4

Spinal cord Functions & reflexes

PHYSIOLOGY
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Team 443

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Editing File

Objectives..

- Know levels of nervous control and Enumerate functions of spinal cord
- Define the reflex arc and its components.
- Classify reflexes (superficial ,deep; monosynaptic polysynaptic) with examples and how they differ from each other.
- Describe the spinal cord reflexes, their significance & pathways
- Describe the organization of the spinal cord for motor functions
- Describe withdrawal reflex & crossed extensor reflex
- Recognize the general properties of spinal cord reflexes

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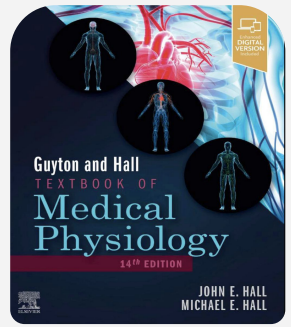


Highly recommended!

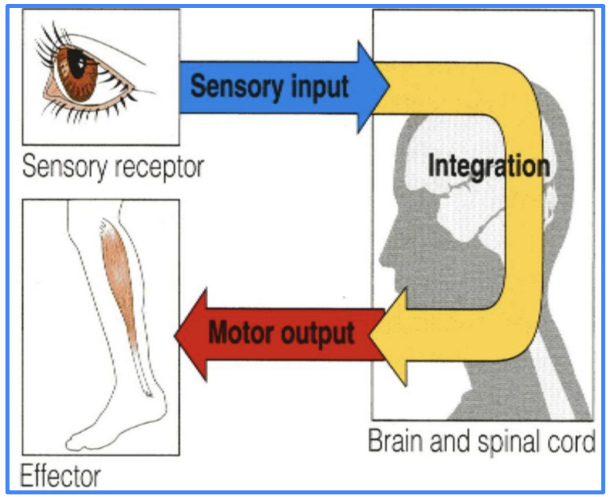
check the pinned comment..

(وَقُلْ رَبِّ زِدْنِي عِلْمًا) [طه: 114]

HOW NERVOUS SYSTEM FUNCTIONS?

From very Simple task to very Complicated..

1. Collection of sensory input
2. Central Integration
   - it happens in the levels of nervous control
3. Motor output



مثال بسيط من الدكتور يوضح أهمية العناصر هاذي كلها وترابطها مع بعض:
لو سألنا شخص عن اسمه بياخذ المعلومة ويفهمها ويجاوبها علطول، لكن لو سألنا نفس الشخص نفس السؤال ولكن بلغة مايفهمها ما بيكون فيه الاوتبت المطلوب، وين حصلت المشكله؟ بالـ Intrgration لأن الشخص مافهم اللغة ..

Levels of nervous system(Nervous Control):

HIGHER BRAIN OR CORTICAL LEVEL:

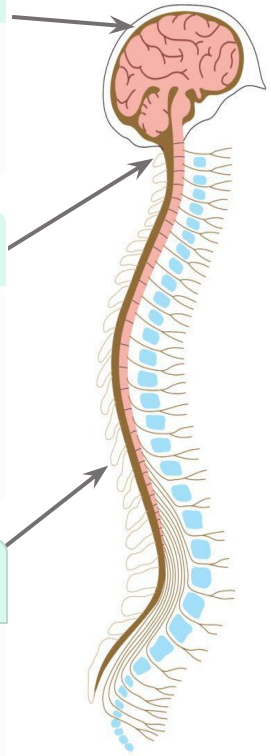
Control all lower centers, thought, processes, memory.
So Lower centers will not work properly without this level

LOWER BRAIN OR SUBCORTICAL LEVEL:

Subconscious activities of the body are controlled in the lower areas of the Brain; the medulla, pons, mesencephalon, hypothalamus, thalamus, cerebellum, and basal ganglia.

SPINAL CORD LEVEL:

(1) walking reflexes
(2) withdrawal reflexes
(3) anti gravity reflexes
(4) Reflexes that control of blood vessels, gastrointestinal, urinary/defecation, Sexual Reflexes



The spinal cord

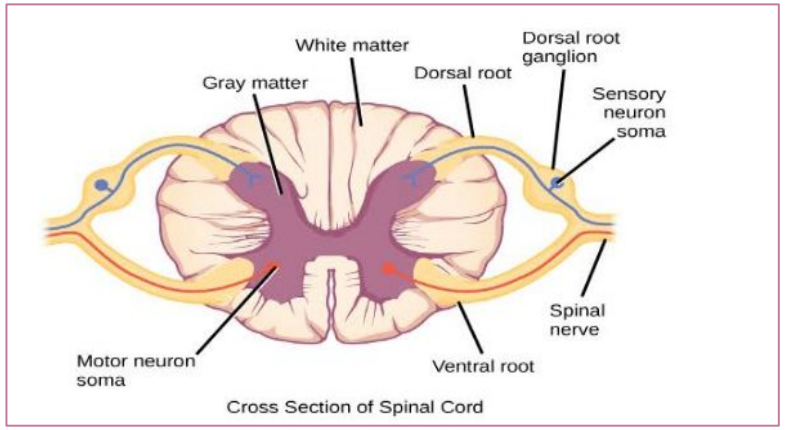
The spinal cord has 31 pairs of spinal nerves. Each spinal nerve has ventral & dorsal roots:

1-THE DORSAL (POSTERIOR) ROOT

- Contains afferent (sensory) fibres coming from receptors.
- The cell body of these neurons is located in dorsal (posterior) root ganglion (DRG).

