BN 260 FINAL EXAMINATION May 9 2002 (1.5 hours to complete) 8 Pages, 160 Points

1. In the space provided, place the ONE letter corresponding best to the structure described. If no structure fits the description, place an X. A letter may be used once, more than once, or not at all. (10 points)

   1. **B** Damage here would impair ADuction of one eye and ABduction of the other on lateral gaze.

   2. **F** Damage here would lead to contralateral hemiplegia

   3. **X** Damage here would cause atrophy of the tongue

   4. **A** Damage here would impair blinking ipsilaterally

   5. **X** Damage here would cause a contralateral loss of cutaneous pain and temperature sensation

   6. **D** These axons come in part from cells in the vestibular nuclei

   7. **X** These axons have their cell bodies in the globus pallidus, pars interna

   8. **F** These axons will decussate caudal to this section

   9. **E** These axons will all synapse in the cerebellar cortex

10. **X** These axons will synapse in the cerebral cortex

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**Diagram:**

- **A (axons)**
- **B (axons)**
- **C (cells)**
- **D (axons)**
- **E (axons)**
- **F (axons)**
- Corticospinal tract
- MLF
- abducens nucleus
- Internal cerebellar peduncle
- Middle cerebellar peduncle
II. Circle the T if the statement is True, the F is the statement if False. (20 points)

T F Homonymous hemianopia may occur with inadequate blood flow in either the anterior or the posterior cerebral circulation.
T F Right superior quadrantopia is more likely to accompany Wernicke’s aphasia than Broca’s aphasia.
T F In retinal detachment, the retina and pigment epithelium peel away from the sclera.
T F Elevated intraocular pressure can lead to papilledema. cupping of the disk
T F Depriving an eye of patterned stimulation early in life can lead to low acuity in that eye.
T F Remote cancers can provoke the formation of antibodies that kill certain retinal neurons.
T F “Afferent pupillary defect” is synonymous with absence of the consensual pupillary light reflex.
T F Diplopia can result from strabismus.
T F An anomalous trichromat can see only two colors instead of the normal three.
T F Activation of cells in the Edinger-Westphal nucleus would result in contraction of the ciliary muscle and sphincter pupillae.
T F Prosopagnosia is another name for amblyopia-ex-anopsia.
T F A mild parietal hemineglect syndrome is often revealed by double simultaneous stimulation.
T F A person with astereognosis cannot perceive depth in 3D movies.
T F Sensory ataxia, but not cerebellar ataxia, is made worse by having the patient close his or her eyes.
T F A patient may complain of pain arising from a region of skin devoid of sensory innervation.
T F Axon reflexes are responsible for referred pain.
T F Cutaneous spatial acuity is best where the skin’s innervation density is lowest.
T F Fast pain is mediated by C or Group IV afferent fibers.
T F Afferent signals from muscle spindles contribute to joint position sense.
T F A person who could never learn to ride a bicycle is said to have an apraxia.
III. MULTIPLE CHOICE. Circle ALL correct answers or completions. There may be one, more than one or no correct completion for a given question. (Think of these questions as multiple true-false; points are lost if a correct completion is not circled or an incorrect completion is circled.) (85 points)

1. Sensory receptors that do not generate action potentials include
   a. olfactory receptors
   b. taste receptors
   c. retinal rods
   d. hair cells of the crista ampullaris
   e. free nerve endings

2. Cranial nerves providing gustatory signals to the nucleus of the solitary tract include
   a. I
   b. VII
   c. IX
   d. X
   e. XII

3. Outer hair cells of the organ of Corti
   a. receive inhibitory synaptic input from the olivocochlear bundle
   b. produce the endocochlear potential
   c. outnumber inner hair cells
   d. are part of the mechanism of the cochlear amplifier
   e. can be killed by certain antibiotics

4. A patient is lying on his back and his head is tilted forward toward his chest by 30 degrees. You perform a caloric test and evoke horizontal nystagmus with the quick phase to the right. Which of the following statements would be true:
   a. cold water was squirted into the left ear canal OR warm water into the right ear canal
   b. the nerve from the left lateral semicircular canal is more active than the nerve from the right
   c. the nystagmus would be present in the right eye or the left eye but not both
   d. the test proves that there is a lesion of the brainstem
   e. if the patient were spun to the left while sitting upright on a stool and suddenly stopped after a few full rotations, an identical nystagmus would appear

