BN 250 FINAL EXAMINATION  May 9, 2003  (8 pages, 150 total points)

I. Name the labeled structures or features in the figure below. (10 points)

A. CORPUS CALLOSUM
B. CAUDATE
C. INSULA
D. CLAUSTRUM
E. HIPPOCAMPUS
F. VERMIS (OF CEREBELLUM)
G. CEREBRAL AQUEDUCT (space)
H. GLOBUS PALLIDUS, PARS INTERNA
J. GLOBUS PALLIDUS, PARS EXTERNA
K. PUTAMEN
II. TRUE OR FALSE. Circle the T or the F if the statement is, respectively, true or false. (10 points)

T F Referred pain is mediated by axon reflexes in the nociceptive afferents.
T F The representation of the face in M1 is closer to Broca’s area than is the representation of the foot.
T F Papilledema causes abnormally high intracranial pressure.
T F Congenital cataract, if not removed early in life, can lead to amblyopia ex anopsia.
T F Destruction of the left auditory cortex produces deafness of the right ear.
T F Certain antibiotics cause hearing loss by killing outer hair cells of the organ of Corti.
T F Head trauma can result in anosmia.
T F An uncinate fit is a type of focal seizure.
T F Cranial nerve dysfunction is pathognomonic of damage to the central nervous system.
T F Bilateral Babinski signs need not be the result of damage to the spinal cord.

III. CRANIAL NERVES. In the space provided place the number [I-XII] or name of the cranial nerve whose dysfunction would produce the clinical finding. Indicate which side is affected. (16 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>L</td>
<td>VII</td>
<td>Inability to close the left eye</td>
</tr>
<tr>
<td>R</td>
<td>VII</td>
<td>Hyperacusis in the right ear (two possibilities, either will do)</td>
</tr>
<tr>
<td>L</td>
<td>X</td>
<td>Hoarseness and deviation of the uvula to the right</td>
</tr>
<tr>
<td>R</td>
<td>III</td>
<td>Ptosis and mydriasis, o.d.</td>
</tr>
<tr>
<td>H</td>
<td>III</td>
<td>Pupil constricts in o.d. but not o.s.</td>
</tr>
<tr>
<td>L</td>
<td>II</td>
<td>Illuminate either eye, pupil constricts in o.d. but not o.s.</td>
</tr>
<tr>
<td>L</td>
<td>V</td>
<td>Illuminate o.s., neither pupil constricts. Illuminate o.d., both pupils constrict.</td>
</tr>
<tr>
<td>R</td>
<td>X II</td>
<td>Touch the left cornea, neither eye blinks; touch the right cornea, both eyes blink</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tongue deviates to right on protrusion</td>
</tr>
</tbody>
</table>

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IV. MULTIPLE CHOICE. Circle the letter next to every correct answer or completion. **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. Hair cells in the ampullae of the semicircular canals

   a. are innervated by neurons located in the spiral ganglion
   b. are depolarized by appropriately directed linear accelerations of the head
   c. send their axons to the vestibular nuclei
   d. can be either excited or inhibited by the movement of endolymph
   e. have stereocilia bearing calcium carbonate crystals on their tips

2. A normal subject lies face up with his head tilted forward 30 degrees (neck flexed). When cold water is flushed into the left ear, nystagmus occurs and **CON** with head is moving **R**

   a. an optokinetic reflex is initiated
   b. the slow component adducts the right eye and abducts the left eye
   c. the quick component occurs only in the left eye.
   d. the right and left medial longitudinal fasciculi discharge in alternation
   e. endolymph moves toward the utricle through the ampulla of the left lateral semicircular canal

3. One motor unit may include

   a. both fast and slow muscle fibers
   b. alpha and gamma motor neurons
   c. one Renshaw cell
   d. muscle fibers in antagonist muscles
   e. fewer than 10 muscle fibers

4. The stretch or myotatic reflex **monosynaptic**

   a. is initiated by a burst of action potentials in Ib axons
   b. is one component of the flexor/crossed extensor reflex
   c. is graded in magnitude, depending on the amount of stretch
   d. cannot be elicited in a zero gravity environment, such as the space station
   e. elicited in one muscle is accompanied by reflex inhibition of antagonist muscles

