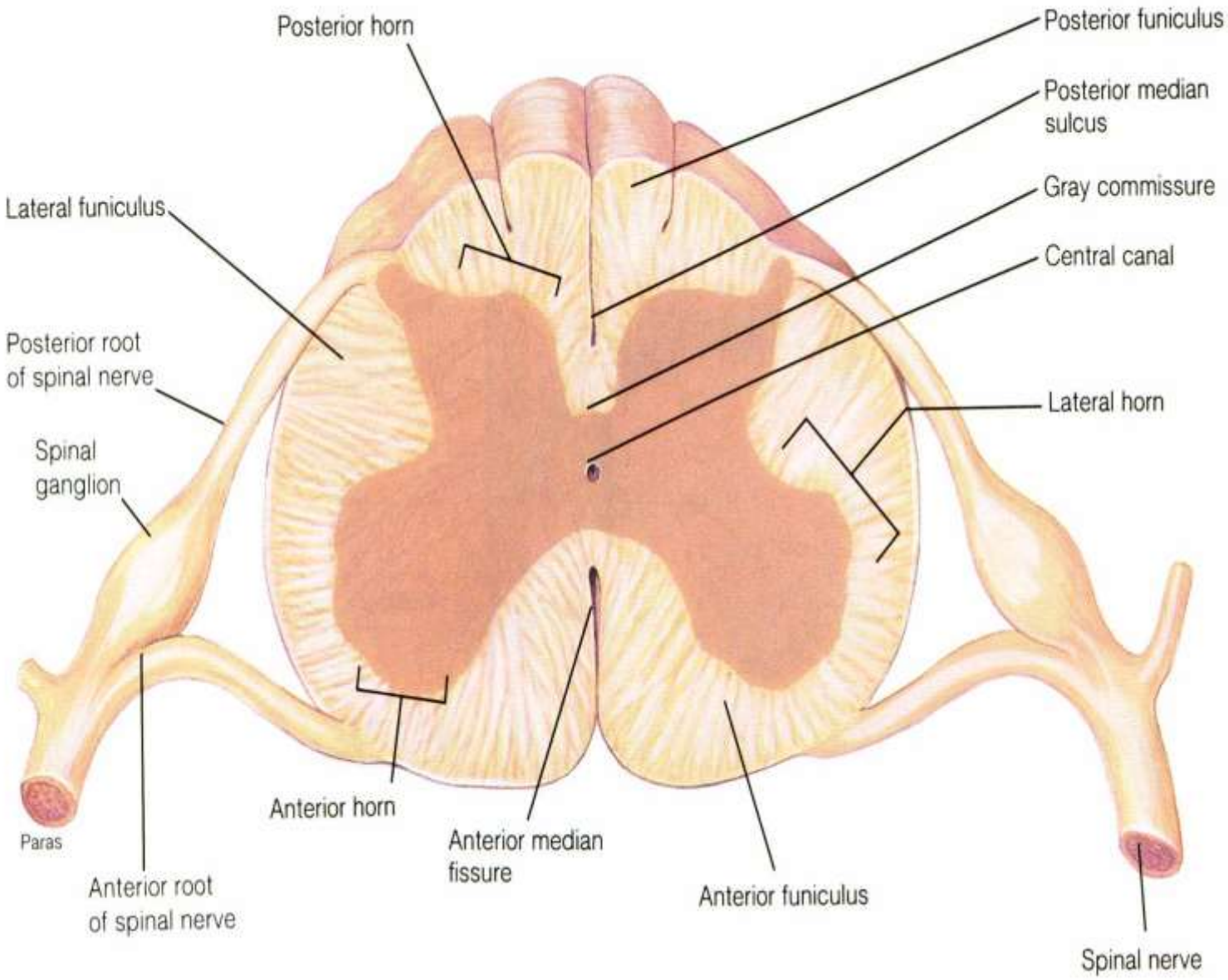
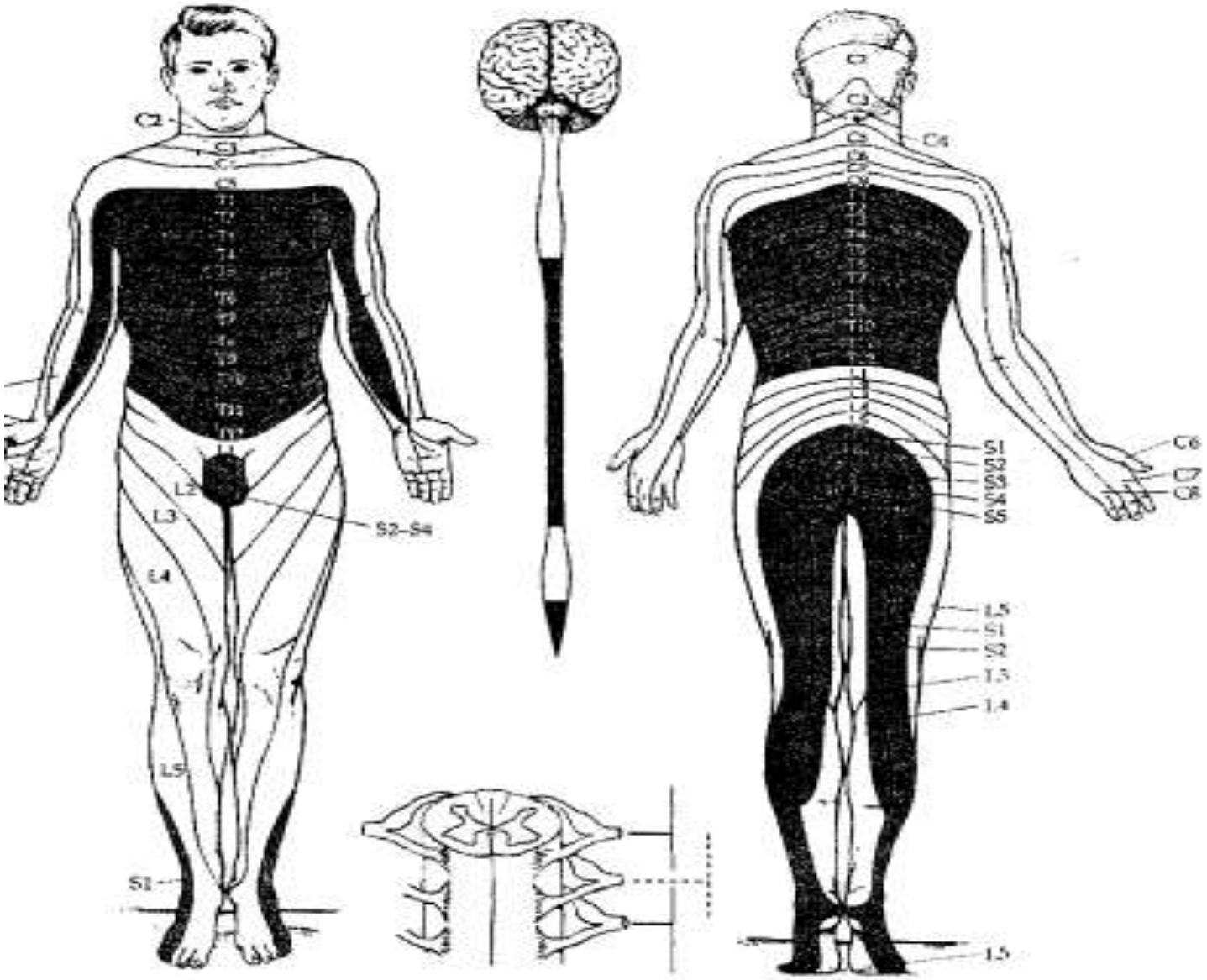
LECTURE 4 . THE ROLE OF THE SPINAL CORD ФТВ THE BRAINSTEM IN THE REGULATION OF MOTOR FUNCTIONS.


Posterior horn
Posterior funiculus
Posterior median sulcus
Gray commissure
Central canal
Lateral funiculus
Posterior root of spinal nerve
Lateral horn
Spinal ganglion
Anterior horn
Paras
Anterior median fissure
Anterior root of spinal nerve
Anterior funiculus
Spinal nerve

