

NEUR0010**Week 5, 6 Questions****2006-2**

1 – 3.5 From the list of structures, choose the best answer matching the following descriptions:

1. structure responsible for most light refraction by the eye

1.5. jelly-like substance responsible for maintaining the eye's shape

2. cataract is decreased optical quality of this structure

2.5. the tough white outer eye sack

3. structure that gives your eyes their “color”

3.5. the retinal “pit” associated with high-resolution vision

iris

cornea
humor

zonule fibers

macula

vitreous

pupil
humor

sclera

optic disk

aqueous

lens
muscle

fovea

retina

ciliary

QUESTION 4 OMITTED

5. When the eye accomodates to bring a nearby object into focus:

a) the ciliary muscle contracts and the lens flattens

b) the ciliary muscle contracts and the lens bulges becoming rounder

c) the ciliary muscle relaxes and the lens flattens

d) the ciliary muscle relaxes and the lens bulges becoming rounder

6. As light penetrates through the retina, what is the order in which it encounters the following cell types:

- a) bipolar cells first, then ganglion cells, then photoreceptors
- b) photoreceptors first, then bipolar cells, then ganglion cells
- c) ganglion cells first, then photoreceptors, then bipolar cells
- d) photoreceptors first, then ganglion cells, then bipolar cells
- e) ganglion cells first, then bipolar cells, then photoreceptors

7. The following statements about phototransduction are all true EXCEPT:

- a) there is a current of Na^+ ions entering the photoreceptor even in the dark
- b) the photoreceptor hyperpolarizes when exposed to light
- c) phosphodiesterase enzyme serves as the g-protein
- d) cGMP is responsible for holding Na^+ channels open
- e) activated photopigment stimulates transducin

8. All the following statements about the distribution of photoreceptors are true EXCEPT:

- a) there are more cones in the fovea than in the retinal periphery
- b) the blind spot is on the nasal retina
- c) in the fovea, more cones project to each bipolar cell than in the retinal periphery
- d) the relative distribution of cones leads to better color vision in the fovea than the periphery

9. Light transduced by a cone hyperpolarizes a directly connected bipolar cell. This means that the cone to bipolar synapse is:

- a) ionotropic and non-inverting
- b) ionotropic and inverting
- c) metabotropic and non-inverting
- d) metabotropic and inverting

10. Consider an off-center on-surround retinal ganglion cell that fires 10 action potentials per second in the dark. Which of the answers below correctly ranks the firing rates of this neuron in response to light in the receptive field center, surround, and both”

- a) light in center resp > light in surround resp > light in both resp
- b) light in center resp > light in both resp > light in surround resp
- c) light in both resp > light in surround resp > light in center resp
- d) light in both resp > light in center resp > light in surround resp
- e) light in surround resp > light in center resp > light in both resp
- f) light in surround resp > light in both resp > light in center resp

11. All the following statements about retinal ganglion cells are true EXCEPT:

- a) there are more magno cells than parvo cells
- b) magno cells have larger somas than parvo cells
- c) cells that are neither magno nor parvo are more likely to be color sensitive than magno cells
- d) an on center magno cell receives red cone input to the receptive field surround

12. The LGN receives direct input from axons in the:

- a) optic tract
- b) optic nerve
- c) optic chiasm
- d) optic radiation
- e) optic tract, optic chiasm, and optic radiation

13. An unfortunate side effect of your summer vacation at Lake Toxicus is an infection by a microbe that selectively attacks LGN cells receiving input from magno ganglion cells of the ipsilateral eye. Thus, this infection specifically attacks LGN layer:

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5
- f) 6

14. Which of the following layers in area V1 receives the greatest amount of direct input from parvocellular layers of the LGN?

