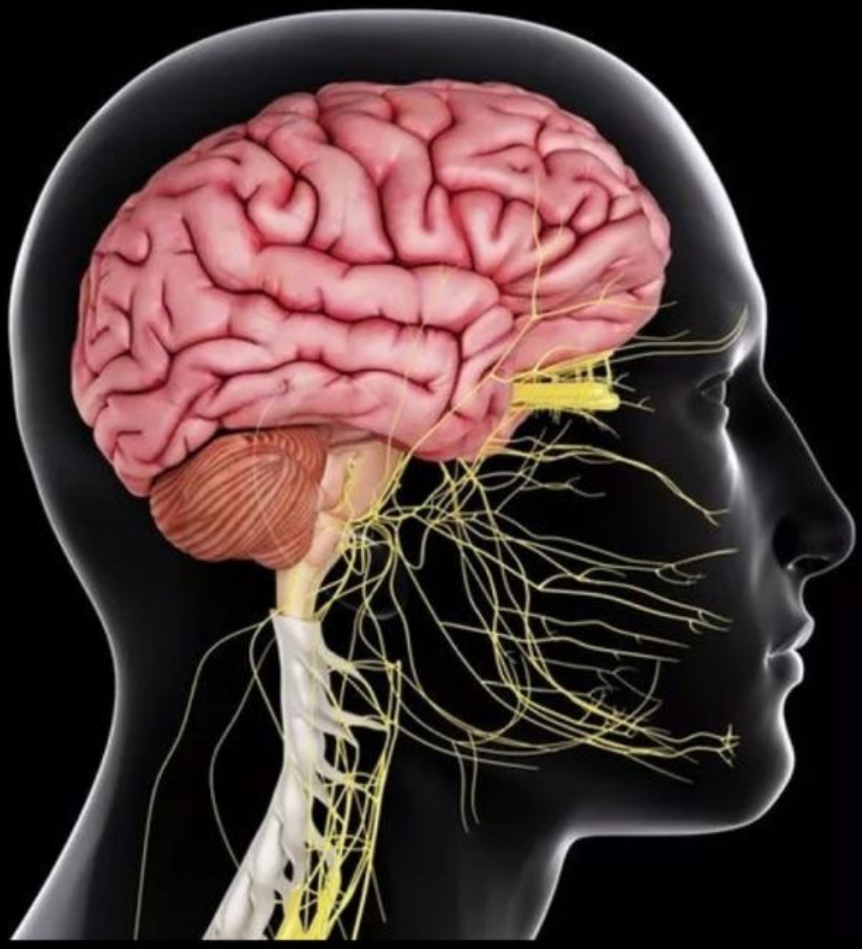
CENTRAL NERVOUS SYSTEM



SUBJECT : Anatomy

LEC NO. : 2

DONE BY : Batool ALzubaidi & Hashem Ata

وَقُل رَّبِّ زِدْنِي عِلْمًا

Spinal Cord
Gross morphology & internal structure

Dr Ashraf Sadek *PhD, MD, MRCPCH*

Assistant Professor of anatomy and embryology

نوتس من المحاضرة الماضية عادهم ب اول سلايد

لما الجنين يكون ببطن امه بكون ماخد طول ال vertebral column كامل، و لكن ال growth of bone اسرع من ال growth of central nervous system بالتالي ال canal بتكبر و هو بصيرله growth بس بكون limited و لما ينولد بكون عند L3 و بس يكبر بوصل لل level of

شو هي ال cuada equina؟ مش حكينا الجنين ببطن امه ال spinal cord بكون على طول ال vertebrae كلهم و بكون كل nerve طالع من ال corresponding vertebrae و بعدها بقصر ال spinal cord بس ال nerves لسا بتطلع من ال vertebral foramens تاعتها يعني راح يطلع من ال nerve S2 راح يطلع من vertebrae S2 و لكن ال origin راح يكون من ال segment الي عند ال lumbar region .. ف ال collection تاعت نهاية ال lumbar,sacral,coccygeal nerves راح يتجمعوا ك nerves منفصلة بالكيس تاع ال dura and arachnoid و اسميهم cauda equina زي ذيل الحصان

Spinal cord segments& levels

ال nerves بتكون oblique نازلة لتحت

Spinal cord segments don't lie opposite the corresponding vertebra as the spinal cord is shorter than the vertebral column

تذكروا ال cervical segments عددهم 8 اما ال vertebrae بس 7

- **Cervical region**: subtract one from spinal cord segment to get number of vertebra
- **In upper 6 thoracic**: subtract 2
- **In lower 6 thoracic**: subtract 3

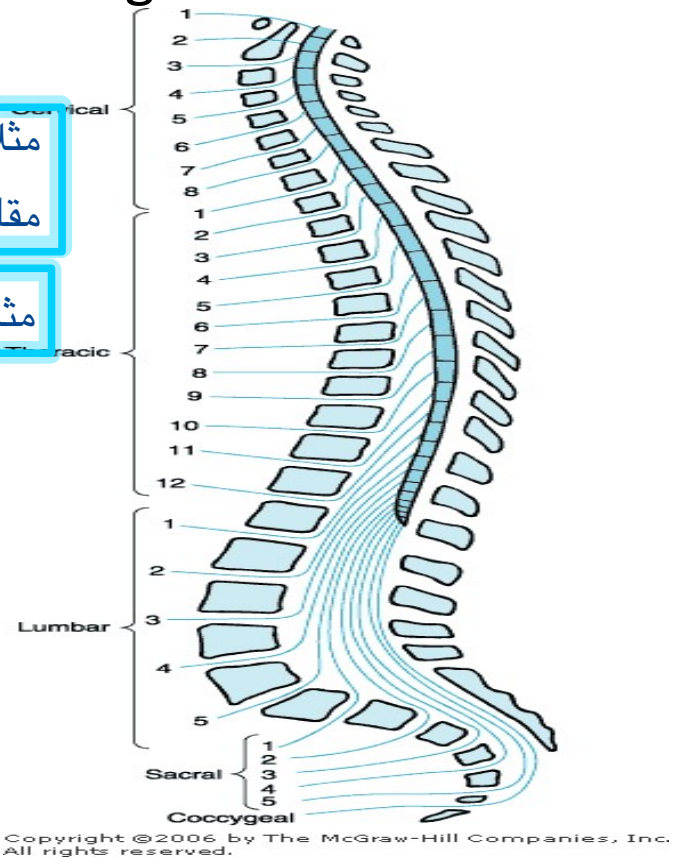
مثلا T9 segment
مقابل T6 vertebrae

- **In lumber** : subtract 4

مثلا L5 segment مقابل L1 vertebrae

- **All sacral& coccygeal:** lie opposite L1 &L2

مهم بيجي بالامتحانات دائما



مثلا لو اجا مريض عنده compression ب T1 segment اي vertebrae
راح تكون ضاغطة عليه ؟ هل T1 vertebrae ؟ لا راح يكون فوق
لو عنده ديسك ب cervical 7 و ضاغط على nerve بال spinal cord هل
راح يكون ضاغط على رقم ٧ segment ؟ برضه لا

