



Physiology of Postural Reflexes



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- Important
- Further Explanation

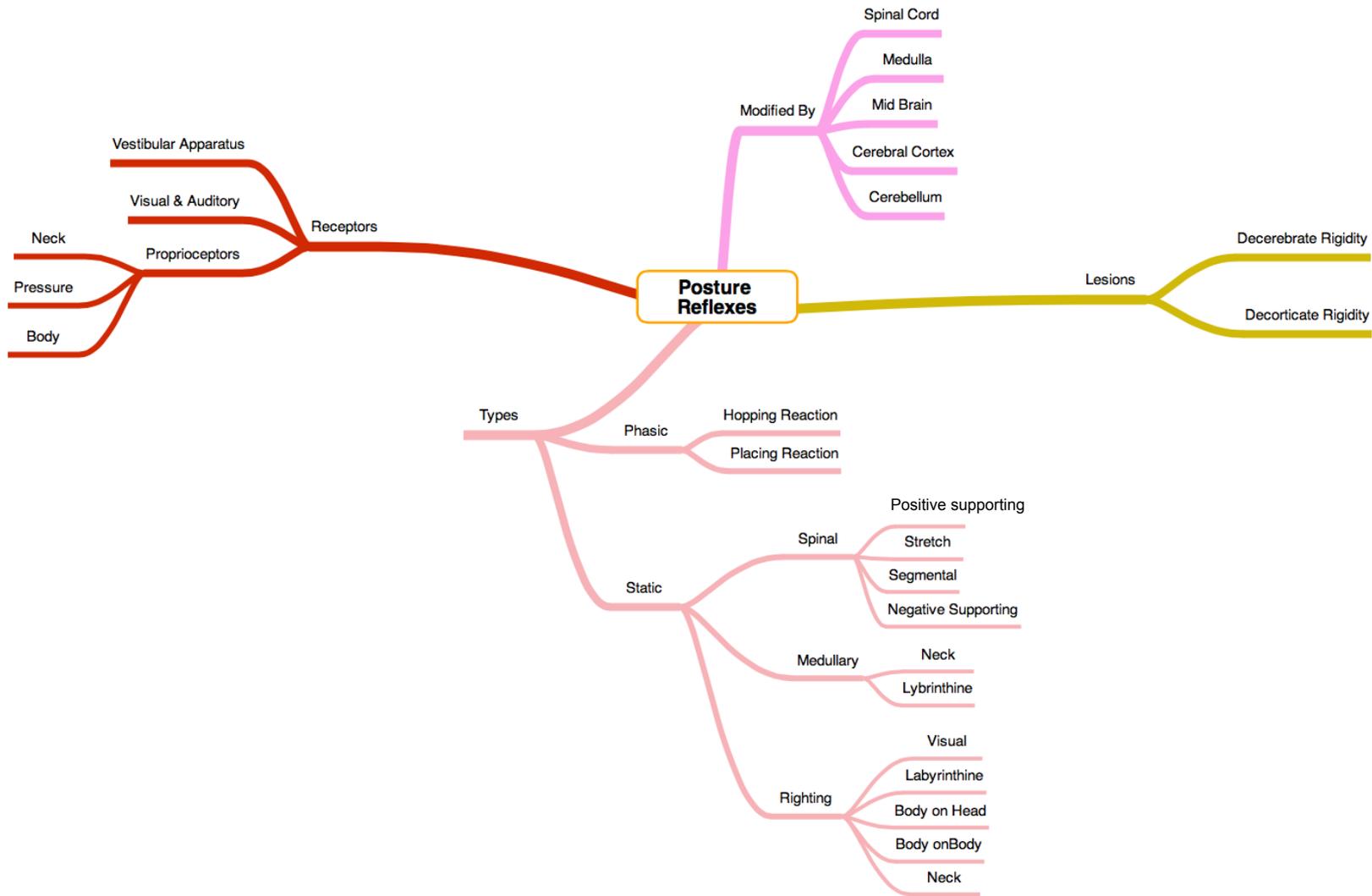
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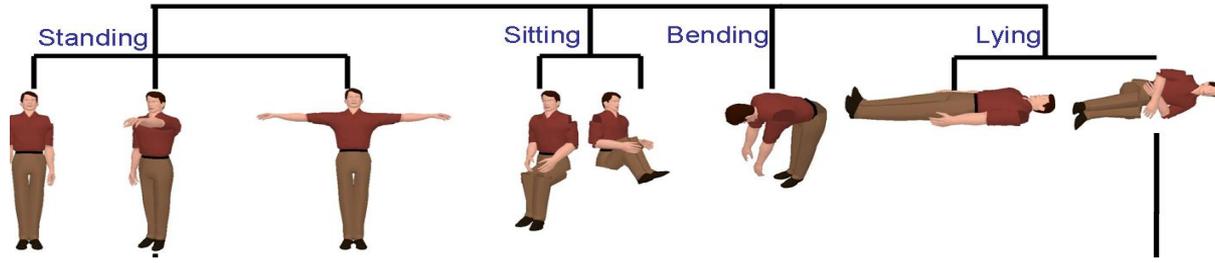
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Posture & Equilibrium