- a) layer 3
- b) layer 4A
- c) layer 4c alpha
- d) layer 4c beta
- e) layer 5

15. Retinotopy in area V1 means that:

- a) each retinal ganglion cell projects to just one neuron in V1
- b) more neurons respond to peripheral stimulation than foveal stimulation
- c) neighboring cells in the LGN project to neighboring cells in V1
- d) there is a little monkey in your head watching everything you do on a tiny neural TV

16. In V1, the most reliable way to distinguish simple and complex receptive fields is:

- a) on and off areas are spatially distinct in simple but not complex cells
- b) complex cells are monocular and simple cells are binocular
- c) complex cells are more likely than simple cells to be located in cytochrome oxidase blobs
- d) simple cells are more likely than complex cells to be direction selective
- e) simple cells don't brag about how sophisticated they are

17. The following statements about neurons in cytochrome oxidase blobs are all generally correct EXCEPT:

- a) they have center surround receptive fields
- b) they are orientation selectivity
- c) they lack direction selectivity
- d) they are monocular
- e) they are color sensitive

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13. Axons between the lateral geniculate nucleus and primary visual cortex compose the:

- a) optic nerve
- b) optic radiation
- c) optic tract
- d) optic chiasm

14. As light travels from outside the eye through the pupil to the retina, the LAST structure the light encounters is:

- a) vitreous humor
- b) lens
- c) cornea
- d) aqueous humor

15. In visual accommodation, a distant object is focused on the retina by:

- a) flexing (contracting) the ciliary muscles
- b) relaxing the cornea
- c) increasing tension in the zonule fibers (ligaments)
- d) making the lens more spherical

16. Lateral connections between different photoreceptors in the retina are made via:

- a) amacrine cells in the inner plexiform layer
- b) amacrine cells in the outer plexiform layer
- c) horizontal cells in the inner plexiform layer
- d) horizontal cells in the outer plexiform layer

17. In which eye disease is central vision lost first as a result of the degeneration of photoreceptors:

- a) detached retina
- b) glaucoma
- c) retinitis pigmentosa
- d) macular degeneration

18. Dark current refers to:

- a) the steady release of neurotransmitter from photoreceptors in the dark
- b) the steady inflow of Na^+ in the dark
- c) the steady inflow of K^+ in the dark
- d) the steady breakdown of cGMP in the dark

19. Which of the following components of phototransduction occurs LAST:

- a) activation of transducin
- b) change in the conformation of retinal
- c) increased activation of cGMP phosphodiesterase
- d) photopigment activation

20. All of the following are true of an off-center bipolar cell EXCEPT:

- a) it has an inverting synapse with a direct path cone that connects to it
- b) the synapse with the direct path cone uses glutamate as a neurotransmitter
- c) it has ionotropic receptors
- d) it makes a non-inverting synapse with a ganglion cell

21. If light covers the entire center and half of the surround of an on-center retinal ganglion cell, the response of the ganglion cell is:

- a) equal to the response when the receptive field is entirely in the dark
- b) less than the response when both the center and surround are entirely covered in light
- c) greater than the response when light covers the entire surround but none of the center
- d) equal to the response when light covers the entire center and none of the surround

22. The following statements about the distribution of photoreceptors on the retina are all correct EXCEPT:

- a) there are more rods than cones
- b) there are more rods in the fovea than the peripheral retina
- c) rods and cones are both absent where ganglion cell axons exit the retina at the optic disk
- d) there are more cones than ganglion cell axons

23. All of the following are better in central vision compared to peripheral vision EXCEPT:

- a) acuity
- b) color perception
- c) ability to see dim lights
- d) ability to read small letters

24. The most common type of retinal ganglion cell is:

- a) magno
- b) parvo
- c) nonM-nonP
- d) konio

25. The most dorsal layer of the LGN contains:

- a) konio cells responding to input from the contralateral eye
- b) parvo cells responding to input from the contralateral eye
- c) magno cells responding to input from the ipsilateral eye
- d) nonM-nonP cells responding to input from the ipsilateral eye

