1. Which of the following statements about the eye is **FALSE**:
   A. aqueous humor is produced by the secretory retina
   B. relaxation of the ciliary muscle causes the lens to flatten (become less convex)
   C. convergence in the pathway increases the retina's sensitivity to light
   D. an increase in the pressure of aqueous humor causes glaucoma
   E. the optic disc contains only cones and has the highest visual acuity

2. Information from the lower nasal retina of the right eye would be found in all the following locations **EXCEPT** the:
   A. right optic tract
   B. right optic nerve
   C. left loop of Meyer
   D. left temporal lobe
   E. left lingual gyrus

3. On examination, you find that a patient's eyes have the position at rest shown on the right. This is most likely due to a lesion of:
   A. Right cranial nerve VI nucleus
   B. Left cranial nerve VI nucleus
   C. MLF
   D. Left cranial nerve III
   E. Right cranial nerve III

4. The accommodation reflex would be affected by damage to which of the following structures:
   A. left and right occipital cortex
   B. right cranial nerve III
   C. right Edinger Westfall nucleus
   D. A, B and C
   E. B and C

5. Horner's syndrome would be caused by damage to which of the following structures:
   A. Edinger-Westfall nucleus
   B. trigeminothalamic fibers
   C. reticulospinal fibers
   D. cranial nerve III
   E. Medial Longitudinal Fasciculus

6. A patient has a large left pupil that does not respond to light shone into either eye although the right pupil does respond. This could be caused by damage to the:
   A. left optic nerve
   B. left cranial nerve III
   C. right cranial nerve III
   D. left pretectal nucleus
   E. left intermediolateral cell column
7. Which of the following statements is **FALSE** about the pathway that controls voluntary conjugate lateral gaze of the eyes:
   A. eye movement is triggered by activity in the frontal lobe
   B. internuclear ophthalmoplegia is caused by a lesion in this pathway
   C. stimulation of the frontal eye fields on one side causes deviation of the eyes to the opposite side
   D. a lesion of the MLF does not effect this movement
   E. the paramedian pontine reticular formation influences the nuclei of CN VI and III

8. Voluntary movement of your eyes to look from one stationary object to another in your visual field is known as:
   A. saccade
   B. smooth pursuit
   C. vergence
   D. nystagmus
   E. tracking movement

9. Smooth pursuit movements can be generated:
   A. by irrigating one ear with warm or cold water
   B. by looking from point to point in a stationary environment
   C. only in response to a moving target
   D. by rotation of the head
   E. all of the above

10. Choose the best answer concerning the retina.
    A. When light strikes a rod photoreceptor, rhodopsin binds to sodium channels in the outer segment membrane.
    B. Cone photoreceptors fire action potentials under conditions of bright light.
    C. Ganglion cells with transient responses are common in the retinal periphery.
    D. The transmitter released at photoreceptor synapses is cGMP.
    E. Both A and B are true

11. Choose the best answer concerning the visual system.
    A. Cells in layers 2, 3, 5, and 6 of the lateral geniculate nucleus respond best to straight lines rather than to spots of light or dark.
    B. Some cells in layer 4 of striate cortex are directionally-selective.
    C. A lesion of parietal cortex will lead to selective loss of ability to recognize faces while leaving the ability to detect the motion of objects intact.
    D. Cells of one column in the striate cortex have the same orientation selectivity.
    E. Both A and B are true

12. Choose the best answer concerning the normal development of the visual system.
    A. In a fetus, about once a minute, all ganglion cells in one eye will fire simultaneously.
    B. NMDA receptors may help to stabilize appropriate connections by triggering calcium influx into cortical cell dendrites.
    C. On the day of birth, the striate cortex on the left side of the brain receives axonal projections from the lateral geniculate nuclei on both sides of the brain.
D. Segregation of left-eye and right-eye inputs to layer 4 of the cortex begins about 1 month after birth.
E. Both A and B are true

13. Select the best answer concerning the effects of a severe cataract in the left eye of a newborn:
A. If the cataract is not removed, axons from some layers of the lateral geniculate will develop smaller arbors than axons from the other layers of the lateral geniculate.
B. If the cataract is not removed, most, but not all, of the cells in the striate cortex will become unresponsive to the left eye.
C. If the cataract is not removed, inhibitory circuits and NMDA receptors will fail to develop in the left eye's ocular dominance columns.
D. Early unilateral cataract disrupts binocularity by preventing any geniculocortical axons from synapsing in layer 4.
E. Both A and B are true.

