DESCENDING TRACTS
MOTOR PATHWAYS

Department of human Anatomy and Embryology
Faculty of Medicine
Mansoura National University, Egypt

Edited By
Dr. Fekry Shata

Intended Learning Outcomes (ILOs)

By the end of the lecture, the students will be able to:

-Know the meaning of tract

-Know the descending tracts

-Know the origin, course, destination and function of tracts

-Know collectively the types of ascending tracts

-Know the descending tracts

-Know that the descending tracts are 2 types; pyramidal and extrapyramidal

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Agenda

1. The meaning of descending tract
2. Origin, course, destination and function of tracts
3. Types of descending tracts, pyramidal and extrapyramidal tracts

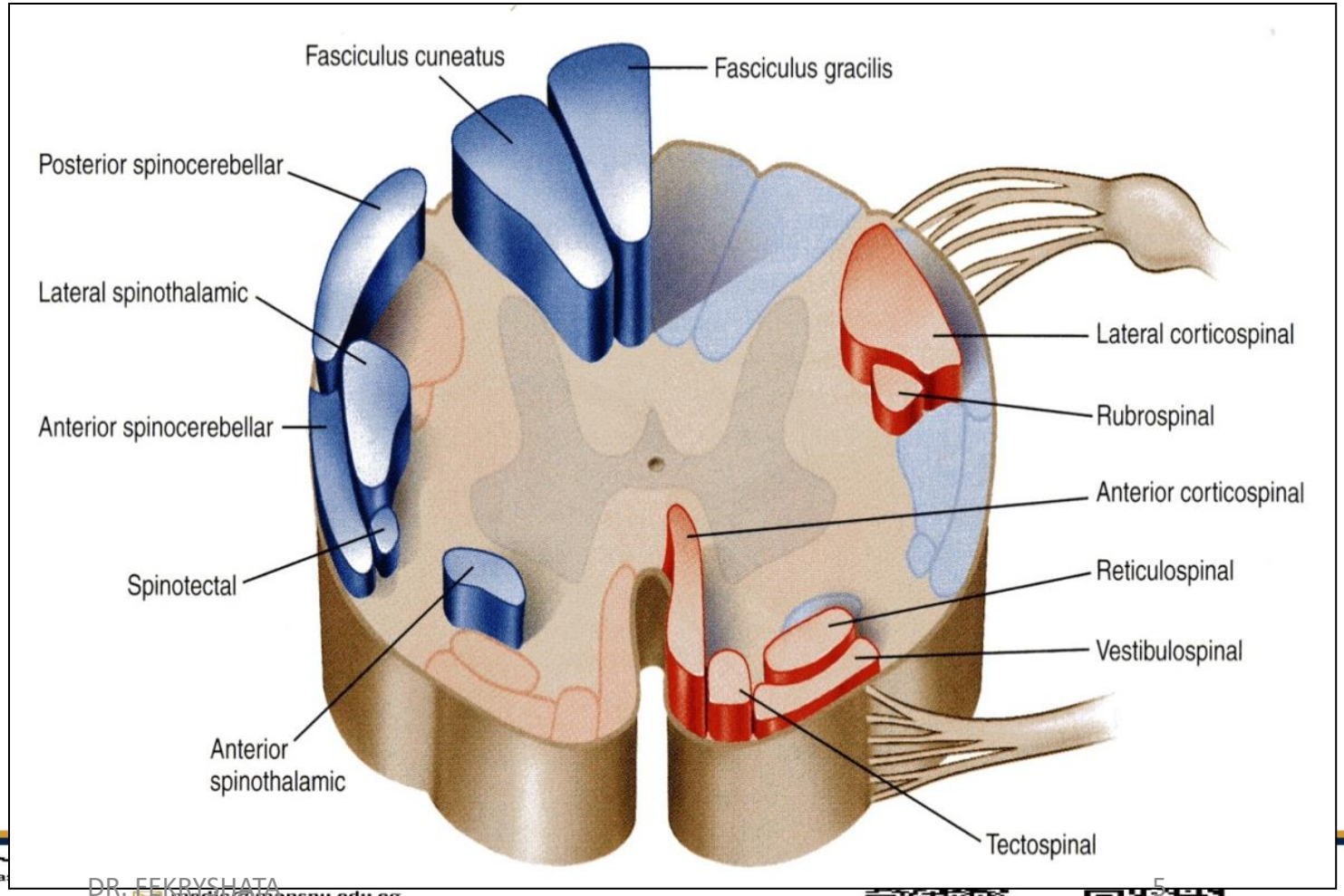
الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Motor Pathways

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

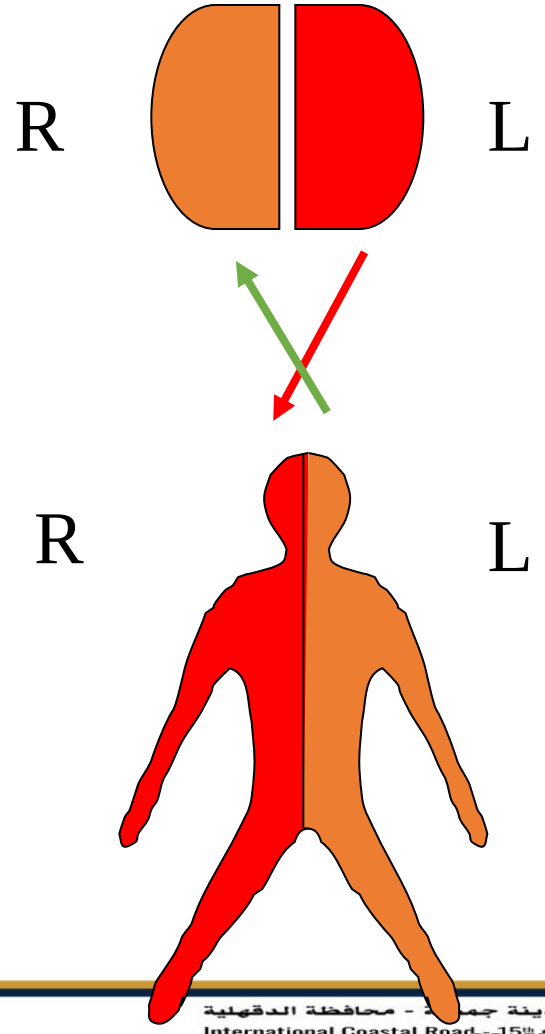
WHITE MATTER TRACTS

- Bundles or fasciculi of fibers have the same **Origin**, **Termination** and carry the same **Function.** MCQ



Control of the body by the brain

MCQ : About 85-90% of motor control in the body follows which type of representation?
Contralateral



Contralateral representation
Decussation = Crossing

Contralateral = Opposite side
Ipsilateral = Same side

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Descending tracts (Motor system)

There are 3 different motor systems

1- Pyramidal system: (corticospinal tract & corticobulbar tract)

2- Extrapyramidal system

3- Motor pathway to the cerebellum

MCQ مهم : Why is the pyramidal tract called "pyramidal"?

A) Because it originates from pyramidal cells in the cerebral cortex

خلي بالكوا اللي هيختار because passes through the pyramids of the medulla oblongata مش هياخد الدرجة وهينقص

Pyramidal system

SAQ: Summarize the pyramidal system ?

والإجابة تكتب السلايد الجاية كلها بما فيها النوتس الزيادة

Pyramidal system

Corticospinal tract

- **Lateral Corticospinal tract**
  - (85-90%) Crosses at the medullary pyramids (decussation) .
- **Ventral Corticospinal tract**
  - (10-15%) Does not cross at the medulla

Corticobulbar tract

to cranial nerve motor nuclei

Cranial Nerves Involved:

CN 3, 4, 6 (Controls eye muscles)
Mandibular branch of CN 5 "Trigeminal" (Controls muscles of mastication)
Motor nucleus of CN 7 "Facial" (Controls muscles of facial expression)
CN 9 "Glossopharyngeal" (Controls stylopharyngeus muscle)
CN 10 & 11 "Vagoaccessory complex" (Controls laryngeal & pharyngeal muscles)
CN 12 "Hypoglossal" (Controls tongue muscles)