مثلا C8 segment بكون مقابل vertebrae رقم 7، بكون C4 segment
مقابل 3 vertebrae، طيب C2 vertebrae اي segment مقابلها C3

Exit of Spinal nerve

- C1 to C7 exit above the corresponding vert.
- C8 Passes below C 7 vertebra
- T1 –L5 passes below corresponding vertebra
- S1- S4 passes in sacral canal
- S5 passes in sacral hiatus

ال neuro anatomy موضوع مهم جداا!! لانه لما تطلع على المستشفى راح تهتم بسؤالين what is the lesion, where what ال .. is the lesion يعني هو tumor, inflammation , ischemia, where اما ال hemorrhage بدي اعرف المكان

نهاية ال spinal cord عند ال lower border of L1 و باقي ال segments بعد L5 بتجمعوا عند هاد ال border و بنزلوا nerves فقط عشان تطلع من ال intervertebral foramen of corresponding segment

لو عندي T8 اي segment راح يكون مقابلها؟ T11

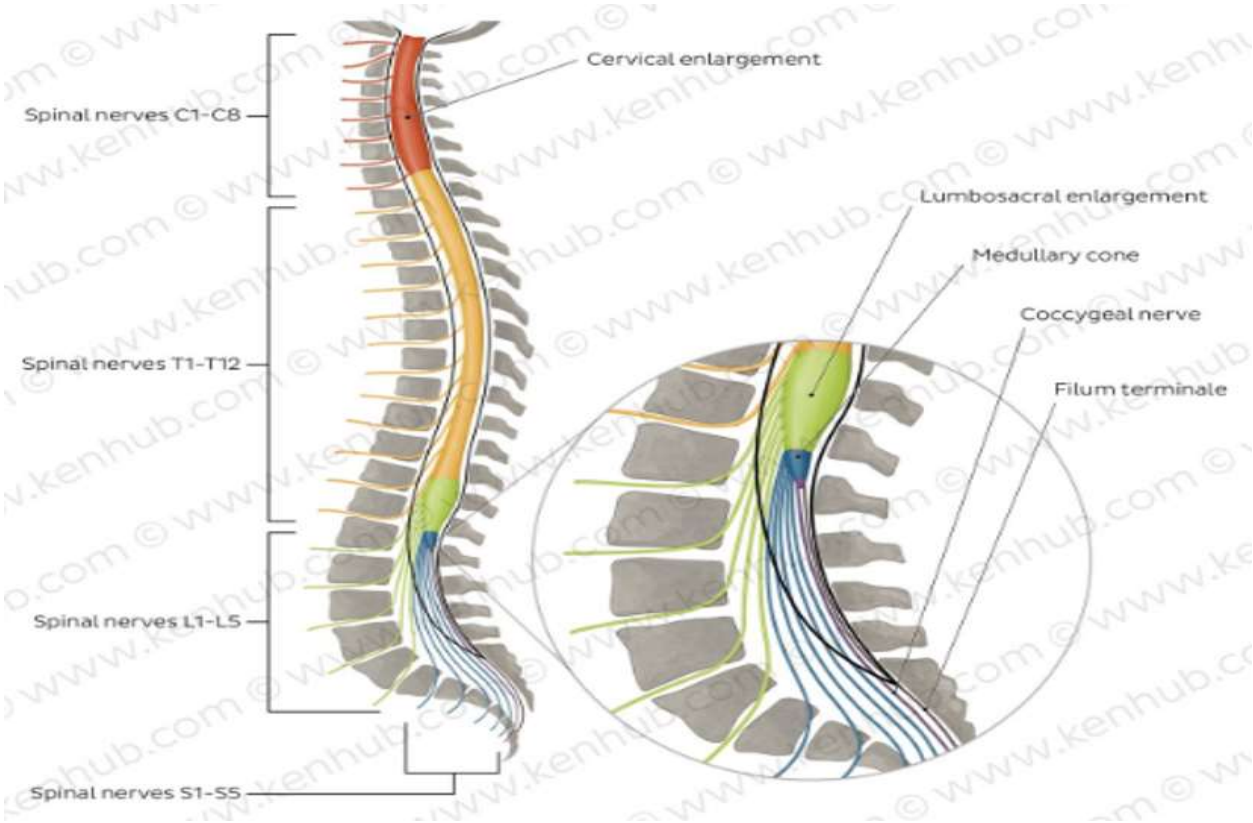
كيف تحل السؤال بس يجي اذا اعطاك ال segment و طلب ال vertebrae بتنقص حسب السلايد الي فوق لو طلب العكس بتزيد

