19
NEUROANATOMY

The neuron

The Neuron is made up of three regions specialized in different ways. The dendrites get messages from other neurons or sensory organs. The Soma is the Cell body that contains the nucleus, ribosomes, ER (Specialized and called the Nissel Bodies). The Soma cannot regenerate. The axon is the last part of the neuron. It sends messages to other organs via a variety of neurotransmitters.

Axons may are insulated by a myelin sheath. This allows the Action potential to move in a salutatory manor. Within the axon are Na/K channels that open as the AP moves down.

At the end of the axon the neuron contains Ca channels, mitochondria, and synaptic vessels full of Neurotransmitters. As an action potential reaches the axon bouton (Its end) it causes the Ca channels to open and let Ca into the cell. Ca inside the cell binds to a protein called Calmodulin a regulatory protein. The Ca bound Calmodulin and the increase [Ca] in cell an Enzyme called Protein Kinase is activated and it phosphorylates the synapsin protein.

The phosphorylated synapsin protein helps the vessel bind to the cell membrane causing it to send Neurotransmitter into the Synaptic cleft (or Neuro-muscular junction if it is a motor neuron).

1. Draw and label a neuron

There are many types of neurotransmitters that activate numerous receptors located of the dendrites of neurons. Acetyl Choline (ACh) is the neurotransmitter (NT) that is sent from pre-synaptic axons to postsynaptic neurons. It is also the NT that is sent from Motor neurons to skeletal muscle.

The two receptors for ACh differ and are referred to by different names. Nicotinic (N) receptors are activated by ACh or Nicotine. These are located in autonomic Ganglia of sympathetic and parasympathetic Nervous system, at neuromuscular junctions, and the Adrenal Medulla. N receptors activate the opening of an Ion channel for K and Na.

Muscarinic receptors (M) are activated by ACh and Muscarine. These receptors are located in the heart, smooth muscle (Except for blood vessels) and glands. They act to inhibit heart rate, and all parasympathetic effects.

As you may not want to repeat activating the nerve or muscle ACh is destroyed in the neuromuscular cleft by ACh esterase (AChE).

2. What receptors are directly stimulated by Nicotine?

3. Which receptors are stimulated INDIRECTLY by Nicotine?

D2 receptors function via the Gi system, it causes the GTP to fall off of the G-Protein and deactivate the cascade. Too many of these receptors activated cause Schizophrenia. Too little of these receptors activated causes Parkinson's disease. Serotonin is in high concentration in the Brain stem. This NT is found in most concentration in the midbrain.

Glutamate is the most prominent excitatory NT in the brain. Its receptor is an ion channel for Ca and Na. It is involved in the storage of memories and three things are needed to open the channels: Glutamate, Glycine from Astrocytes, and a partially depolarized membrane. GABA is the inhibitory NT of the brain. It is made from glutamate and its receptors increase the conductance of Cl. It is the site of action of hypnotics like barbiturates and Benzodiazepines. Glycine is the major inhibitory neurotransmitter found in the Spinal cord. It increases Cl conductance.

Neurons action on other neurons can have one of two effects. An Excitatory Post Synaptic Potential (EPSP) causes excitation of the cell to bring it closer to threshold thus produce an action potential. Inhibitory Post Synaptic Potential (IPSP) causes inhibition of the action potential. These are equal to about 20% of neurons in the CNS.

4. What NT would be used in an EPSP in the brain?

5. Which NT is used as an IPSP in the brain?

6. Which NT would be an IPSP in the Spinal Cord?

7. Which NT is an EPSP in the Spinal Cord?

The Meninges

The Brain and spinal cord are protected by many structures. The Skull is composed of many bones fused together to protect the brain while many bones form the vertebral column that will protect the spinal cord. Under these bones are the Meninges composed of three layers of connective tissue with space in between each layer to protect from trauma.

The Dura Mater is a thick layer of connective tissue under the cranium. This is followed by the Subdural space. Then comes Arachnoid layer of connective tissue. It also has a space that follows it that is called the Subarachnoid Space. It is this area under the Arachnoid that is filled with CSF helping it acting like a shock absorber and transports dissolved particle to and from the area.

The Pia matter is under the Arachnoid tissue and lies on the brain. It is also highly vascular though the blood vessels do not make direct contact with the brain. This is needed because your brain uses most of the oxygen you breath. The Pia matter provides a barrier between the blood and the
Remember, the Meninges P A D protects your brain.

8. Draw and label the layers of the Meninges.

Gross divisions of the Brain.

There are two areas of the entire brain, the cortex and the Medulla, each of these is made up of two types of matter, gray and white.

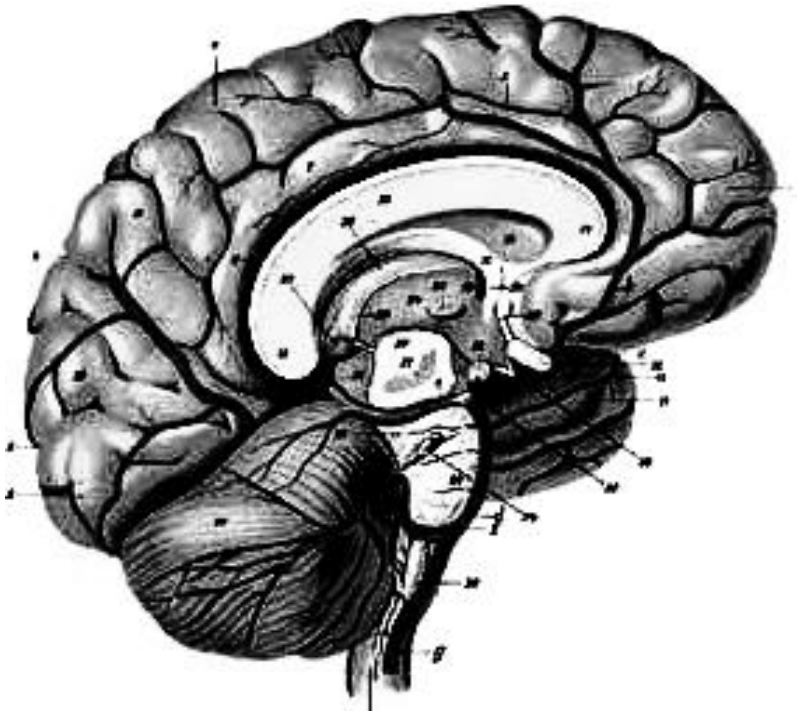
Grey matter is in the cortex or outer region. It contains axons that are not myelinated. White Matter is located on the medulla of the brain, this contains myelinated axons.

