PRACTICAL (1)
REFLEXES

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THE REFLEX ACTION

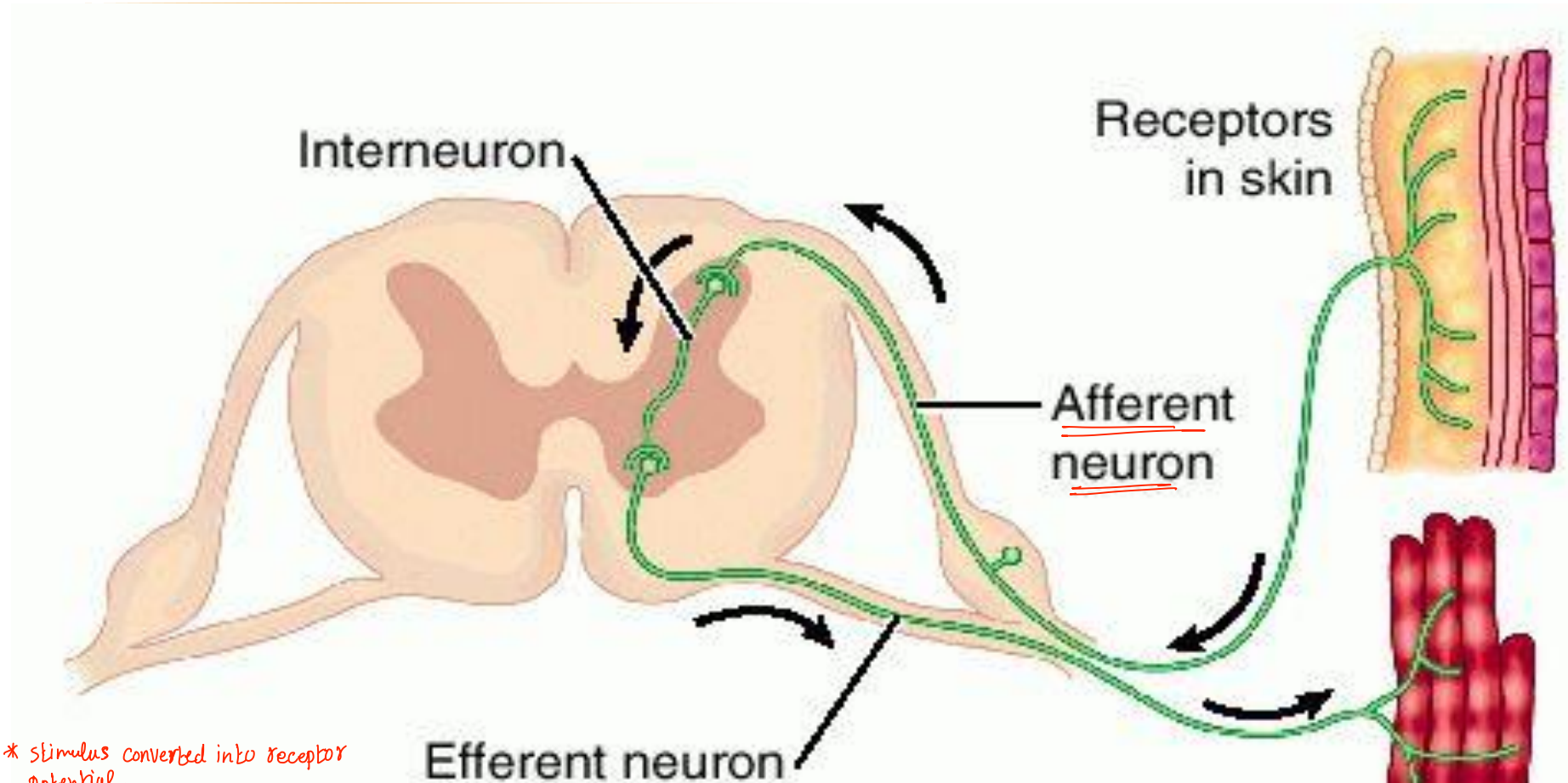
*Neuron considered the structural unit.

The reflex action is the physiological (functional) unit of the nervous system.

The **nervous pathway** of the reflex action is called the ***reflex arc*** which consists of:

- -receptors
- -afferent neuron
- -center
- -efferent neuron
- -effector organ & response

REFLEX ARC



* stimulus converted into receptor potential.
* propagate in the afferent.
*It enters from the dorsal root (The place where all sensation enter).
*1st order neuron ⇒ dorsal root gangelion.
*It enters dorsal horn cell and anastomse with another neuron called interneuron, which is only with polysynaptic reflex, the only exception is stretch reflex, it's considered monosynaptic not polysynaptic, so in this figure the interneuron will not be exist ??
*The interneuron sends (axon) to the anterior horn cell, and takes from it efferent (motor), which will reach effect organ and gives a response.

TYPES OF REFLEXES

- -According to the **number of synapses** the ***reflex arcs*** are classified into:

1- Monosynaptic reflex arc:

- The afferent neuron synapses with the efferent neuron without interneuron in between. e.g. **stretch reflex.**

2- Polysynaptic reflex arc:

(The rest of reflexes)

- In which **interneurons** are present between the afferent and efferent neurons.

(So we will find interneuron as the previous figure)

CLASSIFICATION OF HUMAN REFLEXES

According to the center.

I- PERIPHERAL REFLEXES:

They have ***centers outside C.N.S.*** ***e.g.*** (G.I.T)

a- Local enteric reflex → The center is in the enteric nerve plexus in the wall of GIT

b- Local axon reflex

(antidromic response)

occurs in primary hyperalgesia.

II- CENTRAL REFLEXES:

These reflexes have a ***center inside C.N.S.***

A-Conditioned reflexes: they need: (It needs special circumstances)

- previous education or training, *It's not vital for life, but needed for stabelization.
- intact cerebral cortex

B- Inborn or unconditioned reflexes: (Dosn't has special condition)

which need no education and all of us have them since birth

e.g. micturition reflex. *The center exists under the cortex (subcortical).

INBORN REFLEXES

(central)

according to ***the site of their centers***:

1- ***Spinal reflexes:***

their centers lie in the spinal cord.

2- ***Brain stem reflexes;***

centers lie in the brain stem.

As vomiting, deglutition, cough reflexes, which have their centers in the medulla.

3- ***Hypothalamic reflexes:***

*These are the reflexes that occur during body temperature regulation.

centers lie in the hypothalamus.