5. Somatotopy is an observable feature of

   a. the ventral horn of the spinal cord
   b. Broca’s area
   c. gray matter but not white matter in the CNS
   d. the ventral posterior lateral (VPL) nucleus of the thalamus
   e. the nucleus of cranial nerve VII
6. When the right leg kicks a ball

- α. alpha motor neurons but not gamma motor neurons are activated in the right lumbar cord
- β. the right cerebellum coordinates the movement of the leg
- γ. activity in the ventromedial brainstem pathways declines on both sides
- δ. large motor units are recruited before small ones
- ε. signals traveling in the right medullary pyramid direct the kick

7. Spasticity in a limb is always accompanied by

- α. fibrillation in the affected muscles
- β. fasciculation in the affected muscles
- γ. profound atrophy of the affected muscles
- δ. cogwheel rigidity
- ε. complete paralysis of voluntary movement in the limb

8. Primary motor cortex (M1)

- α. receives inputs directly (i.e. monosynaptically) from neurons in the cerebellum
- β. sends axons directly to the thalamus, striatum, somatosensory cortex, pons, and corticospinal tract
- γ. has a somatotopic organization very similar to that of the primary somatosensory cortex
- δ. controls motor neurons exclusively on the contralateral side of the central nervous system
- ε. supplies all of the axons forming the medullary pyramids

9. The cerebellum

- α. receive its blood supply from the vertebrobasilar system
- β. contains no excitatory neurons
- γ. sends an inhibitory projection to the thalamus
- δ. has no direct (monosynaptic) projection to the spinal cord
- ε. is essential for conscious appreciation of limb position

10. Which of the following clinical signs occur following damage to the cerebellum?

- α. sign of Babinski
- β. pendular knee jerks
- γ. ataxia
- δ. Romberg’s sign
- ε. nystagmus - opsoclonus

11. The direct and indirect pathways of the basal ganglia

- α. employ GABA as a neurotransmitter at some synapses
- β. exert their effects on movement by modulating inhibition of the thalamus
- γ. both make synaptic connections in the subthalamic nucleus
- δ. send axons directly to the spinal cord
- ε. are modulated by activity of dopaminergic cells of the substantia nigra pars compacta
12. Forms of dyskinesia associated with basal ganglia disease include

- a. chorea
- b. athetosis
- c. clonus
- d. ballism
- e. dysdiadochokinesis

13. A retinal image positioned on the fovea would be moved away (displaced) by

- a. the VOR
- b. the quick phase of OKN
- c. a saccade
- d. the EOG
- e. smooth pursuit

14. Situations in which you might observe tonic conjugate deviation of a patient’s eyes would include

- a. bilateral internuclear ophthalmoplegia (MLF syndrome)
- b. Parinaud’s syndrome
- c. damage to the frontal eye field of the cerebral cortex on one side “eyes look at lesion”
- d. seizure activity (abnormal spontaneous neural discharge) in the occipital cortex on one side “eyes look away from lesion”
- e. caloric testing in a comatose patient

15. You just applied the Wada procedure to (i.e. injected Amytal into) the left carotid artery of a patient. Which of the following signs would you expect to observe immediately?

- a. right hemiplegia including the face
- b. long motor tract
- c. loss of pain and temperature sensitivity on the left side of the body
- d. deficit in sound localization
- e. right homonymous hemianopia
- f. alexia without agraphia
- g. splenium of corpus callosum

16. Nonfluent aphasia (Broca’s)

- a. usually occurs together with a right superior quadrantanopia
- b. affects speech but not writing
- c. affects expression more than comprehension
- d. can occur in some patients following right hemisphere damage
- e. is a form of pure word deafness

17. During REM sleep

- a. all alpha motor neurons in the body are profoundly inhibited – not to eye, breathing
- b. brain temperature increases while core body temperature drops
- c. EEG activity is of relatively low amplitude and high frequency
- d. cholinergic brainstem neurons are silent
- e. activity in certain noradrenergic neurons of the locus coeruleus increases
V. MATCHING. In the space provided write the number of an item from the list on the right that BEST matches the term or description on the left. A number may be used once, more than once, or not at all. (15 points)