1. E
2. A
3. E
4. D
5. C
6. B
7. D
8. A
9. C
10. C
11. D
12. B
13. E
29-32. The diagram on the right shows the **VISUAL FIELDS** for the left and right eyes. 1) Shade in the appropriate areas of the visual fields in the right column that correspond to the lesion named in the left column. 2) In the spaces provided in the left column indicate **ONE** place in the visual pathway where a lesion would produce that deficit. **Be sure to indicate the side of the lesion.** (2 points ea)

### Name: Bitemporal Hemianopsia

29. Location: ____________________________

### Name: Left Contralateral Homonymous Hemianopsia

30. Location: ____________________________

### Name: Right Upper Homonymous Quadrantanopsia

31. Location: ____________________________

### Name: Right Contralateral Homonymous Hemianopsia with Macular Sparing

32. Location: ____________________________
1. Neurons in the vestibular ganglion synapse directly on all of the following EXCEPT:
   A. hair cells of the macula
   B. vestibular nuclei
   C. flocculus and nodulus
   D. hair cells of the semicircular canals
   E. ventral horn motoneurons

2. Choose the best answer concerning the auditory system.
   A. A loud tone of 300 Hz depolarizes more hair cells than does a quiet tone of 300 Hz.
   B. Current cochlear prostheses detect the depolarization of the hair cells and transmit that information to electrodes implanted in the cochlear nucleus.
   C. Some inner hair cells are rapidly adapting whereas other inner hair cells are slowly adapting.
   D. Calcification of the basilar membrane is a common cause of hearing loss.
   E. Both A and B are true.

3. Choose the best answer concerning the auditory system.
   A. The characteristic amplitude of a cell in the eighth nerve is the size of its response to appropriate frequencies.
   B. A sound of 250,000 Hz will excite some cells in the cochlear nucleus and will inhibit others.
   C. Both sides of the brain contain some cells that fire when a tone of 2000 Hz is presented.
   D. A lesion in the primary auditory cortex on the right side of the brain will make it more difficult to localize the origin of sound coming from the right side.
   E. Both A and B are true.

4. Choose the best answer concerning the vestibular system:
   A. One of the functions of perilymph is to help bend hair bundles of the semicircular canals during head rotation.
   B. When the head is tilted to the left, some eighth nerve axons in the utricle will fire more slowly than when the head is upright.
   C. Bending the hair bundle generates an action potential in the hair cell.
   D. First-order axons from the semicircular canals always fire action potentials while the head is rotating.
   E. Both A and B are true.

5. Choose the best answer concerning the vestibular system:
   A. Ions such as potassium in the endolymph enter hair cells through mechanoreceptor-type channels in the stereocilia.
   B. The firing rate of CN VIII axons from the utricle signals both the direction and magnitude of tilt.
   C. Cells in the vestibular nuclei on the left side of the brainstem respond to head motion only to the left and not to the right.
   D. Adjacent stereocilia in a hair bundle move independently of one another.
   E. Both A and B are true.

6. Which of the following statements about the vestibular apparatus is FALSE:
A. vestibular hair cells contain a kinocilium at their apical ends
B. in the crista ampullares, stereocilia project into the otolithic membrane
C. the membranous labyrinth is filled with endolymph
D. the cupula is important in transduction of angular rotation of the head
E. hair cells are innervated by bipolar neurons

7. Which is of the following is FALSE about muscles and motoneurons:
   A. for muscles used in fine control, motor unit size is typically small.
   B. S fibers are most resistant to fatigue.
   C. when a muscle contracts, the smallest motor units are recruited last.
   D. the smallest motor units innervate S muscle fibers.
   E. larger motoneurons innervate more muscle fibers than smaller motoneurons.

8. A lesion of the lateral lemniscus on the left side of the rostral pons would result in:
   A. loss of tactile sensation on the right side of the body
   B. loss of hearing on the right side
   C. loss of hearing on the left side
   D. paralysis of the body on the right side
   E. little or no deficit

9. In a patient that cut off the index and middle fingers in an accident, which of the following
cortical changes would NOT be expected after 1 year:
   A. the cortical area for the thumb would increase in size.
   B. cortical neurons in the original area for the thumb would show activity.
   C. the size of receptive fields of cortical cells for areas on the thumb would be larger
   D. the cortical area of the "ring" finger would increase in size.
   E.

10. Which of the following statements about muscles and their innervation is FALSE:
    A. alpha and gamma motoneurons are both located in lamina IX of the spinal cord.
    B. intrafusal fibers are innervated by alpha motoneurons
    C. the main function of muscle spindles is to detect changes in muscle length.
    D. most spindles contain both nuclear chain and nuclear bag fibers
    E. during movement, alpha and gamma motoneurons are co-activated.

11. Which of the following statements about muscle tone is FALSE:
    A. the corticospinal tract normally suppresses muscle tone.
    B. muscle tone is due primarily to the stretch reflex.
    C. basal ganglia disease is associated with an increase in muscle tone.
    D. immediately after spinal cord transection, muscle tone is decreased.
    E. muscle tone is defined as the resistance to passive stretch.