TYPES OF SPINAL REFLEXES → According to the site of the receptor:

a-superficial reflexes

receptors lie in the skin .

b- Deep reflexes

receptors lie in the deep structures as muscles, ligaments, tendon.

c- Visceral reflexes

receptors lie in the viscera e.g. micturition, defecation

(A) SUPERFICIAL REFLEXES

→ It's spinal centeral unconditioned.

1- Abdominal reflexes

Center → هي السيغمنت إلي رح يدخل منها الsensation و يطلع منها الresponse. → At which level of spinal cord that the input enters and the efferent exit.

- **Center:** (T7 – T12)

→ So just doing the abdominal reflexes, you does examination to the integrity of ↩

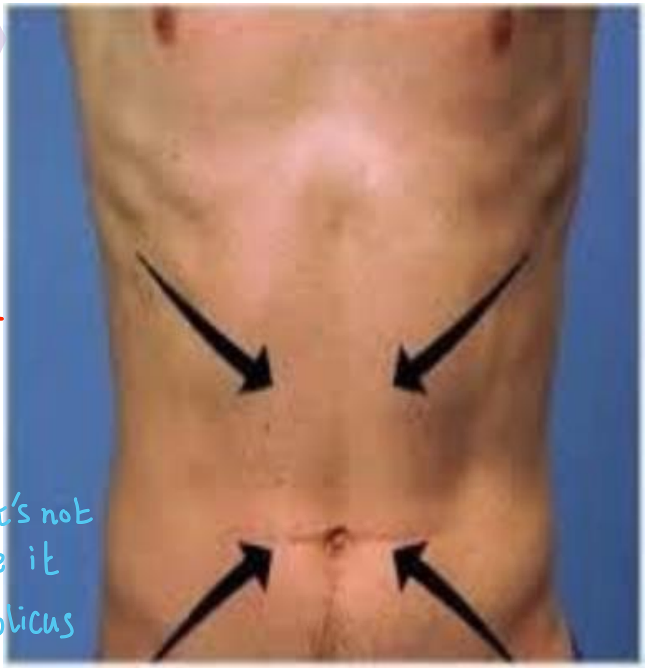
Procedure: light stroking or touching the skin of the abdomen from the periphery inwards.

→ * ما بعمل بالدكة /بشد/ العكسي حتى أعرف أشوف ال response. حتى لا أشد الumbilicus بإيدي، لأنه هذا هو الاشي إلي رح ألاحظه

(The response)

Normal: contraction of underlying abdominal muscle and deviation of umbilicus towards the stimulated side

*When doing contraction if it's not visible enough, I will see it through that → the umblicus will be deviated



2- Cremastric reflex

Center : L1

Procedure : gentle stroking / touching of a medial side of the thigh (in male)

Normal: contraction of cremasteric muscle and retraction / reflex elevation of the testicle of same side

3- Planter reflex

Center : S1

Procedure: stroke the outer edge of the sole of the foot from heel up ward by a blunt object (key) (or we may use the back of the medical hammer) then curve inward across the transverse arch.

(at the lateral aspect)

remember we use it in stereognosis (i).

because if I use sharp object we may stimulate the pain.

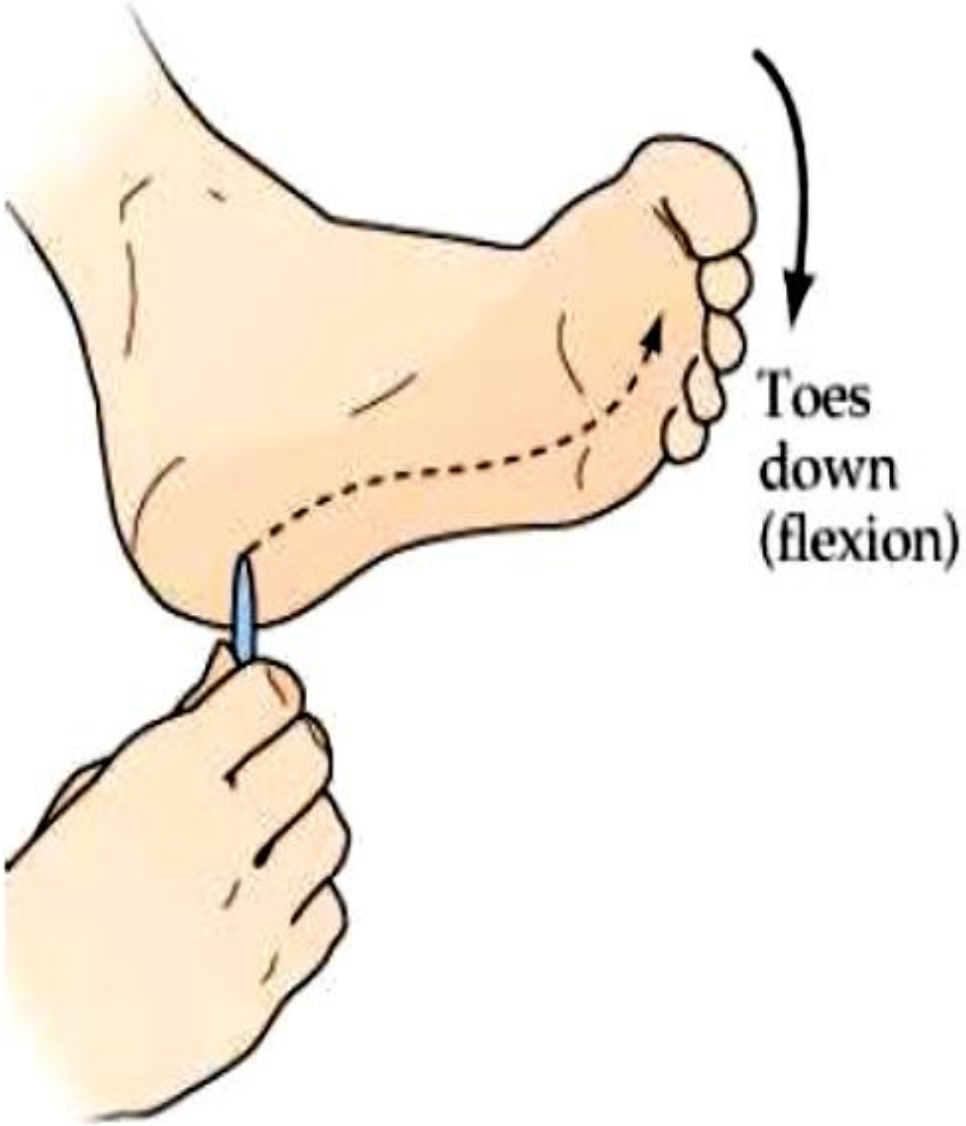
Q: What are the uses of the key if you are doing a neurological examination?
- planter reflex
- stereognosis as a familiar object.

