

## **CNS-1 Anatomy Lab#2**

Note:-this sheet will be divided into 2 parts,the first one:is the theoretical part that is found in the handout the doctor didn't follow the same order of pages while explaining the lecture, some of the illustrations aren't found in the handout itself but I tried my best to make everything clear,the second part is the practical part where the doctor indicates almost everything he said in the first part (but on the brain)

Refer to figure 7.2 on page 14(lower one):-

The cerebellum is made out of 2 cerebellar hemispheres. The middle part is known as the vermis,we have a superior vermis and an inferior one,but the inferior vermis is more prominent than the superior one

\*how is the vermis and its partners(pons,medulla oblongata) separated from each other?

We cut the branches of the cerebellum,every cerebellar hemisphere has 3 branches:-

1 - the middle cerebellar peduncle:that attaches the cerebellum to the pons

2-the inferior cerebellar peduncle:that attaches it to the medulla

3-the superior cerebellar peduncle:that attaches it to the midbrain

\*these 3 parts are found on each side or hemisphere, we'll talk about each of their parts and contents later, but their main function is to bring information,that is needed to the cerebellum (ex.information about the muscle,if it is under tension,or relaxed or contracted that is received from receptors in the muscle)

\*what are the types of receptors in the muscles?

Muscle spindles,intrafusal fibers,we also have receptors in the tendons which are known as golgi tendon organ

Note:the doctor said that the parts of the vermis such as (nodule,pyramid.....) are not necessary to know.

Refer to figure 7.3 on page 6:-

It shows a midsagittal section that passes in the cerebellum,pons,medulla hindbrain and above the pons in the midbrain

\*pons,cerebellum ,medulla-→ forms the hindbrain(rhombencephalon) which has a cavity-→4<sup>th</sup> ventricle

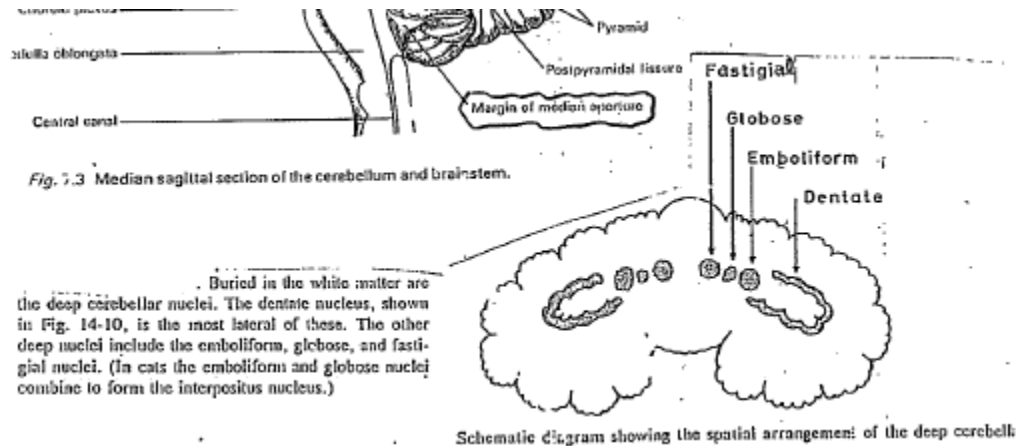
\*the midbrain has a cavity-→cerebral aqueduct and part of the midbrain that is posterior to the duct is called the tectum,which consists of 4 colliculi :-2 superior colliculi one on each side,that has to do with vision

2inferior colliculi one on each side,that has to do with hearing

\*the middle part of the cerebellum is the vermis whether superior and inferior,the superior vermis might have other parts (lingual,central lobule)they are not important to know

The 4<sup>th</sup> ventricle is the final of the CSF, in the roof of this ventricle we have 3 openings, central opening (aperture of magendie) and 2 lateral openings (aperture of luschka), the CSF goes out of them and between the brain meninges until it reaches the subarachnoid space.

\*This figure is not found in the handout:



\*the cerebrum and cerebellum are alike, the cerebrum is cortex from outside and white matter from inside, but inside this white matter we have lobes of gray matter (basal ganglia, diencephalon-thalamus+hypothalamus-)

\*the cerebellum is the same thing, it has a cerebellar cortex but we don't have time to study the cerebral cortex and it's not needed

\*in the white matter we have a lobe of gray matter called the nucleus, we have 3 nuclei in every hemisphere. The most medial nucleus on the left and right side is the fastigial nucleus, we also have 2 nuclei together interpositus nucleus (emboliform and globose), and the biggest and most lateral which is the dentate nucleus.