SAQ الدكتور قال ضيفوها لأنها ممكن تجي

Pyramidal system

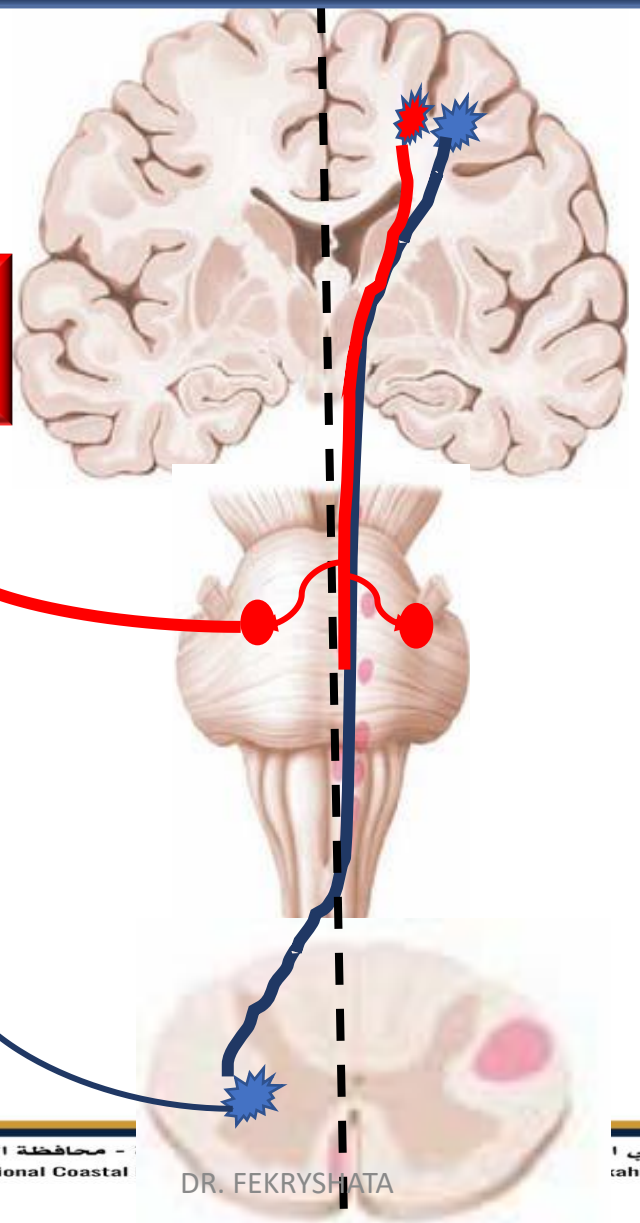
How to control your muscles?

LMN
Cranial nerves

Muscles of H&N

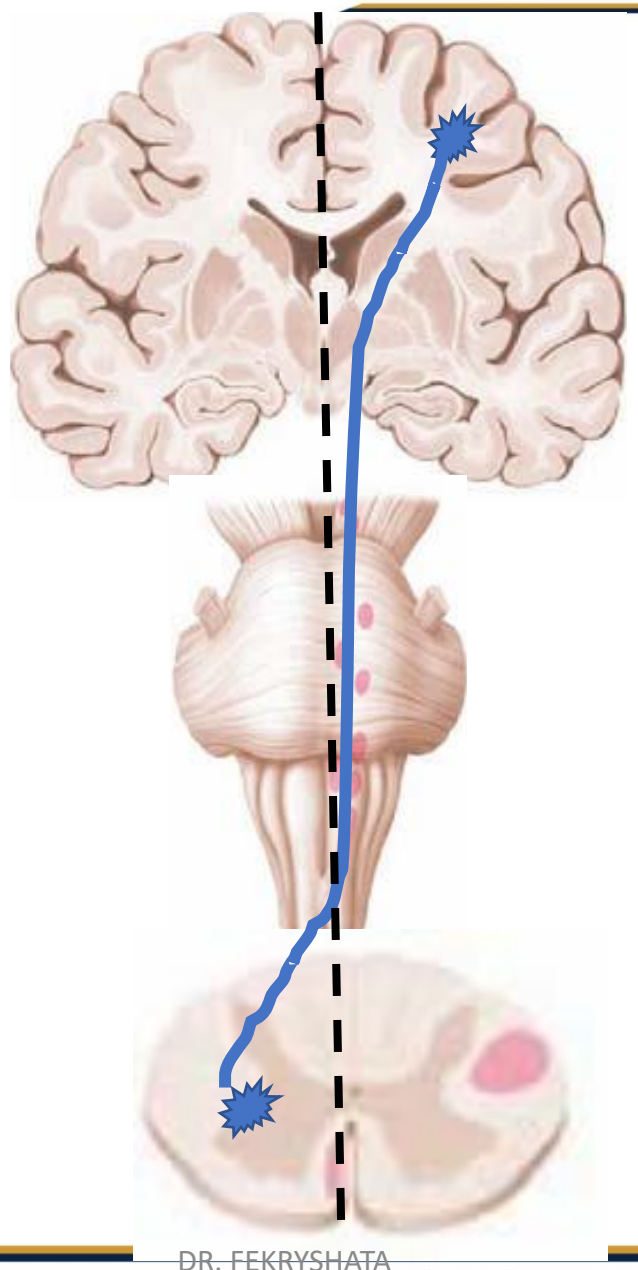
Muscles of the body

LMN
Spinal nerves



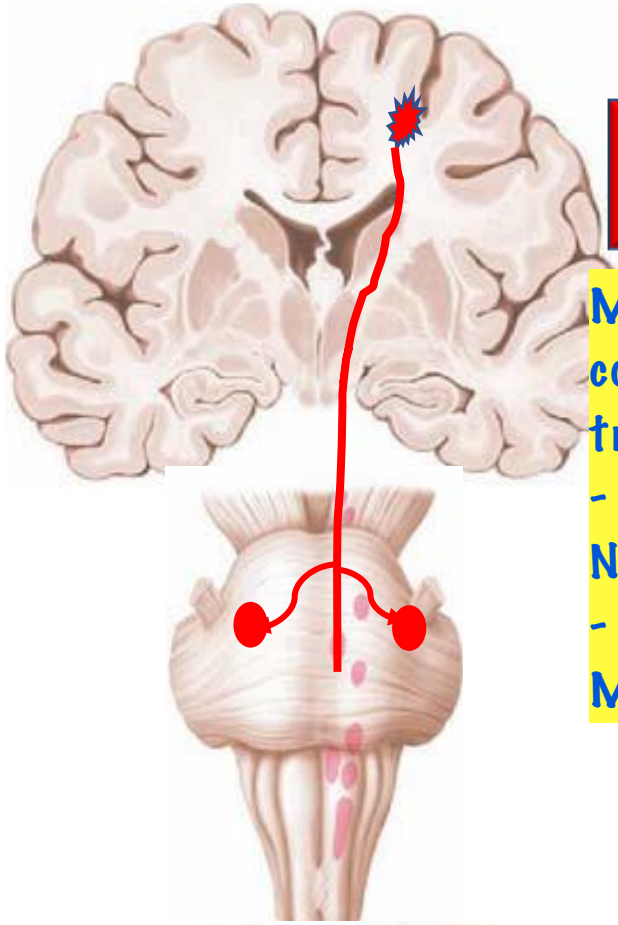
UMN
Corticospinal

UMN
Corticobulbar



Corticospinal tract

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg



Corticobulbar tract

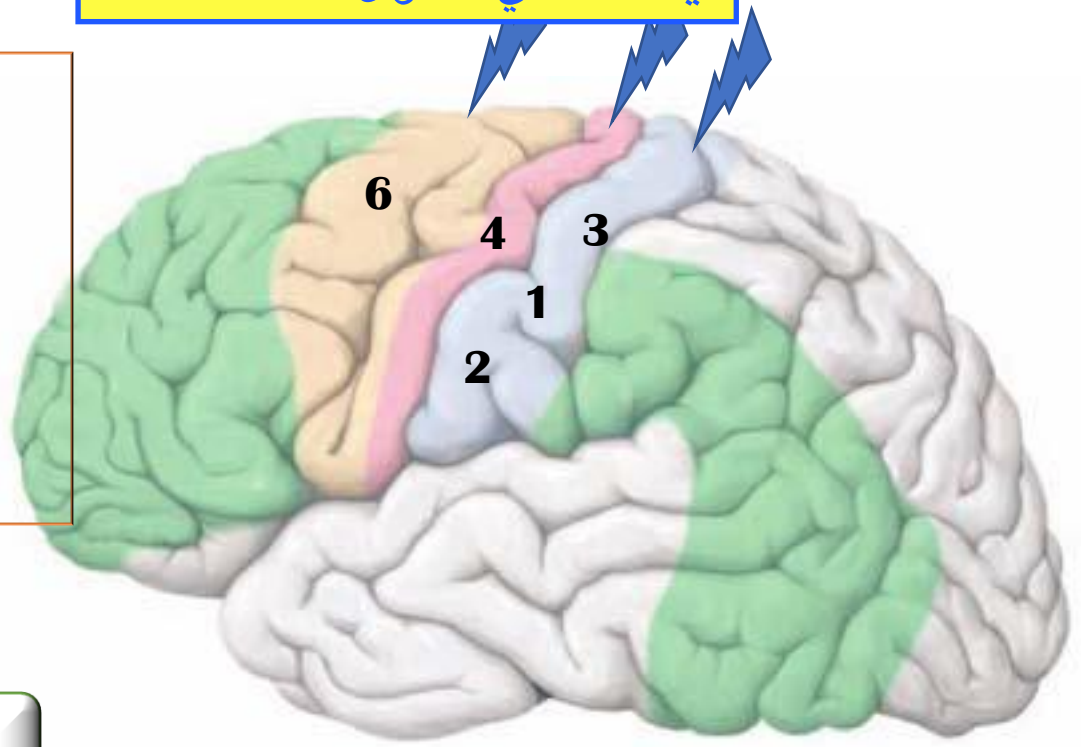
MCQ : Which cranial nerve nuclei receiveing contralateral input only in corticobulbar tract ?

