

Nervous system

MAIN TERMS:

funiculus

x

lemniscus

x

fasciculus = axons-HETEROGENEOUS structure– starts in the different nuclei and ends in different structures too

x

tractus =axons-HOMOGENEOUS structure – the fibers start and end in the same structures

ipsilateral x **kontralateral**

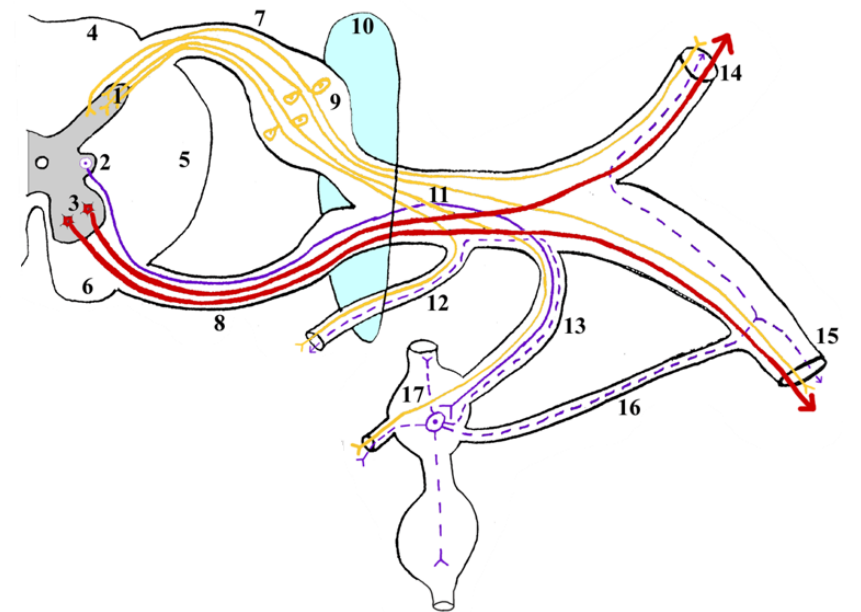
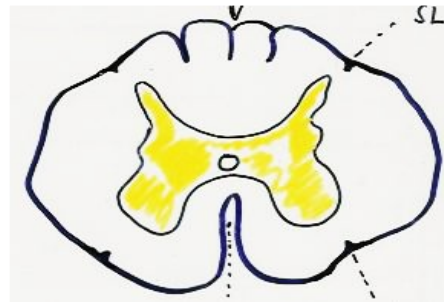
rostral = direction to the nose – forward x **dorsal**

substantia alba x **substantia grisea**

nucleus motorius (originis) x **terminationis (senzorius)**

3 types of somatosensation – somatosensory fibers:

1. Protopathic sensation
2. Epicritic sensation
3. Proprioception

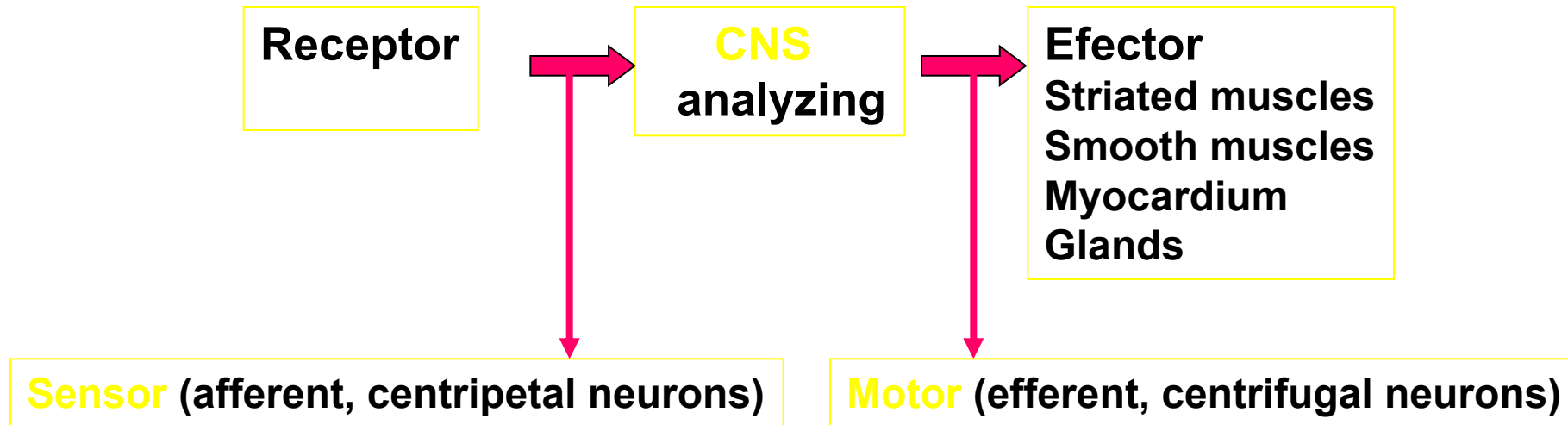


Nervous system

Sensory function – changes in the internal and external environment

Integrative function – analyses, stores and compares informations

Motor function – responds to stimuli by initiating contraction and glandular secretion



DIVISION OF NERVOUS SYSTEM

1. Central (CNS)

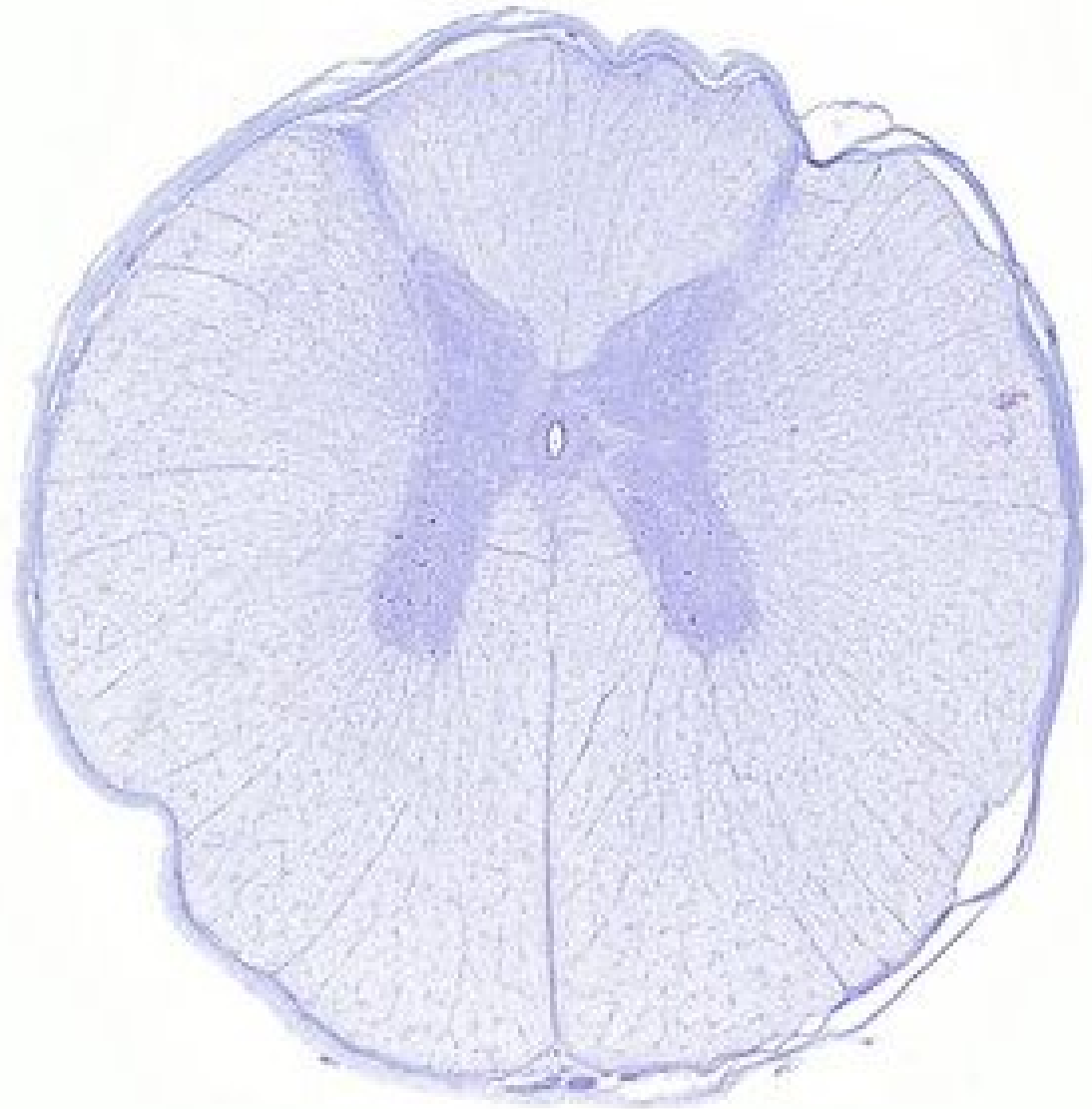
– spinal cord, brain

Gray matter – bodies of neurons (cortex, nuclei – originis, terminationis)

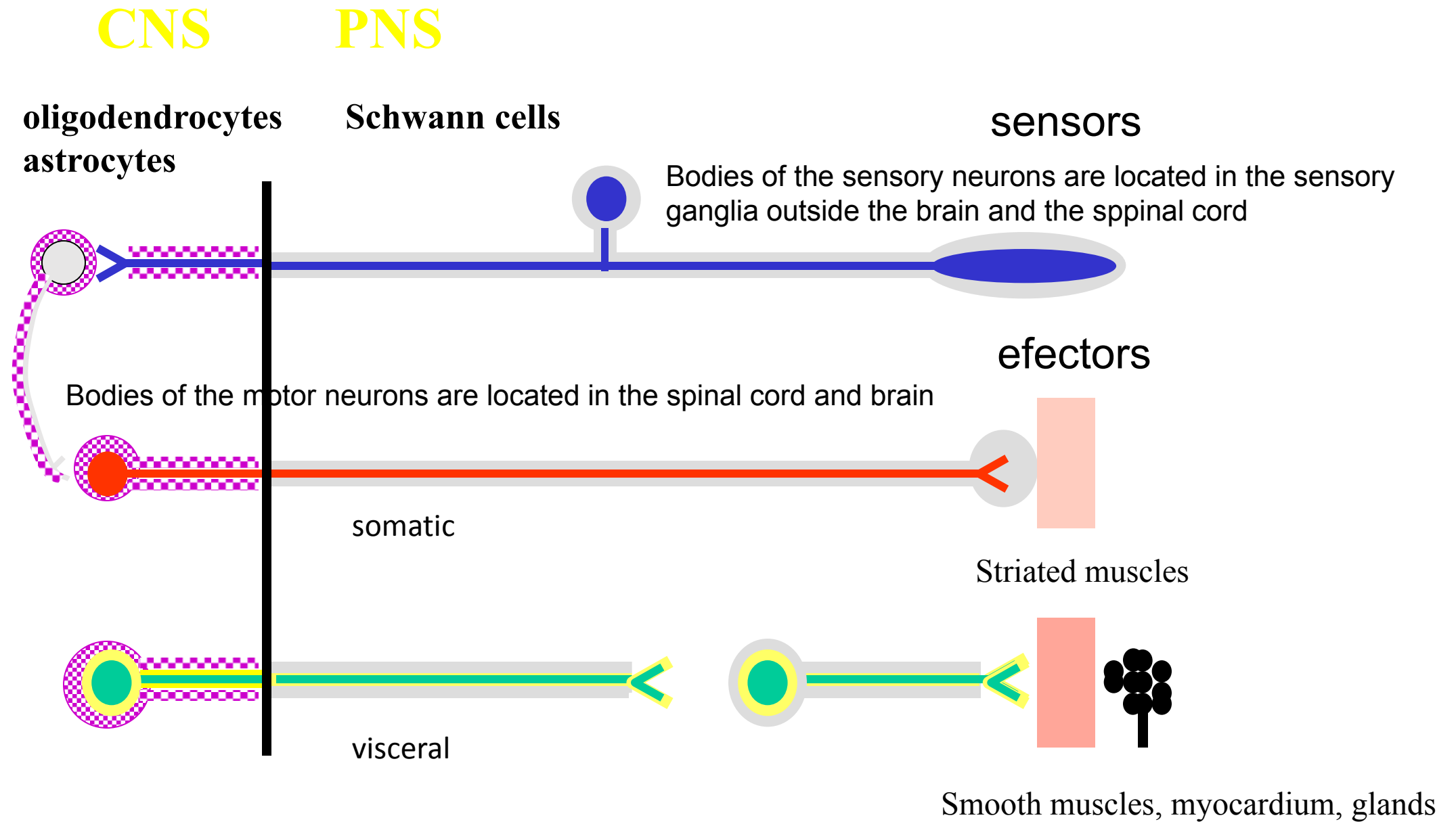
White matter – myelinated nerve fibres (tractus, fasciculus, funiculus, lemniscus)

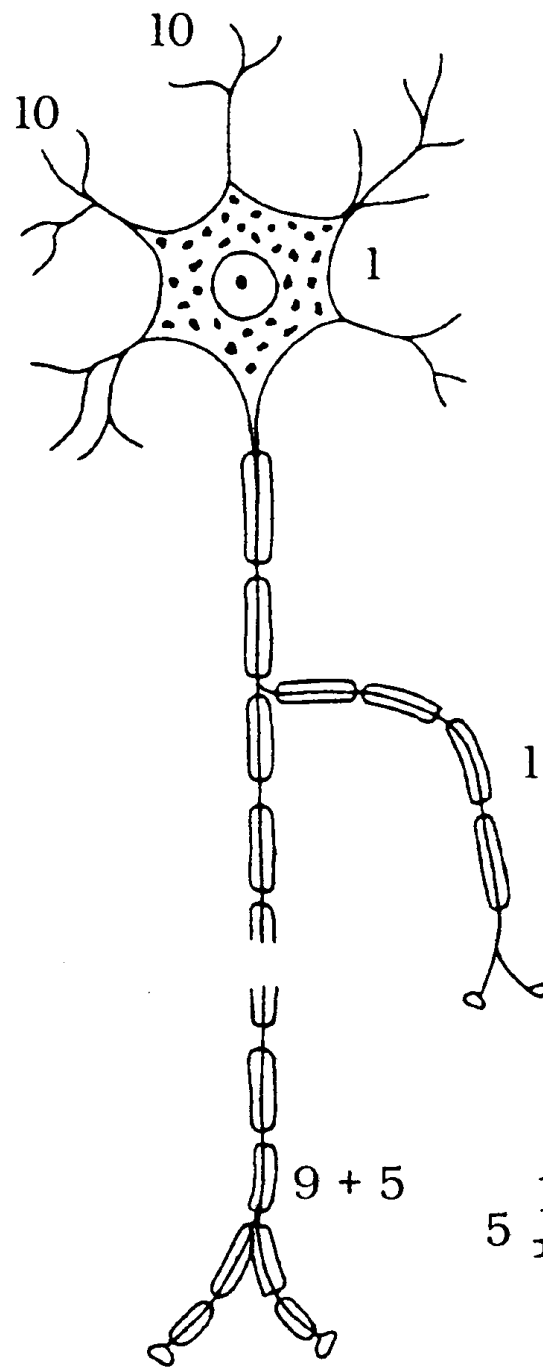
2. Peripheral (PNS)

– spinal, cranial and autonomic nerves
(sensoric, motor, mixed)
plexuses



DIVISIONS OF THE NERVOUS SYSTEM





NEURON

Body (perikaryon)

Dendrits (denritic zone)

Neurit (axon)

– inicial segment

Schwann's covering

Myelin covering

Schwann cells with fat (PNS)

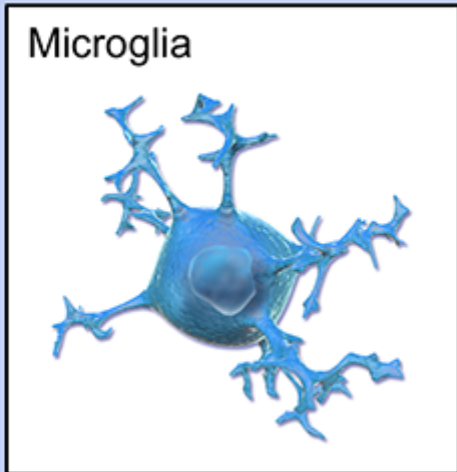
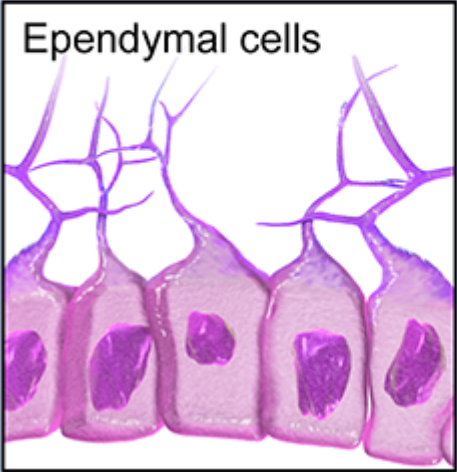
Oligodendrocytes (CNS)