5. Hair cells of the utricle
   a. respond to linear accelerations of the head
   b. contain calcium carbonate granules — hair cells themselves don’t contain endolymph above do
   c. are depolarized when the stereocilia bend toward the kinocilium
   d. have axons that synapse in Scarpa’s ganglion — are innervated by axons— but don’t themselves have axons
   e. are located in a space filled with cerebrospinal fluid

6. Axons of some cells of the vestibular nuclei make monosynaptic connections with cells of the
   a. contralateral vestibular nuclei
   b. spinal cord
   c. nucleus of cranial nerve VI
   d. deep cerebellar nuclei
   e. somatic sensory area of the cerebral cortex
7. Axons of internuclear neurons traveling in the right Medial Longitudinal Fasciculus increase their discharge rate
   a. during convergent eye movements
   b. during leftward saccadic eye movements
   c. during smooth pursuit of an object moving to the left
   d. during rightward quick phases of optokinetic nystagmus
   e. when the head rotates to the right, evoking the VOR

8. Oculomotor mechanisms designed to displace (as opposed to stabilize) images on the retina include
   a. the VOR
   b. optokinetic movements
   c. saccades
   d. physiological nystagmus
   e. smooth pursuit

9. Extraocular muscles that elevate the eye include the
   a. superior oblique
   b. inferior oblique
   c. superior tarsal muscle of Mueller
   d. superior rectus
   e. levator palpebrae superioris

10. Alpha-gamma co-activation
    a. is especially prominent when a muscle exhibits fibrillation
    b. insures that muscle spindles remain sensitive to stretch as the whole muscle shortens
    c. results from monosynaptic 1a input to gamma motor neurons
    d. permits the gamma loop to boost synaptic activation of alpha motor neurons
    e. would be eliminated by cutting the dorsal roots serving a muscle

11. The Golgi tendon organ
    a. is a force sensor
    b. can be activated by contraction of a few motor units
    c. transmits its signals to the CNS via Group II axons
    d. is an essential element of the flexor-crossed extensor reflex
    e. is mechanically in series with extrafusal muscle fibers

12. The left precentral gyrus (M1)
    a. has a representation of foot movements on its lateral-most aspect
    b. can exert control over the left frontalis and orbicularis oculi muscles
    c. contains some neurons that form direct, monosynaptic connections with alpha motor neurons
    d. plays no role in the production of speech
    e. receives most of its arterial blood via the basilar artery

13. For which of the following do axons from the first structure make monosynaptic contacts on cells of the second (arrowed) structure?
    a. Substantia nigra (pars compacta) ⇒ subthalamic nucleus
    b. thalamus ⇒ spinal cord
    c. posterior parietal cortex (areas 5 & 7) ⇒ primary motor cortex (area 4)
    d. raphé nuclei of the brainstem ⇒ frontal cortex
    e. inferior olivary nucleus ⇒ cerebellar cortex
14. Neurons in the dentate nucleus of the cerebellum

a. receive inhibitory synaptic input from the cerebellar cortex  
b. send axons to the VL nucleus of the thalamus  
c. send axons into the cerebello-spinal tract  
d. receive their major Purkinje cell input from the vestibulo-cerebellum  
e. have a stronger influence on movements of the hand than on movements of the trunk

15. Cerebellar lesions can cause

a. paresis and paralysis  
b. characteristic abnormalities in speaking and writing  
c. cog-wheel rigidity  
d. deficits in tactile sensitivity and joint position sense  
e. hypotonia

16. The basal ganglia

a. receive sensory input directly from the spinal cord  
b. exert their influence on sensory-motor cortex by inhibiting the VL nucleus of the thalamus  
c. are exclusively concerned with the control of body movement  
d. have a role in the initiation of voluntary movements  
e. are damaged if a patient exhibits disdiadokokinesis

17. Patients with Wernicke's aphasia characteristically

a. have impaired verbal but not written language skills  
b. produce paraphasias  
c. have good comprehension of spoken words despite their inability to produce intelligible speech  
d. have no trouble repeating words spoken to them  
e. have an acute awareness of their problem, which causes them great distress

IV. In the space provided, write a synonym for the word at the left. (1 point each)

Broca's aphasia: non-fluent aphasia

Wernicke's aphasia: fluent aphasia
V. Circle the T if the statement is True, the F if the statement is False.