2-THE VENTRAL (ANTERIOR) ROOT

- Carries efferent (motor) fibres.
- The cell-body of these motor fibres is located in the ventral (anterior) horn of the spinal cord.



Cross Section of Spinal Cord

The spinal cord, count...

Gray matter | Nuclei

- In the grey matter of the spinal cord and brain, clusters of neuronal cell bodies form functional groups called nuclei.
- Sensory nuclei receive input from receptors via sensory neurons.
- Motor nuclei provide output to effector tissue via motor neurons.
- The **posterior** grey horn contains **axons of sensory neurons** and cell **bodies of interneurons.**
- The **lateral** grey horn contains cell bodies of **autonomic** motor neurons.
- The **anterior** grey horn contains cell bodies of **somatic** motor neurons.

The white matter of spinal cord

contains sensory and motor **tracts**:

1- **Sensory tracts** are the "highways" for conduction of sensory nerve impulses toward the brain.

2- **Motor tracts** are the "highways" for conduction of motor nerve impulses from the brain toward effector tissues.

Spinal nerves and the nerves that branch from the spinal cord connect the CNS to the sensory receptors, muscles, and glands in all parts of the body.

Functions of the Spinal Cord

1. Center for Spinal Cord **Reflexes** (Somatic & Autonomic)
2. Gateway and Conduction **Pathways** for all tracts
3. Gateway for **Pain** control systems

The two-way traffic pathways along the spinal cord:

A. **Sensory signals** from receptors enter the cord through the sensory (posterior) roots, then every sensory signal travels to
<u>two separate destinations:</u>
1- One branch of the sensory nerve terminates in the **sensory neurons of the gray matter of the dorsal horn and elicits local segmental cord reflexes.**

2-Another branch transmits signals to **higher levels in the cord , or to the brain stem, or even to the cerebral cortex** through
spinal ascending sensory tracts as:
1- Dorsal Column Tracts (Gracile & Cuneate)
2-Spinocerebellar Tracts
3-Lateral Spinothalamic Tract & Anterior Spinothalamic Tract

B. **Motor signals & brain motor commands** pass through descending motor tracts & motor neurons to spinal efferent motor nerves to skeletal muscles to execute motor functions.

The spinal cord, count...

THE ORGANIZATION OF THE SPINAL CORD FOR MOTOR FUNCTIONS (ANTERIOR HORN CELLS & INTERNEURONS & NEURONAL POOLS)

Anterior Horn Cells:
Located in each segment of the anterior horns gray matter, thousands neurons that are 50 to 100 percent larger than others neurons, they send motor fibers to innervate the skeletal muscle.

What is the motor unit? motor unit is made up of a motor neuron and all of the skeletal muscle fibers, also known as sarcomere innervated by the neuron's axon terminals.

1-Alpha motor neurons:

ربط: ألفا = ألف، أكثر وأكبر

They give rise to **large type A** alpha (Aa) motor nerve fibers, **14** micrometers in diameter; innervate the large skeletal muscle fibers called **extrafusal** fibers.

2-Gamma motor neurons:

Along with the alpha motor neurons are **smaller** gamma motor neurons. They transmit impulses through much smaller type A gamma motor nerve fibers, **5** micrometers in diameter, which go to special skeletal muscle fibers called **intrafusal** fibers.

Spinal Reflexes

What is a reflex?

Functional unit of CNS, a rapid (fast), predictable, involuntary (automatic) response to a stimulus (Change in environment)

-Example:

pinprick causes withdrawal reflex

Remember:

-structural unit of CNS (Neurons)

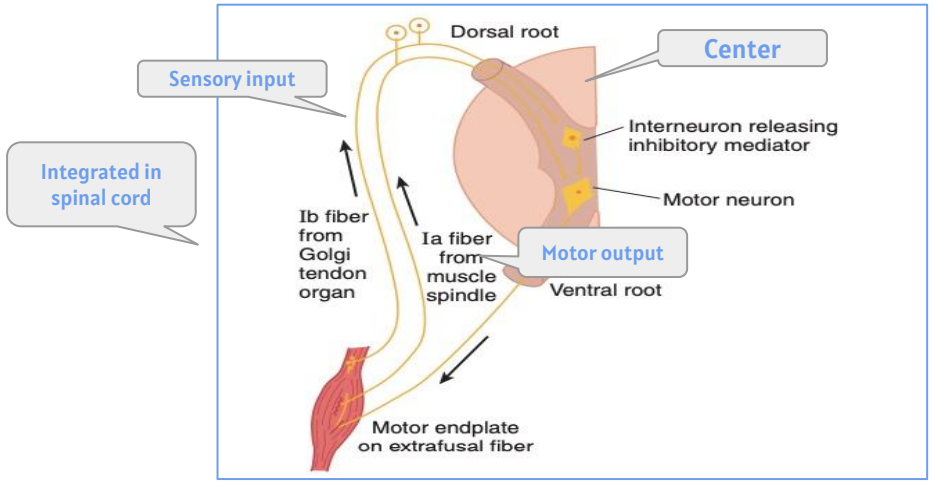
-Fuctional unit of CNS (Reflex)

Terms to remember:
Reflex Arc, ipsilateral, contralateral, monosynaptic, polysynaptic and reciprocal innervation.