❖ **General Definition of Posture:**

It is maintenance of upright position against gravity (center of body is needed to be between the legs) it needs **antigravity muscles**

So stand up straight, put your shoulders back, and lift that chin up 😊..

❖ **Up-right posture** need **postural reflexes**

❖ Posture depends on **muscle tone (stretch reflex)** (basic postural reflex)

❖ **The main pathways concerned with posture are:-**

A- **Medial tracts** as vestibulospinal tract and medial corticospinal tract control **proximal limbs** & axial muscles for posture & gross movements¹.

B- **Lateral tracts** as lateral corticospinal tract and rubrospinal tract control **distal limbs** ex. fingers , toes

¹: are the bigger movements -such as rolling over and sitting- that use the large muscles in the arms, legs, torso, and feet.

Receptors of Postural Reflex

Postural reflexes depends on the following receptors:

1. Vestibular apparatus receptors

- ✧ Maculae for linear acceleration & orientation of head in space
- ✧ Semicircular canal's cristae for angular acceleration

2. Visual & auditory receptors:-

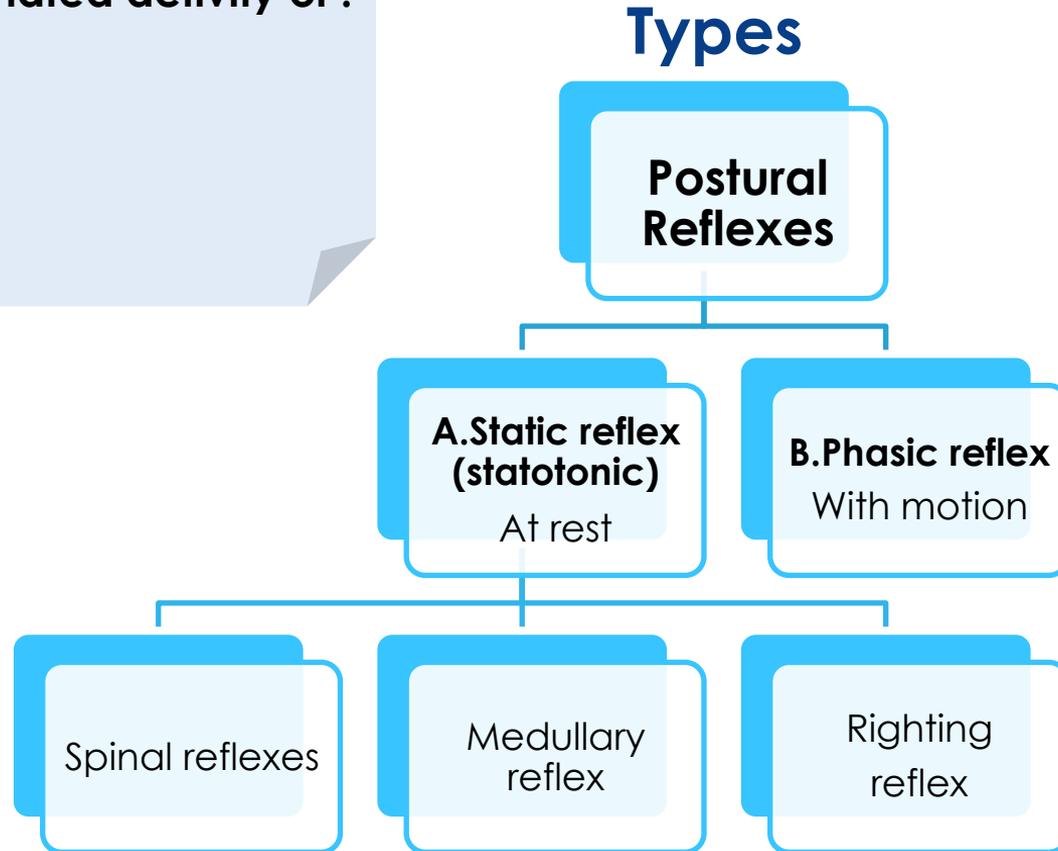
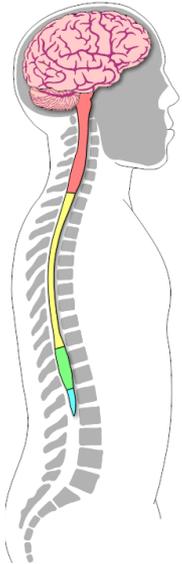
- ✧ Vision can compensate for loss of auditory, vestibular & proprioception
- ✧ (Tabes dorsalis syphilitic myelopathy +ve Rombergism)
- ✧ If Patient with sensory ataxia stands with eyes closed he will fall down

