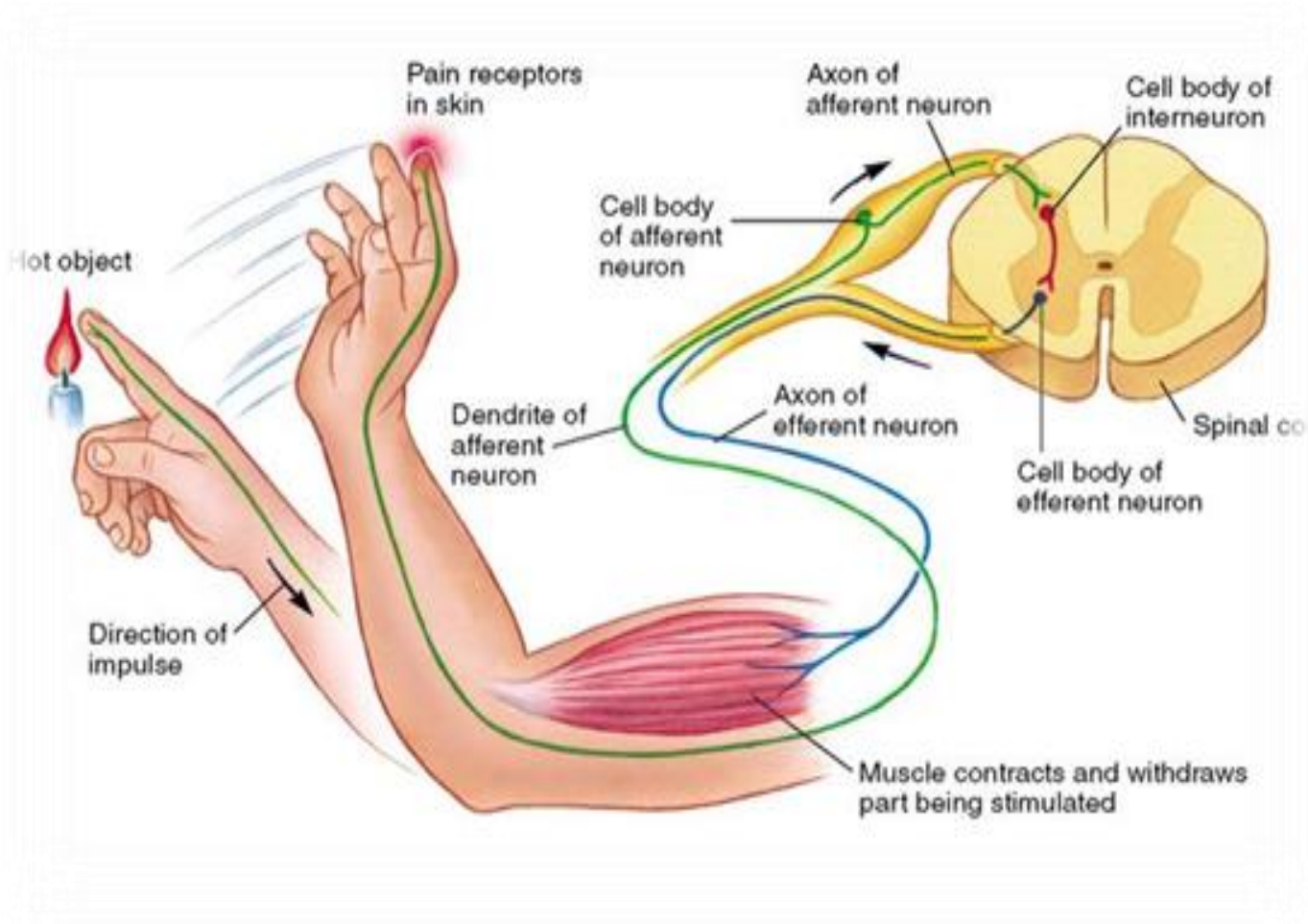
Faculty of Medicine
Physiology Department