Of the entire brain, the Cerebrum is the greatest part and is divided into left and right hemispheres that are connected by the corpus callosum. Each hemisphere is then divided into individual lobes. It is responsible for processing information. Also produces Cerebral Spinal Fluid (CSF) at the Choroid Plexus of the lateral and third ventricles.

The Cerebellum is a smaller structure found inferior and posterior to the Cerebrum. It too is divided into hemispheres.

The last division of the brain connects it with the spinal cord. It is called the Brainstem. It is located inferior and posterior to the Cerebrum and anterior to the Cerebellum. The brain stem is made up of three parts that include the mesencephalon (midbrain), the pons, and the medulla oblongata.

9. On the image of the brain cross section label its major parts include the cortex and medulla.



The Cerebrum is divided into two hemispheres which is then divided into four lobes. It is also responsible for sensory and motor information. In the Frontal lobe, found anterior to the central sulcus, contains the regions known as the premotor area and the principal motor area that is located pre-central gyrus. Motor is contra-lateral to limb controlled and the area of cortical area used for each of the body part is determined by fine movement not. The frontal lobe is also involved in personality and long-term memory.

Posterior to the Frontal lobe is the Parietal Lobe. It starts at the central sulcus and ends at the parieto-occipital sulcus. The Parietal lobe contains the prefrontal gyrus that is involved in sensations where the area used for senses is not determined by size of organ but rather sensation need. Posterior to the Post central gyrus is the Superior parietal lobule. It receives input from the post central gyrus. It is used in tactile discrimination, ability to recognize visual forms, and recognize body positioning.

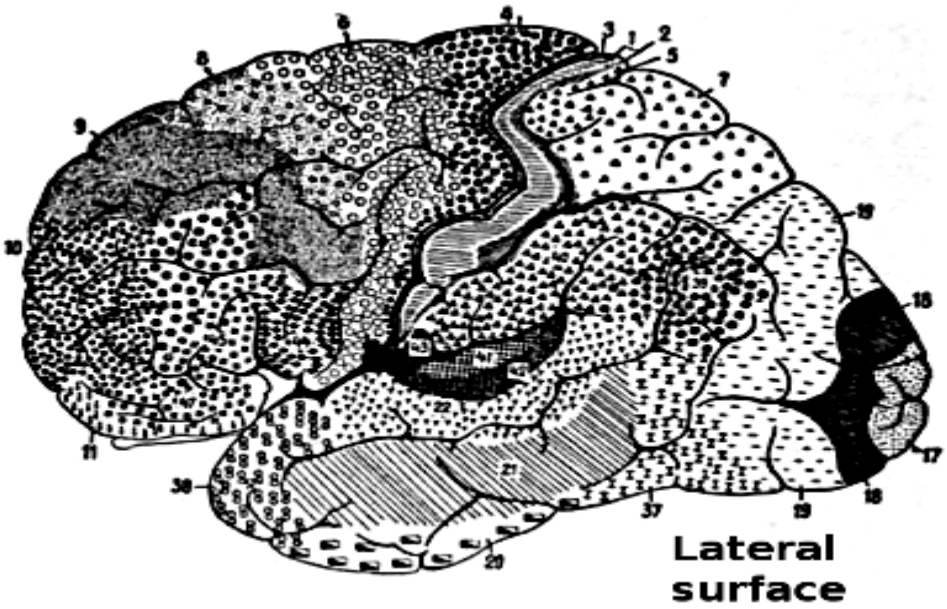
Posterior to the Parietal lobe you find the Occipital Lobe. It starts at the Parieto-occipital Sulcus and ends at the pre-occipital notch. It is responsible mainly for sight and interpreting sight.

Temporal lobe is located down from the Posterior ramus of that Lateral sulcus of Sylvius. Within it are three gyrus. The superior temporal gyrus contains the Primary auditory cortex, and Wernicke's area.

There is also the Angular Gyrus, located at the junction of the parietal, temporal, and occipital lobes is the area that gathers visual, auditory, and somatic information and sends it to the appropriate area of the brain. This area is highly lateralized, so the left is responsible for reading and writing while the right side is for speaking of listening.

9. On the image provided label the following

Frontal lobe
Parietal Lobe.
central sulcus
parieto-occipital sulcus.
prefrontal gyrus
Pre central gyrus
post central gyrus.
Parieto-occipital Sulcus
preoccipital notch
Temporal
Lateral sulcus of Sylvius.
The superior temporal gyrus
Angular Gyrus



Checking overall brain function:

Introduction:

Unlike most other test where physical signs and symptoms can be tested and viewed, the Cerebral cortex offers little in possible observable signs. A clinician can determine function of the Cerebral Cortex by what is referred to as a mini mental state exam. It requires a conscious and cooperative patient. As you are attempting to determine function it would be wise to use a quiet room and make to person a comfortable as possible.

In today's experiment you must test your partners mental function by asking a few simple questions. As this is done in class with other students talking, the scoring can be unreliable. Normally a score of less than 25 is considered deficient.

You will be asking your partner a series of questions and tasks given below. After each question or task you must identify what part of the brain you are checking. Feel free to use your notes, books, or any other material you feel you need.