26. Parvocellular LGN neurons primarily project directly to which layer of striate cortex:

- a) 2
- b) 4
- c) 5
- d) 6

27. Feedback from striate cortex to the LGN comes from cortical layer:

- a) 2
- b) 4
- c) 5
- d) 6

28. Orientation and direction selectivity are related as follows:

- a) orientation selective cells in V1 are a subset of the direction selective cells
- b) direction selective cells in V1 are a subset of the orientation selective cells
- c) simple cells are direction selective, but only complex cells are orientation selective
- d) orientation sensitivity is found in areas V1 and V5 (MT), but direction sensitivity is only found in area V5 (MT)

29. Concerning neurons located in V1 cytochrome oxidase blobs:

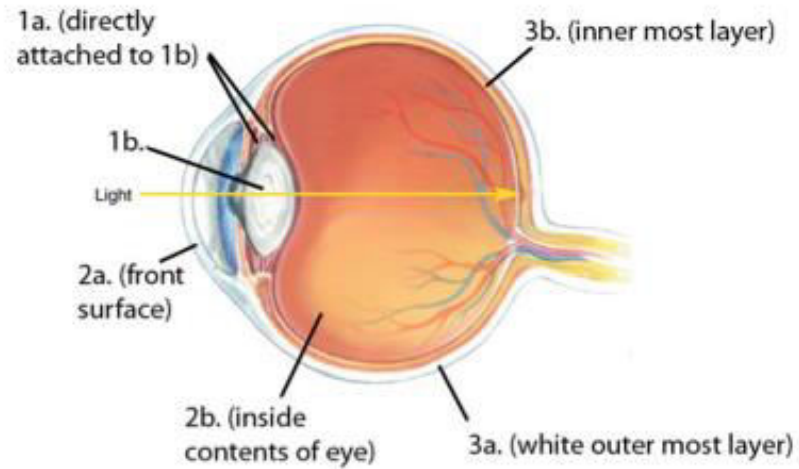
- a) most of the V1 color sensitive neurons are located here
- b) most of the cells are binocular
- c) most of the cells have complex receptive fields
- d) most of the V1 direction sensitive neurons are located here

30. The neural pathway most likely involved in the perception of visual form is the:

- a) interblob pathway
- b) blob pathway
- c) magno/layer 4B pathway
- d) Newborn – GCB pathway

2008-2

1-3 On the answer sheet, label the 6 structures indicated.



4. All of the following carry information from both eyes EXCEPT:

- a) LGN
- b) primary visual cortex
- c) optic tract
- d) optic nerve
- e) optic radiation

QUESTIONS 5 and 6 OMITTED

7. As you walk home from studying for the Neuro 1 exam, the bright inviting lights from Spats and Viva beckon you in. At what transition does light encounter the largest change in index of refraction as it goes from air to retina:

- a) air/cornea
- b) cornea/aqueous
- c) aqueous/lens
- d) lens/vitreous
- e) beer/tongue

8. As you enter the door of Viva, you have completely forgotten about the Neuro 1 exam and then light from the top floors of the Science Library hits your peripheral retina and snaps you back to reality. When light hits your peripheral retina (i.e. not the fovea), which cell type does it encounter first?

- a) amacrine cells
- b) bipolar cells
- c) ganglion cells
- d) horizontal cells
- e) photoreceptors

9. You decide, despite your better judgment, you will have a quick drink anyhow "just to relax so you can sleep". You are magnetically drawn to the bottle of Absolut vodka because of its uncanny resemblance to the shape of a photoreceptor. Which statement best describes the normal state of your photoreceptors?