Д DERMATOMES



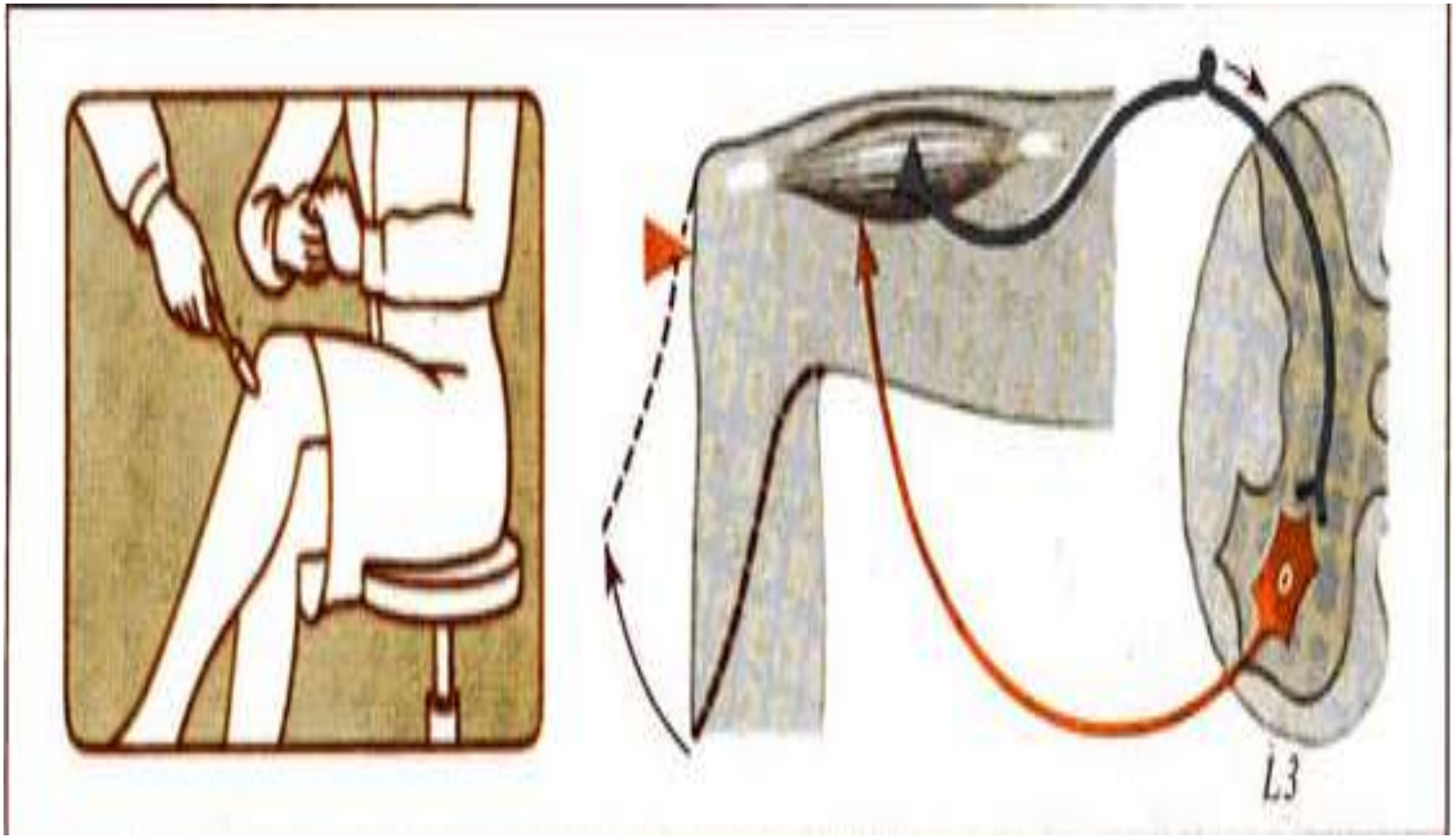
FUNCTIONS OF SPINAL CORD

- Formation of **Pathways** (tracts)
- Perform of Reflexes

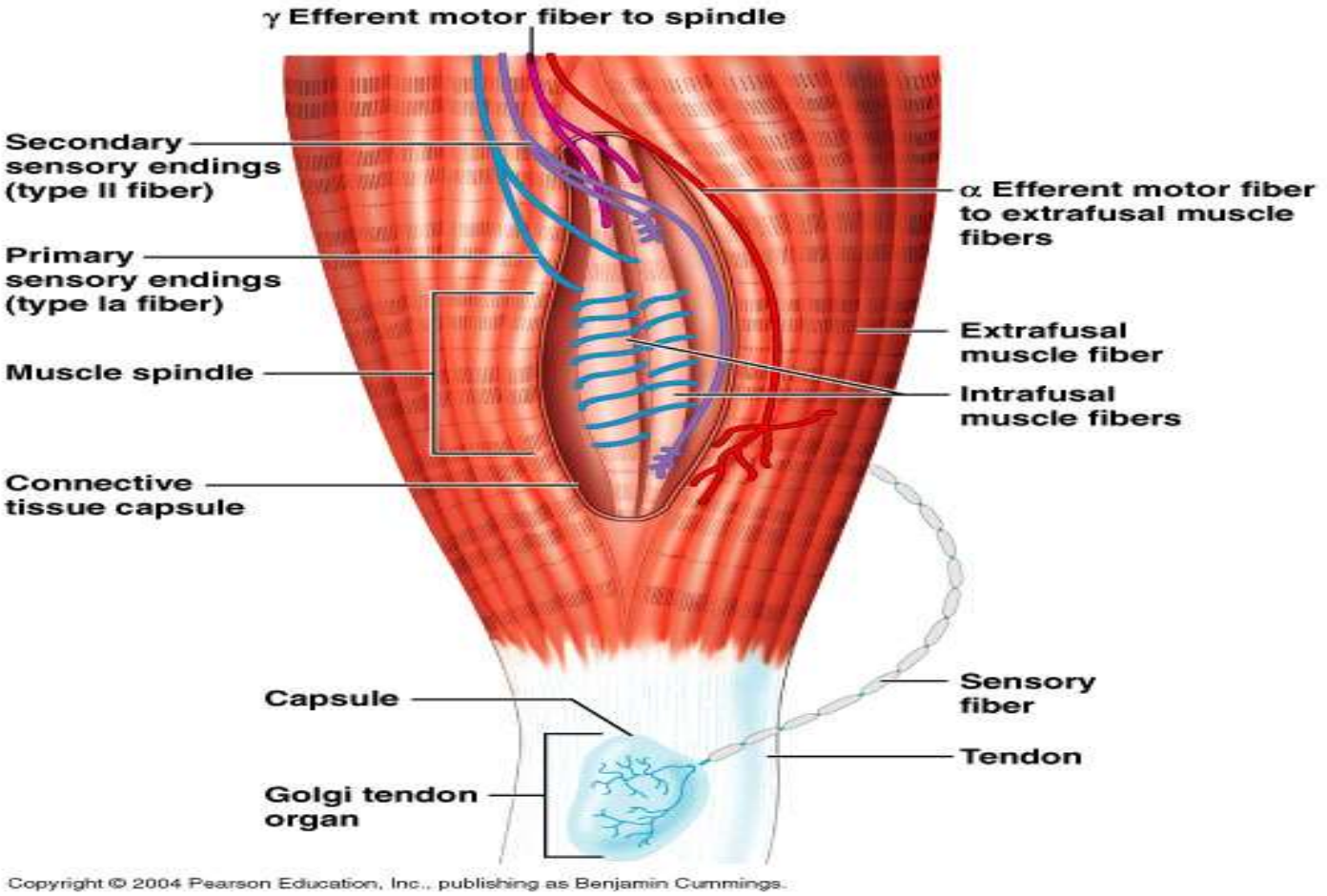
REFLEXES OF SPINAL CORD

1. THE KNEE JERK (TENDON-TAP) REFLEX
2. THE TONIC-STRETCH REFLEX.
3. THE FLEXOR REFLEX
4. THE CROSSED EXTENSOR REFLEX.
5. THE GOLGI TENDON REFLEX.

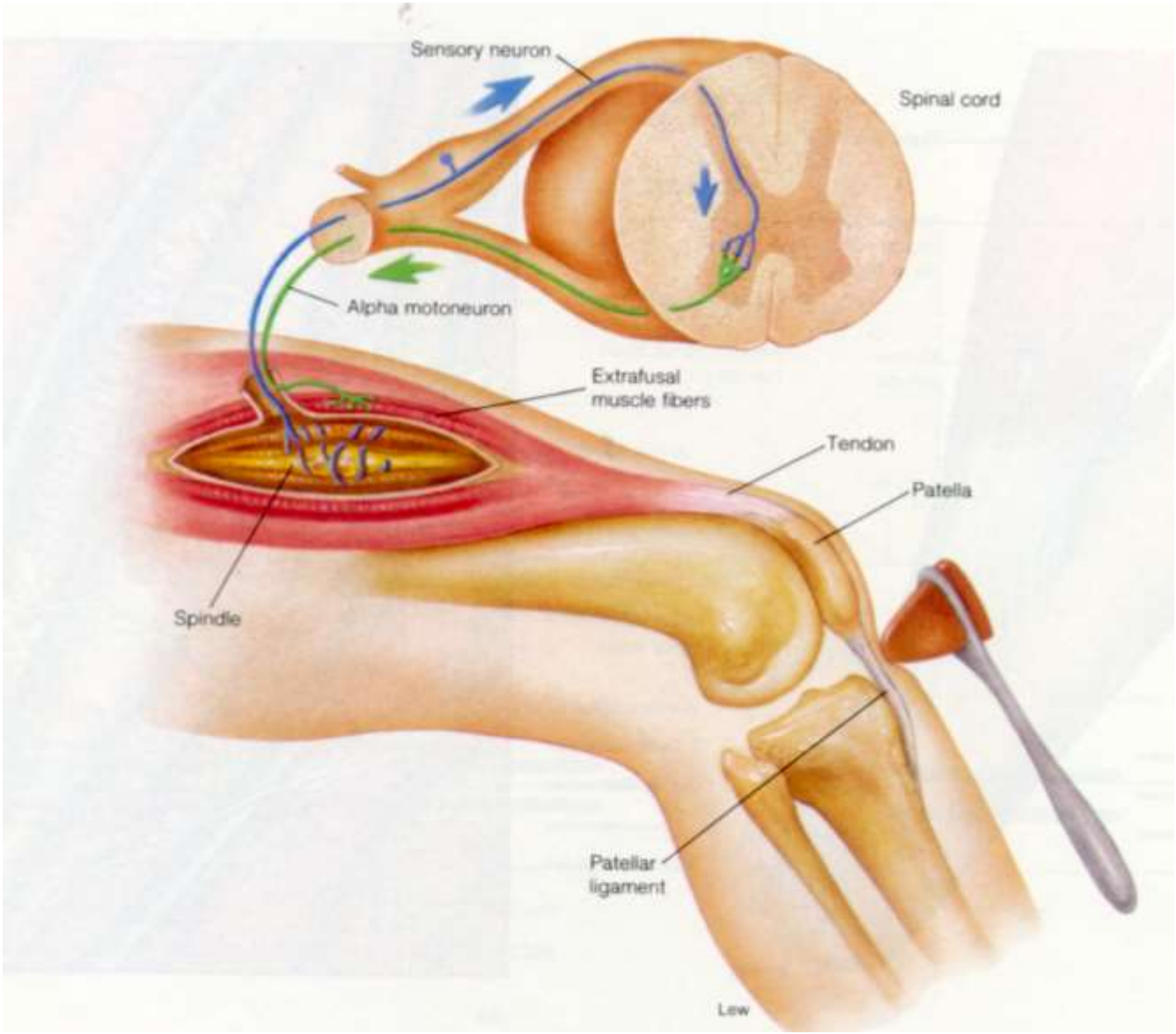
KNEE-JERK REFLEX

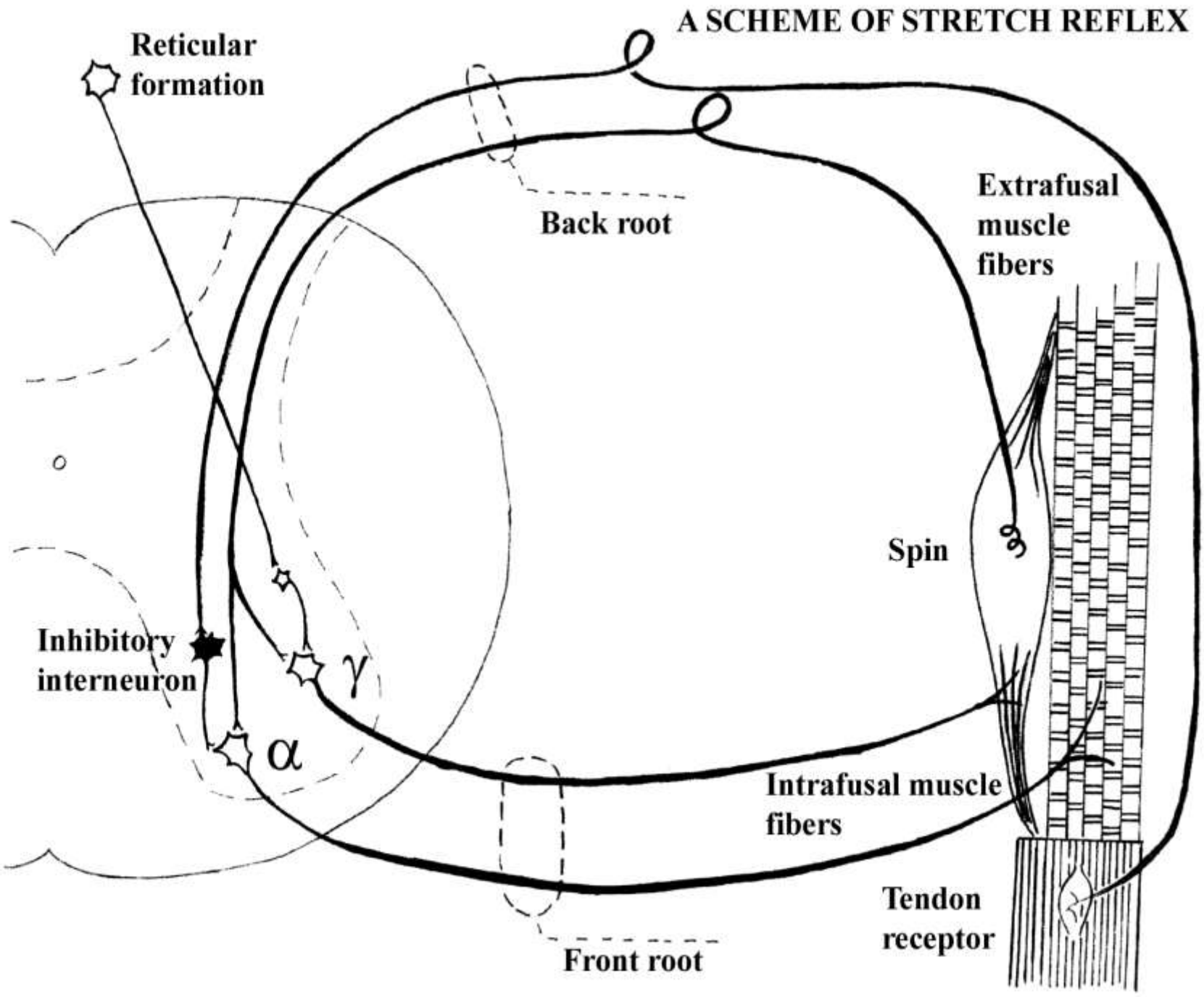


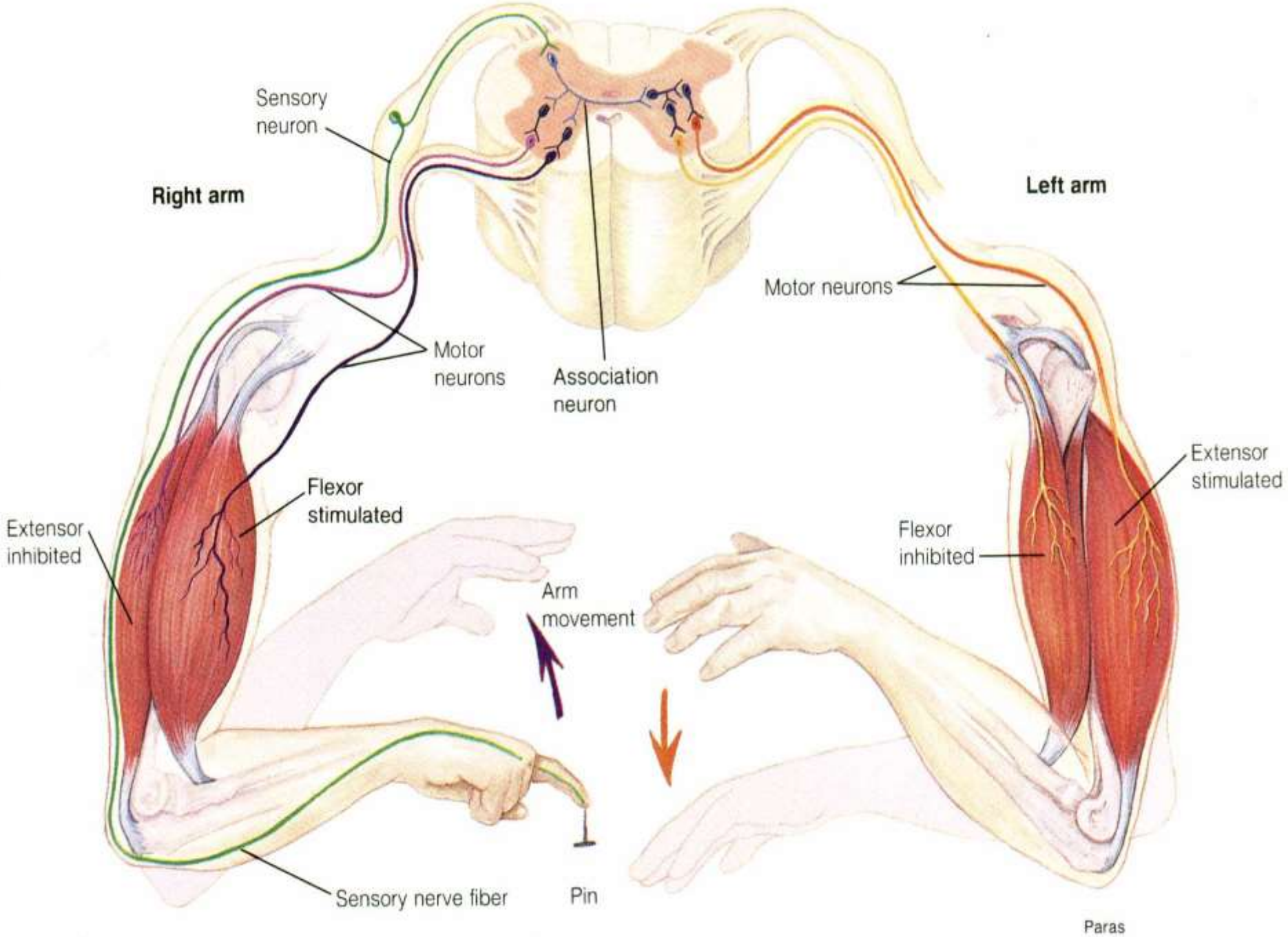
ANATOMY OF THE SPINDLE AND GOLGI TENDON ORGAN