- CN 7 "Facial Nerve" (Lower Part of the Facial Nucleus)
- CN 12 "Hypoglossal Nerve" (Genioglossus Muscle)

Corticospinal tract

Origin تاني أهم سؤال في المحاضرة **SAQ** ← هيحددلك في السؤال **Anatomical**

- ❑ **40% of the fibers from upper two thirds of primary motor area 4** MCQ
- ❑ **40% of the fibers from premotor area 6**
- ❑ **20% of the fibers from general sensory area 3,1&2**



Function: غالبا مش بتيجي

1- Facilitation of the flexor muscle tone

2- Initiation of highly skilled fine movements

3- Modulate sensory input of the spinal cord

MCQ : Which tract receives fibers from the upper two-thirds of the primary motor cortex (Area 4)?
- Corticospinal

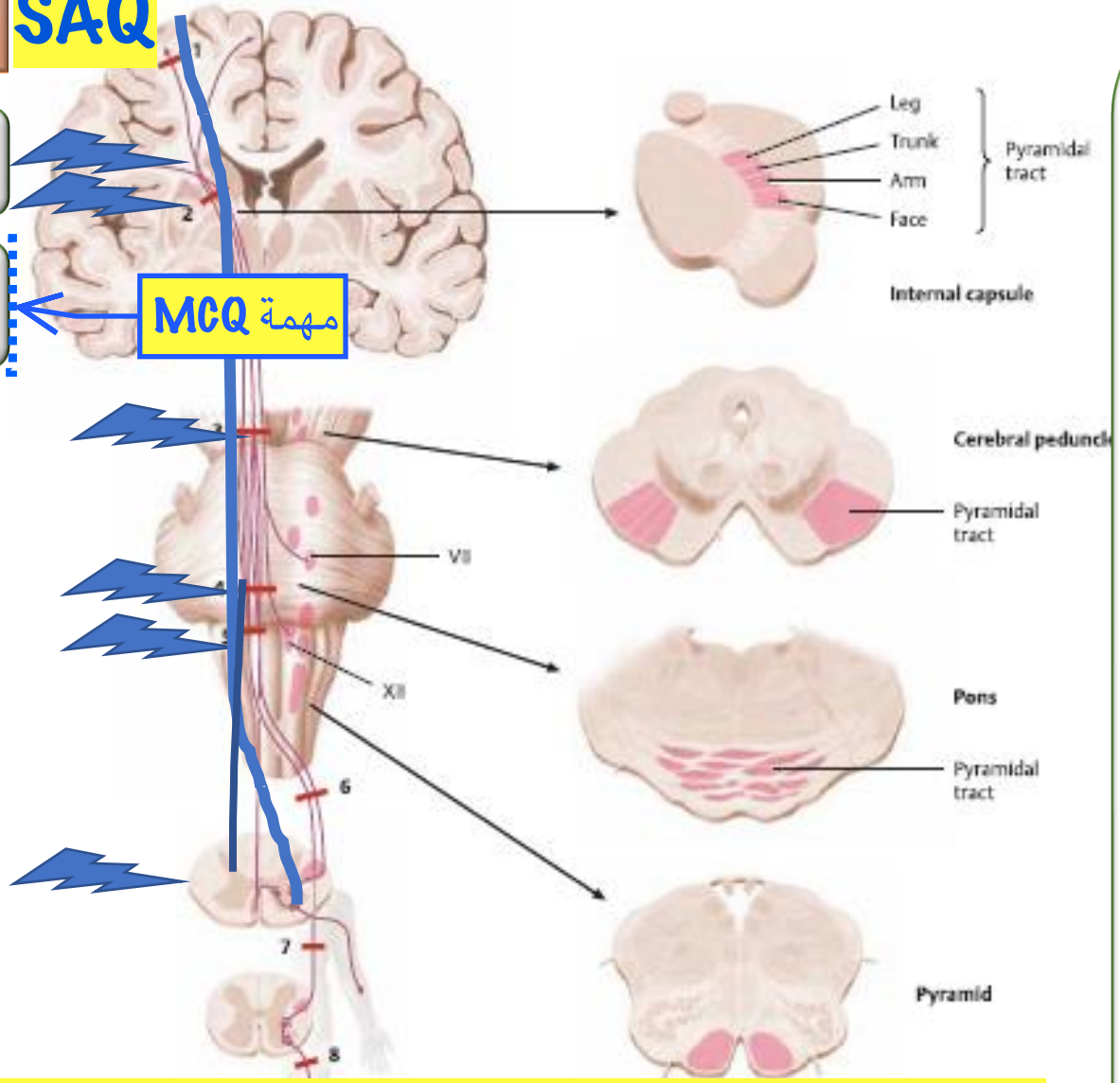
International Coastal Road – 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Course

SAQ

- Corona radiata
- Posterior limb of internal capsule
- Crus cerebri
- Basis pontis
- Pyramid

MCQ مهمة

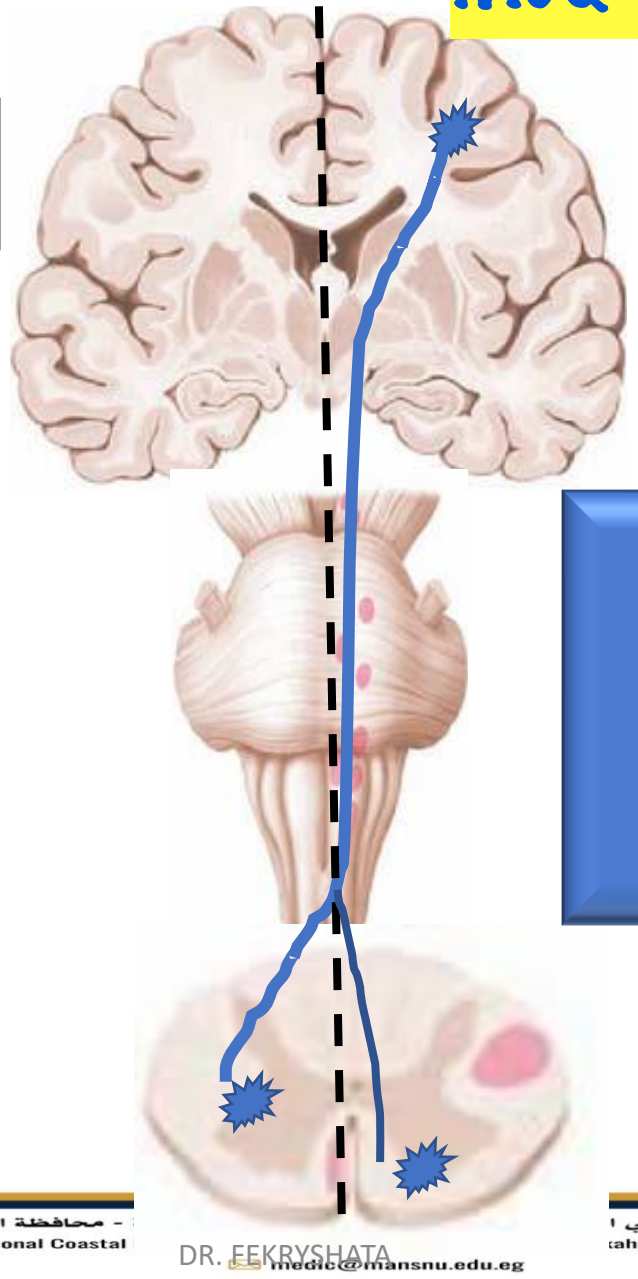


- 85% fibers cross to the opposite side and form lateral corticospinal tract.
- 15% fibers remain uncrossed and form ventral corticospinal tract

SAQ !!!! سؤال مهم جدا : Describe course of corticospinal tract ?