What is Stretch Reflexes?

Male slides only

Pathways responsible for the stretch reflex (Tendon jerks) and the inverse stretch reflex (Golgi Tendon reflex). Stretch stimulates the muscle spindle, which activates Ia fibers that excite the motor neuron. Stretch also stimulates the Golgi tendon organ, which activates Ib fibers that excite an interneuron that releases the **inhibitory** mediator **glycine**.



COMPONENTS OF REFLEX ARC

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Reflex Arc: is the pathway followed by nerve impulses that produce a reflex (reflex circuit) \ direct route from a sensory neuron, to an interneuron, to an effector, it includes five functional components:

SENSORY RECEPTOR :

It responds to a specific stimulus (a change in the internal or external environment) by producing a graded potential called a generator (or receptor) potential. If the generator potential reaches the threshold level of depolarization, it will trigger one or more nerve impulses in the sensory neuron.

SENSORY NEURON:

The nerve impulses propagate from the sensory receptor along the axon of the sensory neuron to the axon terminals, which are located in the grey matter to relay neurons which send nerve impulses to the area of the brain that allows conscious awareness that the reflex has occurred. Or it send to motor neuron or interneuron of the spinal cord.

INTEGRATING CENTRE:

One or more neuron in the gray matter within the spinal cord acts as an integrating center. the integrating centre may be a single synapse between a sensory neuron and a motor neuron

COMPONENTS OF REFLEX ARC, count...

MOTOR NEURON (AHCs) :

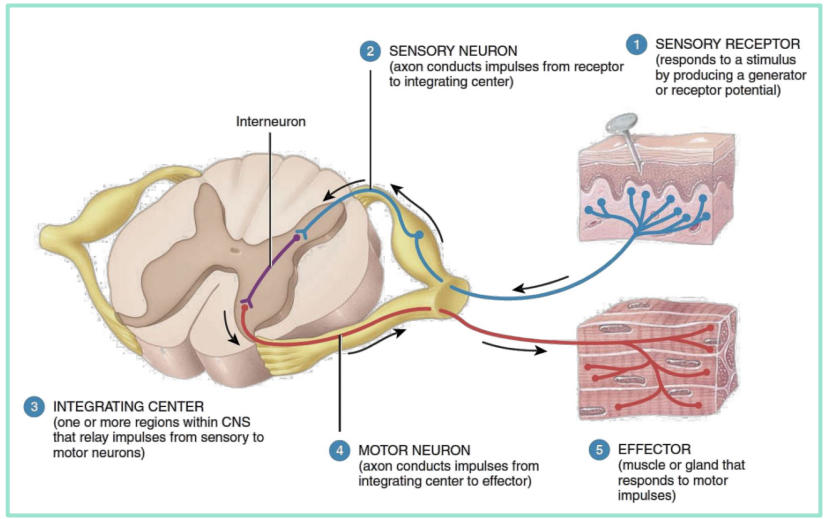
-Efferent Neuron

Impulses triggered by the integrating center propagate out of the spinal cord along motor axons to the part of the body that will respond as skeletal muscle.

EFFECTOR:

The part of the body that responds to the motor nerve impulse, such as a muscle or gland is the effector.

- Its action is called a reflex.
- If the effector is skeletal muscle, the reflex is a somatic reflex.
- If the effector is smooth muscle, or a gland, the reflex is an autonomic (visceral) reflex.



ربط من دكتور ناجي:

SRACER صراصير

S= Stimulus

R= Receptor

A= Afferent

C= Center

E= Efferent

R= Response

Types of integrating center:

1. A reflex pathway having only **one** synapse in the CNS is termed a **monosynaptic** reflex arc.
2. A **polysynaptic** reflex arc: involves more than **two** types of neurons and more than one CNS synapse.

Interneurons & interneuron pool:

- Interneurons are present within the gray matter In the dorsal & anterior horns, and the intermediate areas between them.
- They are 30 times as numerous as the anterior motor
- Neurons, small and highly excitable, often exhibiting spontaneous activity.
- Different types of neuronal circuits are found in the interneuron pool (parallel and reverberating circuits).
- They are excitatory or inhibitory.

Renshaw Cells:

-Small interneurons located in the anterior horns of the spinal cord, in close association with the motor neurons.
-AHCs axon leaves the body of the neuron, sends collateral branches to adjacent Renshaw cells.
-These are inhibitory cells transmit inhibitory signals to the surrounding motor neurons by lateral inhibition
.
-This lateral inhibition helps to focus or sharpen the signals from each motor neuron.