3. Proprioceptors of muscles , tendons , ligaments & joints:-

A. Neck Proprioceptors	B. Body Proprioceptors	C. Pressure Receptors
Detect head position in relation to trunk	Proprioceptors of anti-gravity muscles	As in sole of feet initiate positive supporting reaction (magnet reflex)

✧ **Stretch reflexes & postural reflexes can be modified by coordinated activity of :**

- 1- Spinal cord
- 2- Medulla
- 4- Midbrain
- 5- Cerebral cortex
- 6- cerebellum



Spinal Reflexes

Local Static Reflexes	As positive supporting reaction (magnet reflex) (receptors are proprioceptors of flexors) flexors and extensors are contracted, so there is no reciprocal inhibition.
Stretch Reflex	Discussed earlier!! See stretch reflex lecture.
Segmental Static Reflexes	Mediated by one segment of the spinal cord as crossed extensor reflex
Negative Supporting Reflex	(Which release +ve supporting reaction) receptors are proprioceptors of extensors of the released limb.

N.B Spinal reflexes can be studied in spinal animal with cut at neck between the spinal cord & brain stem so all spinal cord is intact.

THEY ONLY CUT THE FIBERS AND THE NEURAL CONNECTION, NOT THE WHOLE STRUCTURES..

Medullary Static Reflexes

Center in the medulla oblongate



<h3>Neck Static Reflexes</h3> <ul style="list-style-type: none">•Decerebrated¹ animal cut above medulla•Labyrinth destroyed	<p>Stimulus: Changing head position</p> <p>Receptors: Neck proprioceptors</p> <p>Response:</p> <ul style="list-style-type: none">•Ventroflexion of head arms flexion + extend hind limb (as in decerebration)•Dorsiflexion of head arms extended + flexed hindlimb².•Turning head to one side extension of limbs on that side + flexion of other side.
<h3>Labyrinthine Static Reflex</h3> <ul style="list-style-type: none">•Decerebrated animal•Elimination of neck proprioceptors•Labyrinth intact	<p>Stimulus: Gravity</p> <p>Receptors: Otolith organs (maculae)</p> <p>Response:</p> <ul style="list-style-type: none">•Ventroflexion of head (or prone position) 4 limbs flexion•Dorsiflexion of head (or supine position) 4 limbs extended (as in decortication)

1: Removing the cerebrum 2: Either of the back limbs of an animal.