Superficial reflexes and deep reflexes

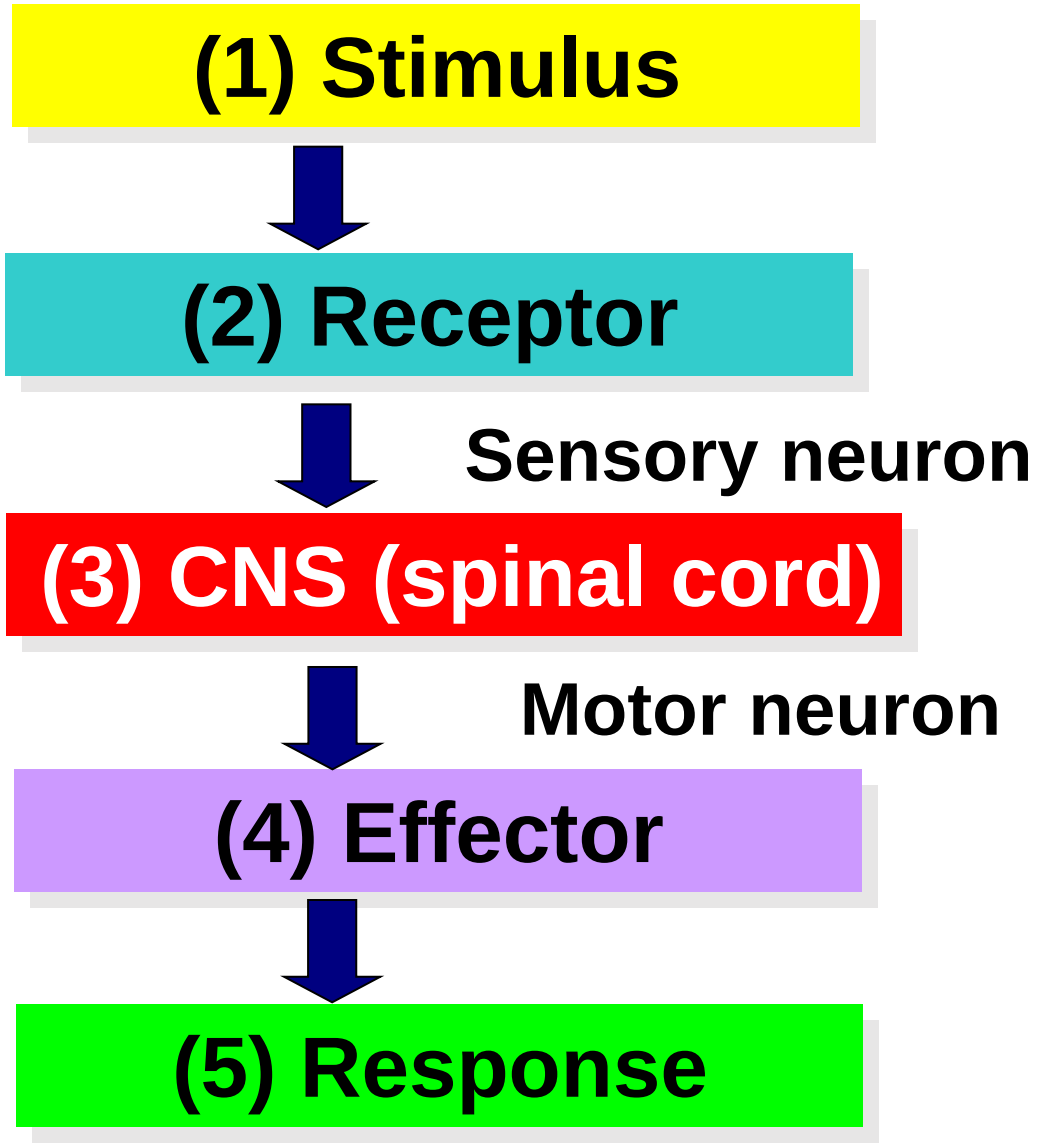
Reflex Action

Def:

- It is an automatic (involuntary) response to adequate stimulus.



Pathway of Reflex Action



Significance of Reflexes

a) Physiological significance:

Its function differs from one reflex to another e.g. flexion withdrawal reflex is protective reflex.

b) Clinical significance:

It tests the integrity of the pathway (to test for normal CNS function).

Classification of Reflexes

Local Reflexes

- Their centers outside CNS

Systemic or General Reflexes

- Their centers inside CNS

local reflexes

- They **occur entirely** at the level of the **tissues** & **don't involve CNS .**
- their centers are **present outside CNS.**
- e.g. **reflex secretion** of **gastric juice** in response to **meal** in stomach.