السلايد دي مهمة MCQ + Type R MCQ

Corticospinal tract



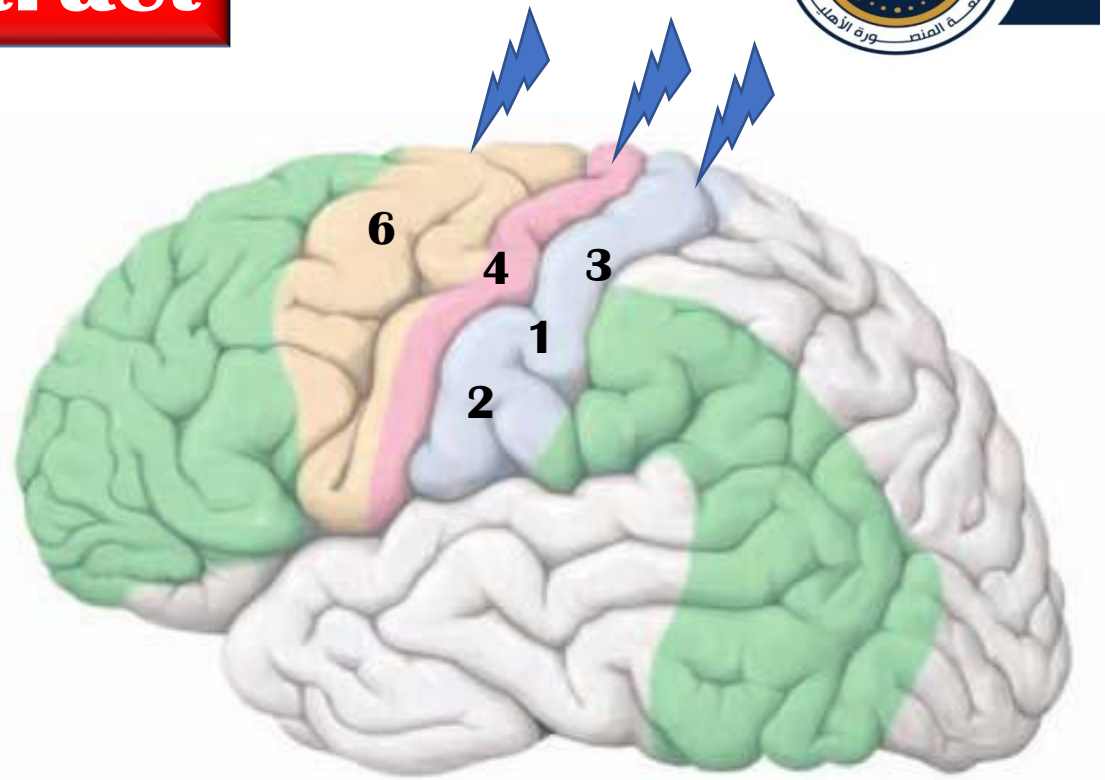
85% fibers cross to the **opposite side** and form **lateral corticospinal tract.**

15% fibers remain **uncrossed** and form **ventral corticospinal tract**

Corticobulbar tract

Origin SAQ

- **40%** of the fibers from **lower third** of **primary motor area** 4 MCQ
- **40%** of the fibers from **premotor area** 6
- **20%** of the fibers from **general sensory area** 3,1&2



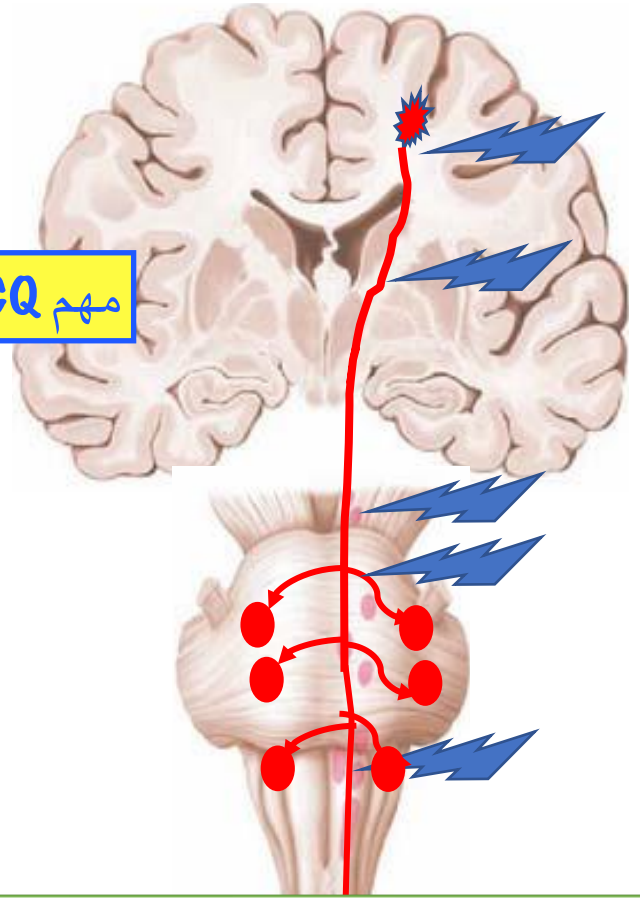
MCQ : Which tract receives fibers from the lower third of the primary motor cortex (Area 4)?
- Corticobulbar

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Course: SAQ

- **Corona radiata**
- **Genu of internal capsule** ← MCQ مهم
- **Crus cerebri**
- **Basis pontis**
- **Pyramid**

Termination



- ❑ It terminates on the cranial nerve motor nuclei of the **two sides**.
- ❑ All cranial nerve motor nuclei receive bilateral corticobulbar fibers **except** the **lower part of facial nucleus** which receives fibers from opposite side only.

CN 12 Hypoglossal Nerve (Genioglossus Muscle only) الدكتور قال نضيف عليها ال

Motor system lesion

Causes:

- **Trauma:** fracture , stab or bullets.
- **Compression:** by tumor or herniated disc.
- **Vascular:** by occlusion of the artery

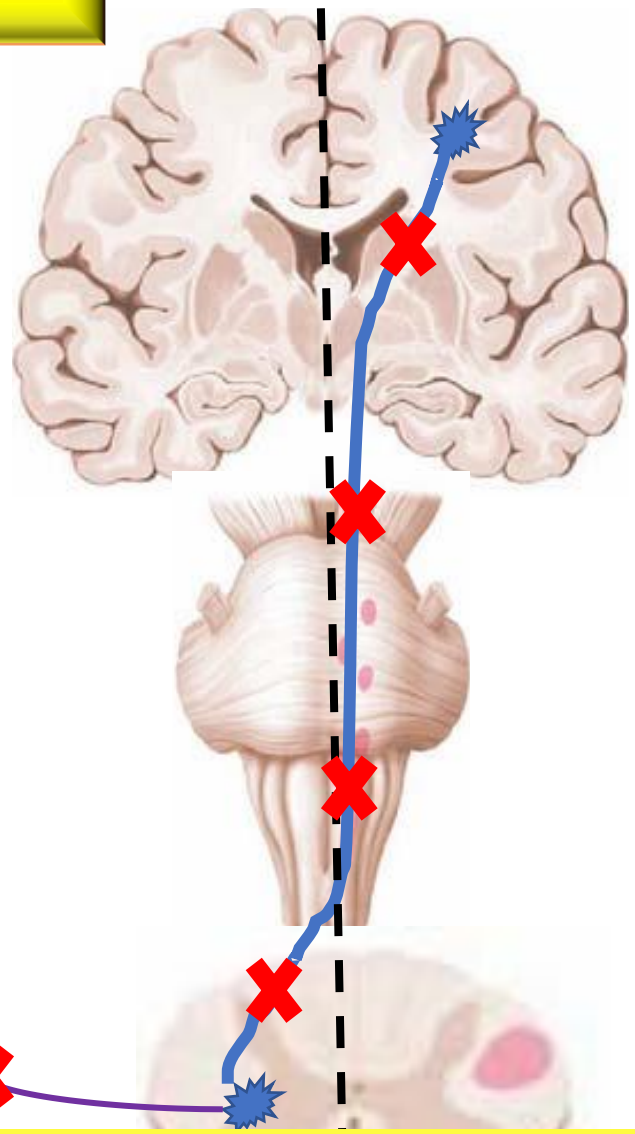
MCQ : Most common cause of pyramidal tract lesion is :
- Vascular

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Types of paralysis

LMNL

- Flaccidity
- Hyportonia
- Hypo-reflexia
- Fibrillation
- Atrophy

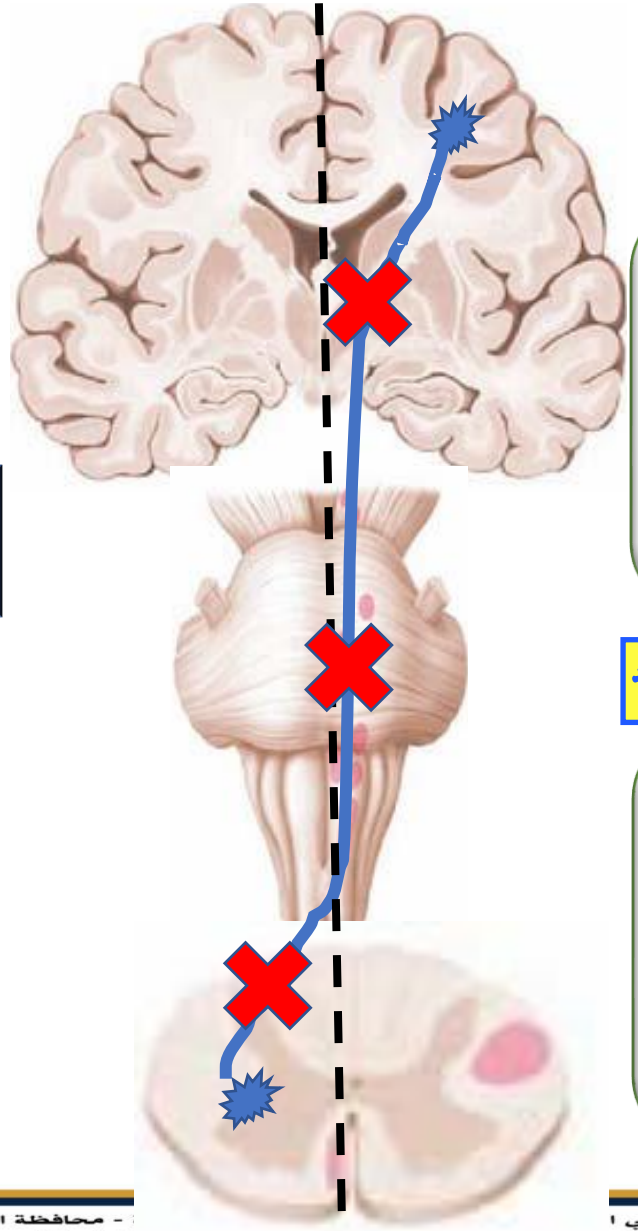


UMNL

- Spasticity
- Hypertonia
- Hyper-reflexia
- Babinski sign
- Clonus

MCQ : manifestation of (UMNL - LMNL) is :