Anterior Horn Cells (Motor neurons)

I. Alpha motor neurons:- large cells, with large myelinated fibres (axons) form 70% of ventral root
- supply extrafusal muscle fibres (2/3 Of skeletal muscle fibers)

2.Gamma motor neurons:- smaller cells- with small axons form 30 % of ventral root
- supply intrafusal muscle fibres (muscle spindles=(I/3 Of skeletal muscle fibers)

NEURONAL POOL CIRCUITS

1. Parallel circuits

- afferent and efferent are parallel to each other (input parallel to output)

2. Reverberatory Circuit

- The simplest reverberatory circuits involves only a single neuron, the output neuron sends a collateral nerve fiber back to its own dendrites or soma to restimulate the input neuron itself & so the circuit may discharge repetitively for a long time and causes signal prolongation.
- A more complex circuits in which both facilitatory and inhibitory fibers involved on the reverberating circuit.
- A facilitatory signal enhances the intensity and frequency of reverberation, whereas an inhibitory signal depresses or stops the reverberation.
- Most reverberating pathways are constituted of many parallel fiber

General Properties Of Reflexes And Their Neuronal Pools such as:

1-Divergence

2-Convergence

3-Reciprocal inhibition

4- Reverberating circuits

5-After-Discharge

6-Central deley

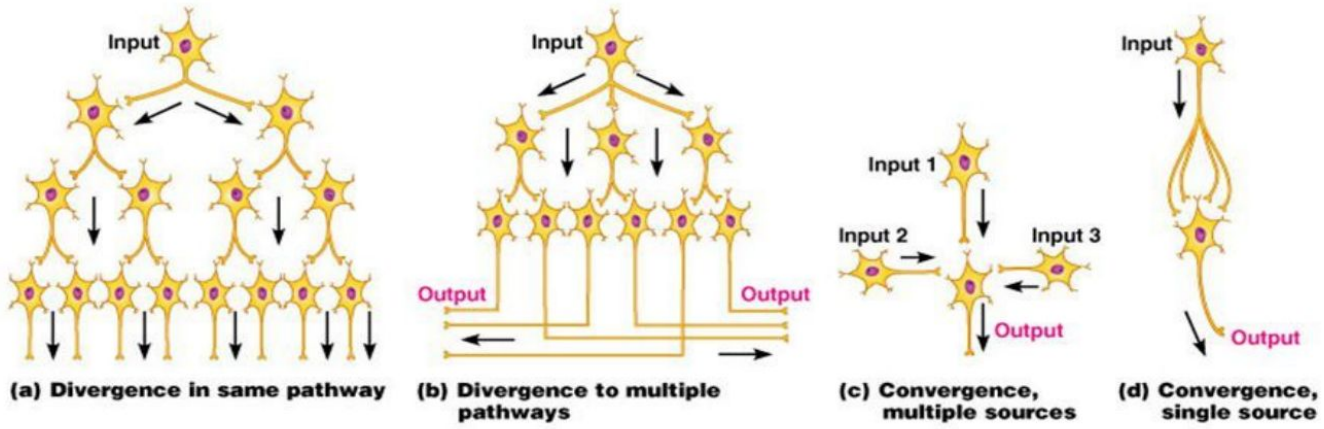
7-Reflex time

8-Recruitment

9-Irradiation

10-minimal synaptic delay

more details in next slides.....



(a) Divergence in same pathway

(b) Divergence to multiple pathways

(c) Convergence, multiple sources

(d) Convergence, single source

Properties of reflexes

Sensory afferent enter spinal cord & as they enter the neuronal pool undergo:

1- Divergence	2- Convergence
Help to spread a single stimulus to a wide area of the spinal cord, so weak signals entering a neuronal pool excite greater numbers of nerve fibers leaving the pool. ❏ Output from one neuron onto many. ❏ Each postsynaptic neuron receives input from the same presynaptic neuron, but may react to it differently. ❏ In a divergent neural circuit ,the axon of one neuron branches to send information to multiple target neuron. ❏ Divergent output allows the same signal to reach many different neurons .	Signals from multiple inputs unit to excite a single neuron multiple action potentials converging on the neuron from multiple terminals provide enough spatial summation to bring the neuron to the threshold required for discharge. (multiple stimuli summate & collect together at the same time)

Properties of reflexes..

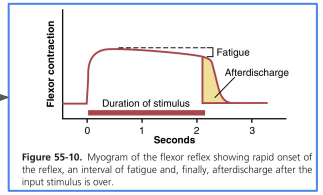


Figure 55-10. Myogram of the flexor reflex showing rapid onset of the reflex, an interval of fatigue and, finally, afterdischarge after the input stimulus is over.

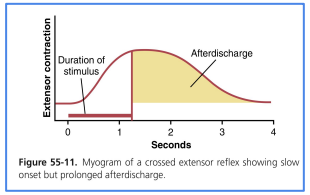


Figure 55-11. Myogram of a crossed extensor reflex showing slow onset but prolonged afterdischarge.

Female slides

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3- After-Discharge

- A signal entering a pool causes a prolonged output - discharge of AHCs called afterdischarge, lasting a few milliseconds to many minutes after the incoming signal is over.

- Types of After-Discharge :

- **Short term afterdischarge** is produced by successive depolarization of the membrane of the neuron after prolonged rhythmic stimulation
- **Prolonged after discharge** results from recurrent pathways that initiate oscillation in reverberating interneuron circuits stimulating AHCs.

- After- discharge occurs due to the following:-

1- Synaptic after-discharge when excitatory synapses discharge on the surfaces of dendrites or soma of a neuron, a postsynaptic electrical potential (PSP) develops in the neuron and lasts for many milliseconds.

-Continue to excite the neuron to transmit repetitive discharges, this cause maintained response continue for some time after cessation of stimulus.