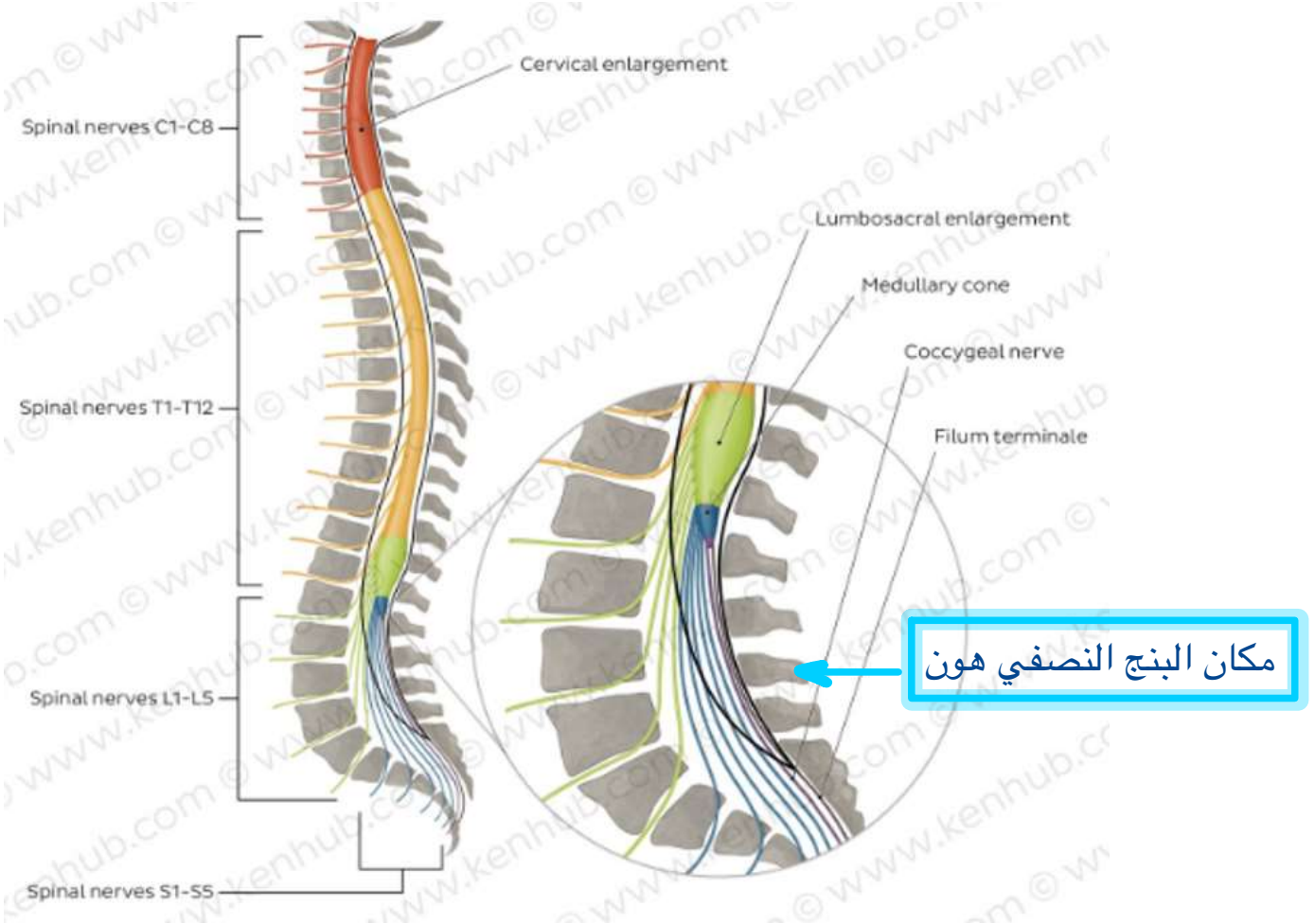
ال structures الي بتطلع منها S5, coccygeal l, filum terminal

Direction of Roots

- **C1 and C2** : pass horizontal
- **C3 to T12**: pass oblique
- **Lumber, sacral, coccygeal**

pass vertical in subarachnoid space to form **cauda equina**




Cervical enlargement
Spinal nerves C1-C8
Lumbosacral enlargement
Medullary cone
Coccygeal nerve
Filum terminale
Spinal nerves T1-T12
Spinal nerves L1-L5
Spinal nerves S1-S5
مكان البنج النصفي هون

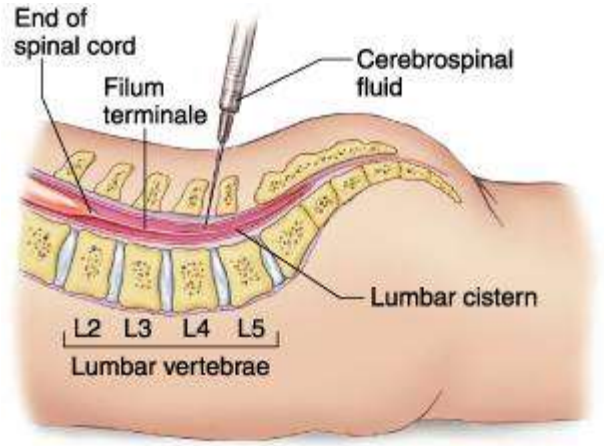
او ممكن ناخد lumbar puncture من ال CSF لحدا ممكن يكون عنده encephalitis or meningitis

Lumbar Puncture

https://youtu.be/RpzqlmzVLp8?si=LdSJvcHWngMMxmlf

الي بحب يشوف

- In subarachnoid space
- Just above or below tip of 4 lumber spine
- Opposite an imaginary line connecting the highest points of iliac crest
- Either diagnostic or therapeutic



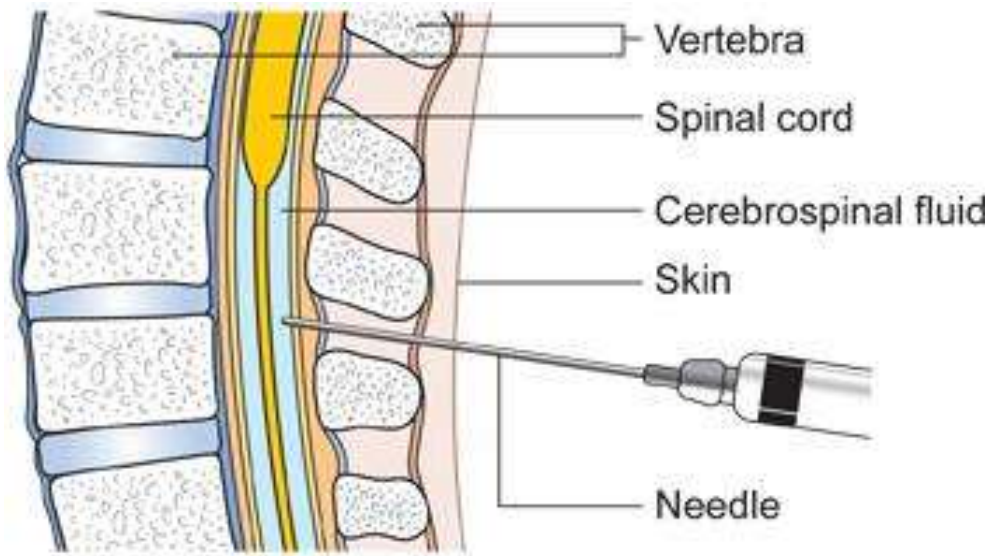


Diagram showing how you have a lumbar puncture

بخلي المريض يقعد بهاي الطريقة على كرسي و يعطينا ضهره و بحقن بين L4 & L5، كيف اعرف وين ؟ امشي على امتداد ال iliac crest على الجهتين عبين ما يلتقوا medial هون بكون L4/L5 level .. انتبه ا لشغلة لو كنا بناخد العينة من طفل بننزل ل level اقل يعني ل L3

Nuclei of Grey matter of Spinal Cord

H shaped structure » gray matter
Anterior is broad » ventral horn
Posterior » dorsal horn

Nucleus » collection of neurons in the central nervous system (spinal cord or the brain)

In Dorsal Horn: - Nuclei are mainly sensory

1. **Substantia Gelatinosa of Rolandi:** Present at tip of dorsal horn in all segments of spinal cord.
   Function: pain modulation.