Ranvier nodes

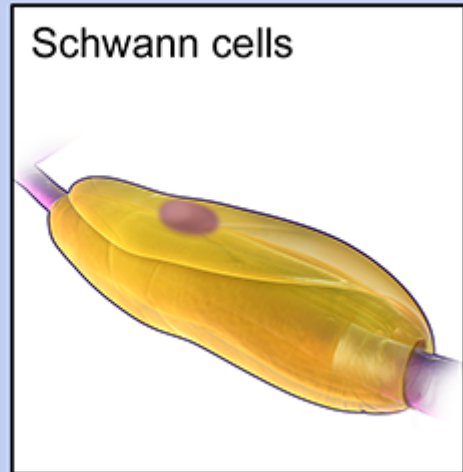
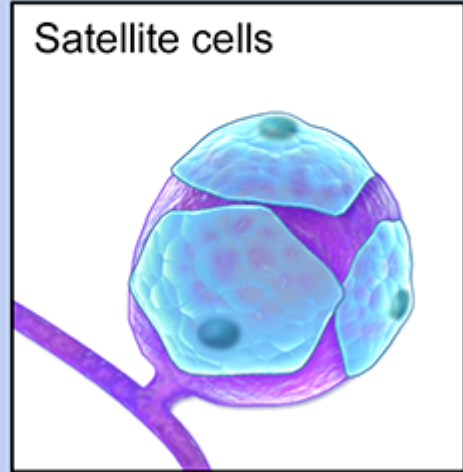
internodal segments

GLIAL CELLS

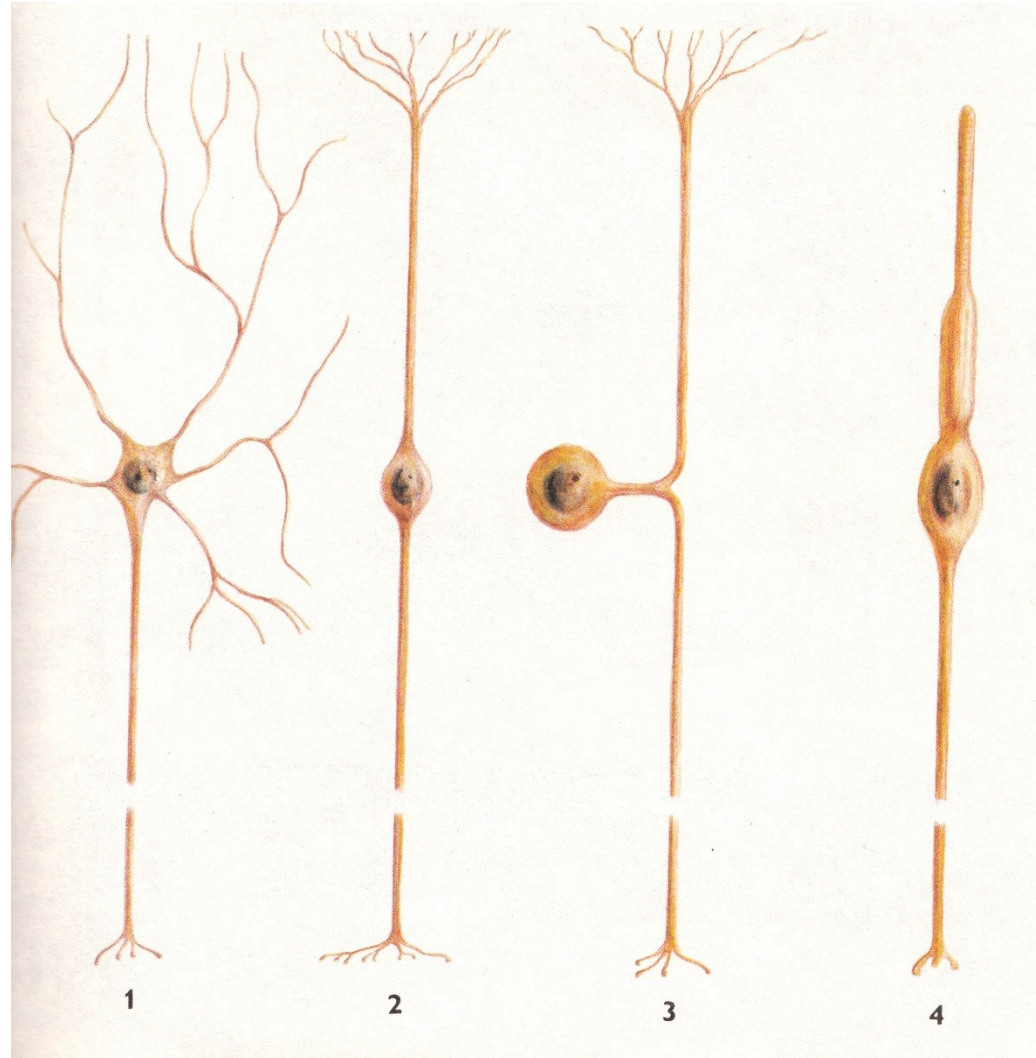
Central Nervous System



Peripheral Nervous System



TYPES OF NEURONS (morphological division)



TYPES OF NEURONS (functional division)

1. SENSORIC (ascendent, aferent, centripetal)

Somatosensoric

(proprioception, exteroception)

Viscerosensoric

(interoception)

2. MOTOR

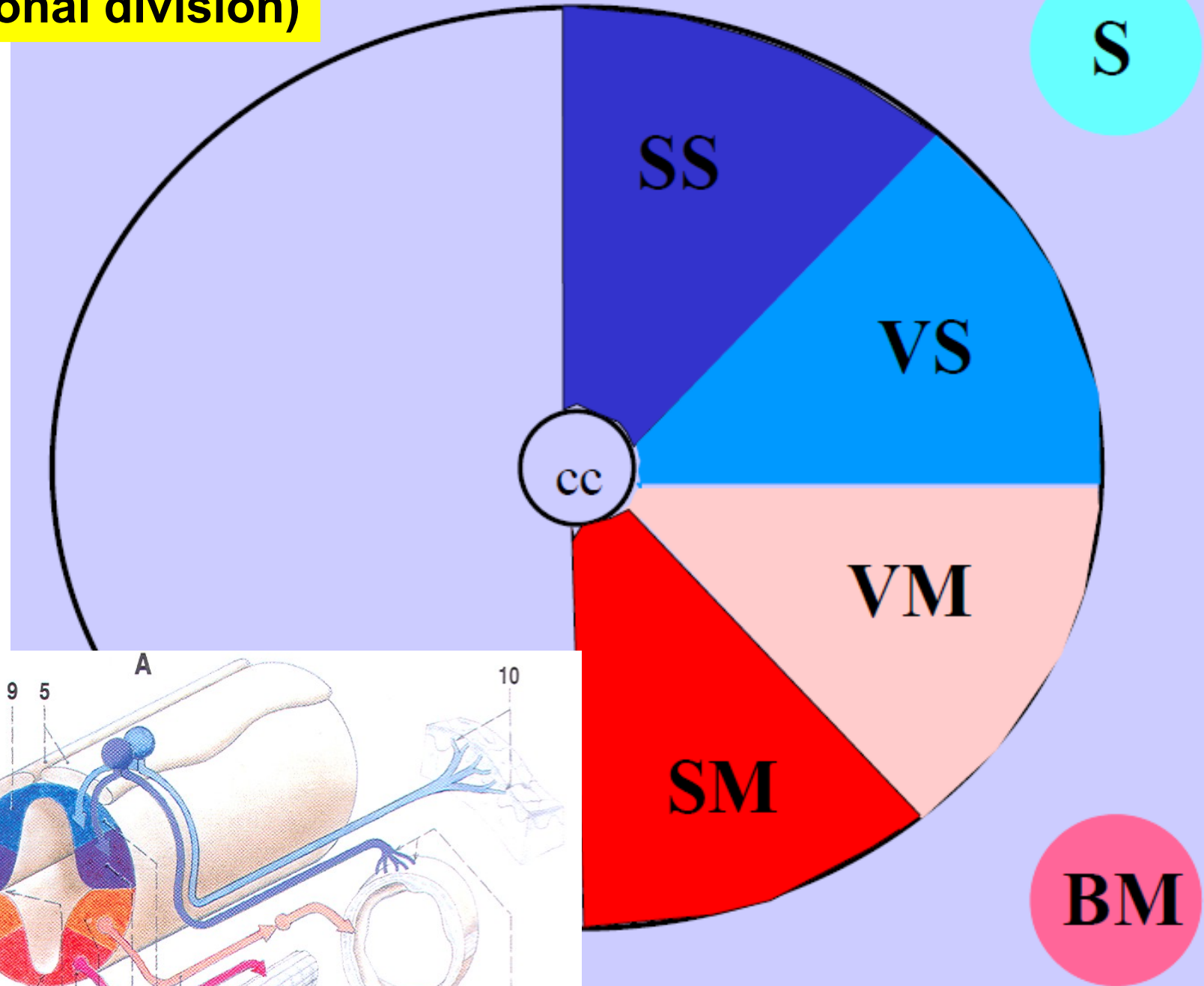
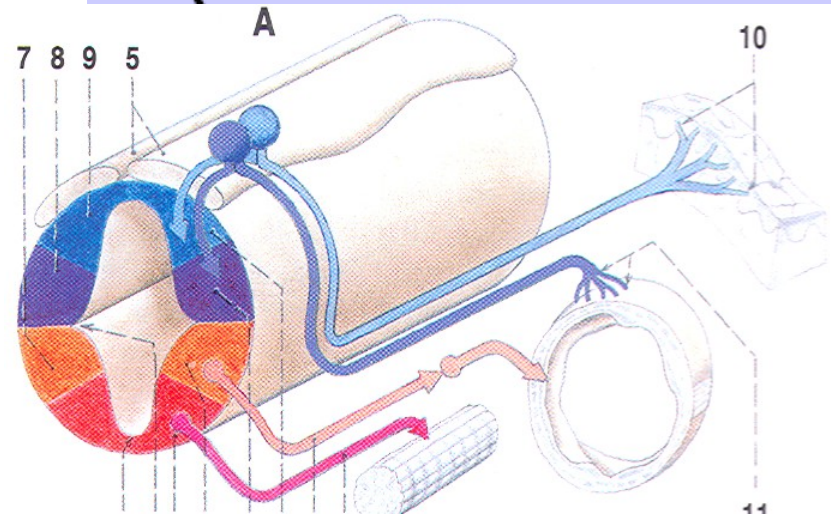
Somatomotor

(striated muscles)

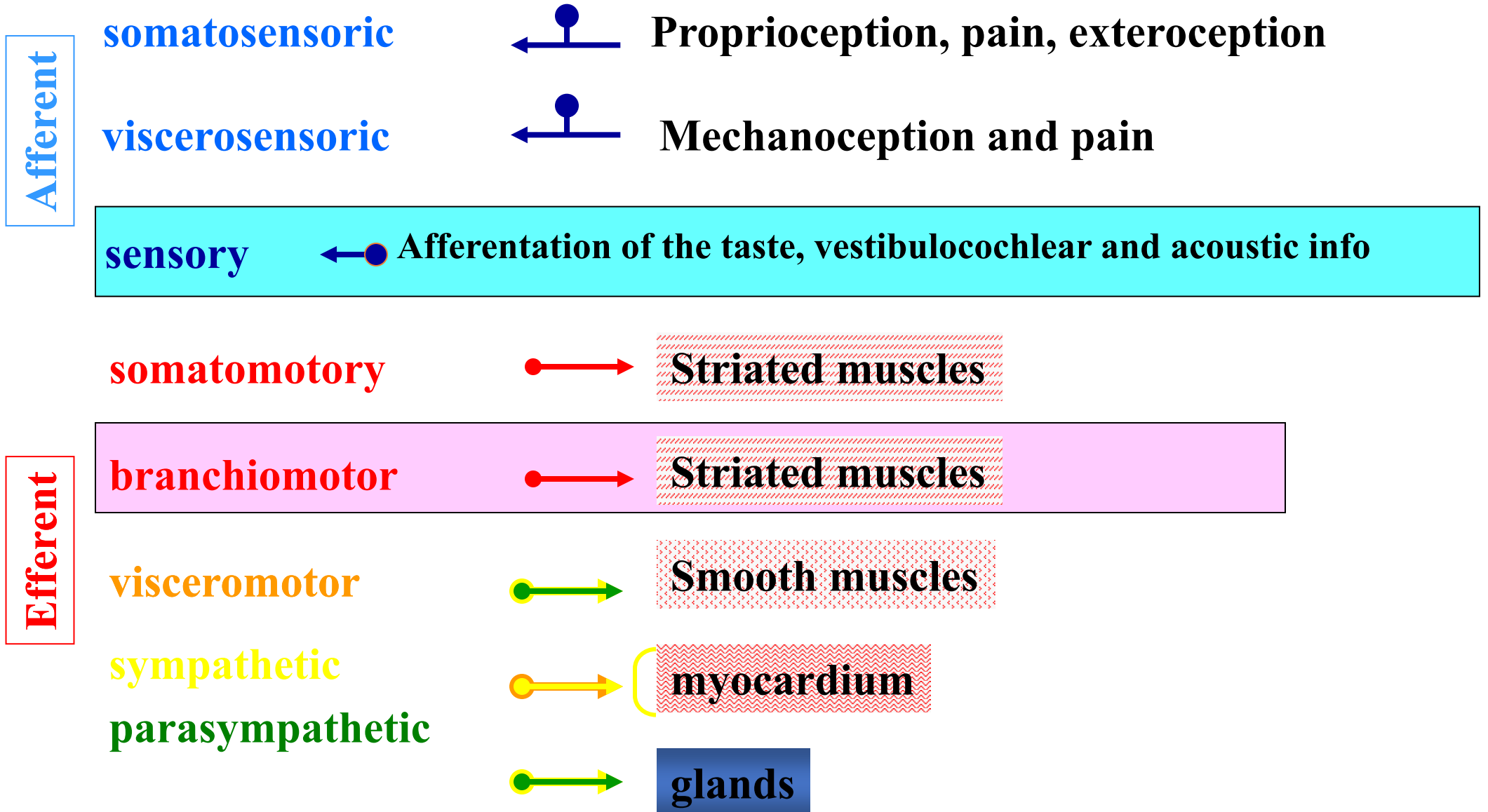
Visceromotor

sympaticus, parasympaticus – vegetativ, autonomic (smooth muscles, heart, glands)

3. INTERNEURONS



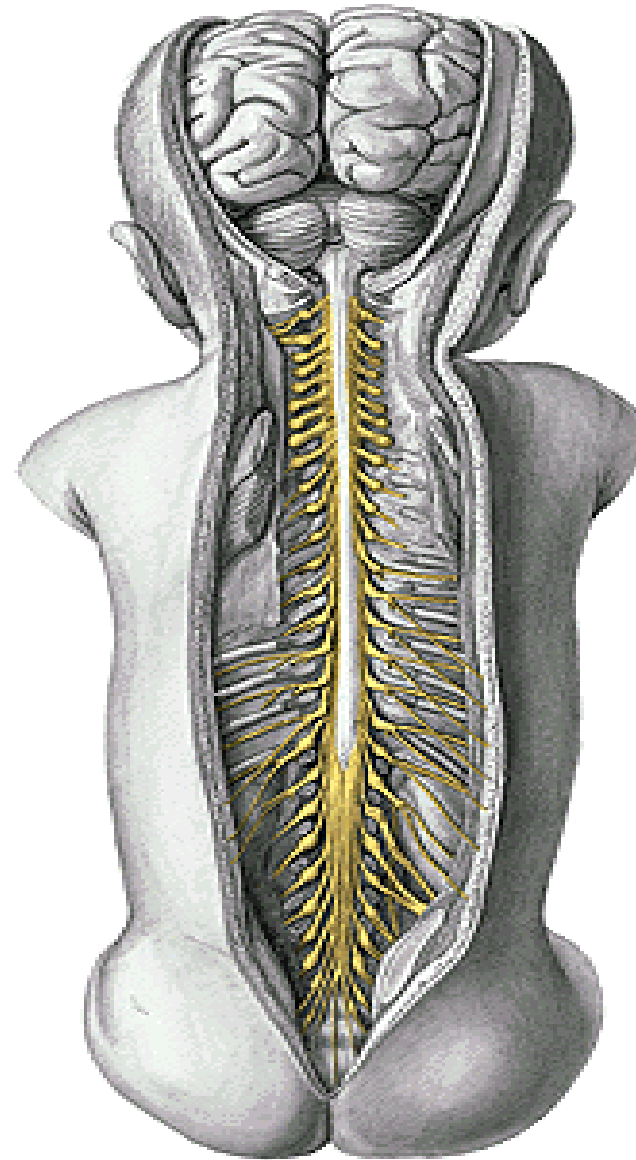
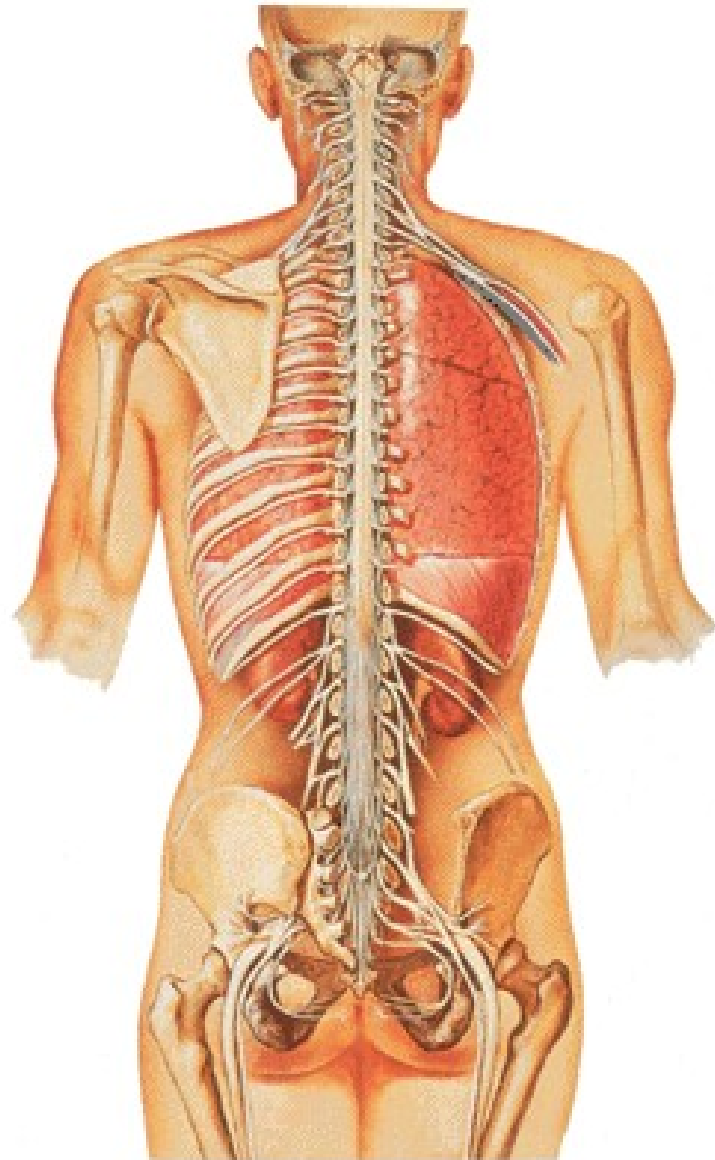
FUNCTIONAL TYPES OF AXONS IN PNS