2- Reverberating circuits restimulate AHCs

4- Reciprocal inhibition circuits

-Stimulation of flexors muscle accompanied by inhibition of extensors through inhibitory interneurons , the neuronal circuit that causes this reciprocal relation is called **reciprocal innervation**

-reflex contraction of an agonist muscle is accompanied by inhibition of the antagonist.
-the input fibre excites the excitatory output pathway, but it stimulates an intermediate inhibitory neuron (neuron 2), which secretes a different type of transmitter substance to inhibit the second output pathway from the pool.

-Reciprocal inhibition is required with the monosynaptic reflex.

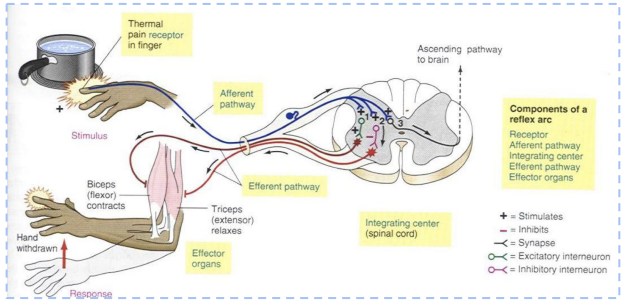
Properties of reflexes, count...

5- Synaptic delay (Central delay)	6-Recruitment	7-Irradiation
• Is the time of reflex to pass through neurons of the spinal cord. • Is the minimal period of time required for transmission of a neuronal signal from a presynaptic neuron to a postsynaptic neuron • Equals 0.5 ms /synapse (it is longer in polysynaptic reflex). - it is > 2 ms in the withdrawal reflex (polysynaptic reflex) • Number of synapses in a reflex = Central delay / 0.5 msc • For knee jerk it equals 0.6 msc = one synapse	Maintained repetitive stimulation of afferent nerve causes Gradual activation of more number of motor neurons (AHCS) Cause of gradual activation/ 1-different conduction velocities of afferents 2-different number of interneurons with short & long pathways to the motor neurons (AHCs)	Spread of excitatory impulses up & down to different segments of motor neurons in the S.C. • A strong stim in sensory afferent irradiate to many segments of S.C due to divergence. • The extent of the response in a reflex depends on the intensity of the stimulus

Reaction time (reflex time)

- Is the time between the application of the stimulus and the response
- Reflex time = central delay + time spent in conduction of impulses along the afferent and efferent nerves
- In humans the reaction time for a stretch reflex such as the knee jerk is 19-24ms.
- The conduction velocities of the afferent and efferent fiber types are known and the distance from the muscle to the spinal cord can be measured (this is responsible for most of the reaction time)

Spinal cord reflexes

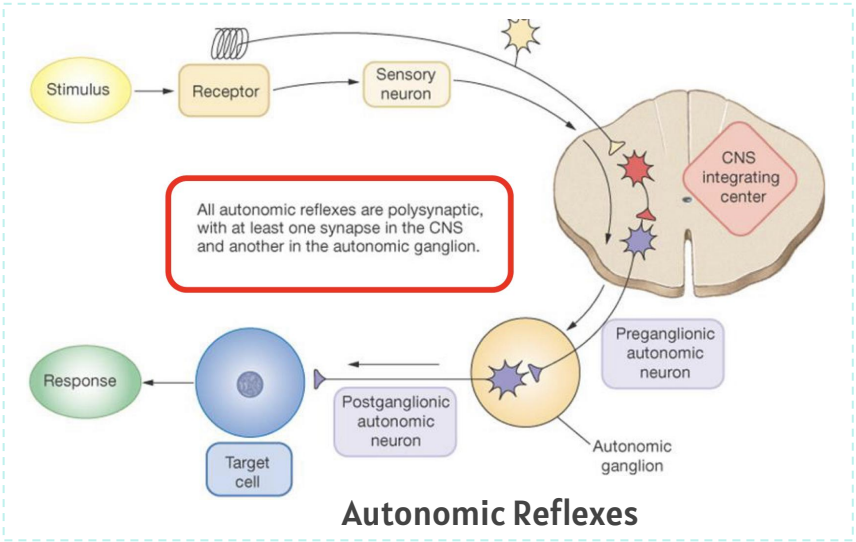


- **Somatic Reflexes Integrated in Spinal Cord:**

Stretch —>Maintain Muscle Tone
Flexor—>Withdrawal
Extensor—>Standing/Posture/Stepping
Rhythmic—>Walking/Scratching

- **Autonomic (Visceral) Reflexes Integrated in Spinal Cord:**

Vasomotor—>Vascular tone
Micturition/Defecation—>Bladder/Bowl
Sexual—> Erection & Ejaculation



Autonomic Reflexes

Reflex	Segmental Innervation	Nerve
Jaw	Pons	Mandibular branch, trigeminal
Biceps	C5, C6	Musculocutaneous
Brachioradialis	C5, C6	Radial
Triceps	C7, C8	Radial
Finger	C8, T1	Median
Knee (patellar)	L3, L4	Femoral
Ankle (Achilles)	S1, S2	Tibial

Types of Reflexes

Overview Slide..