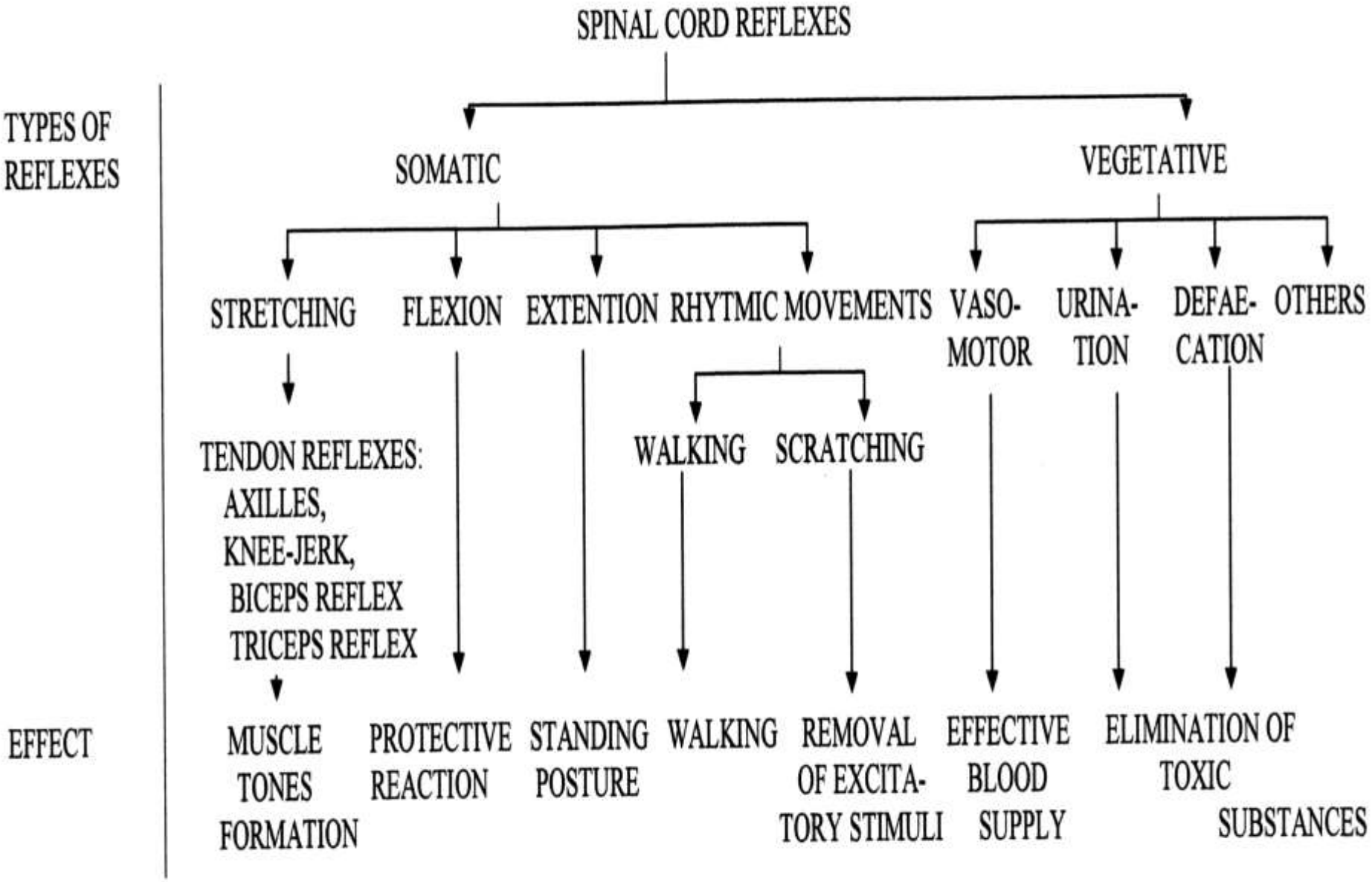


The stretch reflex arc. Note that this reflex arc comprises only two neurons and one synapse. It is therefore a monosynaptic reflex

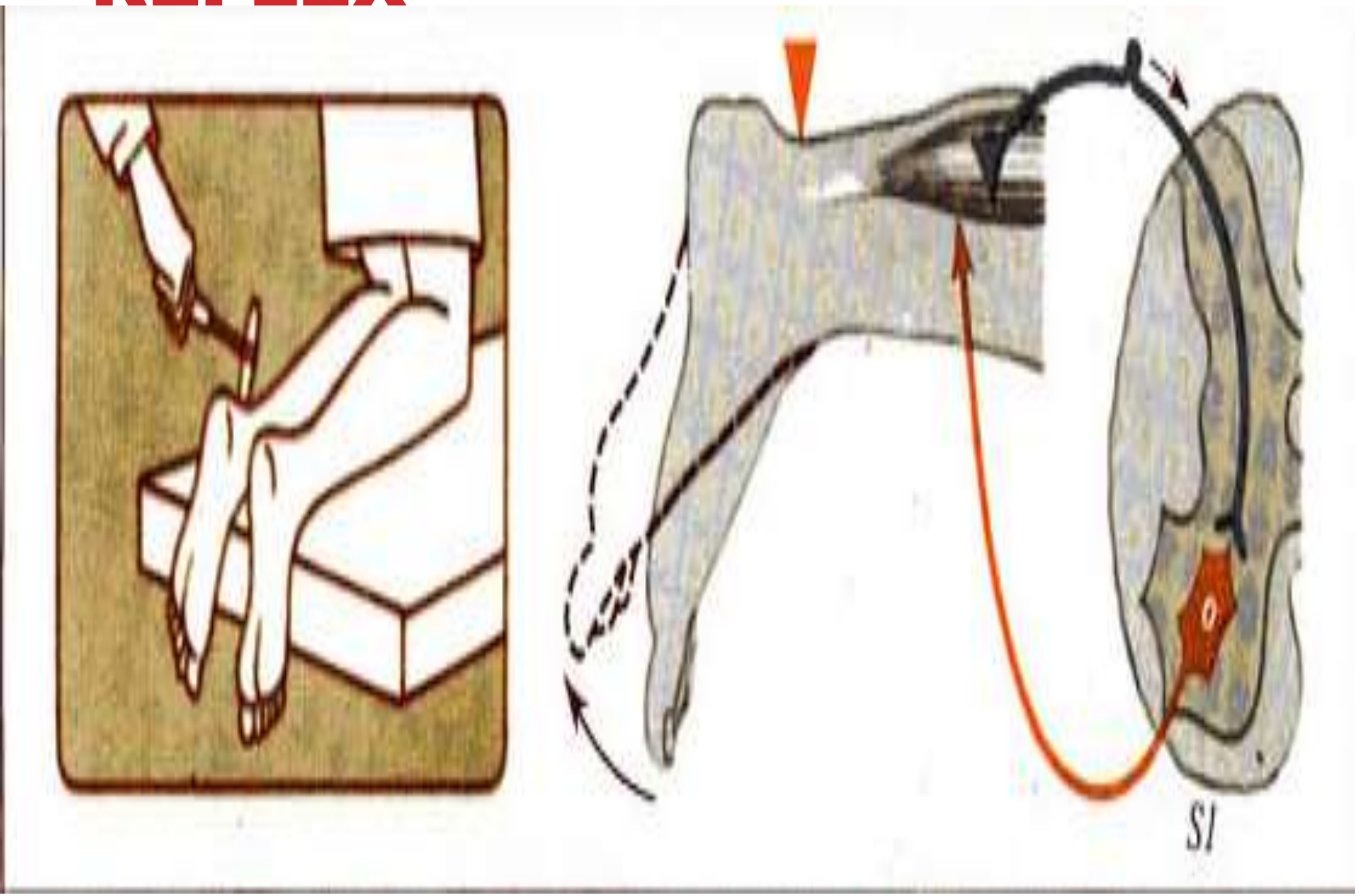



A SCHEME OF STRETCH REFLEX
Reticular formation
Back root
Extrafusal muscle fibers
Spin
Inhibitory interneuron
γ
α
Intrafusal muscle fibers
Tendon receptor
Front root

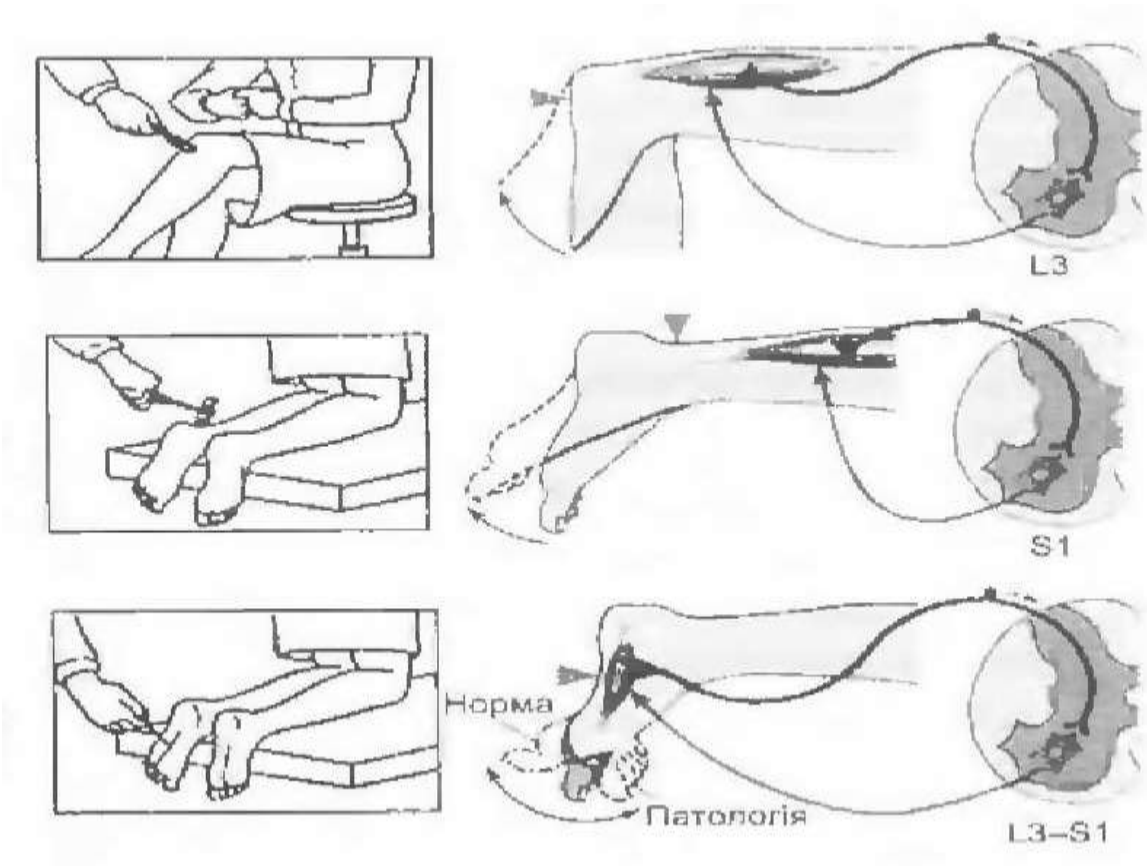

Sensory neuron
Right arm
Left arm
Motor neurons
Motor neurons
Association neuron
Extensor stimulated
Flexor stimulated
Extensor inhibited
Flexor inhibited
Arm movement
Sensory nerve fiber
Pin
Paras


SPINAL CORD REFLEXES
TYPES OF REFLEXES
SOMATIC
VEGETATIVE
STRETCHING
FLEXION
EXTENTION
RHYTMIC MOVEMENTS
VASO-MOTOR
URINA-TION
DEFAE-CATION
OTHERS
TENDON REFLEXES:
AXILLES,
KNEE-JERK,
BICEPS REFLEX
TRICEPS REFLEX
WALKING
SCRATCHING
EFFECT
MUSCLE TONES FORMATION
PROTECTIVE REACTION
STANDING POSTURE
WALKING
REMOVAL OF EXCITA-TORY STIMULI
EFFECTIVE BLOOD SUPPLY
ELIMINATION OF TOXIC SUBSTANCES

