1. Brain Section (10 points)

Name the labelled structures, features or regions in the figure.

A. inferior cerebellar peduncle
B. medial lemniscus
C. olivary nucleus
D. pyramid
E. [Blank]
F. vagus (X) nerve
G. reticular formation
H. solitary tract nucleus
J. [Blank]
K. medial longitudinal fasciculus
II. Name the labelled structures, features or regions in the figure. (10 points)

A. Lateral Ventricle
B. fornix
C. insula
D. claustrum
E. third ventricle
F. uncus
G. globus pallidus
H. putamen
J. internal capsule
K. thalamus caudate
III. In the space provided place the number or name of the cranial nerve whose dysfunction would produce the clinical finding. Indicate which side is affected. (20 points) [o.d. = right eye, o.s. = left eye]

<table>
<thead>
<tr>
<th>Side</th>
<th>Nerve</th>
<th>Clinical Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lt</td>
<td>VII</td>
<td>Inability to close the left eye voluntarily</td>
</tr>
<tr>
<td>Rt</td>
<td>IX</td>
<td>Hyracusis in right ear (two possibilities, either will do)</td>
</tr>
<tr>
<td>Lt</td>
<td>III</td>
<td>Hoarseness and drooping of soft palate on the right</td>
</tr>
<tr>
<td>Lt</td>
<td>III</td>
<td>Ptosis and mydriasis, o.d.</td>
</tr>
<tr>
<td>Lt</td>
<td>VII</td>
<td>Illuminate either eye, pupil of o.d. but not o.s. constricts</td>
</tr>
<tr>
<td>Lt</td>
<td>XI</td>
<td>Neither pupil constricts when o.s. illuminated, both pupils constrict when o.d. illuminated.</td>
</tr>
<tr>
<td>Rt</td>
<td>XI</td>
<td>Touch left cornea, neither eye blinks; touch right cornea, both eyes blink</td>
</tr>
<tr>
<td>Rt</td>
<td>XII</td>
<td>Touch left cornea, only right eye blinks; touch right cornea, only right eye blinks</td>
</tr>
<tr>
<td>Lt</td>
<td>XII</td>
<td>Inability to rotate head to left against moderate resistance</td>
</tr>
<tr>
<td>Rt</td>
<td>XII</td>
<td>Tongue deviates to right on protrusion</td>
</tr>
</tbody>
</table>

IV. True or False. Circle the T if the statement is true, the F is the statement if false. (10 points)

- T F The pineal gland lies just dorsal to the superior colliculus.
- T F Two large bundles of myelinated fibers visible in many MRI images of the brain are the corpus callosum and the internal capsule.
- T F Nuclei of the somatic motor column of the brainstem include the oculomotor, trochlear, abducens and hypoglossal nuclei.
- T F The red nucleus lies in the tegment of the midbrain.
- T F As it exits the interpeduncular fossa cranial nerve III passes between the posterior cerebral and superior cerebellar arteries.
- T F The nucleus ambiguous is composed of preganglionic parasympathetic neurons.
- T F The basilar artery lies on the ventral surface of the pons.
- T F Hydrocephalus can result from extensive destruction of the arachnoid granulations.
- T F Cerebrospinal fluid leaves the subarachnoid space through the foramen of Monro.
- T F A tumor on the falx cerebri could produce symptoms in both feet.

Press against motor cortex from both lobes if "destruction" means blocking of arachnoid granulations.
V. MULTIPLE CHOICE. Circle the letter next to EVERY correct answer or completion. There may be one, more than one or no correct answer for each item. (95 points. 1 point off for each incorrect letter circled and each correct letter not circled. Think of these as multiple true/false questions)

1. The middle cerebral artery
   a. is part of the posterior (vertebro-basilar) circulation
   b. is connected to the anterior cerebral artery by the anterior communicating artery
   c. provides the main blood supply to the inferior surface of the temporal lobe
   d. provides the main blood supply to the hand area of the somatic sensory cortex
   e. provides the main blood supply to the midbrain

2. Access of arterial blood to the left optic radiation would be impaired by disease of the
   a. anterior cerebral artery
   b. basilar artery
   c. right vertebral artery
   d. posterior inferior cerebellar artery
   e. left middle cerebral artery

3. Clinical signs and symptoms caused by complete transection of the left half of the spinal cord at T12 would include
   a. loss of pain and temperature sensation in the right leg
   b. loss of pain and temperature sensation in the right arm
   c. loss of position sense in the left leg
   d. loss of discriminative touch sensation on the left leg
   e. Horner's syndrome on the left

4. Group II (A-beta) axons with terminals in the skin
   a. synapse first in the dorsal root ganglia
   b. mediate temperature and pain sensations
   c. transmit information that eventually travels in the dorsal columns of the spinal cord
   d. on the left side of the body synapse on the left side of the medulla
   e. terminate in the periphery as free nerve endings

5. Axons in the medial lemniscus representing the left arm
   a. have their cell bodies in the left cuneate nucleus (nucleus cuneatus) of the medulla
   b. synapse on thalamic neurons that project to the post-central gyrus on the lateral surface of the cerebral hemisphere
   c. decussate in the pons
   d. carry signals necessary for conscious perception of joint position (among other things)
   e. travel in the pyramidal tract on the left

my answers: a, c, d
6. Trigeminal nuclei of the brainstem:

a. include one that is analogous to the dorsal root ganglion.

b. include one that is analogous to the substantia gelatinosa of the spinal cord.

c. are all located in the pons where the Vth nerve enters the CNS.

d. send their axons to the contralateral ventral posterior medial thalamic nucleus (among others).

e. receive synaptic input from axons innervating the dura and intracranial blood vessels.