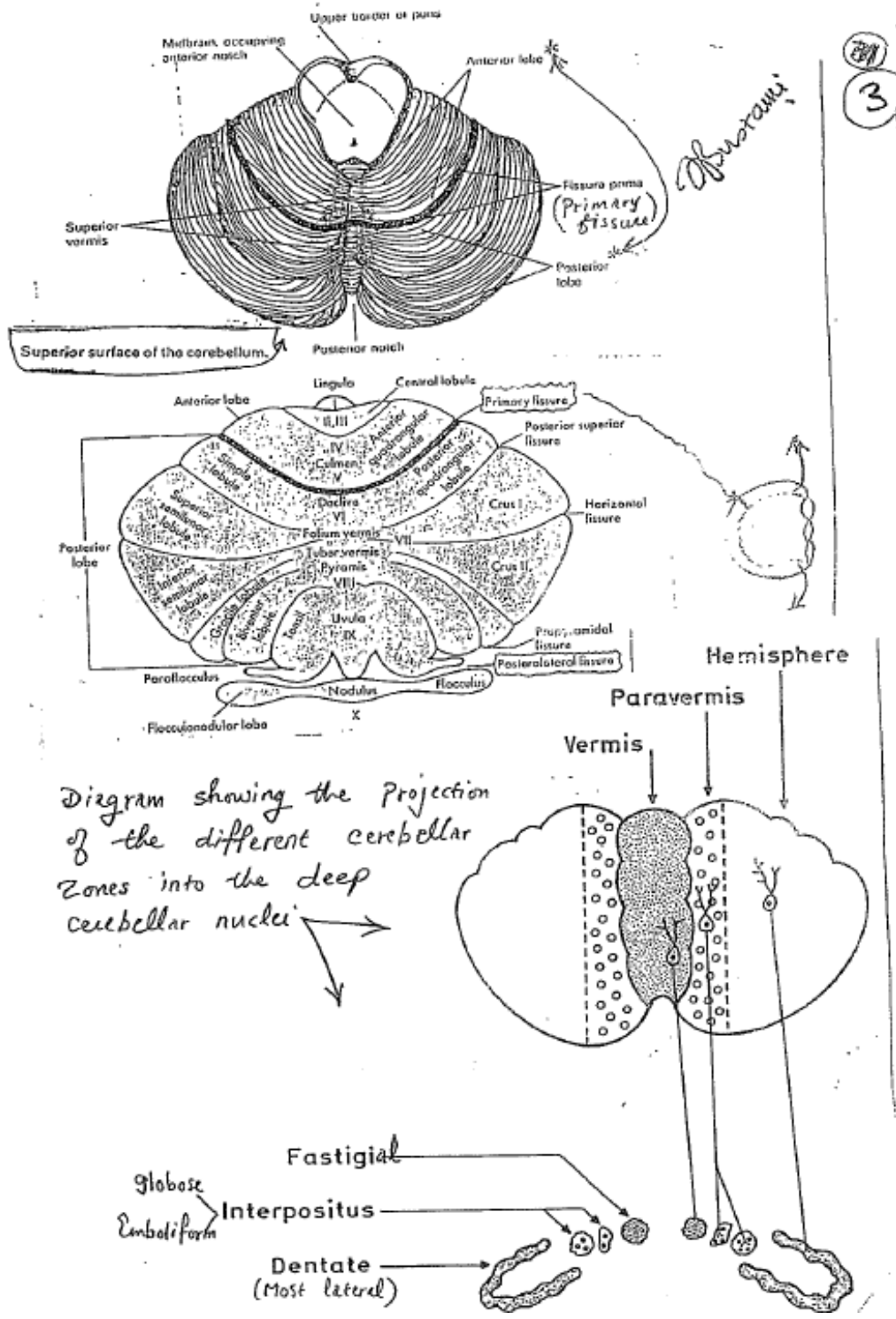
\*What is the importance of the nuclei? If the cerebellum receives an input and we also have an output that will end up coming out of the nuclei in a certain way that we will discuss later on.

