EXPLAINED ANSWERS TO PRACTICE QUESTIONS

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Motor Systems-Spinal Level

1. Which of the following statements is **TRUE**?
A. FALSE LMNs innervating axial muscles lie *medially* in the ventral horn
B. FALSE they are found only at levels in the cervical and lumbosacral areas
C. FALSE LMNs innervating extensors lie *ventral* to those innervating flexors
D. TRUE
E. FALSE a motor neuron pool is all of the LMNs that innervate a muscle; the description given is of a *motor unit*

2. Which of the following is monosynaptic?
A. FALSE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
B. FALSE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
C. FALSE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
D. TRUE THIS IS IT!!!
E. FALSE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!

3. Which of the following statements about gamma efferents is **TRUE**?
A. FALSE they innervate *intrafusal* fibers—there is a difference!
B. FALSE stimulation of gamma dynamics=shortening of bag fibers
C. TRUE especially LCSTs
D. FALSE "pause" can result from shortening the muscle without gamma efferent co-activation
E. FALSE there is no CNS control of Golgi tendon organs

4. Which of the following statements is **TRUE**?
A. FALSE the key word is ONLY! Remember the spinal pattern generators and reflexes.
B. FALSE remember the spinal pattern generators
C. TRUE remember the spinal pattern generators
D. FALSE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!! (All that took was a Ctrl/Alt!)
E. FALSE just the opposite—you pull your foot away from the tack and put your weight on the other leg, right?

5. Which of the following statements is **TRUE**?
A. FALSE reciprocal innervation is INHIBITION of groups of LMNs that innervate muscles with opposing actions
B. FALSE Ib fibers contact Ib inhibitory interneurons
C. TRUE the Ia signal from a muscle spindle produces a very strong divergent excitatory drive
D. FALSE autogenic inhibition is associated with Ia inhibitory interneurons (which receive a signal from Ia fibers)
E. FALSE Ia fibers synapse upon Ia *inhibitory* interneurons

6. Which of the following associations is **TRUE**?
A. FALSE **B=**Ib inhibitory interneuron
B. FALSE **A=**GTO=excitatory input to Ib inhibitory interneuron
C. FALSE **C** innervates contra (to the noxious stimulous) flexors; in order to be true, the contra extensors will be excited while the ipsi flexors are excited
D. TRUE D axon goes to extensors and you want flex to get off the tack/match/fire so= decreased firing
E. FALSE **E=** c and/or d pain and temp fiber

Motor Systems-Influence of "Higher Centers"

1. Which of the following statements is **TRUE**?
A. FALSE the VM system=axial/proximal muscles
B. FALSE the DL system=distal muscles
C. TRUE along with the LCST (the two are buddies)
D. FALSE DL system=only the LCST and its buddy
E. FALSE are LMNs dead or alive?

2. Which of the following statements regarding the dorsolateral pathway is **TRUE**?
A. TRUE
B. FALSE this involves fine motor control—a lesion of DL would make it very difficult
C. FALSE they are in the VM system
D. FALSE part of the VM system
E. FALSE where are ventral horn LMNs that innervate distal muscles, medial or lateral?

3. Which of the following statements regarding the pontine reticulospinal tract (PRST) is **TRUE**?
A. FALSE PRST excites antigravity muscles (flexors of arms and extensors of legs)
B. TRUE PRST excites antigravity muscles (flexors of arms and extensors of legs)
C. FALSE PRST travels in ventral funiculus
D. FALSE the only buddy of the ruber is the LCST
E. FALSE atrophy is related to LMN lesion. Also, interosseous muscles are distal and therefore related to LCST and RST.

4. Which of the following statements regarding the medullary reticulospinal tract (MRST) is **TRUE**?
A. FALSE is the MRST present in the midbrain? Look at your diagram of the VM system.
B. FALSE the MRST inhibits antigravity muscles (flexors in the arms and extensors in the legs)
C. FALSE MRST=ventral funiculus
D. FALSE the LSCT has one, and only one, buddy: the good ol' ruber duber
E. TRUE the MRST inhibits antigravity muscles (flexors in the arms and extensors in the legs)

5. Which of the following is polysynaptic?
A. TRUE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this NOT it!
B. TRUE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
C. TRUE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
D. TRUE does this reflex involve more than 1 synapse in the spinal cord? There is only one monosynaptic reflex pathway and this is NOT it!!!
E TRUE the only <u>mono</u>synaptic reflex pathway is the stretch reflex involving the agonist muscle.