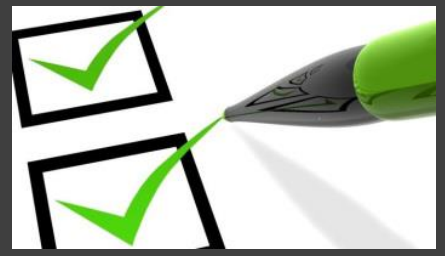
Systemic Reflexes

Conditioned Reflexes

- Their centers present in cerebral cortex

Unconditioned Reflexes

- Their centers present in CNS outside cerebral cortex



Spinal Reflexes

Spinal Reflexes

- **Definition:** They are reflexes whose centers are present in the spinal cord.
- **Classification:** They are classified into 3 types;

A) Superficial spinal reflexes: The receptors of these reflexes are present on **body surface e.g., skin.**

Examples:

- Abdominal reflex.
- Planter reflex.

Spinal Reflexes

- **B) Deep spinal reflexes:** The receptors of these reflexes are present in deep structures e.g., ms, bone and joints. e.g. muscle **stretch reflex or tendon jerk**

- **C) Visceral spinal reflexes:** The receptors of these reflexes are present in visceral organs.

Examples:

- Micturition reflex (its center is S2,3,4)
- Defecation reflex (its center is S2,3,4)

Superficial Spinal Reflexes

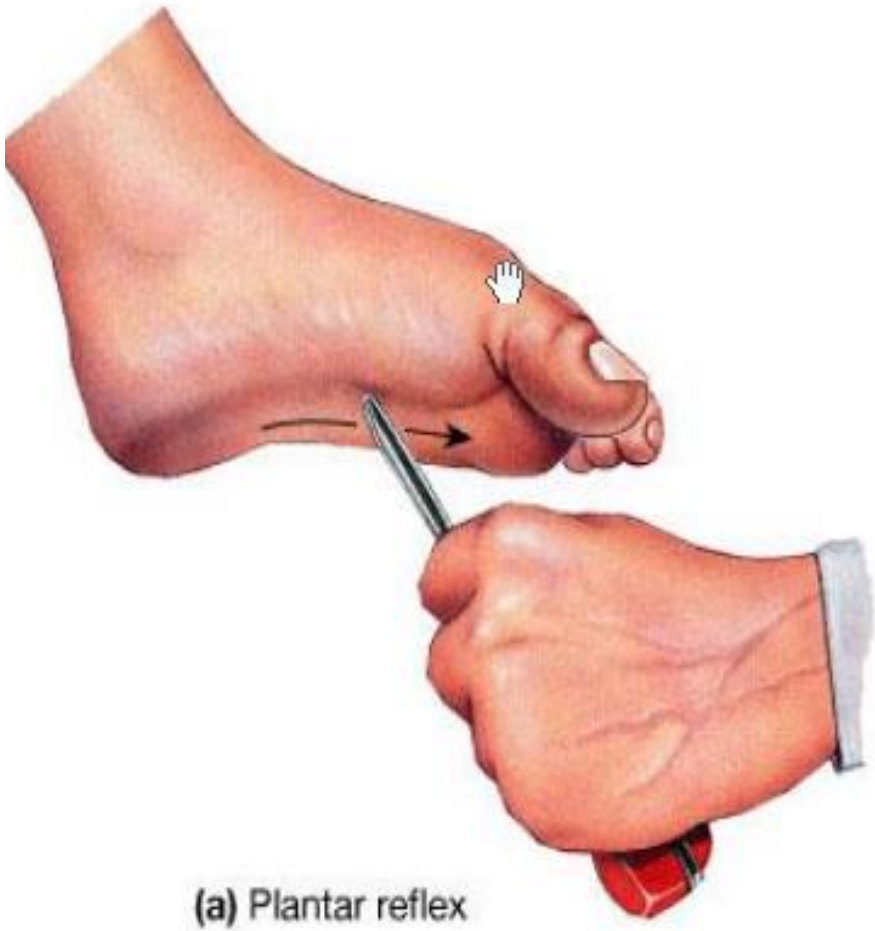
Plantar Reflex

- **Definition:** Scratching the sole of the foot along its lateral margin from the heal toward the toes causes a plantar flexion of all the toes.
- **Center: S1 and S2**
- **Procedure:**

- Raise the heel of the subject with your left hand.

- Then scratch the outer edge of the sole of the foot with your nail or your key.

- The big toe and the other toes show planter flexion.