Questions:

1. **Spinal cord (medulla spinalis): borders, gross anatomy, and general organization of the grey and white matter**
2. **Spinal cord (medulla spinalis): grey matter – main nuclei**
3. **Spinal cord (medulla spinalis): white matter – main ascending and descending pathways and their functions**

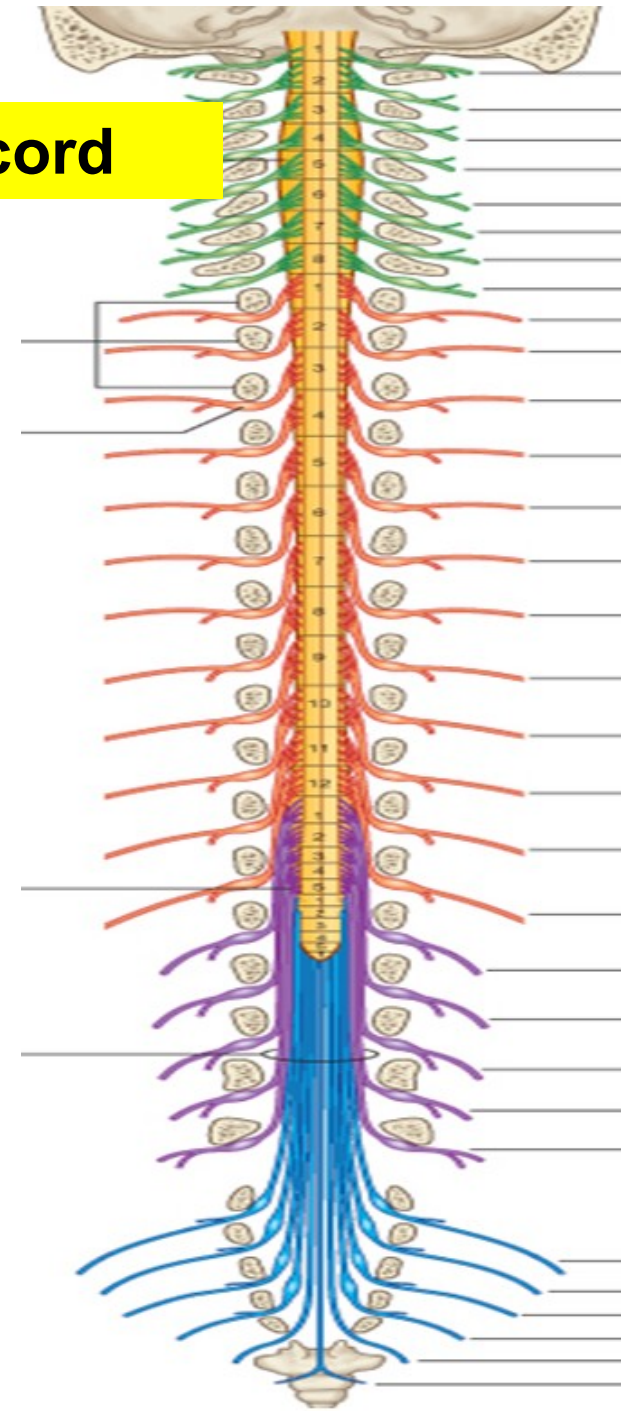
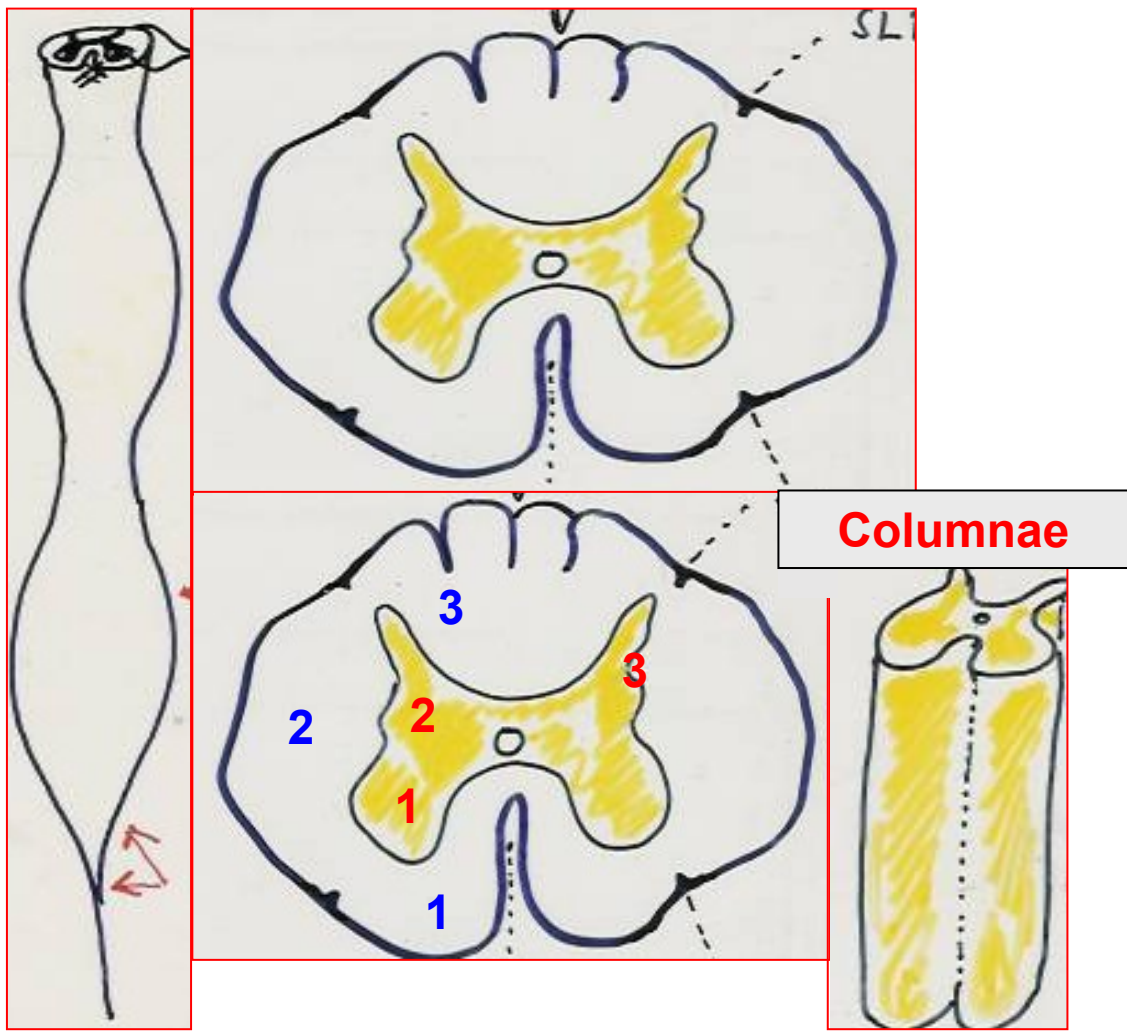
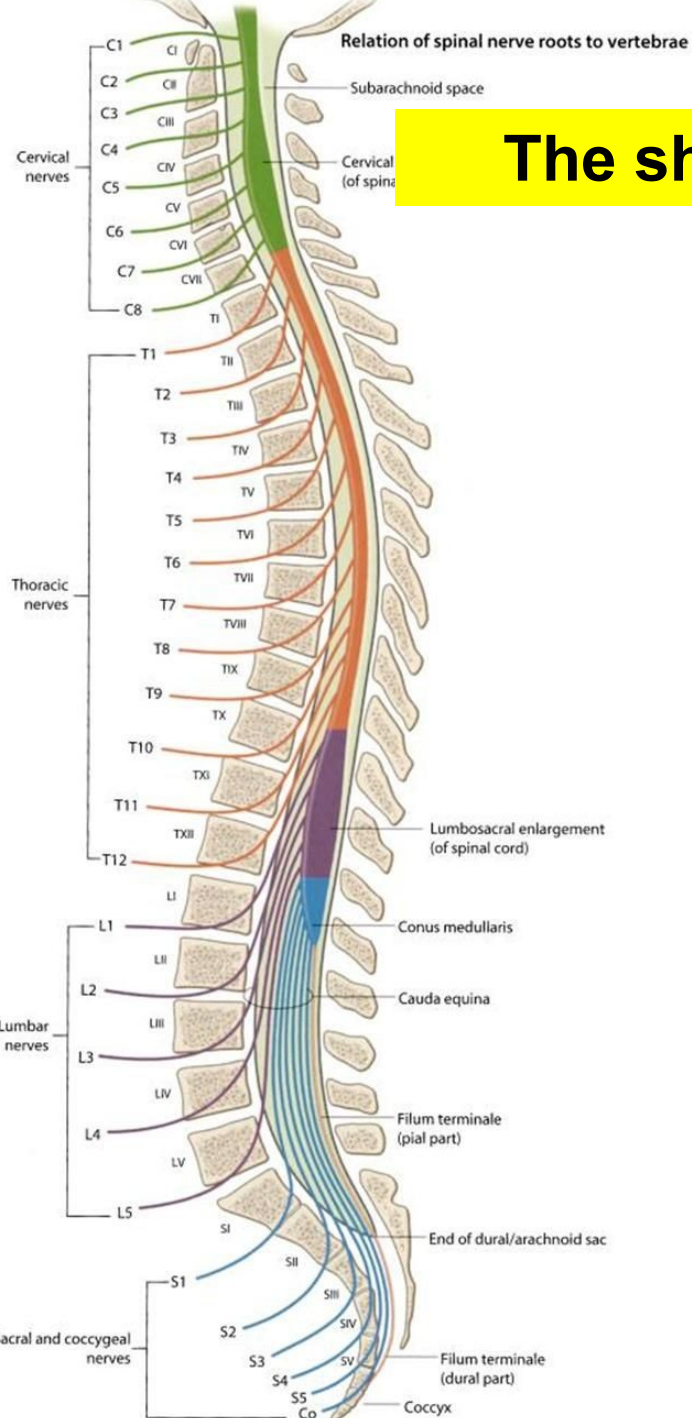
Spinal cord (medulla spinalis)



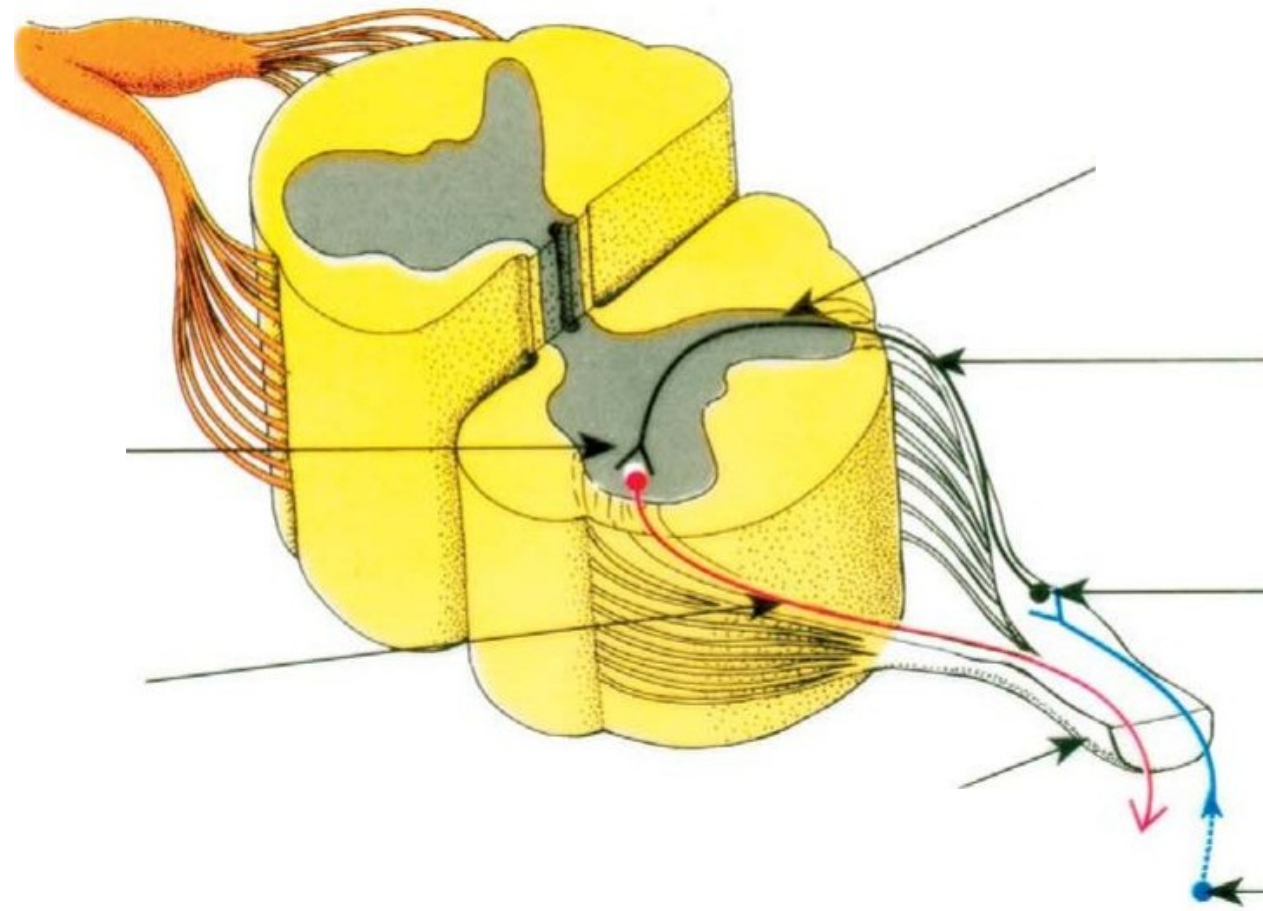
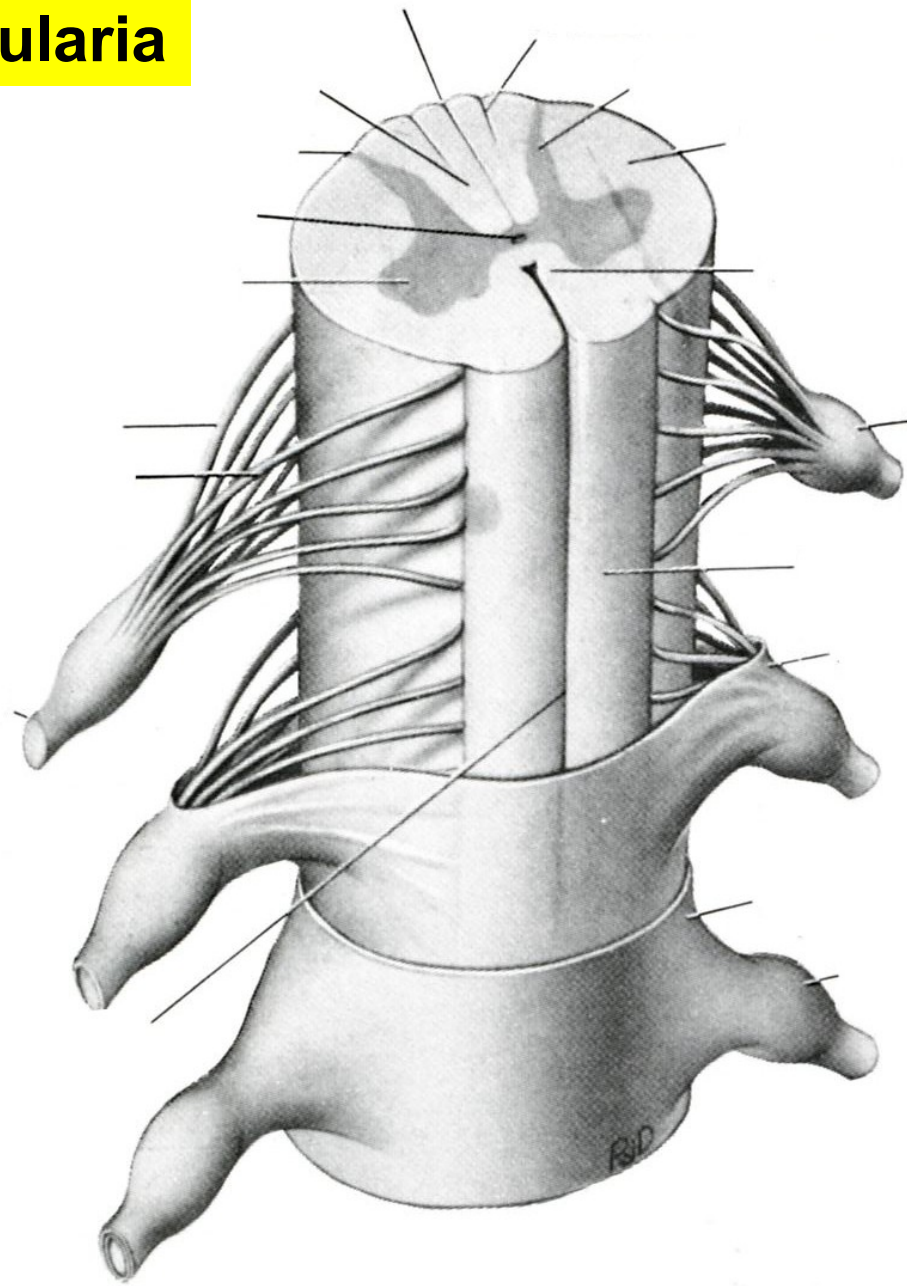


