NEUROSCIENCE UNIT 1
DETAILED ANSWERS FOR BRAIN STEM PRACTICE QUESTIONS

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BRAIN STEM—PYRAMIDS/CORTICOSPINAL TRACT

PYRAMIDS/CORTICOSPINAL TRACT #1

Shaded structure is the right pyramid at level 1 of brain stem. It contains corticospinal axons.

A. FALSE the corticospinal axons in this bundle have not crossed yet, so their cells of origin lie in the ipsilateral or right motor cortex.
B. FALSE the axons in the pyramid have not yet crossed.
C. FALSE we can't call it the lateral corticospinal tract because it is not in the **lateral** funiculus of the spinal cord.
D. TRUE see response A
E. FALSE huh?—is this a throw away or what?

PYRAMIDS/CORTICOSPINAL TRACT #2

Shaded structure is the right pyramid (corticospinal axons) at level 1 of brain stem.

A. TRUE corticospinal fibers in the right pyramid cross to form the left LCST.
B. FALSE UMN lesions=little atrophy. LMN lesions=atrophy
C. FALSE would have left Babinski
D. FALSE would have left hemiplegia
E. FALSE would have normal right arm and leg

PYRAMIDS/CORTICOSPINAL TRACT #3

Shaded structure is the right pyramid seen in a ventral view of the brain stem.

A. FALSE lesion would result in left Babinski and left hemiplegia
B. FALSE **right** motor cortex, axons in the pyramid have not crossed
C. FALSE left side of spinal cord
D. TRUE
E. FALSE—lesion would result in left Babinski

PYRAMIDS/CORTICOSPINAL TRACT—MATCHING

A. right pyramid
B. right pyramid
C. right pyramid or left LCST
D/1.
E. right pyramid or left LCST

PYRAMIDS/CORTICOSPINAL TRACT #4

Explanation: The right hemiplegia and right Babinski could result from a lesion of the left pyramid or the right LSCT. The left pyramid contains corticospinal axons destined to cross and comprise the right LCST. The right LCST will innervate LMNs on the right side of spinal cord.

PYRAMIDS/CORTICOSPINAL TRACT—SPINAL CORD

The shaded areas are the right fasciculus gracilis, DSCT and ALS at spinal level C2.

A. FALSE the lateral surface of the arm is innervated by C6. Unconscious proprioception carried by this root travels in fasciculus cuneatus at spinal level C2 (not the DSCT!)

B. FALSE the index finger is innervated by C6 ("six shooter"). Unconscious proprioception carried by this root travels in fasciculus cuneatus at spinal level C2 (not the DSCT!)

C. TRUE the right ALS at C2 carries pain and temp. from the left side of the body from C4 on down

D. FALSE the right ALS at C2 carries pain and temp. from the left side of the body from C4 on down.

E. FALSE the DSCT carries ipsilateral information.

BRAIN STEM—ANTEROLATERAL SYSTEM (ALS)

ALS #1

The shaded areas are the right pyramid and ALS at the level of the pyramidal decussation. The descending autonomics travel with the ALS fibers.

A. FALSE corticospinal fibers in the right pyramid arise from cells in the right motor cortex; they have NOT crossed yet.

B. FALSE fibers in the right ALS arise from cells in the left dorsal horn

C. TRUE the right ALS terminates in the right VPL. The ALS is not the ALS until it is in the anterolateral part of the white matter of the spinal cord (hence ALS).

D. FALSE when talking ALS, its cells of origin lie in the contralateral dorsal horn. Sure, the pain and temp is picked up by peripheral processes of c and d fibers of dorsal roots, but believe me, DRGs are NOT the cells of origin of the ALS!

E. FALSE the right ALS terminates in the right VPL of the thalamus, then cells in the right VPL project to somatosensory cortex. **DON'T FORGET SYNAPSES ALONG THE WAY!**

ALS #2

The shaded areas are the right pyramid and ALS at the level of the pyramidal decussation. The descending autonomics travel with the ALS fibers.

A. FALSE the right pyramid contains corticospinal fibers destined to cross and comprise the left LCST. Thus a lesion will result in a left Babinski.

B. FALSE hemiplegia would be on the left, but all other statements are true

C. FALSE left hemiplegia, sound familiar?

D. FALSE loss of pain and temperature from the left arm and leg

E. TRUE

ALS #3

Drawing is at the level of the pyramidal decussation.

Explanation: Lesions of the left pyramid and adjacent ALS will result in right UMN problems and deficits in pain and temp. on the right The descending hypothalamic fibers destined for the preganglionic sympathetic cells on the left from T1-L2 travel in the ALS; their interruption results in the constricted pupil in the left eye

ALS—MATCHING

A. cells of origin of right ALS=left dorsal horn **NOT** DRG
B. axons in left pyramid originate from cells in left motor cortex, they don't terminate there
C. left ALS
D. right pyramid
E/2
F. right pyramid or left LCST
G/1
H. right pyramid or left LCST
I. lesion of right ALS in the brainstem results in constricted right pupil

ALS—SPINAL CORD

A. FALSE fewer LMNs and in turn fewer normal axons in a nerve to a muscle=smaller CMAPs
B. FALSE fewer LMNs and in turn normal axons in a nerve does not mean decreased NCV; the good ones camouflage the bad ones!
C. TRUE dying axons=reinnervation by normal ones=type grouping and later group atrophy
D. FALSE decremental CMAPs=defective NMJs
E. FALSE have you ever heard of **increased** SNAP? Ever?

BRAIN STEM—SPINAL NUCLEUS AND TRACT V

SPINAL NUCLEUS AND TRACT V #1

The shaded structures are the pyramid, ALS (and associated autonomic pathway) and the spinal nucleus and tract V. All are on the right side of the medulla at the level of the pyramidal decussation.

A. FALSE cells in the right spinal nucleus V project to the left VPM
B. FALSE the cells of origin of axons in the right spinal tract V lie in the right trigeminal ganglion
C. FALSE the cells of origin of the right ALS lie in the dorsal horn on the left side of the spinal cord
D. TRUE the cells of origin of corticospinal axons in the right pyramid lie in the right motor cortex
E. FALSE cells in the right spinal nucleus V project to the left VPM and cells of the right ALS project to the right VPL

SPINAL NUCLEUS AND TRACT V #2

The shaded structures are the pyramid, ALS (and associated autonomic pathway) and the spinal nucleus and tract V. All are on the right side of the medulla at the level of the pyramidal decussation.

A. FALSE left Babinski and loss of pain and temperature from the right side of the face
B. FALSE loss of pain and temperature in the left arm and leg
C. FALSE constricted pupil in the right eye
D. TRUE
E. FALSE a constricted pupil in the right eye

SPINAL NUCLEUS AND TRACT V #3

The shaded area is the left spinal tract V in the medulla at the level of the pyramidal decussation.

A. FALSE left side of the face

B. FALSE adjacent/ipsilateral spinal nucleus V

C. FALSE left trigeminal ganglion

D. FALSE left trigeminal ganglion, the left *superior* ganglion IX or X, or the left geniculate ganglion

E. TRUE

SPINAL NUCLEUS AND TRACT V #4

The drawing is of the medulla at the level of the pyramidal decussation.

Explanation: A continuous lesion would be the left LCST fibers, the left spinal nucleus and tract V and the left ALS (and associated descending hypothalamic fibers).

SPINAL NUCLEUS AND TRACT V—MATCHING

A. left pyramid or right LCST

B/1

C. left ALS

D/3

E. left ALS

F. left spinal tract V

G. left pyramid or right LCST

H/2

I. left pyramid or right LCST

J. left spinal nucleus V or right TTT

SPINAL NUCLEUS AND TRACT V—SPINAL CORD

The shaded areas are the medial part of fasciculus gracilis, the lateral part of the LCST and the ALS all on the right at spinal level L5.

A. TRUE There are axons in the left ALS at L5 that have their cell bodies in the right dorsal horn at S1. Do this simple exercise. Draw a cell in the left dorsal horn at L5. Now, draw its axon as it crosses and enters the right ALS to lie in its medial part. Now, answer this simple question. “Is there an axon in the right ALS at L5 whose cell body lies in the contralateral/left dorsal horn at L5.” Please say YES!!! Now, do the same thing at S1 (yes, draw the cell in the left dorsal horn and then its crossing axon) Now, answer the question, “is there an axon in the right ALS at S1 whose cell body lies in the contralateral/left dorsal horn at S1. Please say YES. If you said YES, where is this axon at L5? Please say it is in the right ALS!!!

B. FALSE the shaded fibers in the LCST at L5 are destined for more caudal levels and thus their interruption would not affect S1 LMNs; also, these fibers would innervate *ipsi* LMNs.

C. FALSE again, the LCST terminates on ipsilateral ventral horn cells

D. FALSE II or 1b fibers carrying unconscious proprio. from L5 would enter fasciculus gracilis and be positioned at the lateral most part of the nucleus (last one in is most lateral as you ascend). The shaded axons in fasciculus gracilis are from levels caudal to L5.

E. FALSE (See A above.)

BRAIN STEM—NUCLEUS GRACILIS AND CUNEATUS

NUCLEUS GRACILIS AND CUNEATUS #1

The shaded fibers are the right medial lemniscus, the right ALS (and associated descending fibers) and right spinal tract V. The cell group is the right spinal nucleus V.

A. FALSE axons comprising the right spinal tract V terminate in the right caudal spinal nucleus V.
B. TRUE axons comprising the right medial lemniscus arise from cells in the left nucleus gracilis and cuneatus.
C. FALSE the descending hypothalamic fibers traveling with the right ALS terminate on preganglionic sympathetic cells (T1-L2) on the right
D. FALSE fibers comprising the right ALS arise from cells in the dorsal horn on the left
E. FALSE cells in the right caudal spinal nucleus V project (via the TTT) to the left VPM

NUCLEUS GRACILIS AND CUNEATUS #2

The shaded fibers are the right medial lemniscus, the right ALS (and associated descending fibers) and the right spinal tract V. The shaded cell group is the right spinal nucleus V.

A. FALSE loss of vibratory sense from the left arm and leg
B. TRUE
C. FALSE corticospinal fibers not shaded and constricted pupil in the right eye
D. FALSE constricted pupil in the right eye
E. FALSE corticospinal fibers not shaded

NUCLEUS GRACILIS AND CUNEATUS #3

The shaded area is the left nucleus gracilis.

A. FALSE loss of vibratory sense from the left leg
B. FALSE cells project to right VPL
C. FALSE loss of *2 pt. etcetera* from the left *leg*
D. TRUE
E. FALSE cells project to right VPL

NUCLEUS GRACILIS AND CUNEATUS—MATCHING

A. lesion of right ALS etcetera=*constricted* pupil in right eye
B. right spinal tract or nucleus V or left TTT
C. cells of origin of the right fasciculus gracilis or cuneatus are in the right dorsal root ganglia. Cells of origin of fibers in the left ALS lie in the right dorsal *horn*. Cells of origin of the right medial lemniscus lie in left nucleus gracilis and cuneatus.
D/1
E. left ALS
F/3
G. left pyramid or right LSCT (a lesion of the pyramidal dec. would result in right hemiplegia, but also left hemiplegia)
H. left TTT or axons of cells in right spinal nucleus V (which make up the left TTT)
I/2
J/4

NUCLEUS GRACILIS AND CUNEATUS #4
Drawing is through the medulla at the middle of the inferior olive and hypoglossal nucleus.
Explanation: lesion of the left medial lemniscus and the adjacent left TTT. The stabbing pain in the right eye is due to the irritation of some fibers in the left TTT as they are dying.

NUCLEUS GRACILIS AND CUNEATUS—SPINAL CORD
A. FALSE the surviving axons camouflage the bad ones
B. **TRUE** fewer LMNs and in turn normal axons in a nerve to a muscle=smaller CMAPs
C. **TRUE** dying axons=reinnervation by normal ones=increase in amplitude of MUPs
D. FALSE there is no myopathy
E. TRUE (B and C above)

BRAIN STEM—ACCESSORY CUNEATE NUCLEUS

ACCESSORY CUNEATE NUCLEUS #1
The shaded fiber bundles/tracts are the right ALS (with associated descending autonomics) and the left caudal spinal tract V. The shaded nuclei are the right accessory cuneate nucleus and the left spinal nucleus V.
A. FALSE cells in the right accessory cuneate nucleus project to the right cerebellum
B. FALSE cells in the left spinal nucleus V project to the right VPM via the right TTT
C. FALSE the right ALS projects to the right VPL
D. FALSE the corticospinal fibers on the right are not shaded
E. TRUE—good old descending fibers from the hypothalamus traveling in the right ALS

ACCESSORY CUNEATE NUCLEUS #2
The shaded fiber tracts are the right ALS etc and left caudal spinal tract V. The shaded nuclei are the right accessory cuneate nucleus and the left spinal nucleus V.
A. a lesion of the right accessory cuneate nucleus=in incoordination of the right arm; a lesion of the left spinal nucleus and/or tract V results in loss of pain and temp from the left side of face
B. there is no shading of corticospinal fibers on the right side
C. *constricted* pupil in the *right* eye
D. TRUE
E. FALSE the upper part of the left medial lemniscus is not shaded

ACCESSORY CUNEATE NUCLEUS—MATCHING
A. left nucleus gracilis and cuneatus or right medial lemniscus
B. left spinal nucleus V or right TTT
C. right accessory cuneate nucleus or right DSCT
D/2
E. left nucleus gracilis and cuneatus or right medial lemniscus
F/3
G. lesion of the right ALS etcetera results in constricted pupil in the right eye
H/4; I/5; J/1
ACCESSORY CUNEATE NUCLEUS #3
The level is through the middle of the inferior olive.

Explanation: a single continuous lesion involving the left caudal spinal nucleus and tract V and the left accessory cuneate nucleus will do it. The stabbing pain in the eye represents the irritation of the pathways as the axons die (I don't know why just the eye is affected). Later on, pain and temp. from the entire trigeminal distribution will be reduced/gone.