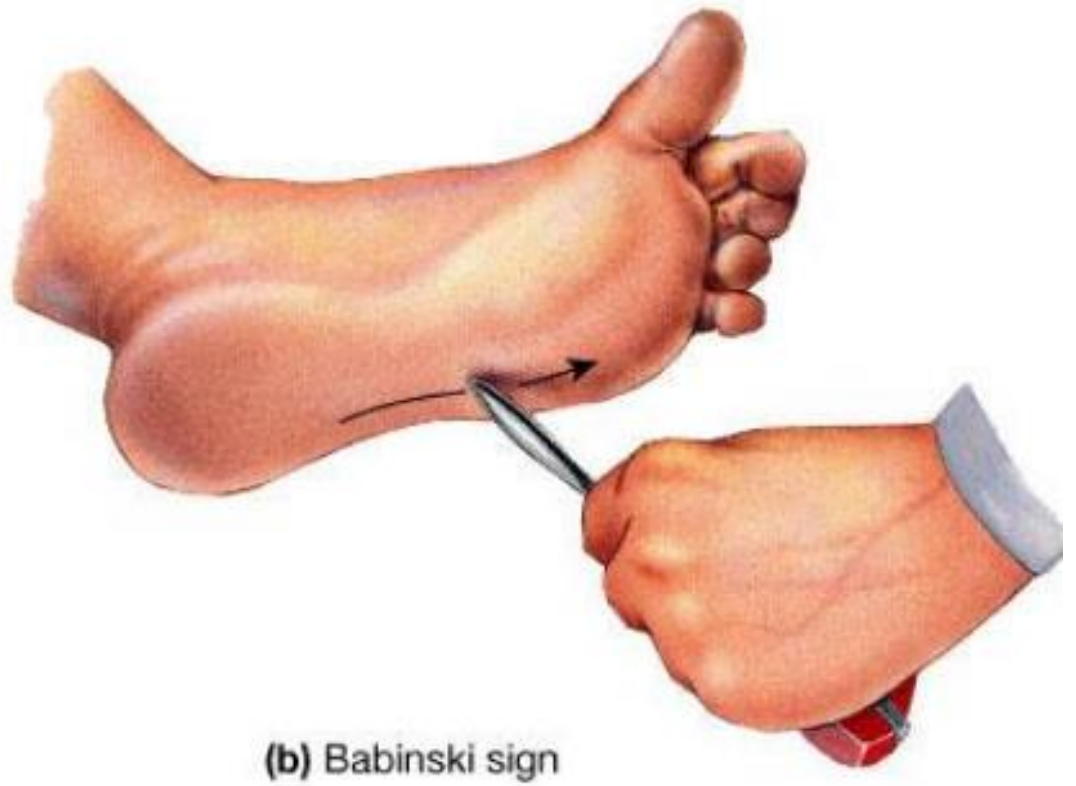
(a) Plantar reflex

Babinski sign

- Scratching the sole of the foot along its lateral margin from the heal toward the toes causes:

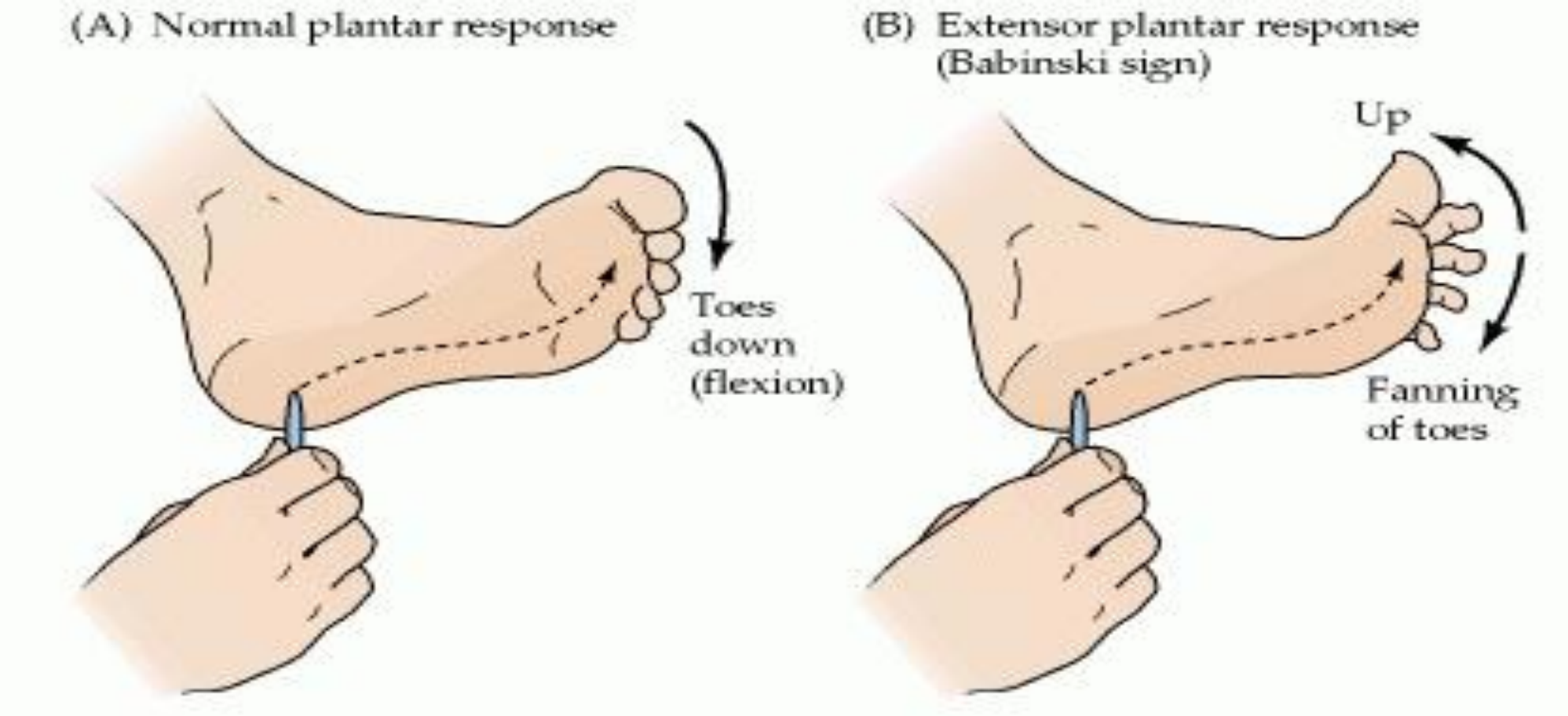
- Dorsiflexion of the big toe (due to pyramidal tract lesion) and/or

- Separation (or fanning out) of the other four toes (due to extrapyramidal tract lesion).



(b) Babinski sign

Normal Plantar Response and Babinski Sign



Babinski Sign

- **Causes of Babinski sign:**

a) Physiological causes:	b) Pathological causes:
Newly born infants: during the 1st few months of their life due to incomplete myelination of pyramidal tract.	**UMNL.**
Normal adults: during **deep sleep** or during general **anesthesia**.	When the cerebral cortical function is depressed as in **coma**

Babinski Sign

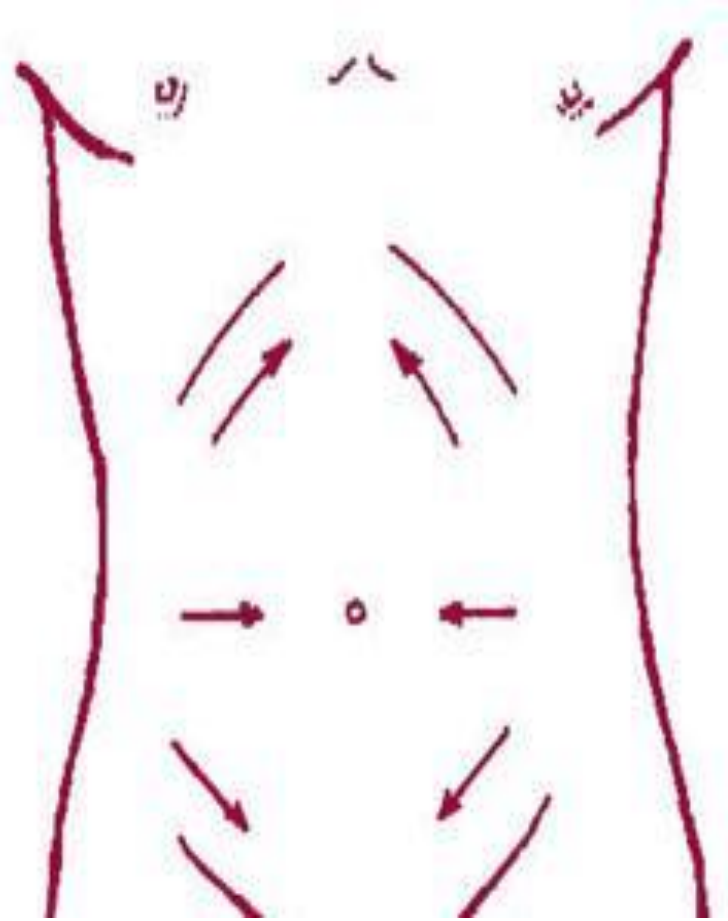
In adults

In infants

Abdominal reflex

- **Definition:**

Stroke the skin over the abdomen outward toward the umbilicus to upper and lower abdominal quadrants leads to contraction of underlying muscles. This is indicated by movement of the umbilicus.