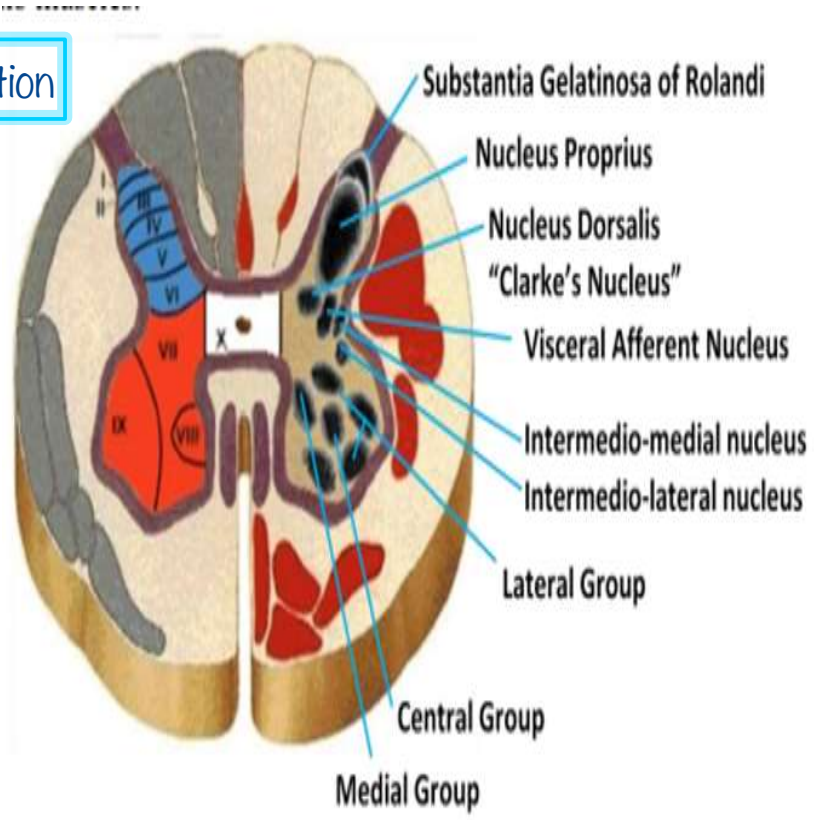
Responsible of brain sensation

2- Nucleus Proprius: Present anterior to Substantia Gelatinosa in all segments of spinal cord.
Function: relays exteroception.

Main sensory nucleus, receives most of sensations from external surface

3-Nucleus Dorsalis "Clarke"s Nucleus": Present at the base of dorsal horn in C8 to L3 segments of the spinal cord. Function: relays unconscious proprioception.

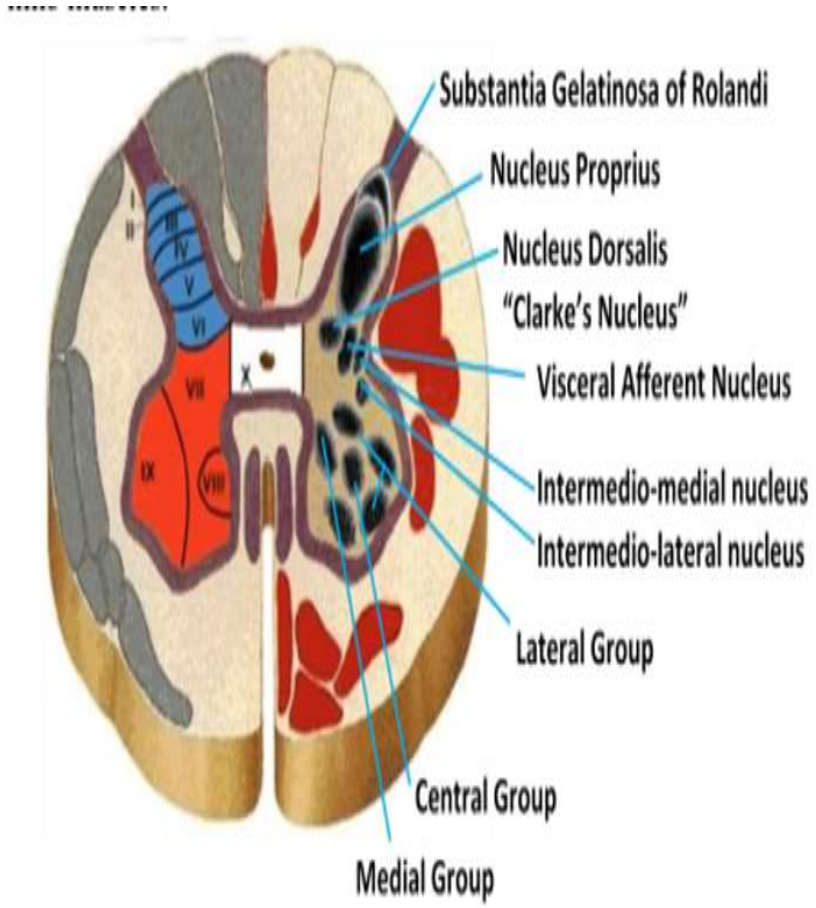
4- Visceral Afferent Nucleus: Present in C8 to L3 segments of the spinal cord lies lateral to Clarke"s Nucleus.
Function: relays visceral sensations.



Sympathetic flow » thoraco-lumbar » (T1 -T12 + L1,L2)
Parasympathetic flow » cranio-sacral » (cranio → cranial nerves)

In Lateral Horn:

- Contains the intermediate nucleus present in thoracic & upper 3 lumbar segments.
- It is further divided into Intermedio-medial & intermedio-lateral nuclei.
- These are sympathetic neurons whose axons pass in the ventral root of the corresponding spinal nerves to reach the ganglia of the sympathetic trunk.
- A similar group of autonomic neurons "Sacral Parasympathetic" is present in S2, 3, 4 segments of the spinal cord but these do not form a lateral horn.