The response:

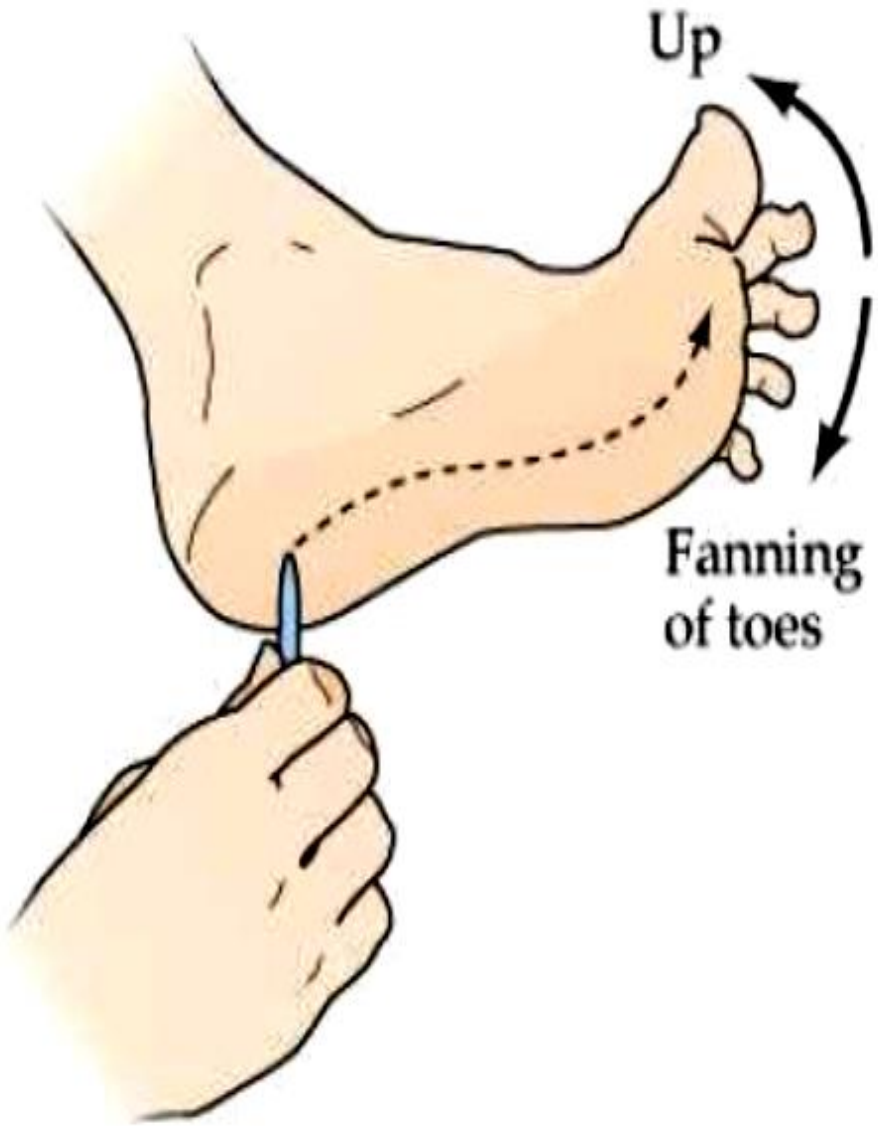
Normal: planter flexion of big toe and adduction and planter flexion of other toes

(يقربوا عم بعض و يروحوا باتجاه الـ sole of the foot)

normal response means intact **pyramidal and extrapyramidal** systems.



Normal plantar response



(Babinski sign)

There may be another response occurs (abnormal) !!

- Abnormal response in planter reflex is called "Babinski's sign" dorsiflexion of the big toe (indicates pyramidal lesion) with fanning (and dorsiflexion as well) in other toes (indicates extra pyramidal lesion).
- Babinski's sign may occur **normally** in a newly born (1) (2) due to lack of myelination of the tracts, deep sleep, and during anesthesia (3). (It's normal physiological)