ACCESSORY CUNEATE NUCLEUS SPINAL CORD—MATCHING

A. right DSCT at C1 (This lesion would also include other parts of the body on the right.)
B/1
C. right fasciculus gracilis at C1
D. left ALS
E/5 (T2)
F/3
G. right ALS above C6 (hand is C6-C8, therefore at C6, part of the hand would have a sensory deficit)
H/4
I/2
J/6

BRAIN STEM—INFERIOR OLIVARY COMPLEX

INFERIOR OLIVARY COMPLEX #1

The shaded fiber tracts/pathways are the right ALS etcetera and the right caudal spinal tract V; the shaded nuclei are the right inferior olive and the right spinal nucleus V.

A. FALSE the right spinal tract arises from cells in the right trigeminal ganglion (and the right geniculate, right superior ganglion IX and right superior ganglion X)
B. FALSE the right ALS terminates in the right VPL
C. TRUE the right inferior olive projects to the left side of the cerebellum
D. FALSE the etcetera of the ALS terminate on preganglionic sympathetic neurons in the lateral horn from T1-L2.
E. FALSE the right ALS terminates in the right VPL. The right spinal tract V terminates in the adjacent right spinal nucleus V. The cell bodies of the right spinal nucleus V send axons (the TTT) that terminate in the left VPM.

INFERIOR OLIVARY COMPLEX #2

The shaded fiber tracts/pathways are the right ALS etcetera and the right caudal spinal tract V; the shaded nuclei are the right inferior olive and the right spinal nucleus V.

A. FALSE the medial lemniscus is not shaded
B. FALSE lesion of the right inferior olive results in left sided incoordination
C. FALSE lesion of the right ALS results in loss of pain and temp from left side of body
D. FALSE lesion of the right inferior olive results in left side incoordination; lesion of right spinal nucleus and tract V results in loss of pain and temp. from right side of face; lesion of right ALS results in left side loss of pain and temp.
E. TRUE love those E's

INFERIOR OLIVARY COMPLEX—MATCHING

A. right medial lemniscus or left nucleus cuneatus and nucleus gracilis

B/5

C. left spinal nucleus V 9(via right TTT)

D/4

E. right inferior cerebellar peduncle

F. right inferior olive

G/2

H/3

I/1

J. right ALS

INFERIOR OLIVARY COMPLEX #3

The drawing is of the middle of the inferior olivary complex.

Explanation: lesion would include the right caudal spinal nucleus and tract V and adjacent right inferior cerebellar peduncle**-OR-**the left TTT and left inferior olive. Take your pick!!

INFERIOR OLIVARY COMPLEX #4

The shaded area is the left inferior olive.

A. FALSE a lesion of the left inf. Olive=incoordination of the right side of the body

B. FALSE the left inf. olive projects to the right side of the cerebellum via climbing fibers

C. TRUE

D. FALSE don't confuse the inferior olive with the cuneate and gracile tubercles (bumps caused by fasciculus/nucleus cuneatus and fasciculus/nucleus gracilis, respectively)

E. FALSE don't confuse the inferior olive with the tuberculum cinereum (bump caused by spinal nucleus and tract V)

INFERIOR OLIVARY COMPLEX—SPINAL CORD I

A. FALSE fewer axons=fewer APs=lower SNAPs

B. FALSE fewer normal axons in a nerve to a muscle—stimulate the nerve—smaller number of muscle fiber action potential=lower CMAP

C. FALSE NMJ all the way!

D. TRUE remaining axons conduct at normal speed

E. FALSE larger MUPs with reinnervation

INFERIOR OLIVARY COMPLEX—SPINAL CORD II

A. TRUE fiber #9 lies in the medial part of the left ALS at spinal level T1. The cell body of this axon lies in the contralateral dorsal horn at this same level. This dorsal horn cell receives information about pain and temperature from the T3 dermatome on the right. Thus, the axon of this dorsal horn cell, fiber #9, also carries info from the T3 dermatome on the right.

B. TRUE #5 shows the ventral roots on the right at T1. Their lesion will result in atrophy of the intrinsic muscles of the right hand

C. FALSE #2 is a delta dorsal root fiber. It conveys info about first pain and cooling.

D. TRUE #1 is a Ia dorsal root fiber, which conveys info about both constant length and changing length of muscle.

E. TRUE see A, B, and D above

BRAIN STEM—HYPOGLOSSAL NUCLEUS

HYPOGLOSSAL NUCLEUS #1

The fiber paths/tracts are the left ALS etc and the right spinal tract V. The shaded nuclei are the left accessory cuneate, right hypoglossal, and right spinal nucleus V.

A. FALSE the right hypoglossal nucleus innervates the right side of the tongue

B. FALSE axons in the right spinal tract V arise from cells in the right trigeminal, right geniculate and right superior IX and superior X ganglia

C. FALSE cells in the left accessory cuneate nucleus send their axons into the left inferior cerebellar peduncle

D. TRUE

E. FALSE the left accessory cuneate nucleus sends axons to the left half of the cerebellum via the inferior cerebellar peduncle

HYPOGLOSSAL NUCLEUS #2

The shaded fiber paths/tracts are the left ALS etcetera and right spinal tract V. The shaded nuclei are the left accessory cuneate, right hypoglossal and spinal nucleus V.

A. FALSE a lesion of the left accessory cuneate nucleus = in incoordination of the left arm; a lesion of the right hypoglossal nucleus = deviation of the tongue to the right

B. FALSE a lesion of left ALS etcetera = loss of pain and temperature from the right side of the body and constricted pupil in the left eye

C. FALSE the medial lemniscus is not shaded

D. TRUE

E. FALSE no corticospinal fibers are shaded

HYPOGLOSSAL NUCLEUS #3

The drawing is of a level through the middle of the inferior olivary complex.

Explanation: For the above signs and deficits the following should be shaded: the left hypoglossal nucleus, left medial lemniscus and left TTT.

HYPOGLOSSAL NUCLEUS—MATCHING

A. right nucleus gracilis

B. cells in the right accessory cuneate nucleus or cells in the left inferior olive

C. cells in the right spinal nucleus V via the left TTT

D/4

E. left inferior cerebellar peduncle

F/5

G/2

H. the right spinal nucleus V receives pain and temperature from the right side of the larynx via central processes of cells in the right superior ganglion X

I/3

J/1

HYPOGLOSSAL NUCLEUS—SPINAL CORD

The spinal level is T1.

Explanation: the ALS on the right at T1 would do the trick!

HYPOGLOSSAL NUCLEUS #4

A. FALSE a lesion of the right hypoglossal nerve=atrophy on the right side of the tongue
B. FALSE tongue goes right and hemiplegia on left
C. FALSE huh? The axons of hypoglossal cells do not cross!
D. TRUE
E. FALSE this is hypoglossal (a motor pathway) not trigeminal (a sensory pathyway)!!

BRAIN STEM—DORSAL MOTOR X

DORSAL MOTOR X #1

The shaded pathways/fiber tracts are the left spinal tractV and the right ALS etcetera. The shaded nuclei are the left spinal nucleus V, left dorsal motor X, left hypoglossal and right accessory cuneate nucleus.

A. FALSE the dorsal motor X is a preganglionic parasympathetic cell group; postganglionics innervate smooth muscle.
B. FALSE the right accessory cuneate nucleus receives input from DRG on the right that are rostral to C8
C. FALSE gee, is the fasciculus gracilis shaded/present?
D. TRUE good old ALS
E. FALSE the left hypoglossal nucleus innervates intrinsic tongue muscles on left

DORSAL MOTOR X #2

The shaded pathways are the left spinal tractV and the right ALS etcetera. The nuclei are the left spinal nucleus V, left dorsal motor X, left hypoglossal and right accessory cuneate nucleus

A. FALSE a lesion of the dorsal motor X will result in an increase in heart rate
B. FALSE a lesion of the left hypoglossal nucleus results in the deviation of the tongue to the left upon protrusion
C. FALSE is the medial lemniscus shaded?
D. TRUE
E. FALSE a lesion of the right ALS=loss of pain and temp from the left side of the body

DORSAL MOTOR X #3

The drawing is through the middle of the inferior cerebellar peduncle):

Explanation: these problems can be accounted for by a single continuous lesion of the right hypoglossal nucleus and the adjacent right dorsal motor X

DORSAL MOTOR X—MATCHING

A. corticospinal fibers—either the right pyramid or left DSCT
B. the left TTT; these fibers originate in the right spinal nucleus V
C. a lesion of the right hypoglossal nucleus will result in atrophy of only the right side of the tongue; bilateral atrophy would require lesion of both hypoglossal nuclei or both CN XIIs
D. left hypoglossal nucleus
E/1; F/2; G/3; H/4; I/5
J. right spinal tract and/or nucleus V or left TTT

DORSAL MOTOR X—SPINAL CORD

SPINAL ROOT	MUSCLE INNERVATED
C5/C6	biceps brachii brachioradialis ***deltoid*** ***infraspinatus*** supraspinatus
C7	triceps
C7/C8	***extensors and flexors of wrist***
C8/T1	***intrinsic muscles of hand***
L2/L3	hip flexors ***Iliopsoas***
L3/L4	knee extensor ***vastus lateralis*** **vastus medialis**
L5	ankle dorsiflexion ankle eversion and inversion ***hip abductor***
S1	plantar flexion of ankle ***hip extensors***

BRAIN STEM—NUCLEUS AMBIGUUS

1. **NUCLEUS AMBIGUUS PROBLEM SOLVING**

1. FALSE Information about the stimulus is not able to get into the brain stem!

2. TRUE information is carried via the right CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

3. TRUE information is carried via CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

4. FALSE Information about the stimulus does not get into the brain stem!

5. FALSE nucleus ambiguous (or the cranial nerves themselves) needs to be damaged to have atrophy of pharyngeal and laryngeal muscles

2. **NUCLEUS AMBIGUUS PROBLEM SOLVING**

1. FALSE Information about the stimulus does not get to the left spinal nucleus V.

2. TRUE information is carried via the right CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

3. TRUE information is carried via CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

4. FALSE how can it?? Information about the stimulus does not go anywhere, i.e., it does not get past the left spinal tract V into the brain stem!

5. FALSE nucleus ambiguus needs to be damaged to have atrophy of pharyngeal and laryngeal muscles

3. **NUCLEUS AMBIGUUS PROBLEM SOLVING**

1. FALSE information is carried via the left CNs IX and X from the pharynx into the left spinal tract V to the left caudal spinal nucleus V (synapse). Then cells in the left spinal nucleus V send axons into the right TTT to innervate the right and left nuclei ambiguii=gag. With a lesion of the right TTT, information from the left side of the pharynx will not get to the muscles of the pharynx on the right or left.

2. TRUE information is carried via the right CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

3. TRUE information is carried via CNs IX and X from the pharynx, into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right and left nuclei ambiguii=gag

4. FALSE information is carried via the left CNs IX and X from the pharynx into the left spinal tract V to the left caudal spinal nucleus V (synapse). Then cells in the left spinal nucleus V send axons into the right TTT to innervate the right and left nuclei ambiguii=gag. With a lesion of the right TTT, information from the left side of the pharynx will not get to the muscles of the pharynx on the right or left

5. FALSE nucleus ambiguous needs to be damaged to have atrophy of pharyngeal and laryngeal muscles

4. **NUCLEUS AMBIGUUS PROBLEM SOLVING**

1. FALSE information is carried via the left CNs IX and X from the pharynx into the left spinal tract V to the left caudal spinal nucleus V (synapse). Then cells in the left spinal nucleus V send axons into the right TTT to innervate the right (consensual) and left nuclei (direct) ambiguii=gag. With a lesion of the right nucleus ambiguous there is no contraction of the muscles on the right (consensual) side of the pharynx

2. FALSE information is carried via the right CNs IX and X from the pharynx into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send axons into the left TTT to innervate the right (direct) and left (consensual) nuclei ambiguii=gag. With a lesion of the right nucleus ambiguous there is no contraction of the muscles on the right side (direct) of the pharynx

3. TRUE information is carried via the right CNs IX and X from the pharynx into the right spinal tract V to the right caudal spinal nucleus V (synapse). Then cells in the right spinal nucleus V send

axons into the left TTT to innervate the right (direct) and left (consensual) nuclei ambiguii=gag. With a lesion of the right nucleus ambiguous there is contraction of the muscles on the left (consensual) side of the pharynx

4. TRUE information is carried via the left CNs IX and X from the pharynx into the left spinal tract V to the left caudal spinal nucleus V (synapse). Then cells in the left spinal nucleus V send axons into the right TTT to innervate the right and left nuclei ambiguii=gag. With a lesion of the right nucleus ambiguous there is no contraction of the muscles on the right side (consensual) of the pharynx but the muscles on the left do contract (direct)

5. **NUCLEUS AMBIGUUS PROBLEM SOLVING**

1. FALSE A lesion of the right spinal nucleus and tract of V has no effect on the consensual reflex. However, the lesion of the right nucleus ambiguous wipes out the consensual reflex

2. FALSE A lesion of the right spinal nucleus and tract of V prevents the information from the right side of the pharynx from getting into the left TTT; also, the lesion of the right nucleus ambiguus would not allow for a direct response

3. FALSE A lesion of the right spinal nucleus/tract V prevents the info from the right side of the pharynx from getting into the left TTT; you can't respond to a stimulus you can't feel

4. TRUE information is carried via the left CNs IX and X from the pharynx, into the left spinal tract V to the left caudal spinal nucleus V (synapse). Then cells in the left spinal nucleus V send axons into the right TTT to innervate the left (direct) nucleus ambiguii=gag on left

NUCLEUS AMBIGUUS #1

The shaded fiber tracts/pathways are the right pyramid, and the right ALS etcetera. The shaded nuclei are the right nucleus ambiguous, the right dorsal motor X and the right hypoglossal nucleus.

A. FALSE the right nucleus ambiguous innervates pharyngeal constrictors on the right.

B. TRUE the right nucleus ambiguous receives input from both the right and the left spinal nucleus V (via the right and left TTT).

C. FALSE the corticospinal fibers in the right pyramid arise from cells in the right motor cortex (there are NO corticobulbar fibers to the hypoglossal or ambiguous shaded!)

D. FALSE the right hypoglossal nucleus innervates muscles on the right side of the tongue

E. FALSE the "etcetera" of the right ALS arise from the right side of the hypothalamus and travel with the ALS in the brainstem

NUCLEUS AMBIGUUS #2

The shaded fiber tracts/pathways are the right pyramid, and the right ALS etcetera. The shaded nuclei are the right nucleus ambiguous, the right dorsal motor X and the right hypoglossal nucleus.