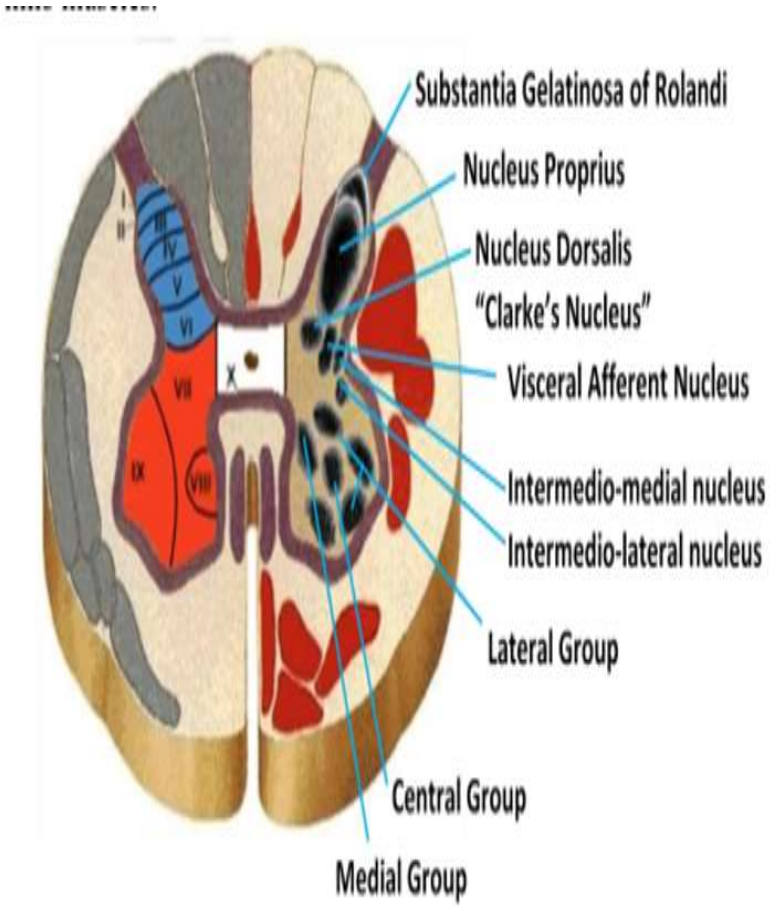
In Ventral Horn

- Nuclei are mainly motor neurons which are either
- 1. Alpha-motor neurons (anterior horn cells- AHC): Large, their axons pass in ventral root to supply extrafusal muscle fibers.
- 2. Gamma- motor neurons: Small, their axons also pass in ventral root to supply intrafusal muscle fibers (muscle spindles) –

- **The nuclei in the ventral horn are arranged in three groups:**
- 1. Medial Group: present throughout the whole length of the spinal cord and supply trunk muscles
- 2. Central Group: present only in some cervical segments e.g. Phrenic Nucleus C3,4,5 & spinal accessory nucleus (C1-5).
- 3. Lateral Group: present in cervical & lumbosacral segments and supply limb muscles

Supplies diaphragm

Supplies trapezius muscle



https://youtu.be/BmZCgyeXblk?si=9R7xhTLHGqP6GMK9

فيديو يلخص الـ horns

Grey matter Laminae „of Rexed" Rexed (1964)

described 10 laminae in the grey matter of the spinal cord depending on neurons size, density, shape & cytological features.

Laminae I -VI: are sensory & occupy the posterior horn.

L I = marginal layer of Waldeyer

L II + part of LIII = Substantia gelatinosa of Rolandi.

The rest of LIII + L IV = Main sensory nucleus. Lamina VII occupies the lateral horn & extends into the middle part of the anterior horn.

It contains: - Clarke's nucleus. - Lateral horn nuclei (intermediolateral & internediomedial). –

Middle part of anterior horn (between L VIII & IX), contains Renshaw cells.

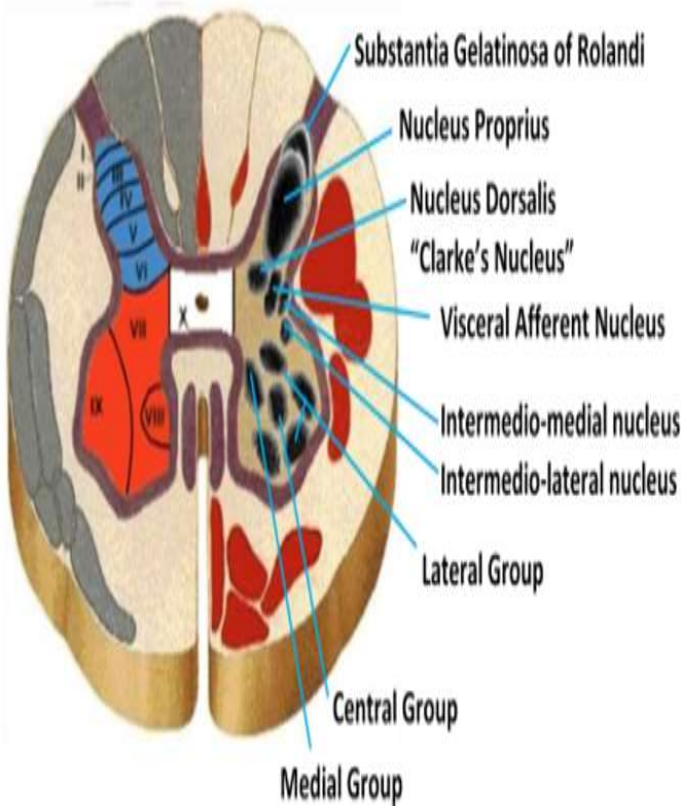
Laminae VIII- IX occupy the anterior horn.

L IX is lateral. It contains the motor neurons. LVIII is medial. It controls the muscle tone.

Lamina X surrounds the central canal.

الي عليهم هايلايت المعلومتين

الوحيدات الي تعرفوهم بهاد السلايد



Unconscious proprioception » cerebellum

3 groups according to anatomy and physiology

ال lemniscus هو ال tract الي بمشي فيه ال brain stem

Tracts OF WHITE MATTER:

يعني لو لمست حدا بالقلم و هو مغمض (عيونه راح يقدر يحدد المكان ولا لأ), tactile discrimination (لو لمست بنقطتين راح تعرف نقطتين ولا نقطة وحدة), vibration (tinning fork) Deep touch » fine touch 2.