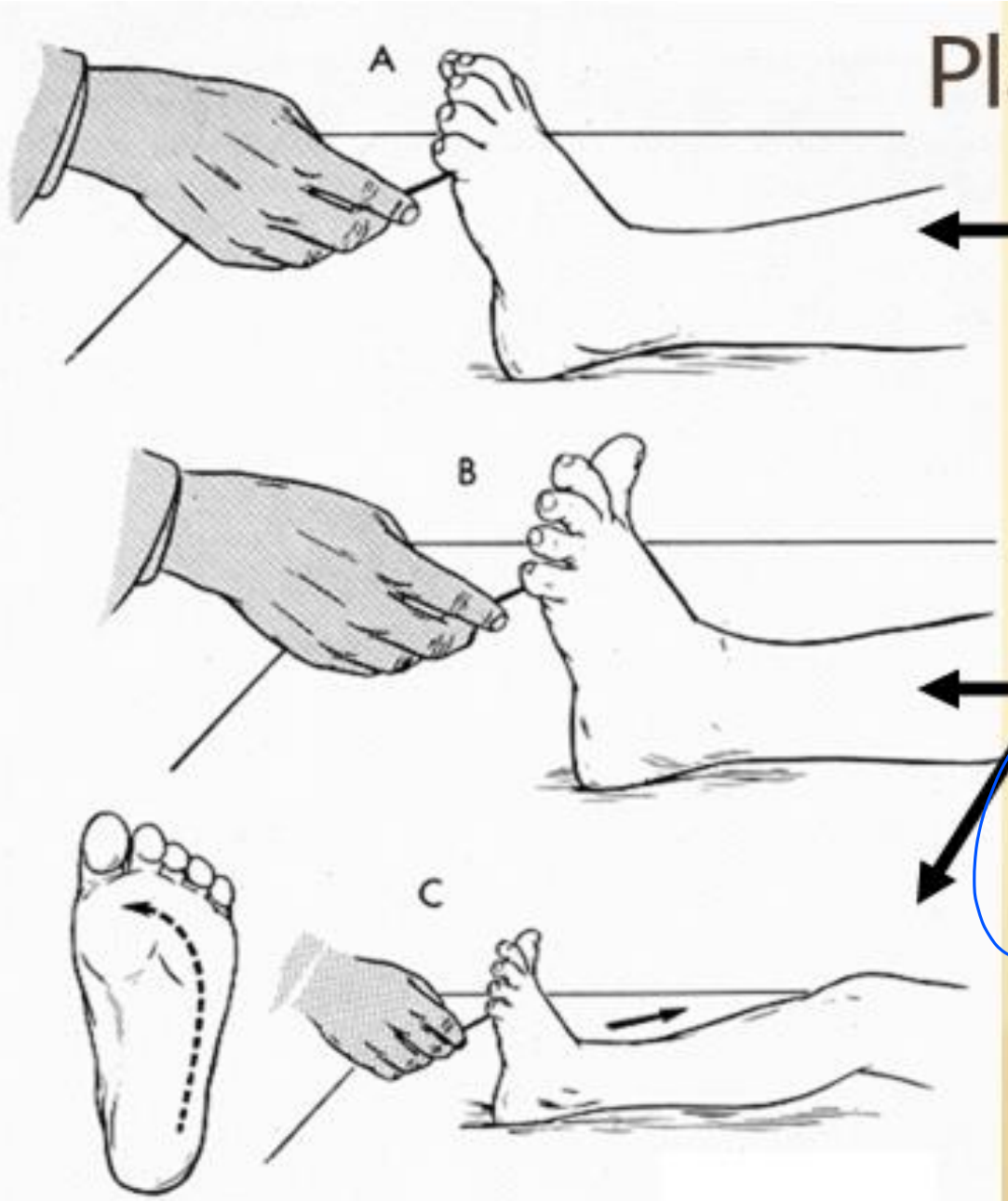
→ It occurs physiologically in ①

لـ ما عنده البيبي أي مشاكل .

لـ أي بيبي تحت الـ 3 سنين رح نجد عنده positive Babinski sign

لـ ما يتم السنتين فما فوق بحيث Complete mylination of the descending tract and converted from Babinski's sign to normal plantar response.

Plantar Reflex



Normal

Abnormal (Babinski's)

- إذا طفل تحت السنتين ← Normal

Once I find it in adult person indicate upper motor neuron lesion.

*As long as he is not under anesthesia, not in deep sleep, not ... coma and not difficient myelination → so he has cutting in the pyramidal and extrapyramidal → so upper motor neuron lesion.

DEEP REFLEXES

STRETCH REFLEX

- The stretch reflex means stretch of a muscle leads to reflex contraction.
- In the skeletal muscle it is central deep spinal unconditioned monosynaptic reflex .

- the stretch reflex **has two phases**

1 - The static phase, the muscle tone .

2 - The dynamic phase, the tendon jerk.

*The receptor has a pathway called pathway arc.

- Deep receptor in muscle spindle (muscle).
- It exists in between the fleshy fibers and parallel to it.
- It has 2 types of fibers: nuclear bag and nuclear chain.

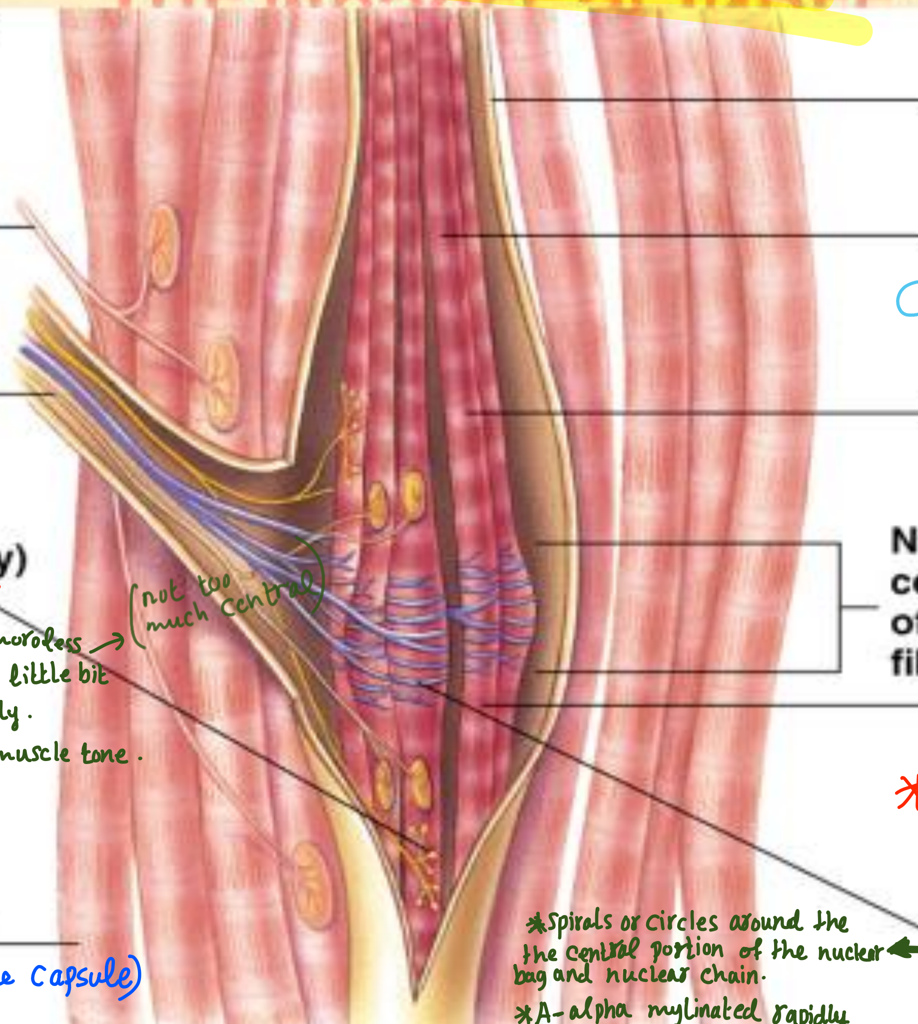
nuclear bag: ← Thick, ← عددها قليل في الspindle (2-3 in each spindle), ← stretched

nuclear chain: ← Thinner, ← عددها أكبر (4-6 in each muscle spindle)

(*) ذكرت عليهم الدكتورة المعلومات إلي بالجدول كمان.

THE RECEPTOR OF THE STRETCH REFLEX: "THE MUSCLE SPINDLE"

*يخرج منها afferent وبرجع بيجي إلها efferent.



Intrafusal (spindle) muscle fibers (Inside the capsule)
→ It's central portion is a receptor area and it's non contractile. It's peripheral has a striation and it's contractile.