Segments

The shape and inner structure of the spinal cord

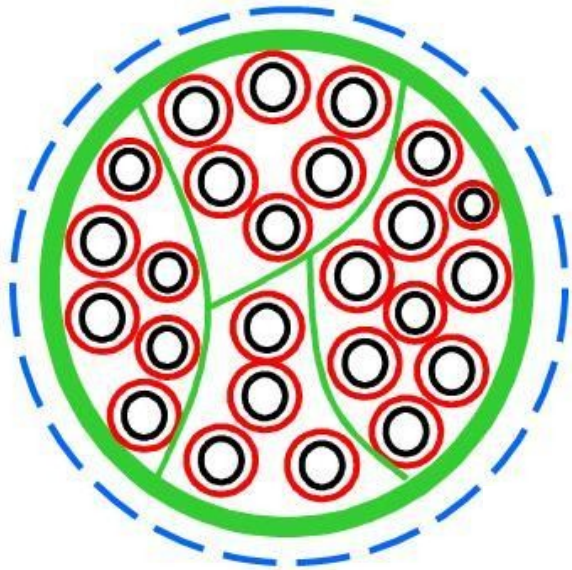


Fila radicularia

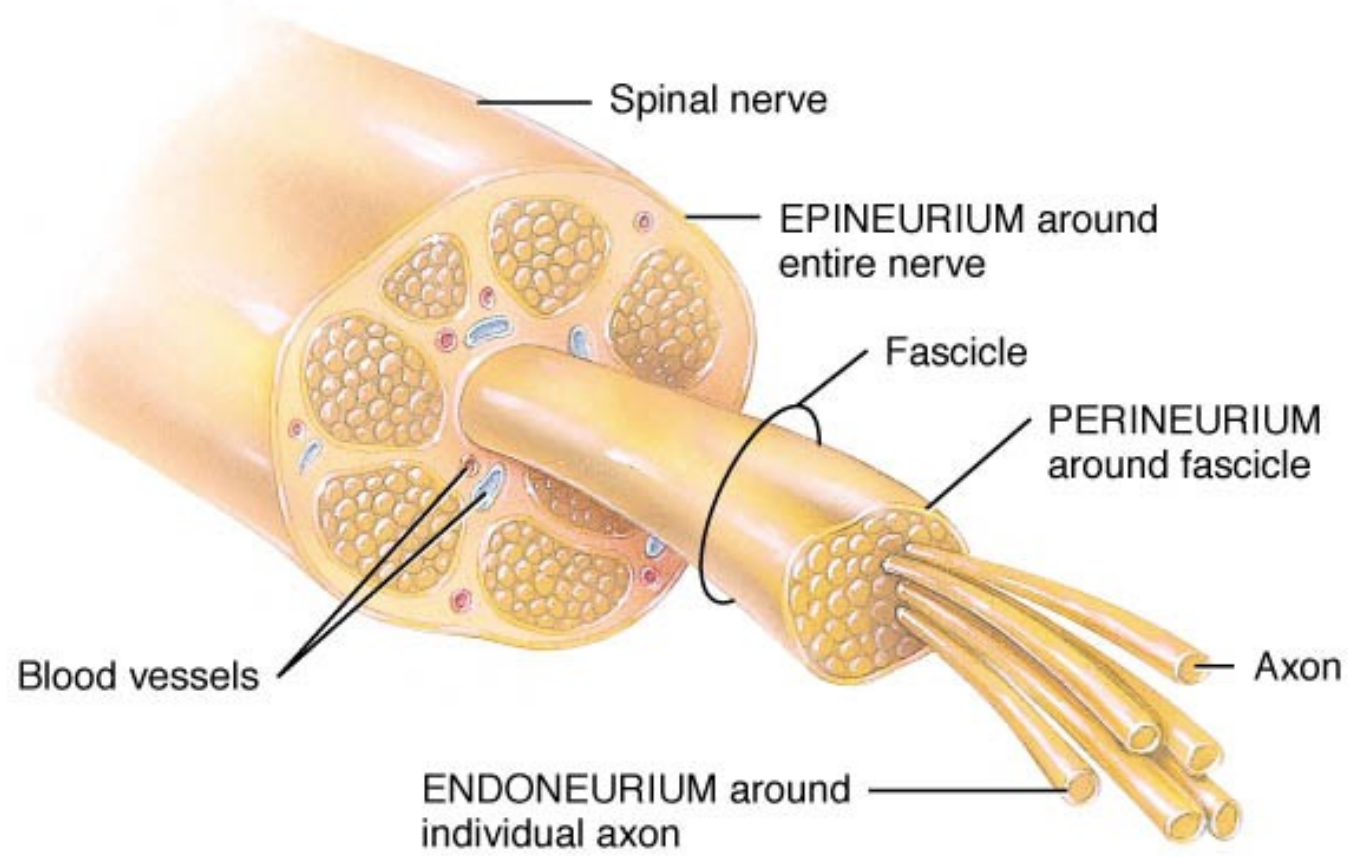


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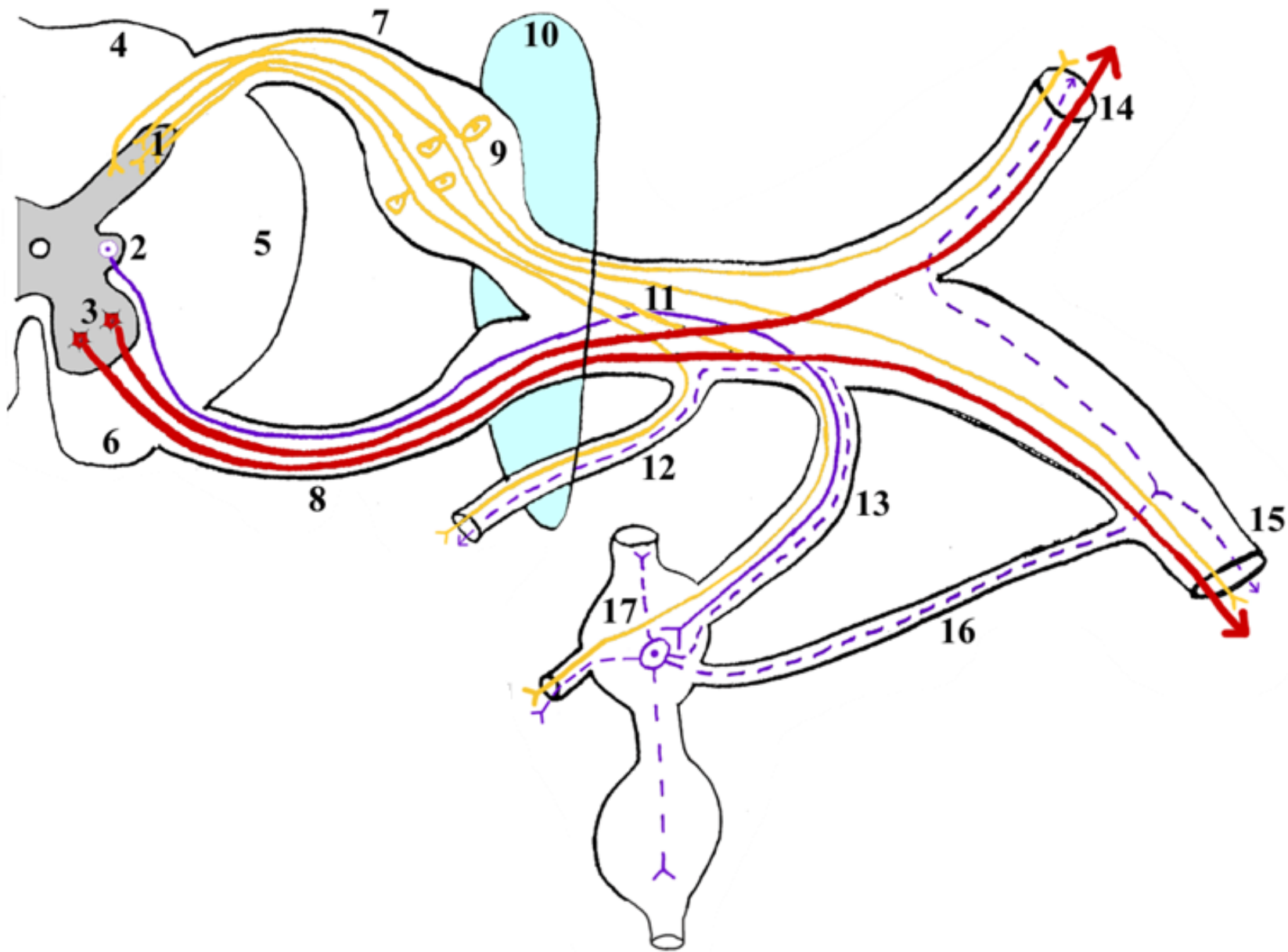
Structure of the spinal nerve

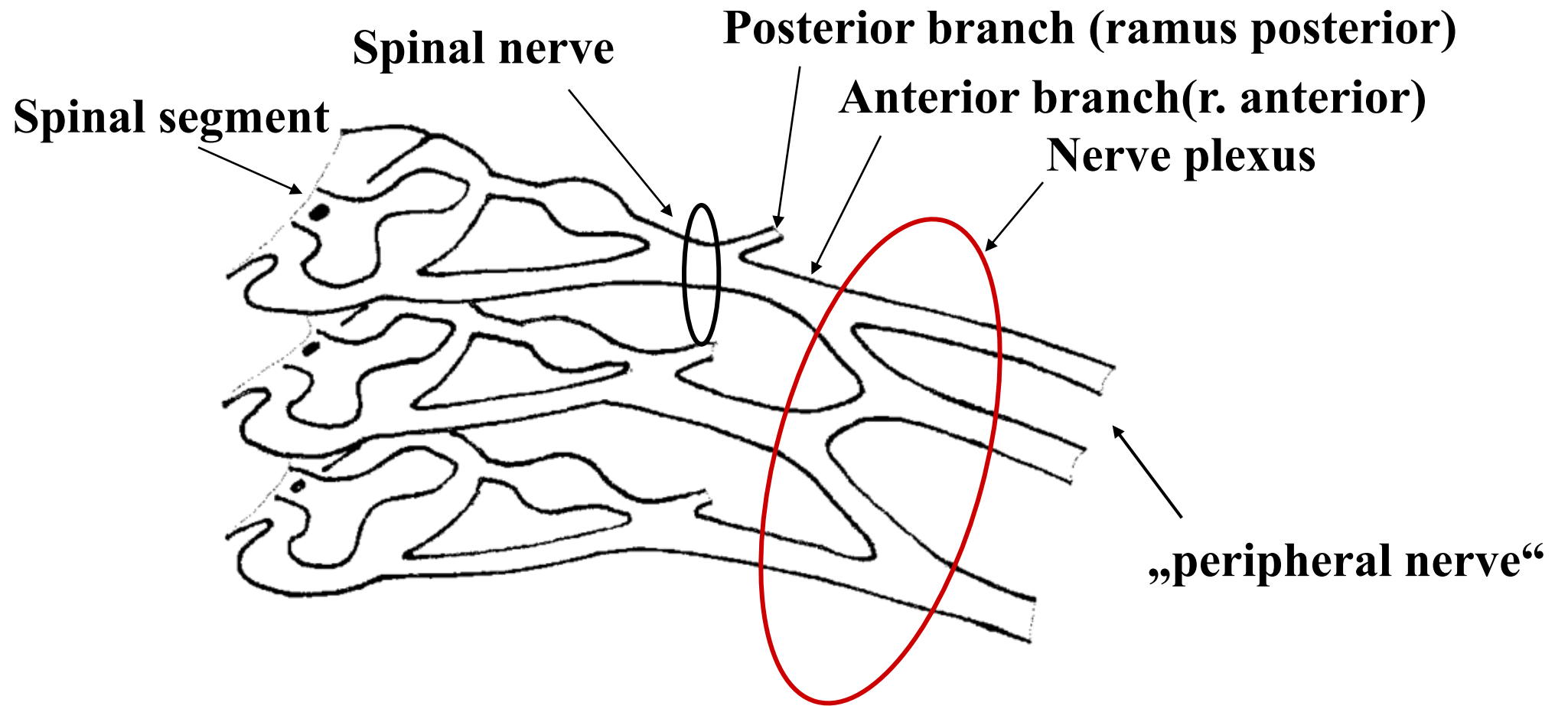


- nerve fiber
- endoneurium
- perineurium
- perineurial partition / septum
- epineurium



