I. Brain Section (12 points)

Circle the level of the section: spinal cord medulla pons midbrain

Circle what is stained: cells axons

Name the labelled structures or features in the figure.

A. red nucleus
B. MLF (a tract)
C. cerebral aqueduct
D. superior colliculus
E. periaqueductal grey
F. medial lemniscus (a tract)
G. brainstem \( (\text{cerebral peduncle}) \)
H. interpeduncular fossa
J. III (cranial nerve)
K. substantia nigra

\[ \text{Diagram Image} \]
II. Place the ONE letter from the figure next to the function or phenomenon associated with the structure indicated. Each letter may be used once, more than once, or not at all. (15 points)

**E** Corticospinal (pyramidal) tract decussates here. (Image: Lower part of figure)

**E** Transection of this nerve would cause ipsilateral ptosis (among other things)

**G** Nerve with motor nucleus at level of inferior colliculus

**A** Nerve innervating tensor tympani muscle (among other things)

**A** Lesion here would paralyze or weaken the face, arm and leg on the left

**L** Lesion here would paralyze or weaken arm and leg on the right, but not the face

**H** Nerve innervating the lateral rectus muscle

**F** Nerve containing fibers that innervate the sphincter pupillae muscle

**J** Transection of this nerve would interrupt the olivocochlear bundle

**K** Transection of this nerve would cause atrophy of ipsilateral tongue musculature

**M** Motor fibers in this nerve enter the skull via the foramen magnum

**B** Nerve carrying afferent limb of the corneal reflex

**D** Inferior olivary nucleus lies beneath surface here.

**C** Transection of this nerve would prevent closure of the ipsilateral eye

**F** Transection of this nerve would eliminate pupillary constriction in the left eye

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Right

Left

A  B  C  D  E  F'  G  H  J  K  L  M

Semi-
III. Brain section. (15 points)

Plane of section (circle correct answer):  Horizontal  
Coronal  
Sagittal

What is stained (circle correct answer):  Cells
Axons (fibers)

In the space provided, write the name of the labeled structure or feature next to the letter corresponding to its label.

A.  Corpus callosum
B.  internal capsule
C.  putamen
D.  globus pallidus (extern)
E.  globus pallidus (int 
F.  3rd ventricle
G.  claustrum

H.  caudate
J.  fornix
K.  hippocampus * (medial wall of lateral ventricle)
L.  mammillary body
M.  amygdal
N.  thalamus
IV. MULTIPLE CHOICE. Circle ALL correct answers or completions. There may be one, more than one or no correct completion for a given question. (75 points)

1. The cerebro-spinal fluid
   A. is produced by the cerebral aqueduct
   B. fills the epidural space
   C. exits the lateral ventricles via the foramina of Monro
   D. exits the fourth ventricle via the arterial villi or granulations
   E. drains ultimately into the venous system

2. The middle cerebral artery
   A. if occluded, may cause visual disturbances
   B. normally receives most of its blood from the basilar artery
   C. provides the main blood supply to the lateral surface of the cerebral hemisphere
   D. supplies the main blood supply to the foot area of the SI, the somatic sensory cortex
   E. supplies corticospinal fibers at some point in their course

3. The basilar artery
   A. lies next to the ventral surface of the medulla
   B. is formed from the fusion of the two vertebral arteries
   C. supplies corticospinal fibers at some point in their course
   D. supplies blood to the superior cerebellar arteries
   E. when occluded may lead to visual disturbances

4. Position sense in the left arm and leg could be impaired following damage restricted to the
   A. left half of the spinal cord at C2
   B. anterior half of the spinal cord at C2
   C. left half of the medulla at the ponto-medullary junction
   D. right cerebral peduncle
   E. internal capsule on the right

5. Two-point discrimination testing on the skin yields the best acuities (smallest separations)
   A. where the innervation density of the skin is highest
   B. where the receptive fields of cutaneous fibers are the largest
   C. in areas with the greatest magnification in the somatotopic map on the post-central gyrus
   D. when only Group IV (C) fibers are activated
   E. on the back of the hand and foot