Extrafusal ("ordinary") muscle fibers (outside the capsule)
→ All of it → Contractile

Secondary (flower-spray) endings of afferent fibers (Type2) → It takes the sensation more or less (not too much central) from the peripheral part a little bit from the nuclear chain only.
*It's the afferent of the muscle tone.

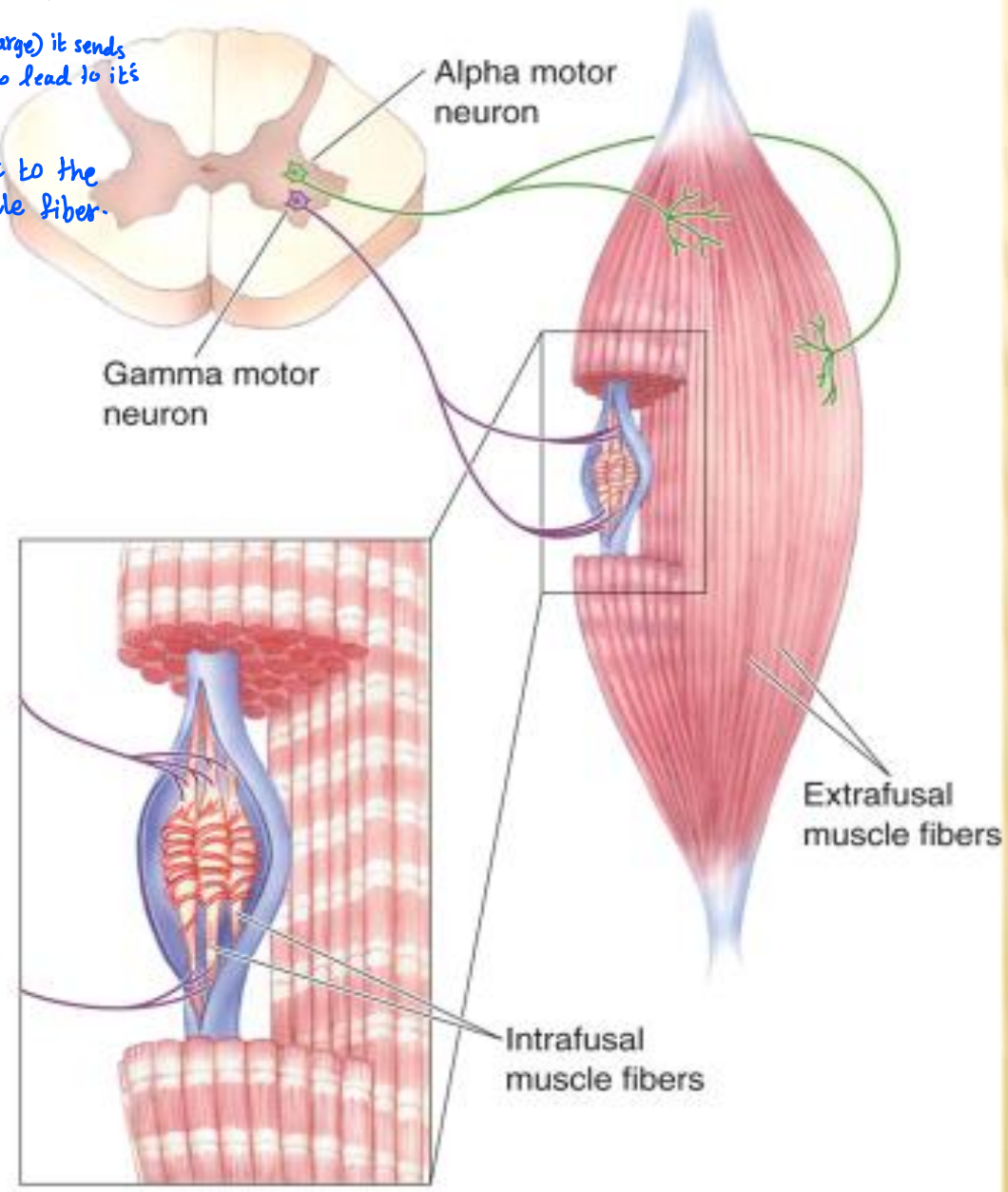
*The 2 types of afferent fibers:

(1) Primary (annulospiral) endings of afferent fibers (Type1)
- *Spirals or circles around the the central portion of the nuclear bag and nuclear chain.
- *A-alpha mylinated rapidly conducting (diameter 16μ, velocity: 100m/s)

*The efferent ⇒ exist go out from the anterior horn cell.

*2 types of anterior horn cell: ① Alpha cell (large) it sends efferent to the extrafusal muscle fiber ⇒ so lead to its contraction.

② Gamma cell (small) sends efferent to the peripheral contractile intrafusal muscle fiber.



MODE OF STIMULATION OF MUSCLE SPINDLE

- 1-Application of a sudden stretch on the extrafusal muscle fibers like during tapping on muscle's tendons (tendon jerk), stimulate the nuclear bags in the spindle and evokes the dynamic response.

(Fiber الـ Tendon إلى يتجمع منه كل الـ)

*By medical hammer.
*passive stretch (I'm doing by my hand).
*The best most of stimulation (sudden tapping on the tendon).

- 2-Pulling effect of gravity, exerts a sort of stretch specially in the antigravity muscles stimulating the static phase of the stretch reflex.

*Always the muscle is stretched ⇒ (The distance between origin and insertion longer than the original length of the muscle, we find that we do disection to the muscle)
(mild stretch)

*we want to do stretching on the receptor area (the central) ∞

- 3-Contraction of the periphery of the intrafusal fibers due to efferent discharge from gamma γ fibers that innervate both the nuclear bag and the nuclear chain

- 4) Contraction of the antagonist of the muscle leads to stretch and stimulation of muscle spindle. *Contraction of biceps leads to stretch of triceps (Example)

N.B: Maximal stimulation of muscle spindle: when muscle is passively stretched (like during tapping its tendon).

- Minimal stimulation of muscle spindle: during voluntary contraction.

- -N.B: gamma cells in the anterior horn (of the spinal cord) are stimulated by many higher centers in the brain stem and the cerebral cortex to enhance muscle contraction from CNS so the stretch reflex is the only reflex which its stimulation can be started from the CNS.

The γ cells in the anterior horn are controlled by many higher centers through the descending tracts of two types:

Above the level of the spinal cord.