I. Ascending tracts (sensory):includes3 main groups:

Sensation of position and movement

A. Lemniscal system: lie in the **dorsal column** - carries conscious **proprioception** (from deep structures such as muscles & joints) to the cerebral cortex:

ال consciousness يعني الاحساس وصللها

1. **Gracile tract** [lower body proprioception]
2. **Cuneate tract** [upper body proprioception]

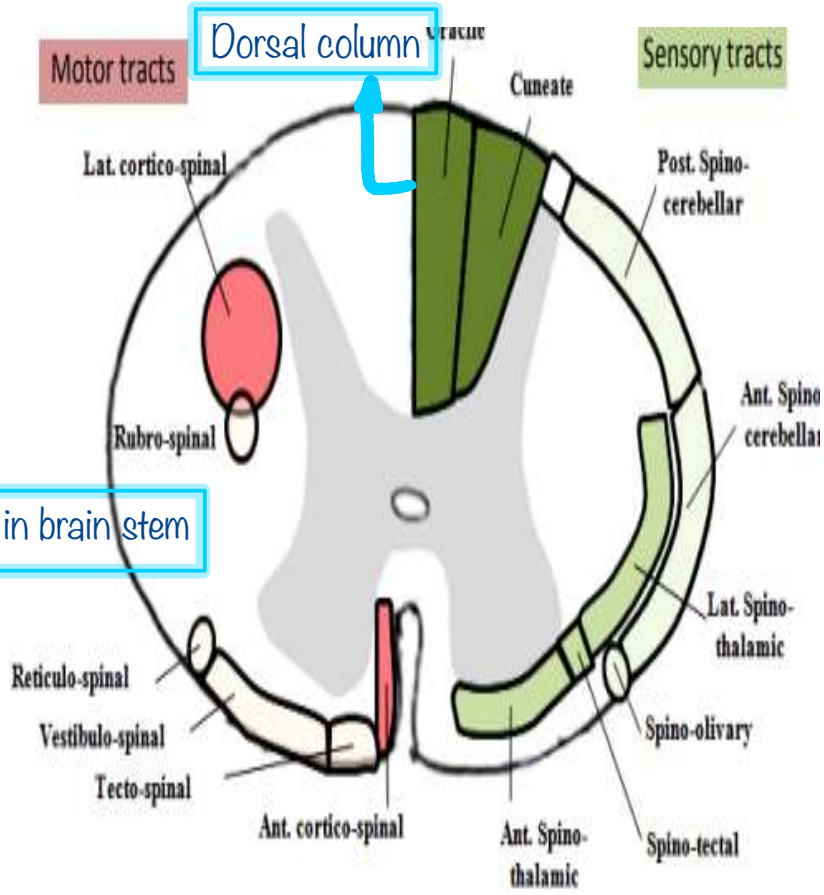
B. Unconcious proprioceptive tracts(to cerebellum): lie superficially in the **lat. column**

1. **Two spino-cerebellar tracts** (Post. & Ant.)
2. **Spino-olivary tract**

Olivary nucleus » in medulla oblingata in brain stem

C. Anterolateral system: lie in the **ant. and lat. columns** - carries **exteroception**

1. **Lat. Spinothalamic tract** [pain & temp]
2. **Ant. spinothalamic tract** [crude touch]
3. **Spino-reticular tract**
4. **Spino-tectal trac**



https://youtu.be/_G-d8gKIlOw?si=yU87qZDtyPRxaGtU

فيديو لطيف مجمع معلومات

II. Descending tracts (motor):

A. Pyramidal:

lateral & anterior corticospinal tracts.

From cortex » responsible for voluntary movements, skills

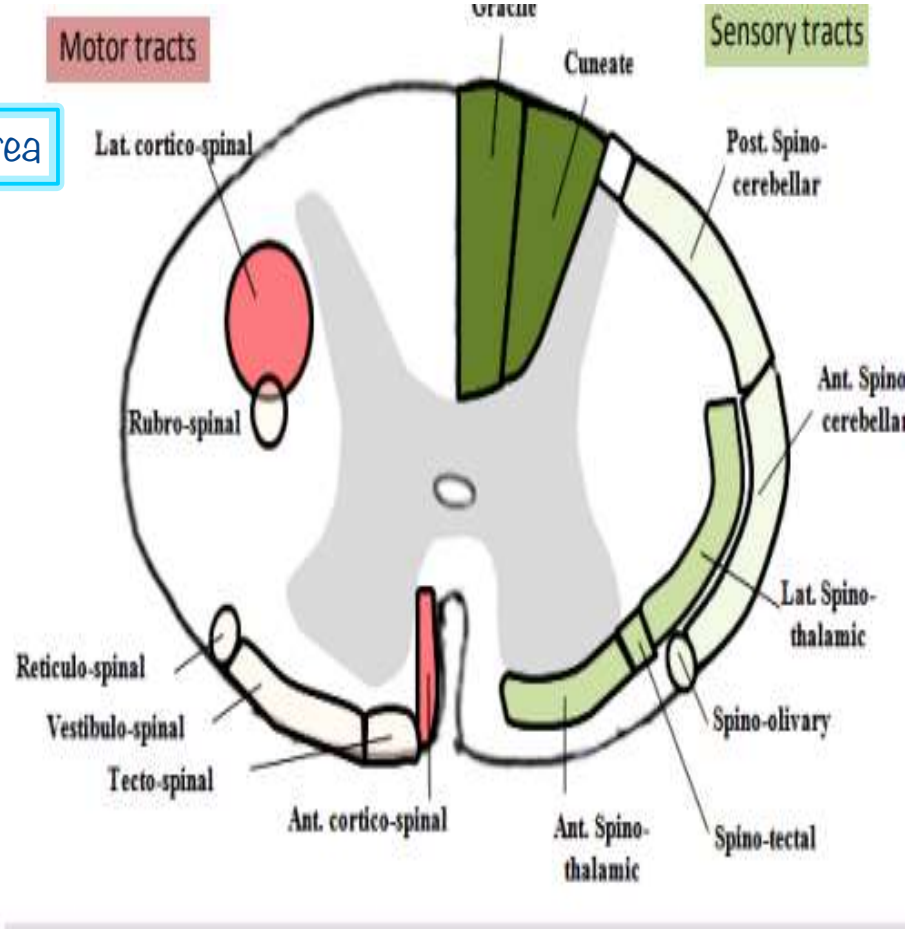
B. Extrapyramidal: - Brain stem & subcortical area

2 from the midbrain: rubro-spinal tract & tecto-spinal tract

2 reticulo-spinal tracts: medial & lateral

2 Vestibulo-spinal tracts: medial & lateral

Olivo-spinal tract.