Corticospinal tract



1- lesion above the decussation: contralateral hemiplegia MCQ

+ At the level of the nucleus

2- lesion below the decussation: ipsilateral paralysis MCQ

Lesion of Corticospinal tract

Lesion :

Type : it is UMNL

1- lesion above the decussation: contralateral hemiplegia

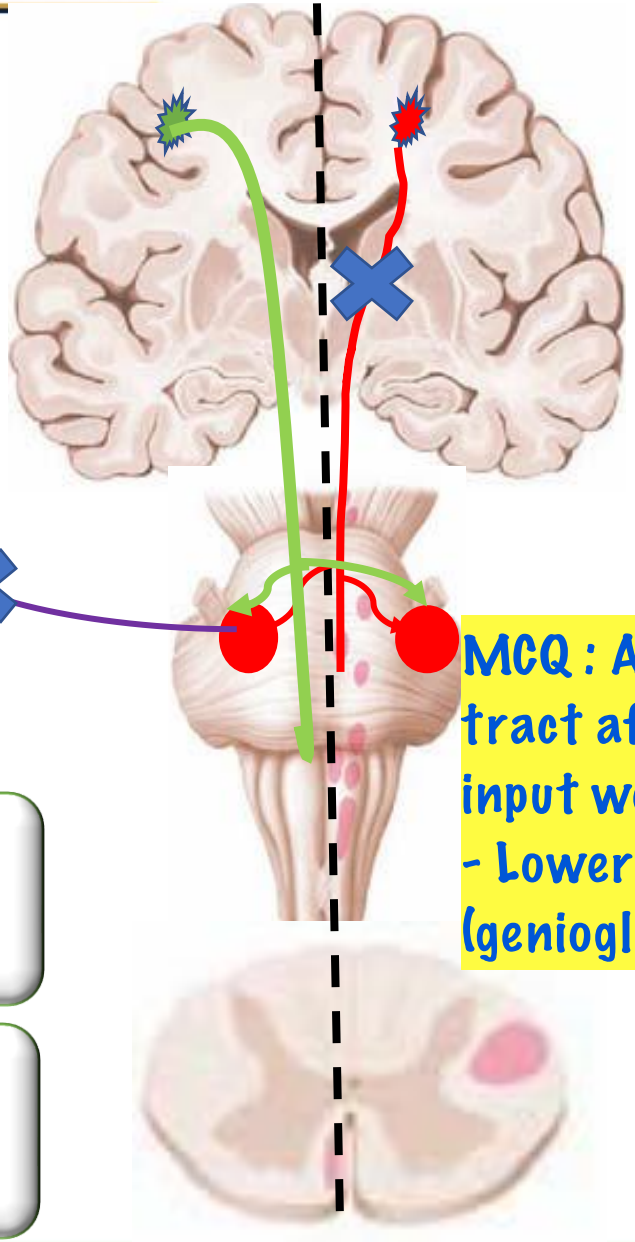
2- lesion below the decussation: ipsilateral paralysis

Sign of UMNL

- **Hypertonia**
- **Hyper-reflexia**
- **Spasticity**
- **Babinski sign**
- **Clonus**

Loss of the superficial abdominal reflexes and cremasteric reflex

Lesion of Corticobulbar tract



Muscles of H&N

LMN
Cranial nerves

UMN
Corticobulbar

Lesion :

Type : it is UMNL

1- paralysis of the lower part of the contralateral facial nerve nucleus

2- weakness of the muscles supplied by the cranial nerves

MCQ : A lesion in the corticobulbar tract affecting only contralateral input would cause paralysis in ?
- Lower face and tongue (genioglossus muscle)

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

SAQ : List extra pyramidal tract & one function of it ?

SAQ : Mention extrapyramidal tract which facilitate flexor ms tone ?

خلي بالكوا ما تكتبوش الextensor

2- Extrapyramidal system

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

2- Extrapyramidal system

Connection between the cerebral cortex and spinal cord through the brain stem

Function: مهمة

- **All pyramidal and extrapyramidal tracts facilitate the flexor muscle tone except the 2 tracts which arise from the pons facilitate the extensor muscle tone:**
  - **1- pontine vesibulospinal tract (vesibulospinal).**
  - **2- pontine reticulospinal tract**

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Extrapyramidal tracts

بييجي سؤال SAQ بثلاث درجات وMCQ

TWO

A- From the midbrain:

1- **Rubrospinal tract:**

2- **Tectospinal tract:**

TWO

B- From the vestibular nuclei:

1- **pontine vesibulospinal tract: (vesibulospinal)**

2- **medullary vesibulospinal tract: (Sulcomarginal)**

TWO

C- From the Reticular formation:

1- **pontine reticulospinal tract:**

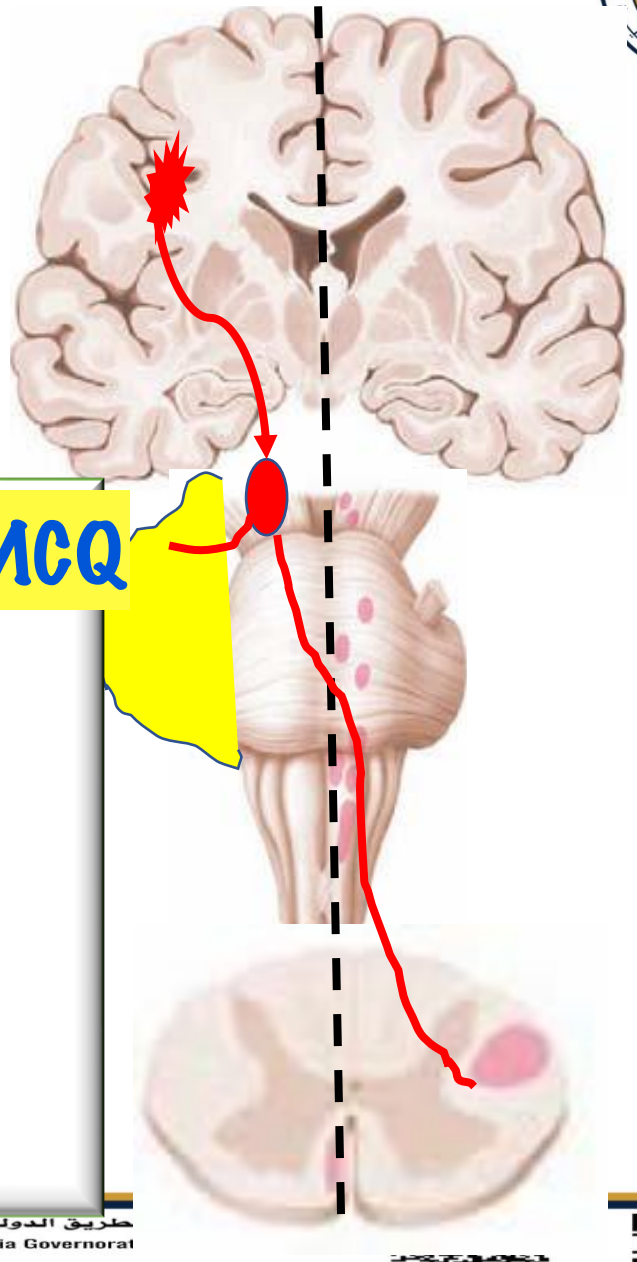
2- **medullary reticulospinal tract:**

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

A- From the midbrain:

Rubrospinal tract:

- **Origin:** red nucleus of the opposite side. MCQ
- **Function:**
  - Carries information from cerebral cortex & cerebellum to the spinal cord
  - Facilitate the flexor muscle tone.

