | 3                          |
| 5) Proprioceptors          | 5                          |
| 6) Voluntary               | 1                          |
| 7) Tunics                  | 2                          |
| 8) Cornea                  | 28) Bleaches/changes shape |
| Sclera                     | Nerve signal               |
| 9) Choroid                 | 31) a = Ciliary body       |
| 10) Retina                 | b = Iris                   |
| 11) Iris                   | c = Lens                   |
| Control the pupil size     | d = Pupil                  |
| 12) Smooth muscle          | e = Cornea                 |
| 13) Dilate                 | g = Retina                 |
| 14) Humors                 | h = Choroid                |
| 16) Lens                   | i = Sclera                 |
| 17) Photoreceptors         | k = optic nerve            |
| 18) Cones                  | l = Blind spot/optic disc  |
| Rods                       | m = Humor                  |
| 19) Cones                  | 34) Accommodation          |
| Rods                       | 35) Ciliary body           |
| 20) Red                    | Lens                       |
| Blue                       | 36) Far                    |
| Green                      | 37) Near                   |
| 21) Ganglion cells         | 38) Myopia                 |
| Bipolar cells              | Anterior                   |
| Photoreceptor cells        | 39) Hyperopia              |
| 22) Ganglion cells         | Posterior                  |
| Bipolar cells              | 40) Hyperopia              |
| 23) Optic nerve            | 41) Hyperopia              |
| 24) Blind spot             | 42) On                     |
| Optic disc                 | 43) In front of            |
| Photoreceptor cells/vision | 44) In front of            |
| 25) Cone types             | 45) On                     |

- 46) Behind
- 51) Pinna
- 52) Tympanic membrane
- 53) Ossicles
  
- 54) Malleus (hammer)
  - Incus (anvil)
  - Stapes (stirrups)
- 55) Endolymph
- 56) Tympanic membrane
- 57) A = Auricle
  - B = Tympanic membrane
  - C = Ossicles
  - D = Semicircular canals
  - F = Cochlea
  - G = Vestibule
- 58) Malleus
- 59) Vestibule
- 60) Endolymph
- 61) The sense of hearing
- 62) Organ of Corti
- 63) Basilar
  - Hair cells
- 64) Tectorial
- 71) Equilibrium
- 73) Rotational movement
- 74) Otolith
- 75) Utricle
  - Saccule
- 76) Macula

- Otoliths
- 77) Linear
  - Rotational
- 78) Calcium
- 79) Ampula
- 80) a) = E
  - b) = D
  - c) = C
  - d) = D or F
  - e) = F
  - f) = F
  - g) = F
  - h) = D, E, and F
- 81) Ampulla
  - Cupula
- 82) Bends
  - Generate a nerve signal
- 83) Chemoreceptors
- 85) Olfactory
- 86) Sweet
  - Salty
  - Sour
  - Bitter
  - Umami (meaty)
- 87) Salty
  - Bitter
- 88) Sour
- 89) Taste buds
- 90) Nasal epithelium
- 91) 380

### **Short answer questions:**

- 1) What do the external (extrinsic) eye muscles do? In what ways are they different from the other eye muscles (the iris and the ciliary body)?
  
- 2) Explain (in two or three sentences) what is the anatomical reason that we have a blind spot. In other words, what is at that spot instead of light-detecting cells?
  
  
  
  
  
  
- 6) When we are spun around in a circle and then come to a stop, we feel as if we are still spinning. Explain (using the anatomy of our rotation sensors) exactly why the spinning feeling persists after we stop. You may use drawings or diagrams to help clarify your explanation.
  
  
- 7) Given that we only have five types of taste receptors, explain how we can differentiate the tastes of thousands of different foods?

### **Answers to short answer questions:**

- 1) The extrinsic eye muscles move the eyes up, down, left, and right. They differ from the iris and ciliary body muscles in two ways: They are skeletal (voluntary) muscle, and they are on the outside of the eye.
  
- 2) The blind spot occurs because the optic nerve passes through the retina. There is no room for photoreceptors at that location (because the optic nerve takes up that area) so we have no vision in the blind spot.
  
  
  
  
  
  
- 6) Rotation is sensed when the endolymph fluid in the semi-circular canals moves. The moving endolymph bends the cilia of hair cell neurons, which results the sensation of spinning. When we stop spinning, it takes a few seconds for the endolymph to stop flowing. This results a continued feeling of spinning.
  
  
- 7) Even though we have only five taste receptor types, we also smell foods as we eat them. We have hundreds of different olfactory (smell) receptor types, and this allows us to differentiate the “tastes” (really the smells) of many food types.