Primary Motor Cortex/Execution of Movements

1. Which of the following statements is **TRUE** regarding primary motor cortex (MI)?
A. TRUE MI/area 4/primary motor cortex, precental gyrus are all synonymous
B. TRUE corticospinals and pyramidals are synonymous
C. TRUE see A
D. TRUE the anterior cerebral travels on the medial wall and supplies the part of MI (leg representation) on the medial wall and also supplies some of MI on the lateral hemisphere. The rest is supplied by the middle cerebral artery.
E. TRUE

2. Which of the following statements is **TRUE** regarding primary motor cortex (MI)?
A. TRUE tongue representation lies near lateral fissure
B. FALSE left cortex lesion=*right* side deficit
C. FALSE MI cells *before* the movement begins
D. FALSE MI is supplied by both anterior and middle cerebral arteries
E. FALSE area 6 is a premotor area that lies rostral to the primary motor cortex (MI)

3. Which of the following statements is **TRUE**?
A. FALSE cortical lesions=contra problems; cerebellar lesions=ipsi problems
B. TRUE classic National Board trivia
C. FALSE atrophy is related to LMN lesions
D. FALSE the inverse myotatic reflex involves Ib inhibitory interneurons
E. FALSE autogenic excitation is functionally associated muscle spindles

4. Which of the following statements is **TRUE**?
A. FALSE remember central pattern generators?
B. FALSE the LCST is part of the *dorsolateral* system
C. TRUE axial=medial; distal=lateral; extensors=ventral; flexors=dorsal
D. FALSE when you step on a tack, you activate ipsilateral flexors and contralateral extensors
E. FALSE haven't we seen this earlier? Gamma efferents innervate <u>intra</u>fusal muscle fibers.

5. Which of the following statements is **TRUE**?
A. FALSE would you want to kiss with your toe? All those fine movements involved in speech (and kissing) require a large amount of motor representation in MI
B. TRUE Lip=**L**ateral
C. FALSE haven't we seen this before—gamma efferents=muscle spindles
D. FALSE PRST=excite flexors of arms and extensors of legs
E. FALSE the ruber duber has only one buddy: the good ol' LCST!

6. Which of the following statements is **TRUE**?
A. TRUE
B. FALSE a motor *unit* is all of the muscle fibers innervated by a single LMN
C. FALSE they are the biggies
D. FALSE a motor *pool* is all of the LMNs that project to a muscle
E. FALSE the ruber-duber and the LCST travel in the lateral funiculus and are in the DL system

Motor Association/Premotor Cortical Areas

1. Which of the following statements is **TRUE** regarding premotor association areas?
A. FALSE the lateral premotor (PMl) and supplementary motor area (SMA) are both premotor areas but they lie/comprise *area 6*. Brodman area 4 is MI.
B. FALSE premotor area lesions result in deficits in planning called apraxia. The lesion needs to be in area 4 to result in hemiplegia/weakness/paralysis
C. FALSE MI or area 4 is involved in execution; area 6 is related to planning
D. TRUE so true, and this medial part is supplied by the anterior cerebral artery
E. FALSE see D

2. Which of the following statements is **TRUE** regarding the shaded area shown below?
This shaded area is the precentral gyrus and all of its numerous synonyms. How can you tell it from area 6? Well, notice how the three rostro-caudal (front to back) oriented frontal gyri (superior, middle, and inferior) run into the dorso-ventral running precental gyrus? Area 6 would lie in the caudal part of those three frontal gyri!
A. TRUE contralaterally
B. FALSE are cells in this area LMNs?
C. FALSE SMA lies rostral to the shaded area
D. FALSE areas 3,1,2 is synonymous with the postcentral gyrus or primary somatosensory cortex. That area lies caudal to the shaded area, caudal to the big central sulcus.
E. FALSE apraxia=planning problems=impaired ability to carry out a motor act *in the absence of weakness or sensory deficits*

3. Which of the following statements is **TRUE** regarding the shaded area shown below?
This shaded area is the precentral gyrus.
A. FALSE mostly from the middle cerebral but some from the anterior cerebral, especially the leg representation.
B. FALSE the entire later surface of area 4 is shaded. The leg representation is on the medial wall.
C. TRUE Betz cells=only area 4=big
D. FALSE corticospinals course in the ipsi pyramid
E. FALSE lesions of area 4=weakness/paresis/paralysis; lesions of area 6=apraxia

4. Which of the following statements is **TRUE** regarding the shaded area shown below?
This shaded area lies rostral to the precentral gyrus. You can see that the shading includes the caudal part of the three frontal gyri. This is area 6 and includes the lateral premotor area and the SMA.
A. FALSE SMA yes, area 4 no
B. TRUE we are talking lateral premotor here!
C. FALSE imagining=SMA=more medial part of shaded area
D. FALSE MI is the executor!!
E. FALSE are we talking a myopathy here?