7. Cutaneous spatial resolution (two-point discrimination):

a. of high acuity is mediated by group III and group IV afferents.

b. is best where the innervation density of the skin is highest.

c. is best in regions with exaggerated representation in the somatic sensory cortex.

d. is best where the receptive fields of the primary afferents don’t overlap.

e. is better on the forehead than the lips.

8. Pain caused by injury to the right foot:

a. results in release of Substance P in the dorsal horn of the spinal cord.

b. triggers axon reflexes that cause the local release of vasoactive substances.

c. can be ameliorated by stimulation of the periaqueductal gray matter.

d. can result in hyperalgesia at uninjured sites around the injury.

e. causes increased activity in the intralaminar thalamic nuclei on the left.

9. Transection of the anterior white commissure at the 6th thoracic segment would:

a. eliminate pain sensation from the trunk and both legs.

b. produce bilateral loss of pain and temperature limited to a band of skin circling the thorax.

c. damage axons whose cell bodies are in the dorsal root ganglia. (Answers: b, d)

d. cause degeneration of some axons in the anterolateral columns.

e. eliminate vibration sense in both legs.

10. Astereognosis (impaired ability to identify unseen three-dimensional objects by handling them):

a. is also called Romberg’s sign.

b. can occur in the left hand if there is damage to the right posterior parietal cortex that spares S1.

c. is tested by double simultaneous (bilateral) stimulation.

d. may be accompanied by constructional apraxia and the hemineglect syndrome.

e. can be blocked by Naloxone.

11. Depolarization of inner hair cells in the organ of Corti:

a. occurs when the cilia are bent in any direction.

b. require that there be a large concentration gradient of potassium across the membrane of the cilia (hairst) of the hair-cells.

c. increases in magnitude as displacement of the basilar membrane grows in amplitude.

d. may result from abnormal activity of the outer hair cells in the absence of sound stimulation.

e. activates more 8th nerve afferents than does an equivalent depolarization of outer hair cells.
12. Axons of the auditory division of the 8th cranial nerve
   a. can encode low sound frequencies as synchronized volleys of action potentials
   b. terminate in the cochlear nuclei of the medulla
   c. discharge at rates corresponding exactly to the frequency of audible sounds
   d. have their cell bodies in the spiral ganglion
   e. each respond to only one frequency of audible sound

13. Decreased sensitivity to sound in the left ear might result from damage to the
   a. olivocochlear bundle on the left
   b. primary auditory cortex (Heschl's gyrus) on the right
   c. facial nerve on the left
   d. trigeminal nerve on the left
   e. inferior colliculus on the left

14. Perception of food qualities may be impaired if there is damage to cranial nerves
   a. I
   b. V ➔ can't sense texture of food
   c. VII
   d. IX
   e. XI

15. Primary olfactory neurons
   a. have their cell bodies in the olfactory bulbs
   b. generate action potentials
   c. express only one of a thousand possible receptor proteins in their cilia
   d. respond to the odor of only one chemical substance
   e. die and are replaced

16. Vertebrate photoreceptors
   a. hyperpolarize in response to light
   b. employ a form of Vitamin A as the chromophore of their photopigments
   c. depend entirely on the central retinal artery for their oxygen supply
   d. synapse directly on ganglion cells
   e. exhibit different spectral sensitivities when the opsins components of their photopigments differ

17. Which of the following is/are true of a myope?
   a. with accommodation paralyzed, the eye's optics form the image of a distant object in front of the retina
   b. when viewing a distant object the ciliary muscle must contract harder than that of a hyperope (hypermetropes)
   c. the appropriate corrective lens for this condition diverges light rays
   d. viewing through a pinhole will improve image quality
   e. may need a toric corrective lens if there is astigmatism
18. Complete transection (interference) of the right optic tract would
a. result in a left homonymous hemianopia
b. eliminate the consensual pupillary response to light shone in the left eye
c. cause degeneration of nerve terminals in the lateral geniculate nucleus and pretectum on the right
d. interrupt fibers from the nasal retina of the left eye and the temporal retina of the right eye
e. interrupt preganglionic parasympathetic fibers to the ciliary muscle.

19. Consequences of retinal detachment include
a. anomalous trichromacy
b. failure of photopigment regeneration
c. interruption of outer-segment disc shedding by photoreceptors
d. disappearance of the membrane potential of the photoreceptors → hypoxia causes channels to be closed.
e. papilledema

VI. Circle T if the statement is TRUE, F is the statement of FALSE. (1 point each; 10 total)

T F Evaporation of the tear film is impeded by the presence of an oily layer next to the air.
T F Glaucoma is a condition in which the intraocular pressure is higher than normal.
T F Mydriasis is a component of the near response.
T F Lens transparency depends on the intracellular concentration of proteins called crystallins.
T F Stiffening of the lens with age is called presbyopia.
T F As pupil size increases, image quality is increasingly degraded. → one has to squint to sharpen image of distant star (but circle)
T F Both the ciliary and the ciliary body contain muscle with sphincter-like actions.
T F Aqueous humor passes from the posterior to the anterior chamber of the eye through Schlemm's canal.
T F Immersing the human eye in water creates a situation analogous to hyperopia (hypermetropia).
T F Increased intracranial pressure can produce cupping of the optic disc.