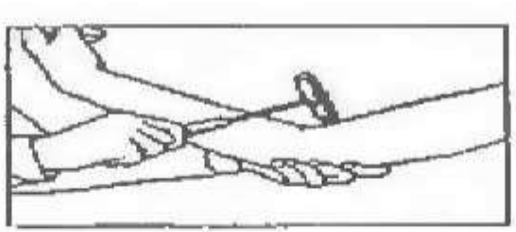
AHILLES REFLEX

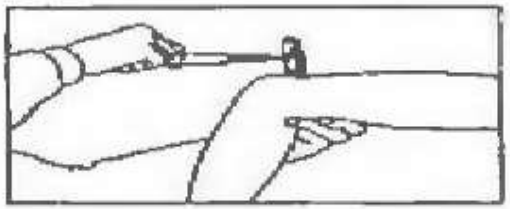


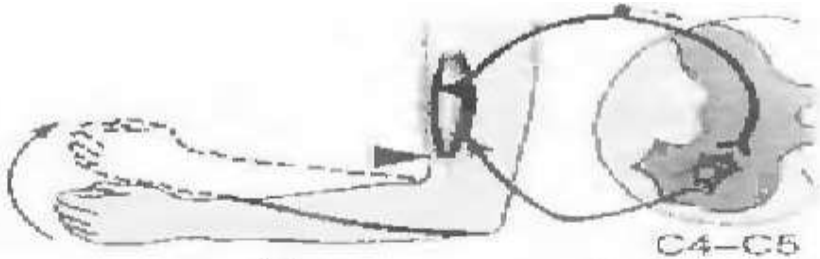
KNEE JERK REFLEX
AHILLES REFLEX
BABINSKY REFLEX

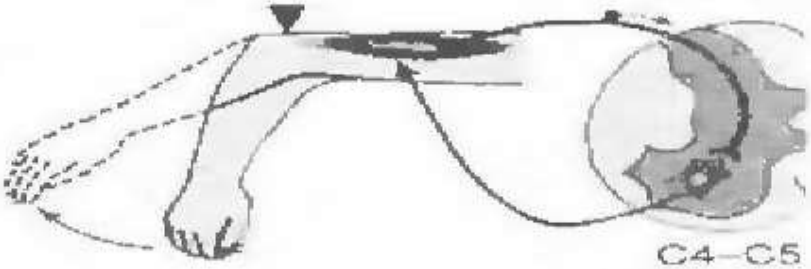


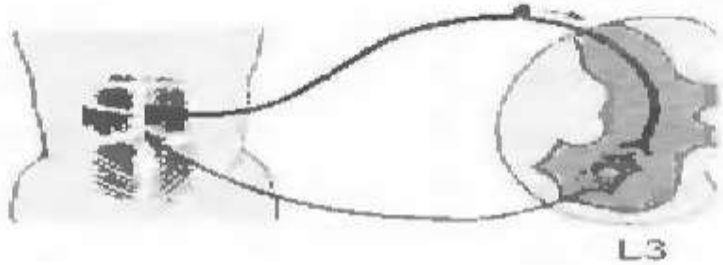
BICEPS REFLEXES, TRICEPS REFLEXES, ABDOMINAL REFLEX





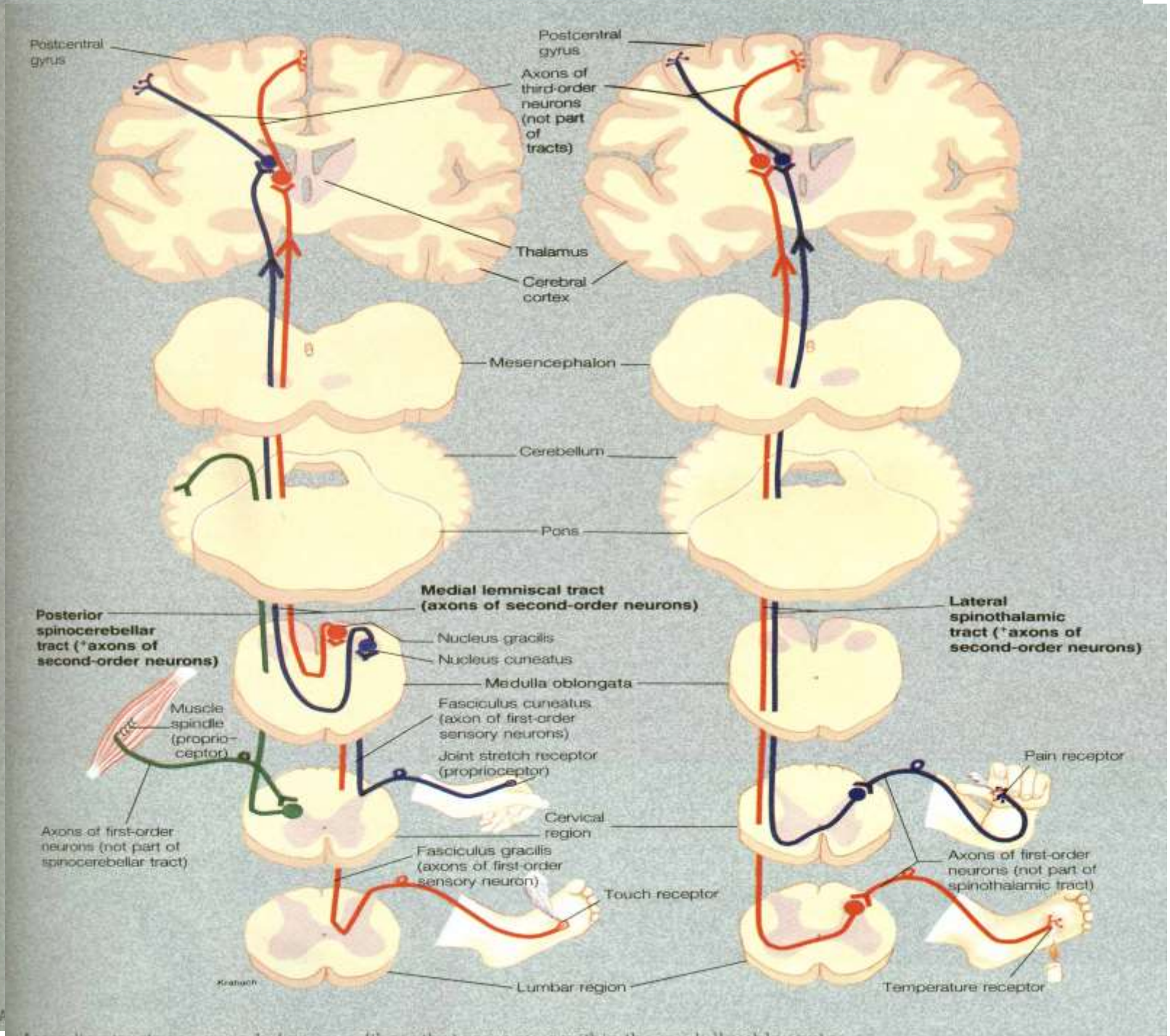






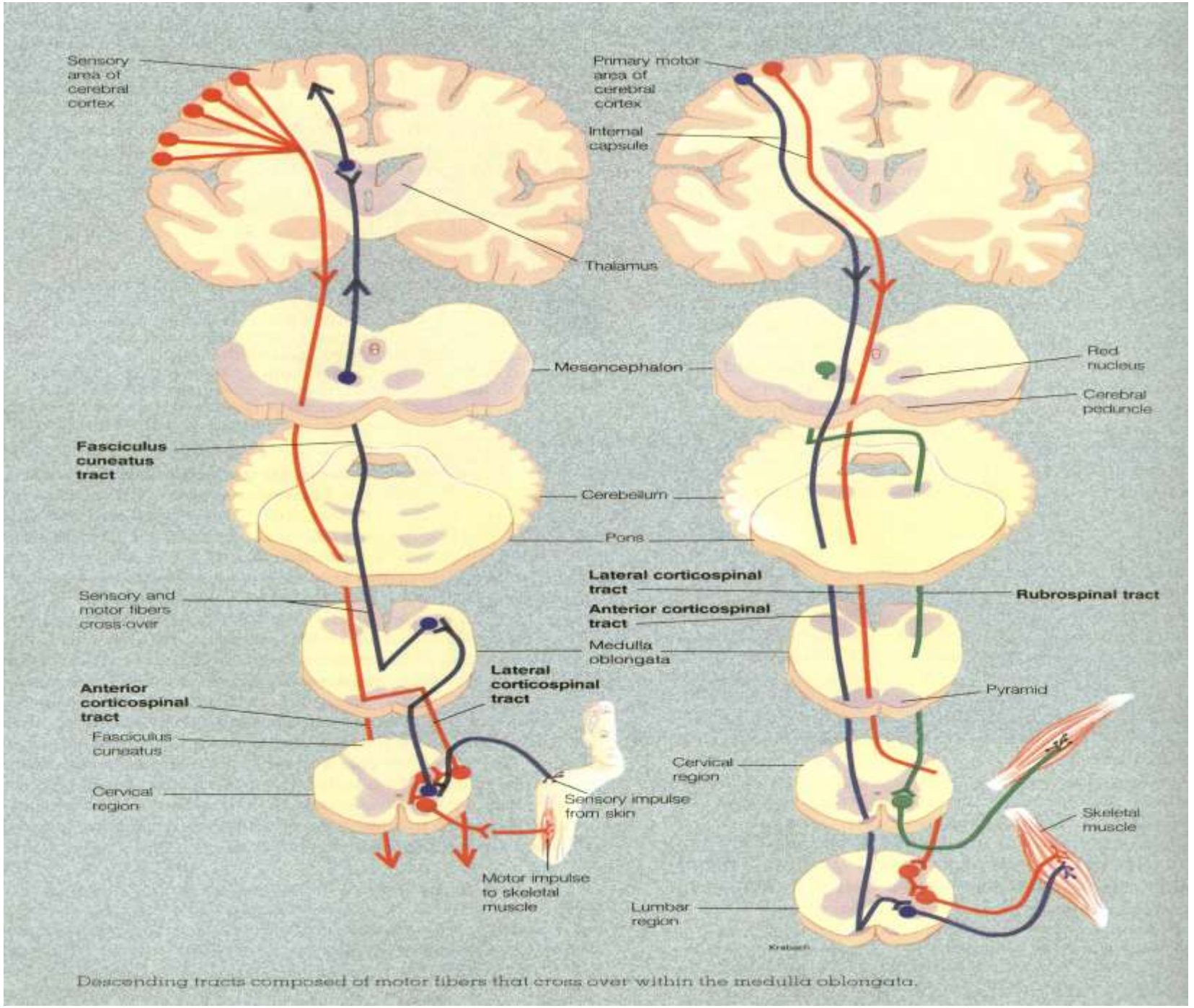
CONDUCTION FUNCTION

ASCENDING PATHWAYS (SENSORY)


Postcentral gyrus
Postcentral gyrus
Axons of third-order neurons (not part of tracts)
Thalamus
Cerebral cortex
Mesencephalon
Cerebellum
Pons
Medial lemniscal tract (axons of second-order neurons)
Posterior spinocerebellar tract (⁺axons of second-order neurons)
Lateral spinothalamic tract (⁺axons of second-order neurons)
Nucleus gracilis
Nucleus cuneatus
Medulla oblongata
Muscle spindle (proprio-ceptor)
Fasciculus cuneatus (axon of first-order sensory neurons)
Joint stretch receptor (proprioceptor)
Pain receptor
Axons of first-order neurons (not part of spinocerebellar tract)
Cervical region
Fasciculus gracilis (axons of first-order sensory neuron)
Touch receptor
Axons of first-order neurons (not part of spinothalamic tract)
Lumbar region
Temperature receptor

DESCENDING PATHWAYS (MOTOR)

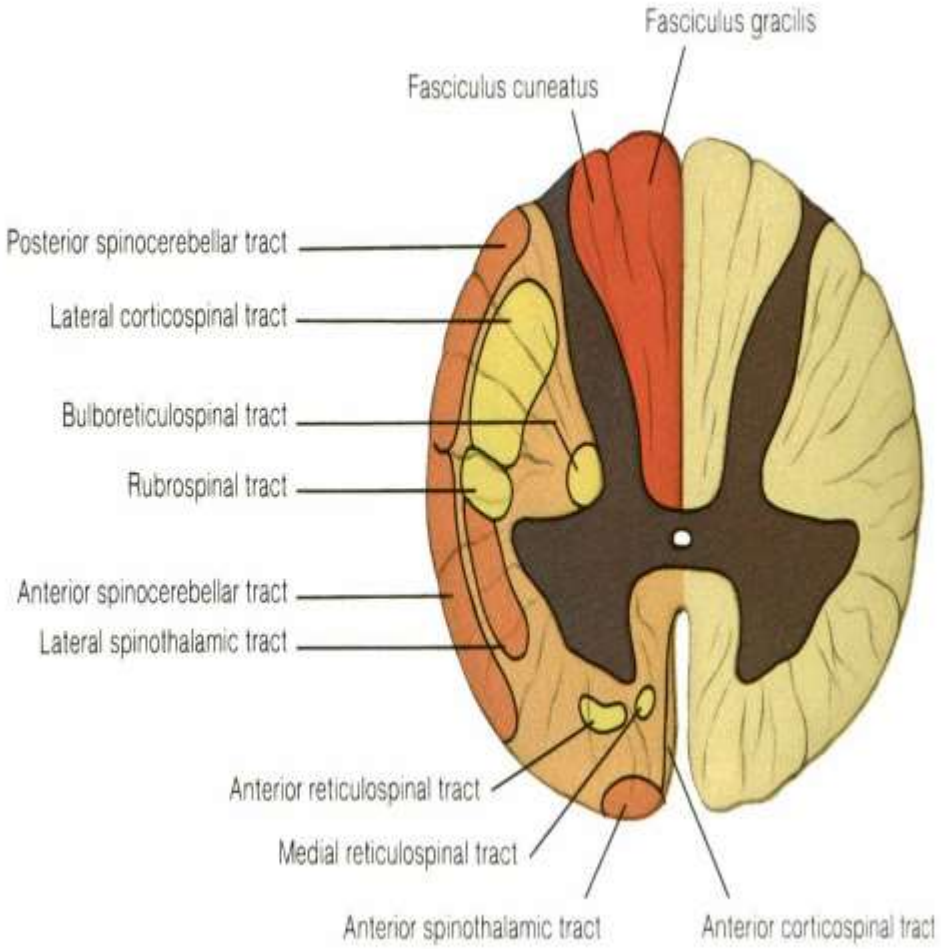
1. CORTICOSPINAL TRACT
2. RETICULOSPINAL TRACT.
3. VESTIBULOSPINAL TRACT.
4. RUBROSPINAL TRACT.
5. TECTOSPINAL TRACT.