5. Which of the following statements is **TRUE** regarding the shaded area shown below?
This shaded area lies rostral to the precentral gyrus. You can see that the shading includes the morelateral part of area 6, the lateral premotor area.
A. FALSE this is the lateral premotor area which does correspond to part of area 6
B. FALSE tooooo far laterally. Supplied by middle cerebral artery
C. TRUE sure does
D. FALSE this area is toooo smart for such a simple act
E. FALSE were talking SMA for internally generated movements

6. Which of the following statements is **TRUE**?
A. FALSE flexor innervating neurons=dorsal; extensor innervating neurons=ventral; axial innervating neurons=medial; distal innervating neurons=lateral
B. FALSE there is only one monosynaptic reflex and it can't involve an inhibitory interneuron, can it??
C. FALSE the pause can only occur if the muscle shortens without gamma efferent co-activation
D. TRUE the part of SMA on the medial wall of the hemisphere
E. FALSE Ib fibers excite Ib inhibitory interneurons

7. Which of the following statements is **TRUE**?
A. FALSE the corticospinal fibers travel with the rubrospinal fibers in the dorsolateral system/ pathway
B. FALSE excitation of antigravity muscles belongs to the PRST fibers.. MRST=inhibition of antigravity muscles
C. FALSE this system innervates axial and proximal LMNs, and you know such LMNs lie medially in the ventral horn.
D. FALSE DL system=distal muscles=fine motor control.
E. TRUE do you agree that the dispatcher tells the cab driver what to do? and the cab driver does the work. Get it? Or perhaps it should be that the cab driver=MI and the engine=LMNs! I don't care, as long as you get it!!

8. Which of the following is **TRUE**?
A. TRUE sure, since the anterior cerebral supplies the part of SMA on the medial wall
B. FALSE planning needs more circuitry than executing!
C. FALSE we have seen this many times now!
D. FALSE planning is higher than execution
E. FALSE autogenic inhibition is associated with the inverse myotatic reflex (GTO)

9. Which of the following associations is **TRUE**? (the big integrator!)
A. FALSE lesion=weakness/pareis/paralysis not apraxia
B. FALSE digital dexterity=DL system=ruber/CST=buddies
C. FALSE MVST=VMT
D. FALSE atrophy=LMNs only
E. TRUE

Basal Ganglia

1. Which of the following statements is **TRUE** regarding cells in the lateral (outer) segment of the globus pallidus (GPe)? (There may be more than one correct answer.)
A. FALSE all output from the striatum is inhibitory
B. FALSE GPe only projects to (and inhibits) the SUB
C. TRUE
D. TRUE
E. TRUE see C and D

2. Which of the following statements is **TRUE** regarding the striatum? (There may be more than one correct answer.)
A. FALSE all cortical input to the striatum is excitatory (glutamate)
B. FALSE the striatum=caudate + putamen
C. TRUE classic National Board
D. TRUE
E. TRUE see C and D

3. Which of the following statements is **FALSE** regarding cells in the VA/VL?
A. TRUE the direct pathway leads to increased firing of VA/VL which in turn leads to increased firing in the cortex which permits movement
B. TRUE indirect =decreased firing of VA/VL/cortex/movement
C. TRUE lots of unwanted movement
D. TRUE lots of unwanted movement
E. FALSE in Parkinson's, there is decreased firing of VA/VL/cortex and less movement

4. Which of the following statements is **FALSE** regarding cells in the inner segment of the globus pallidus (GPi)?
A. TRUE the SUB excites the GPi via glutamate
B. FALSE cortex only projects to the striatum; SUB gets input only from GPe (inhibitory)
C. TRUE the GPi inhibits the ipsi VA/VL via ansa and lenticular fasciculus
D. TRUE the GPi inhibits the ipsi VA/VL via ansa and lenticular fasciculus
E. TRUE the GPi inhibits the ipsi VA/VL via ansa and lenticular fasciculus

5. Which of the following statements is **TRUE** regarding dopamine input to the striatum?
A. FALSE DA excites striatal cells associated with the direct pathway
B. FALSE DA excites striatal cells associated with the direct pathway
C. FALSE DA excites striatal cells associated with the direct pathway; direct pathway =increase in movement; reduction DA=less movement (like Parkinson's)
D. TRUE Ach inhibits direct pathway; less Ach inhibition via antagonist=more movement
E. FALSE Ach inhibits direct pathway; more Ach inhibition via agonist=less movement

6. Which of the following statements is **TRUE** regarding acetylcholine?
A. FALSE Ach inhibits striatal cells that are part of the direct pathway
B. FALSE Ach excites striatal cells that are part of the indirect pathway
C. FALSE the Ach is transmitter of striatal interneurons; corticostriates use glutamate
D. FALSE all striatal output cells use GABA
E. TRUE classic National Boards

7. Which of the following statements is **TRUE** regarding Parkinson's disease?
A. FALSE in Parkinson's: reduced movement is due to decreased firing of striatal neurons that project to the GP*i*• ¨more firing of GPi• ¨more inhibition of VA/VL• ¨less movement. Also, in Parkinson's: increased firing of striatal cells that project to GP*e*• ¨less firing of GPe• ¨increase firing of SUB• ¨increased firing of GPi• ¨more inhibition of VA/VL• ¨less movement
B. See explanation in A
C. TRUE
D. See explanation in A
E. See explanation in A