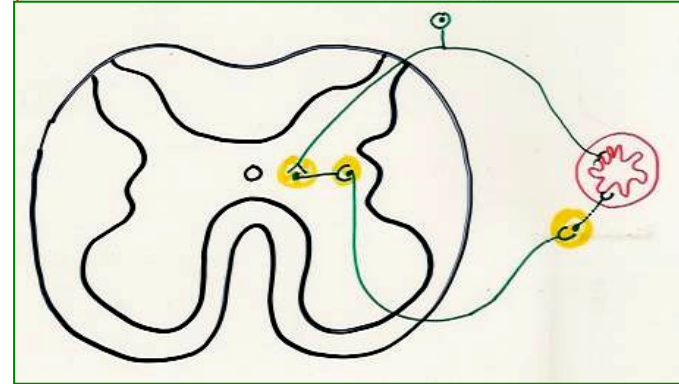
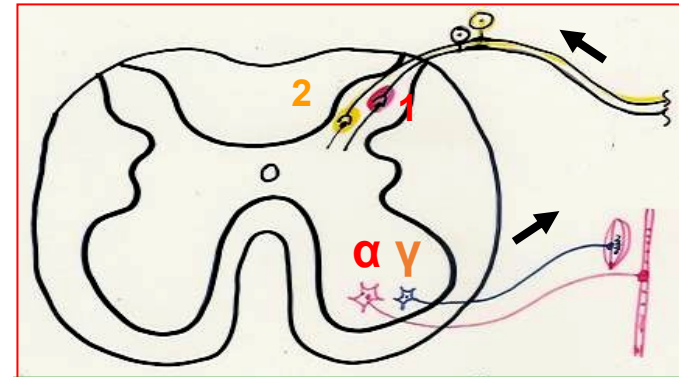
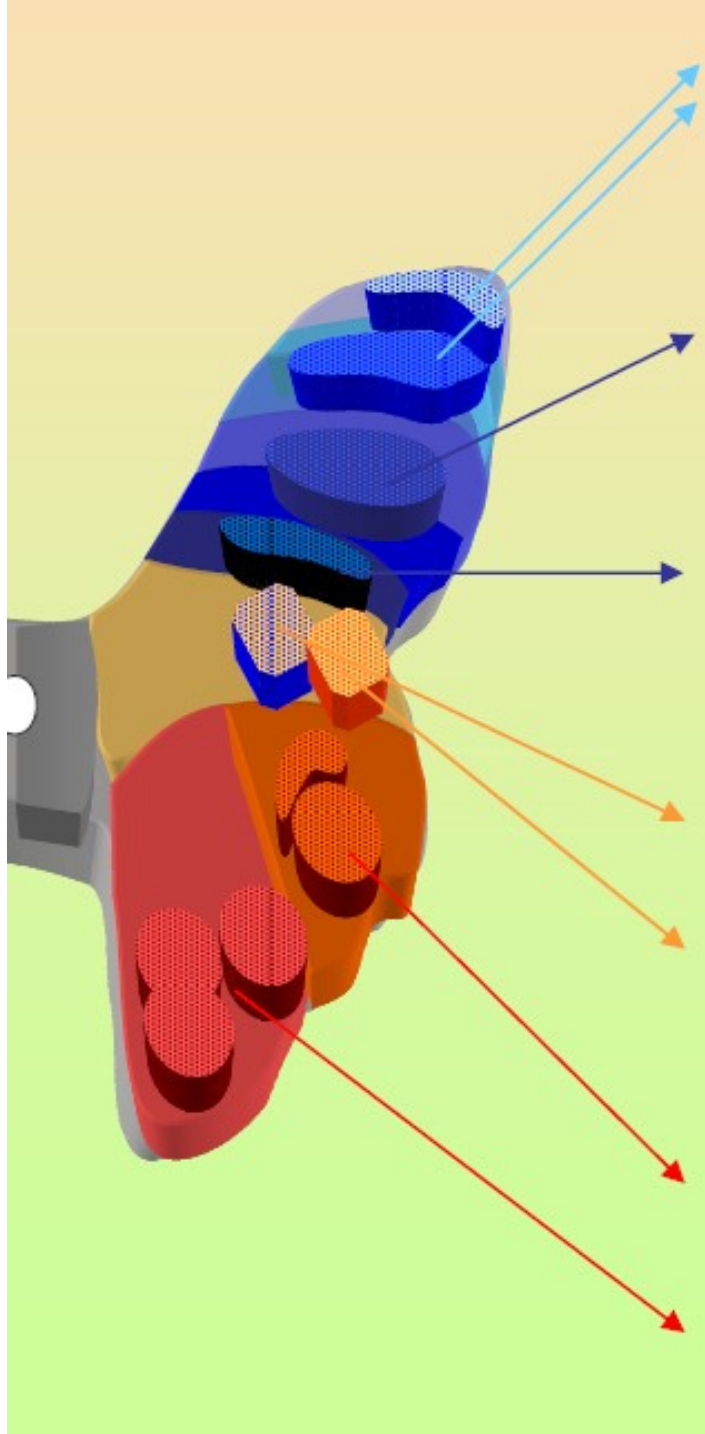
The scheme of the spinal nerve



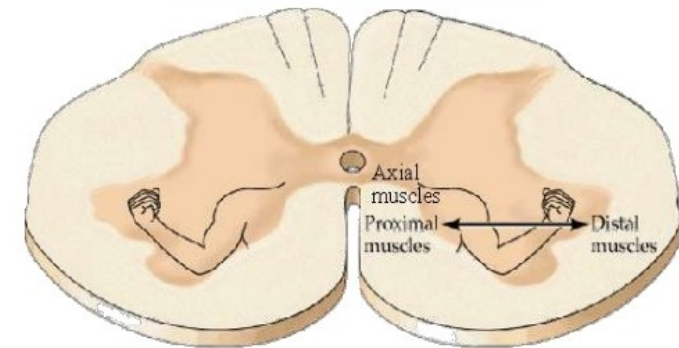


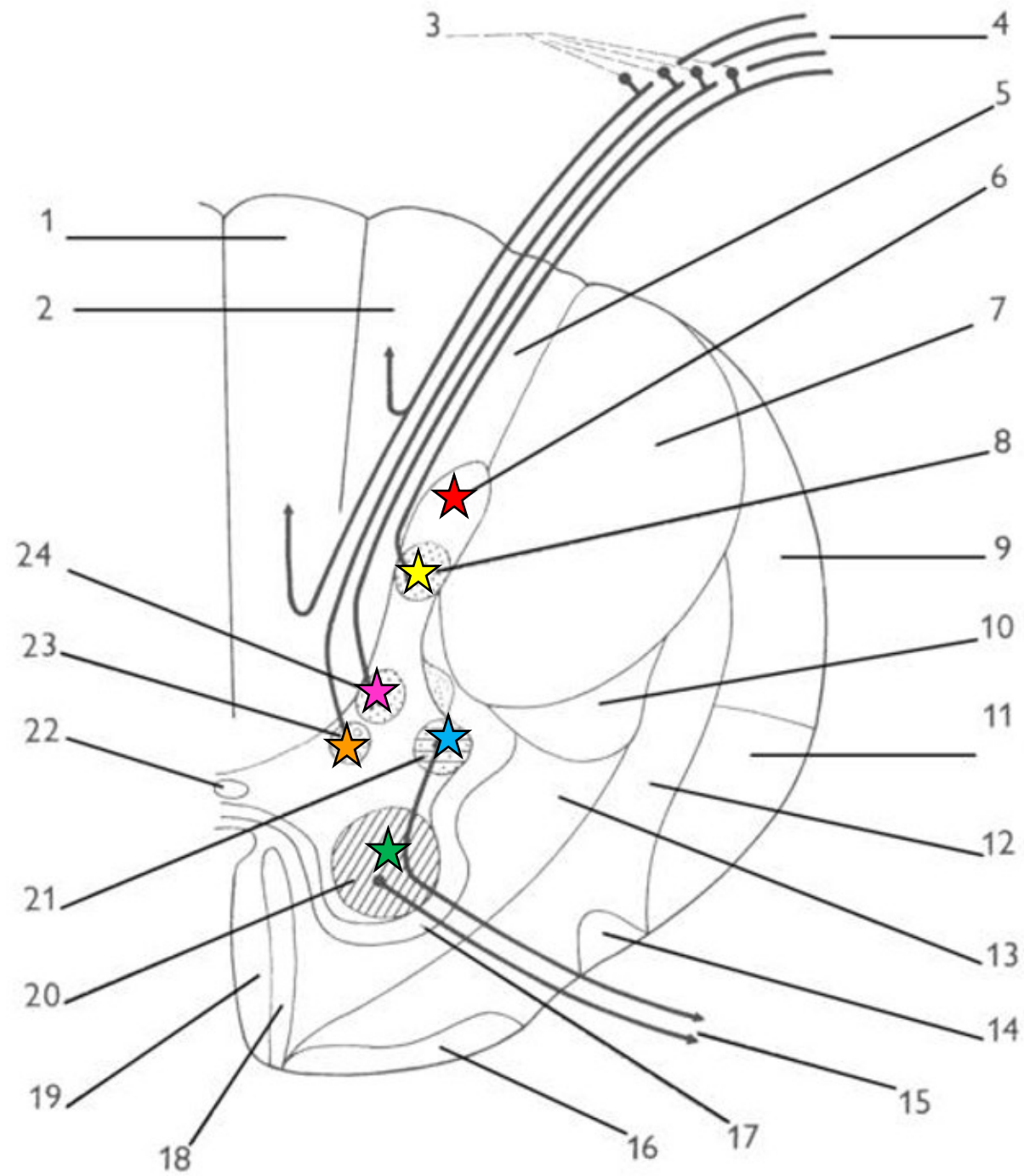
The nervous plexuses are formed only by ventral branches of the spinal nerves

THE GREY MATTER OF THE SPINAL CORD



**Somatotopic Organization
Ventral Horn Motor Neurons**





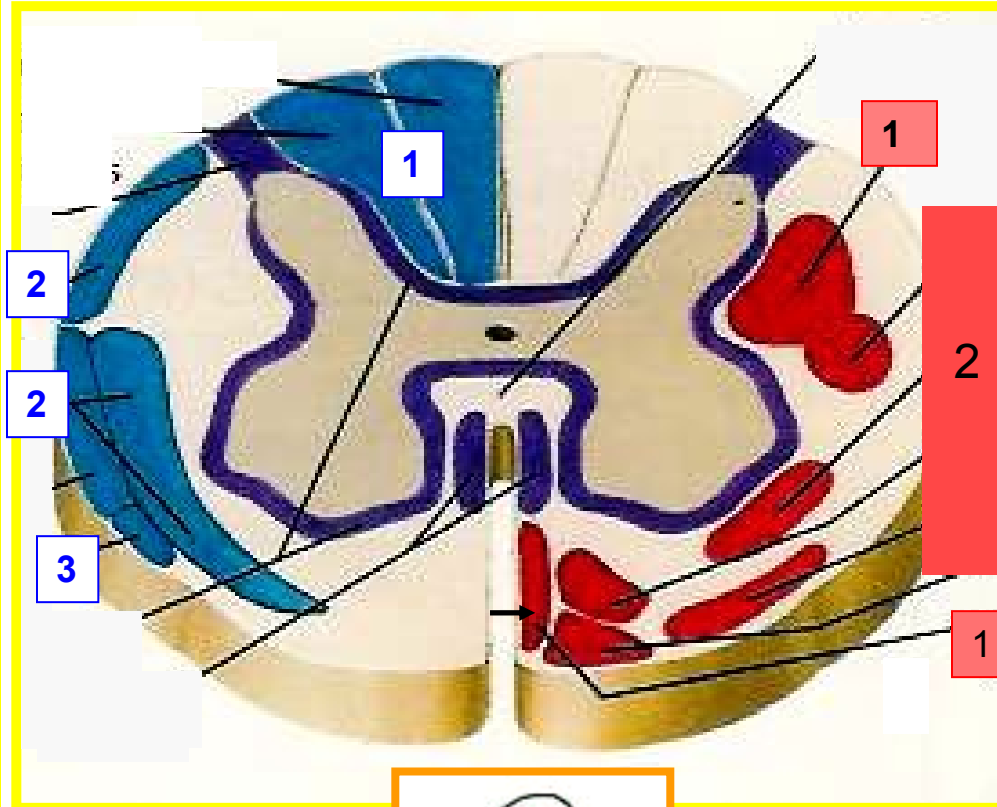
THE WHITE MATTER OF THE SPINAL CORD TRACTUS NERVOSI

CENTRIPETAL - ASCENDENT SENZORY TRACTS

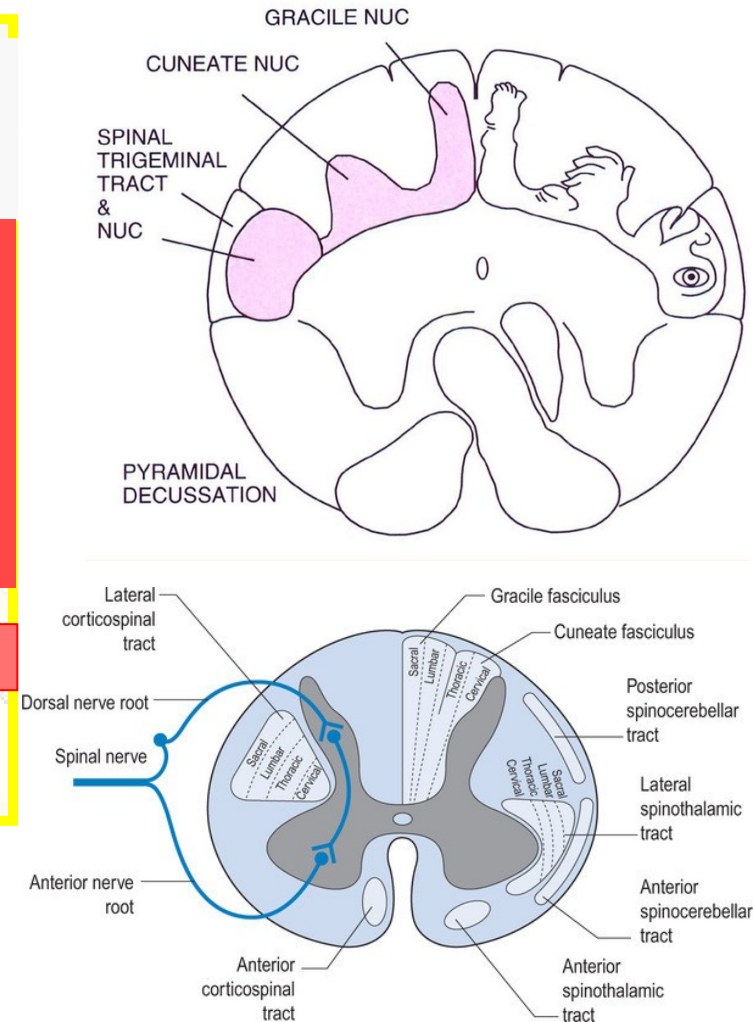
1. **Spino-bulbo-thamo-cortical tracts:** for epikritic sensation and conscious proprioception
2. **Tractus spinocerebellaris anterior et posterior:** propriception to the cerebellum
3. **Tractus spinothalamicus anterior et lateralis:** for unconscious protopathic sensation , heat and pain

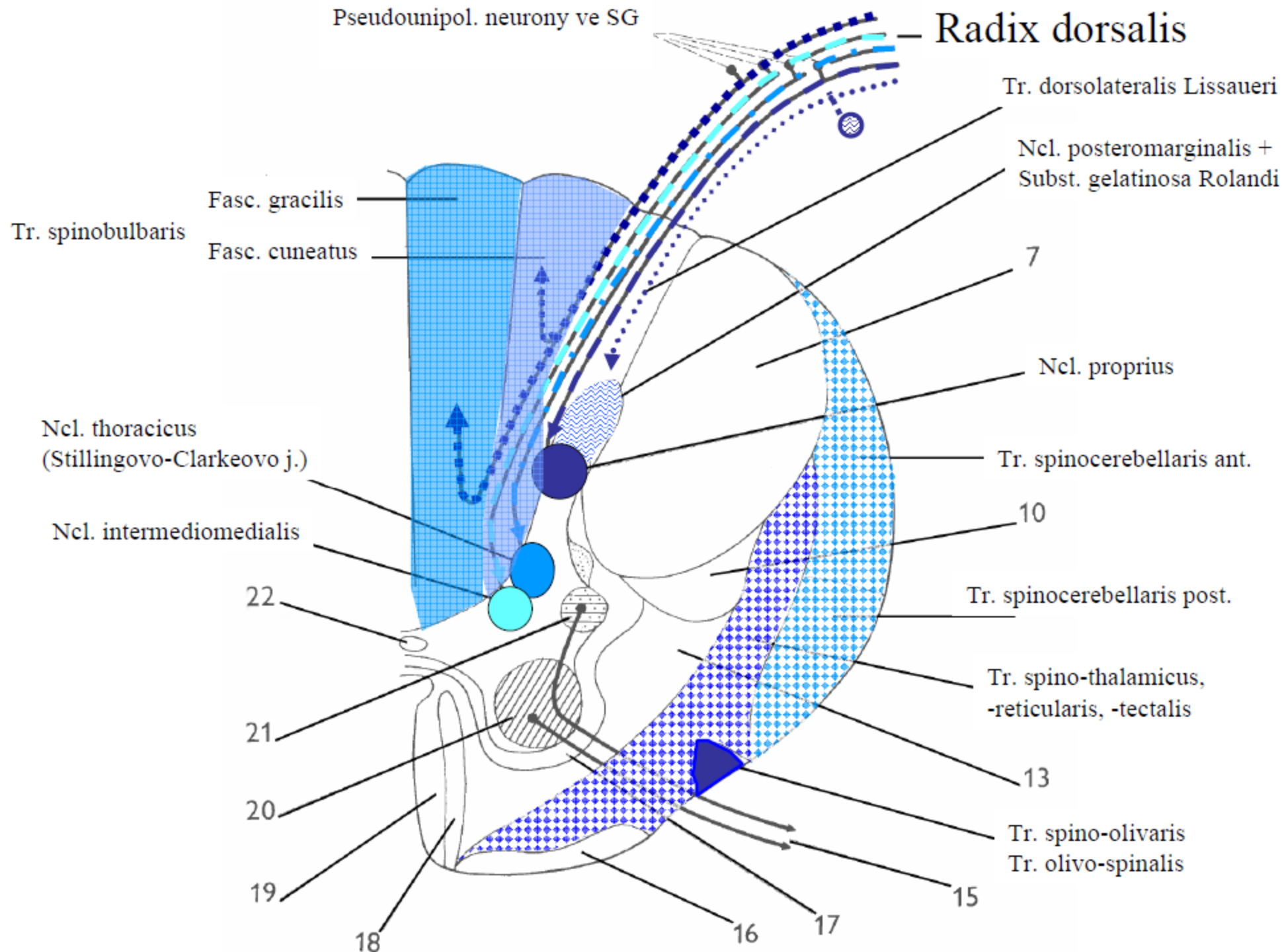
CENTRIFUGAL - DESCENDENT MOTOR TRACTS

1. **Pyramid tracts= tractus corticospinalis anterior et lateralis:** tracts of conscious movements
2. **Extrapyramid tracts**
tr. rubrospinalis, tr. reticulospinalis, tr. tectospinalis, tr. vestibulospinalis
tracts of unconscious movements