Righting¹ Static Reflex

When upright posture is disturbed as in falling down studied in a decerebrated animal (**Cut above midbrain**)

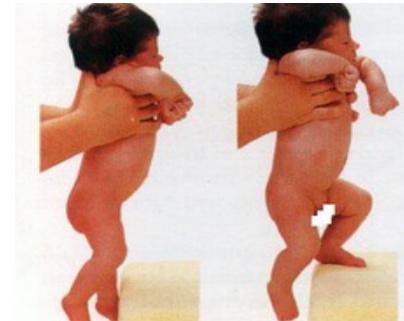
Reflex	Site	Stimulus	Receptor	Response
Visual Righting Reflexes	Center in cerebral cortex	Visual stimulus	Eye receptors	Adjustment of posture according to the visual image
Labyrinthine Righting Reflexes	Midbrain	Covered eyes and tilting the head	Otolith organs to stimulate neck muscles to correct the head level	Righting of head
Body on Head Righting Reflexes		Pressure on side of body	Trunk proprioceptors	Reflex correction of head.
Body on Body		Pressure on side of the body and head is fixed	Trunk proprioceptors	Reflex correction of body
Neck Righting Reflexes		Stretch of neck muscles (if head is corrected & body still tilted) righting of shoulders & body.	Muscle spindles of neck muscles	Righting of body

B. Phasic Reflexes (Statokinetic Reflexes)

✧ It is to maintain Posture during Movement.

✧ Center: cerebral cortex

Reaction	I. Hopping Reaction	II. Placing Reaction
Stimulus	The animal is moved laterally. (the majority of its weight is on one limb)	Blind folded animal suspended in air & moved towards a supporting surface.
Receptor	In muscle spindles.	Touch receptors and proprioceptors in soles of feet
Response	Normal animals hop on the tested limb to accommodate a new body position	The feet will be placed firmly on the supporting surface