8. Which of the following statements is **TRUE** regarding Parkinson's disease?
A. FALSE **spasticity** is associated with UMN lesions involving the very famous CST and LCST Spasticity is defined as a motor disorder characterized by a **velocity-dependent** increase in tonic stretch reflexes (muscle tone), with exaggerated tendon jerks resulting from hyper excitability of the stretch reflex. The antigravity muscles (flexors of UL and extensors of LL) are most affected and other UMN signs like clonus, the clasp-knife phenomenon, a Babinski sign and flexor and extensor spasms. **Rigidity**, which *is* seen in Parkinson's, is distinguished from spasticity in that it affects both extensors and flexors (like bending a pipe or "lead pipe rigidity") and is NOT dependent upon the speed of the muscle stretch. In addition, rigidity is *not* associated with UMN signs like tendon hyper-reflexia, clonus, the clasp-knife phenomenon, flexor and extensor spasms and a Babinski sign.
B. FALSE do LMNs die in Parkinson's? Check the circuitry diagrams!
C. FALSE hypotona is most associated with lesions affected the LMNs, peripheral nerves and spinal reflexes. You also know that there can be hypotonia in spinal shock. Basal ganglia diseases do not result in decreased tone.
D. FALSE movement (intention) tremor is seen in cerebellar problems
E. TRUE classic National Board

9. Which of the following statements is **TRUE** regarding Huntington's chorea?
A. FALSE a Babinski is associated solely with CST/LCST lesions
B. FALSE akinesia means NO movement and Huntington's patients have TOO much uncontrollable involuntary movement
C. FALSE rigidity is associated with Parkinson's
D. TRUE
E. FALSE spasticity is related to lesions of CST/LCST

10. Which of the following statements is **TRUE** regarding a Babinski sign?
A. FALSE Babinski is related to lesions of CST/LCST/UMN
B. FALSE Babinski is related to lesions of CST/LCST/UMN
C. FALSE Babinski is related to lesions of CST/LCST/UMN
D. FALSE Babinski is related to lesions of CST/LCST/UMN
E. TRUE a Babinski sign is a component of the UMN syndrome (along with tendon hyper-reflexia, clonus, the clasp-knife phenomenon, flexor and extensor spasms and spasticity)

11. Which of the following statements is **FALSE** regarding hemiballism?
A TRUE classic National Board
B. TRUE less activity of SUB• ¨less activity of GPi• ¨more activity of VA/VL• ¨more movement
C. TRUE See explanation for B
D. TRUE See explanation for B
E. TRUE SUB is part of indirect pathway
(Trick question, I guess—no false statements.)

12. Which of the following statements is **TRUE** regarding substantia nigra pars compacta?
A. FALSE substantia nigra pars compacta projects to the striatum
B. FALSE lesions of this area lead to Parkinson's, too little movement and a *hypo*kinetic state
C. FALSE substantia nigra pars compacta projects to the striatum
D. TRUE DA excites striatal cells in direct pathway and inhibits striatal cells in indirect pathway
E. FALSE loss of these neurons results in Parkinson's; Huntington's is due to loss of striatal cells that project to GPe

13. Which of the following statements is **FALSE** regarding the medial segment of the globus pallidus (GPi)?
A. TRUE all output cells (versus interneurons) of striatum use the inhibitory transmitter GABA
B. TRUE lesion of GPi results in less inhibition of VA/VL
C. TRUE into the ansa and the lenticular fasciculus
D. TRUE into the ansa and the lenticular fasciculus
E. FALSE SUB input to the GPi is via glutamate, an *excitatory* transmitter

14. Which of the following statements is **FALSE** regarding the striatum?
A. TRUE these cells use GABA and are part of direct pathway
B. TRUE these cells use GABA and are part of indirect pathway
C. TRUE cortical input is excitatory via glutamate
D. TRUE these cells are interneurons with opposite effects on direct (+) and indirect (-) pathways
E. FALSE the only way to SUB is via GPe

15. Which of the following statements is **FALSE** regarding the lateral segment of the globus pallidus (GPe)?
A. FALSE the only place GPe goes is to the SUB
B. TRUE
C. TRUE all outputs of the striatum are inhibitory
D. TRUE the only place GPe goes is to the SUB
E. TRUE

16. Which of the following statements is **FALSE** regarding the corticospinal tract?
A. TRUE classic Parkinson's
B. TRUE classic hemiballsim
C. TRUE ACh inhibits direct and ACh loss• ¨too much direct• ¨too much movement
D. TRUE lesion GPe• ¨SUB goes wild• ¨GPi goes wild• ¨poor VA/VL feeling depressed
E. FALSE lesion GPi• ¨VA/VL feeling good again and go WILD

