EXPLAINED ANSWERS TO PRACTICE QUESTIONS

TABLE OF CONTENTS

Motor Systems—Spinal Level.................................................................2
Motor Systems—Influence of Higher Centers.................................3
Primary Motor Cortex/Execution of Movements..............................4
Motor Association/Premotor Cortical Areas.................................5
Basal Ganglia...................................................................................7
Cerebellum/Peduncles......................................................................13
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  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/Akt!)  
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 stimulus) 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 monosynaptic 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, precentral 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 intrafusal 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=Lateral
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 more lateral 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** we 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 excitates 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. **FALSE** 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 GPi • “more firing of Gpi” • “more inhibition of VA/VL” • “less movement.  Also, in Parkinson’s: increased firing of striatal cells that project to GPe • “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 antigraft 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  \(\cdots\)  less activity of GPi  \(\cdots\)  more activity of VA/VL  \(\cdots\)  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. **TRUE**  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**
Motor systems

16. Which of the following statements is **FALSE** regarding the corticospinal tract?
A. **TRUE** classic Parkinson’s
B. **TRUE** classic hemiballism
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 of 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 of 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. TRUE** see C and D

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. **FALSE** 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 GPe=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 GPe=decreased firing VA/VL
C. **FALSE** stimulate SUB • “increased firing GPi” • “decreased firing VA/VL
**D. TRUE** stimulate GPe • “decreased firing SUB” • “decreased firing GPe” • “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=too 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 antagonist 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 decreased 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 neurantatomist call it)

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

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 structure 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 pons 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 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 lateral 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 cerebellum?  
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 interpositus 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 nystagmus

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 fastigial 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 nystagmus following a lesion of the right flocculonodular lobe
   FALSE: Lesion of right flocculonodular lobe will result in right Purks (inhibitory) in that lobe that project to the right vestibular nuclei, which will then dominate due to loss of Purkinje inhibition. The eyes will slowly move to the left and snap back to the right, resulting in left nystagmus.

B. Babinski sign
   FALSE: Babinski sign is associated with lesions of the CST/LCST, not the cerebellum.

C. right nystagmus following a lesion of the right fastigial nucleus
   FALSE: Lesion of the right fastigial nucleus will result in loss of excitation to the right vestibular nuclei, causing left vestibular nuclei to dominate. The eyes will slowly move to the right and snap back to the left, resulting in left nystagmus.

D. hyperreflexia
   FALSE: Cerebellar lesion should result in hyporeflexia, not hyperreflexia.

E. hemiplegia
   FALSE: Hemiplegia is associated with lesions of the CST/LCST, not the cerebellum.

F. resting tremor
   FALSE: Resting tremor is associated with Parkinson’s disease, not cerebellar lesions.

G. apraxia
   FALSE: Apraxia is a higher cortical planning problem (esp. area 6) and is limited to cortical lesions, not cerebellar lesions.

H. rigidity
   FALSE: Usually seen with Parkinson’s disease. Cerebellar lesions are associated with hypotonia.

I. bradykinesia
   FALSE: Usually seen with Parkinson’s disease.

J. hemiballism
   FALSE: Classic you know what for lesion of cells in striatum that project to GPe=Huntington’s disease.

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

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