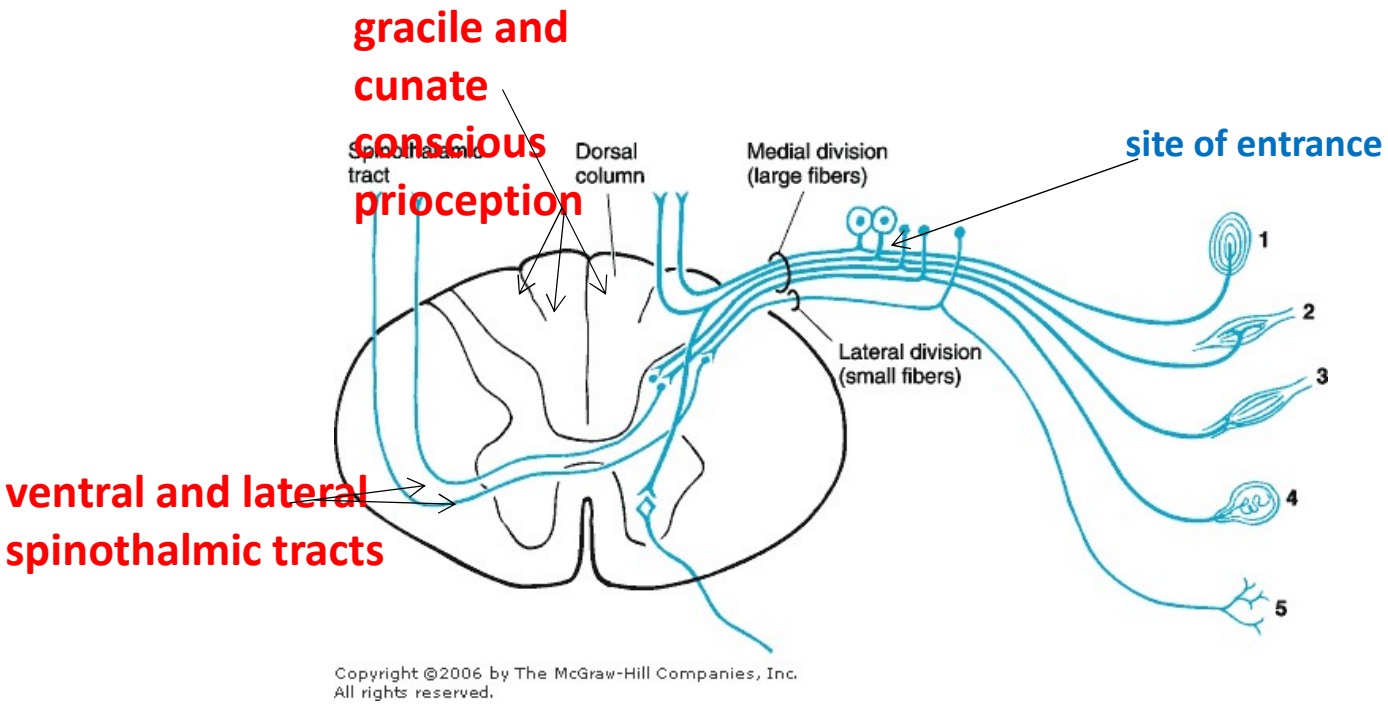


III. Intersegmental tracts

(propriospinal): Surround the grey matter forming the fasciculus proprius anterior, lateralis & posterior. Contains ascending and descending short axons of interneurons between adjacent segments of spinal cords

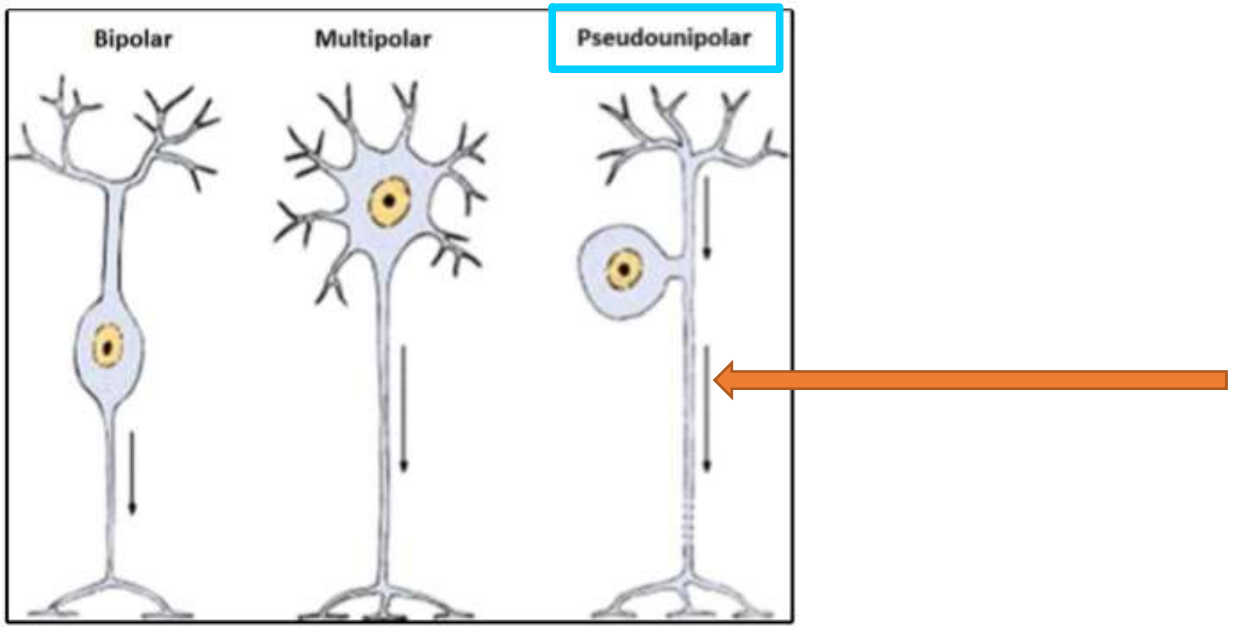
يعني segment يبعت لل segment الي تحته او الي فوقه حناخدها اكتر ب الفسيو بال reflux arc يعني sensory neuron
بلقط ال sensation و ببعت امر لل motor على طول يعمل reflex بدون الحاجة انه ال sensation يطلع لل brain و يعطي
ردة فعل ال intersegmental بسمح ب reflex سريع راح يبعت لل brain انه حصل كذا ولكن مش ال brain الي تصرف