A. FALSE the only way the chin becomes rotated or atrophy of the trapezius is seen is via a lesion the SPINAL part of CN XI. Cells in nucleus ambiguus DO NOT send axons into the spinal division.

B. FALSE is any trigeminal-related pathway shaded?

C. FALSE the circuitry underlying contraction of the pharyngeal muscles on the left upon stimulation of the right side of the pharynx is intact

D. TRUE

E. FALSE with "incoordination," think mainly unconscious proprioceptive pathways, the cerebellum, and pathways to and from the cerebellum. (A corticospinal tract lesion (right pyramid) results in weakness). Is the left spinal tract and nucleus V or right TTT shaded?

NUCLEUS AMBIGUUS—MATCHING

A. hypoglossal nucleus
B. left TTT
C. the only thing that could result in bilateral atrophy of the tongue is bilateral lesion of the hypoglossal nuclei or nerves
D. a lesion of the right nucleus ambiguous results in deviation of the uvula to the left
E/1
F. the lesion would have to be in the right spinal nucleus and tract V or the left TTT
G/3
H/5
I/4
J/2

NUCLEUS AMBIGUUS #3

The drawing is of the level through the middle of the inferior olivary complex
Explanation: a continuous lesion involving the left nucleus ambiguous, (atrophy of the left pharyngeal constrictors, dysphagia, dysphonia, right deviation of uvula) the left caudal spinal nucleus/tract (loss pain and temperature on the left side of face) and the left inferior olive (incoordination of right arm and leg).

NUCLEUS AMBIGUUS—SPINAL CORD

The shaded areas are at spinal level T1. The pathways/fibers include the right fasciculus cuneatus, right DSCT, and right ALS etc; the shaded cells lie in the right ventral horn.
A. FALSE a lesion in the right ventral horn at T1=atrophy of right intrinsic hand muscles
B. FALSE is the LCST shaded?
C. TRUE
D. FALSE is the LCST shaded?
E. the shoulder is innervated by dermatomes C4-C5. The spinal level is T1 so the subject is moot!

BRAIN STEM—INFERIOR SALIVATORY NUCLEUS

INFERIOR SALIVATORY NUCLEUS—MATCHING

A. left inferior cerebellar peduncle
B. right nucleus ambiguus
C/1
D. the only way to get bilateral atrophy of the muscles of the soft palate, pharynx and larynx is via a bilateral lesion of nucleus ambiguus or a bilateral lesion of CNs IX and X. Bilateral damage to corticobulbar fibers terminating in nucleus ambiguous does not do it either.
E/4
F/5
G/3
H. . the only thing that could result in bilateral atrophy of the tongue is bilateral lesion of the hypoglossal nuclei or nerves. Corticobulbar lesions can’t do it either.
I/2
J. left spinal nucleus or tract V

INFERIOR SALIVATORY NUCLEUS #1

The brain stem drawing is through the middle of the inferior cerebellar peduncle

Explanation: The lesion involves the left ALS etcetera (ptosis of the left eyelid and constriction of the left pupil; pain in the right arm and leg followed by loss of pain and temp from the right arm and leg), the left inferior olive (incoordination of the right arm and leg), left nucleus ambiguous (hoarseness and dysphagia), left inferior salivatory nucleus (decrease in saliva) and left spinal nucleus/tract V (pain in the left eye followed by loss of pain and temperature from the left side of the face).

INFERIOR SALIVATORY NUCLEUS—SPINAL CORD I

A. FALSE it is a NMJ problem, not a problem with axons
B. FALSE it is a NMJ problem, not a problem with axons
C. FALSE it is a NMJ problem, not a problem with LMNs/axons and reinnervation
D. FALSE it is a NMJ problem, not a problem with LMNs/axons and reinnervation
E. TRUE myasthenia gravis=NMJ problem = decremental CMAPS—never forget it!!

INFERIOR SALIVATORY NUCLEUS—SPINAL CORD II

A. TRUE myopathy=increase in CK; never forget it!!
B. **TRUE** sure, there are myopathies caused by inflammation
C. TRUE less muscle, smaller CMAPs
D. TRUE it is a muscle problem, not a problem with axons and their APs
E. TRUE are you sick of E's?

INFERIOR SALIVATORY NUCLEUS #2

The fiber pathways/tracts shaded are the right inferior cerebellar peduncle, right ALS etc and right spinal tract V. The cell groups/nuclei shaded include the right hypoglossal nucleus, the right dorsal motor X, the right spinal nucleus V, the right nucleus ambiguous and the right inferior salivatory nucleus.

A. FALSE the right nucleus ambiguous innervates the right pharyngeal constrictors
B. FALSE Cells of the right inferior salivatory nucleus are presynaptic parasympathetic fibers that synapse in the right otic ganglion, which sends postsynaptic fibers to synapse on the secretory cells of the parotid gland. Also, the right ALS terminates in the right VPL. The right spinal tract V terminates in the right spinal nucleus V. The right spinal nucleus V sends axons into the left TTT, which terminates in the left VPM. Whew!
C. TRUE some of the axons in the right ICP arise from the left inferior olive
D. FALSE the "etcetera" axons in the right ALS terminate on preganglionic sympathetic neurons on the right side of the spinal cord; the pain and temperature carrying fibers in the right ALS arise from cells in the dorsal horn on the left side of the spinal cord
E. FALSE axons in the right inferior cerebellar peduncle arise from cells in the right accessory cuneate nucleus; also, the axons that project to postganglionic parasympathetic ganglia have cell bodies located in the inferior salivatory nucleus

INFERIOR SALIVATORY NUCLEUS #3

The fiber pathways/tracts shaded are the right inferior cerebellar peduncle, right ALS etc and right spinal tract V. The cell groups/nuclei shaded include the right hypoglossal nucleus, the right dorsal motor X, the right spinal nucleus V, the right nucleus ambiguus and the right inferior salivatory nucleus.

A. FALSE a lesion of the “etcetera” of the right ALS=constricted pupil in the right eye
B. TRUE
C. FALSE is the spinal nucleus and tract V on the left or the TTT on the right shaded?
D. FALSE does chin rotation result from a lesion of nucleus ambiguous? Remember, the spinal fibers for CN XI originate in the spinal chord, not nucleus ambiguus.
E. FALSE is the left medial lemniscus shaded?

BRAIN STEM—NUCLEUS AND TRACTUS SOLITARIUS

NUCLEUS AND TRACTUS SOLITARIUS #1

The fiber tract/pathways shaded are the right pyramid, the right ALS etc, right spinal tract V, right TTT and left fasciculus solitarius. The shaded cell groups/nuclei are the right spinal nucleus V, left hypoglossal, left dorsal motor X, left solitarius, left ambiguus and left inferior salivatory.
A. FALSE fibers from the left superior ganglion IX are in the left spinal tract V; fibers from the left *inferior* ganglion IX are in the left tractus/nucleus solitarius
B. FALSE is the right nucleus ambiguous shaded?
C. FALSE axons in the right TTT arise from the left caudal spinal nucleus V
D. FALSE the “etcetera” of the right ALS arise from the right side of the hypothalamus
E. TRUE the right spinal nucleus V and the left nucleus solitarius both send axons to the left VPM via the left TTT and STT, respectively; remember, the STT is uncrossed!

NUCLEUS AND TRACTUS SOLITARIUS #2

The fiber tract/pathways shaded are the right pyramid, the right ALS etcetera, the right spinal tract V, the right TTT and the left fasciculus solitarius. The shaded cell groups/nuclei are the right spinal nucleus V, the left hypoglossal nucleus, the left dorsal motor X, the left nucleus solitarius, the left nucleus ambiguous and the left inferior salivatory nucleus.
A. FALSE a lesion of the left rostral solitary tract and nucleus=loss of taste on the *left* side of the tongue; a lesion of the dorsal motor X=*increase* in heart rate
B. FALSE a lesion of the corticospinal fibers on the right rostral to their decussation=left Babinski
C. FALSE a lesion of the etcetera of the right ALS etc=constricted pupil in the right eye
D. FALSE a lesion of the left hypoglossal nucleus=atrophy of tongue muscles on the left
E. **TRUE**, lesions of the right spinal tract/nucleus V eliminates pain and temperature of the right side of the face, tongue, and pharynx (via CNs V, VII, IX, and X); a lesion of the right TTT eliminates pain and temperature of these same structures on the left

NUCLEUS AND TRACTUS SOLITARIUS—MATCHING

A. right STT
B. left nucleus ambiguus
C/5
D. left LCST or right pyramid
E. right spinal tract V
F/1
G/4 (nucleus ambiguus receives bilateral corticobulbar input)
H. dorsal motor X; I know what you are thinking now, but the left STT goes to **thalamus**, not to the dorsal motor X. The only part of the solitary complex that goes to the thalamus is the gustatory part!
I/3
J/2

NUCLEUS AND TRACTUS SOLITARIUS SPINAL CORD

The level is C2 and only fibers are shaded, all on the right; these include the medial third of fasciculus gracilis, the lateral fifth of the DSCT, the lateral third of the LCST and lateral fifth of the ALS.

A. the most lateral fibers of the right ALS at spinal level C2 carry pain and temperature information from sacral levels on the left, which is nowhere near the arm

B. the most medial fiber in fasciculus gracilis at spinal level C2 carry 2pt. etcetera from sacral levels on the right; vibration from the arm is carried in the fasciculus cuneatus

C. fibers in the lateral third of the right LCST at spinal level C2 innervate ventral horn cells in the lumbosacral levels on the right.

D. the most lateral fibers in the right DSCT at spinal level C2 carry unconscious proprioception from lumbosacral levels

E. TRUE—Tough question!

NUCLEUS AND TRACTUS SOLITARIUS #3

The drawing is through the middle of the inferior olive.

Explanation: a continuous lesion involving the left hypoglossal nucleus (fasciculations and atrophy of the muscles on the left side of the tongue), left solitary tract and nucleus (loss of taste from the left side of the tongue), left spinal tract and nucleus V (loss of pain and temperature from the left side of the tongue), left dorsal motor X (increase in heart rate) and the left inferior cerebellar peduncle (incoordination of the left arm and leg).

BRAIN STEM—DORSAL AND VENTRAL COCHLEAR NUCLEI

DORSAL AND VENTRAL COCHLEAR NUCLEI #1

The brain stem level is through the pontomedullary junction. The shaded fiber tracts/ pathways are the right pyramid, the right medial lemniscus, the right TTT, the right STT and the right spinal tract V. The cell groups/nuclei are the right dorsal and ventral cochlear nuclei and the right spinal nucleus V.

A. FALSE axons comprising the right TTT arise from cells in the left spinal nucleus V

B. FALSE the right ML arises from cells in the left nucleus gracilis and cuneatus

C. FALSE the right ventral and dorsal cochlear nuclei receive input from the right cochlear or spiral ganglion

D. FALSE the right STT arises from cells in the right solitary nucleus

E. TRUE right spinal tract V

DORSAL AND VENTRAL COCHLEAR NUCLEI #2

The brain stem level is through the pontomedullary junction. The shaded fiber tracts/ pathways are the right pyramid, the right medial lemniscus, the right TTT, the right STT and the right spinal tract V. The cell groups/nuclei are the right dorsal and ventral cochlear nuclei and the right spinal nucleus V.

A. FALSE lesions of the right ventral and dorsal cochlear nuclei=deafness in the right ear

B. FALSE a lesion of the right pyramid=left Babinski

C. FALSE a lesion of the right STT=loss of taste from the right side of the tongue

D. FALSE a lesion of the right medial lemniscus =loss 2pt. etcetera left arm and leg

E. TRUE loss from the right side via right spinal tract/nucleus V lesion and loss from the left via right TTT lesion

DORSAL AND VENTRAL COCHLEAR NUCLEI #3

The shaded nerve is the auditory part of the right CN VIII. Notice that it is dorsal to the vestibular division of CN VIII.

A. FALSE the nerve is on the right side of the brain stem
B. FALSE the nerve is on the right side of the brain stem
C. FALSE all of the fibers in the auditory part of CN VIII terminate in the cochlear nuclei (dorsal and ventral). The MGB is in the thalamus!
D. FALSE can you tell the difference between CNs V and VIII on the brain stem?
E. TRUE

DORSAL AND VENTRAL COCHLEAR NUCLEI—MATCHING

A/4
B. cells in the left inferior salivatory nucleus synase on postganglionic cells in the otic ganglion, which in turn synapse on secretory cells of the parotid gland
C. the central processes of dorsal root ganglia on the right project into the right fasciculus gracilis and cuneatus and the right zone of Lissauer.
D/3
E/1
F. left nucleus ambiguus or left CNs IX and X
G/2
H/5
I**.** left hypoglossal nucleus or nerve
J. right medial geniculate body (MGB)

DORSAL AND VENTRAL COCHLEAR NUCLEI #4

The drawing is at the level of the pontomedullary junction).

Explanation: the continuous lesion involves the left dorsal and ventral cochlear nuclei (deafness in the left ear), the left inferior cerebellar peduncle (incoordination of the left arm and leg) and the left spinal tract and nucleus V (loss of pain and temperature from the left side of the face).