Decerebrate Rigidity & Decorticate Rigidity

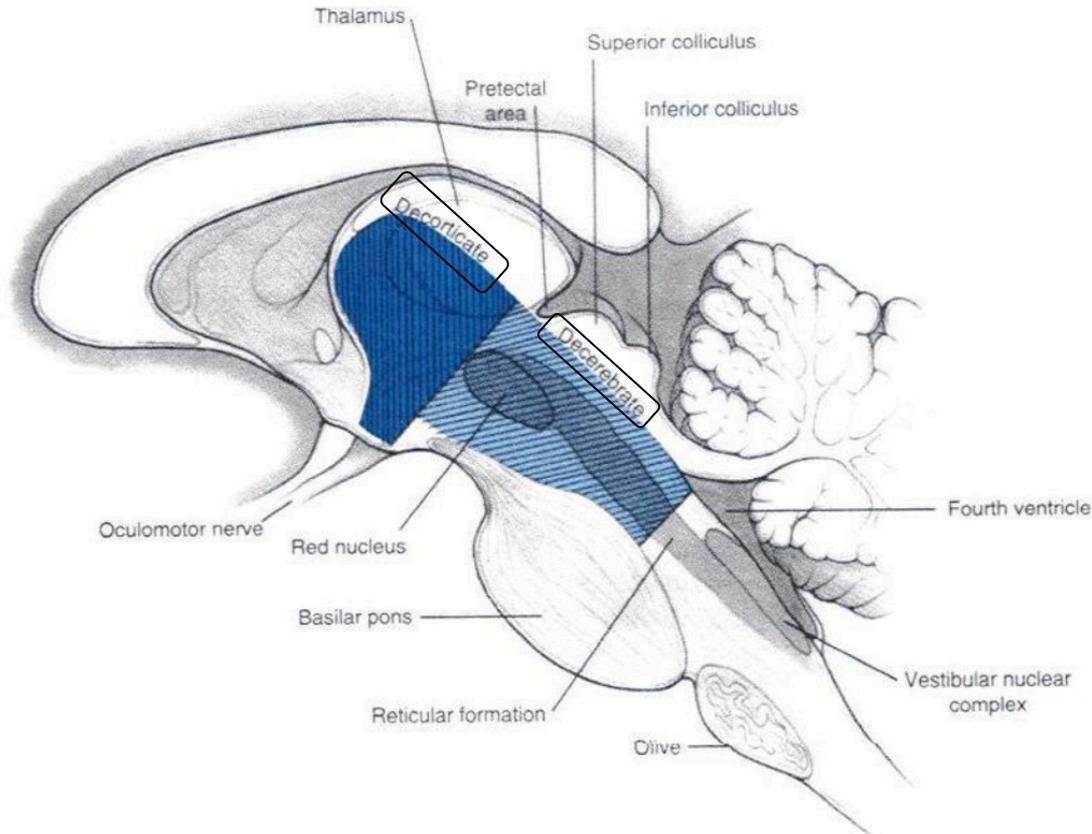


Figure 7-3 Median view of brainstem showing levels of impairment associated with abnormal posturing: rostral to red nucleus—decorticate; midbrain or rostral pons—decerebrate.

I. Decerebrate Rigidity

- It is a **midcollicular lesion** (section between superior & inferior colliculi of midbrain)
- block normal **inhibitory** signals from brain (corticospinal and corticobulbar tracts) and red nucleus (rubrospinal tract) in midbrain to tonically active Pontile R.F and Vestibular nucleus.

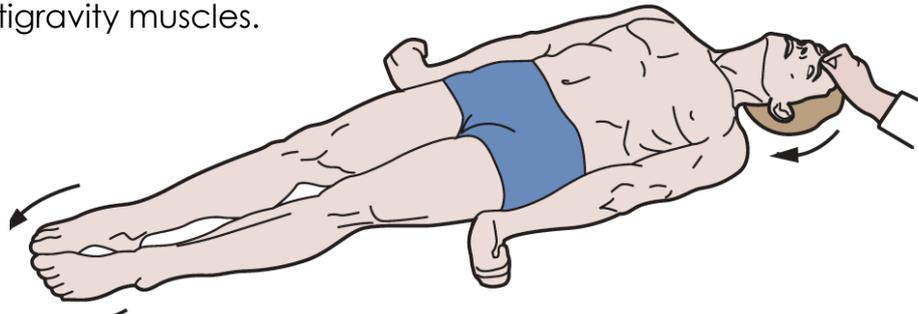
*It happens In human by vascular lesion of brain stem between red N & vestibular nucleus

- **Causing:**

- ✧ Maintained tonic static postural reflexes that support animal against gravity (medullary tonic neck & labyrinthine R).
- ✧ Absent midbrain righting R.
- ✧ Extension of head & 4 limbs extensors. The jaw may be clenched with the neck hyperextended due **to increased** extensor tone from vestibulospinal & reticulospinal tracts to extensor motor neurons.
- ✧ Spasticity, rigidity and extension in antigravity muscles.



Clenched jaw



II. Decorticate Rigidity

* More common in humans

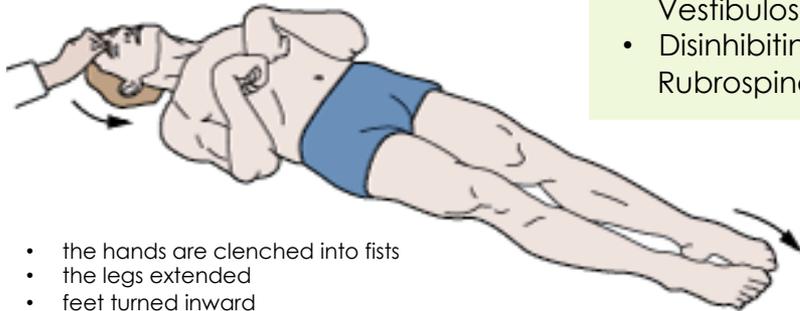
Location: **lesion in cerebral cortex but brain stem is intact.**

- ◇ Medullary tonic neck & tonic labyrinthine reflexes present.
- ◇ Righting midbrain reflexes present.
- ◇ Visual righting, placing & hopping reflexes lost. (They're in the cerebral cortex)
- ◇ It causes extensor rigidity in legs & moderate flexion of arms **if head unturned**.
- ◇ **Tonic neck reflexes** are produced **by turning the head to one side** e.g. to the left → extension of limbs on left side & flexion on right side.