\*refer to figure 7.1 on page 14:-

The superior cerebellum surface isn't just dermis and a hemisphere, it has an opening in the cortex that divides it into lobes and lobules. We have an opening that can be seen on the upper surface of the cerebellum called primary fissure (it was known as fissure prima in the past). This opening that is extended on the 2 hemispheres, everything in front of it is the anterior lobe of cerebellum and behind it the posterior lobe that is larger.

\*if I put the upper surface on top of the inferior surface parallel to each other, we can see that the posterior is much larger.

\*we also have other fissures that can't be seen which is the posterolateral fissure. It separates the posterior lobe from the flocculonodular lobe (nodules in the middle + 2 flocculi on both sides), it's the oldest part of the cerebellum.



During evolution and development of fish, amphibians, and then mammals :

1-in fish the cerebellum consists of flocculonodular lobe only (folocculus-folocculus on both sides and nodule in the middle) because a fish only needs some balance inside the water

2-in amphibians:which are active on land and in water,so the anterior lobe starts forming, it coordinates the movements of walking so they can walk,Coordination is the primary function of the Cerebellum (coordination between different muscle groups especially the agonist and antagonist,meaning flexors and extensors)

3-humans:have precise skilled movements(eating,typing...typing)so the posterior lobe is formed,we call that part archicerebellum(the oldest part)also known as vestibular cerebellum (for balance) ,we also have paleocerebellum (old,but not as much as archicerebellum) A.K.A spinocerebellum because it attaches to the spinal cord that brings information from receptors,the last part is the neocerebellum(from new)A.K.A cerebrocerebellum because it attaches to the cerebral cortex (the commander)

\*refer to the last figure of the previous page:-

We said that horizontally we divide the cerebellum to anterior lobe,posterior lobe flocculonodular lobe through the primary fissure and the posterolateral fissure,the rest of the fissures (horizontal...blah blah...)are not necessary to know,and the lobes can be divided into different lobules and we don't need to name them.

\*now we'll talk about the vertical divisions:-the middle part is the vermis on both sides of the vermis we have paravermis/intermediate zone,then we have the lateral zone(which occupies most of the hemisphere)

\*we'll associate the vertical and horizontal divisions together in a way that'll be discussed later on

\*in lecture#3 we talked about the pyramidal and extrapyramidal and then we talked about the medial and lateral motor system(which is the lateral corticospinal and the rubrospinal)and the rest are medial.

\*why are they called lateral,medial motor systems?

Because the lateral makes a synapse on the motor neurons that are on the lateral part of the ventral horn(lamina 9)that send axons to the distal muscles,and the medial goes to the medial part,they are named depending on the last path that synapses on any motor neurons.

\*every part of the cerebellum (vermis,paravermis,lateral part)must have a nucleus inside

vermis	Fastigial
paravermis	Interpositus
Lateral part	Dentate

\*the flocculonodular lobe has connections to the lateral vestibular nucleus

\*the vestibular nerve has 4 nuclei,one of them was in the cerebellum but migrated outside and went to the brain stem,so these nuclei are all found inside the cerebellum except for one which is the lateral vestibule nucleus which the flocculonodular lobule deals with.

\*the most important cell in the cerebellar cortex is the purkinje cell,each one deals with a nucleus inside in a way that'll be explained later,the purkinje cell from the lateral part-→dentate,

The purkinje cells in the paravermis-→interpositus

In the vermis-→fastigial on each side

\*refer to page 5:-we know that the brain stem consists of midbrain,pons and medulla,next to the brain stem we have the optic chiasm منطقة التصلب البصري

So we have the optic nerve,and then the optic chiasm and then the optic tract

\*the origin of the cranial nerves:-

#1 the olfactory nerve-→can't be seen here,purely sensory

#2 the optic nerve-→purely sensory

#3 the oculomotor-→in the upper part of the midbrain on both sides right and left areas we call them crus cerebri (basis pedunculi), the mother cells of it come from the medial side of the midbrain

#4 the trochlear nerve-→from the posterior part of the midbrain, it's the only one that has an origin from the posterior surface

#5 the trigeminal nerve-→from the lateral side of the pons

#6 the abducent nerve-→between the pons and the anterior part of the medulla(pyramidal)