DORSAL AND VENTRAL COCHLEAR NUCLEI—SPINAL CORD

1. Which of the following statements is **true** regarding **compression radiculopathy**?
A. FALSE the most common cause of compression radiculopathy is intervertebral disc herniation
B. FALSE both dorsal and ventral roots can be involved
C. FALSE both dorsal and ventral roots can be involved
D. FALSE they can also occur in the intervertebral foramina
E. TRUE

2. Which of the following is the “hallmark” deficit resulting from **root compression**?
A. FALSE the “hallmark” deficit resulting from root compression is pain
B. FALSE the “hallmark” deficit resulting from root compression is pain
C. TRUE the “hallmark” deficit resulting from root compression is pain
D. FALSE the “hallmark” deficit resulting from root compression is pain
E. FALSE the “hallmark” deficit resulting from root compression is pain

3. Which of the following statements is **true**?
A. FALSE nerve root L5 exits below the vertebra
B. FALSE the cauda equina is made up of roots L1 on down
C. TRUE a classic
D. TRUE a classic
E. TRUE (see C and D above)

BRAIN STEM—VESTIBULAR/ABDUCENS

VESTIBULAR/ABDUCENS—PROBLEM SOLVING

1. Which of the following statements is/are TRUE regarding a lesion of the **left abducens nucleus?**
   1. TRUE
   2. FALSE
   3. TRUE cold water in the right ear "turns down" the firing in the vestibular division of the right CN VIII. The eyes will go slowly to the right as the left side is now in control. The right abducens/lateral rectus and left medial rectus are fine
   4. FALSE

2. Which of the following neurological deficits would be present immediately following a lesion of the **right frontal eye fields**?
   1. FALSE atrophy occurs only with LMN lesions
   2. FALSE atrophy occurs only with LMN lesions
   3. FALSE the right FEF turns the eyes to the left
   4. TRUE the right FEF turns the eyes to the left

3. Which of the following deficits would result from a lesion of the **left PPRF**?
   1. FALSE does the PPRF directly innervate muscle?
   2. FALSE does the PPRF directly innervate muscle?
   3. FALSE the left PPRF directs both eyes to the left (ipsi)
   4. TRUE

4. You spin your patient to the right. After keeping the speed of head rotation to the right constant for a while, you suddenly stop. Which of the following statements are true regarding the movement of the eyes.
   1. FALSE when you start to spin to the right the eyes move slowly to the left because the stereocilia in the right horizontal semicircular canal side are being deflected in the "excitatory way" (toward the kinocilium; just the opposite happens on the left side). The eyes will go as far as they can to the left and then suddenly snap back to the right (right nystagmus!). Once the head spins to the right for a while the fluid catches up with the bony chambers and there is no deflection of the stereocilia (and no nystagmus). When you stop spinning to the right the inertia of the endolymph now stimulates haircells in the left horizontal semicircular canal and it is now in command. Your eyes go slowly to the right and snap back to the left (left nystagmus!)
   2. TRUE see explanation for #1
   3. FALSE see explanation for #1
   4. TRUE see explanation for #1

5. Which of the following deficits would occur following a bilateral lesion of the MLF between the abducens nucleus and the oculomotor nucleus?

1. TRUE the fibers in the right MLF tell the cells in the right oculomotor complex that innervate muscle fibers in the right medial rectus to fire and contract, which move the right eye medially (to the left)

2. FALSE MLF axons do not innervate any muscle **DIRECTLY**! They are not LMNs!

3. TRUE the fibers in the left MLF tell the cells in the left oculomotor complex that innervate muscle fibers in the left medial rectus to fire and contract, which move the left eye medially (to the right)

4. FALSE MLF axons do not innervate any muscle **DIRECTLY**! They are not LMNs!

6. Which of the following would result after destruction of the **right vestibular nuclei?**

1. TRUE the right "side" is down and the left is "up"/dominates. Left side pushes the eyes slowly to the right and then they snap back to the left=left nystagmus

2. FALSE see #1

3. TRUE the right "side" is "down" and the left is "up"/dominate Left side pushes the body to the right=falling to the right

4. FALSE see #3

7. Which of the following statements is/are TRUE?

1. FALSE with sudden rotation to the right, the right horizontal semicircular canal is deflected the "excitatory way" (toward the kinocilium; the opposite happens on the left).

2. TRUE once the head spins to the right for a while the fluid catches up with the bony chambers and there is no deflection of the stereocilia (and no nystagmus). When you stop spinning to the right, the inertia of the endolymph puts the left horizontal semicircular canal in command.

3. FALSE when you start to spin to the right the eyes move slowly to the left because the stereocilia in the right horizontal semicircular canal side are being deflected in an "excitatory way" (toward the kinocilium; just the opposite happens on the left side). The eyes will go as far as they can to the left and then snap back to the right (right nystagmus.

4. TRUE the patient cannot *voluntarily* move his/her eyes to the left without the right FEF. However, the vestibular nerve, nuclei, PPRF, abducens and oculomotor nuclei and nerves are fine. So the eyes will move slowly to the left when the head is moved to the right. They also will snap back to the right as the left FEF is fine.

8. Which of the following will occur following a lesion of the **left abducens nucleus?**

1. TRUE the left abducens moves the left eye left and the right eye left via the MLF and medial rectus neurons of CN III.

2. FALSE the left eye can not rotate laterally to the left. The right eye will not rotate medially to the left.

3. TRUE the right PPRF helps move both eyes to the right (ipsi). This is accomplished via projections to the right abducens nucleus, which innervates the right LR6 and left MR neurons via the MLF.

4. FALSE without the left abducens, the left PPRF can't move the eyes to the left

9. You stimulate the right horizontal semicircular canal with cold water. Which of the following will occur? (REMEMBER, COWS!)

1 TRUE cold water in the right ear "turns down" the firing in the vestibular division of the right CN VIII. This means less stimulation of the right vestibular nuclei, left PPRF, left abducens nucleus, left lateral rectus and right medial rectus. With the above happening, the left vestibular nerve is "tuned up," as are the left vestibular nuclei, right PPRF, right abducens, right lateral rectus and left medial rectus.

2 FALSE cold water in the right ear "turns down" the firing in the vestibular division of the right CN VIII. The eyes will go slowly to the right as the left side is now in control. The eyes will then snap back to the right (right nystagmus)

3. TRUE see explanations 1 and 2

4. FALSE see explanations 1 and 2

10. You have a large lesion of the **right frontal lobe**, including the frontal eye fields and motor cortex (area 4). Which of the following deficits would you see?

1. FALSE the lesion of the right FEF=eyes deviated to the right. Lesion of right motor cortex (corticospinal fibers)=left hemiplegia

2. FALSE see explanation #1

3. FALSE are any LMNs affected? That is the only way there is atrophy!

4. TRUE see explanation #1

11. You have a large lesion in the **left** pons that involves the corticospinal fibers and the PPRF. Which of the following statements is/are TRUE?

1. FALSE interruption of the corticospinal fibers in the left side of the pons=right hemiplegia. Damage to the left PPRF=inability to turn both eyes to the left and slight deviation of the eyes to the right

2. FALSE see explanation #1

3. FALSE see explanation #1

4. TRUE see explanation #1

12. Which of the following statements is/are true regarding diplopia?

1. FALSE both eyes are deviated, not just one eye

2. TRUE only one eye is deviated

3. FALSE are both eyes deviated or only one eye?

4. TRUE is one eye deviated?

VESTIBULAR/ABDUCENS #1

The brain stem level is the pontomedullary junction. The tracts/pathways shaded are the right ALS etcetera and the right spinal tract V. The cells/nuclei that are shaded include the right spinal nucleus V and the right vestibular nuclei.

A. FALSE axons in the right ALS are from the dorsal horn on the left side of the spinal cord

B. FALSE this would only occur with a lesion of the right TTT

C. FALSE the axons in the right spinal tract V arise from the right geniculate ganglion (CN VII) and the right superior ganglia IX and X

D. TRUE cells in the right spinal nucleus V project to the left VPM via the left TTT

E. FALSE the right vestibular nuclei receive input from the right vestibular nerve/ganglion

VESTIBULAR/ABDUCENS #2

The brain stem level is the pontomedullary junction. The tracts/pathways shaded are the right ALS etcetera and the right spinal tract V. The cells/nuclei that are shaded include the right spinal nucleus V and the right vestibular nuclei.

A. FALSE is the medial lemniscus or pyramid shaded?

B. TRUE spinal nucleus and tract V are shaded

C. FALSE interruption of the right "etcetera" of ALS =constricted pupil in right eye. Lesion of the right vestibular nuclei=left vestibular nuclei dominating and pushing to the right=stumbling to the right and left nystagmus

D. FALSE This would result in nausea because the vestibular system is out of balance (pun), but a right ALS lesion=loss pain and temperature from left side of body

E. FALSE left vestibular nuclei in control and turns on/up right PPRF and both eyes go slowly to the right and snap back to the left (left nystagmus)

VESTIBULAR/ABDUCENS #3

The brainstem level is through the pontomedullary junction.

Explanation: the continuous lesion affects the left vestibular nuclei (nausea, stumbling to the left), the left STT (loss of taste from the left side of the tongue), left spinal nucleus/tract V and right TTT (bilateral loss of pain and temperature from the face and tongue).

VESTIBULAR/ABDUCENS #4

The right vestibular division of CN VIII is shaded. Note that it is VENTRAL to the auditory division.

A. FALSE the right vestibular division of CN VIII arises from cells in the right vestibular (Scarpa's) ganglion

B. FALSE know right from left on the brain stem. Please!

C. TRUE left dominates! Pushes eyes slowly to the right, snap back to left=left nystagmus

D. FALSE left dominates! Pushes body to right. Right is weak/down!!

E. FALSE You may want to review LVST and the MVST/descending MLF pathways!

VESTIBULAR/ABDUCENS #5

CN VI on the right side of the brain stem is shaded.

A. FALSE please know right versus left!

B. FALSE a lesion of the right abducens nerve=deviation of the right eye medially (to the left). Interruption of the corticospinal fibers on the right side of the pons=left hemiplegia

C. FALSE the abducens nerve is "past" the abducens nucleus—only one eye will be affected

D. TRUE what head movement will result in having both eyes aligned? The right eye is rotated medially (to the left). Rotate the head to the right causes the left eye to reflexively rotate to the left and the two eyes are aligned. Remember, **ROTATE** to the side of the lesion in the case of a CN VI nerve lesion.

E. FALSE the right abducens nerve terminates in the right lateral rectus

VESTIBULAR/ABDUCENS—SPINAL CORD

All of the pathways and cell groups that you have learned are shaded on the right at spinal level T1. A hemisection (one half of the cord) of the spinal cord is called a "Brown-Sequard."

A. FALSE the DSCT is interrupted on the right

B. FALSE the right LCST is shaded and it arises from the left motor cortex

C. FALSE what side are we talking about? Fibers from levels T2 and T3 on the right, however, are traveling in the right zone of Lissauer.

D. FALSE huh? Directly is the trick!! The preganglionic sympathetics of the lateral horn synapse upon postganglionic sympathetics and the latter innervate the blood vessels.

E. TRUE—don't forget about those descending fibers traveling just medial to the LCST.

VESTIBULAR/ABDUCENS—MATCHING I

A. left spinal tract V (somatosensation) or left solitary fasciculus (taste)

B/5 left vestibular nerve down=right circuitry pushing eyes slowly to the left and snap back to the right (right nystagmus)

C. left rostral nucleus solitarius

D/2 via right STT

E. right vestibular nerve or nucleus (leads to left circuitry pushing body to the right)

F/4

G/3 JKH thought/note: Pain and temperature from the right side of the tongue is conveyed via CNs V and IX. Central processes of cells in the trigeminal and superior ganglion IX enter the spinal tract V at the level of the pons and then go all the way down to the caudal level of the spinal tract and nucleus V to synapse. The central processes of cells in the inferior ganglion IX enter at the medulla where the inferior olive is in full bloom. So, it is only at this level that taste related fibers associated with both VII and IX are in the spinal tract and nucleus V.

H. left TTT (carrying fibers from cells in the right spinal tract V) or left STT (carrying fibers from the left nucleus solitarius)

I/1 (corticobulbars to XII are crossed)

J. left or right dorsal motor X would result in *increased* heart rate

VESTIBULAR/ABDUCENS—MATCHING II

A. left vestibular ganglion

B. left vestibular nuclei

C. take your pick: left geniculate ganglion, left inferior ganglion IX, left solitary nucleus/tract, left STT, left VPM or left somatosensory cortex; some of these would also lead to other deficits as well (pretty complete, huh?)

D. right TTT (from the left spinal nucleus V) or right STT (from right nucleus solitarius)

E/3

F/1

G. right trigeminal ganglion, right spinal nucleus/tract V, left TTT, left VPM, or left somatosensory cortex (got all that?)

H/5

I/4

J/2

BRAIN STEM—MOTOR VII

MOTOR VII #1

The brain stem level is through the facial colliculus level of the pons. The shaded pathways/fiber tracts are the right spinal tract V, right lateral lemniscus, right MLF and right "fab 4" (ALS etc, ML, TTT). The nuclei/cell groups shaded are the right spinal nucleus V, right motor VII and right superior olive.

A. FALSE axons in the right ALS arise from cells in the left dorsal horn. The right vestibular nuclei project to the left PPRF and to the right and left side of the spinal cord (LVST and MVST)
B. FALSE the right PPRF projects to the right abducens nucleus but not over any particular pathway
C. FALSE is the right STT shaded?
D. FALSE while the cells of the superior olivary complex send axons into the lateral lemniscus, the lateral lemniscus terminates in the inferior colliculus. The IC projects to the MGB.
E. TRUE one of the fab 4—the medial lemniscus

MOTOR VII #2

The brain stem level is through the facial colliculus level of the pons. The shaded pathways/fiber tracts are the right spinal tract V, right lateral lemniscus, right MLF and right "fab 4" (ALS etc, ML, TTT). The nuclei/cell groups shaded are the right spinal nucleus V, right motor VII and right superior olive.

A. FALSE a lesion of the right TTT and left spinal tract/nucleus V=bilateral loss of pain and temperature of the face, but the lesion of the right ALS=loss of pain and temperature on the left side of body
B. FALSE deafness only results from lesions of the auditory nerve or both the dorsal and ventral cochlear nuclei. Higher up (or more central) in the auditory pathways="subtle auditory deficits."
C. FALSE a lesion of the right MLF does not result in atrophy of right medial rectus. The medial rectus neurons on the right are lonely but still kicking.
D. FALSE the rootlets of the right CN VI (lateral rectus) are not shaded.
E. TRUE the lateral lemniscus and superior olive are subtle auditory deficits and the right motor VII innervates the right orbicularis oculi

MOTOR VII #3

The motor portion of the right CN VII is shaded. The intermediate nerve of VII lies more lateral and carries somatosensory, autonomic and taste fibers.

A. FALSE where is CN VI in this view of the brain stem?
B. FALSE this is the right CN VII, not the left!
C. FALSE this is the right CN VII, not the left!
D. FALSE this is the right CN VII, not the left!
E. TRUE Finally!