SOMATOTOPY IN THE SPINAL CORD





MOTOR TRACTS

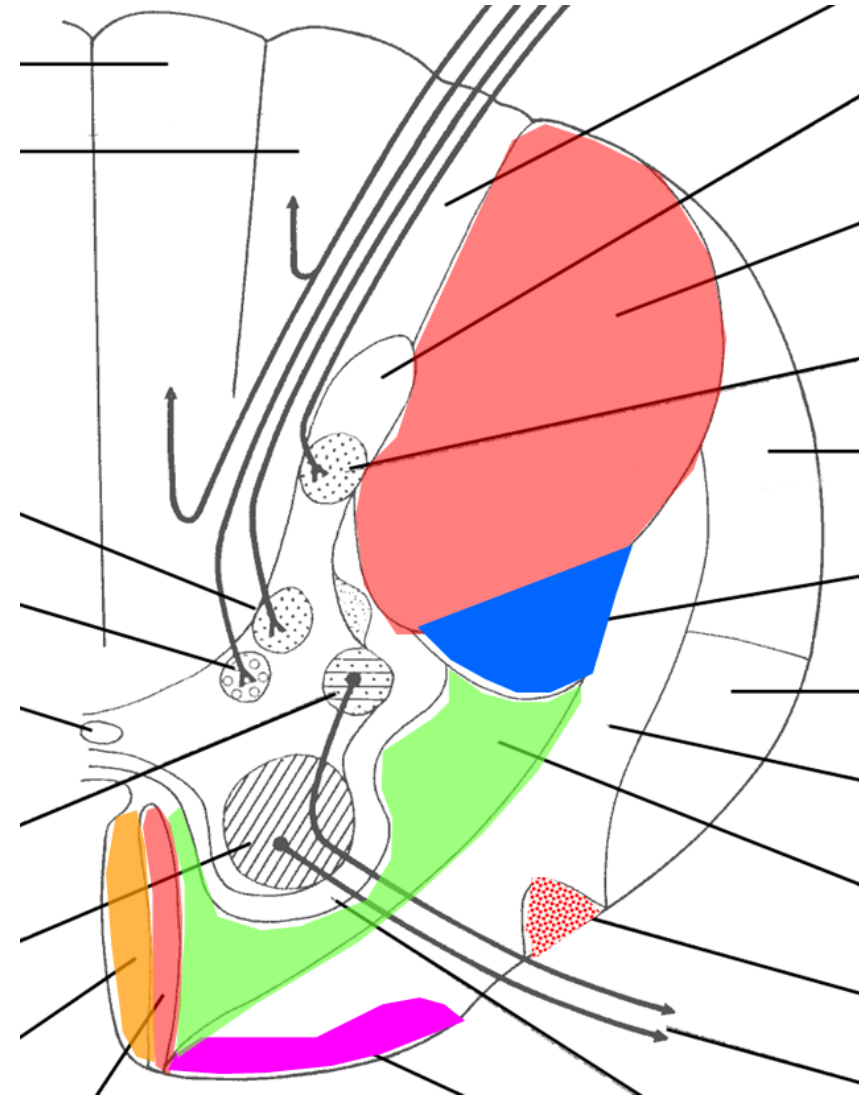
funiculus anterolateralis

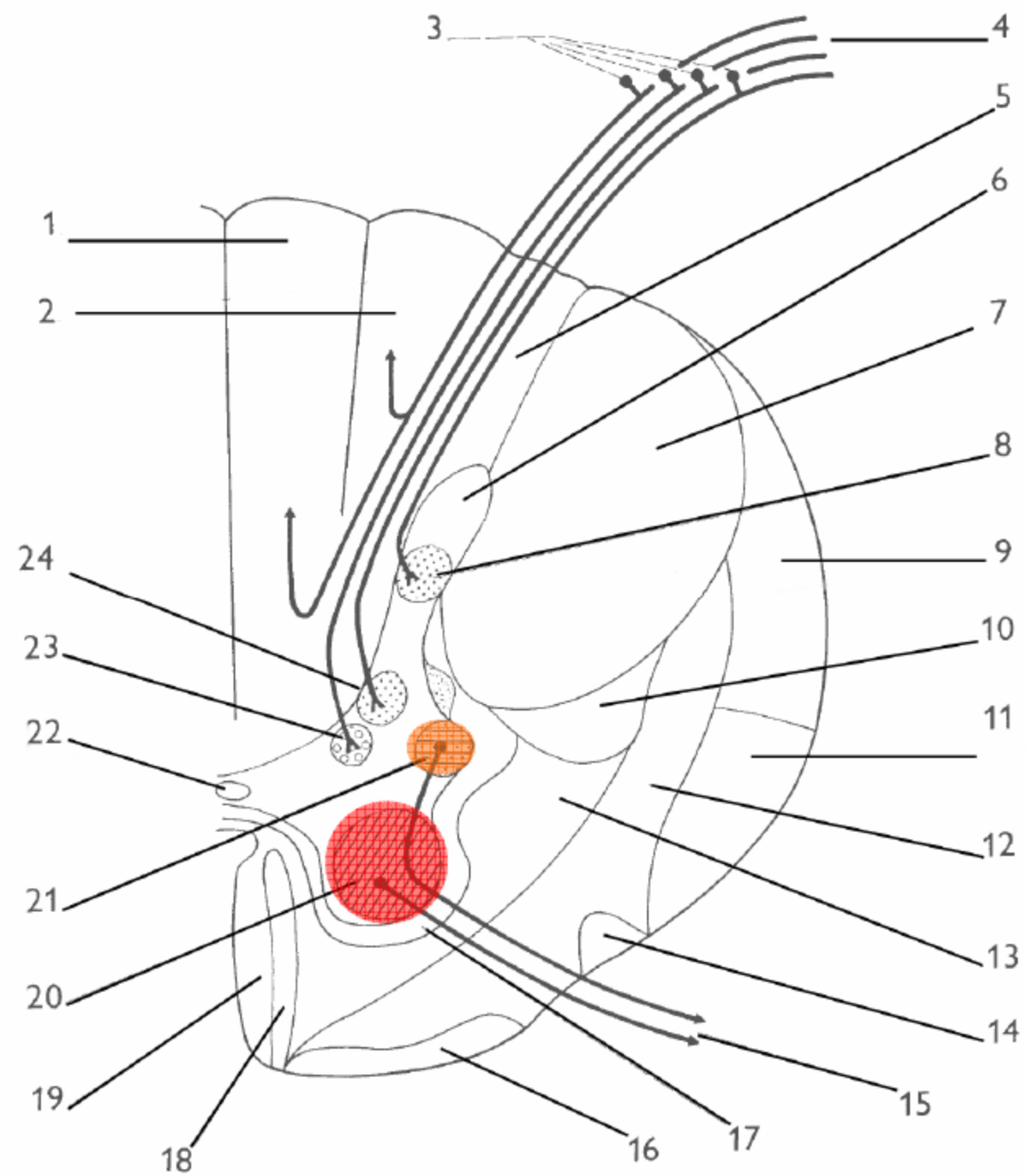
PYRAMID TRACTS

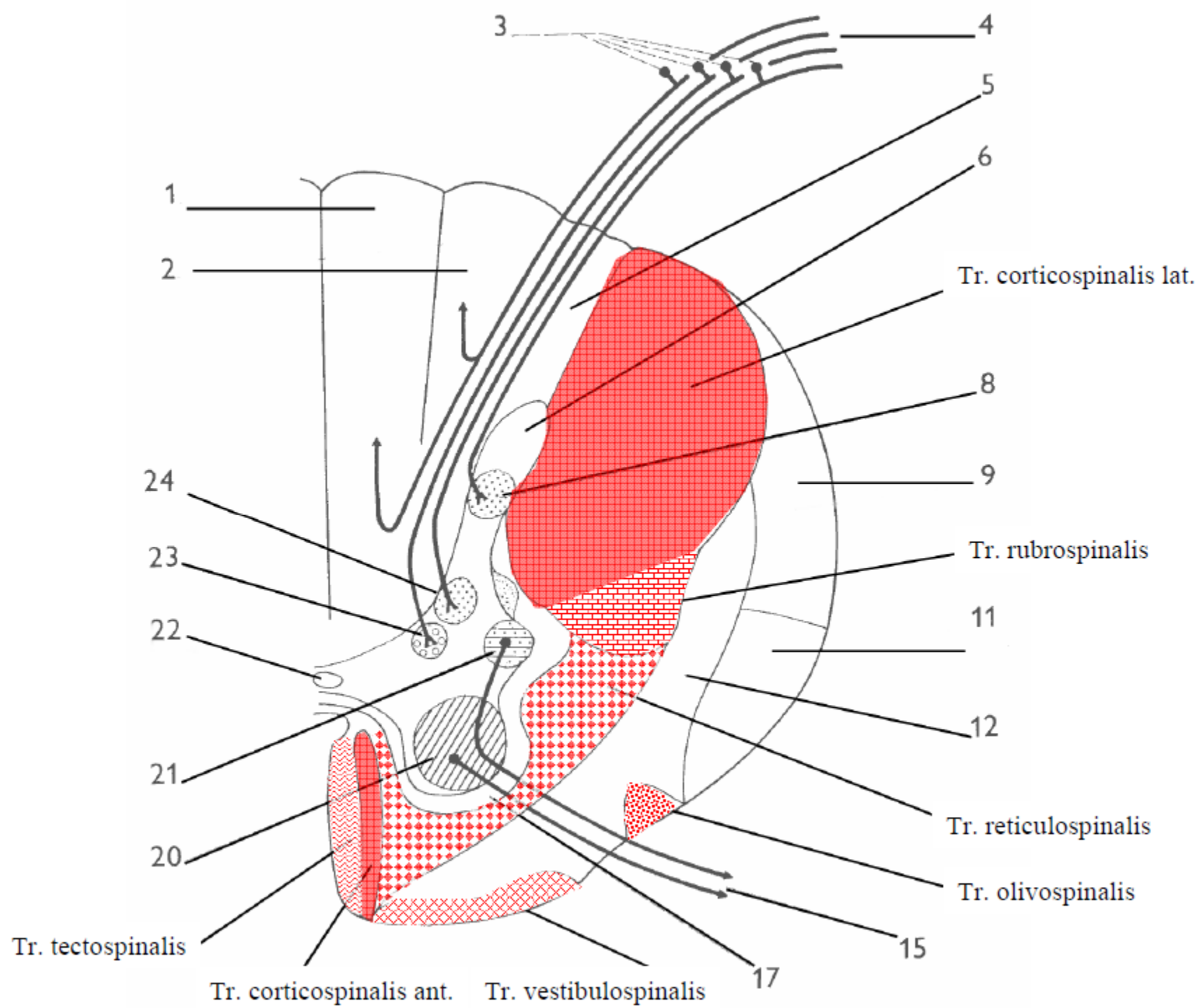
- direct- phylogenetically young
- **Tr.corticospinalis- lateralis, anterior-** cross
- voluntary, conscious movements of the striated muscles

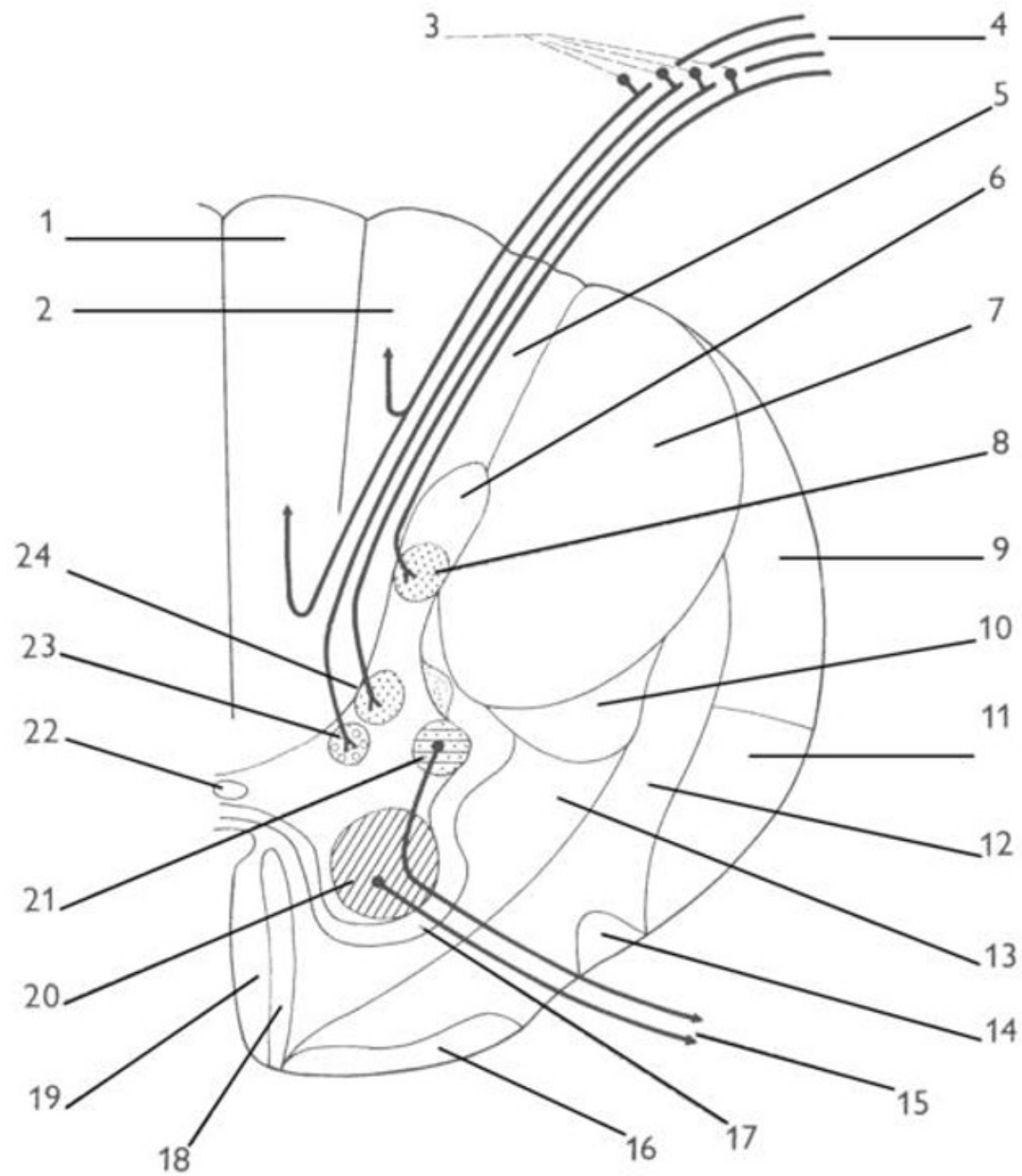
EXTRAPYRAMID TRACTS

- undirect- phylogenetically old
- Starts on the nuclei of RF, brainstem, vestibular nuclei
- **Tr. Rubrospinalis** (flexors)
- **Tr. tectospinalis** (visual stimuli)
- **Tr. Reticulospinalis**
- **Tr. Vestibulospinalis** (extensors)
- Maintenance of the muscle tension, equilibrium, automatic movements – dance, walk...