- **Center:**

T_7 **to** T_{12} segments of spinal cord

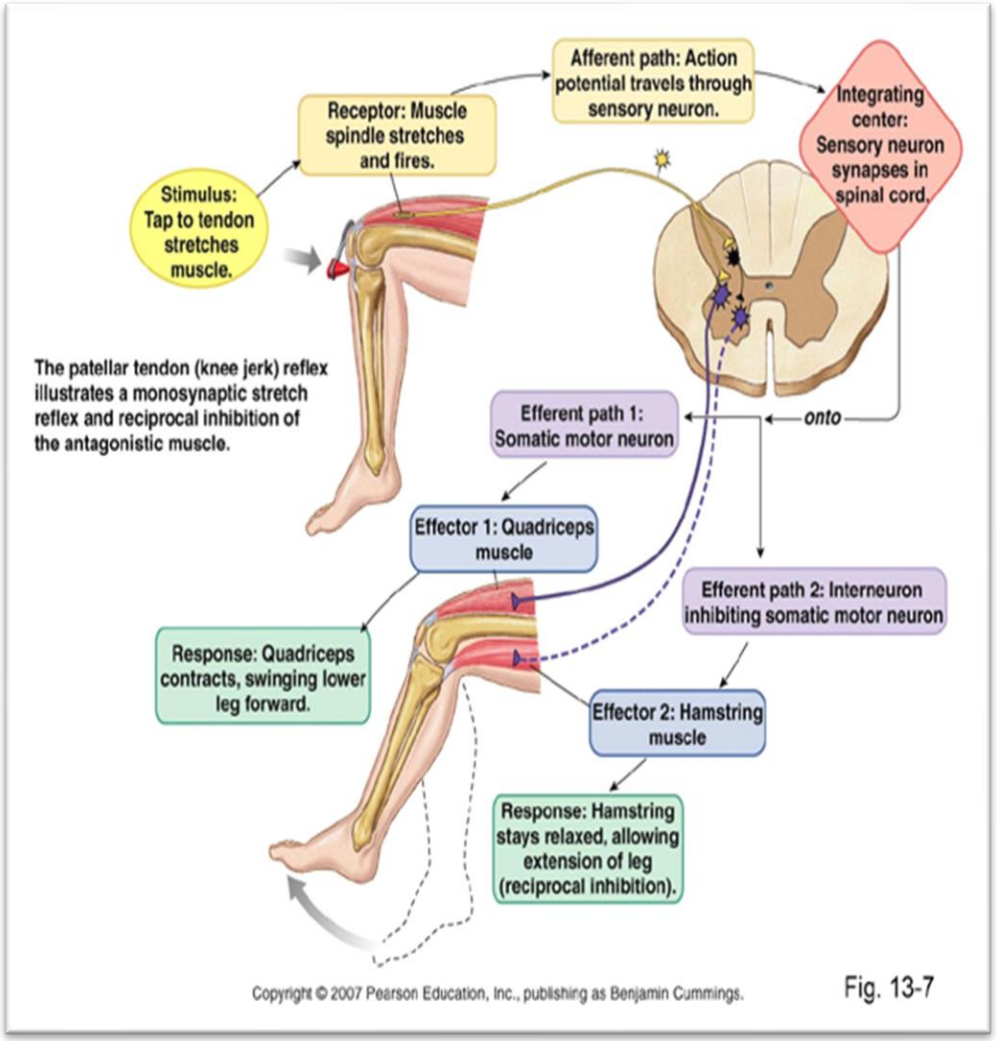
- **Significance:**

- This reflex is **lost** in **pyramidal tract lesion** or **UMNL**
- It is **non-specific** because it is lost also in abdominal surgery, repeated pregnancy and old age.

Tendon Jerk

Def:

It is a brief contraction of a skeletal MS to sudden stretch produced by tapping its tendon sharply & strongly (using a reflex hammer).



- **Mechanism:** It is a dynamic type of the stretch reflex.