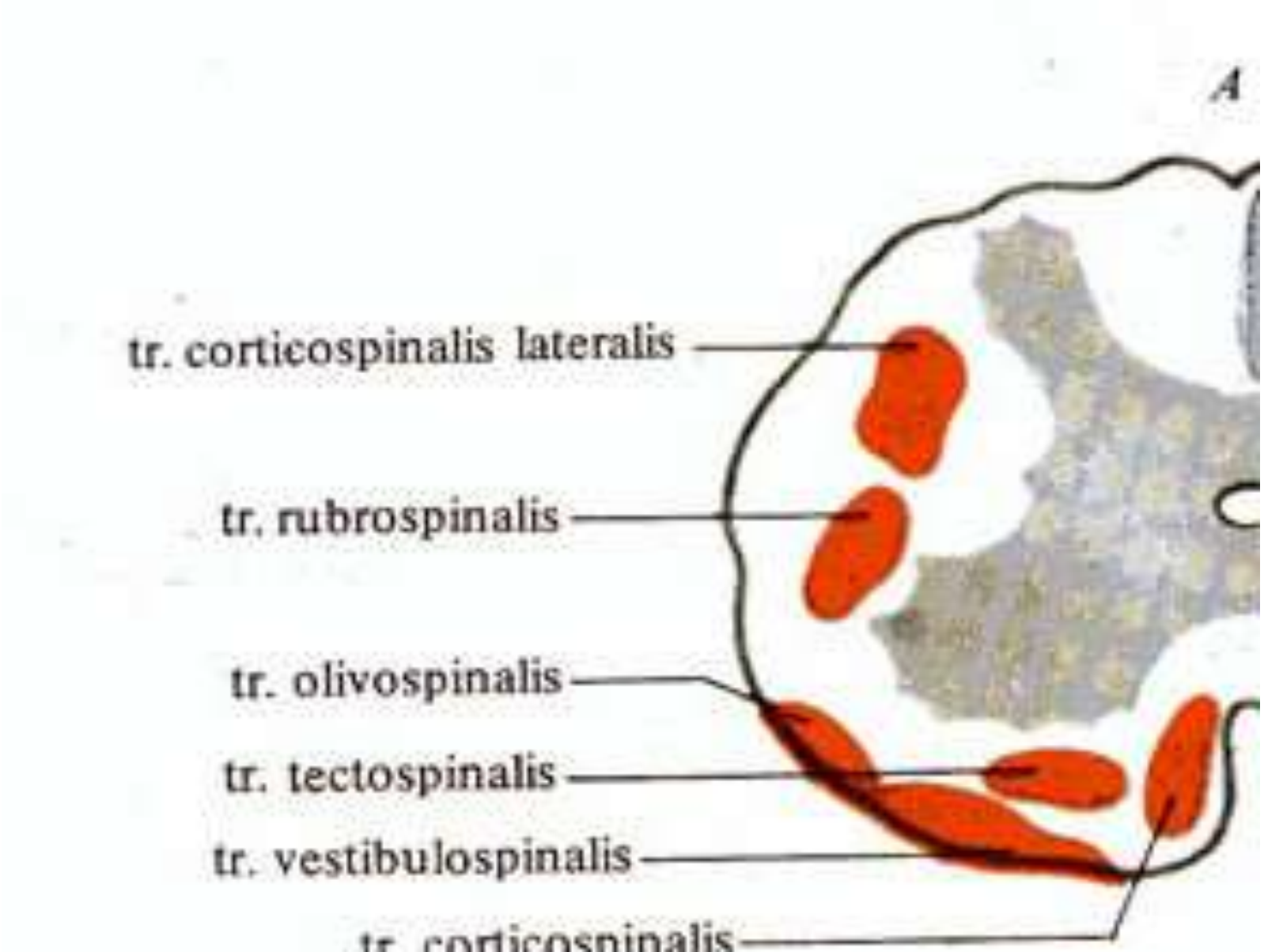
Descending tracts composed of motor fibers that cross over within the medulla oblongata.

of brain; crosses to opposite side of cord

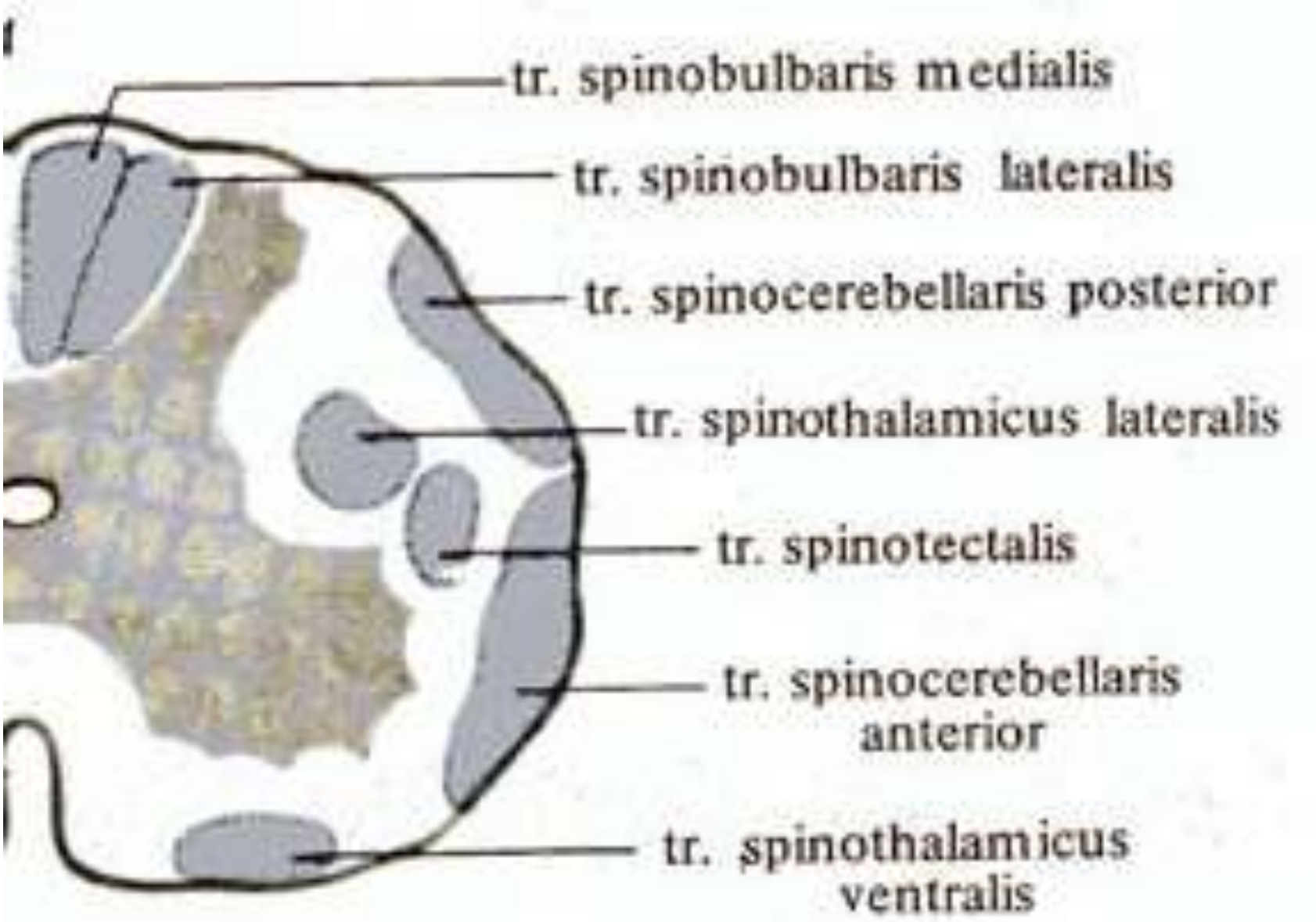
from cerebrum to spinal nerves and outward to cells of anterior horns for coordinated, precise voluntary movements of skeletal muscle