MMSE

I.Orientation each worth one point

1. What is the name of this building?
2. What city are you in?
3. What's the date?
4. Month?
5. Year?
6. What state are you in?
7. What county?
8. What floor are we on?
9. What day of the week is it
10. What season are we in?

II. Registration:

11. Name three items and have your partner repeat them. (Score 1-3 depending on how many times you repeated before they got it right.)

12. Attention and calculation: Tell them to subtract 7 from 100 until they reach 65 (max score=5)
13. Recall: Ask partner to rename the objects named in 11 (1 pt for each they get correct)
14. Language test: Tell them to name two objects that you point to (1pt for each)
    i. Tell then to repeat: Me myself and I (1pt)
    ii. Tell them: pick up a piece of paper in your right hand, fold it in half, and set it on the floor (1-3)
    iii. Write on a paper "stand up," ask them to do what it says.
    iv. Tell them to write a sentence.

III.Construction:

15. Draw a clock

Final score:

Results:

What score did your partner have?

What was your score?

Conclusion:
Use your drawing to determine what part of the brain each of the questions was checking?

Where the scores what you expected?

Name three factors that may lead to a lower score in a normal individual.

Cranial Nerves
E Introduction:

After any head injury, cerebral vascular insult or anything that interferes with normal brain function, most people will check the cranial nerves. The Cranial nerves are twelve nerves which come directly off the brain. By counting the nerves of the brain starting from the Cerebrum you can number each nerve. Beside the number, each nerve has its own name.

Name	Number	Coming off of what Brain part	Action
Olfactory Nerve	I	Anterior Commissure of Cerebrum	Smell
Optic Nerve	II	Optic tract of the Cerebrum	Vision and sensation
Oculomotor	III	midbrain at Edinger-Westphal nuc. and CNIII nuc. of the cerebral peduncles	Accommodation, pupil constriction, and most eye movement
Trochlear	IV	Midbrain	Move Superior Oblique
Trigeminal	V	CNIII Nucleus in Pons	Facial sensation and control of muscles of mastication
Abducens	VI	CNIII Nuc. dorsal Pons	Controls Lateral Rectus
Facial	VII	CNVII Nuc. in tegmentum of Pons	Muscles of facial expression, 2/3 anterior sensation of the tongue
Vestibulocochlear	VIII	Vestibular + Cochlear Nuc.s of Medulla Oblongata	Hearing and balance
Glossopharyngeal	IX	Nuc Ambiguus in upper Medulla and Inf. Salvatory Nuc in Medulla Oblongata	Swallowing, posterior 1/3 of tongue sensation
Vagus	X	Dorsal Vagus Nuc. at Medulla Oblongata , Nuc Ambiguus, and Tractus Solitarius	Muscle of speech, gag reflex and various other processes
Accessory	XI	Nuc. Ambiguus of Medulla Oblongata	Sternocleoiomastiod, Trapezium
Hypoglossal	XII	CN XII Nuc at inf. Portion of Medulla Oblongata	Movement of tongue

Materials:

This lab sheet.
Vial of coffee
Limon/lime
pen light
tongue depressor
sugar packet
Tongue blade
Cotton ball

Methods:

You will begin by examining your partner. Then you must tell me what part of the brain you are checking with each test.

CNI

To check the first Cranial nerve, you must ask you partner to close their eyes. Place either the vial of coffee or a piece of lime under their nose and ask if the smell anything, then what do they smell.

CN II, CN III, CN IV, CNVI

Check these four Cranial Nerves together. Ask you partner to look at your finger and follow it with their eyes without moving their heads. You may need to use your other hand to hold their head straight. Make an "H" shape and watch the movement. Then bring your finger closer to their face and then pull back while watching the pupils.

Finally with your light pen shine the light into their eyes one at a time. First, look if the pupil that has been hit with light contracts, then see if the one is not hit with light changes.

CNV

Have your partner open and close their mouth and look for symmetry. Damage to this nerve will lead to deviation of the jaw.

CNVII

Have your partner smile. Then close their eyes and touch their face with a cotton ball. Both tests must be done to determine function due to the cross over of the superior branch. Also ask you partner to say "Me, me, me"

CN VIII

Have your partner stand and close their eyes with both hands outstretched. If there is a rocking, there may be a lesion (Called Romburg's sign). Ask them to close their eyes and whisper "can you hear me?" into both ears.

CNIX

Hand your partner a glass of water and ask them to have a drink. Watch them swallow.

CNX

With a tongue blade in hand ask your partner to say "Aah," then place the blade on back of tongue to elicit the gag reflex. Next ask you partner to say "Kuh, kuh kuh"

CNXI

Place one hand on each of your partner's shoulders and ask them to shrug, is the strength the same?

CNXII

Have your partner stick their tongue out at you first straight out then wave it from side to side. Now ask you partner to say "La la la"

Conclusion:

Knowing that all Cranial nerves are paired what would you expect to happen if there was a lesion at the site of the nerve path? How do you think that checking the Cranial Nerves could determine the site of occlusion in a stroke patient?

<u>Special senses</u>

Within the body, there are specialized cells that convert environmental stimuli to neural signals. These environmental stimuli can be mechanical force, light, sound, chemicals and temperature. Three types of sensory cells exist. Mechanoreceptors are found in joint receptors, muscle stretch receptors in muscles, hair cells in vestibular system (for hearing), and a specialized receptor in skin called Pacinian and Meissner's corpuscle.

Photoreceptors are found in the rods and cones of the retina. Chemoreceptors are the olfactory receptors, taste receptors, osmoreceptor, and Carotid body O_2 receptors. Nociceptors can detect pain and extreme temperatures.