1 Clinical classification

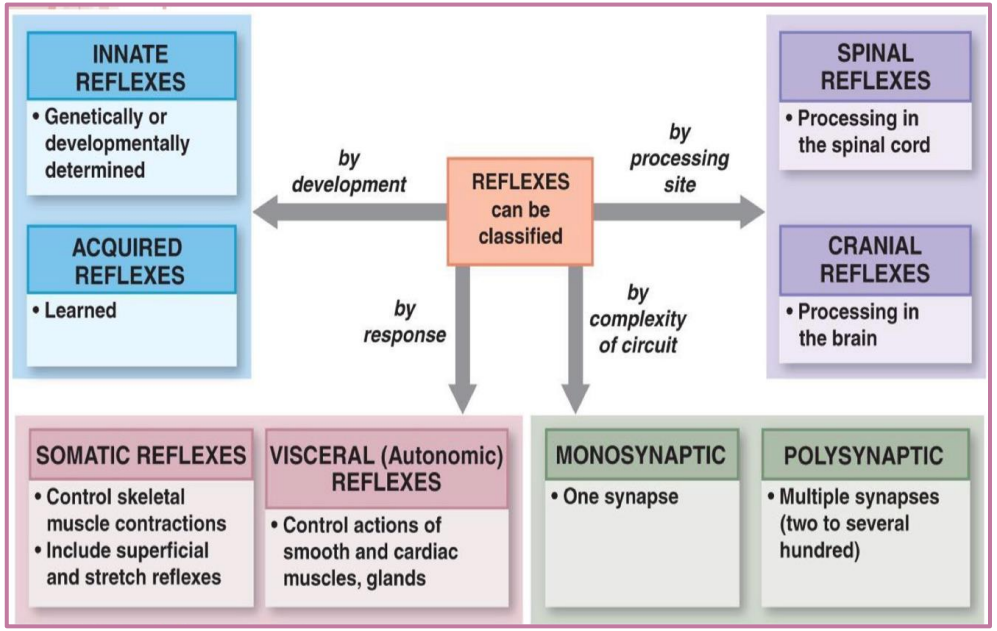
- 1-Superficial reflexes:
- 2-Deep reflexes
- 3- Visceral reflexes

2 Classification By Complexity

- Monosynaptic or stretch reflex or tendon jerk
- Polysynaptic reflex

3 Classification by Response

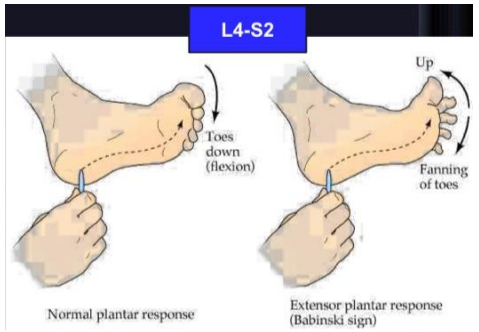
- 1- Somatic reflexes
- 2- Visceral/Autonomic

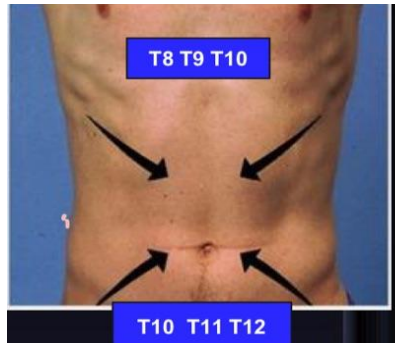


Types of spinal reflexes (According to number of neurons)

Classification of reflexes By **Complexity:**

Monosynaptic or stretch reflex or tendon jerk	Polysynaptic
Sensory axon (afferent) synapse directly anterior horn cell (No interneuron)	Sensory axon (afferent) synapse with one or more interneuron.
Ex.Stretch reflex , Bicep jerk, triceps jerk, supinator jerk, knee jerk, ankle jerk.	Ex.Withdrawal reflex, visceral abdominal reflex (T8-TI2), plantar reflex (L4-S2), Cremasteric reflex (LI-L2)

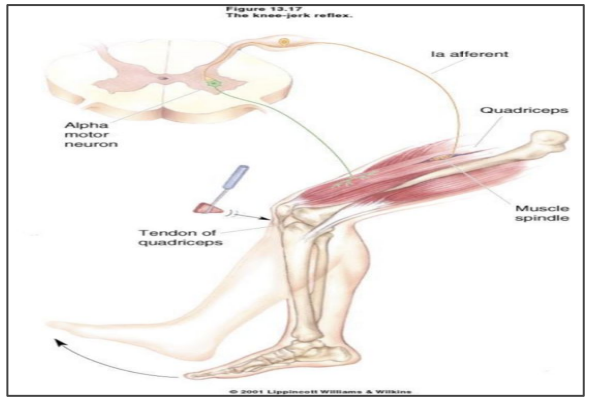




Try it on yourself!!
tip: You can use a tip of a pen

is a superficial reflex found in human males that is elicited when the inner part of the thigh is stroked. Stroking of the skin causes the cremaster muscle to contract and pull up the ipsilateral testicle toward the inguinal canal.

These reflexes are mediated by the spinal cord, but influenced by higher centers.



MONOSYNAPTIC REFLEXES As **knee reflex**:
- When a reflex arc consist of only two neuron in an animal (One sensory neuron, and one motor neuron) It is defined as MONOSYNAPTIC.
- In the simplest type of Reflex, the integration center is a single synapse between a sensory neuron and a motor neuron.