MOTOR VII—MATCHING

A. left oculomotor nucleus
B. right motor cortex or left hypoglossal nucleus or nerve
C/4 ahhhhhhhhh
D/2
E/1
F. CNs IX and X on the left, left spinal tract/nucleus V, right TTT, right VPM or right somatosensory cortex
G. left motor nucleus VII or motor part of CN VII
H. CN VIII or right dorsal and ventral cochlear nuclei
I/5
J/3

MOTOR VII #4

The level is through the facial colliculus of the pons.

Explanation: single continuous lesion on the right can account for the deficits. The loss of pain and temperature from the left side of the body is accounted for by a lesion of the right ALS. The double vision, especially when attempting to turn eyes to the right, is due to a lesion of the right rootlets of CN VI; when the patient looks to the right, the right eye will not go laterally to the right. Hypersensitivity to sounds, drooling from the right side of the mouth and a dry cornea on the right can all be accounted for via a lesion of the right motor VII.

MOTOR VII—SPINAL CORD

A. FALSE MUPs are larger in LMN disease
B. FALSE MUPs are larger in axonal nerve disease
C. FALSE NMJ=decremental CMAP but no effect on MUPs
D. FALSE the needle has to be **IN** the muscle (in contrast to recording CMAPs)
E. TRUE dying axons=reinnervation=larger MUPs

MOTOR VII—EYE MOVEMENTS

(A=right abducens nucleus; B=left rootlets of CN VI; C=right vestibular nuclei; D=right MLF; E=left FEF)

A. TRUE
B. FALSE is one eye affected, or both?
C. FALSE a lesion of the left rootlets of CN VI=medial deviation of the ipsilateral (left) eye
D. TRUE right side "controls," pushes eyes slowly to the left followed by snap back to the right (right nystagmus)
E. FALSE a lesion of the right MLF=inability to turn right eye to the contralateral side

BRAIN STEM—SUPERIOR SALIVATORY/LACRIMAL NUCLEI

SUPERIOR SALIVATORY/LACRIMAL NUCLEI #1

The shaded pathway/fiber tract at the level through the middle of the inferior olive is the right ALS etcetera. The shaded nuclei at this medullary level are the right nucleus ambiguus and the adjacent inferior salivatory nucleus. The shaded nuclei at the level of the facial colliculus of the pons are the right motor VII and the adjacent superior salivatory and lacrimal nuclei.

A. FALSE the right inferior salivatory nucleus projects directly to cells in the otic ganglion. The left ALS arises from cells in the dorsal horn on the left side of the spinal cord
B. FALSE motor VII is shaded, not superior olive (which does project to the IC). The right nucleus ambiguous does receive input from the left motor cortex as its corticobulbar input is bilateral.
C. FALSE the right ALS terminates in the right VPL
D. TRUE
E. FALSE the right lacrimal nucleus projects directly to cells in the pterygopalatine ganglion.

SUPERIOR SALIVATORY/LACRIMAL NUCLEI #2

The shaded pathway/fiber tract at the level through the middle of the inferior olive is the right ALS etcetera. The shaded nuclei at this medullary level are the right nucleus ambiguous and the adjacent inferior salivatory nucleus. The shaded nuclei at the level of the facial colliculus of the pons are the right motor VII and the adjacent superior salivatory and lacrimal nuclei.

A. FALSE a lesion of the right nucleus ambiguus=deviation of the uvula to the left.
B. FALSE vibration sense? Is the ML or fab 4 shaded?
C. TRUE right motor VII
D. FALSE hyperacusis=motor VII lesion (no stapedius)=increased sensitivity to noises
E. FALSE there is a lesion of the inferior salivatory nucleus!!

SUPERIOR SALIVATORY/LACRIMAL NUCLEI #3

The intermediate nerve of CN VII (nerve of Wrisberg!! I know!) is shaded on right.

A. FALSE inferior salivatory=CN IX
B. FALSE this is CN VII, not CN V—please know your nerves
C. FALSE this nerve is not branchiomotor
D. FALSE please know right from left
E. TRUE contains superior salivatory preganglionic parasympathetics destined for the submandibular ganglion

SUPERIOR SALIVATORY/LACRIMAL NUCLEI #4

The left facial colliculus is shaded; it includes, the underlying left abducens nucleus and the looping fibers of the left motor VII.

A. FALSE do fibers from the superior salivatory/lacrimal nuclei loop?
B. FALSE know right and left please!
C. TRUE cells in the left abducens nucleus project to the right oculomotor nucleus.
D. FALSE just the opposite—can't turn both eyes to the left
E. FALSE the looping left motor VII fibers do not cross—this is CN VII on the left

SUPERIOR SALIVATORY/LACRIMAL NUCLEI #5

The drawing/levels are through the middle of the inferior cerebellar peduncle and the facial colliculus of the pons.

Explanation: At the level of the medulla, the lesion invades the left hypoglossal nucleus (deviation of the tongue to the left upon protrusion and fasciculations on the left side). The lesion also invades the adjacent left dorsal motor X (increase in heart rate). At the level of the pons, the lesion invades the abducens nucleus (inability to turn both eyes past the midline of the orbits upon attempted horizontal gaze to the left). The hypersensitivity to sounds, drooling from the left side of the mouth and inability to close the left eyelid is because the lesion invaded the looping fibers of motor VII.

SUPERIOR SALIVATORY/LACRIMAL NUCLEI—EYE MOVEMENTS

(A=right PPRF; B=right abducens nucleus; C=rootlets of right CN VI.)

A. FALSE are cells in the PPRF LMNs?
B. FALSE the left vestibular nerve terminates in the left vestibular nuclei
C. TRUE
D. FALSE ipsilateral PPRF
E. TRUE

SUPERIOR SALIVATORY/LACRIMAL NUCLEI—MATCHING

A. left spinal tract/nucleus V or right TTT
B. is the left "etcetera" of left ALS in the left hand column?
C/4
D/1
E/5
F. are the left nucleus ambiguous or left CNs IX and X listed in the left hand column?
G/2
H/3
I. is the right motor VII in the left hand column?
J. is the auditory division of CN VIII in the left hand column?

SUPERIOR SALIVATORY/LACRIMAL NUCLEI—SPINAL CORD

All of the pathways and cell groups that you have learned are shaded on the right at spinal level T1. A hemisection (one half of he cord) of the spinal cord is called a "Brown-Sequard."

A. TRUE anesthesia means without sensation (no pain, temp, touch). The lesion of the dorsal columns on the right at T1 means that there is a loss of 2pt etc from T1 on down on the right. Now. If you add in the deficits from the lesion of the zone of Lissauer (ZL), you have the absence of pain and temperature on the right from T1-T3. So, T1 on the right (which is ipsilateral to the lesion), is anesthetic.
B. FALSE analgesia mean without (no) pain. With a lesion of the right ALS, there is loss of pain and temperature from **T3** on down on the left side (contralateral to the lesion)
C. the lesion is at T1, so the preganglionic sympathetic cells at this level on the right are damaged. This means the right (ipsilateral) pupil is constricted.
D. FALSE the descending hypothalamic are interrupted at T1 and can't innervate the lateral horn cells (pregang. sym.) below T1—this affects that entire side of the body, AND face.
E. FALSE see A

BRAIN STEM—PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE #1

The shaded pathway/fiber tracts at this level are the right corticospinal, corticobulbar and corticopontine fibers (corticospinal etcetera) and the right fab 4. The shaded nuclei/cell groups are the right motor VII and right PPRF.

A. FALSE the right ML arises from cells in the left dorsal column nuclei (gracilis and cuneatus)
B. FALSE the right PPRF projects to the right abducens nucleus.
C. FALSE is the right STT shaded?
D. FALSE the axons of the right motor VII loop over and form part of the right facial colliculus; the descending autonomics (one of the fab 4) terminate on cells on the right side of the spinal cord
E. TRUE good old right PPRF

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE #2
The shaded pathway/fiber tracts at this level are the right corticospinal, corticobulbar and corticopontine fibers (corticospinal etcetera) and the right fab 4. The shaded nuclei/cell groups are the right motor VII and right PPRF.
A. FALSE the corticobulbar input to nucleus ambiguus is bilateral (ummmm good!)
B. FALSE a lesion of the right corticobulbars in the pons=tongue deviation to the left; cortical input to the hypoglossal nucleus is crossed
C. FALSE is there a lesion of the LMNs to the pharyngeal constrictors on the left?
D. TRUE right motor VII—a LMN
E. FALSE is there a lesion of LMNs to the lateral rectus (abducens)? The PPRF does not contain LMNs.

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE #3
The level shown is through the facial colliculus of the pons.
Explanation: damage to the rootlets of CN VI on the left results double vision, especially when turning the eyes to the left; damage to the adjacent left STT= loss of taste from the left side of the tongue

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE—MATCHING
A. a lesion of the right basilar pontine grey=incoordination of the left side of the body
B/4
C. left frontal eye field or left vestibular nuclei
D. right rostral solitary complex
E. right corticospinal, right corticobulbar or right corticopontine fibers
F/3
G/5
H/1
I. is right superior salivatory nucleus listed in the left column?
J/2

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE #4
What is wiped out here are the right corticospinals, corticobulbars and corticopontine (corticospinal etc) and right pontine grey.
A. FALSE this is the right side of the basilar pons, therefore, left hemiplegia
B. TRUE—input to the hypoglossal nucleus is crossed
C. FALSE the lesion involves corticobulbars in the right basilar pons before they get to the ventral/lower part of the left right motor VII. Thus, the drooling would be from the left side of the mouth.
D. FALSE is the STT in the basilar or tegmental part of the pons? Please say tegmental!
E. FALSE is the ALS etcetera in the basilar or tegmental part of the pons?

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE—SPINAL CORD
The shading is in the right fasciculus gracilis at spinal level C2.
A. FALSE does vibration sense from the thumb travel in fasciculus gracilis?
B. FALSE does 2 pt information (that helps us recognize letters and numbers traced on the palm) travel in fasciculus gracilis?
C. FALSE the spinal level is C2 while the deficits are in the leg (fasc. gracilis=T7 and down)
D. FALSE dorsal columns=alpha-betas!
E. TRUE see C above

PONTINE NUCLEI/MIDDLE CEREBELLAR PEDUNCLE—EYE MOVEMENTS
(A=right hypoglossal nucleus; B=right nucleus ambiguus; C=right MLF; D=right STT)
A. TRUE lesion of right hypoglossal=deviation of tongue to the right; lesion of right MLF=deviation of the right eye to right
B. FALSE see A
C. FALSE lesion of right hypoglossal=deviation of tongue to the right; lesion of right ambiguus=deviation of the uvula to the left
D. FALSE **D** is not the PPRF but the STT. Tricky!! A lesion of the right MLF would not affect **conjugate gaze** (both eyes together)
E. TRUE uvula to the left and right eye to the right
Remember, more than one statement can be correct!

BRAIN STEM—MOTOR, CHIEF SENSORY AND MESENCEPHALIC V

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V #1
The shaded pathway/fiber tracts at this chief/motor V level of the pons are the right corticospinals etc, right fab 4, right STT, right ML and right lateral lemniscus. The shaded nuclei are the right chief sensory V, right the motor V and right pontine grey.
A. FALSE the right MLF terminates in the right oculomotor nucleus. The right STT and TTT terminate in the right VPM.
B. FALSE the ventral part of motor VII receives only crossed corticobulbar input. So, the shaded corticobulbars on the right are destined for the ventral and dorsal parts of the left motor VII and only the dorsal part of the right motor VII.
(JKH note. Both the right motor V and the right pontine grey receive input from the right motor cortex.)
C. FALSE the right ML arises from cells in the right nucleus gracilis and cuneatus
D. TRUE part of the “fab 4” are descending autonomics
E. FALSE axons in the right MLF arise from cells in the left abducens nucleus

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V #2
The shaded pathway/fiber tracts at this chief/motor V level of the pons are the right corticospinals etc, right fab 4,right STT, right ML and right lateral lemniscus. The shaded nuclei are the right chief sensory V, right the motor V and right pontine grey.
A. FALSE a lesion of the right corticobulbars in the pons=tongue deviation to the left
B. FALSE “inability to turn the right eye laterally upon attempted horizontal gaze to the right” Huh. Who wrote that?
C. FALSE a lesion of the right STT=loss of taste from the right side of the tongue
D. FALSE the weakened facial muscles are below the eye on the left
E. TRUE a lesion of the right ML (part of the “fab 4”)=loss of vibrational sense on the left side of the body

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V—MATCHING

A. a lesion of the right motor V=jaw deviation to the right

B. cells from the right pontine grey or axons in the left middle cerebellar peduncle (from the right pontine grey) terminate in the left side of the cerebellum

C/2

D/1

E/3

F. is the right solitary tract/nucleus or right STT in the left column? is the choice "a lesion of the right CNs VII, IX and X" in the column?

G. cells that receive input from the left caudal spinal nucleus V include the right and left nucleus ambiguii and the right VPM. The right TTT is a tract/pathway not a cell group!

H/5 motor V receives bilateral corticobulbar input

I/4

J. is the left motor VII in the column

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V #3

The drawing is the chief/motor V level of the pons.

Explanation: a lesion of the left CN V and left middle cerebellar peduncle as CN V penetrates it. This accounts for all of the deficits. Think about everything going in and out of CN V. WOW!

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V #4

The right MOTOR ROOT of CN V is shaded. Motor=medial and smaller than the sensory root!