- a) they have a resting potential of -30 mV because cGMP holds Na^+ channels open
- b) they have a resting potential of -65 mV because K^+ channels are open and Na^+ channels are closed
- c) they have a resting potential of -30 mV because transducin holds K^+ channels open
- d) they have a resting potential of -65 mV because of the dark current
- e) they have a resting potential of -30 mV because they fire action potentials even in the dark

10. It is darker inside Viva than the brightly lit Thayer Street and at first you can't recognize any of the faces of the people. Photoreceptor adaptation kicks in and after a few minutes you are shocked to realize President Simmons is sitting next to you at the bar drinking a shot of Jagermeister. You muster your nerve and strike up a conversation with her, explaining how important photoreceptor adaptation is. All of the following statements about the role of Ca^{++} in cone adaptation are correct EXCEPT:

- a) Ca^{++} enters photoreceptors through the same channels as Na^+
- b) Ca^{++} inhibits guanylyl cyclase
- c) when guanylyl cyclase is more active, more cGMP is produced
- d) Ca^{++} activates transducin
- e) Ca^{++} entry into the photoreceptor ultimately leads to a change in membrane potential

11. All the following statements about ganglion cells are correct EXCEPT:

- a) an ON-center ganglion cell will fire more action potentials with light only in the receptive field center than with light only in the RF surround
- b) ganglion cells are the only retinal cells we studied that fire action potentials
- c) cone input making up the RF center comes through a retinal circuit including horizontal cells
- d) many ganglion cell receptive fields are sensitive to different wavelengths of light in the RF center and surround
- e) ganglion cells fire action potentials even in the dark

12. Both magno and parvo cells from the LGN project directly to which layer of primary visual cortex:
a) layer 3
b) layer 4A
c) layer 4B
d) layer 4C
e) layer 6

13. A neuron in layer 3 of the LGN:
a) is magno and from the ipsilateral eye
b) is magno and from the contralateral eye
c) is parvo and from the ipsilateral eye
d) is parvo and from the contralateral eye
e) is half as smart as a neuron in layer 6

14. Primary visual cortex has all of the following organizational systems EXCEPT:
a) orientation columns
b) direction of motion columns
c) ocular dominance columns
d) cytochrome oxidase blobs
e) six layers with subdivisions

15. Most cells in primary visual cortex have receptive fields that are called either Simple or Complex. The key difference between these two types of receptive fields is that:
a) simple cells have distinct ON and OFF areas but complex cells do not
b) simple cells are orientation selective but complex cells are not
c) most color selective neurons in V1 are simple but few are complex
d) simple cells have center surround receptive fields and complex RFs are elongated
e) simple cells are located primarily in the magno-layer 4B pathway and complex cells mainly in the blob pathway

16. All the following statements about the projection to primary visual cortex are correct EXCEPT:
a) it is retinotopically organized
b) information from the right visual field is represented in the right hemisphere V1
c) more neurons in V1 respond to light in the fovea than light in a similarly sized portion of peripheral retina
d) a small spot of light excites many V1 neurons
e) neurons responding to light in the fovea are located in the most lateral portion of V1

17. Primary visual cortex projects to groups of visual cortical areas in distinct dorsal and ventral pathways. The dorsal pathway appears to be most involved in:
a) color perception
b) object recognition
c) motion perception
d) detection of edges
e) isoluminant vision

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24. All the following cell types are in the direct path by which visual information leaves the retina EXCEPT:

- a) bipolar cell
- b) cone
- c) ganglion cell
- d) horizontal cell

25. Suppose you are at Spats when a food fight breaks out. A French fry comes flying toward you and you quickly adjust your visual accommodation to focus on the sputtering spud as it approaches your nose. Your effort to focus on such a nearby object is associated with:

- a) contraction of the ciliary muscle and increased tension in the zonule fibers
- b) contraction of the ciliary muscle and decreased tension in the zonule fibers
- c) relaxation of the ciliary muscle and increased tension in the zonule fibers
- d) relaxation of the ciliary muscle and decreased tension in the zonule fibers

26. Information from the left nasal retina reaches all the following structures EXCEPT:

- a) left optic nerve
- b) optic chiasm
- c) left lateral geniculate nucleus
- d) right primary visual cortex

27. All the following statements about retinal ganglion cells are true EXCEPT:

- a) they generally fire action potentials even in the absence of visual input
- b) most of them are magnocellular
- c) they have center/surround receptive fields
- d) most of them are color sensitive