Stimulus arrives at the sensory receptor causing ion channels to open, which usually causes a

depolarization (Exception occurs in light where it causes a hyper polarization.) If the receptor potential is strong enough to depolarize and cause an action potential, it causes the sensory neuron to fire. Receptor potentials are graded in size, the stronger the stimuli the higher the potential.

Special senses include vision (Eyes), Audition and vestibular system (Ears), Olfactory (Smell), and Taste (Tongue).

Vision:

The eye is composed of various structures. It is important to know the parts of the eyes when looking at them. Looking at the outermost portion we find the white sclera and clear cornea. Posterior to the cornea we can see the colored Iris that is formed from mostly connective tissue and smooth muscle. It controls the amount of light that enters the eye.

Anterior to the iris and posterior to the cornea we have a chamber of fluid called. That chamber is called the anterior chamber. Behind the iris we find the lens. This is the elastic lens held in place by the Suspensory ligaments. The lens is pulled to the desired shape by Ciliary muscles. Anterior to the lens and posterior to the iris we find a cavity called the posterior cavity.

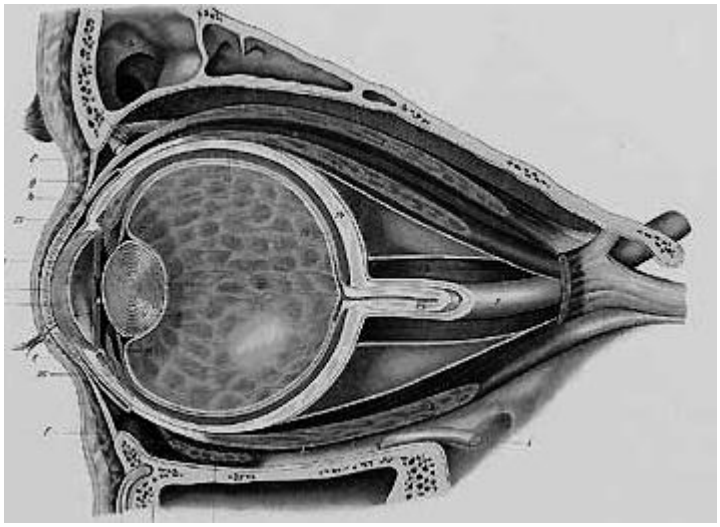
Both the anterior chamber and posterior chamber are filled with a fluid called Aqueous humor. This is the area that is affected in uvitis.

Posterior to the Lens we find the Vitreous Chamber that extend to the back of the eye. It is filled with Vitreous Humor. Making up the boundary of the Vitreous Chamber are three distinct layers.

The outer most is the Sclera. The Sclera is the whites of the eye. The Choroid layer is just deep to the Sclera and supplied the eye with blood. Finally we reach the retina. The retina is the neural portion of the eye.

If we look at the back of the eye we see two regions that look different. The first is the optic disc, which is where the retinal artery and optic nerve enter the eye as well as the vein leaves it. The other area that is different is the Macula lutea that is the area of highest visual acuity

1. Draw a cross section of the eye and label the Cornea, iris, lens, sclera, choroids, and retina. Next label the All segments.



When we look at something light reflects off the object seen and goes through the cornea then is refracted by the lens. The refracted light then hits the back of the eye where the Pigmented epithelial cells absorb stray light and prevent scattering of light. Light then reflects off of the pigmented epithelial tissue and activated specialized cells called rods and cones. Rods are receptors for light intensity (Help you see in black and white). Cones will let you see in red, green, or blue.

The rods and cones are connected to a layer of cells called ganglion cells that transmit the messages to the optic nerve.

2. Draw the layers or the retina, labeling the pigmented epithelium, and the neural layer.

To use an ophthalmoscope, you will want to take it in the same hand of the eye you will look into as you will also use the same eye. Have the patient look straight ahead to some spot and start at the lateral corner of the eye then slowly move medial. As you begin to investigate the lens you will get a flash of red called the red reflect.

As you continue, you will be able to see the back of the eye.

3. Draw what you see at the back of the eye with the aid of the ophthalmoscope. Label the optic disk, retinal artery and veins, and the Macula luteum

Rods and cones are not present in the optic disc as this is the area that the optic nerve will exit through. The Macula lutea will counteract this blind spot as it has more cones than any other place in the eye giving better acuity.

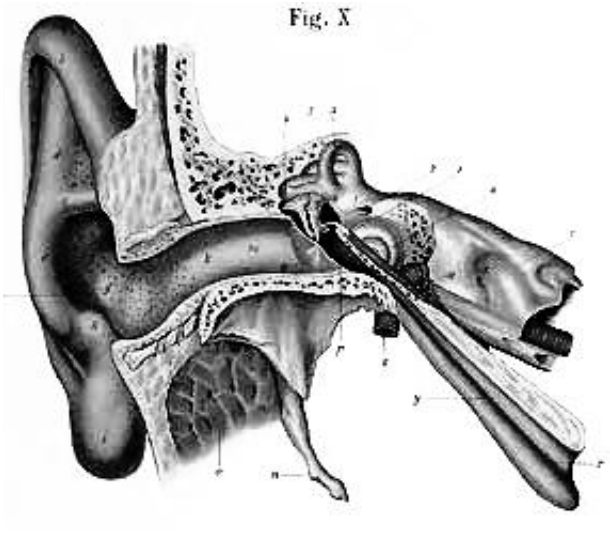
Messages from the Ganglionic cells go through the optic nerve the optic chiasm just over the pituitary. There the message from each eye splits with what is seen medially crossing over forming the Optic Tract with what is seen Laterally on the other side. Optic tract ends at the Lateral Geniculate tract that take the message to the Occipital cortex.