18. tremor observed in Parkinsonism
16. gamma → Ia → alpha
11. origin of cerebellar climbing fibers
15. A1
19. a cystic lesion of the CNS
14. 21. a sign of optic nerve disease
 8. a common trait in professors
22. afflicts waking narcoleptics
 3. REM sleep phenomenon in males
12. a cerebellar ‘gyrus’
10. cortical language areas are locate here
 9. participates in olfactory transduction
17. reverses flow in the left vertebral artery
 4. shorten when depolarized
23. distal end of Ib axon

1. subthalamic nucleus
2. nucleus ruber
X. NPT
4. outer hair cells
5. constructional apraxia
6. clonus
7. perisylvian
X. logorrhea
X. GoIf
10. planum temporale
11. inferior olivary nucleus
12. folium
13. dysdiadokokinesis
14. afferent pupillary defect
15. Heschl’s gyrus
16. gamma loop
17. subclavian steal
18. pill-rolling
19. syrinx
20. Purkinje cell
2X. uveitis
22. cataplexy
23. GTO
24. uncinate fit
25. p.i.c.a.
VI. CLINICAL CASES (used to assess Problem Solving Competency)

1. Luther Brown, age 70, was washing his car when he fainted and remained unconscious for a few minutes. Upon reaching the emergency room, he was found to have the following neurological signs:
   - deviation of the right eye toward the nose
   - inability to abduct the right eye
   - inability to close his right eye or show his teeth on the right
   - inability to move the left arm and leg voluntarily
   - hyperactive tendon reflexes in the left arm and leg
   - increased resistance to passive movement at left knee and elbow
   - Babinski sign on the left

   Where and on which side has damage occurred to Mr. Brown's nervous system? (2 points)
   - right pons

2. Joe Botz, age 40, was injured in a construction accident. Examination revealed:
   - spastic paralysis of the left leg
   - Babinski sign on the left
   - decreased appreciation of joint position and touch in the left leg
   - decreased appreciation of pin-prick and temperature in the right leg

   Where and on which side has damage occurred in Mr. Botz's nervous system? (2 points)
   - left spinal cord (below cervical region, around thoracic or lumbar)

3. Susan White, age 80, falls in her home and is found unconscious by her husband. She regains consciousness and is rushed to the emergency room where examination reveals the following:
   - left homonymous hemianopia
   - spastic hemiparesis of the left arm, leg and face
   - decreased appreciation of touch, vibration, joint position, pin-prick and temperature on the entire left side including the face
   - Babinski sign on the left

   If this pattern of deficit has resulted from a relatively small area of damage, where and on which side has it most likely occurred? (2 points)
   - right internal capsule

If this clinical picture resulted from obstruction of a cerebral artery, which would be the most likely candidate? (1 point)
   - middle cerebral a.
4. Over the past year, Jane Smith developed the following neurological signs and symptoms:

- increasing deafness in her right ear
- decreased sensitivity to touch, pressure, pin prick and temperature on the right side of her face
- smoothing of the nasolabial fold on the right
- neurological exam was otherwise within normal limits

*Where and on which side has damage most likely occurred to Ms. Smith's nervous system? (2 points)*

**cerebellar-pontine angle - right**

5. Tom Butler suddenly complained of diplopia. Positive neurological signs were:

- The right eye could be elevated and depressed but not abducted or adducted
- The left eye could be elevated, depressed, abducted, but not adducted
- Both eyes adducted on convergence

*1/2 syndrome*

*Where and on which side has damage most likely occurred to Mr. Butler's nervous system? (2 points)*

**Right nucleus of CN VI (pons) involving both MLFs.**

6. Cynthia Bridges, aged 68, fell suddenly and was rushed to the hospital. On admission she was found to have the following positive neurological signs:

- Right pupil diameter 5 mm. Left pupil 3 mm
- Ptosis of left eyelid
- Hoarseness and great difficulty swallowing
- Decreased pain and temperature sensibility on left side of face
- Total loss of pain and temperature sensation on the right side of the body, up to and including the chin and right ear. Touch was perceived normally
- Marked ataxia of the left extremities

*Where and on which side has damage most likely occurred to Ms. Bridges' nervous system? (2 points)*

**Left inferior cerebellar peduncle**

*If this clinical picture resulted from obstruction of a cerebral artery, which would be the most likely candidate? (1 point)*

**PICA**