Classification (Types) of reflexes
(According to site of receptor) (clinical classification)

Deep reflexes	Superficial reflexes	Visceral (Autonomic)
Stimulation of receptors which are located deep in muscles spindles and Golgi tendons organs . (1) **Stretch Reflexes** (Tendon jerks) , called tendon reflexes they are monosynaptic, **such as knee-jerk** (patellar reflex) **and ankle jerk** . -The receptor for all these is the muscle spindle (is located deep within the muscle itself) (2) **Inverse Stretch Reflex** (Golgi Tendon organ reflex) , polysynaptic . -The receptor is called Golgi Tendon Organ present deep in the muscle tendon Also there are -Extensor: Standing/Posture/Stepping -Rhythmic Walking/Scratching	-Are polysynaptic (multisynaptic) reflexes. -The receptors are superficial in the skin or mucous membrane. -Involve functional upper motor pathways plus spinal cord level reflex arcs. -Examples are: **Withdrawal, Abdominal reflexes (T8-T12) corneal and plantar** reflex (response) and conjunctival reflexes.	-Are the reflexes where at least one part of the reflex arc is autonomic nerve. -By stimulation of receptors in wall of viscera as Micturition, defecation. -E.g, **pupillary reflex, carotid sinus reflex**

Withdrawal reflex

Female slides

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- **Characterised by:**

1- **Diverging circuits:** to spread the reflex to the necessary muscles for withdrawal.

2- **Reciprocal inhibition circuits:** stimulation of flexors muscles(agonist) accompanied by inhibition of extensors(antagonist) through inhibitory interneurons.

3- **Recruitment(**Motor unit recruitment): If a repetitive & stronger stimulus is maintained, there will be gradual increase in the force of the muscle contraction until the maximum force is reached , due to gradual recruitment/activation of more and more motor neurons

4- **After-discharge:** The ability of neurons to rhythmically discharge impulses for a relatively longer time after cessation of the stimulus.

-Circuits to cause after discharge lasting many fractions of a second after the stimulus is over.

-The duration of after-discharge depends on the intensity of the sensory stimulus that elicited the reflex.

-Cause : Presence of reverberating circuit & synaptic after-discharge restimulate AHCs

-Value : Prolong the protective response of reflex

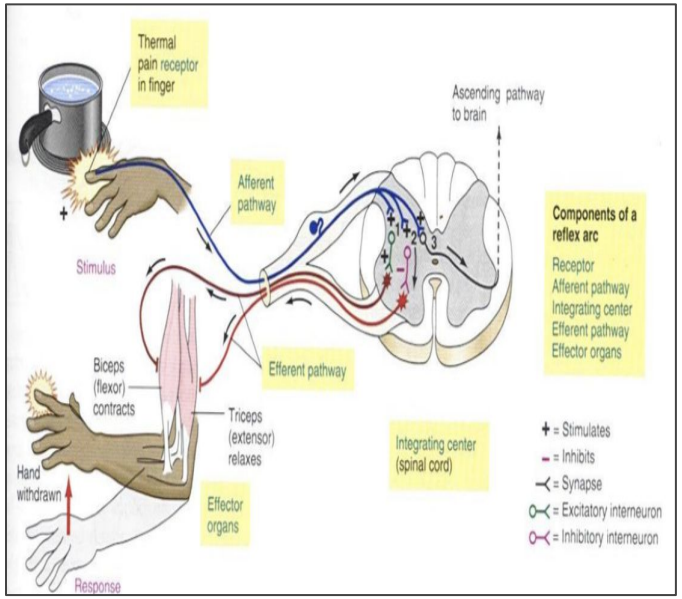
5- **Irradiation:** Spread of impulses up & down to different segments and motor neurons in the S.C.

A strong stim in sensory afferent irradiate to many segments of S.C due to divergence

-The extent of the response in a reflex depends on the intensity of the stimulus.

Weak stim: irradiates to small number of neurons , so it causes weak flexion of limb

Strong stim: irradiates to large number of neurons , so it causes strong withdrawal of affected limb & extension of opposite limb.(as in crossed extensor reflex)



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Reflex	Withdrawal reflex (flexor reflex) (nociceptive reflex):
Overview	-In the spinal or decerebrate animal, almost any type of cutaneous sensory stimulus from a limb is likely to cause the flexor muscles of the limb to contract, thereby with drawing the limb from the stimulating object. This reflex is called the **flexor reflex**. -Superficial polysynaptic reflex. - Stimulation of pain receptors of hand (a pin- prick, heat, or a wound)—>impulses to SC in pain fibers as A delta or C fibres —> Interneuron pools —> motor neurons —> stimulate hand flexor muscles —> move the hand away from the injurious stimulus
Clinical test|stemulus	Sharp painful stimulus (stepping on nail)
Response	Limb is rapidly withdrawn
Sensory receptor	Cutaneous skin and pain receptors (Elicited most powerfully by stimulation of pain endings)
Synapses involved	Polysynaptic (via interneuron)
Effects on muscle	Contracts flexor muscle
Other effects	- Relaxes (-) extensor muscle of the same limb - Reverse effect on opposite limb (cross extensor reflex)
Function	- Protective-Withdrawal from painful stimulus - Cross extensor aids in maintaining posture when opposing leg is lifted

Crossed Extensor Reflex

●About **0.2 to 0.5 seconds** after a stimulus elicits a flexor reflex in one limb, the **opposite limb** begins to **extend**. This reflex is called the **crossed extensor reflex.** / It takes 200 to 500 milliseconds after onset of the initial pain stimulus, because many interneurons are involved in the circuit between the input sensory neuron and the motor neurons of the opposite side of the cord.