28. Professor Paradiso's projected handwritten notes are atrocious when you look straight at them, but you don't even notice the funky squiggles and blotches when you look away from the screen. The higher central visual acuity you observe (relative to peripheral vision) is associated with all of the following properties of the fovea EXCEPT:

- a) greater cone density
- b) lateral displacement of cells that light usually hits before the photoreceptors
- c) increased vascularization (higher density of blood vessels)
- d) lower convergence onto bipolar cells

29. Layer 5 of the lateral geniculate nucleus contains:

- a) magno cells from the ipsilateral eye
- b) parvo cells from the ipsilateral eye
- c) magno cells from the contralateral eye
- d) parvo cells from the contralateral eye

30. Which layer of area V1 projects to secondary visual cortical brain areas?

- a) 1
- b) 2
- c) 4c
- d) 6

31. All the following statements about cytochrome oxidase blobs in V1 are true EXCEPT:

- a) blobs are centered on the borders between left and right eye ocular dominance columns
- b) neurons in blobs are more metabolically active than neurons in surrounding cortex
- c) blobs receive konio, magno, and parvo input either directly or indirectly
- d) blobs extend vertically spanning the layers of V1

32. Suppose you are studying a V1 neuron that is orientation selective but not direction selective. You find the strongest response comes when you present a vertical bar of light moving leftward. Which of the following is most likely to produce the greatest response?
- a) a vertical bar of light moving rightward
 - b) a horizontal bar of light moving downward
 - c) a horizontal bar of light moving upward
 - d) a bar of light tilted 45 deg right of vertical moving up and left perpendicular to its orientation

2009-2

1. The axons that extend from the optic chiasm to the LGN are collectively known as the
 - a) optic disk
 - b) optic nerve
 - c) optic radiation
 - d) optic tract
2. Soldiers in the American revolutionary army were told “don’t shoot until you see the whites of their eyes”. If you had been the General your knowledge of neuroscience would have led you to use a more anatomically correct term to say “don’t shoot until you see the”:
 - a) cornea
 - b) iris
 - c) retina
 - d) sclera
3. At Thanksgiving dinner this year you sit next to old Aunt Iris who explains that she is having trouble seeing everyone at the table. You learn that she is suffering from a loss of peripheral vision associated with elevated intraocular pressure. You immediately diagnose her disorder as:
 - a) detached retina
 - b) glaucoma
 - c) macular degeneration
 - d) retinitis pigmentosa
4. While eating dinner at the Ratty, a blob of jello comes flying at your nose from across the room. You want to know if the jello missile is strawberry or lime so you focus as close as possible to your face. Accommodating the eye to look at the nearby jello requires:
 - a) flexing the ciliary muscle and tightening the ligaments attached to the lens
 - b) flexing the ciliary muscle and relaxing the ligaments attached to the lens
 - c) relaxing the ciliary muscle and tightening the ligaments attached to the lens
 - d) relaxing the ciliary muscle and relaxing the ligaments attached to the lens

5. Which of the following cell types is on the innermost part of the retina:
- a) bipolar cells
 - b) ganglion cells
 - c) horizontal cells
 - d) photoreceptors
6. Of all the photoreceptors in humans, the ones sensitive to the shortest wavelengths of light are:
- a) blue cones
 - b) green cones
 - c) red cones
 - d) rods
7. When light hits a photoreceptor, it leads to activation of a G-protein called
- a) cGMP
 - b) opsin
 - c) retinal
 - d) transducin
8. Just after light first hits a photoreceptor
- a) Ca^{++} entry into the photoreceptor increases and this increases cGMP synthesis
 - b) Ca^{++} entry into the photoreceptor increases and this decreases cGMP synthesis
 - c) Ca^{++} entry into the photoreceptor decreases and this increases cGMP synthesis
 - d) Ca^{++} entry into the photoreceptor decreases and this decreases cGMP synthesis
9. At the fovea
- a) there are no cones
 - b) the ganglion cell layer is displaced to the side
 - c) there is the highest density of rods anywhere on the retina
 - d) the axons from retinal ganglion cells exit the eye
10. The central retina is better than the peripheral retina at all the following EXCEPT:
- a) discriminating subtle differences in color of your “gotta love green” wardrobe
 - b) reading small letters on your history term paper that you formatted with 6pt Times Roman to fit into the 5 page limit
 - c) picking out a dim star on a moonless night to dedicate to all the hopeful contestants of American Idol
 - d) counting the number of sprinkles on your *Chunky Mitochondria* ice cream at Ben and Jerry’s
11. All the following cell types are in the Direct Path that takes visual information to the brain EXCEPT:
- a) bipolar cell
 - b) cone
 - c) ganglion cell
 - d) horizontal cell