Hearing:

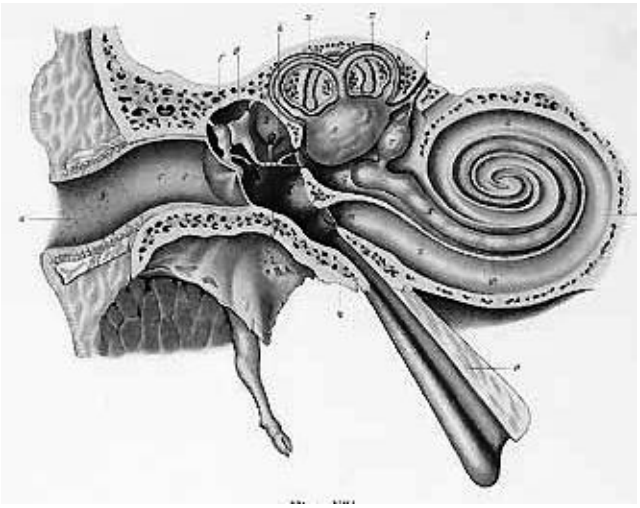
The hearing range is tested between 250-8000Hz (normal speech is 500-2000Hz). The outer ear functions to direct sound to the middle ear. The middle ear is an air-filled area that contains the Tympanic membrane (TM) and auditory ossicles. When sound strikes the Tympanic membrane, it vibrates causing the ossicles to move. The Stapes is attached to the oval window of the inner ear. When it moves it cause sound to become sent down the inner ear. The inner ear has two functions balance and hearing.

As sound enters the inner ear, the vibrations are sent to the organ of Corti where the vibrations cause the movement of hair cells. This changes the K conductance and activates the Cochlear nerve to send messages to the brain.

4. on the images provided label the following
   a. Auricle
   b. External auditory canal
   c. Tympanic membrane
   d. middle ear
   e. Ossicles
   f. inner ear.



5. Draw the organ of Corti label the tectorial membrane, the hair cells, and basilar membrane.



6. How does sound enter the cochlea and how does it exit?

The ears via the Vestibular system (Semicircular canals, Utricles and Saccules) control posture and balance. During a rotation of the head fluid within the endolymph system moves this causes stereocilia to bend. The movement of the stereocilia will cause a depolarization or a hyper polarization depending on the direction of the movement. If they bend towards the kinocilium (Longest of cilium of the group) it causes a depolarization. Messages are sent to CN VIII.

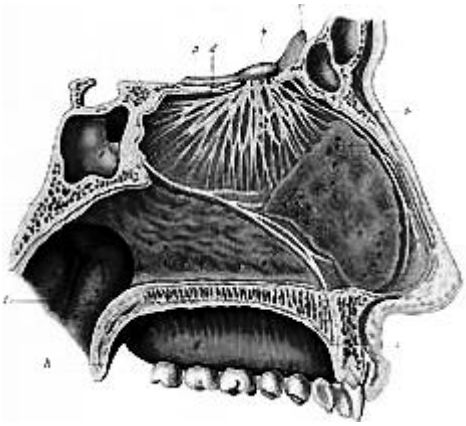
Nystagmus is a bouncing movement in eyes caused by many different reasons. It happens to a small extent in normal individuals because of the Vestibular-ocular reflex.

Smell

The sense of smell is controlled by CN I and CN V (only unpleasant) The olfactory receptors are located in nose just beneath the cribriform plate. They are the smallest and slowest of unmyelinated nerves. The stimulus binds to the receptors and activate a G-protein cascade, which increases cAMP and causes an

action potential. The Olfactory receptors send the action potential to Mital cells in the Olfactory bulb and goes to the limbic system. Olfactory cell are constantly being replaced, the replacement cells come from undifferentiated basal cells in the epithelium.

Olfactory cells are an example of naked neurons, they are exposed directly to the particles that stimulate them.



7. On the picture provided label the following:
   a. Ofactory nerves
   b. Cribiform plate of ethmoid bone
   c. Olfactory bulb

Taste:

Taste receptors are located in the tongue and they are not neurons. The sense of taste is controlled by two CN CNVII controls the anterior 2/3 (mosty Salty and sweet). CN IX controls the posterior 1/3 (mostly Sour and bitter).

Spinal cord and peripheral nerves.

Looking at the Spinal cord transverse cross-section we see many functional areas. First, we can divide it into white (the Myelinated area) matter and gray matter. Unlike the brain, the white matter in the spinal cord is found surrounding the gray. Within the Gray mater we see a pore that travels the length of the spinal cord down the middle. Embryologically, you must remember that this was the neural tube. The hole is the cavity of the tube now called the central canal. It is a channel for Cerebral Spinal fluid to travel through.

Continuing with the gray matter you will see that there is bilateral symmetry. It has a H-shaped pattern which consists of two Dorsal horns and two ventral horns. At the level of C8 you will see Lateral Horns as well which disappear and reappear again when you reach the level of T1-L3

Now looking at the White matter you will see three major divisions. These are the Dorsal column, the Lateral Funiculus, and Ventral Funiculus.

Hanging off the spinal cord are things called nerve roots and a large dorsal root ganglion. The Dorsal roots are nerves bringing information to the spinal cord from the periphery. The nerves and neurons there are referred to as General Somatic Afferents (GSA). The Somas are located in the Dorsal Root Ganglion (DRG). The Ventral roots are sending to a target tissue. This will be discussed later.

1. Draw a transverse cross-section of the spinal cord. Label the Gray and white matter, include all the divisions mentioned above and the Central Canal.
2. Label the dorsal median sulcus, Ventral median fissure, and ventral white commissure. Also label the Fasciculus Gracilus and Fasciculus cuneatus
3. Draw the Dorsal and ventral roots as well as the DRG.

4. Where are the cell bodies of the neurons of the ventral roots? (Pay attention to your picture)

Now with a basic understanding of the Spinal Cord coronal cross-section we can look at the spinal cord as a whole. If you do not remember the vertebrae, it will help to review them.