#7the facial nerve,#8the vestibulocochlear-→in between them we have a very thin nerve called nerves intermedius (originating from #7),both of 7 and 8 originate between the pons and the medulla, in the area between the pons and the cerebellum we have an angle called the cerebellopontine angle, the cerebellum is behind the pons, so if any tumor emerged near this angle it could originate from nerve 7 or 8

\*in the medulla we have a pyramid,posterior to it we have an olive shaped process -→the olivary body

#12the hypoglossal nerve-→between the pyramid and the olivary body

#9 glossopharyngeal,#10 the vagus and #11accessory-→posterior to the olivary body

The last 4 nerves originate from the medulla,all of these cranial nerves are very difficult to indicate on the brain practically

\*refer to page #8:-this is a section where we had cut through the corpus callosum,brain stem and cerebellum,it can be seen as an MRI

The first thing we see is the corpus callosum and its parts( rostrum,genu,body,splenium),under it we have a very thin membrane called the septum lucidum,when it's removed we are inside the cerebellar hemisphere,just inside the lateral ventricle,under the septum we can also see a bundle of fibers that are very delicate and easily torn,the fornix represented as

the letter (P) in the figure, this fornix comes from a nucleus in the temporal lobe called hippocampal gyrus, so the fornix comes out of the hippocampal gyrus until reaching the hypothalamus because it connects the hippocampus with hypothalamus

\*the limbic lobe and system: cingulate gyrus that becomes very narrow posteriorly and then turns into the isthmus and at the end we have the parahippocampal gyrus + uncus, by adding parts of the hypothalamus and hippocampus → we get the limbic system

\*the thalamus and hypothalamus → diencephalon

\*Note: 99% of American scientists in anatomy and physiology are non-medical, which is a big problem so they consider the thalamus to be part of the brain stem but it truly isn't (this is important if you're studying from anatomy books that have American authors).

\*the brain stem contains: 1- ascending and descending tracts

2- nuclei of the cranial nerves: the midbrain (3,4), the pons (5,6,7,8), medulla (9,10,11,12)

3- the reticular formation

\*notice that the anterior part of the midbrain is the crus and the posterior part is the tectum and between them (the black region) (U) is the cerebral aqueduct (the duct of the midbrain) which opens in the 4<sup>th</sup> ventricle

\*notice the parietooccipital sulcus anterior to it we have the parietal lobe and posterior to it we have the occipital, just in the middle of the latter we have calcarine sulcus (J), on both sides upper and lower there's area 17 (the primary visual area), 18 + 19 (the association area, where we understand what we see or interpretation of images)

\*above the cingulate gyrus there's the cingulate sulcus which turns into marginal anterior to it we have the paracentral lobule (an extension of 6,4,3,2) which represents the lower limb + sphincters.

\*refer to page 10: the corpus callosum and its parts, notice the anterior commissure and other commissure so the corpus callosum isn't the only one

\*notice the pituitary gland from the stalk and anterior to it we have part of the optic pathway (optic chiasm)

\*also notice the midbrain and its duct (cerebral aqueduct), the posterior part is the tectum that divides into superior colliculus (just above it we have the pineal body الغدة الصنوبرية) and the inferior colliculus

\*refer to page 9: MRI, very important you'll see it everyday in the hospital, it's the same as the previous section we can see the corpus callosum, the septum lucidum underneath and we can see the cingulate gyrus, the doctor said that he doesn't ask you what this or that part is, but he might ask questions like, what connects the occipital-occipital? This part is the thalamus ... it has a sensory and motor function, all sensations pass it besides the olfaction, and the motor function is to coordinate between the parts of motion: 1- motor cortex, 2- basal ganglia, 3- cerebellum, it's (thalamus) considered to have the secretarial

association with them, do the 3<sup>rd</sup> and 4<sup>th</sup> cranial nerves originate from the midbrain? the medulla has a pontine reticulospinal tract, that acts on flexors and extensors but mainly the extensors? (the answer is yes)

The 2<sup>nd</sup> part (practical): -I'm only going to mention details he didn't talk about in the theoretical part,

- \*under the fornix the doctor pinned it and said that you'll find an opening underneath called the interventricular foramen, it attaches the lateral ventricle with the 3<sup>rd</sup> where is the 3<sup>rd</sup> ventricle? Between one thalamus and the other