DESCENDING TRACTS

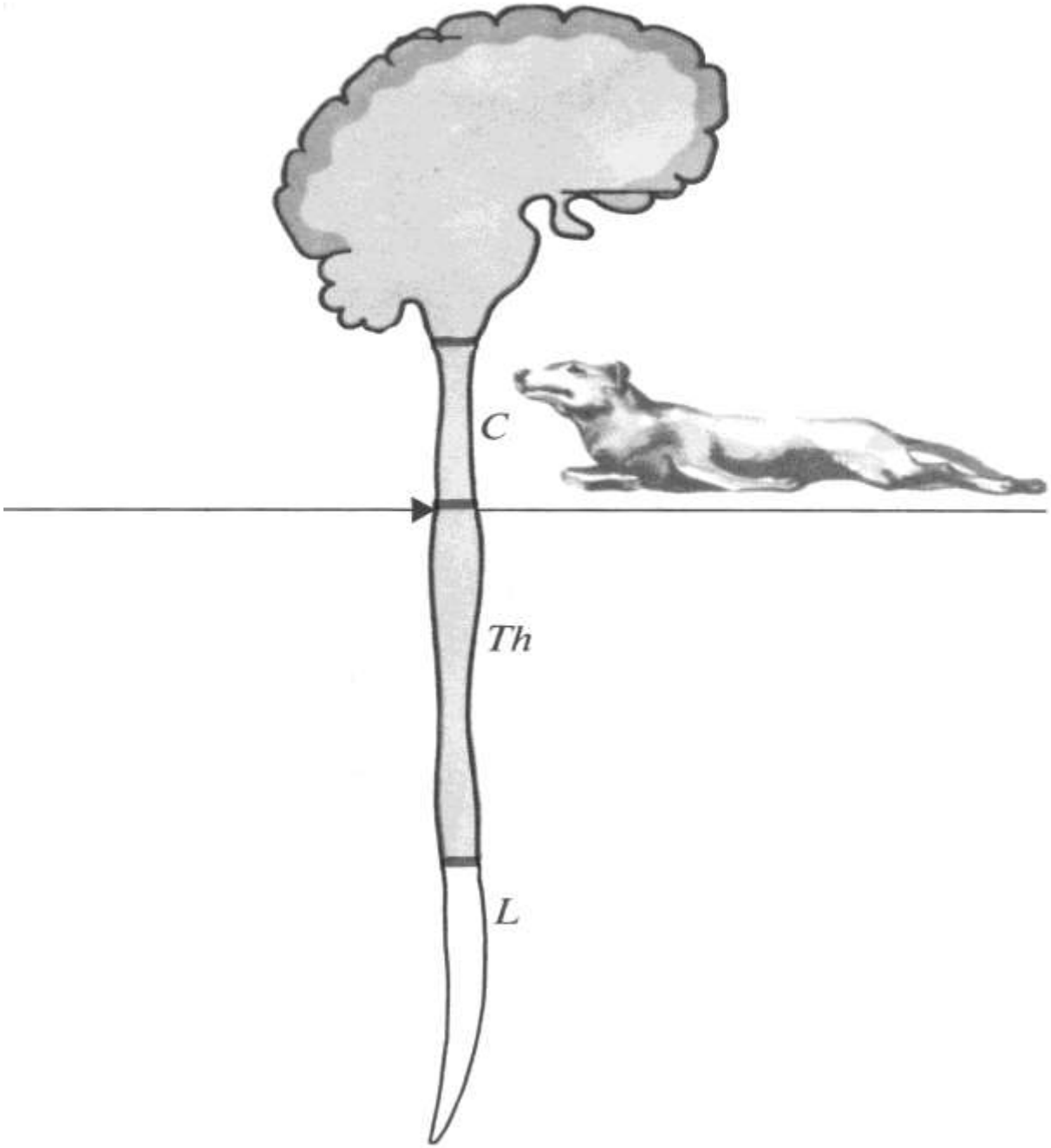


ASCENDING TRACTS



SPINAL SHOCK

Decreased excitability of spinal cord nervous centers below the level of trauma due to the absence of impulses from higher nervous centers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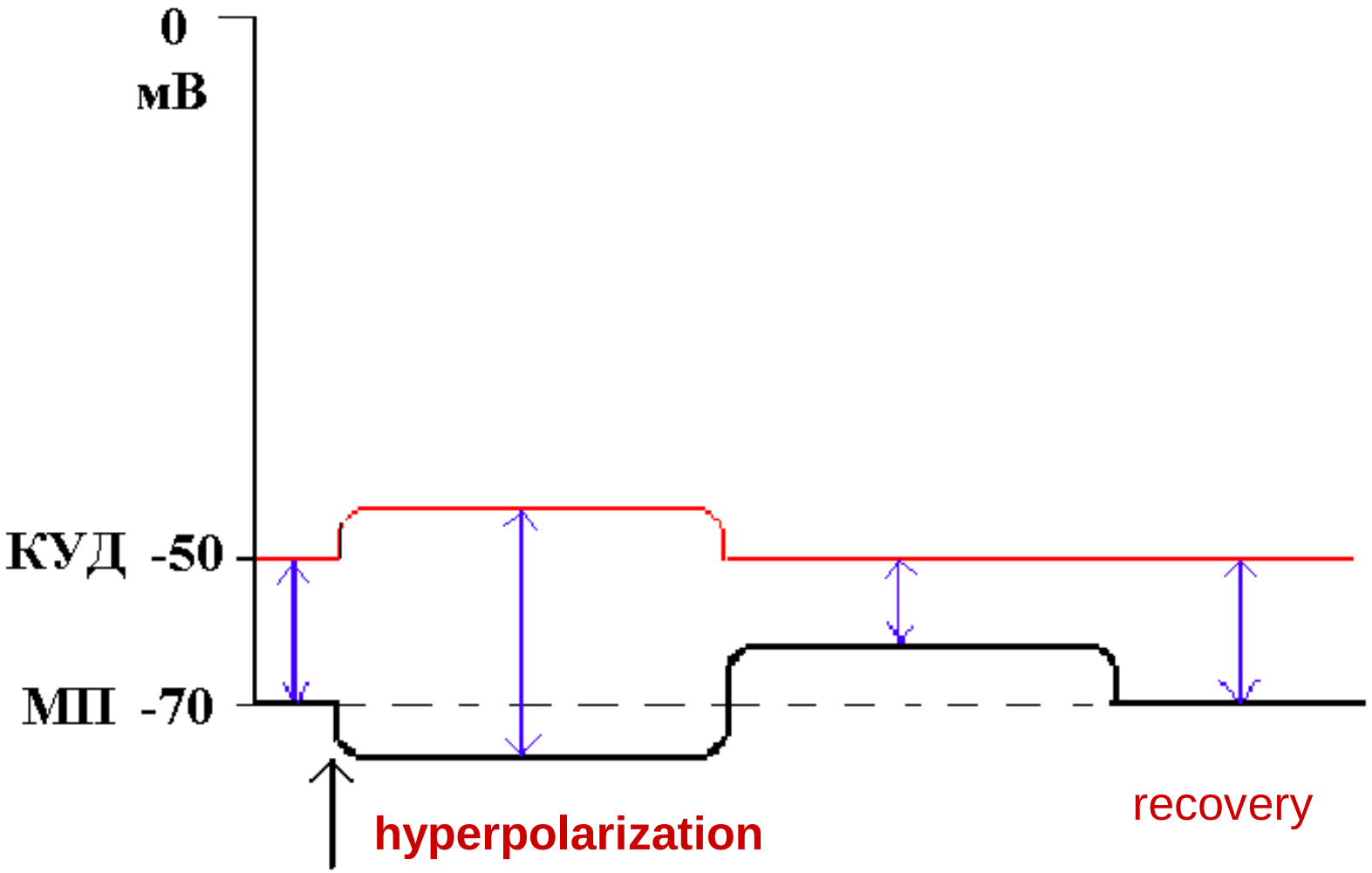
SPINAL SHOCK MANIFESTATIONS

- Absence of spinal cord proper reflexes
- Loss of sensitivity (astesia)
- Decrease of muscle tone (atonia)
- Inability to perform voluntarily movements

CHANGE OF PARAMETERS OF EXCITABILITY OF MOTONEURON DURING OF THE SPINAL SHOCK



SPINAL SHOCK

Duration in different animals depends on the degree of corticalization of functions. The more the cortex of the large hemispheres has taken on controlling influences, the longer the spinal shock.

Frog - minutes, hours

Rodents – hours, days

Cats and dogs - days-weeks

Monkeys-weeks-months

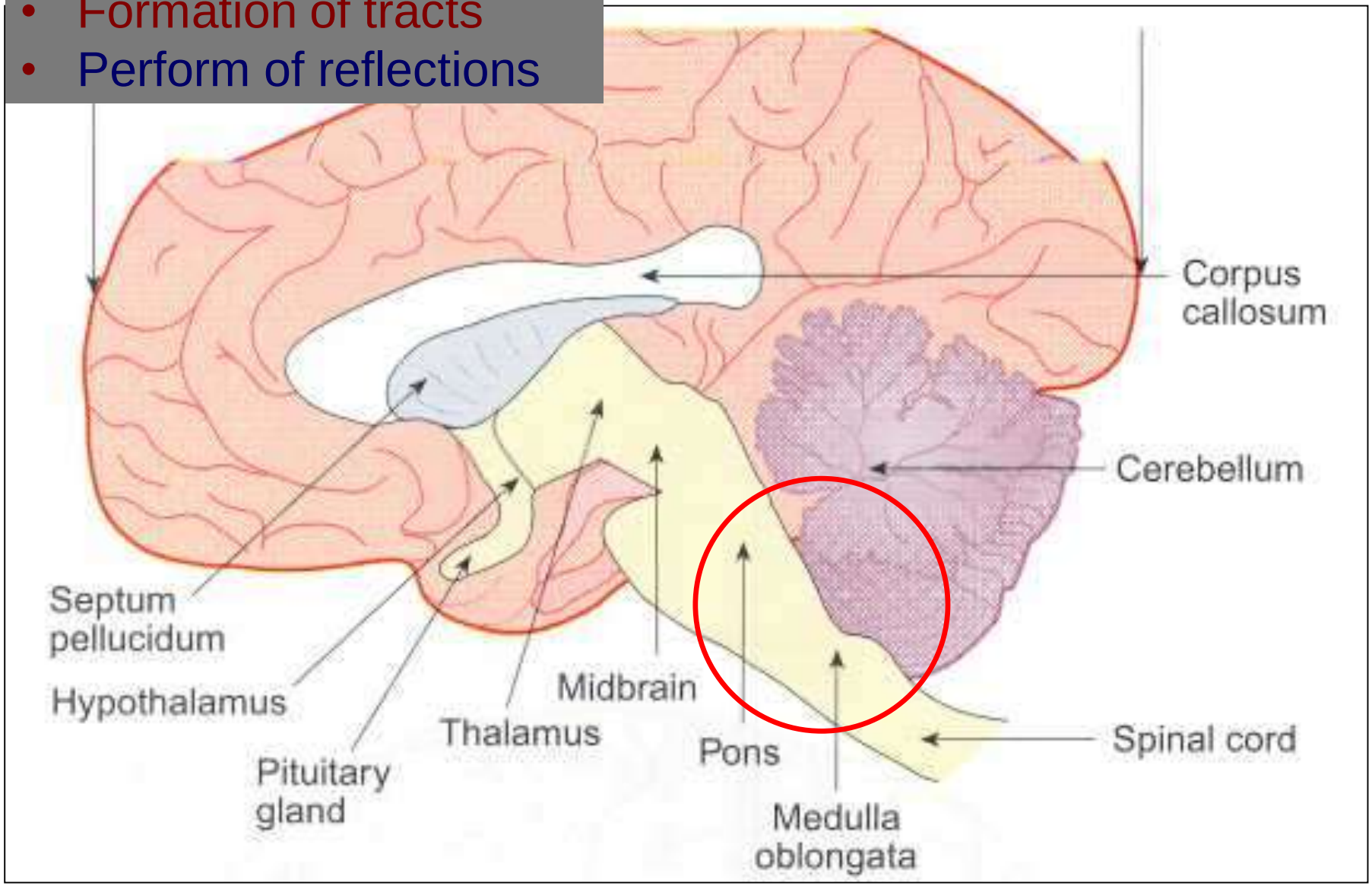
Humans - 0,5 years-year

Signs of the end of spinal shock - in connection with the fact that the spinal cord neurons do not receive inhibitory impulses from the overlying structures, the excitability of nerve centers is not only restored, but also becomes elevated. Reflexes are amplified (extended receptive field, large amplitude of motion, weak impact)

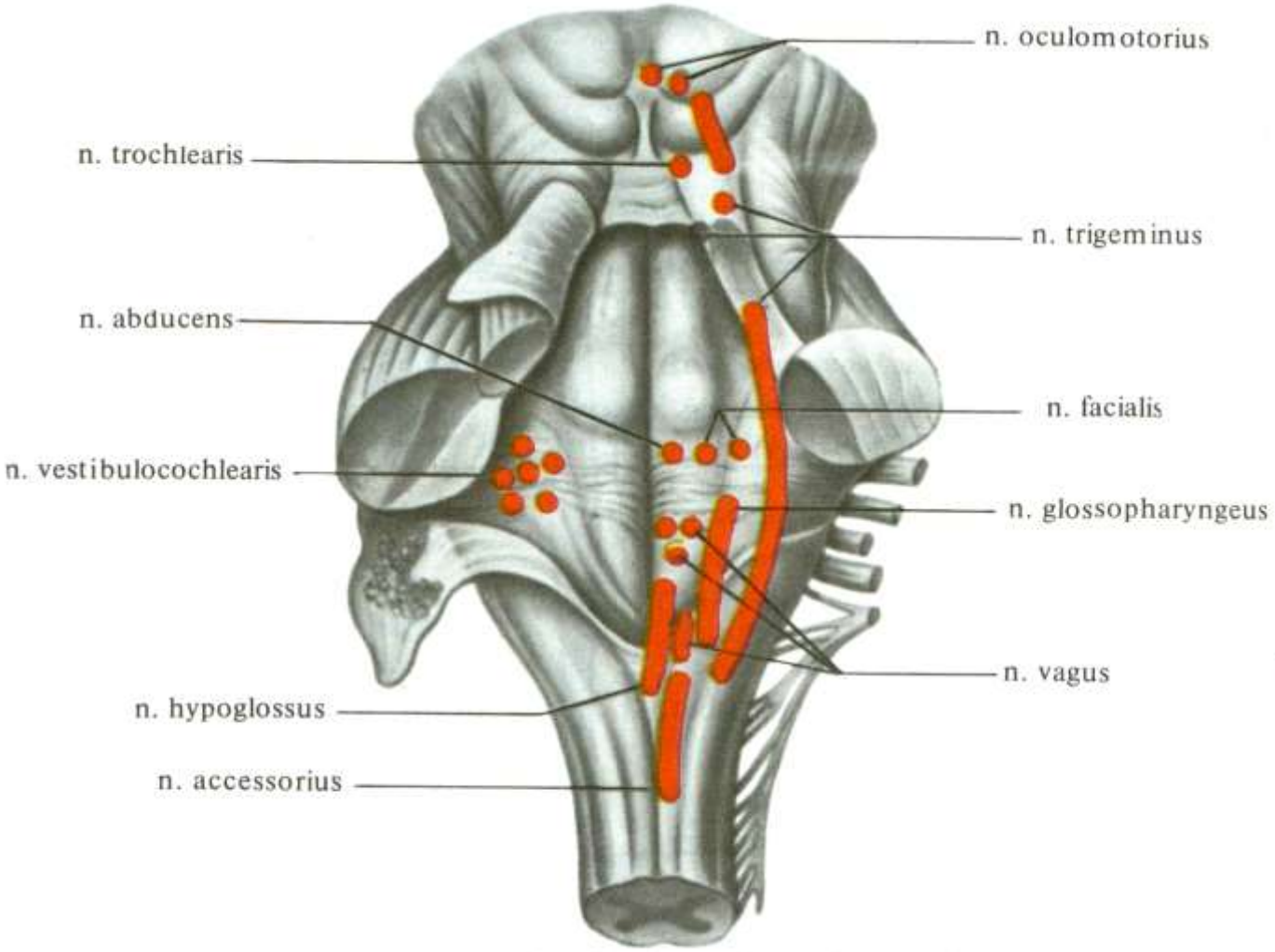
Brain Stem

FUNCTIONS

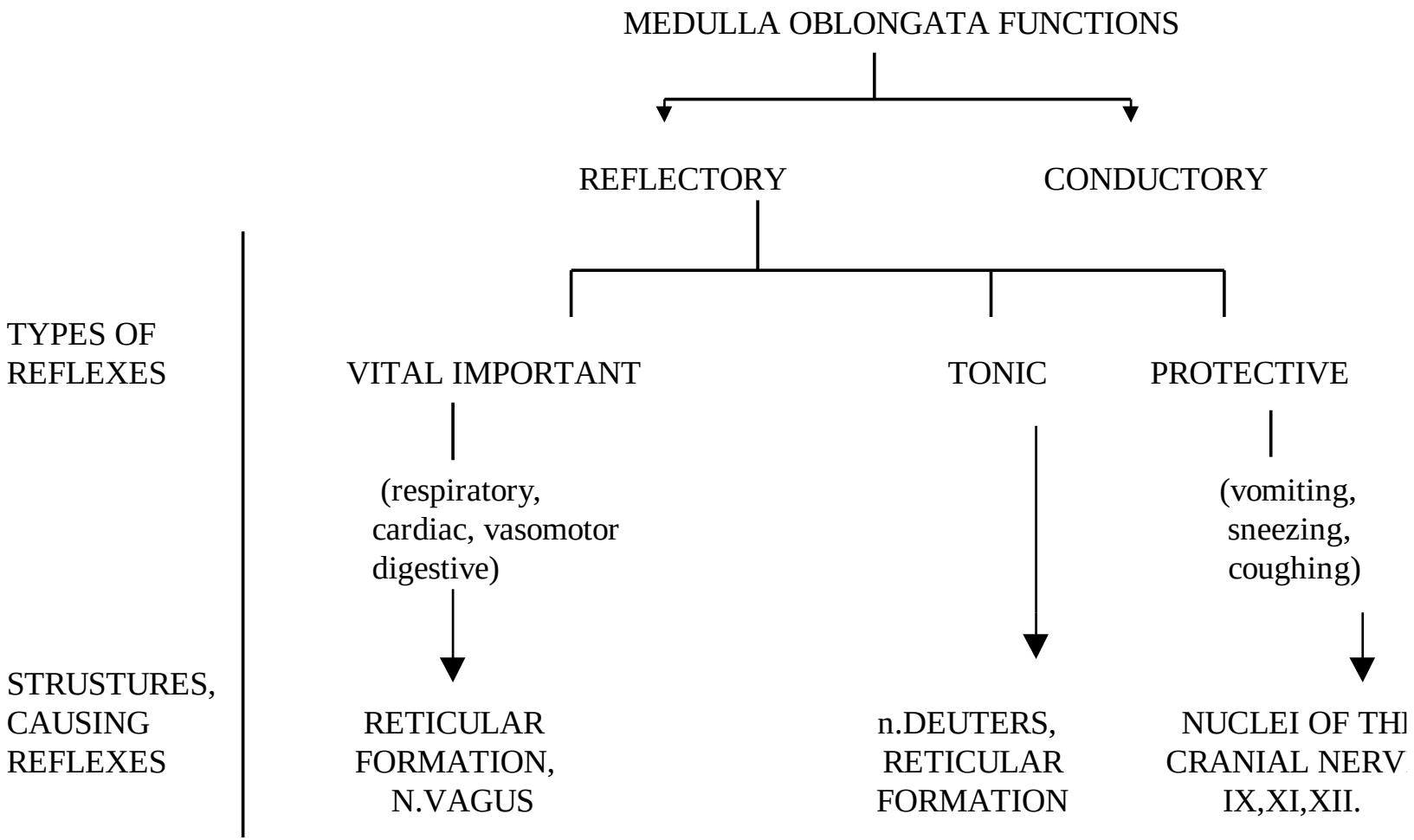
- Formation of tracts
- Perform of reflections