17. Which if the following statement is **TRUE**?
A. FALSE all outputs of the striatum are inhibitory
B. FALSE inhibition of inhibition=excitation
C. FALSE GPi inhibits VA/VL
D. TRUE inhibition of inhibition=excitation
E. FALSE see D
18. Which if the following statement is **TRUE**?
A. TRUE
B. FALSE the direct pathway through the basal ganglia increases movement by increasing the firing of cells in VA/VL
C. FALSE striatum = caudate + putamen
D. FALSE striatal cells go only to GPi and GPe and are always inhibitory
E. FALSE cells in the GPi are inhibitory to VA/VL

19. Which of the following are excitatory?
A. FALSE all striatal output cells (versus interneurons) are GABAergic/inhibitory
B. FALSE all pallidal cells are GABAergic
C. TRUE VA/VL cells are excitatory on the cortex
D. TRUE cortical input to the striatum is excitatory (glutamate)
E. TRUE see C and D

20. Which of the following statements is **TRUE** regarding the lettered structures below and to the right? Consider only the circuitry illustrated. **(A=GPe; B=SUB; C=GPi; D=VA/VL; E=striatum)**
A. TRUE all striatal output cells are inhibitory
B. FALSE a lesion of SUB=decreased firing of GPi
C. FALSE lesion of GPe=more firing of SUB=more firing of GPi=decreased firing of VA/VL
D. FALSE lesion of striatum=increased firing of GPe=decreased firing of SUB=decreased firing of GPi
E. FALSE GPe=indirect pathway

21. **Stimulation** of which of the lettered structures to the right will result in **increased** firing of **D**? Consider only the circuitry illustrated. **(A=GPe; B=SUB; C=GPi; D=VA/VL; E=striatum)**
A. FALSE stimulation of striatum• ¨decreased firing GPe• ¨increased firing SUB• ¨increased firing GPi• ¨decreased firing VA/VL
B. stimulate GPi=decreased firing VA/VL
C. FALSE stimulate SUB• ¨increased firing GPi• ¨decreased firing VA/VL
D. TRUE stimulate GPe• ¨decreased firing SUB• ¨decreased firing GPi• ¨increased firing VA/VL
E. FALSE see only D

22. Which of the following statements is **TRUE**?
A. TRUE D1 receptors are found on striatal cells that are part of the direct pathway (project to GPi)
B. FALSE ACh excites the indirect pathway
C. TRUE D2 receptors are on striatal cells that are part of the indirect pathway (project to GPe).
D. FALSE ACh inhibits the direct pathway
E. TRUE see A and C

23. Which of the following statements is **TRUE**?
A. FALSE loss of DA=Parkinson's=little movement=hypokinesia
B. FALSE ACh inhibits direct and excites indirect. ACh antagonist=less ACh=more firing in direct and less firing indirect
C. FALSE DA excites direct and inhibits indirect. DA agonist=more DA=more firing in direct and less firing indirect
D. FALSE ACh inhibits direct and excites indirect. ACh agonist=moreACh=less firing in direct and more firing indirect
E. TRUE classic National Boards

24. Which of the following statements is **TRUE**?
A. FALSE SUB eventually influences the ipsi thalamus/cortex! Is the corticospinal tract crossed?
B. FALSE the SUB normally excites the GPi cells of the indirect pathway; a lesion=less firing of such cells in GPi
C. TRUE hemiballism=toooooo much movement. You need to slow down the overactive direct pathway!! ACh inhibits direct and excites indirect. ACh agonist=moreACh=less firing in direct and more firing indirect=less movement in the hemiballismic patient
D. FALSE this would do just the opposite of what we said in C (an *ant*agonist is the opposite of an agonist)
E. FALSE DA excites direct and inhibits indirect. DA agonist=more DA=more firing in direct and less firing indirect= more movement in the already hemiballismic patient

25. Select the **correct** statement concerning this patient.
A. FALSE this is classic Parkinson's—the degeneration would be related to the substantia nigra, pars compacta which leads to descreased levels of DA in the Striatum
B. FALSE Ach inhibits the direct and excites the indirect; giving Ach to her would only make her condition worse
C. FALSE we all know this is Parkinson's
D. TRUE administration of this form of DA would excite the direct pathway allowing an increase in movement
E. FALSE only D

26. Select the **true** statement concerning this patient.
A. FALSE this is classic Huntington's
B. TRUE the degeneration in Huntington's is in the striatal cells that project to GPe, especially the caudate nucleus
C. FALSE loss of dopamine producing cells in the substantia nigra=Parkinson's
D. FALSE administration of DA in this case will further excite the direct pathway and make the problem worse
E. FALSE only B

Cerebellum/Peduncles

1. A. Name the peduncle that lies adjacent to the fourth ventricle in the section below.
This is the superior cerebellar peduncle, in all of its glory! (or brachium conjunctivum)

B. Where are the cells of origin of the axons in this peduncle?
In the ipsilateral dentate nucleus and interpositus nucleus (globose and emboliform)

2. A. Name the peduncle present in the dorsal part of the section below.
This is the inferior cerebellar peduncle (or restiform body as the neuranantomist call it)

B. Name four fiber tracts that contribute to this peduncle
olivocerebellar, dorsal spinocerebellar, cuneocerebellar and vesstibulocerebellar

3. A. Name the peduncle present in the section below.
This is the middle cerebellar peduncle.

B. Where are the cells of origin of the axons in this peduncle?
In the contralateral pontine grey.

Organization of inputs to the cerebellum.