● Mostly in the lower limb to support balance.

● With strong stimulus while pushing the body **away from the injurious agent** by **withdrawal reflex**, the **crossed extensor reflex** in the other limb **supporting the body weight** against gravity, Flexion and withdrawal of the stimulated limb --> extension of the opposite limb>> why?

● Flexors in the opposite limb are inhibited while extensors are excited ,the crossed extensor reflex supporting the body weight against gravity.

●Extension of the opposite limb can push the entire body away from the object, causing the painful stimulus in the with-drawn limb, after the painful stimulus is removed, the crossed extensor reflex has a prolonged after-discharge, Crossed extensor reflex prolonged than flexor, why? results from reverberating circuits.

● Reciprocal innervations occurs in crossed extensor reflex. How?

●Signals from sensory neurons that activates withdrawal reflex in the stimulated limb, cross to the opposite side of the cord by irradiation & divergence to excite excitatory interneurons to activate motor neurons of extensor muscles neurons & send collaterals to inhibitory interneurons to inhibit motor neurons of the flexors (in the other limb).

Irradiation and Recruitment

Strong stimuli can generate activity in the interneuron pool that spreads

Irradiation

This spread of excitatory impulses up and down the spinal cord to more and more motor neurons is called **irradiation** of the stimulus.

Recruitment

The gradual increase in the number of active motor units is called **recruitment** of motor units.

Examples of reflexes

Reflex of Posture and Locomotion	Stepping and walking movements	Scratch reflex	Spinal cord reflexes that cause muscle spasm
• Positive Supportive Reaction • Cord "Righting" Reflex	• Rhythmical Stepping Movements of a Single Limb. • Reciprocal Stepping of Opposite Limbs. • Diagonal Stepping of All Four Limbs—"Mark Time" Reflex. • Galloping reflex.	• Position sense that allows the paw to find the exact point of irritation on the surface of the body. • A to-and-fro scratching movement.	• Muscle Spasm Resulting From a Broken Bone. • Abdominal Muscle Spasm in Persons with Peritonitis. • Muscle Cramps.

Segmental autonomic reflexes (integrated in the Spinal Cord)	Mass reflex
• changes in vascular tone resulting from changes in local skin heat • sweating, which results from localized heat on the surface of the body. • intestinointestinal reflexes that control some motor functions of the gut. • peritoneointestinal reflexes that inhibit gastrointestinal motility in response to peritoneal irritation. • evacuation reflexes for emptying the full bladder.	In a spinal animal or human being, sometimes the spinal cord suddenly becomes excessively active by painful stimulus , causing massive discharge in large portions of the cord leads to muscle spasm, bowel/bladder evacuations, sweating and increase BP

Practice Questions?

We discuss FOUR major reflexes that are integrated within the spinal cord: the stretch reflex, the Golgi tendon reflex, the withdrawal reflex and the crossed extensor reflex.

- Stretch reflex is: Monosynaptic, Somatic, Deep, Stretch, Spinal.
- Inverse Stretch reflex is: Polysynaptic, Somatic, Deep, Stretch, Spinal.
- Knee jerk is: Monosynaptic, Somatic, Deep, Stretch, Spinal.
- Abdominal reflex is?

- What are the 5 components of a reflex arc?
- How does effector pathway in an autonomic reflex differ from that of a somatic reflex?
- Give 3 examples of each category in superficial, deep and autonomic reflexes?
- What is reciprocal innervation and reciprocal inhibition?
- Why crossed extensor reflex is prolonged compared to flexor reflex response?

TEST YOURSELF !

1- What is it called when an output neuron sends restimulating collaterals to the input nerve?

A) Reverberation

B) Divergence

C) Convergence

D) Reactivation

2- What is the function of Renshaw cells in the spinal cord?

A)Sending signals to the higher cortex

B)Excitatory signals to neighbouring neurons

C)Inhibitory signals to neighbouring neurons

D)Control of lower limb movement

3-Which one of the following is a deep reflex?

A)Tendon jerk

B)Withdrawal reflex

C)Plantar reflex

D)Visceral reflex

4- Regarding gamma, which one is correct?

A)supply extrafusal fibers

B)sensitive to spindle stretch

C)don't receive supraspinal

D)cause direct contraction to muscles

Answers : A, C, A, B

SAQ

1- Enumerate the component of reflex arc?

in Slides

2- Explain Reciprocal inhibition circuits?

in Slides

3- What are the classification of reflexes according to receptors? give an example to each.

Answer 3: Deep (ex: knee jerk), 2. Superficial (ex: planter reflex) 3. Visceral (ex: carotid sinus reflex)

اللهم إني استودعتك ما فهمت وما حفظت وما تعلمت فرُده إلىّ عند حاجتي إليه ..

Team Leaders


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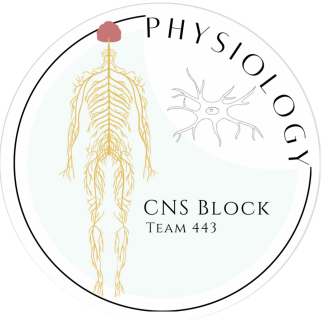

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