12. Lesions of motor cortex, area 4, typically result in a number of symptoms including paralysis
    and changes in arm posture such that the arm is flexed at the elbow, wrist and fingers, which is
    a sign of decorticate rigidity. This arm posture primarily is due to:
    A. activity in the rubrospinal tract
    B. activity in the reticulospinal tract
    C. loss of reticulospinal inhibitory effects
D. activity of the vestibulospinal tracts
E. loss of corticospinal inhibitory effects

13. Which of the following statements about the cerebellar cortex is TRUE:
   A. it has 4 layers
   B. mossy fibers and climbing fibers are inhibitory.
   C. climbing fibers arise from cell bodies in the vestibular nuclei.
   D. parallel fibers mediate the major inhibitory input to cerebellar cortex.
   E. purkinje cells inhibit cells of the deep cerebellar nuclei.

14. Primary sensory fibers from the medial geniculate nucleus terminate in cortical layer:
   A. II
   B. III
   C. IV
   D. V
   E. VI

15. The axons of the corpus callosum arise from which type of cortical neuron:
   A. granule
   B. pyramidal
   C. golgi type I
   D. purkinje
   E. horizontal

16. Damage to the right motor cortex would cause weakness/paralysis of:
   A. right jaw muscles
   B. left jaw muscles
   C. closing the right eye
   D. closing the left eye
   E. none of the above

17. Which part of the cerebellum is correctly matched with its deep nucleus for cerebellar output:
   A. intermediate zone : fastigial
   B. vermis : interpositus
   C. lateral hemisphere : dentate
   D. nodulus : fastigial
   E. flocculus : dentate

18. Damage to the inferior lateral area of the frontal lobe as shown in the picture would result in which of the following:
   A. Broca's aphasia
   B. Wernicke's aphasia
   C. prosopagnosia
   D. astereognosis
   E. neglect

19. Which of the following statements about apraxia is FALSE:
   A. it can occur with lesions in the parietal lobe
B. it is a disorder in the execution of skilled movements  
C. it can occur with lesions in the supplementary motor area  
D. it is frequently associated with paralysis  
E. it is usually not associated with sensory impairment

20. A 39 year-old baseball player noticed the abrupt onset of involuntary movements on his right side. His right arm would make large, violent, flailing or ballistic movements that interfered with his game. The most likely site of the damage was the:
   A. left substantia nigra  
   B. left globus pallidus  
   C. right globus pallidus  
   D. left subthalamic nucleus  
   E. right subthalamic nucleus

21. Which of the following are examples of upper motor neurons:
   A. corticospinal tract  
   B. cerebellum  
   C. lateral vestibulospinal tract  
   D. all of the above  
   E. A and C

22. The basal ganglia and cerebellum are similar in that both:
   A. send axons to the spinal cord  
   B. influence the supplementary motor area  
   C. influence cerebral cortex on the side opposite to their location  
   D. use ventral lateral nucleus of thalamus as a relay  
   E. receive sensory information from the spinal cord

23. Sensory information travelling from the leg to the cerebellum is carried by all of the following structures EXCEPT:
   A. nucleus dorsalis  
   B. lateral cuneate nucleus  
   C. dorsal spinocerebellar tract  
   D. fasciculus gracilis  
   E. inferior cerebellar peduncle

24. Which of the following statements about GPi (Globus Pallidus internal segment) is FALSE:
   A. it sends axons to the ventral lateral nucleus.  
   B. axons from the subthalamic nucleus excite it.  
   C. its axons excite cells of the ventral lateral nucleus  
   D. its axons travel in the thalamic fasciculus  
   E. axons from the putamen synapse on it.

25. Symptoms of cerebellar disease include all of the following EXCEPT:
   A. bradykinesia  
   B. intention tremor  
   C. decreased muscle tone  
   D. ataxia
E. dysmetria

29. Using the diagram below, draw the spinocerebellar **output** circuit involved in the adjustment of **DISTAL** movement. Start at the cerebellar cortex and show how it controls other motor components. You do not need to show sensory pathways to the spinocerebellum. Clearly indicate each neuron in the pathway with a cell body, axon, and terminal **at the appropriate levels, places, and sides** of the nervous system and label each location beginning with the area of cerebellar cortex. **DRAW NEATLY IF YOU WANT FULL CREDIT.** (6 points).
1. E
2. A
3. C
4. B
5. E
6. B
7. C
8. E
9. C
10. B
11. A
12. A
13. E
14. C
15. B
16. E
17. C
18. A
19. D
20. D
21. E
22. D
23. B
24. C
25. A