5. How many Cervical, thoracic, and lumbar vertebrae are there?

6. How many sacral Foramens are there?

It you look at the Spinal nerves, you will note that the roots are named for the region that they are found in. The first Cervical nerve comes off between the occipital bone and C1. The last comes off between C7 and T1. These are nerves not neurons, they contain both afferent (going to brain) and efferent (going away from brain) fibers.

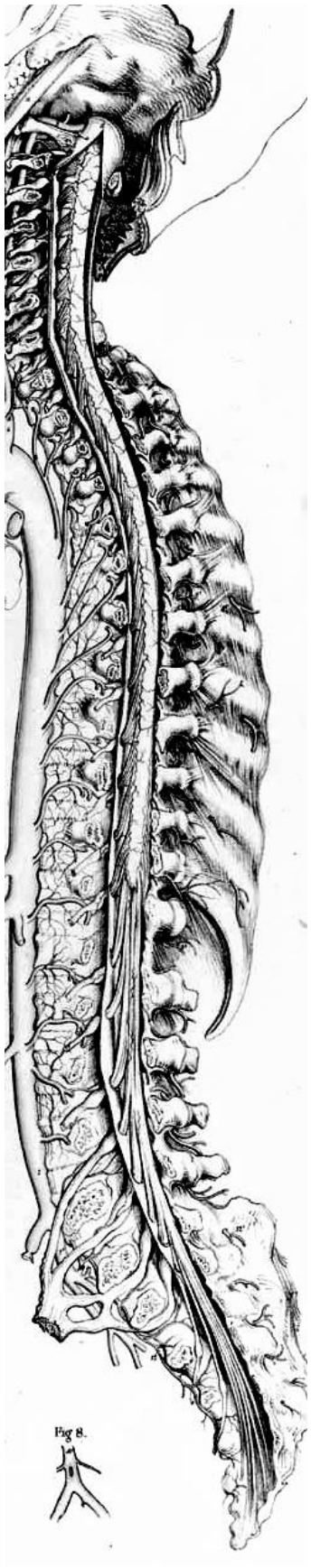
At the end of the Spinal Cord is the Cauda Equina which is a collection of free nerves (no longer bound as in the spinal cord).

7. How many pairs of Cervical nerves are there?

8. How many pairs spinal nerves are there?

9. At what vertebral level does the Spinal Cord end and the Cauda Equina begin?

10. When doing a Spinal tap, you find the Iliac crest and move medial until you hit the spinal cord, what vertebral level are you at and why would this be a logical place to put a needle in when needed?



Now we have the basics for talking about nerve tracts in a generic sense. We will look at the ascending tracts first. This is made up of Three neurons. The first order neurons get the initial stimuli at its dentrite located at area of sensation. The Soma is found in the DRG.

There are three paths that sensation can take depending on type. When dealing with tactile discrimination, vibration, from recognition, joint and muscle sensation it will take the Dorsal Column. The 1st order neuron will send its axon travels to the dorsal horn then enters the Dorsal Column and go to the Medulla oblongata.

The 1st order neuron ends and passes the message to the 2nd order neuron that will cross over to the contra-lateral side and take the message to Thalamus to transfer the message to the 3rd order neuron. The 3rd order neuron will take the signal to the Postcentral Gyrus of the Cerebral Cortex for interpretation.

There is another pathway for pain and temperature sensation called the lateral spinothalamic tract. 1st order neurons are in the DRG

and have axons that enter the dorsal horns where they synapse with the 2nd order neuron.

The 2nd order neuron crossed the Ventral White Commissure then to the Lateral funiculus where it ascends to the medulla oblongata to project to the reticular formation but terminates at the thalamus.

The 3rd order neuron takes the message to the Cerebral cortex Postcentral gyrus.

For the unconscious proprioceptive information (balance and coordination) there is a two-neuron systems. There are three systems one for dorsal one for ventral. For this class we will deal with both just by name and where it ends. They are called the Dorsal, Ventral Spinocerebellar as well as the cuneocerebellar tracts. As the name implies, they end at the cerebellum.

Next, we have the Descending Tracts. These are sending messages to a target organ. We will start with the Corticospinal pyramidal tract. It functions in voluntary movement. The tract begins in the promotor, precentral and central gyurs collectively and pass though the brainstem as the axons pass through the Pyramids of the Medulla oblongata after which the axon crosses over. The 1st motor neuron (now called an Upper motor neuron (UMN)) reaches the spinal cord and travels in the lateral funiculus until it reaches the area where it will leave the spinal cord then enters the ventral horn of the gray matter before ending.

The UMN will pass the message to a lower motor neuron (LMN). Its axon will exit via the ventral roots and hit the muscle tissue desired to move.

11. Draw all three tracts described above labeling all the parts.

We can now talk about something you will see again in physiology, the Arch reflex. This is used in clinics to see if spinal damage has been suffered by a patient. The way it works is this. All sensation is meant to protect the body so it may be necessary to get movement of a part to prevent too much damage. Think of touching something hot, you immediately let it go, you don't feel then let go. This is done by sending the message from sensory nerve directly to a motor nerve on its way to the brain.

12. Draw the path of an arc reflex. Label each nerve type.

For centuries people have mapped the path of nerve. In many martial arts, areas where nerve are superficial have long been used as pressure points or strike points (areas that cause severe pain or temporary decreased use of limbs). These are sights that in clinic can be used to numb an area without putting the patient under general anesthesia.

In this lab instead of numbing the area we will use discomfort to check the path of different nerves as well as reflexes.

Materials:

You will need as partner to let you practice on. IMPORTANT!!! Use small amount of pressure on you partner as this may hurt a lot otherwise.

Spinal nerves of the head and neck

Some of these nerves have been discussed previously in the cranial nerve lab so refer back to those for further reading.

The Cervical Plexus is formed by nerves from C1-C5 most will affect sensation and movement of head, neck and upper chest area though this is mostly accomplished by aid of certain Cranial nerves (discussed in previous lab). The most important of this nerve is the phrenic nerve.