4. A. In the figure below, name the **zones** of the cerebellum that receive input from axons traveling within the structure labeled **A.** _____, _____, _____, _____
A is the inferior cerebellar peduncle. Olivocerebellars terminate in all four zones. Dorsal spinocerebellars terminate in the intermediate and medial zones. Pontocerebellars terminate in the intermediate and lateral zones. Vestibulocerebellars terminate in the floccunodular zone.

B. In the figure below, name the **zones** of the cerebellum that receive input from the structured labeled **B.**
B is the middle cerebellar peduncle (or brachium pontis=arm of the pons). Pontocerebellar fibers terminate in the lateral and intermediate zones.

5. A. Axons from **B** travel in which cerebellar peduncle?
B is posterior parietal cortex and axons arising from this area project to the ipsi. pontine grey; they DO NOT traverse any cerebellar peduncle but do travel in the cerebral peduncle at midbrain levels.

B. Does **A** project to the same side of the <u>pons</u> and spinal cord?
A is the precentral gyrus or area 4. The corticopontine fibers terminate in the ipsi pontine grey and the corticospinals terminate on the contra side of the spinal cord.

C. Which cortical areas are is involved in “higher” planning of motor movements?
Planning=posterior parietal (B) and premotor (D).

D. Which cortical area(s) send(s) information **(via the pons)** to the <u>lateral</u> zone of the cerebellum?
Planning=posterior parietal (B) and premotor (D).

E. Which cortical area(s) send(s) information **(via the pons)** to the intermediate zone of the erebellum?
The executioner/MI/precentral gyrus/Brodmann's area 4 (A).

F. Does either cortical area **A** or **B** send information (via the pons) to the medial zone of the cerebellum (via the pons)?
The poor medial zone is lonely for cortical input. NO

G. Does either cortical area **A** or **B** send information (via the pons) to the flocculonodular zone (or lobe) of the cerebellum?
The poor floc is also lonely for cortical input. **NO**

6. A. What cortical areas project to **D**?
D is the pontine grey. The premotor areas, the primary motor cortex and the posterior parietal area project here.

B. What zone(s) of the cerebellum are innervated by axons of the cells in **A**?
A is Clarke's column. The DSCT projects to the intermediate and medial zones.

C. A lesion of **B** results in loss of pain and temperature (DON'T FORGET THE SPINAL CORD) from what level(s)?
The level is T1 so the deficit is on the contra side from T3 south!!

D. Axons in **E** terminate in which zones of the cerebellum?
E is the middle cerebellar peduncle. Axons in this peduncle reach the lateral and intermediate zones.

E. Do axons with cell bodies in the motor cortex travel in **E**?
NO. All cortical axons in pathways to the cerebellum end in the pontine grey. Then they are relayed to the cerebellum.

7. A. Fibers from cells that lie in nucleus **A** project to which zone of the cerebellum?
A=vestibular nuclei and these cells project to the flocculonodular lobe.

B. True or False; Cells in **A** project to the lateral zone of the right cerebellum via the middle cerebellar peduncle.
FALSE A=vestibular nuclei and these cells project to the flocculonodular lobe.

C. **B** is the _____ cerebellar peduncle or _____body.
B is the inferior cerebellar peduncle or restiform body.

D. Vestibular input reaches the cerebellum via 2 pathways; peripherally from the _____ and centrally from the _____.
Vestibular input reaches the cerebellum via 2 pathways; peripherally from the vestibular nerve and centrally from the vestibular nuclei.

E. True or False; axons of cells in **E** project directly to the cerebellum.
E is the vestibular ganglion. Central processes of these cells end in the flocculonodular lobe as well as the vestibular nuclei.