T (F) Alexia without agraphia typically results from occlusion of the anterior cerebral artery

T (F) Pure word deafness is a type of aphasia

T (F) For most left-handed people, the right hemisphere is dominant for language

T (F) Paralysis of the tongue can cause aphasia.

T (F) The term ‘paradoxical sleep’ refers to the fact that sleep walkers appear to be awake.

T F Thermoregulatory mechanisms of the body are inactive during REM sleep.

T F An adult spends more time in Non-REM (SWS) than in REM sleep.

T F Alpha motor neurons are more strongly inhibited during Non-REM than REM sleep

T F Narcoleptics characteristically begin their sleep periods with an epoch of stage IV SWS.

T F Cataplexy, like narcolepsy, is a form of epilepsy.

T F Certain physiological responses during REM sleep can be used to assess impotence in males.

T F During REM sleep the EEG is isoelectric.

T F Narcoleptics tend to have higher levels of orexin/hypocretin in their brains than do normals.

CLINICAL CASES Your score parts VI and VII will be included in the overall exam score and will be used to evaluate Ability IX: Problem Solving (21 out of 30 points is a pass)

VI. Circle ALL correct answers or completions. There may be one, more than one or no correct completion for a given question.

1. Mrs. Jones is admitted to the hospital because of severe headaches, decreased hearing in her left ear and unsteady gait. The following neurological tests were abnormal:

   - she cannot close her left eye against force or show her teeth on the left
   - touching her right cornea causes the right eye to blink
   - when her left cornea is touched, neither eye blinks
   - a vibrating tuning fork held against her forehead sounds louder on the right than on the left

From these findings, taken together, you can conclude that Mrs. Jones has a condition affecting her

a. left middle ear
b. central nervous system
c. right facial nerve
d. left facial nerve
e. left trigeminal nerve
2. Joe Botz, age 75 is admitted to the hospital after fainting at home. He complains of intermittent diplopia. Neurological examination was normal except for the following:

- mydriasis and ptosis, O.S.
- Babinski sign on the right

From these observations and the history you can infer that he has

- a dissociated sensory loss
- a lesion in his midbrain
- a crossed syndrome
- a V1th nerve palsy
- occlusion of his middle cerebral artery

3. You examine a patient who has hoarseness, difficulty swallowing, loss of sensitivity to pinprick and temperature on the left side of her face and the right side of her body below the neck, but no deficit in touch or position sense.

This pattern of deficit is consistent with

- a lesion of the midbrain on the right
- a lesion of the medulla on the left
- a lesion of the cervical spinal cord on the left
- occlusion of a branch of the basilar artery
- occlusion of a branch of the vertebral artery - PICA

The same patient is likely to exhibit

- nystagmus
- aphasia
- tremor at rest
- homonymous hemianopia
- ptosis and miosis, O.S

VII. Answer the questions in the space provided. Please write legibly.

1. A 65 year-old woman was found unconscious and rushed to the hospital. Upon regaining consciousness, she was found to have the following neurological deficits:

- right spastic hemiplegia involving the lower part of her face
- Babinski sign on the right
- diminished sensitivity to touch and pinprick on the right side of the body, including the face
- loss of vision in the nasal field of her left eye and the temporal field of her right eye (4 points)
- slurring of speech and difficulty finding words - aphasia

List all evidence that points to damage to this lady’s central nervous system.

- spasticity
- Sign of Babinski
- aphasia
- homonymous hemianopia

Occlusion of which artery would be most likely to cause this clinical picture?

- Lt. middle cerebral artery
2. A 35 y/o male is admitted to the hospital complaining of weakness of his right arm and leg and difficulty speaking. Examination reveals a Babinski sign on the right and impaired position sense and two-point tactile sensation in the left arm and leg. His tongue deviates to the left on protrusion.

List the neural structures that have been involved by a pathological process in this patient?

- long motor tracts - especially corticospinal as indicated by sign of Babinski
- DCML system - by loss of position sense & touch
- XII nerve / on LT

Where and on which side is this process located?

Lesion is in LT medulla
DCML decussate here - so explains LT sided impairment.

I drew picture of RT sided lesion but I meant LT