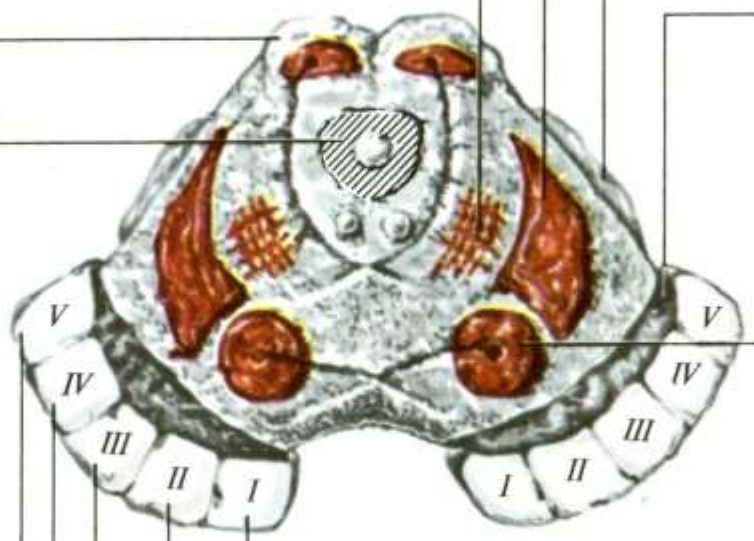
MEDULLA OBLONGATA STRUCTURES



MEDULLA OBLONGATA STRUCTURES


MEDULLA OBLONGATA FUNCTIONS
REFLECTORY
CONDUCTORY
TYPES OF REFLEXES
VITAL IMPORTANT
TONIC
PROTECTIVE
(respiratory, cardiac, vasomotor digestive)
(vomiting, sneezing, coughing)
STRUSTURES, CAUSING REFLEXES
RETICULAR FORMATION, N.VAGUS
n.DEUTERS, RETICULAR FORMATION
NUCLEI OF THI CRANIAL NERV IX,XI,XII.

MIDBRAIN STRUCTURES



formatio reticularis

lemniscus medialis

lemniscus lateralis

substantia nigra

nucleus ruber

colliculus inferior

aqueductus cerebri

tractus corticopontinus

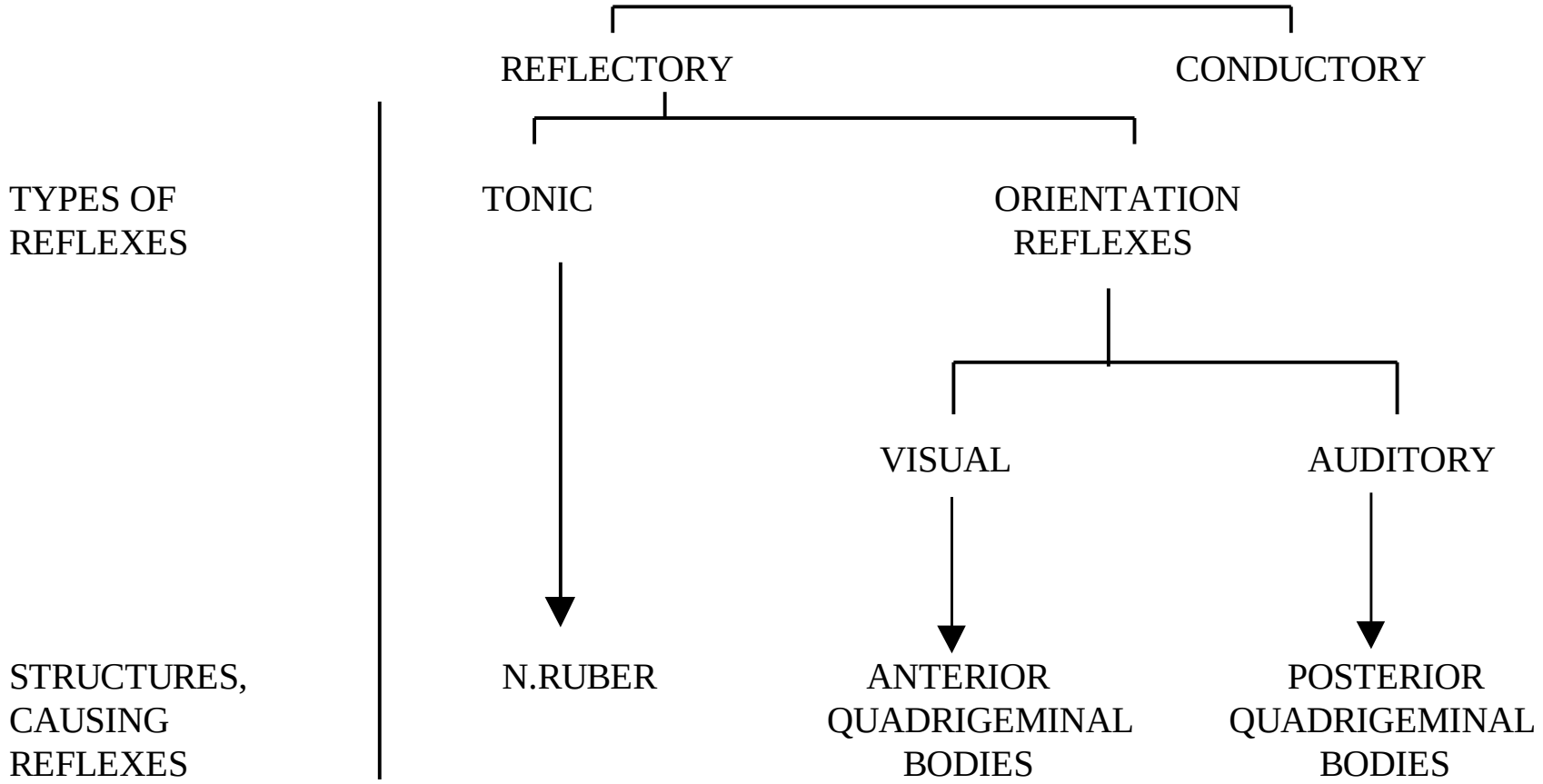
tr. corticospinalis anterior

tr. corticospinalis lateralis

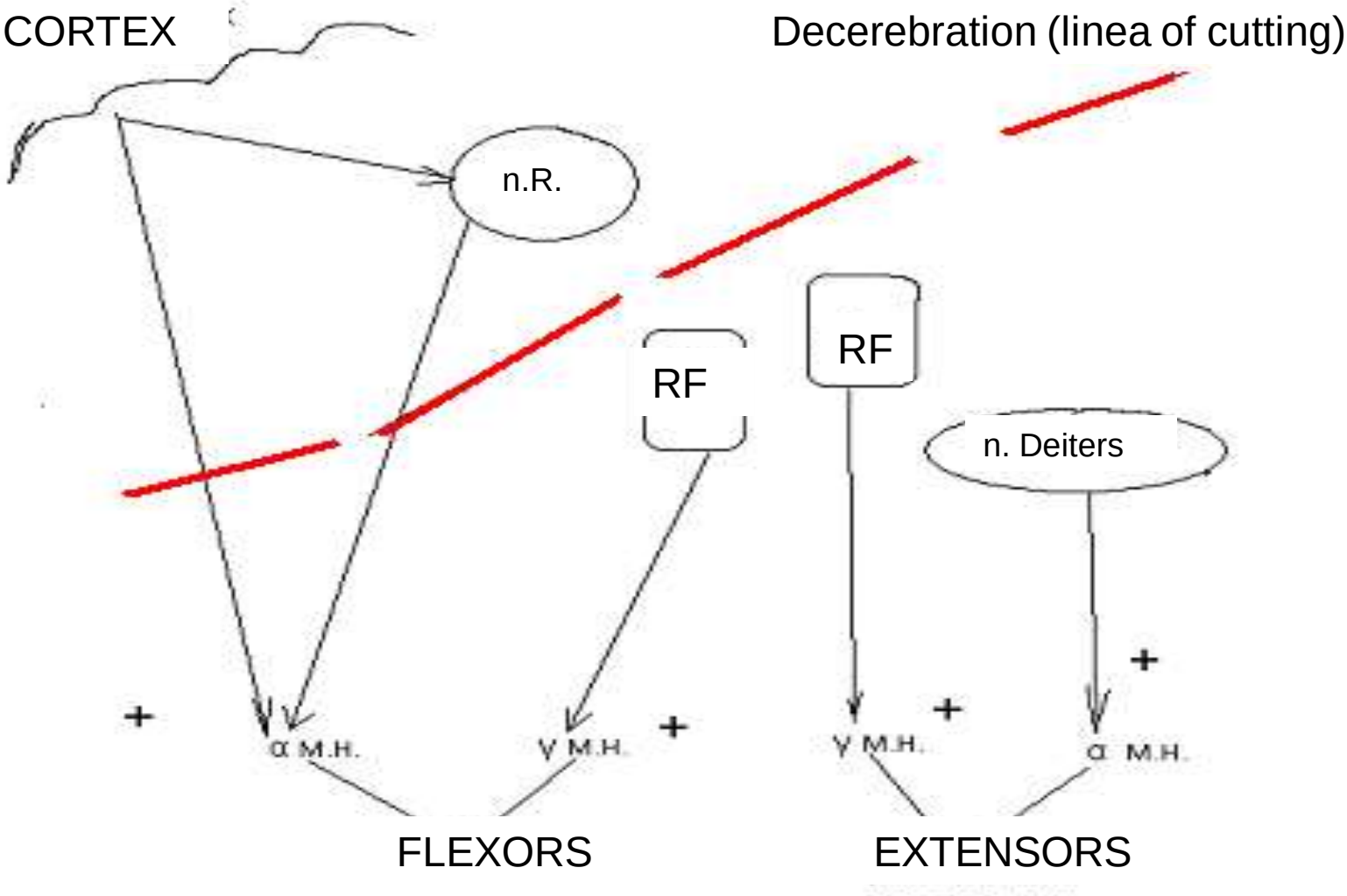
tr. corticonuclearis

tr. corticopontinus frontalis

MID-BRAIN FUNCTIONS



MUSCLE TONE REGULATION



FIBRES OF THE MID-BRAIN CONNECT CORTEX, MID-BRAIN WITH HIND-BRAIN AND SPINAL CORD. IF THE BRAIN STEM OF A CAT IS SEVERED ABOVE THE MEDULLA OBLONGATA SO THAT THE RED NUCLEI ARE ABOVE THE INCISION A SPECIAL STATE OF THE BODY MUSCULATURE DEVELOPS CALLED **DECEREBRATE RIGIDITY**. THIS STATE IS CHARACTERIZED BY SHARPLY INCREASED TONE OF THE EXTENSOR MUSCLES. THE EXTREMITIES ARE GREATLY EXTENDED; THE HEAD IS TILTED BACK AND THE TAIL RAISED.

Functions of the Reticular Formation

1. Control the level of consciousness (wakefulness) trough the ARAS.
2. Regulation of the stretch reflexes and muscle tone.
3. Pain inhibition.
4. Control of sleep.
5. Control visceral functions (e.g. heart rate, BP, respiration, salivation, swallowing and vomiting).
6. Serotonin production.