8. Which of the following statements is correct?
A. FALSE Babinski=CST/LCST/UMN syndrome
B. FALSE any LMNs in the cerebellum?
C. TRUE and we don't exactly know why!
D. FALSE cerebellum=coordination! Speech characteristics reflect the effects of incoordination and reduced muscle tone. Slow and inaccurate force, range of motion, timing and direction of speech movements
E. FALSE dysdiadochokinesia is the inability to perform rapid, alternating tasks

9. Which of the following statements is correct?
A. FALSE only neuro profs play above the rim!
B. FALSE past pointing is a cardinal sign of cerebellar damage
C. FALSE intention tremor/movement tremor=cerebellar damage; resting tremor=Parkinson's
D. FALSE intention tremor/movement tremor=cerebellar damage; resting tremor=Parkinson's
E. TRUE atrophy is, as you know very well, a sign of LMN disease

10. Which of the following statements is correct?
A. FALSE gamma efferents control the length of the intrafusal fibers. Think about spasticity. Move the arm and you get more of a reflex resistance than normal. Perhaps the gamma efferents have set the "gain" of the system too high. (That is, for X amount of muscle lengthening, there normally is X amount of shortening.). Imagine if the gamma efferents set the gain so that there would be less shortening than normal in response to X amount of lengthening (stretch).
B. FALSE spasticity is classically associated with lesions of the CST/LCST.
C. FALSE cerebral cortex=contra while cerebellum=ipsi.!!!! Classic National Board!!
D. FALSE is does occur but is poorly understood. Incoordination dominates!
E. TRUE

11. Which of the following statements is correct?
A. FALSE the fastigial nucleus does not send fibers into the SCP
B. FALSE duh
C. TRUE classic you know what!
D. FALSE the interpositus only sends fibers rostrally into the SCP
E. FALSE duh

12. Which of the following statements is correct?
A. FALSE lesion of right floc• ¨dead right Purks (inhibitory) in that lobe that project to the right vestibular nuclei• ¨right vestibular nuclei dominating due to loss of Purk inhibition• ¨eyes slowly to the left• ¨snap back to the right• ¨right nystagmus
B. FALSE lesion of right floc• ¨dead right Purks (inhibitory) in that lobe that project to the right vestibular nuclei• ¨right vestibular nuclei dominating due to loss of Purk inhibition• ¨staggering to the left
C. FALSE lesion of right fastigial• ¨loss of excitation to right vestibular nuclei• ¨left vestibular nuclei dominating• ¨stagger to right
D. lesion of right fastigial• ¨loss of excitation to right vestibular nuclei• ¨left vestibular nuclei dominating• ¨eyes slowly to the right• ¨snap back to left• ¨left nystagmus
E. TRUE

16. Which of the following associations are true?
A=dentate nucleus; B=interpostitus nucleus; C=fastigial nucleus

A-planning-
TRUE: The dentate is the deep nucleus of the lateral zone, which receives input from cells in the pons which receive input from planning the SMA and PPC.

A-updating
FALSE: The dentate is the deep nucleus of the lateral zone, which receives input from cells in the pons which receive input from planning the SMA and PPC.

A-posterior parietal cortex
TRUE: The dentate is the deep nucleus of the lateral zone, which receives input from cells in the pons which receive input from planning the SMA and PPC.

A-VA/VL
TRUE: The dentate projects via the SCP to the VA/VL.

A-premotor and supplementary motor cortex
TRUE: The dentate is the deep nucleus of the lateral zone, which receives input from cells in the pons which receive input from planning the SMA and PPC.

A-reticular formation
FALSE: No descending projections to the reticular formation arise from the dentate. Such projections arise from the fastigial and vestibular nuclei.

A-vestibular nuclei
FALSE: The dentate projects via the SCP to the VA/VL. No descending projections to the reticular formation or vestibular nuclei arise from the dentate. Such projections arise from the fastigial and vestibular nuclei.

A-fires after movement
FALSE: The dentate is a "planner" and fires prior to the movement.

B-ruber
TRUE: Nucleus interpositus projects to both the VA/VL and the ruber-duber

B-updating
TRUE: Nucleus interpositus is associated with the intermediate zone. This zone receives info about the intended/ongoing movement from pontine grey cells targeted by MI and info about the ongoing movement from the DSCT and CCT. Interpositus sends info into the SCP to reach the ruber-duber for quick changes via the rubrospinal tract and to the VA/VL for changes via the corticospinal tract.

B-reticular formation
FALSE: Sole province of the fastigial and vestibular nuclei

B-primary motor cortex
TRUE: Interpositus sends info. into the SCP to reach the ruber-duber for quick changes via the rubrospinal tract and to the VA/VL for changes via the primary motor cortex/corticospinal tract.

B-vestibular nuclei
FALSE: Sole province of the fastigial and vestibular nuclei

B-comparing and updating
TRUE: Nucleus interpositus is associated with the intermediate zone. This zone receives info about the intended/ongoing movement from pontine grey cells targeted by MI and info about the ongoing movement from the DSCT and CCT. Interpositus sends info into the SCP to reach the ruber-duber for quick changes via the rubrospinal tract and to the VA/VL for changes via the corticospinal tract

B-fires before movement
TRUE: Nucleus interpositus is associated with the intermediate zone. This zone receives info about the intended/ongoing movement from pontine grey cells targeted by MI. So cells in the interpostius do not fire before the movement.

C-nystagmus
TRUE: Remember from earlier question: lesion of right fastigial=loss of excitation to right vestibular nuclei=left vestibular nuclei dominating=eyes slowly to the right=snap back to the left=left nuystagmus

C-reticular formation
TRUE: The fastigial projects to the reticular nuclei in order to control axial/proximal muscles for balance etc.