12. If you count action potentials fired by a retinal ganglion cell that has an OFF-Center ON-surround receptive field (RF) you will find that:

- a) the cell fires more with light covering the entire RF than with light covering only the RF center
- b) the cell fires more with light covering only the RF center than with light covering only the RF surround
- c) the cell fires at the highest possible rate with light covering only the RF center and no light in the RF surround
- d) the cell fires at the same rate with no light anywhere as it does with light only in the RF surround

13. Layer 3 of the lateral geniculate nucleus contains neurons that:

- a) receive magno input from the contralateral eye
- b) receive magno input from the ipsilateral eye
- c) receive parvo input from the contralateral eye
- d) receive parvo input from the ipsilateral eye

14. Konio cells from the lateral geniculate nucleus project directly to neurons in which layer of cortical area V1?

- a) layer 1
- b) layer 2
- c) layer 4
- d) layer 6

15. The layer of area V1 that has the highest proportion of monocular neurons is:

- a) layer 1
- b) layer 2
- c) layer 4
- d) layer 6

16. The highest proportion of color sensitive neurons in V1 appears to be in

- a) layer 1
- b) layer 3 blobs
- c) layer 3 interblob areas
- d) layer 4B

2009-3

26. As light passes from into the eye, it goes through structures in which order (not all structures traversed are necessarily listed)

- a) cornea -> aqueous humor -> lens -> vitreous humor
- b) cornea -> pupil -> vitreous humor -> lens
- c) lens -> pupil -> aqueous humor -> retina
- d) pupil -> vitreous humor -> lens -> retina

27. A loss of central vision that affects one third of all adults over the age of 75 is

- a) cataracts
- b) glaucoma
- c) macular degeneration
- d) retinitis pigmentosa

28. Which type of retinal neuron sends axons to the LGN nucleus of the thalamus?

- a) amacrine cells
- b) bipolar cells
- c) ganglion cells
- d) horizontal cells

29. The dark current entering photoreceptors is based on the flow of

- a) K⁺ at cGMP-gated channels
- b) K⁺ at transducin-gated channels
- c) Na⁺ at cGMP-gated channels
- d) Na⁺ at transducin-gated channels

30. Center surround opponent receptive fields are found in

- a) retina only
- b) retina and LGN only
- c) retina, LGN, and V1
- d) V1 only

31. The bundle of axons stretching from the LGN to area V1 is called the

- a) optic chiasm
- b) optic nerve
- c) optic radiation
- d) optic tract

32. In which layer of the LGN would you be most likely to find receptive fields that respond to light in the contralateral eye and are not color sensitive?

- a) layer 1
- b) layer 2
- c) layer 3
- d) layer 4

33. When magnocellular neurons in the LGN project to area V1, they first make a synapse in which V1 layer?

- a) 3
- b) 4c
- c) 5
- d) 6

34. Neurons in V1 referred to as simple cells have

- a) center-surround receptive fields with distinct on and off areas
- b) orientation-selective receptive fields with no distinct on and off areas
- c) receptive fields that are both orientation and direction selective but without distinct on and off areas
- d) receptive fields that are orientation selective and have distinct on and off areas