4. Medulla oblongata: borders, gross anatomy and general organization of the grey and white matter

5. Medulla oblongata: grey matter – main nuclei

6. Medulla oblongata: white matter – main pathways and their functions

7. Pons: borders, gross anatomy and general organization of the grey and white matter

8. Pons: grey matter – main nuclei

9. Pons: main pathways and their functions

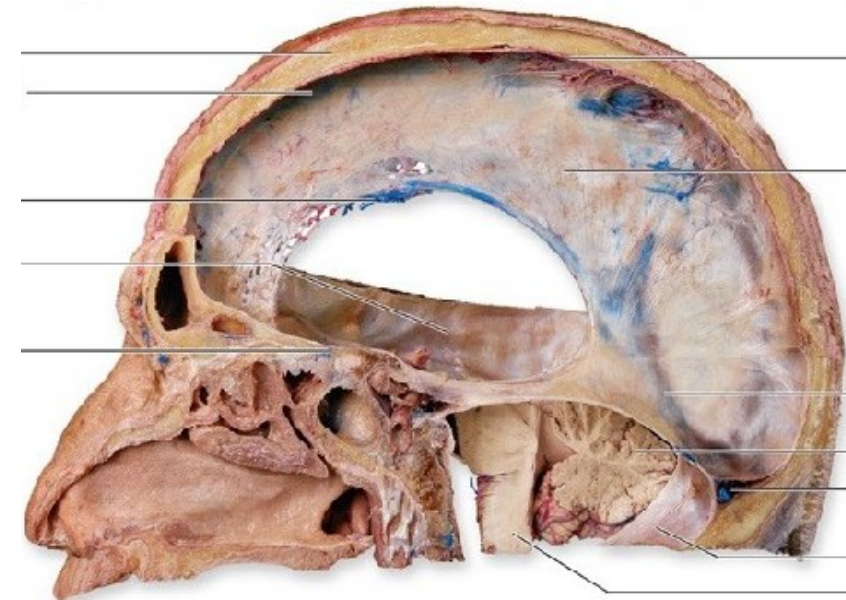
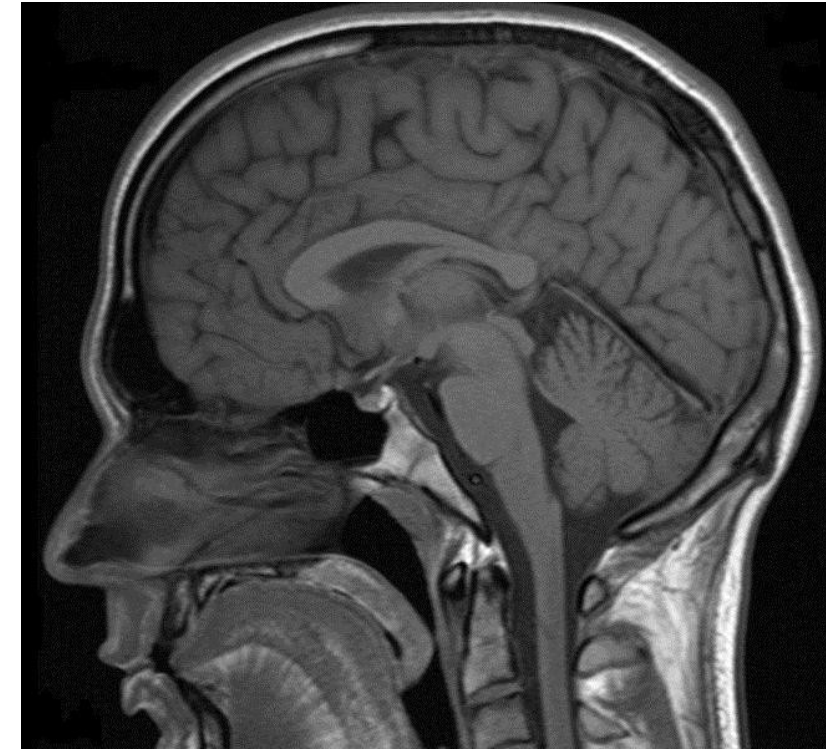
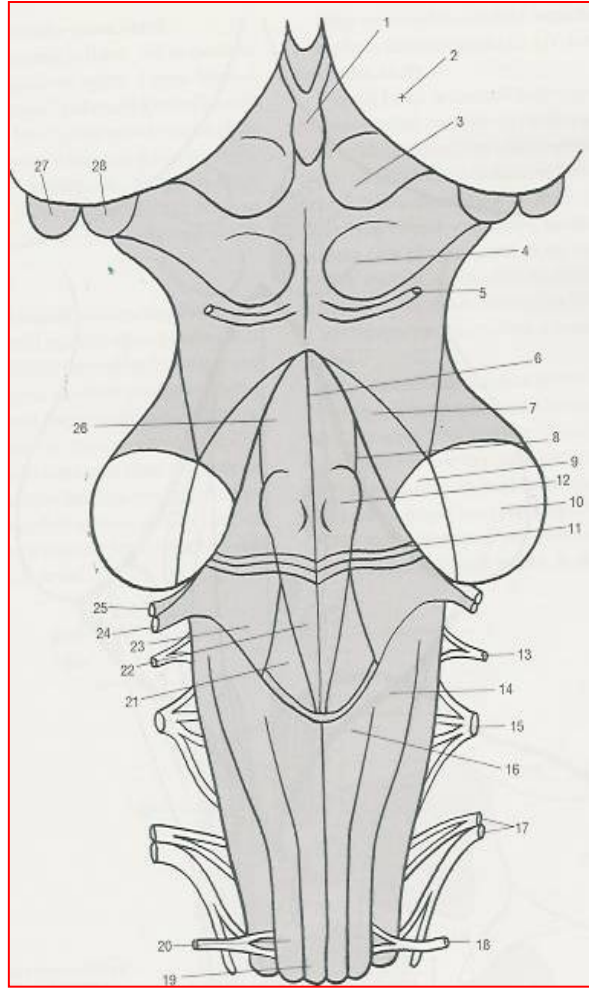
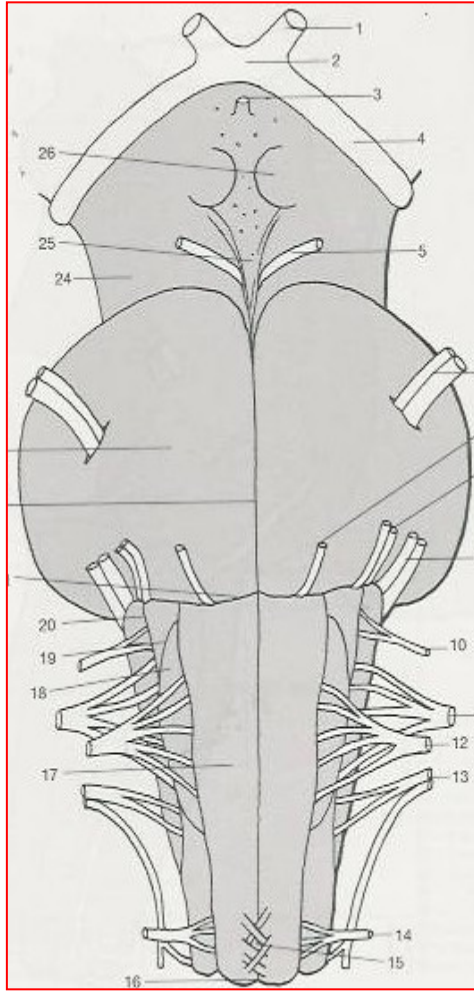
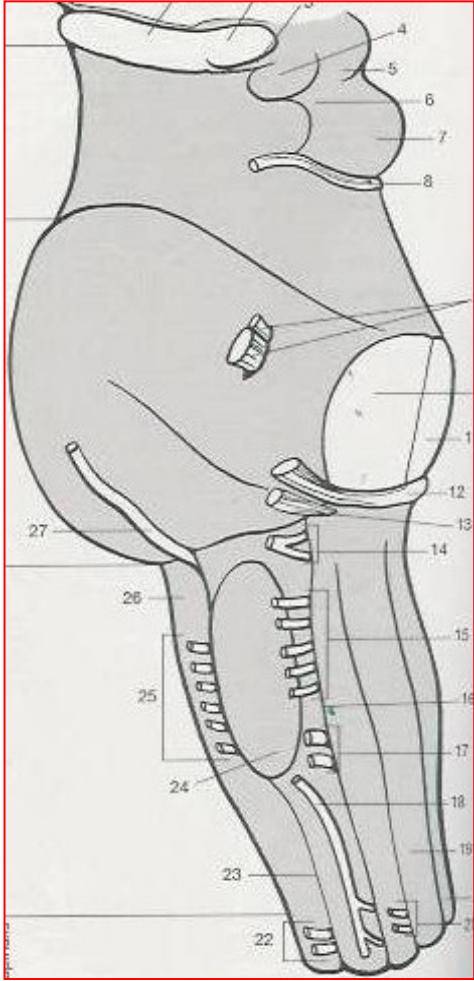
10. Midbrain (*mesencephalon*): borders, gross anatomy and general organization of the grey and white matter

11. Midbrain (*mesencephalon*): grey matter – main nuclei

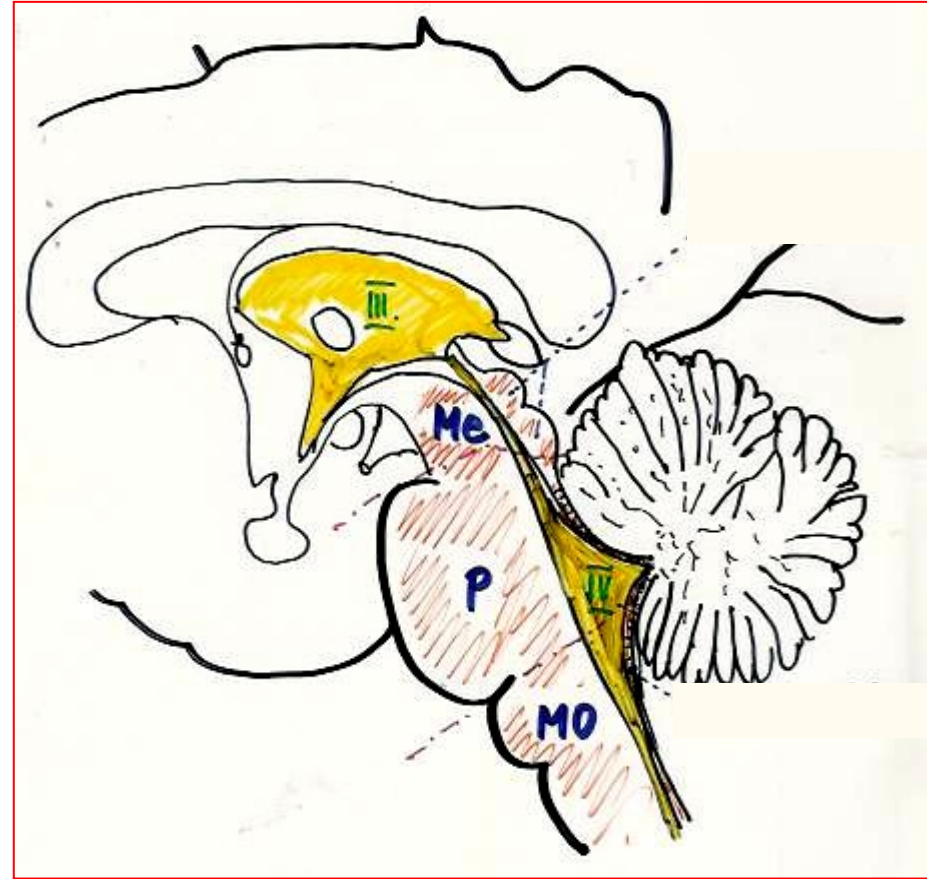
12. Midbrain (*mesencephalon*): white matter – main pathways and their functions