C-ruber
FALSE: Sole province of the interpositus—too smart for fatigial and vestibular nuclei after all, is a buddie of LCST

C-VA/VL
FALSE: Sole province of the dentate and interpositus—too smart for fatigial and vestibular nuclei

C-bilateral efferent projection (but mostly ipsi.)
TRUE

17. Which of the following is associated with cerebellar lesions?

A. left nystagnmus following a lesion of the right flocculonodular lobe
FALSE: Lesion of right floc• ¨dead right Purks (inhibitory) in that lobe that project to the right vestibular nuclei• ¨right vestibular nuclei dominating due to loss of Purk inhibition• ¨eyes slowly to the left• ¨snap back to the right• ¨right nystagmus

B. Babinski sign
FALSE: Babinski=lesion CST/LCST

C. right nystagnmus following a lesion of the right fastigial nucleus
FALSE: Lesion of right fastigial• ¨loss of excitation to right vestibular nuclei• ¨left vestibular nuclei dominating• ¨eyes slowly to the right• ¨snap back to left• ¨left nystagmus

D. hyperreflexia
FALSE: Cerebellar lesion=hyporeflexia

E. hemiplegia
FALSE: Hemiplegia=CST/LCST

F. resting tremor
FALSE: Resting tremor=Parkinsosn's; cerebellar=intention/movement tremor

G. apraxia
FALSE: Apraxia is a higher cortical planning problem (esp. area 6) Even though lateral zone is "planning," apraxias are limited to cortical lesions.

H. rigidity
FALSE: Usually seen with Parkinson's. Cerebellar=hypotonia

I. bradykinesia
FALSE: Usually seen with Parkinson's.

J. hemiballism
FALSE: Classic you know what for SUBTHALAMIC NUCLEUS!!!

K. chorea
FALSE: Classic you know what for lesion of cells in striatum that project to GPe=Huntington's

L. atrophy
FALSE: Any LMNs in cerebellum?

M. anesthesia
FALSE: Any pain pathways reach cerebellum?

N. analgesia
FALSE: Complete loss of sensation??

O. pronator drift
FALSE: Usually associated with CST/stroke. I know, I know, there is some weakness in cerebellar lesion but I am pretty sure pronator drift does not occur.

P. intention (movement) tremor
TRUE: Sooooo TRUE! Classic…….

Q. rebound
TRUE: Sooooo TRUE! Classic…….

R. dysdiadochokinesia
TRUE: Sooooo TRUE! Classic…….

S. past-pointing
TRUE: Sooooo TRUE! Classic…….

18. Which of the following statements regarding climbing fibers is **TRUE**?
A. TRUE
B. TRUE
C. TRUE
D. TRUE
E. TRUE

19. Which of the following statements regarding mossy fibers is **TRUE**?
A. TRUE the vestibular nuclei, vestibular nerve, DSCT and CCT do not reach the lateral zone, just PCTs
B. TRUE but no vestibular nuclei/vestibular nerve input
C. TRUE but no vestibular nuclei/vestibular nerve input or PCTs
D. TRUE vestibular nuclei/vestibular nerve to floc. but no CCT, DSCT or PCTs
E. TRUE I love E's
20. Which of the following statements is **TRUE**?
A. FALSE Purks only inhibit
B. FALSE Purks in the medial zone inhibit the fastigial
C. FALSE Purks in the intermediate zone inhibit the interpositus
D. FALSE Purks in the floc. inhibit the vestibular nuclei
E. TRUE

21. Which of the following could be true of this patient?
A. FALSE the signs/symptoms point to damage to part of the cerebellum that controls the ventromedial descending system and thus walking/balance. The fibers in the superior cerebellar peduncle arise from the dentate and interpositus and are more concerned with distal muscles.
B. TRUE the malnutrition often accompanying chronic alcoholism causes degeneration of the cerebellar cortex and this tends to start at the anterior end of the anterior lobe and spread backwards. A great deal of the anterior lobe is occupied by vermis and the legs are represented most anteriorly.
C. TRUE the degeneration of the anterior lobe means cell death, fewer cells and bigger than normal sulci between the folia (little gyri). Have you ever seen the sulci in a brain from an advanced case of Alzheimer's? They are huge!
D. FALSE the lateral zone is involved in
E. TRUE See B and C

22. Which of the following could be true of this patient?

A. TRUE the Horner's is on the right and the pain and temp loss on the left; makes sense! Suggests lesion is on the right side.

B. TRUE the relatively sudden onset suggests that there was a vascular accident and the cerebellar deficits are not those seen with more midline tumors/vascular accidents rather they are deficits related to lesions of the intermediate and lateral zones.

C. TRUE classic National Board!

D. FALSE see A, B and C

E. TRUE A, B and C