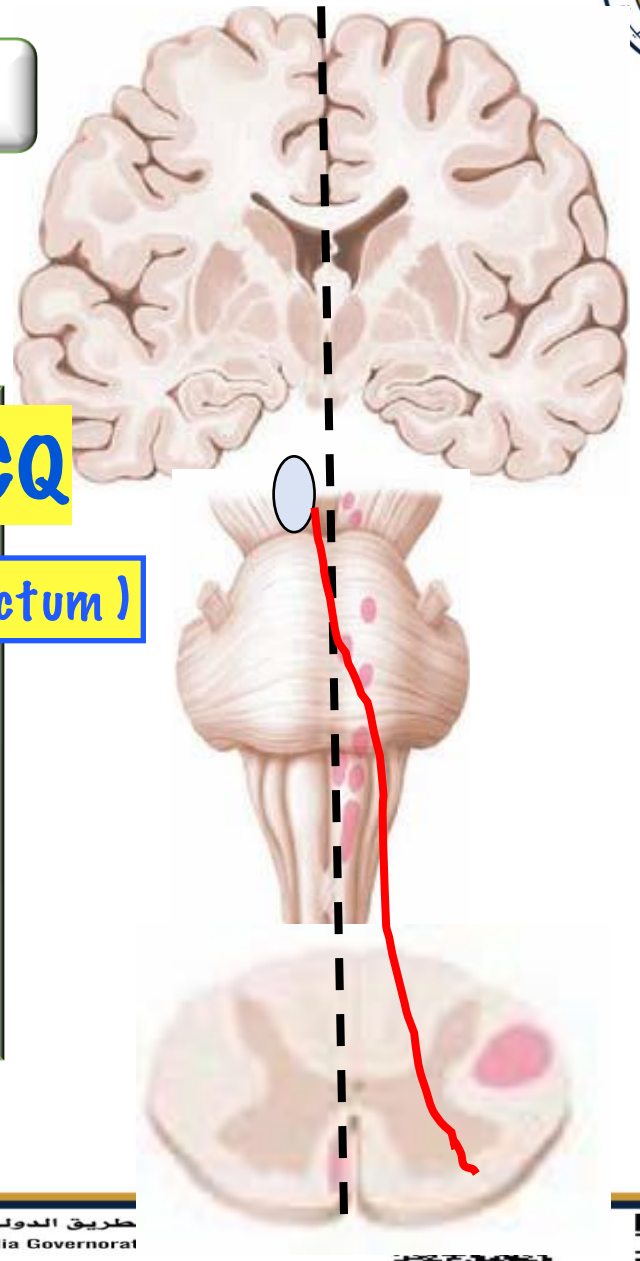


طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

A- From the midbrain:

Tectospinal tract:

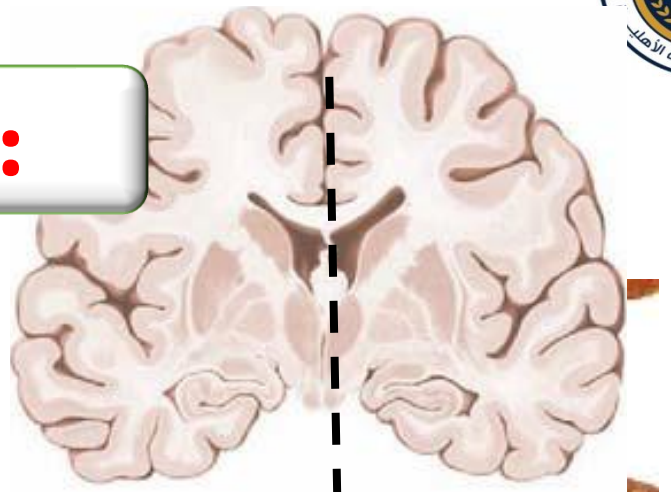
- **Origin:** superior colliculus of the opposite side. MCQ
  - + inferior colliculs (tectum)
- **Function:**
  - Reflexes associated with vision and hearing

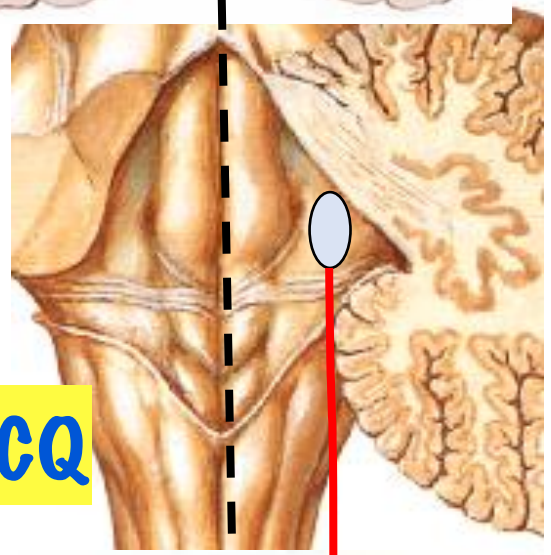


طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

B- From the pontine vestibular nuclei:

Pontine vesibulospinal tract: (vesibulospinal)





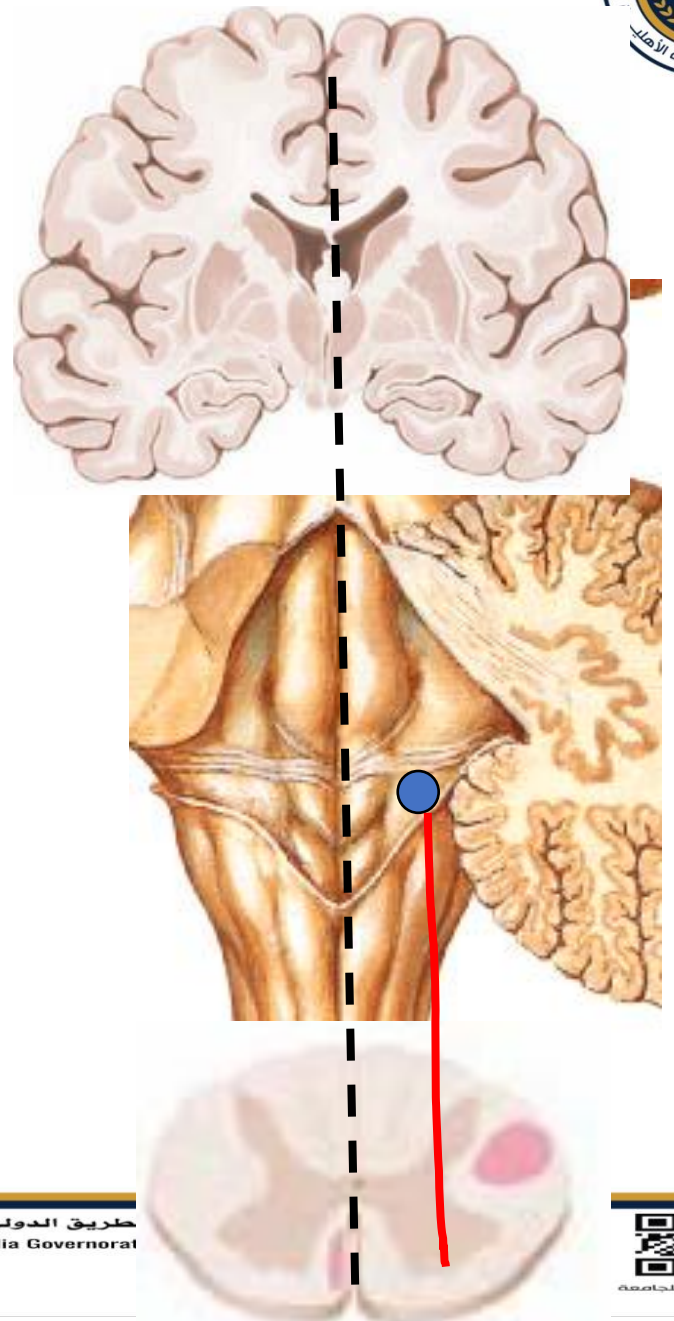
- **Origin:** from lateral vestibular nucleus.
- **Function:**
  - Facilitate the extensor muscles tone. MCQ

طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

B- From the medullary vestibular nuclei:

Medullary vesibulospinal tract: (Sulcomarginal)

- **Origin:** from medial vestibular nucleus.
- **Function:**
  - Facilitate the flexor muscles tone.