A. FALSE do you know right from left?

B. TRUE

C. FALSE this is the motor root. Cells in the chief sensory do not send axons out the nerve!!

D. FALSE this is the motor root!

E. FALSE this is CV not VII. Please know where these nerves are on the brain stem.

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V—SPINAL CORD I

A. TRUE amyotrophic lateral sclerosis has both UMN and LMN symptoms/signs.

B. FALSE NMJ=decremental CMAPs. Is not UMN problem.

C. FALSE Guillain-Barre is not a UMN problem. It affects peripheral nerves so it can have LMN signs/symptoms.

D. FALSE A Babinski comes from an UMN lesion.

E. FALSE LCST damage=ipsilateral signs/symptoms

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V—SPINAL CORD II

A. TRUE there is death of LMNs and thus axonal death and reinnervation=increase in size of MUPs. Neurogenic=result of nerve/neuronal damage/change

B. TRUE if there is enough damage/compression to have axonal death and reinnervation

C. TRUE

D. TRUE a myopathy=myogenic MUPs=smaller

E. FALSE a lesion of the LCST results in no EMG changes since the LMNs and nerves are A-OK!

MOTOR, CHIEF SENSORY AND MESENCEPHALIC V—EYE MOVEMENTS
(A=right ALS etc; B=right rootlets of CN VI; C=right vestibular nuclei.)
A. FALSE right eye deviates to left; constricted pupil in right eye
B. TRUE see A
C. FALSE constricted pupil in right eye; lesion of right vestibular nuclei=left driving=eyes slowly to the right and snap back to the left (left nystagmus)
D. TRUE constricted pupil in right eye; warm left ear=left in charge=eyes slowly to the right
E. FALSE right eye is deviated left; right vestibular nuclei down=left side in charge=stumbling to right

BRAIN STEM—SUPERIOR CEREBELLAR PEDUNCLE

SUPERIOR CEREBELLAR PEDUNCLE #1
The drawing is of the superior cerebellar peduncle (SCP) level of the pons. The shaded fibers/ pathways are the right SCP, right MLF, right STT and right fab 4. No cell groups/nuclei are shaded.
A. TRUE Don't worry, you will learn much more about those deep cerebellar nuclei later.
B. FALSE the right MLF terminates in the right oculomotor nucleus
C. FALSE the right ML arises from the left nucleus gracilis and cuneatus
D. FALSE the right MLF arises from cells in the left abducens nucleus
E. FALSE the right STT arises from cells in the right nucleus solitarius

SUPERIOR CEREBELLAR PEDUNCLE #2
The drawing is of the superior cerebellar peduncle (SCP) level of the pons. The shaded fibers/ pathways are the right SCP, right MLF, right STT and right fab. No cell groups/nuclei are shaded
A. FALSE a lesion of the right ML and TTT=loss of vibration on left side face and body
B. FALSE the left motor V and left ALS are not shaded
C. TRUE right SCP=right incoordination—lesions of the SCP are ipsi until its decussation at level 9; right STT=loss of taste from the right side of the tongue
D. FALSE lesions of the right MLF does not result in atrophy of the right medial rectus; this happens only with a lesion of the right oculomotor nucleus or right CN III; lesion of the right SCP results in incoordination of the right arm and leg
E. FALSE a lesion of the right TTT at this level=loss of pain and temp and 2pt etcetera on the left side of the face

SUPERIOR CEREBELLAR PEDUNCLE—MATCHING
A. gee, I guess I was trying to trick someone here! The only way this could happen would be to have lesions of the abducens *and* oculomotor nuclei/nerves
B. is the right motor V in the left hand column?
C/4
D. the left pontine grey sends mossy fibers to the right side of the cerebellum
E/5; F/2; G/3
H. is the inferior colliculus listed in the left column?
I. is the left ML listed in the left column?
J/1

SUPERIOR CEREBELLAR PEDUNCLE—SPINAL CORD
The drawing shows an UMN lesion involving the bladder.
A. **TRUE** the detrussor is spastic and contracts reflexively and often
B. FALSE the detrussor is spastic and contracts reflexively and often
C. FALSE the detrussor is spastic and contracts reflexively and often
D. **TRUE** the detrussor is spastic and contracts reflexively and often
E. TRUE A and D

SUPERIOR CEREBELLAR PEDUNCLE #3
The drawing is through the SCP level of the pons.
Explanation: a lesion in the basilar pons on the left accounts for all of the deficits

SUPERIOR CEREBELLAR PEDUNCLE—EYE MOVEMENTS
(A=right rootlets of CN VI; B=right cerebral peduncle (contains corticospinals, corticobulbars and corticopontines)).
A. FALSE lesion of right rootlets of VI=head rotation to the right; lesion of right corticobulbars=deviation of tongue to the left
B. TRUE see explanation A
C. FALSE there is no atrophy of tongue muscles with corticobulbar damage
D. TRUE assuming some axons survive, lesion=reinnervation and increase in sizes of MUPs
E. FALSE loss of corticobulbar (like corticospinal) inputs to LMNs has no EMG effects.

BRAIN STEM—TROCHLEAR NUCLEUS

TROCHLEAR NUCLEUS #1
The shaded pathways/fibers are the right cerebral peduncle, right lateral lemniscus, right fab 4, right STT, right MLF, right rootlets of CN IV and right SCP. Shaded cell groups include the right substantia nigra, right trochlear nucleus and right periaqueductal grey.
A. FALSE the right MLF arises from cells in the left abducens nucleus
B. TRUE
C. FALSE the right ML and right ALS terminate in the right VPL
D. FALSE the right SCP arises from cells in the right deep cerebellar nuclei
E. FALSE only CN VIII arises from these cells

TROCHLEAR NUCLEUS #2
The shaded pathways/fibers are the right cerebral peduncle, right lateral lemniscus, right fab 4, right STT, right MLF, right rootlets of CN IV and right SCP. Shaded cell groups include the right substantia nigra, right trochlear nucleus and right periaqueductal grey.
A. FALSE nucleus ambiguous=bilateral corticobulbar input. Uummmm good!!
B. FALSE the right trochlear nucleus and CN IV rootlets are shaded. Thus, the left SO4 is weak!!! The patient would tilt their head to the right (away from the weak muscle).
C. FALSE a lesion of the right ML, ALS and TTT=problems on the left
D. FALSE head rotation=lesion of CN VI not IV!! CN IV=tilting away from affected muscle.
E. TRUE the right corticospinal fibers are damaged leading to a positive Babinski

TROCHLEAR NUCLEUS #3

The shaded structures are the left SCP, left inferior colliculus, and left CN IV.

A. FALSE a lesion of the left SCP before it decussates=left sided incoordination

B. FALSE the left SCP projects to the right VA/VL

C. TRUE left dentate projects into left SCP; cells of right trochlear nucleus send axons into left CN IV

D. FALSE axons in the left SCP innervate the right ruber-duber

E. FALSE lesion affects left CN IV and left SO4; tilt head to the right

TROCHLEAR NUCLEUS #4

The right CN IV is shaded.

A. FALSE the right CN IV arises from the left trochlear nucleus

B. FALSE the right CN IV terminates in the right SO4 muscle

C. FALSE lesion affects right CN IV and right SO4=tilt head to the left

D. TRUE lesion affects right CN IV and right SO4=tilt head to the left

E. FALSE huh? Would anyone out there mistake CNs IV and VI? Please!

TROCHLEAR NUCLEUS #5

The drawing is of the pons/midbrain junction.

Explanation: Gee, a nice discrete lesion of the left lateral lemniscus (subtle auditory deficits) and the left rootlets of CN IV before they decussate. Of course, you also could have a small lesion involving the right lateral lemniscus and the right CN IV after it has crossed where it is resting on the dorsolateral aspect of the brain stem

TROCHLEAR NUCLEUS—MATCHING

A/4

B. a lesion of the right SCP would result in incoordination on the right side

C/1

D/2

E. head tilt to the left=lesion of right trochlear nerve or left trochlear nucleus

F. for atrophy of the left inferior oblique you need the have the left oculomotor nucleus or nerve in the left hand column

G/3

H/5

I. a lesion of the right corticobulbar fibers rostral to motor VII will result in weakness in the muscles below the eye on the left

J. is the right TTT or STT

TROCHLEAR NUCLEUS—SPINAL CORD

The spinal level is T6 and the right fasciculus gracilis and cuneatus, right LSCT and right ALS are shaded.

A. FALSE lesion of right LCST=right hemiplegia

B. FALSE lesion of right LCST=right Babinski

C. FALSE first pain is lost from T8 on down on the left (big toe)

D. FALSE lesion of right LCST=right spasticity of leg (lesion is at T6)

E. TRUE see explanation D

TROCHLEAR NUCLEUS—EYE MOVEMENTS
(A=right trochlear nucleus; B=spinal part of right CN X)
A. TRUE lesion of right trochlear nucleus=atrophy of left SO4=head tilt to the **right;** lesion of right spinal CN XI=chin rotated to the **right**
B. FALSE lesion of right trochlear nucleus=atrophy of left SO4=head tilt to the right; lesion of right spinal CN XI=chin rotated to the right
C. FALSE the spinal part of CN XI does not innervate the stylopharyngeus

BRAIN STEM—SUBSTANTIA NIGRA

SUBSTANTIA NIGRA #1
The shaded pathways are the right corticospinal, right corticobulbar and right corticopontines, right "fab 4," right lateral lemniscus, the right STT and the right MLF. The cell groups/nuclei shaded are the right inferior colliculus and substantia nigra.
A. FALSE the ventral part of motor VII receives only crossed corticobulbar input. So, the shaded corticobulbars on the right are destined for the ventral and dorsal parts of the left motor VII and only the dorsal part of the right motor VII (you have seen this before!!)
B. FALSE the right MLF terminates in the right oculomotor nucleus
C. FALSE the right STT has its cells of origin in the right solitary nucleus
D. FALSE The cells of origin of the right ML lie in the LEFT nucleus gracilis and cuneatus
E. TRUE

SUBSTANTIA NIGRA #2
The drawing is through the inferior collicular (caudal) level of the midbrain. The shaded pathways/fiber tracts are the right corticospinal, right corticobulbar and right corticopontines, right "fab 4," right lateral lemniscus, the right STT and the right MLF. The cell groups/nuclei shaded are the right inferior colliculus and substantia nigra.
A. FALSE a lesion of the right STT=loss of taste on the right side of the tongue
B. FALSE a lesion of the right corticospinal tract=left hemiplegia
C. TRUE
D. FALSE a lesion of the right corticobulbars in the caudal midbrain=left tongue deviation
E. FALSE motor V receives bilateral corticobulbar input (so no jaw deviation) and the only way you get atrophy of muscles of the uvula =LMN disease of nucleus ambiguus

SUBSTANTIA NIGRA—MATCHING
A. is the left inferior salivatory in the left hand column?
B/5
C. the cells of origin of the right ALS lie in the dorsal horn on the left
D/2 remember, the right TTT innervates both ambiguii.
E/1
F. huh? A lesion of the substantia nigra=increase in DA—NEVER
G/4
H. is right spiral ganglion, auditory division of CN VIII or dorsal and ventral cochlear nuclei
I/3
J. is the left ML listed in the left hand column?

SUBSTANTIA NIGRA—SPINAL CORD
In other words all inputs and outputs associated with the bladder are damaged.
A. FALSE how can it be spastic if there are no reflex connections. Think about skeletal muscle; can you have spasticity without a reflex arc?
B. **TRUE** can't have reflex without intact reflex circuitry!
C. **TRUE** sure—the bag fills and spills
D. **TRUE** can the bladder be voluntarily controlled?
E. TRUE see B, C and D

SUBSTANTIA NIGRA #3
The drawing is of the inferior collicular (caudal) level of the midbrain.
Explanation: gee, nice little lesions in both MLFs. Who would have thought?

SUBSTANTIA NIGRA—EYE MOVEMENTS
(A=left MLF; B=left PPRF)
A. FALSE a lesion of the left PPRF means that the right and left eye will not turn past the midline to the left
B. TRUE a lesion of the left PPRF means that the right and left eye will not turn past the midline to the left. The lesion of the left MLF means that the left eye cannot turn to the right.
C. FALSE no LMNs are affected
D. FALSE a lesion of the left PPRF means that the right and left eye will not turn past the midline to the left. The lesion of the left MLF means that the left eye cannot turn to the right.
E. FALSE a lesion of the left PPRF means that the left and eye will not turn past the midline to the left

BRAIN STEM—OCULOMOTOR NUCLEAR COMPLEX

OCULOMOTOR NUCLEAR COMPLEX #1
The drawing is through the superior collicular/ruber-duber level of the midbrain. The shaded pathways/fiber tracts are the right corticospinals, corticobulbars and corticopontines (all in the right cerebral peduncle) and the right brachium of the inferior colliculus. The shaded cell group/nucleus is the oculomotor nucleus.
A. FALSE cells in the right Edinger-Westphal nucleus project to the right ciliary ganglion and cells in the ciliary ganglion project to the sphincter (constrictor) pupillae
B. FALSE the ventral part of motor VII receives only crossed corticobulbar input. So, the shaded corticobulbars on the right are destined for the ventral and dorsal parts of the left motor VII and only the dorsal part of the right motor VII (you have seen this before!!)
C. FALSE the ventral part of motor VII receives only crossed corticobulbar input. So, the shaded corticobulbars on the right are destined for the ventral and dorsal parts of the left motor VII and only the dorsal part of the right motor VII (you have seen this before!!)
D. TRUE
E. FALSE the right brachium of the inferior colliculus terminates in the right medial geniculate body

OCULOMOTOR NUCLEAR COMPLEX #2

The drawing is through the superior collicular/ruber-duber level of the midbrain. The shaded pathways/fiber tracts are the right corticospinals, corticobulbars and corticopontines (all in the right cerebral peduncle) and the right brachium of the inferior colliculus. The shaded cell group/nucleus is the oculomotor nucleus/complex.

A. FALSE a lesion of the right oculomotor complex=right eye down and out!
B. FALSE the corticobulbars to nucleus ambiguous=bilateral. Ummmmm good
C. TRUE
D. FALSE the corticobulbars to motor V=bilateral. Ummmmm good
E. FALSE a lesion of the corticobulbars on the right does not affect the ventral part of the right motor VII, as the left cortex is still healthy and providing cortical input (crossed) to this region.

OCULOMOTOR NUCLEAR COMPLEX #3

The right CN III is shaded.

A. FALSE please know right from left!
B. FALSE please know right from left!
C. FALSE don't forget about the ciliary ganglion
D. TRUE some of them
E. FALSE please know CN III from CV IV!

OCULOMOTOR NUCLEAR COMPLEX #4

The drawing is through the superior collicular/ruber-duber level of the midbrain (rostral).

Explanation: Gee, looks to me like a nice lesion that involves the left side of the midbrain and in particular the substantia nigra (fine tremor at rest, slow and shuffling gait, muscle rigidity) and the adjacent fibers of CN III (ptosis of the left eyelid, dilated pupil in the left eye) on their way to the very famous interpeduncular fossa.