Ascending tracts

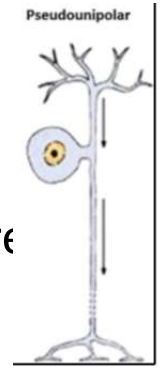


اتفقنا انه ال ascending بحمل ال sensations طيب كيف ؟عن طريق ال dorsal root ganglion which is
بكون peripheral axon و اله psuedounipolar بكون peripheral nerve و اله an aggression of neurons
sensation تاع ال dorsal horn من ال spinal cord بدخل ال central axon و receptors واصل ال

What is the type of dorsal root ganglion neuron cell?



Ascending tracts

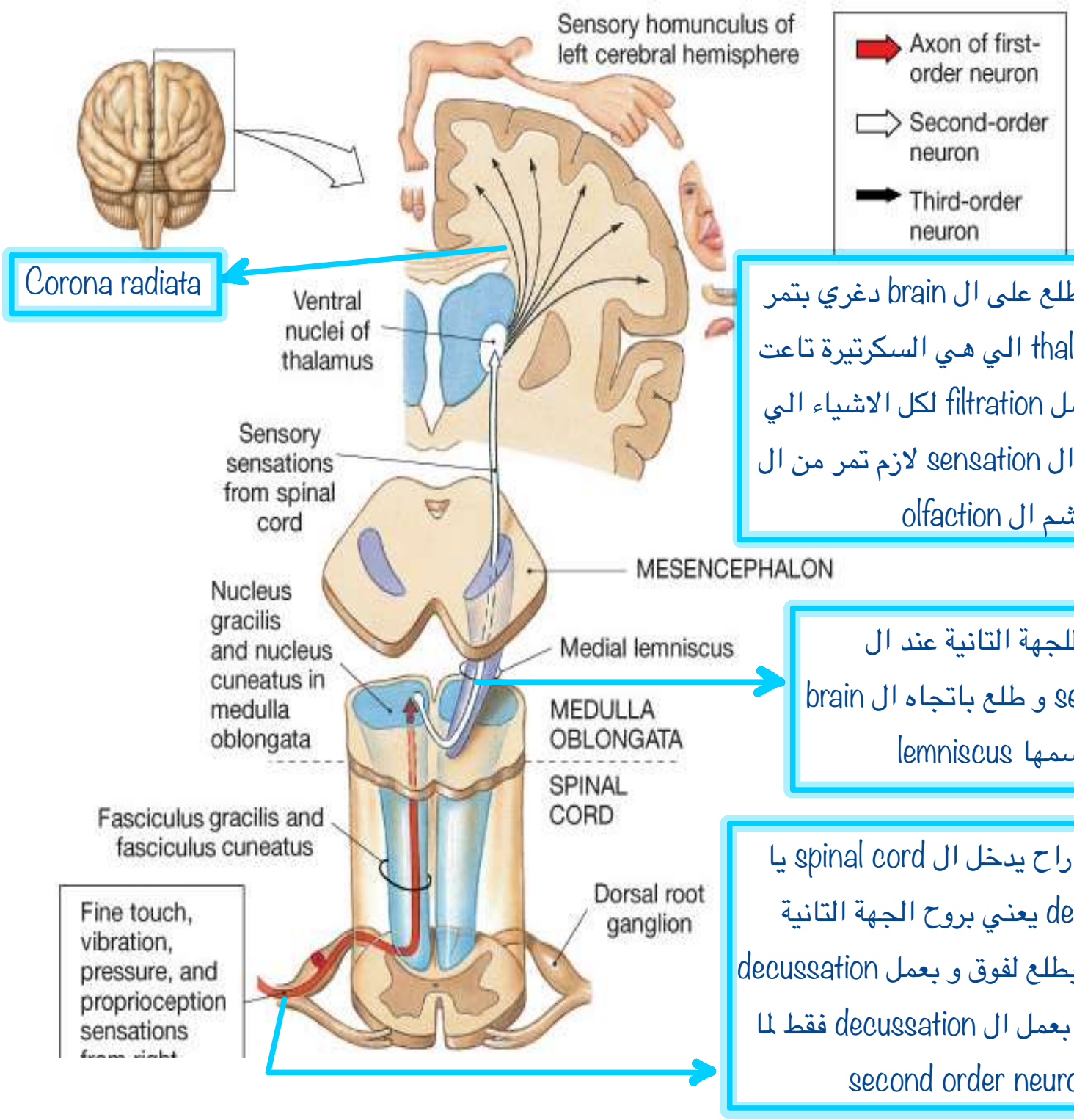


Form parts of the sensory pathways. A sensory pathway is formed of thre neurons.

1. First-order Neuron is always a pseudounipolar cell of the Dorsal Root Ganglion. It carries sensation by its peripheral process from receptors & conveys this sensation by its central processes to the dorsal root to the spinal cord.

2. Second-order neuron is always a cell in the CNS (spinal cord or medulla oblongata). Its axon always decussates to the opposite side and ascends in the brainstem as lemniscus to end in the thalamus.

3. Third-order Neuron is always cells of the Ventral Postero-Lateral Nucleus of Thalamus (VPLN). Their axons pass through posterior limb of internal capsule, then through corona radiata to reach sensory area of cerebral cortex.



ال lemniscus ما بتطلع على ال brain دغري بتمر اول اشي بال thalamus الي هي السكرتيرة تاعت الدماغ هي الي بتعمل filtration لكل الاشياء الي داخلة ال brain، كل ال sensation لازم تمر من ال thalamus ما عدا الشم ال olfaction

هون ال neuron راح للجهة التانية عند ال second order neuron و طلع باتجاه ال brain stem و هون بصير اسمها lemniscus

هاد order neuron راح يدخل ال spinal cord يا اما بعمل decussation يعني بروح الجهة التانية اول ما يدخل يا اما بطلع لفوق و بعمل decussation عند ال brain stem، بعمل ال decussation فقط لما يلاقي ال second order neuron neuron


THANK YOU!
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