6. Stereognosis (i.e. the ability to recognize 3-dimensional objects simply by handling them)
   A. utilizes information from muscle receptors
   B. is disturbed by lesions of the parietal lobe
   C. may be accompanied by constructional apraxia in some patients
   D. may be defective if the dorsal columns are involved by disease
   E. depends entirely on joint receptors
7. Sensory axons of group IV (C)
   - Synapse in the dorsal horn of the spinal cord and spinal nucleus of cranial nerve V
   - Conduct impulses responsible for the fast component of pain
   - May be found in the anterior white commissure of the spinal cord
   - Carry information that reaches the reticular formation and intralaminar thalamic nuclei
   - Have endings in the viscera

8. Active reduction of ascending pain signals in the central nervous system
   - Involves a "gating" mechanism in the dorsal horn of the spinal cord
   - Is mediated by axons descending in the dorsolateral columns
   - Can be induced artificially by stimulation of the peri-aqueductal gray matter
   - Depends normally on the actions of endogenous opioid compounds
   - May be triggered by the ascending pain signals themselves (i.e., feedback)

9. A bitemporal hemianopia
   - May result from damage restricted to the left optic tract
   - May result from damage to the midline of the optic chiasm
   - Would eliminate the pupillary response to light shone in either eye
   - Can result from occlusion of the either posterior cerebral artery
   - May indicate the presence of a pituitary tumor

10. Contributing to the high spatial acuity of foveal vision is/are
    - The high concentration of cone photoreceptors in the fovea
    - The absence of retinal vessels in front of the central fovea
    - Increased thickness of the retina in the fovea due to the high concentration of ganglion cells
    - The fact that the fovea has no pigment epithelium
    - The relatively large magnification of the foveal representation in the striate cortex

11. Retinal detachment
    - Creates a space between the pigment epithelium and the choroid
    - Results in cessation of shedding of outer segment discs into the pigment epithelium
    - Prevents regeneration of photopigment in the photoreceptors
    - Decreases the retinal-ganglion cell and nerve fiber layers of their blood supply
    - Results in complete hyperpolarization of the photoreceptors

12. Which of the following is/are true of a hyperope (hypermetropia)?
    - The eye's optics form the image of a distant object in front of the retina
    - The ciliary muscle must contract to focus the images of objects located at any distance from the subject
    - The appropriate corrective lens for this condition magnifies images closer
    - Viewing through a pinhole will improve image quality
    - The lens cannot accommodate because it is too stiff
13. A patient presents with ptosis on the right upper eyelid and a difference in size of the right and left pupils.
   [a] The ptosis could be due to weakness of the levator palpebrae superioris or Müller's muscle
   [b] The patient has Horner's syndrome if the left pupil is larger than the right
   [c] The patient has a IIIrd nerve palsy if the left pupil is smaller than the right
   [d] A brainstem lesion can be excluded in this patient
   [e] The ptosis may be due to damage to the facial nerve

14. A large lesion of the right temporal lobe
   [a] may produce unilateral deafness in the left ear
   [b] could be accompanied by a left superior quadrantanopia
   [c] would decrease the patient's ability to localize sounds in space
   [d] may result from occlusion of the right middle cerebral artery
       can produce spontaneous otoacoustic emissions

15. The olfactory system resembles the gustatory system in that
   [a] receptor cells in both systems are periodically replaced throughout life
   [b] neither system has a relay nucleus in the thalamus
   [c] damage to either may result in a complaint of impaired taste by a patient
   [d] both systems respond exclusively to a single chemical substance.

V. Circle the T if the statement is TRUE, the F is the statement is FALSE. (8 points)
   T F Traveling waves on the basilar membrane move from the stapedial (basal) to the helicotrema (apical) end (and back)
   T F Bone conducted sound is louder in an ear affected by nerve deafness than in the contralateral, normal ear.
   T F The stria vascularis is a blood vessel located inside the organ of Corti.
   T F The medial geniculate nucleus is a synaptic relay station in the ascending auditory pathway.
   T F Tonotopic maps may be found in certain nuclei of the medulla, pons and midbrain
   T F Damage to the outer hair cells of the organ of Corti on one side will make sounds seem louder in that ear.
   T F Damage to the organ of Corti in the basal turn of the cochlea would affect predominantly sensitivity of high frequency sounds.
   T F The acoustic reflex involves cranial nerves V, VII and VIII.

* Assuming that "damage" means the OHCs are no longer functioning in cell. Sometimes damage can result in spontaneous activity or extra sound - tinnitus.