2010-2

1. A single cut inflicted to your visual system causes left eye blindness in the temporal visual field and right eye blindness in the temporal visual field. The cut must have severed the
 - a) optic radiation
 - b) left LGN
 - c) optic nerve
 - d) optic tract
 - e) optic chiasm
2. You wake up late one night to find your roommate shining a bright red laser pointer into your eye. After the light goes through your cornea, the next thing it goes through (just before you whack your roommate) is:
 - a) aqueous humor
 - b) iris
 - c) pupil
 - d) vitreous humor
3. At Thanksgiving dinner your elderly Aunt Iris scoops a load of gravy and butter onto her meal while she takes a drag on a cigarette. As she does this she explains to you that her central vision has gotten very bad (low acuity, blurry) even though her peripheral vision is good. She can't remember the name of her disorder, but she shows you the pills the doctor has prescribed to treat her condition. You hide your disgust at the cigarette ashes in the mashed potatoes and explain to Aunt Iris that she most likely suffers from:
 - a) cataracts
 - b) detached retina
 - c) macular degeneration
 - d) retinitis pigmentosa
4. As light enters your eye, the greatest amount of refraction occurs at the interface of which two media?
 - a) air/vitreous humor
 - b) lens/aqueous humor
 - c) air/cornea
 - d) lens/aqueous humor
 - e) air/lens
5. When you focus on a nearby object,
 - a) the ciliary muscle contracts and the zonule fibers tighten
 - b) the ciliary muscle contracts and the zonule fibers relax
 - c) the ciliary muscle relaxes and the zonule fibers tighten
 - d) the ciliary muscle relaxes and the zonule fibers relax

6. Photoreceptors make synapses with which two retinal cell types:

- a) amacrine and bipolar cells
- b) ganglion and horizontal cells
- c) amacrine and ganglion cells
- d) bipolar and horizontal cells

7. The optic nerve consists of axons from which type of retinal neurons:

- a) amacrine cells
- b) bipolar cells
- c) horizontal cells
- d) ganglion cells

8. Photopic vision is best described as

- a) cones operating in high light conditions
- b) cones operating in low light conditions
- c) rods operating in high light conditions
- d) rods operating in low light conditions

9. The photoreceptors responsive to the longest wavelengths of light are:

- a) blue cones
- b) green cones
- c) red cones
- d) rods

10. The second messenger involved in phototransduction is:

- a) cGMP
- b) Ca^{++}
- c) retinal
- d) transducin

11. At rest, which two ions flow into photoreceptors?

- a) K^+ and Na^+
- b) Na^+ and Ca^{++}
- c) K^+ and Ca^{++}
- d) Na^+ and Cl^-

12. You are outside on a clear moonless night pondering how the ancients ever saw Orion in the stars when suddenly a dimly lit UFO flies into view. In your peripheral vision you think you see a small green creature waving at you. In amazement you look straight at the spaceship but it disappears. The spaceship disappears because:

- a) in low light the central retina is not sensitive to motion
- b) there are more cones in the peripheral than central retina
- c) there are no rods in the central retina
- d) the spaceship is imaged on the portion of your retina where axons and blood vessels enter and exit the eye
- e) your psychiatrist has dragged you aside to take your medicine

13. All the following types of retinal cells are in the indirect path sending information out of the eye EXCEPT:

- a) amacrine
- b) bipolar
- c) ganglion
- d) horizontal

14. The most common type of retinal ganglion cell is

- a) konio
- b) magno
- c) parvo
- d) dunno

15. In Neuro 1 lecture one day we conduct a new demonstration in which “super seeing sauce” is injected into one layer of your left LGN. The effect of the injection is that you temporarily have super color vision in the right eye. You infer that the sauce was injected into which layer of the left LGN?