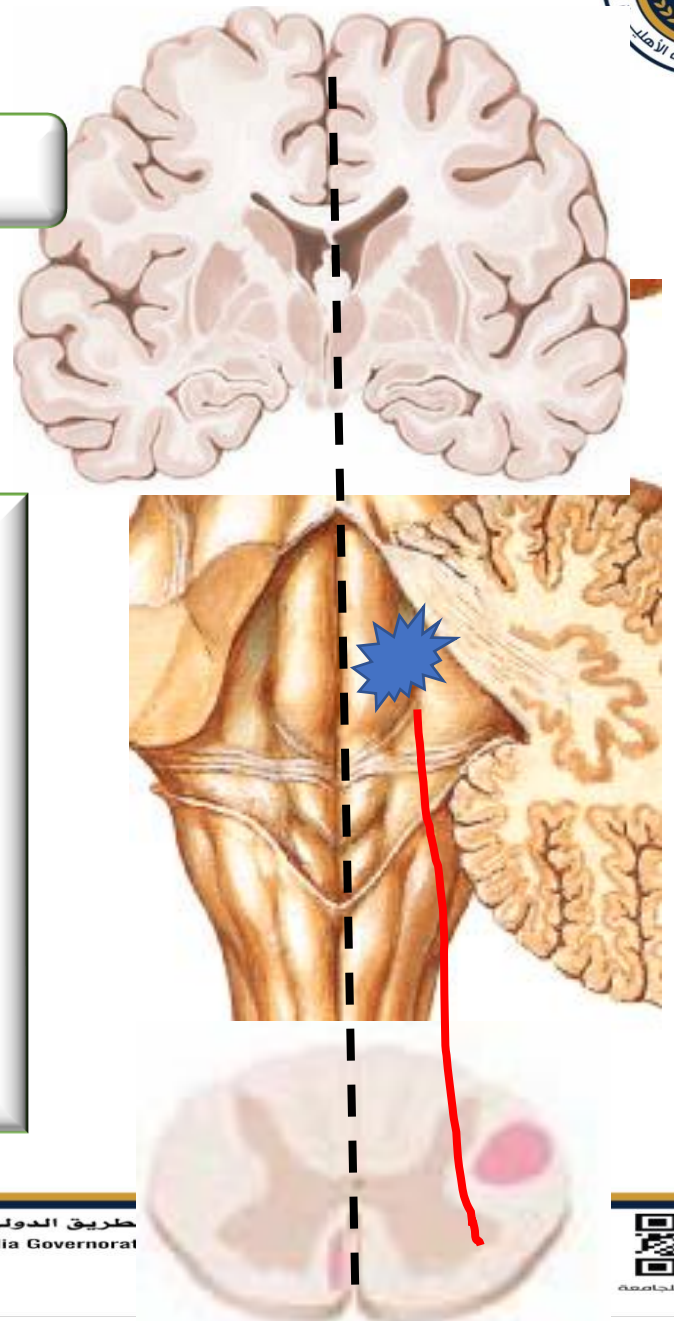


طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

C- From the Reticular formation:

Pontine reticulospinal tract:

- **Origin:** from **pontine reticular formation**.
- **Function:**
  - **Facilitate the extensor muscles tone.** MCQ

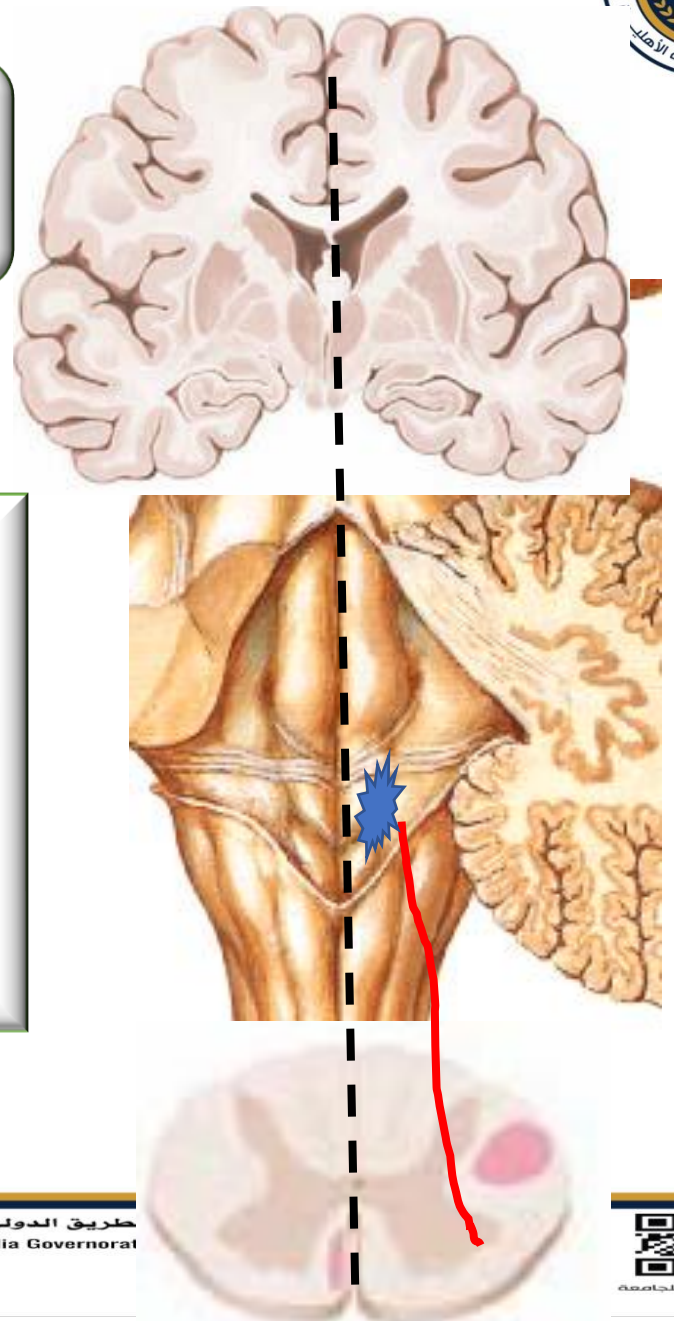


طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

B- From the Reticular formation:

Medullary reticulospinal tract:

- **Origin:** from **medullary reticular formation**.
- **Function:**
  - **Facilitate the flexor** muscles tone.