- \*under the thalamus we have the midbrain and under the midbrain we have the pons and then the medulla oblongata

- \*the cerebral aqueduct (cavity of the midbrain) opens onto the 4<sup>th</sup> ventricle (cavity of the hindbrain)

- \*above the corpus callosum I have the cingulate gyrus which is part of the limbic lobe which is part of the limbic system

- \*the doctor showed as a fold of dura matter: -it's found between 2 cerebral hemispheres, that's why it's close to the paracentral lobule (the area that moves the lower limb), if a tumor (meningioma) came out of the falx cerebri it will cause pressure on the paracentral lobule on the right and left sides, it will cause paraplegia and loss of continence (the ability to voluntarily control urinary and fecal discharge)

- \*the upper part of the falx cerebri has the superior sagittal sinus

- \*we also have the falx cerebelli, and tentorium under the latter we have the hindbrain (cerebellum, pons and medulla)

In the posterior cranial fossa (in the infratentorial compartment), in the supratentorial compartment we also have the forebrain (the cerebrum), on the borders there's the midbrain (in the tentorial notch), if a patient had a trauma that will cause a hematoma that will push the cerebrum downwards, it will cause the midbrain to be pushed downwards rather than staying in its place (the notch), this process is known as herniation of the midbrain, that will also push the pons which will push the medulla and it will exit the foramen magnum that will cause pressure over the arteries in the area, and it will compete with the cerebellum to exit that unfortunately, will compromise the blood supply, the medulla will die and the patient will die because of respiratory failure because in the medulla we have the respiratory center, so sometimes the surgeon might perform the operation in a hurry without sanitization, or shaving the hair on the scalp just for the sake of saving the patient's life, even though he/she might be prone to infection which is not that big of a deal compared with death, it can be dealt with and the patient can live after that.

- \*when we see a person that has an increase in the intracranial pressure what happens? the midbrain will be pulled downwards and originating from it is the 3<sup>rd</sup> cranial nerve oculomotor which has the parasympathetic for the constrictor pupillae muscle so there is no parasympathetic innervations (because the nerve is affected by stretch), the sympathetic will do its work which is the dilatation of the pupil.

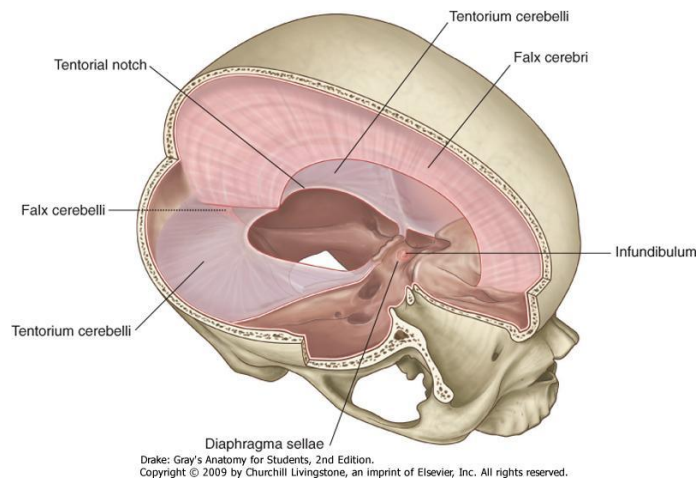
- \*accompanied with the midbrain sometimes the lower part of the cerebrum (the uncus) → causing uncus herniation

- \*it's hard to indicate the central sulcus, but when you do you can find the frontal lobe and parietal lobe, in front of the sulcus we have the precentral gyrus A.K.A area 4 and primary motor area how is the area presented? upside down precisely but

disproportionally (the largest part is presented by the hand), in front of the precentral gyrus we can find area 6, the lower part is premotor the superior is the supplementary motor area.

\*in the other part of frontal lobe we have 2 sulci (sup. & inf.) that separate 3 gyri (sup., mid. & inf.), in the posterior part of the middle we have area 8 (frontal eye field) → if stimulated on the right the eyes go to the left, if there's a lesion on the right side the eye moves to the right.

\*if a tumor appeared in part of the brain which will cause more severe intracranial pressure symptoms if the tumor originated from the hindbrain or forebrain? the hindbrain because the infratentorial area is smaller than the supratentorial



I apologize for any mistakes

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