Supra-spinal facilitatory centers	Supra-spinal inhibitory centers
1-Primary motor area "4"	1-Suppressor cortical areas "4s
2-Facilitatory pontine reticular formation.	2-Inhibitory medullary reticular formation.
3-Neocerebellum .	3-Paleocerebellum.
4-Vestibular nucleus.	4- Red nucleus.
5- caudate nucleus of basal ganglia.	5-lentiform nucleus.

gamma efferent عرع تنشغل ال

Neocerebellum syndrome

paleo will work, so suppression.

paleo... syndrome

Facilitatory

SKELETAL MUSCLE TONE

- nearly all skeletal muscles specially the antigravity muscles are in state of stretch due to the pulling effect of the gravity.

- This state of maintained stretch initiate in our muscles a state of maintained rhythmic mild contraction "skeletal muscle tone" or (static phase of stretch reflex)

TENDON JERK

sudden tap on a tendon of any muscle (Dynamic phase of stretch reflex)

→

sudden stretch which stimulate deep receptors "the muscle spindle" ← by sudden tapping on the tendon.

→

sudden visible reflex contraction "tendon jerk". → *passive stretch (The doctor doing it)

→ *It's not necessary to be strong enough to move a joint, so the muscle that I do to it the tendon jerk examination it should be visible → مكشوفة

strong enough ← يكون قوي بما فيه الكفاية
to move a joint

حتى أشوف الـ contraction

*1 tapping on the tendon of the quadriceps muscle, it's tendon does insertion in the knee by medical hammer.

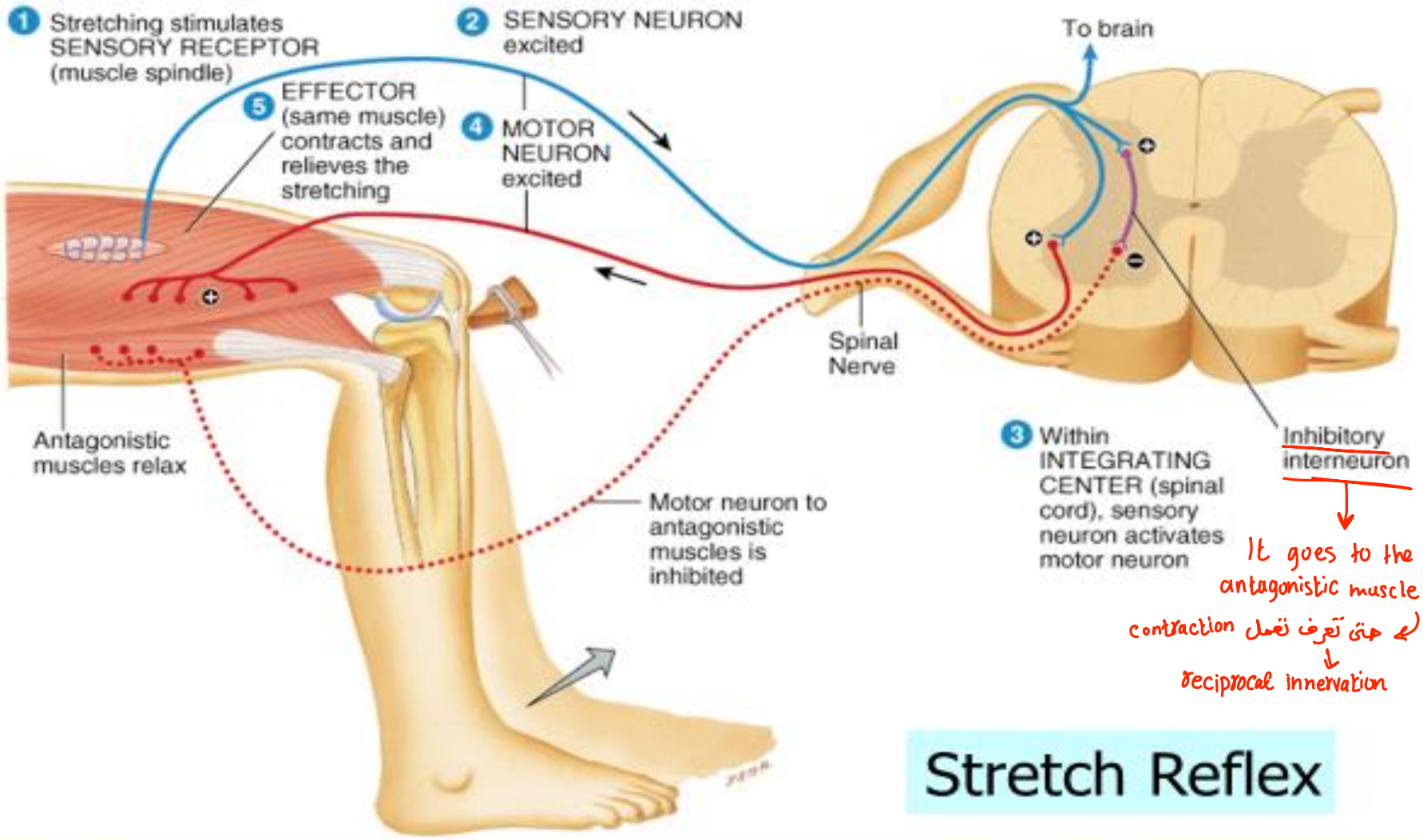
*2 it stretches the muscle so stimulating the receptor.

*3 The receptor that gives response to the sudden stretch: nuclear bag (it's stimulated).

*4 It will send afferent, which enters from the dorsal root.

*5 firstly it will go to the brain to stimulate supraspinal facilitatory center to strenghth the power of contraction if I need more contraction and it does anastomoses directly with efferent: cause it's monosynaptic.

Knee tendon jerk



It goes to the antagonistic muscle

contraction حتى تعرف تعمل

reciprocal innervation

Stretch Reflex

Types of tendon jerk

I- In the upper limb:

So we examine there activity

1) Biceps reflex Center : (C 5,6)

Procedure :-

- Tap the biceps tendon indirectly i.e the tap is done on the ~~index~~ thumb finger placed over the tendon .The forearm is semi flexed till the elbow is at 120º.