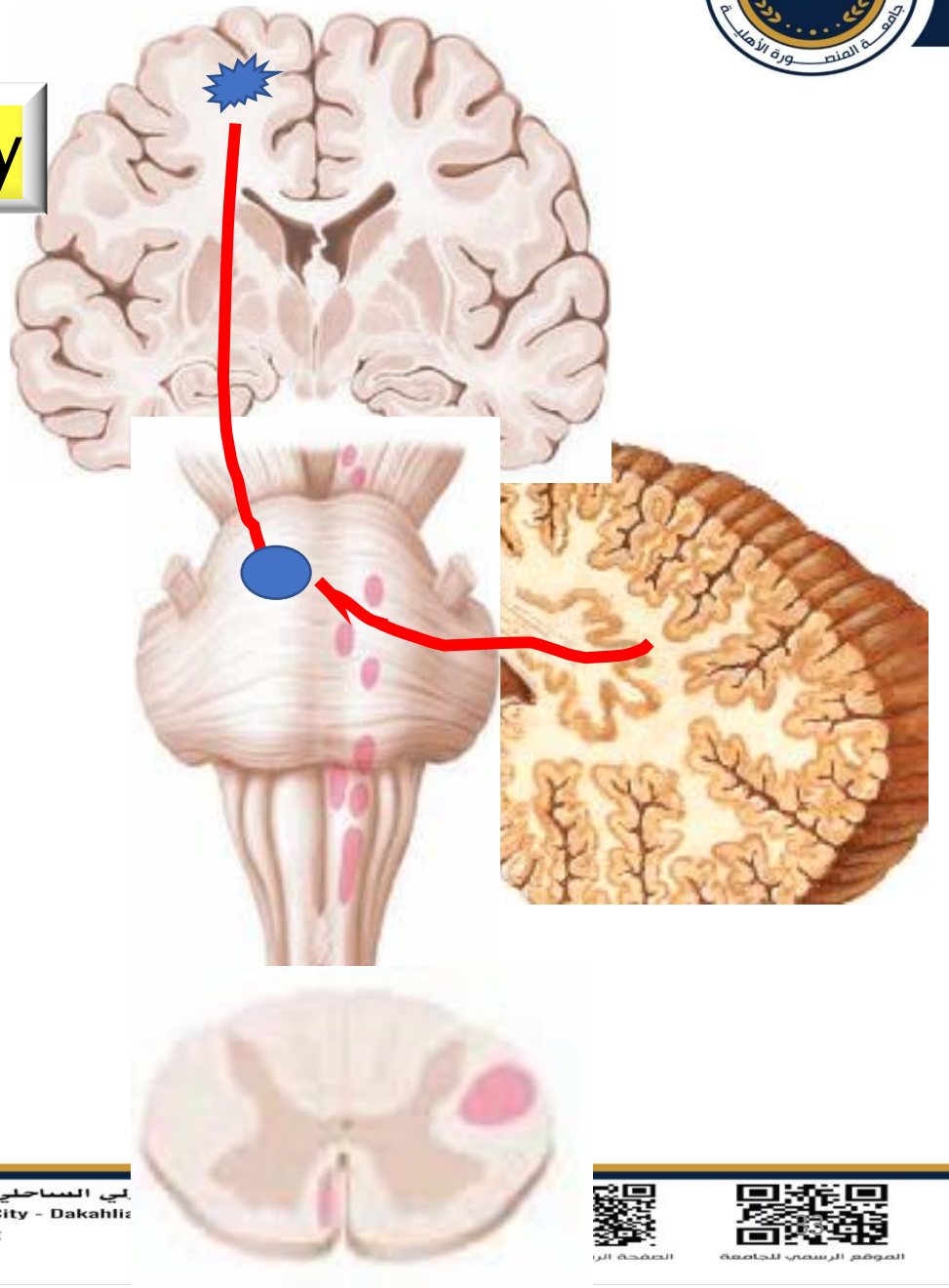


طريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorat
medic@mansnu.edu.eg

3- Motor pathway to the cerebellum

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

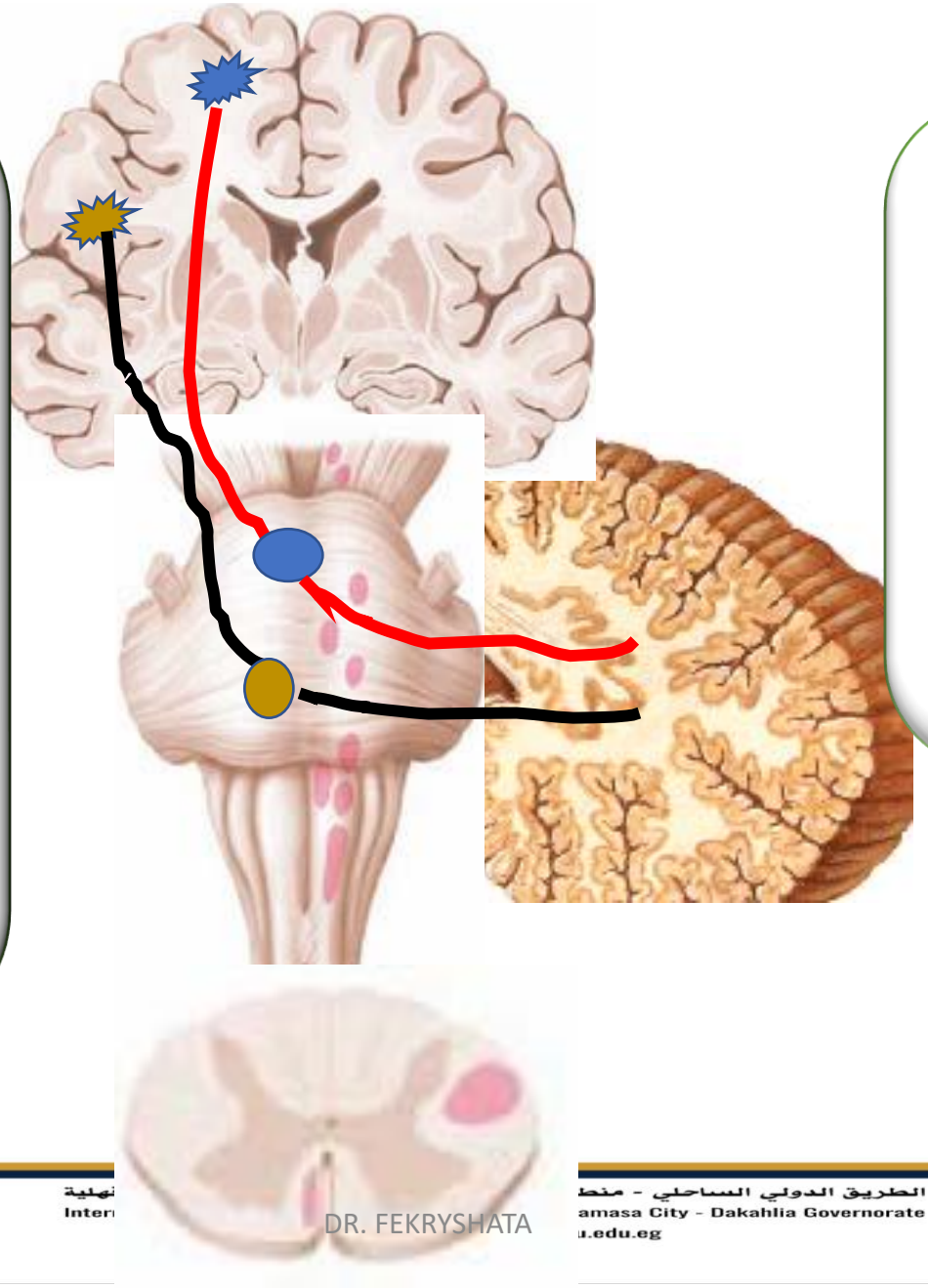
3- cortico-ponto-cerebellar pathway



International Coastal Road - 15th of May District - Gamasa City - Dakahlia
medic@mansnu.edu.eg

B- non fronto-pontine fibers:

- From the parietal, temporal and occipital lobes.
- Transmit sensory information. MCQ



A- Fronto-pontine fibers:

- From the frontal lobe.
- Transmit motor information.

MCQ

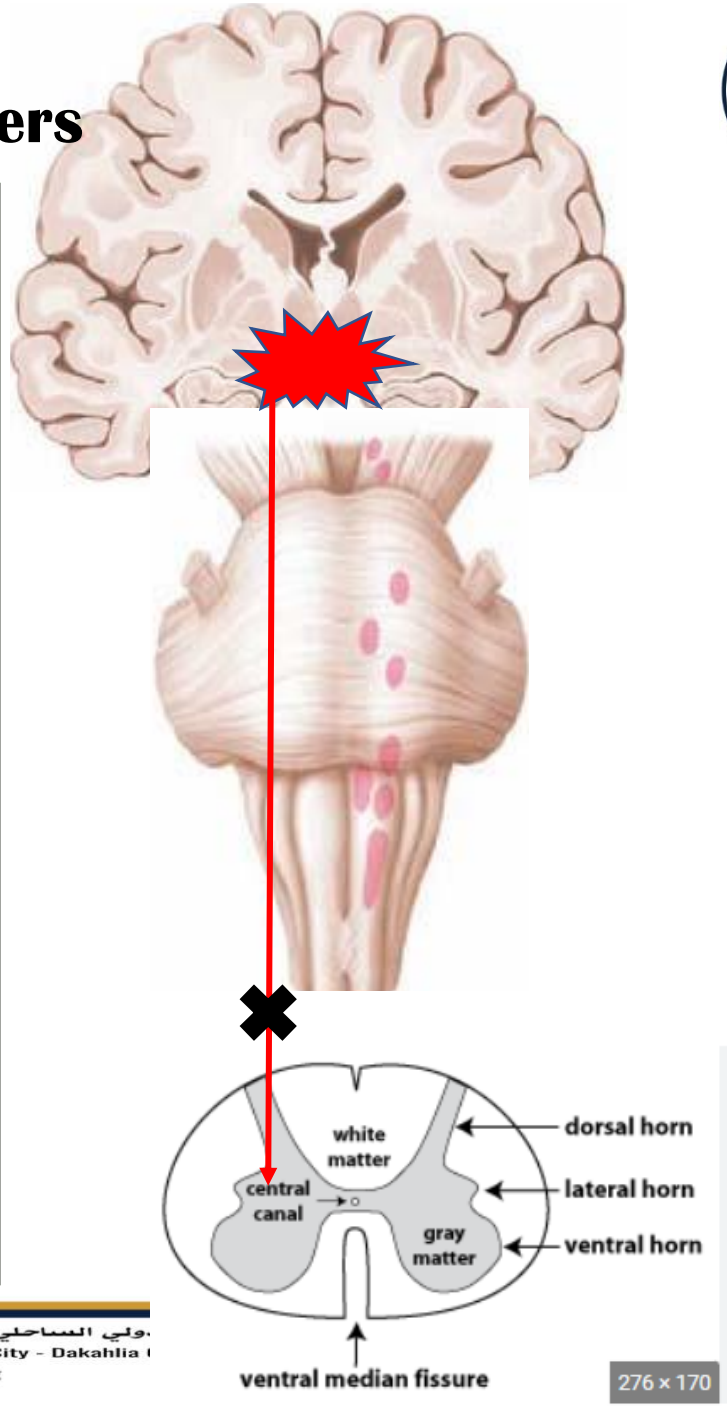
Descending Autonomic Fibers

غالبا بييجي فيها ال Horner's syndrome

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Descending Autonomic Fibers

- **Origin:** from hypothalamus and autonomic centers in the reticular formation. MCQ
- **Termination:**
  - Sympathetic nucleus in the lateral horn of spinal cord (T_1—L_3).
  - Sacral parasympathetic nucleus (S_2—S_4).
- **Lesion:**
  - Above T_1 will cause Horner's syndrome



International Coastal Road - 15th of May District - Gamasa City - Dakahlia
medic@mansnu.edu.eg

مهم ومتكرر كتير في الامتحانات

Horner's syndrome

- **Ptosis:** paralysis of muller's muscle.
- **Miosis:** constriction of pupil.
- **Anhidrosis:** dry face due to paralysis of sweat glands.
- **Enophthalmos:** retraction of the eyeball.
- **Flushing:** warm and red face

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

Quiz

تعديل : نشطب C عشان ما يكونش إجابتين صح

1. **40%** of the corticobulbar fibers from

A. lower third of primary motor area 4

B. Upper two thirds of primary motor area 4

C. ~~Premotor area~~

D. General sensory area

Answer: A

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

تعديل : الإجابة B

Quiz

2. **40%** of the corticospinal fibers from

A. lower third of primary motor area 4
B. Upper two thirds of primary motor area 4
C. Premotor area
D. General sensory area

Answer: B

References for further readings

- Oxford Handbook of Clinical Medicine (3rd edition).
- Gray’s anatomy for students
- The Clinical Practice Of Neurological and Neurosurgical Nursing Fourth Edition.


الحمد لله
Thank You
Thank You