- a) 1
- b) 2
- c) 3
- d) 4

16. Which layer of primary visual cortex sends the greatest number of axons projecting to other areas of visual cortex?

- a) 1
- b) 2
- c) 4c
- d) 5
- e) 6

17. In which later of primary visual cortex is there the highest percentage of neurons with monocular receptive fields?

- a) 1
- b) 2
- c) 4c
- d) 5
- e) 6

2010-3

22. If you could remove your LGN and the direct inputs and outputs with a razor-sharp ice-cream scoop (not recommended), you would sever axons in:
- a) optic nerve
 - b) optic radiation
 - c) optic tract
 - d) both the tract and the nerve
 - e) both the radiation and the tract
23. Which eye structure has the largest volume:
- a) aqueous humor
 - b) lens
 - c) iris
 - d) vitreous humor
24. Cataracts is a clouding a which eye structure:
- a) aqueous humor
 - b) lens
 - c) iris
 - d) vitreous humor
25. Phototransduction occurs where in photoreceptors:
- a) axons
 - b) dendrites
 - c) disks
 - d) somas
26. The resting potential of photoreceptor (adapted to whatever light is present) is closest to:
- a) - 65 mV
 - b) -30 mV
 - c) +30 mV
 - d) + 65 mV
27. The largest number of photoreceptors are:
- a) cones in the fovea
 - b) cones in the peripheral retina
 - c) rods in the fovea
 - d) rods in the peripheral retina
28. The most dorsal layer of the LGN has what kind of neurons:
- a) magno cells from the contralateral eye
 - b) magno cells from the ipsilateral eye
 - c) parvo cells from the contralateral eye
 - d) parvo cells from the ipsilateral eye

29. At what stage of visual processing are orientation-selective neurons first found:

- a) retina
- b) LGN
- c) primary visual cortex
- d) later visual cortex in the ventral stream

30. Cytochrome oxidase blobs in layers 2 and 3 have an unusually high concentration of neurons with which property:

- a) binocularity
- b) color sensitivity
- c) motion sensitivity
- d) orientation selectivity

31. Which layer of primary visual cortex sends feedback to the LGN:

- a) 1
- b) 2.
- c) 3
- d) 4
- e) 5
- f) 6

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22. All the following types of retinal neurons are in the Direct Path out of the eye EXCEPT:

- a) bipolar cells
- b) cones
- c) ganglion cells
- d) horizontal cells

23. A common disease in the elderly involving a selective loss of central vision is:

- a) cataract
- b) detached retina
- c) macular degeneration
- d) retinitis pigmentosa

24. Dark current in photoreceptors is a leakage of which ion:

- a) Ca^{++}
- b) Na^{+}
- c) K^{+}

25. The G-protein involved in phototransduction is:

- a) rhodopsin
- b) cGMP phosphodiesterase
- c) retinal
- d) transducin

26. In response to light in the center of its receptive field, an ON-center bipolar cell will:

- a) depolarize
- b) hyperpolarize
- c) depolarize AND fire more action potentials
- d) hyperpolarize AND fire fewer action potentials

27. Which type of retinal ganglion cell is most common:

- a) magno
- b) parvo
- c) non-M non-P

28. A tiny horse named Peter somehow gets inside your brain and jumps on top of the LGN (i.e. on top of layer 6) on the left side of your brain. You might experience a slight disruption of vision in:

- a) magno vision with the left eye
- b) magno vision with the right eye
- c) parvo vision with the left eye
- d) parvo vision with the right eye

29. Peter gets spooked when you squeal at the LGN shenanigans and he retreats all the way back to primary visual cortex in your occipital lobe. He bumps his head into layer 6 temporarily stopping neural activity there. This most directly interferes with:

- a) visual input to your superior colliculus that guides eye movements
- b) feedback to your LGN
- c) output from V1 to other parts of the brain involved in seeing motion
- d) output from V1 to other parts of the brain involved in seeing color

30. What distinguishes neurons in V1 cytochrome oxidase blobs from neurons in surrounding cortex is that:

- a) the blobs have a higher concentration of direction-selective cells
- b) blob cells are more binocular
- c) blob cells are more metabolically active
- d) blob cells have almost exclusively simple receptive fields