13. How many Cervical nerves are there? How many vertebrae?

14. What roots make up the phrenic nerve? What muscle does this nerve innervate?

Nerves of the arms

Before starting it is important to understand the Brachial Plexus. It is made up of roots from C5--T1. The roots come together as trunks. Each of these trunks will divide into two parts posterior and anterior divisions. These divisions will come together into cords.

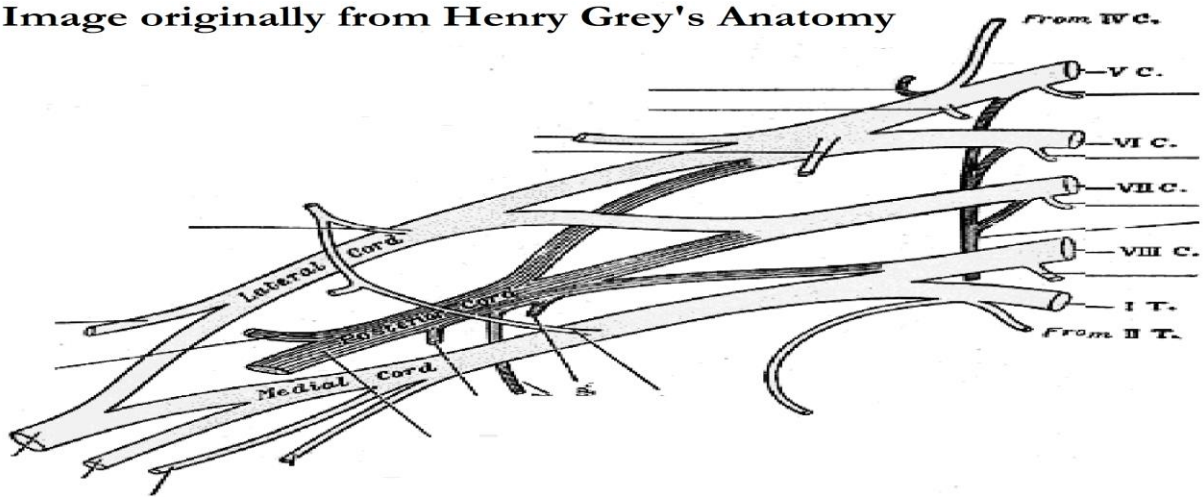
You will note that the medial and lateral cords come together to form the Median nerve. The Lateral cord also has a branch called the musculocutaneous nerve. The medial cord will have three branches, two are the median cutaneous nerves of the arm and forearm (just mentioned here) and the Ulnar nerve. You will note that if you look at the arrangement of the Medial and lateral cords with their three major nerves (Musculocutaneous, Median, and Ulnar) you will see a W formation.

The Posterior Cord splits into two major nerves. Most nerves of the arm come off the Brachial plexus with the five nerves mentioned being of great importance because they cause sensation and muscle contraction. So important they get their own car (VW) remember that this order will arm you (ARMMU).

15. Label the brachial plexus
    a. Roots
    b.trunks
    c.divisions
    d.cords
    e. nerves

16. What are the roots in the Median, Ulnar, Radial, Axillary, and musculocutaneous nerves?

Motor function of nerves from the Brachial Plexus (use your picture of the Brachial Plexus for the



following questions).

17. While doing this portion consider, where the muscle is and when abducting you shoulder, what muscles are you using? What nerves and roots are used?

18. Now flex the elbow, what three muscles are you using? What nerves are use?

19. Extend your elbow, what muscles are used? What nerves are used?

20. What muscles pronate the forearm and which supinate, what nerves innervate each of them?

21. Now look at the muscles in the forearm that flex the wrist and fingers what are the muscles and what nerve innervates them?

22. Look at the location of the extensors, what nerve innervates these.

23. When Damage to the brachial Plexus occurs at the roots there are three paralysis that can occur?

24. Erbs Paralysis there is damage to spinal nerves C5 and C6. It presents with paralysis of the deltoid, bicepts brachia, brachialis, supinator, supraspinatus and infraspinatus. What nerves are effected?

25. Klumpke Paralysis is due to damage to C8-T1. What nerves will be affected?

Sensation of the arm

Look at your partner's triceps brachii near the middle of the muscle and give a slight pinch, ask your partner for three words that describe the pain. Next have your partner give you the thumbs up. Look at where the tendons of the extensor pollicis brevis and the abductor pollicis longus form the anatomical snuff box. Gently press on snuffbox. Again, ask about the sensation.

26. What nerve did you irritating? What are its roots? What Cord did it arise from? What is the other nerve that comes from that Cord?

27. Take your partners arm and look at the medial epicondyle, what nerve to you find here? What area does it give sensation to? What are its roots?