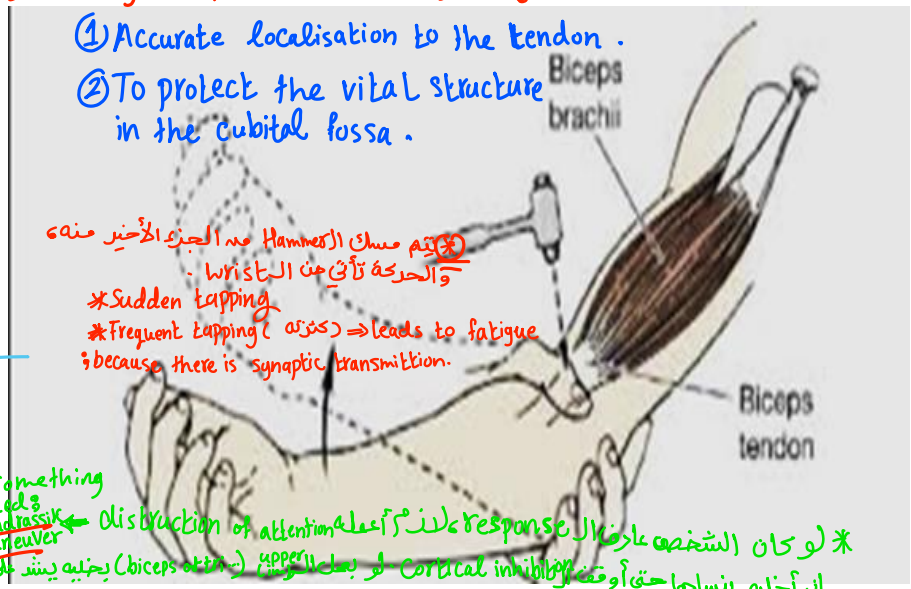
By medical hammer

- **Normal :** mild contraction of biceps with slight flexion of elbow

2) Triceps reflex Center (C 6,7)

Procedure :-

- Tapping the triceps directly while the elbow is flexed at 90º.
- **Normal :-** Mild contraction of triceps and extension of elbow .



Why to put the thumb on ?

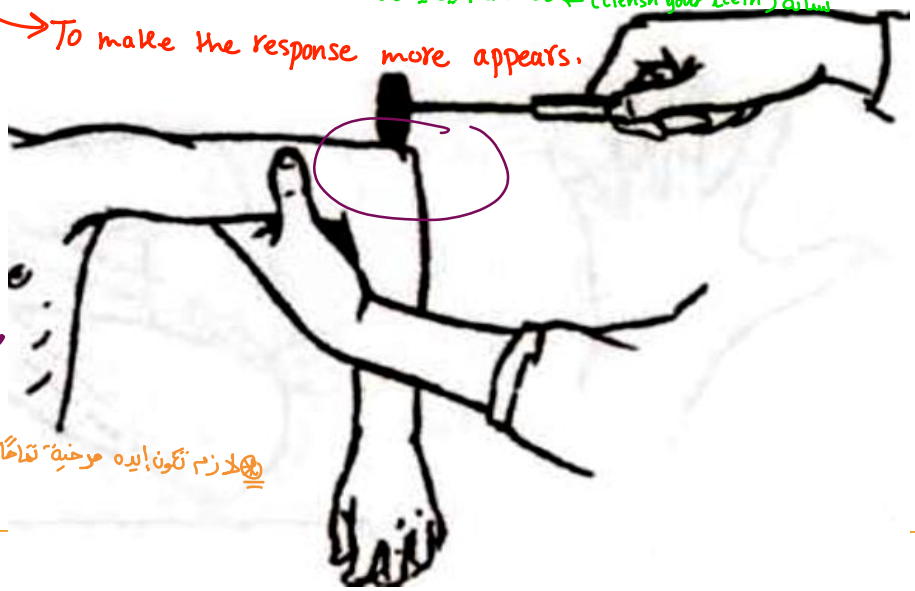
1. Accurate localisation to the tendon .
2. To protect the vital structure in the cubital fossa .

*Sudden tapping

*Frequent tapping ⇒ leads to fatigue ; because there is synaptic transmission.

Something called Tendrassic maneuver ← Distruction of attention ← response

To make the response more appears.



II- in the lower limb

→It has 2 position, for normal person and in a bedridden patient.
*It has Jendrassik maneuver to be inforce the appearance or the contraction ⇒ Ask the patient to hold his hand against each other and stretch → فيكون مركز الـreflex بهذا الشي وانا بعمله

1) knee jerk   Center (L2,3,4)

(The most one will give response)

Procedure :- Tapping the patellar (quadriceps) tendon while the hip and knee joints are flexed.

Normal :- Contraction of quadriceps and **extension** of knee. (or to the lower Limb)

2- Ankle jerk   Center (S1 , 2)

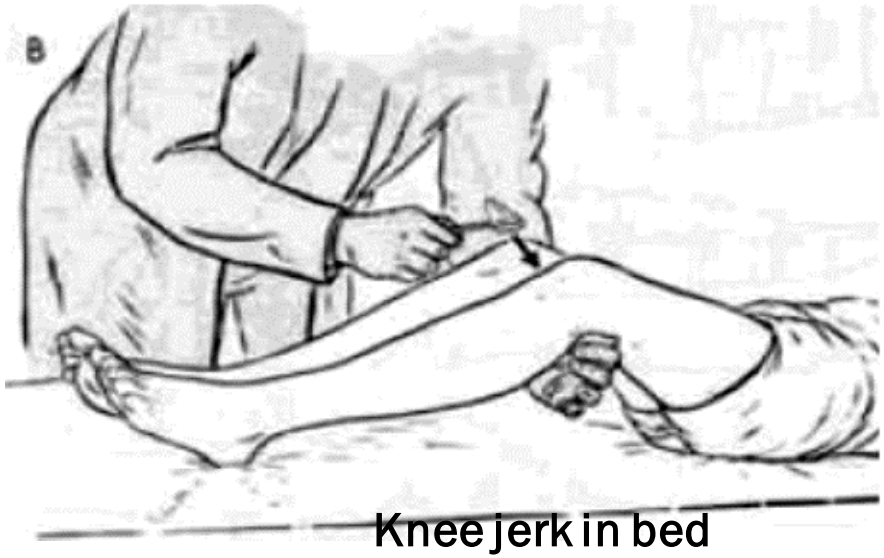
Procedure: Tap on tendo Achilis while the hip is abducted and externally rotated , the knee is flexed at 90 degree and Ankle is dorsi-flexed .

→To magnifie the response I do passive dorsiflexion with my hand, So when I tap on the tendon it will do planter flexion to a Longer distance.