Receptor: Nuclear bag fibers of muscle spindle

Afferent: 1ry endings.

Center: α-MNs of the stretched skeletal muscle

Efferent: Thick myelinated type Aα nerve fiber

Response: brief contraction followed by rapid relaxation.

Examples of tendon jerks

- Knee jerk
- Ankle jerk
- Biceps jerk
- Triceps jerk
- Jaw jerk

How to Do test

1) The muscle group to be tested must be **exposed**.

2) The muscle group to be tested must be in **a neutral position** (i.e. neither stretched nor contracted) (= semiflexed & in dependent position).

3) The **tendon** attached to the muscle(s) which is/are to be tested must be **clearly identified**.

4) **Strike the tendon with a single, brisk, stroke**.

Medical hammer

Examples of tendon jerks

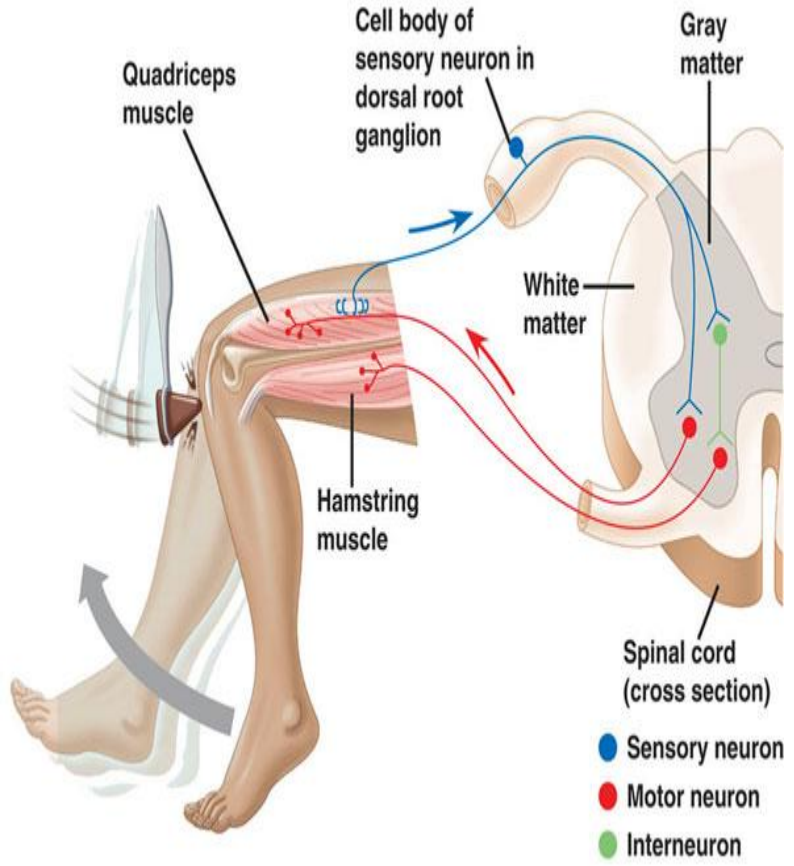
- **Knee jerk:**

Center: L-2-3-4

Muscle Tendon: Tapping on patellar tendon

Movement: Extension of the knee

Contraction of muscle: Quadriceps femoris



Examples of tendon jerks

- **Ankle jerk:**

Center: S1-2

Muscle Tendon: Tapping on tendoachilles

Movement: Plantar flexion.

Contraction of muscle: Gastroceniumus and soleus

Examples of tendon jerks

- **Biceps jerk:**

Center: C5-6

Muscle Tendon: Tapping on biceps tendon.

Movement: Flexion of the forearm.

Contraction of muscle: Biceps muscle.

Examples of tendon jerks

- **Triceps jerk:**

Center: C 6-7

Muscle Tendon: Tapping on triceps tendon directly.

Movement: Extension of the forearm.

Contraction of muscle: Triceps muscle.

Summary of tendon jerks

Jerk	Center	Muscle Tendon	Movement	Contraction of muscle
Biceps jerk	C5,6	Tapping on biceps tendon	Flexion of the forearm	**Biceps muscle**
Triceps jerk	C6,7	Tapping on triceps tendon directly	Extension of the forearm	**Triceps muscle**
Knee jerk	L2, 3 & 4	Tapping on patellar tendon	Extension of the knee	**Quadriceps femoris**
Ankle jerk	S1,2	**Tapping on tendo-Achilles**	**Plantar flexion.**	**Gastrocnemius and soleus**

Reinforcement of the tendon jerks

- The response of the tendon jerks can be **reinforced by facilitating the spinal centers.**
- This can be done by either ;

a.Jendrassik's maneuver → ask the patient to hook his fingers or to clench his teeth → send signals from the contracted ms which stimulating γ-MNs.

b.Distracting patient's attention→ prevents any voluntary inhibition of the reflex.