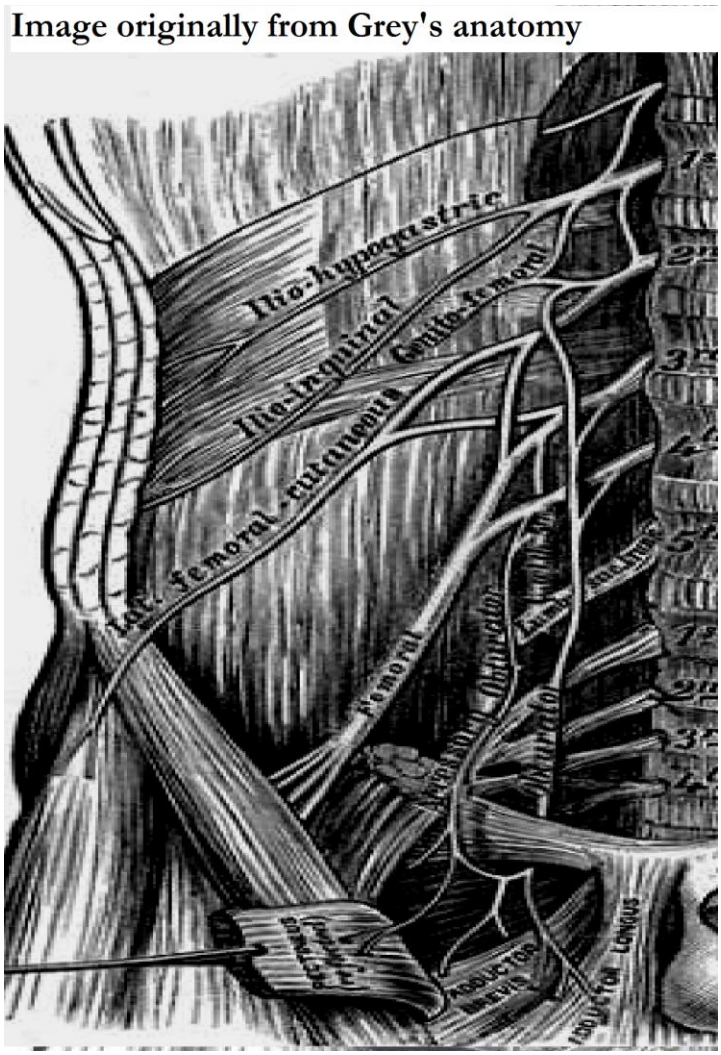
28. Now look at the area where you would find the brachioradialis, pinch this area on your partner, is the pain greater than you would have expected? What nerve did you stimulate? What are its roots?

Now looking at the wrist, at the area of the Transverse Carpal ligament (flexor retinaculum) right in the middle of where this ligament exist you can tap it with a finger or reflex hammer.

28. This is a way to clinically test for Carpal Tunnel Syndrome, what are the roots of the median nerve? Now knowing what it innervates and gives sensation to, what would median nerve compression cause? What are the Cords that give rise to this and the two nerves discussed previous?

29. There is a sign called "winged Scapula" which occurs when one of the nerves of the brachial plexus is damaged, what nerve is damaged when this occurs and what muscle does that nerve innervate?

Nerves of the legs and lower body



Lumbar Plexus:

The lumbar plexus is composed of nerve roots from T12-L5. The nerves of this plexus that we will be concentrating on come from L2-L5. L2 and L3 come together first to make the lateral cutaneous nerve of the thigh. The L2-L4 roots will come together on the posterior side to form the femoral nerve which will travel through the Inguinal canal giving sensation and motor control to the anterior muscles of the thigh, that are these muscles.

29. What will it give sensation to the anterior division of the lumbar plexus will give rise to the obturator nerve?

Sacral plexus

The sacral plexus is formed from the roots of L4-S5. The major nerve from this plexus is the Sciatic nerve formed from L4-S3. The Sciatic Nerve is formed from both anterior and posterior divisions of these.

30. What part of the Sciatic nerve is formed from the Anterior division of L4-S2? What is formed from the Posterior divisions on L4-S3? What does each of these nerves innervate?

Another clinically important nerve from this plexus is the Pudendal nerve formed from S2-S4. An important nerve in OB/Gyn it is blocked by finding the Ischial tuberosity.

31. What organs does it act on in both male and female?

The Autonomic Nervous system

The synapses between neurons of the autonomic nervous system are made in the autonomic ganglia. These will control Smooth muscle, cardiac muscle, and glands and are divided into two divisions. Both start out with pre-ganglionic cells that release Acetyl Choline (Ach) that will act upon Nicotinic type receptors.

The preganglionic neurons of the Parasympathetics will release Ach at a ganglia located near the effector organs. The Post-ganglionic cells will then send Ach to the target tissue and bind to Muscarinic type Ach receptors. This part of the ANS is involved in maintaining the body. It will slow heart rate, stimulate gland secretions and the Digestive tract as well as relax the body. Preganglionic neurons are found in the cranial and sacral region. The major nerves of the Parasympathetics are the following:

1. CNIII: constriction of the pupil
2. CNVII: Lacrimal and nasal gland activation
3. CNIX: activation of submandibular and sublingual glands

4. CNX: Slows heart, increase bronchial secretions, and increase GI Motility.
5. Pelvic splanchnic Nerves: Large intestine motility, bladder contraction (Micturition), penile/clitoral erection.

In contrast, the Sympathetic Preganglionic neurons originate in the thoracolumbar region and end at the Sympathetic Chain Ganglia located next to the vertebrae. These neurons will then go to the target organ and release Norepinephrine to cause increase heart rate, respiration rate, and increase blood flow and breathing in general. It will slow or stop most gland secretions, and the Digestive tract. The sympathetic division of the ANS will speed up the body. This is your fight or flight response.

One of the major features of the SNS is the inclusion of the endocrine system with the Adrenal Medulla. Preganglionic fibers go directly to the Adrenal medulla to the chromaffin cells so the Adrenal medulla acts as a specialized ganglia of the SNS. The Chromaffin Cells secrete Epinephrine into the Blood stream.

6. Draw a schematic of the Parasympathetic label activation and deactivation of the organs involved.

7. Draw a schematic of the Sympathetic label activation and deactivation of the organs involved.

Sympathetic/Parasympathetic response.

The Autonomic nervous system is divided into the Parasympathetic (Relax) and the Sympathetic (Fight or flight) responds. These have mass effects on the body. We will try to see the effects of both of these.

Step one:

Take your resting pulse: As you are all aware, this can be done by feeling the beat over the radial artery for fifteen seconds and multiplying it by four. (So you will have x Beats/min). Write this down on a piece of paper.

Step Two:

Now that you have your pulse, press on your eyes for twenty seconds and record your pulse as described above. What is the effect on heart rate? Why do you suspect that this effect occurs?

Step Three:

To stimulate your sympathetic drink a coffee (or have a partner scare you). What happened to heart rate?