Tonic neck reflex



- ◇ Since the Corticospinal tract is interrupted:
 - The pontine reticulospinal and the medial and lateral Vestibulospinal extend Lower L.
 - Disinhibiting of the red nucleus with facilitation of the Rubrospinal tract flex Upper L.



- the hands are clenched into fists
- the legs extended
- feet turned inward

(as what seen in Hemiplegic patients on affected side **after Hemorrhage of internal capsule**, there is loss of inhibitory cortical signals to gamma motor neurons via reticulospinal (from suppressor area 4 strip in the anterior edge of precentral gyrus)

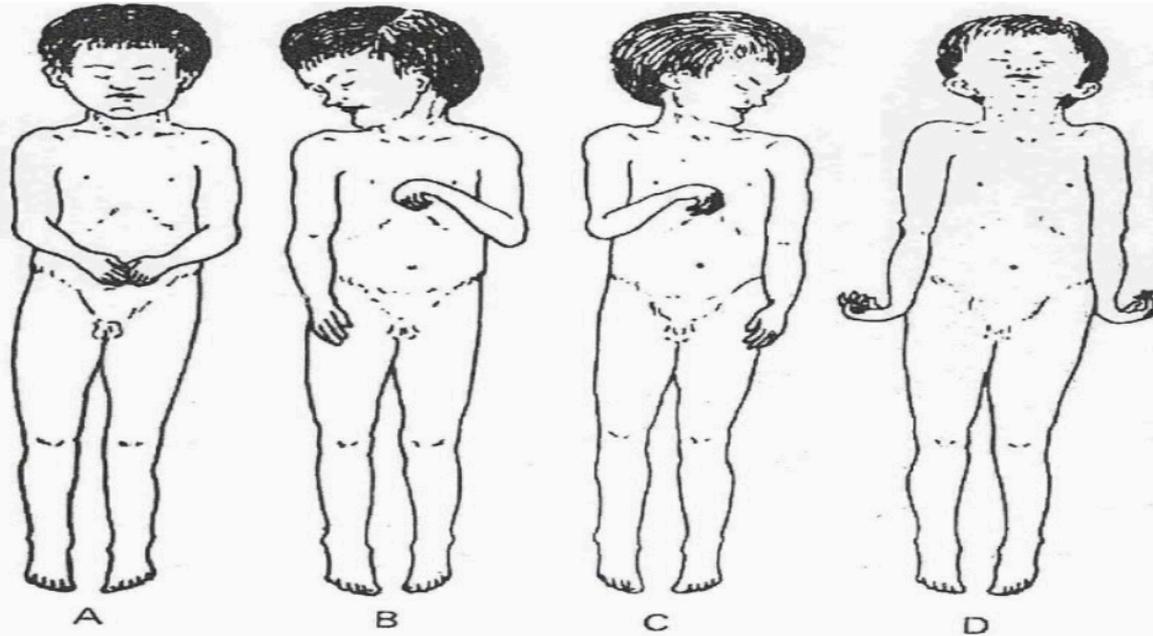


Figure 12-7. Human decorticate rigidity (**A–C**) and true decerebrate rigidity (**D**). In **A** the patient is lying supine with the head unturned. In **B** and **C**, the tonic neck reflex patterns produced by turning of the head to the right or left are shown. (Reproduced, with permission, from Fulton JF [editor]: *Textbook of Physiology*, 17th ed. Saunders, 1955.)