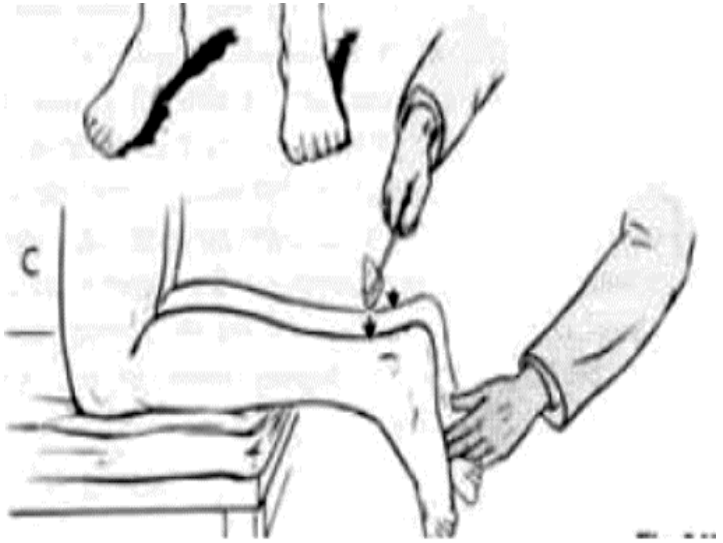
Normal: mild contraction of the calf muscles with **planter** Flexion of the ankle .

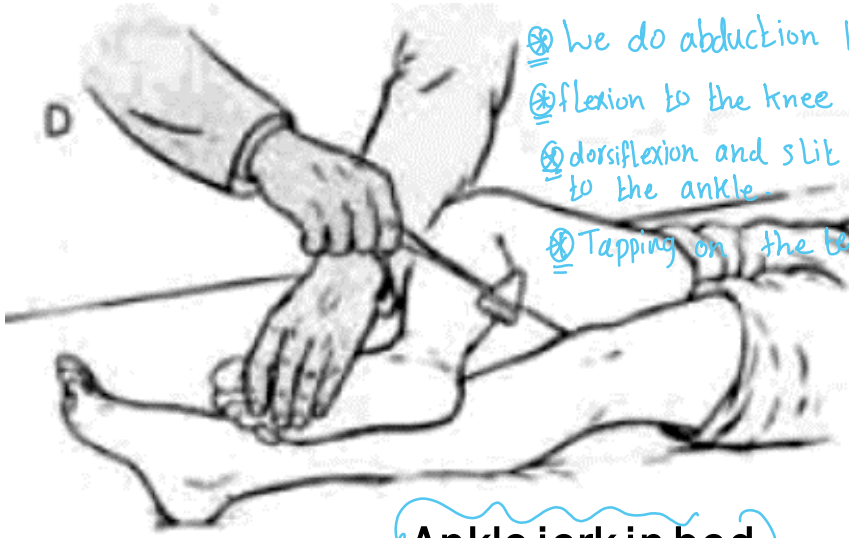
*The Knee → 90°, foot with the knee 90°
*The 2 foot aren't supported (بيكونوا طالعين برجلهم)
*The tapping should be on the quadriceps tendon → knee, the tapping shouldn't be on the bone; cause it's very painful.
*The tendon is the depression between patella and the tibial tubrosity.
*So firstly we have to do localisation to the tendon.

*The doctor holds the patient knee (the two) on his hand (arm).
- supported حتى ما تكون
و يرفع رجله بشكل كامل من السرير
*Tapping on the tendon of the quadriceps.



Knee jerk in bed





- we do abduction to the hip.
- flexion to the knee.
- dorsiflexion and slit rotation to the ankle.
- Tapping on the tendon.

Ankle jerk in bed

CLINICAL ABNORMALITIES OF THE TENDON JERK

Areflexia ← قبل لا تحكي

In lower → بنشد على إيديين ← Jendrassik maneuver أول ما طلع Response من حدة لازم أجرب

In upper → clensh your teeth

* لو ما طلع Response أيضًا احتمال إنه يطلع Normal
* الاحتمالات التالية:

A- *EXAGGERATED (HYPEREFLEXIA)*

- 1-Upper motor neuron lesion.
- 2- Hyperthyrodisim.
- 3- Tetany (Ca++ deficiency).
- 4-Paleocerebellum syndrome. (So neo is working/stimulated)
- 5- Anxiety.
- 6- Eclampsia (toxicity of pregnancy). → she has albuminuria, hypertension and convulsion.

B-INHIBITED (HYPOREFLEXIA)

- 1 - Sleep
- 2 - Coma
- 3 - Shock
- 4- Anesthesia
- 5-Myxodema (hypothyroidism)

C- COMPLETELY ABSENT, "AREFLEXIA"

↳ we have to do the Jendrassik maneuver and insure that there is no response at all.

- 1- Lower motor neuron lesion. → Affecting the reflex arch.
- 2- Shock stage of complete transection of the spinal cord. ↓
- 3-Advanced tabes dorsalis { Hyperflexia بتتحول بعد شوي areflexia ← في الأول بتكون

↓
It affects the dorsal root gangelion.

D-"PENDULAR" KNEE JERK (HYPOTONIA):

*we tap on the tendon just once.

like the "pendulum" of the watch, occurs in hypotonia.

Low level of muscle tone

On tapping the tendon there will be a weak contraction of the muscle, then the limb is dropped like a dead object which causes another stretch of the tendon, and a second weaker contraction occurs and the limb oscillates for few times then stops.

Causes: 1 - Neocerebellar syndrome .

2- Chorea (lesion in basal ganglia) .

3-Anterior quadrant lesion of the spinal cord.

4- Pure motor area "4" lesion.

E-CLONUS

*It's pathological reflex

*It's side to side with hypereflexia → clonus على بدور hypereflexia والدكتور بعمل *
إذا ما وجد hypereflexia عند وجد hypo أو aflexia
أو normal لا يجب أن يذهب ناحية الـ clonus

- It is an abnormal response of tendon jerk that occurs in U.M.N.L. (upper motor neuron lesion) It is either ankle or patellar clonus

↳ which I find in it the exaggerated tendon jerk (hyperreflexia)

- Ankle clonus: If a ***sudden sustained stretch*** (without using hammer, with the hand) is applied on tendocalcanius by dorsiflexion of the foot, there will be ***regular rhythmic oscillation of contractions and relaxations***

→ that's if he is clonus positive.

→ He stops only if the doctor takes his hand.

→ Explanation of that: stretch reflex occured followed by inverse stretch reflex.

(Remember:) The receptor isn't in the muscle, it's in the tendon called golgi tendor organ - (polysynaptic)

*Excessive stretch of the muscle leads to reflex relaxation (protective)

Thank You