Clinical Significance of Tendon Jerk

- Examination of the tendon jerks is important in:
- **1. Localization of spinal cord lesions:** Loss of TJ means the lesion in its center e.g., ankle jerk is lost in sacral region lesion.
- **2. Assessment of the ms tone :**

- In hyperreflexia (exaggerated tendon jerks)→ hypertonia (↑ms tone).

- In hyporeflexia (↓ed tendon jerks)→ hypotonia (↓ms tone).

- In areflexia (lost tendon jerks)→ atonia (lost ms tone).

Clinical Significance of Tendon Jerk

- **3. Assessment of the integrity of pathway of stretch reflex:**
- Lost TJ means lesion in its arc, as follow:

Site of lesion	Condition
Afferent lesion	Tabes dorsalis
Center (AHC) lesion	Poliomyelitis
Efferent lesion	Trauma or neuritis

Clinical Significance of Tendon Jerk

- **4. Assessment of the state of Supraspinal centers:**

	Hyperactive(exaggerated) TJ	Hypoactive (decreased) TJ
Physiological causes	Anxiety and nervousness	Sleep and anesthesia
Pathological causes	-UMNL -Lesion in area 6 -tetany and hyperthyroidism -lesion of paleocerebellum	-LMNL -Lesion in area 4 -hypothyroidism -neocerebellar syndrome

Clonus

- **Definition:**

This is alternating rhythmic contractions and relaxations of a muscle in response to sudden maintained stretch.

It is a sign of supraspinal facilitation.

- **Cause:** UMNL

Clonus

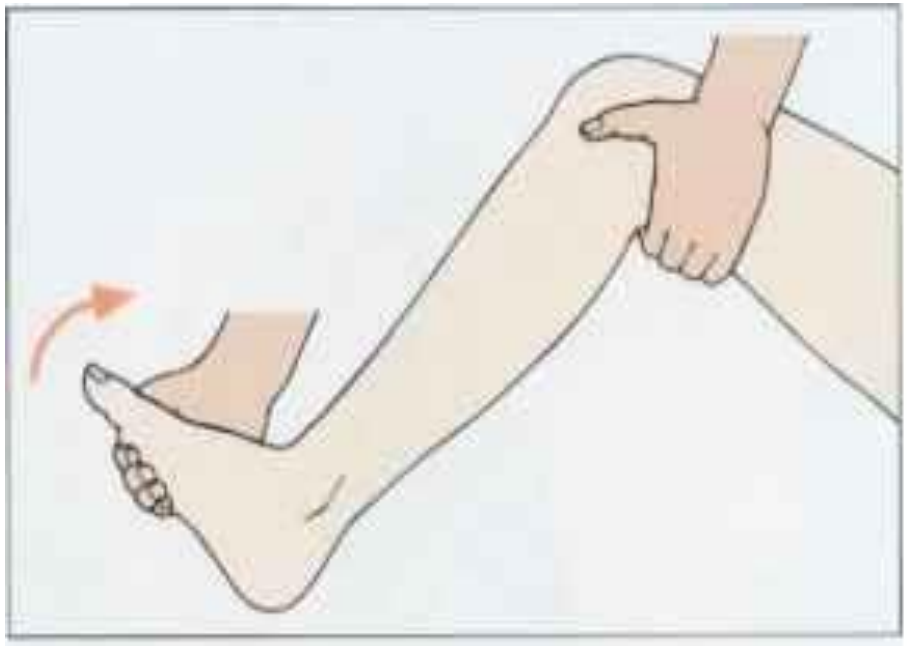
- **Types:**

1. Knee (patellar) clonus:

This is elicited by sudden maintained pulling of the patella downwards, using the index finger and thumb, which produces clonus in the quadriceps femoris muscle.

2. Ankle clonus:

This is elicited by sudden maintained dorsiflexion of the foot, which produces clonus in the calf muscle.



Ankle clonus

- **Mechanism of clonus:**

Clonus is the result of a **stretch reflex inverse stretch reflex sequence**.

Thank you