TONIC REFLEXES

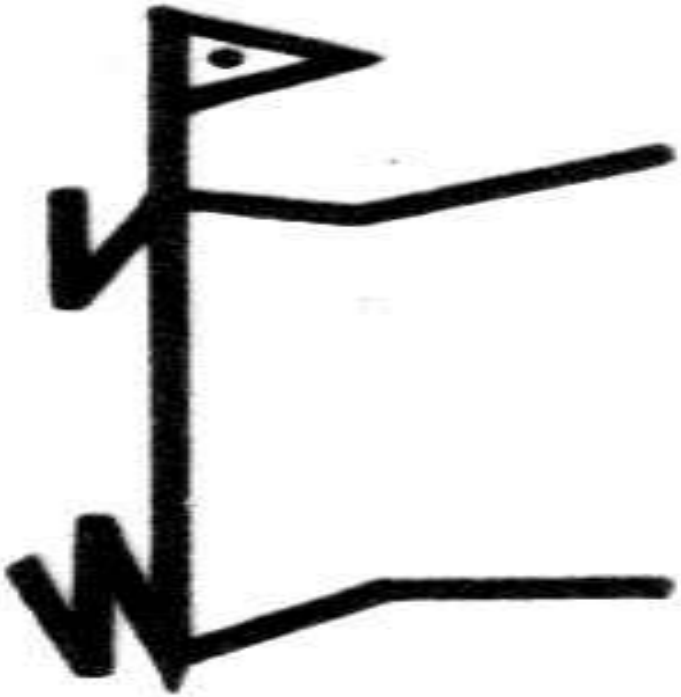
I. STATIC – redistribution of muscle tone to maintain stable posture:

a) posture reflexes

b) up-rightening reflex

A) POSTURE REFLEX – REDISTRIBUTION OF MUSCLE TONE TO MAINTAINE STABLE POSTURE ON CHANGING HEAD POSITION.

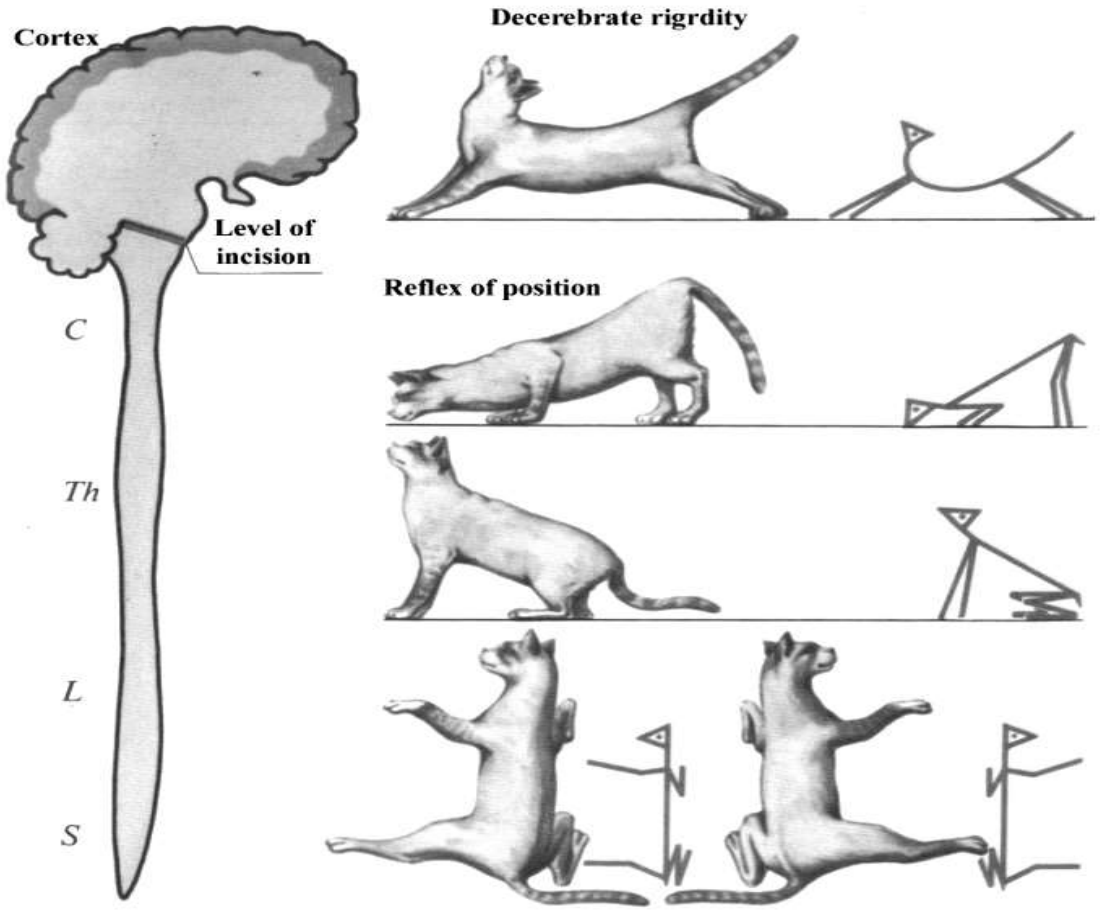
RECEPTIVE FIELD – PROPRIORECEPTORS OF HEAD & NECK MUSCLES, RECEPTORS OF SEMICIRCULAR CHANNELS & OTOLIT APPARATUS



B) RIGHTING REFLEXES –

RETURNING TO THE POSITION WITH THE CROWN UP.

RECEPTIVE FIELD – PROPRIORECEPTORS OF NECK & TRUNK MUSCLES, RECEPTORS OF SEMICIRCULAR CHANNELS & OTOLIT APPARATUS, SKIN RECEPTORS, RETINA RECEPTORS



MOTOR FUNCTIONS OF MEDULLA OBLONGATA

II. STATO-KINETIC - REDISTRIBUTION OF MUSCLE TONE TO MAINTAIN EQUILIBRIUM DURING PASSIVE ACCELERATED MOVEMENT (JUMPING, FALLING DOWN, ON TRANSPORT).

A) ON LINEAR ACCELERATED MOVEMENT – ***LIFT REFLEX, REFLEX OF READINESS TO JUMP***

B) ON ROTATION – EYE & HEAD NYSTAGMUS

RECEPTIVE FIELD – VESTIBULORECEPTORS

A) ON LINEAR ACCELERATED MOVEMENT –*RECEPTORS OF OTOLIT APPARATUS*

B) ON ROTATION – RECEPTORS OF SEMICIRCULAR CHANNELS

TRANSPORT).

A) ON LINEAR ACCELERATED MOVEMENT – ***LIFT REFLEX, REFLEX OF READINESS TO JUMP***

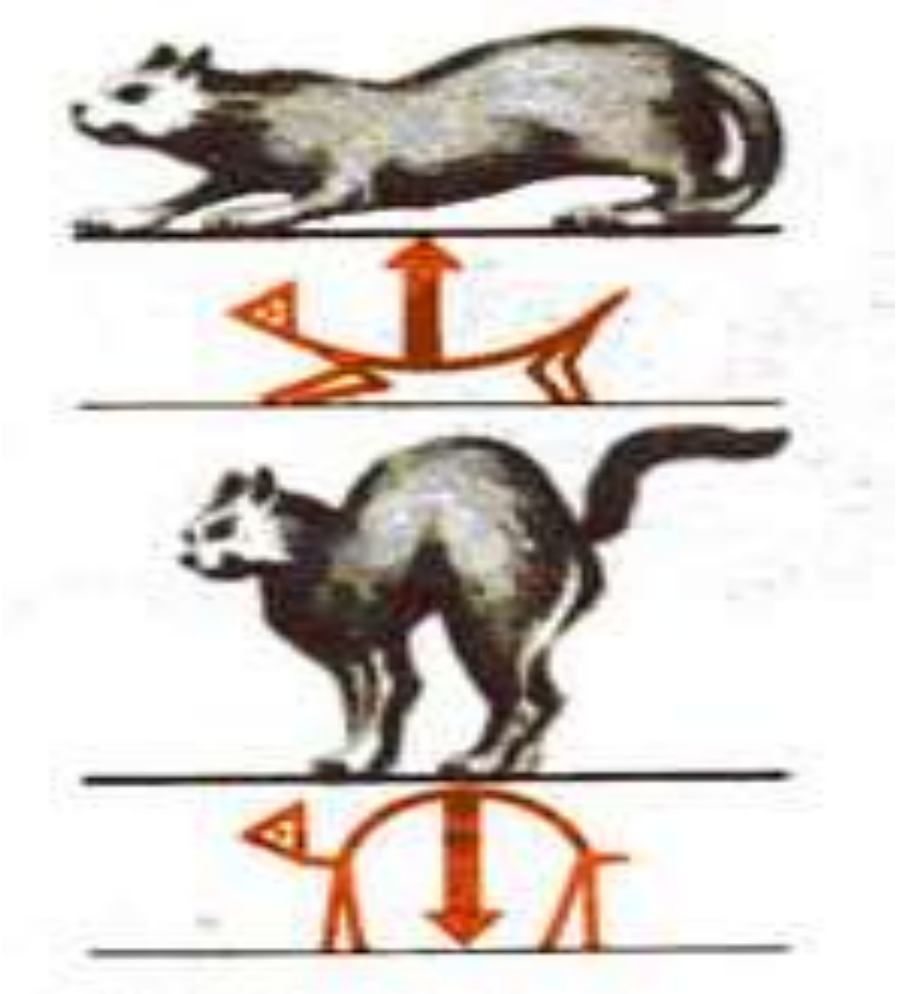
B) ON ROTATION – EYE & HEAD NYSTAGMUS

RECEPTIVE FIELD – VESTIBULORECEPTORS

A) ON LINEAR ACCELERATED MOVEMENT – ***RECEPTORS OF OTOLIT APPARATUS***

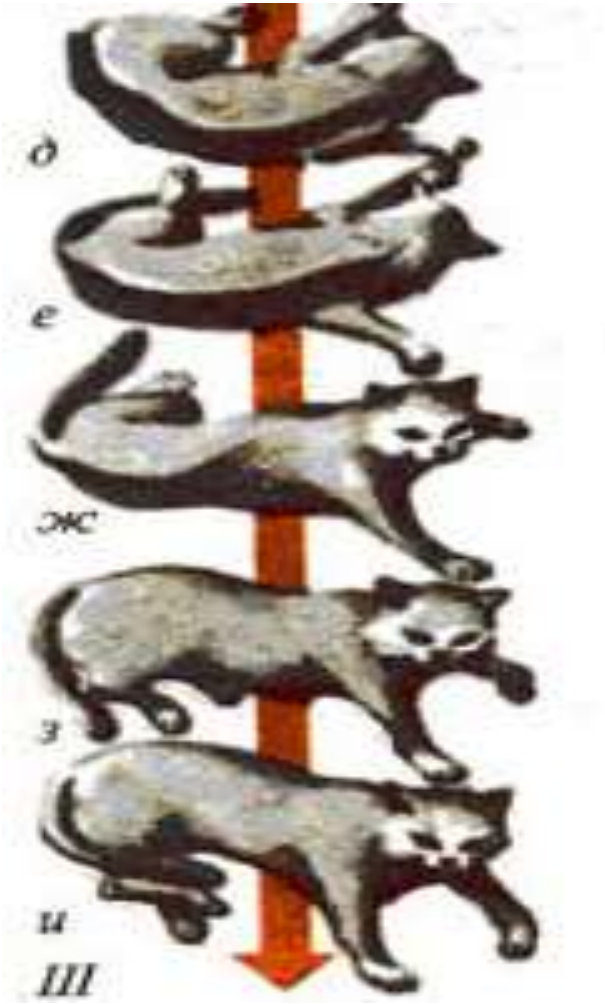
B) ON ROTATION – RECEPTORS OF SEMICIRCULAR CHANNELS

LIFT REFLEX



APPROACHING THE GROUND

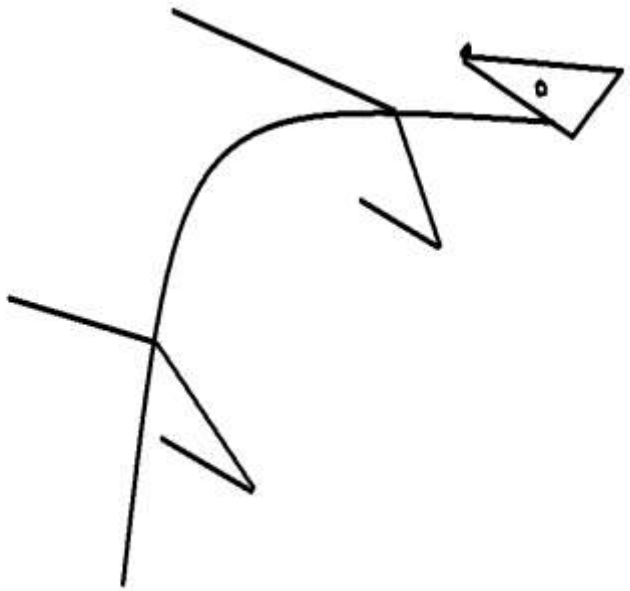
MUSCLE TONE INCREASES IN THE EXTREMITIES OF FRONT LEGS & FLEXORS OF HIND LEGS



CHANGING OF MUSCLE TONE AT ROTATION –

HEAD IS TURNED TO THE SIDE OPPOSITE TO ROTATION,

ON THE SAME SIDE EXTENSORS TONE IS INCREASED IN EXTREMITIES, ON THE SIDE OF ROTATION – MUSCLE TONE OF FLEXORS IS INCREASED



NYSTAGMUS COMPONENTS

Slow movement to the side opposite to rotation

Fast movement back

A most important function of the mesencephalic structures — is the redistribution of muscular tone according to the posture of the body.

The redistribution is effected reflexly and ensures maintenance of balance.