	Reflex	Receptor	Stimulus	Response	Center	
Static	Spinal	Stretch	Muscle Spindle	Stretch	Contraction of muscle	Spinal Cord
		Negative Supporting	Proprioceptors in extensors		Release of of positive supporting reaction	
		Positive Supporting	Proprioceptors in distal flexor	Contact with sole or palm	Foot extended to support body	
		Segmental as: Crossed extensor	Pain receptors	Sharp painful	Flexion of stimulated limb & extension of other limb.	
	Medullary	Labyrinthine	Otolithic Organ	Gravity → Ventroflexion of head	Flexion of 4 limbs	Medulla
				Gravity → Dorsiflexion of head	Extension of 4 limbs	
		Neck	Neck proprioceptors	Head to side	Extension of limbs on that side & flexion of other side.	
				Dorsiflexion of head	Arms extended & flexed hindlimb	
	Ventroflexion of head	Arms flexion & extend hindlimb				
	Righting	Visual	Eye receptors	Visual cues	Adjustment of posture according to the visual cues	Cerebral Cortex
		Labyrinthine	Otolith organ	Covered eyes and tilting the head	Righting of head	Midbrain
		Body on Head	Trunk proprioceptors	Pressure on side of body	Reflex correction of head.	
		Body on Body		Pressure on side of the body	Reflex correction of body	
	Neck Righting	Muscle spindles	Stretch of neck muscles	Righting of body		
	Phasic	Hopping Reaction	Muscle spindles	The animal is moved laterally.	Normal animals hop on the tested limb to accommodate a new body position	Cerebral Cortex
Placing Reaction		Touch receptors & proprioceptors in soles of feet	Blind folded animal suspended in air & moved towards a supporting surface.	The feet will be placed firmly on the supporting surface		

1- Posture depends on?

- A. Gravity
- B. Vision
- C. Muscle tone

2- What does body proprioceptors detect?

- A. Head position in relation to trunk
- B. Anti-gravity muscles
- C. Non of above.

3-What is the receptor for labyrinth righting reflex?

- A. Muscle spindles
- B. Trunk proprioceptors
- C. Otolith organs

4- Which of the following reflexes is lost in decorticate rigidity

- A. Visual righting.
- B. Placing reflex.
- C. hopping reflex.
- D. All of above.

5- Which of these reflexes is present in Decerebrate rigidity?

- A. Righting Reflexes
- B. Placing and Hopping Reactions
- C. Tonic Neck Reflex

6-For efficient well-coordinated posture we need:

- A. Vestibular apparatus.
- B. Basal ganglia.
- C. Cerebellum.
- D. All of above.

7-Which of the following is a statokinetic reflex:

- A. Spinal reflex
- B. Placing reflex
- C. Medullary reflex

8-The effects on corticospinal and rubrospinal tracts by lesions above the red nucleus is what leads to:

- A. Extensor posturing of the UL and flexion posturing of the LL.
- B. Flexion posturing of the UL and extensor posturing of the LL.

1- what are the main pathways concerned with posture?

- Medial pathways → control proximal limbs & axial muscles for posture & gross movements.
- Lateral pathways → control distal limbs.

2-Which time of rigidity is possible to be seen on the hemiplegic side in humans after hemorrhages or thromboses in the internal capsule?

Decorticate Rigidity.

3- What is the reason for the extension of all limbs in decerebrate rigidity?

It is because the inhibitory signals from the brain and red nucleus are blocked, that will result in excitation of Medial Reticulospinal & Vestibulospinal tracts.

4- What are the clinical features of decorticate posture rigidity?

- the hands are clenched into fists
- the legs extended
- feet turned inward.

5- What are the structure needed to maintain coordination of Stretch reflexes & postural reflexes?

1. Spinal cord
2. Medulla
3. Midbrain
4. Cerebral cortex
5. Cerebellum

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

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YOU HAVE THE ABILITY
TO CHOOSE WHICH WAY
YOU WANT TO GO. YOU
HAVE TO BELIEVE GREAT
THINGS ARE GOING TO
HAPPEN IN YOUR LIFE.
DO EVERYTHING
YOU CAN - PREPARE,
PRAY AND ACHIEVE -
TO MAKE IT HAPPEN.

BEN CARSON