OCULOMOTOR NUCLEAR COMPLEX—SPINAL CORD

The drawing is of the T1 spinal level.

Explanation: The lesions are on the right side at T1 and involve the more lateral fibers in the ALS (deficit in burning pain from the left leg) and the ventral horn (atrophy of the intrinsic muscles of the hand muscles in the right hand) and the lateral horn (ptosis of the right eyelid and miosis of the right pupil).

OCULOMOTOR NUCLEAR COMPLEX—MATCHING

A. lesion of the left motor nucleus V=atrophy of the left muscles of mastication
B/5
C. is the left abducens nucleus in the left column?
D. is the left ML or ALS in the left column?
E. lesion of the right motor nucleus V=atrophy of the right muscles of mastication
F. is the left MLF listed on the left?
G/4
H/3 right nucleus innervates left SO4
I/2
J/1

OCULOMOTOR NUCLEAR COMPLEX—EYE MOVEMENTS
(A=left oculomotor nucleus; B=left "fab 4," C=left motor VII.)
A. FALSE lesion of left "etcetera" of ALS =right ptosis; lesion of right motor VII=inability to close left eye (orbicularis oculi)
B. FALSE lesion of left oculomotor nucleus=mydriasis (dilated) of pupil; lesion of "etcetera"=constricted (miosis) pupil in left eye
C. TRUE lesion of left oculomotor nucleus=eye down and out (lateral); lesion of left motor VII=sensitivity to sound in left ear
D. FALSE see explanation C
E. TRUE

BRAIN STEM—RUBER-DUBER

RUBER-DUBER #1
The drawing is through the rostral midbrain i.e., superior collicular/ruber-duber. The pathways/fiber tracts that are shaded include the right brachium of inferior colliculus, the right CN III and fibers of the SCP rostral to its decussation. The shaded cell group/nucleus is the ruber-duber in all its glory.
A. FALSE is the left TTT labeled?
B. FALSE rubrospinal axons travel in the lateral funiculus, just ventral to the LCST; is the right STT shaded?
C. FALSE the fibers surrounding the right ruber-duber arose from the left dentate nucleus
D. TRUE
E. FALSE the fibers surrounding the right ruber-duber terminate in the right VA/VL

RUBER-DUBER #2
The drawing is through the rostral midbrain i.e., superior collicular/ruber-duber. The pathways/fiber tracts that are shaded include the right brachium of inferior colliculus, the right CN III and fibers of the SCP rostral to its decussation. The shaded cell group/nucleus is the ruber-duber in all its glory.
A. FALSE are the left ALS and TTT shaded?
B. TRUE
C. FALSE are the left ML and TTT shaded?
D. FALSE a lesion of the right CN III results in an inability to open the eye (levator palpebrae superioris is shot!). There is a ptosis!
E. FALSE there is motor incoordination of the **left** arm and leg due the lesion of the right red nucleus and the SCP fibers that surround the right ruber

RUBER-DUBER #3
The drawing is at the level of the rostral midbrain (superior colliculus and ruber-duber).
Explanation: the lesion includes the left brachium of the inferior colliculus subtle auditory deficits) the left ALS etc (constricted pupil in left eye), the left TTT (loss of pain and temperature from the right side of the tongue and the left STT (loss of taste from the left side of the tongue).

RUBER-DUBER—MATCHING

A. cells in the right lacrimal nucleus project (directly) to the pterygopalatine ganglion; cells from the pterygopalatine ganglion project to the secretory cells of the lacrimal gland

B/5

C/4

D/1

E. are the right and left motor cortices (corticobulbars) in the left hand column? (Which brainstem motor nuclei receive crossed or bilateral input from the cortex?)

F. the left pontine grey, right middle cerebellar peduncle, and right inferior cerebellar peduncle project to the right side of the cerebellum

G. cells in the right trigeminal ganglion terminate in the right chief nucleus and right spinal nucleus V

H/2

I/3

J. is the left oculomotor nucleus in the left column?

RUBER-DUBER—SPINAL CORD

A.__L4__

B.__L3__

C.__S1__

D.__L5__

RUBER-DUBER—EYE MOVEMENTS I

(A=left rootlets of CN VI; B=left MLF; C=left trochlear nucleus; D=left Edinger-Westphal nucleus.)

A. **TRUE** lesion of left CN VI=atrophy left LR; lesion of left trochlear nucleus=atrophy of right SO

B. FALSE lesion of left CN VI=left head rotation; lesion of left Edinger-Westphal nucleus=dilated pupil in left eye

C. TRUE lesion of left CN VI means left eye can not move to the left; lesion of left MLF means left eye can not move to the right

D. FALSE cells and axons are dying=decrease in CMAPs

E. FALSE lesion of left trochlear nucleus=left head tilt; lesion of left Edinger-Westphal=left **dilated** pupil

RUBER-DUBER—EYE MOVEMENTS II (LAST ONE!!)

(A=left internal arcuate fibers; B=left vestibular nuclei; C=left superior cerebellar peduncle; D=left MLF.)

A. FALSE lesion of left internal arcuate fibers=loss of 2pt. etc left side; lesion of left vestibular nuclei=right nystagmus; lesion of left SCP=left side incoordination

B. TRUE lesion of left internal arcuate fibers=loss of 2pt. etc left side; lesion of left vestibular nuclei=left side stumbling; lesion of left SCP=left side incoordination

C. TRUE lesion of left internal arcuate fibers=loss of 2pt. etc left side; lesion of left MLF=can not turn left eye medially to the right but can turn left eye laterally to the left

D. TRUE I know the truth!

E. TRUE I know the truth!

BRAIN STEM—SUPERIOR COLLICULUS

SUPERIOR COLLICULUS #1

The shaded fiber tracts/pathways are the right cerebral peduncle, right SCP rostral to its decussation, the right "fab 4," the right brachium of the inferior colliculus and the right STT. The nuclei/cell groups are the right substantia nigra, the right ruber-duber, the right periaqueductal grey and the right superior colliculus.

A. FALSE the cells of origin of the SCP fibers surrounding the right ruber-duber=left deep cerebellar nuclei

B. TRUE

C. FALSE the cells of origin of the right ALS=left dorsal horn

D. FALSE the SCP fibers surrounding the right ruber-duber terminate in the right VA/VL

E. FALSE cells in the right superior colliculus project to the left side of the cervical spinal cord and travel in the ventral funiculus

SUPERIOR COLLICULUS #2

The shaded fiber tracts/pathways are the right cerebral peduncle, right SCP rostral to its decussation, the right "fab 4," the right brachium of the inferior colliculus and the right STT. The nuclei/cell groups are the right substantia nigra, the right ruber-duber, the right periaqueductal grey and the right superior colliculus.

A. FALSE a lesion of the right STT=loss of taste from the right side of the tongue. There can be no atrophy of the right medial rectus muscle without a lesion of the oculomotor nucleus or nerve; the right MLF won't do it!

B. FALSE a lesion of the "etcetera" fibers of the right ALS=constricted pupil in the right eye

C. FALSE a lesion of the right corticobulbar fibers in the cerebral peduncle=deviation of the tongue to the left. Nucleus ambiguous receives bilateral corticobulbar input. Lesion of corticobulbar input to motor V does not result in atrophy

D. FALSE a lesion of the right corticobulbars will result in weakness below the eye on the left. JKH note—a flash of light on the left ends up reaching the right SC and the right SC influences the left cervical cord to turn your head to the left i.e., toward the flash. The muscles used do NOT include the sternocleidomastoid!

E. TRUE

SUPERIOR COLLICULUS #3

Both superior colliculi are shaded on this dorsal view of the brain stem.

A. FALSE Parinaud syndrome=paralysis of upward gaze (this means the patient can't look up, not that the eyes are stuck (paralyzed) in upward gaze!!

B. FALSE the SC receives input about somatosensation, vision, and audition

C. FALSE the SC receives input about somatosensation, vision, and audition

D. TRUE

E. FALSE huh? Who wrote this question? We are in the midbrain!

SUPERIOR COLLICULUS #4

The drawing is through the rostral midbrain at the level of the superior colliculus/ruber-duber

Explanation: One continuous lesion involving left cerebral peduncle (right Babinski, deviation of the tongue to the right upon protrusion, drooling of food from the right side of the mouth) and the adjacent CN III (dilated pupil in the left eye, when left eyelid is elevated manually, left eyeball can be seen to be rotated laterally and ventrally—you're totally down and out with no CN III!)

SUPERIOR COLLICULUS—SPINAL CORD I

The right fasciculus gracilis is shaded at spinal level L5.

A. **TRUE** good old fasciculus gracilis

B. **TRUE** these unconscious proprio.-carrying fibers from L5 and below have been looking for Clarke's column and need to ascend to reach it (to L3)

C. **TRUE** good old fasciculus gracilis

D. **TRUE** these unconscious proprio.-carrying fibers from L5 and below are looking for Clarke's column and need to ascend to reach it (to L3)

E. TRUE

SUPERIOR COLLICULUS—MATCHING

A. the cells of origin of the left LCST=right motor cortex

B/1

C. the right SCP (before decussation) terminates in the left ruber-duber

D. is the right middle or inferior cerebellar peduncle in the left hand column?

E. is the substantia nigra in the left hand column?

F/5

G/3

H/4 the rubrospinal tract influences ipsilateral movements while the ruber-duber influences contralateral movements.

I/2

J. are the right rootlets of CN VI or right abducens nucleus in the left hand column?

SUPERIOR COLLICULUS—SPINAL CORD II

Sensorimotor deficit in a cape and gown distribution. Assume that only the pain and temperature is affected under "sensory!"

A. TRUE

B. TRUE

C. TRUE

D. TRUE T4=nipple; T10=lint saver (ie, the umbilicus—disgusting, but true)

E. FALSE gee, that would mean a bilateral loss of pain and temp from C4 on down

BRAIN STEM—PERIAQUEDUCTAL GREY

PERIAQUEDUCTAL GREY #1

A. TRUE there are three opiate receptors in the brain: mu, kappa and delta. These receptors are found in distinct places in the brain and bind differently with various opiate substances. The wide variety of effects experienced by heroin users can be attributed to the receptors and receptor location with which the drug binds. High concentrations of receptors are found in the limbic system (a topic we will spend some time on in the next unit). Due to the limbic systems role in regulation of an individuals emotions, when the drug binds to these receptors a feeling of pleasure, relaxation and contentment are experienced Binding to these receptors is responsible for analgesia.

B. **TRUE**

C. **TRUE**

D. **TRUE**

E. **TRUE**

PERIAQUEDUCTAL GREY #2

A. **TRUE**
B. **TRUE**
C. **TRUE**
D. **TRUE**
E. TRUE

PROBLEM SOLVING—BRAIN STEM LEVELS

THE LEFT SIDE OF THE MEDULLA (LEVELS #1-#4):

1. TRUE results from a lesion of the left vestibular nuclei
2. FALSE vibration from the face enters the brain stem in the rostral pons with CN V.
3. FALSE atrophy=LMN and the LMNs of the inferior rectus muscle are in the midbrain
4. FALSE atrophy=LMN and the LMNs of the SO muscle are in the caudal midbrain
5. FALSE the superior colliculi are in the rostral midbrain
6. TRUE fibers of the left geniculate ganglion in the left spinal tract V and solitary complex
7. FALSE atrophy=LMNs and they are in the rostral pons in motor V
8. FALSE except for the cochlear nuclei, the "subtle deficit" nuclei are all rostral
9. TRUE lesion of the left ALS=right side problems
10. FALSE if we consider the touch to go into the chief before being relayed to motor VII, all the necessary circuitry is more rostral in the brain stem
11. FALSE internuclear ophthalmoplegia is caused by a lesion of the MLF between the abducens nucleus and the oculomotor nucleus; this circuitry is rostral
12. FALSE atrophy=LMNs and motor VII is rostral
13. FALSE such positioning follows lesions of CNs III, IV and VI which are all rostral. In a CN III lesion, the lid is down so there is no double vision. However, if the lid is up, the patient would want the good eye to be down and in (to match the bad eye that is down and out). So they would tilt back (extended; good eye goes down) and tilted (good eye goes in)
14. TRUE left vestibular nuclei
15. FALSE the substantia nigra is in the midbrain
16. FALSE the PPRF, abducens nucleus and FEF are rostral
17. FALSE motor VII is rostral
18. FALSE motor V is rostral
19. TRUE left "etc" of ALS
20. TRUE left inferior cerebellar peduncle
21. TRUE left nucleus ambiguus
22. FALSE atrophy=LMNs and they are in the midbrain
23. FALSE atrophy=LMNs and they are in the midbrain
24. TRUE left spinal nucleus/tract V
25. FALSE diplopia follows lesions of CNs III, IV and VI and they are all rostral
26. TRUE left tract/nucleus solitarius
27. FALSE motor VII is rostral
28. TRUE left corticospinals
29. TRUE dorsal and ventral cochlear nuclei
30. TRUE area surrounding solitarius
31. TRUE left hypoglossal nucleus or nerve
32. TRUE left "etc" of ALS
33. TRUE left nucleus gracilis/cuneatus and left internal arcuate fibers
34. TRUE left corticospinals
35. FALSE Edinger-Westphal/CN III is in the rostral midbrain
36. TRUE dorsal motor X
37. TRUE nucleus ambiguus
38. TRUE spinal nucleus V, TTT or nucleus ambiguus

THE LEFT SIDE OF THE PONS (LEVELS #5-#8):

1. TRUE-there superior vestibular nucleus is present at the level of the facial colliculus. This is extremely picky!!
2. TRUE left CN V and left chief
3. FALSE atrophy=LMN and the LMNs are in the rostral midbrain
4. TRUE atrophy=LMN and the LMNs of the SO muscle are in the rostral-most pons
5. FALSE the superior colliculi are in the rostral midbrain
6. TRUE motor VII, fibers from the left geniculate ganglion in the left spinal tract V and heading south for the solitary complex, the left STT carrying taste from the ant. 2/3rds of the tongue, the superior salivatory/lacrimal nucleus
7. TRUE atrophy=LMNs and they are in the rostral pons in motor V
8. TRUE superior olive, lateral lemniscus
9. TRUE lesion of the left ALS=right problems
10. TRUE touch goes into the chief before being relayed to motor VIIs, all the necessary circuitry is at these levels
11. TRUE internuclear ophthalmoplegia is caused by a lesion of the MLF between the abducens nucleus and the oculomotor nucleus; much of this circuitry is at these levels
12. TRUE atrophy=LMNs and motor VII is right here
13. TRUE such positioning follows lesions of CNs III, IV and VI.
14. TRUE left superior nucleus also see it with internuclear ophthalmoplegia
15. FALSE the substantia nigra is in the midbrain
16. TRUE the PPRF and abducens nucleus
17. TRUE motor VII
18. TRUE motor V
19. TRUE left "etc" of ALS
20. TRUE left superior cerebellar peduncle; left middle cerebellar peduncle
21. FALSE nucleus ambiguus is south of here
22. TRUE atrophy=abducens nucleus (LMN) is in the pons
23. FALSE atrophy=LMNs and they are in the midbrain
24. TRUE CN V
25. TRUE diplopia follows lesions of CNs III, IV and VI. CNs IV and VI are here
26. TRUE left tract/nucleus solitarius
27. TRUE motor VII
28. TRUE left corticospinals
29. FALSE rostral to CN VIII and dorsal and ventral cochlear nuclei
30. FALSE solitarius is south of here
31. FALSE hypoglossal nucleus and nerve are south of here
32. TRUE left "etc" of ALS
33. FALSE left ML=right loss
34. TRUE left corticospinals
35. FALSE Edinger-Westphal/CN III is in the rostral midbrain
36. FALSE dorsal motor X is south of here
37. TRUE nucleus ambiguus is south of here, but some dysphonia may occur with lesion of motor VII
38. FALSE nothing sensory from the pharynx and larynx enters via CN V. CN IX and X enter brain stem further south, at the level of the middle of the inferior olive

THE LEFT SIDE OF THE MIDBRAIN (LEVELS #9-10):

1. FALSE all of the vestibular stuff is caudal
2. FALSE-a lesion of the left TTT=right loss
3. **TRUE** oculomotor nucleus/nerve
4. **TRUE** trochlear nucleus
5. FALSE sure, the superior colliculi are here but the lesion has to be bilateral
6. **TRUE** there are fibers in the STT about taste, in the TTT about pain and temp from the ear and corticobulbars to motor VII
7. FALSE atrophy=LMNs and they are in the rostral pons in motor V
8. **TRUE** lateral lemniscus, inferior colliculus and brachium of inferior colliculus
9. **TRUE** lesion of the left ALS=right problems
10. FALSE if we consider the touch to go into the chief before being relayed to motor VII, all the necessary circuitry is caudal
11. **TRUE** but only at the level of the inferior colliculus
12. FALSE atrophy=LMNs and motor VII is caudal
13. **TRUE** such positioning follows lesions of CNs III, IV and VI two of them are here (III and IV)
14. **TRUE** lesion of the MLF; however, if you are thinking about a left CN III lesion alone, when gazing to the right, the left eye cannot move medially. Right eye should not exhibit nystagmus.
15. **TRUE** Substantia nigra
16. FALSE the PPRF, abducens nucleus and FEF are not here
17. FALSE motor VII is caudal. Could this result from corticobulbar loss to the ventral part of the right motor VII? I don't know!!
18. FALSE motor V gets bilateral corticobulbar input and the nucleus lies south
19. **TRUE** left "etc" of ALS etc
20. **TRUE** l SCP fibers of the SCP at the inferior collicular level
21. FALSE nucleus ambiguous is south and receives bilateral corticobulbar projections
22. FALSE atrophy=LMNs and they are in the pons
23. **TRUE** CN III
24. FALSE problems with left TTT=right deficits
25. **TRUE** CNs III and IV
26. **TRUE** left STT
27. FALSE motor VII is caudal and left corticobulbar lesion=right side drooling
28. **TRUE** left corticospinals
29. FALSE CN VIII and dorsal and ventral cochlear nuclei lie south
30. FALSE solitarius is south
31. FALSE hypoglossal nucleus lies in medulla and corticobulbar loss does not=atrophy
32. **TRUE** left "etc" of ALS
33. FALSE lesion of left ML=right side deficit
34. **TRUE** left corticospinals
35. **TRUE** Edinger-Westphal/CN III
36. FALSE dorsal motor X is in the medulla and STT carries only taste
37. FALSE nucleus ambiguous lies in the midbrain and corticobulbars are bilateral
38. FALSE all circuitry lies more caudal

CRANIAL NERVE REVIEW

1. **The somatomotor cells in the oculomotor nucleus are shaded**.
A. **TRUE**
B. **TRUE**
C. **TRUE**
D. **TRUE** remember, with this lesion, diplopia is masked because the ipsi eyelid is closed
E. TRUE

2. **The left CN IV is shaded**.
A. FALSE a lesion of the left CN IV=atrophy of the left SO
B. FALSE this is CN IV from the trochlear nucleus
C. FALSE the patient tilts their head contralateral to the weak muscle
D. FALSE CN IV=tilt; CN VI=rotation
E. TRUE lesion of left CN III=tilt to the right; lesion of left cerebral peduncle=right hemiplegia

3. **The right CN VI is shaded**.
A. FALSE a lesion of CN VI=atrophy of ipsilateral lateral rectus
B. FALSE these axons are destined for the LR; they don't go up the MLF
C. **TRUE**
D. **TRUE** CN VI lesion=ipsi head rotation; CN IV lesion=contra head tilt
E. TRUE

4. **The left hypoglossal nerve is shaded.**
A. FALSE a lesion of CN XII=ipsi tongue deviation
B. **TRUE**
C. **TRUE**
D. **TRUE**
E. TRUE

5. **The shaded axons are the central processes of cells in the trigeminal ganglion that convey pain and temperature. These processes head south in the spinal tract V, which cannot be seen at this level.**
A. FALSE all of the circuitry in this drawing is related to only CN V
B. FALSE this is the trigeminal=head
C. FALSE the contra CN V and both spinal tracts/nuclei are fine (these are the structures that are involved with sensory innervation of the pharynx), as are the TTTs and ambiguii.
D. FALSE these are pain and temp fibers. The 2 pointers dive into the chief.
E. TRUE

6. **The shaded fibers arise in motor V**.
A. FALSE this entire drawing is CN V circuitry only!
B. TRUE
C. FALSE ipsilaterally
D. FALSE this is CN V, not VII
E. FALSE see explanation B

7. **The fibers in CN V that carry 2p. etc are shaded. They terminate in the chief**.
A. FALSE these are 2 pointers!
B. FALSE these are 2 pointers, not motor
C. **TRUE** like I said they are 2 pointers!
D. **TRUE** vibration
E. TRUE

8. **The entire CN V is shaded**
A. **TRUE** the information cannot get into the brain stem to cause either eyelid to close
B. **TRUE**
C. FALSE ipsilateral side
D. FALSE once the information gets into the brain stem on the left side it can eventually reach both motor VIIs
E. TRUE

9. **This shows the circuitry for CN VII only. The shaded axon has its cells of origin in the superior salivatory/lacrimal nucleus.**
A. FALSE what about the other side and the functioning inferior salivatory nuclei of CN IX?
B. FALSE superior salivatory/lacrimal.
C. FALSE submandibular and pterygopalatine ganglia
D. FALSE submandibular and pterygopalatine ganglia
E. TRUE

10. **This shows the circuitry for CN VII only! The shaded axon has its cells of origin in motor VII.**
A. **TRUE**, so TRUE wrinkle that forehead!!
B. FALSE it says above motor VII
C. **TRUE** one of those pearls
D. **TRUE** another pearl
E. TRUE see A, C and D

11. **This shows the circuitry for CN VII only! The axon is carrying taste and heading south for the solitary complex.**
A. FALSE they arise from the ipsilateral geniculate ganglion
B. FALSE they arise from the ipsilateral geniculate ganglion
C. FALSE they carry taste information. They don't enter the spinal tract V do they?
D. FALSE you are thinking CN IX
E. TRUE

12. **This shows the circuitry for CN VII only! The axon is carrying pain and temp. and can be seen diving into the spinal tract V.**
A. **TRUE** the pain and temp axons descend to the caudal spinal nucleus to synapse
B. **TRUE** all sensory fibers associated with CN VII arise in the geniculate ganglion
C. **TRUE**
D. **TRUE** that ear sure is lucky!!
E. TRUE

13. **This shows the circuitry for CN IX only. The shaded axon has its cell of origin in the inferior salivatory nucleus.**
A. FALSE inferior salivatory nucleus
B. FALSE huh? Who wrote this one?
C. TRUE
D. FALSE this axon does not arise from ambiguous
E. FALSE it says above that it is part of CN IX.

14. **This shows the circuitry for CN IX only! The shaded axon has its cell of origin in nucleus ambiguus**.
A. TRUE
B. FALSE this is ambiguous, not inf. salivatory
C. FALSE this is ambiguous, not inf. salivatory
D. FALSE this is ambiguous, not inf. salivatory
E. FALSE

15. **This shows the circuitry for CN IX only! The shaded axon enters the caudal part of the solitary complex and has its cell of origin in the inferior ganglion IX.**
A. FALSE caudal part of the solitary complex
B. FALSE the axon enters the caudal part of the solitary complex and contains information about blood pressure from the carotid sinus
C. FALSE the axon enters the caudal part of the solitary complex and arises from the inferior ganglion. Superior ganglion=pain and temp/spinal nucleus
D. TRUE
E. FALSE the axon enters the caudal part of the solitary complex and arises from the inferior ganglion. Taste=rostral part of solitarius

16. **This shows the circuitry for CN IX only! The shaded axon enters the rostral part of the solitary complex and has its cell of origin in the inferior ganglion IX.**
A. **TRUE** duh!
B. FALSE does any CN convey taste (or pain and temp) from just the ant. one-third of the tongue? CN IX is responsible for taste from the posterior 1/3 of the tongue.
C. FALSE these are taste fibers (*inferior* ganglion IX) not pain and temp.
D. **TRUE** the pain and temp fibers are fine!! So, the gag reflex will work. Taste fibers have nothing to do with the gag reflex part of CN IX
E. TRUE see A and D

17. **This shows the circuitry for CN IX only! The shaded axon has its cell body on the superior ganglion IX and is entering the spinal nucleus V.**
A. **TRUE**
B. **TRUE**
C. **TRUE**
D. FALSE the pain and temp information cannot get into the brain stem
E. TRUE

18. **This shows the circuitry for CN X only! The circuitry is similar to CN IX except that here the pregang. para. is dorsal motor and in the case of CN IX it is inferior salivatory. The shaded axon has its cells of origin in the nucleus ambiguus.**
A. **TRUE** the info can get in, but the reaction can't get out on the ipsi side
B. FALSE the info can get in, and the reaction can still get out on the contra side
C. **TRUE**
D. **TRUE**
E. TRUE

19. **This shows the circuitry for CN X only! The shaded axon has its cell of origin in the dorsal motor X.**
A. FALSE the axon first synapses on postganglionic parasympathetic neurons
B. **TRUE** along with inferior salivatory (IX), superior salivatory/lacrimal (CN VII) and Edinger–Westphal (CN III).
C. FALSE preg. parasympathetic slow heart. Loss=increase=tachycardia
D. **TRUE** preg. parasympathetic slow heart. Loss=increase=tachycardia
E. TRUE see B and D

20. **This shows the circuitry for CN X only! The shaded axon has its cell of origin in the inferior ganglion X and enters the caudal solitary complex.**
A. **TRUE** duh!
B. **TRUE** double duh!
C. **TRUE** viscerosensory
D. FALSE superior ganglion is somatosensory
E. TRUE

21. **This shows the circuitry for CN X only! The shaded axon has its cell of origin in the inferior ganglion X and enters the rostral solitary complex**
A. **TRUE** duh, duh and duh
B. FALSE duh, duh and duh
C. **TRUE**
D. FALSE solitarius=viscerosensory; spinal nucleus/tract V=somatosensory; besides, the posterior 1/3 of the tongue is the territory of CN IX
E. TRUE see A and C

22. **This shows the circuitry for CN X only! The shaded axon has its cell of origin in the superior ganglion X and enters the spinal tract/nucleus V.**
A. TRUE
B. FALSE caudal spinal nucleus V
C. FALSE-pain and temp from the lower pharynx and larynx
D. FALSE stimulate left side of pharynx—left spinal nuc. V—right TTT—right ambiguus=consensual response
E. FALSE stimulate left side of pharynx—left spinal nuc. V—right TTT—left ambiguus=direct response

23. **This shows the circuitry for CN VIII only! The shaded axon has its cell of origin in the vestibular ganglion and terminates in the vestibular nuclei.**
A. FALSE the stumbling is toward the side of the lesion
B. FALSE the nystagmus is toward the normal side
C. FALSE contra side in control=eyes move slowly to ipsi side
D. FALSE right horiz. SSC is turned up during head movements to the right
E. TRUE right horiz. SSC is turned up during head movements to the right

24. **This shows the circuitry for CN VIII only! The shaded axon has its cell of origin in the cochlear ganglion and terminates in the ventral and dorsal cochlear nuclei.**
A. **TRUE**
B. **TRUE**
C. FALSE innervates hair cells in organ of Corti
D. FALSE all axons in auditory part of CN VIII terminate in dorsal and ventral cochlear nuclei
E. TRUE see A and B

25. **This shows the circuitry for CN XI only! The shaded axon has its cell of origin in the right upper cervical spinal cord and passes to the right SCM and trapezius**
A. FALSE the right SCM moves the chin to the left. Its loss=chin to the right (ipsilaterally)
B. FALSE drooping of ipsi shoulder
C. FALSE CN XI
D. FALSE atrophy of the ipsi SCM
E. TRUE the right SCM moves the chin to the left. Its loss=chin to the right (ipsilaterally)

26. **This shows the circuitry for CN XI only! The shaded axon has its cell of origin in the right nucleus ambiguus and passes to the right larynx.**
A. FALSE this is the rostral/cranial part of CN XI not the caudal/spinal part
B. **TRUE**
C. **TRUE**
D. FALSE this is the rostral/cranial part of CN XI not the caudal/ spinal part
E. TRUE