13. Reticular formation (*formatio reticularis*) of the brain stem (*truncus cerebri*): its functions and main nuclei

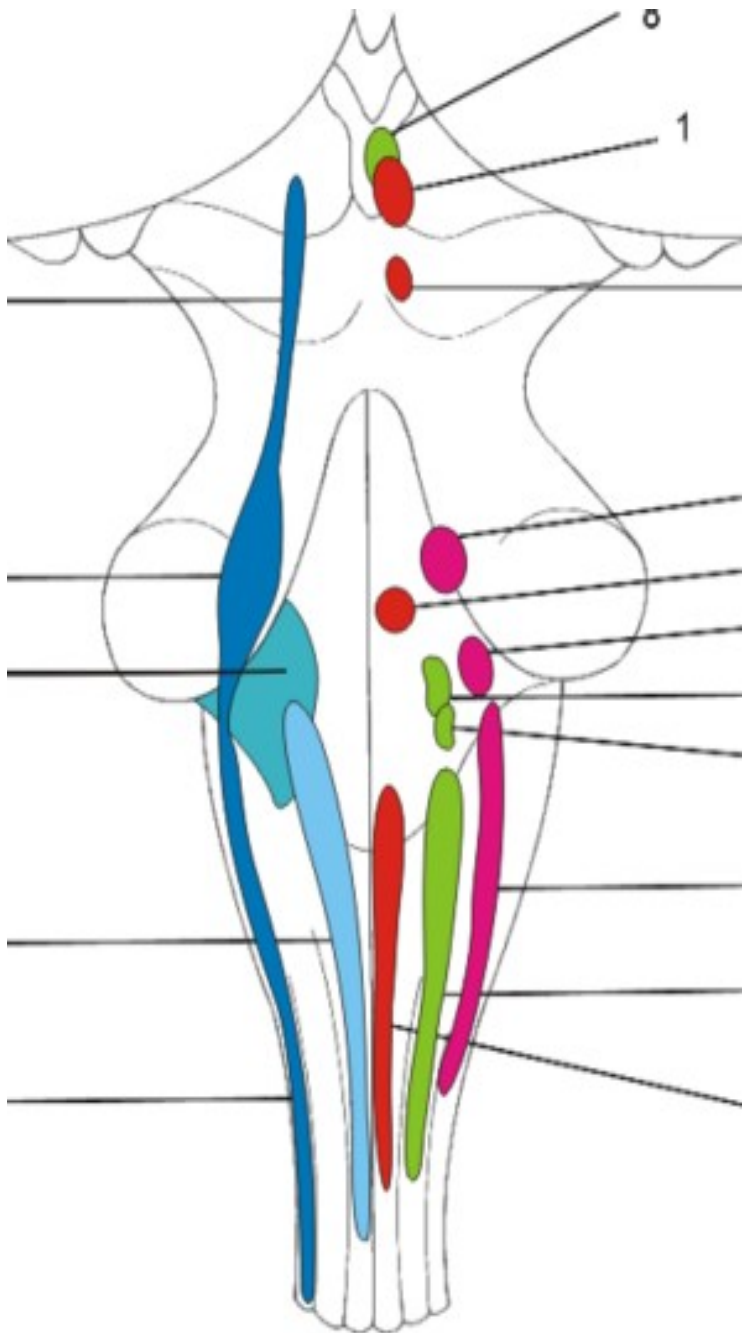
BRAINSTEM- LONGITUDINAL PARTS



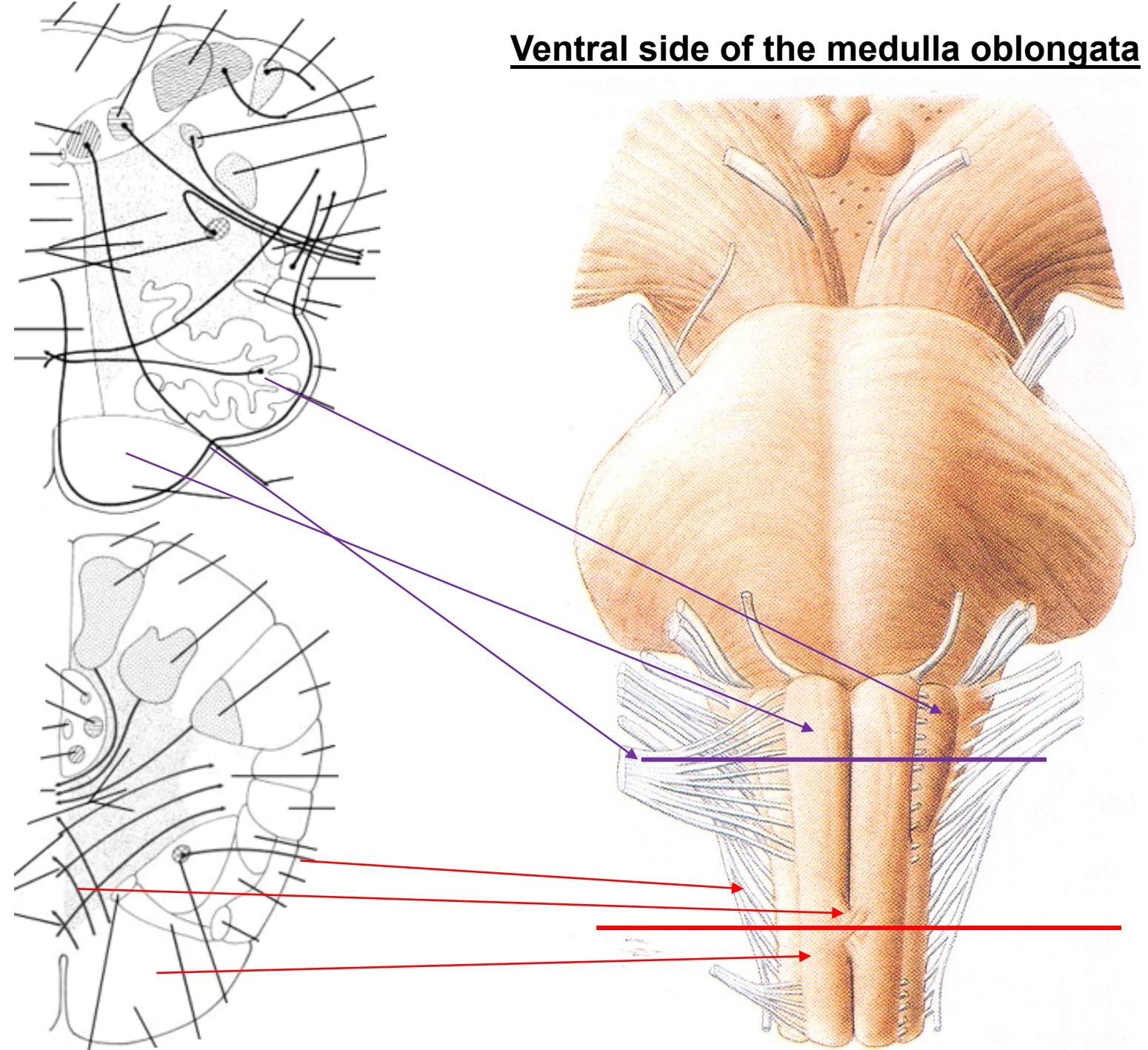
SAGITAL SECTION OF THE BRAINSTEM



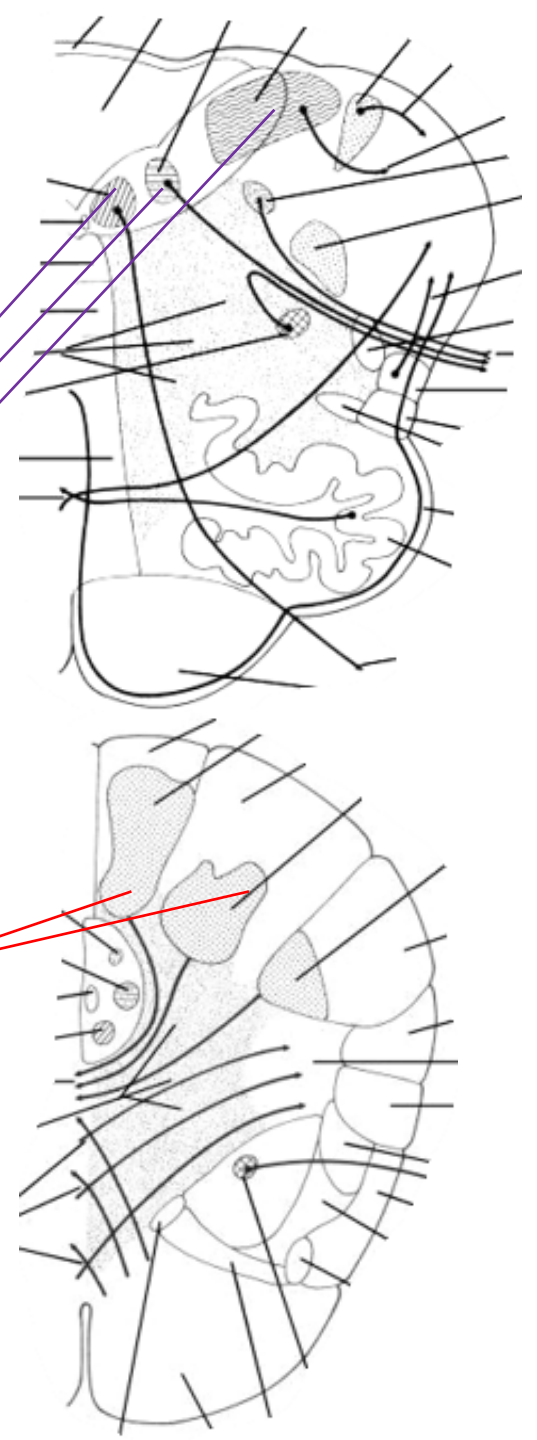
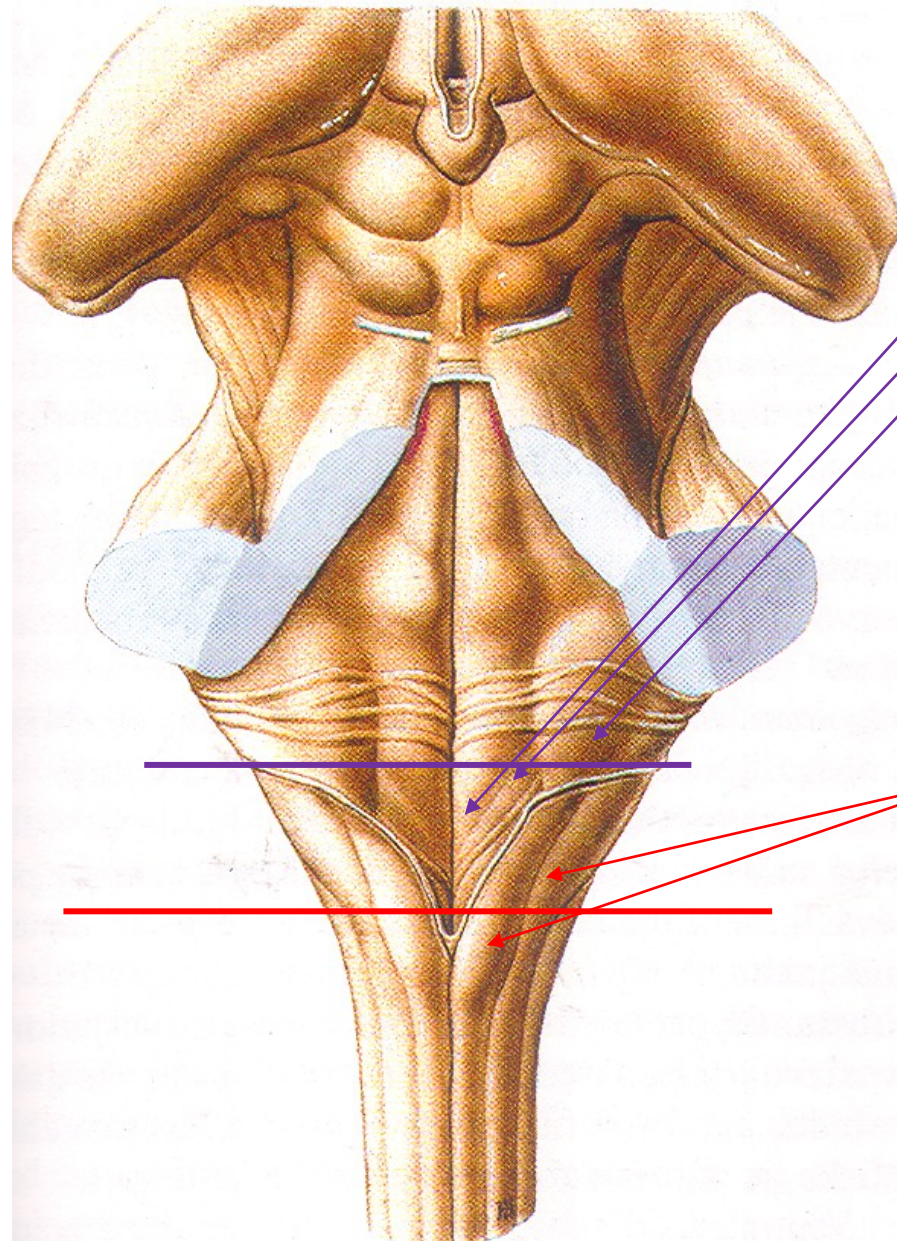
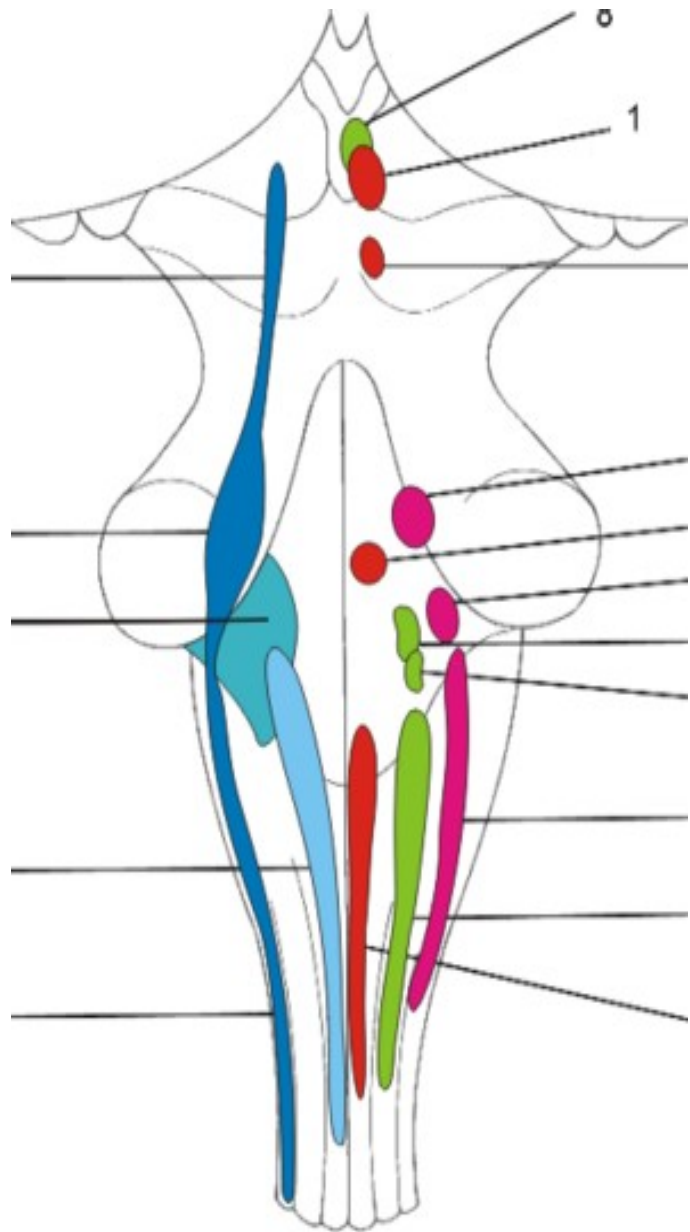
Medulla oblongata



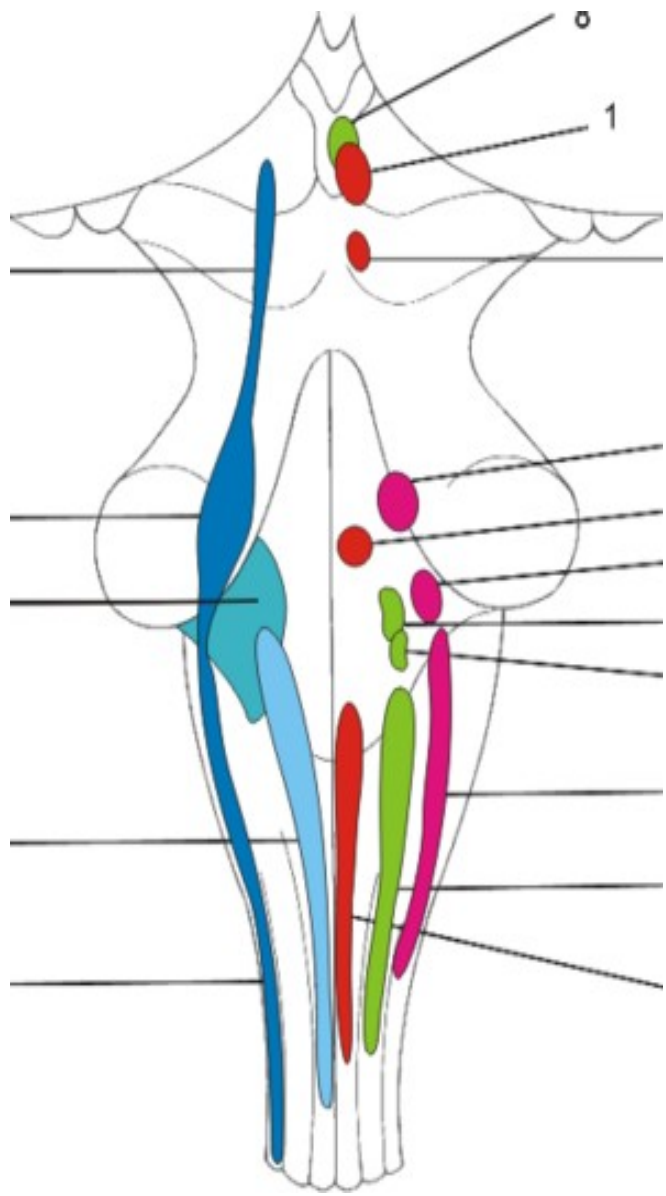
Ventral side of the medulla oblongata



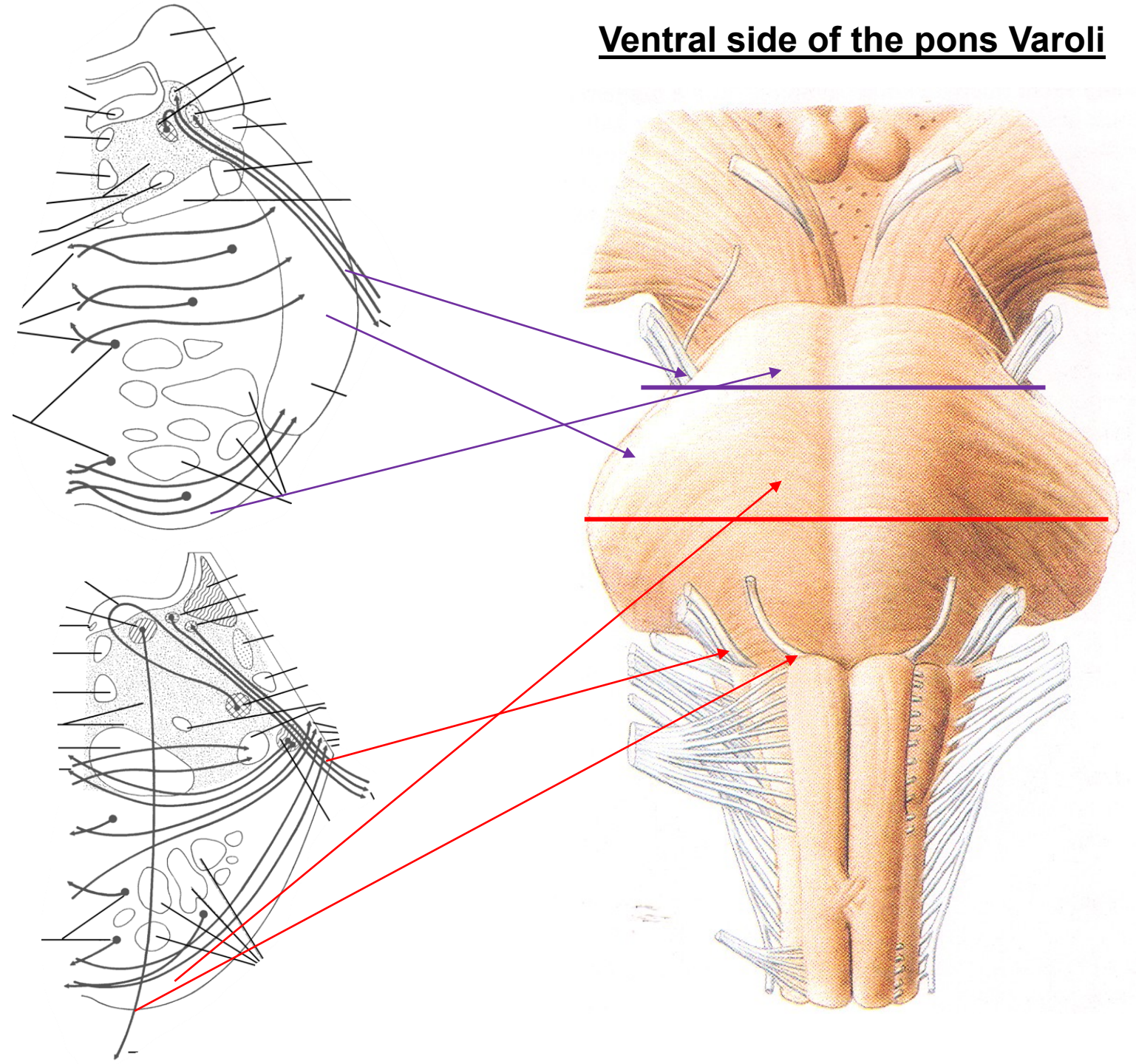
Dorsal side of the medulla oblongata



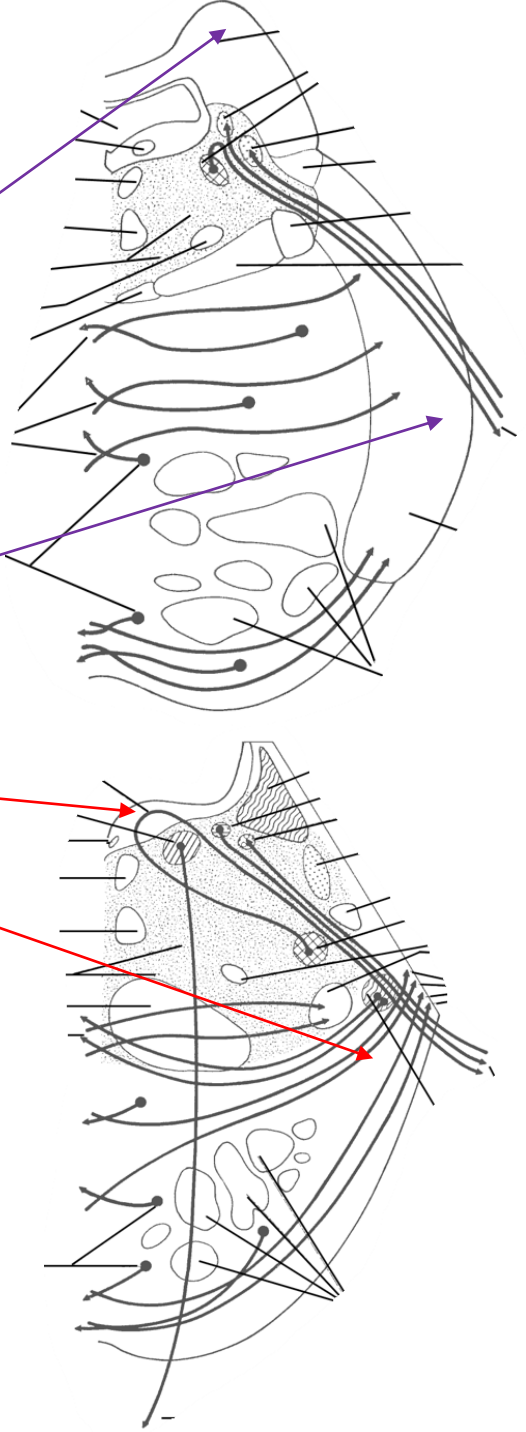
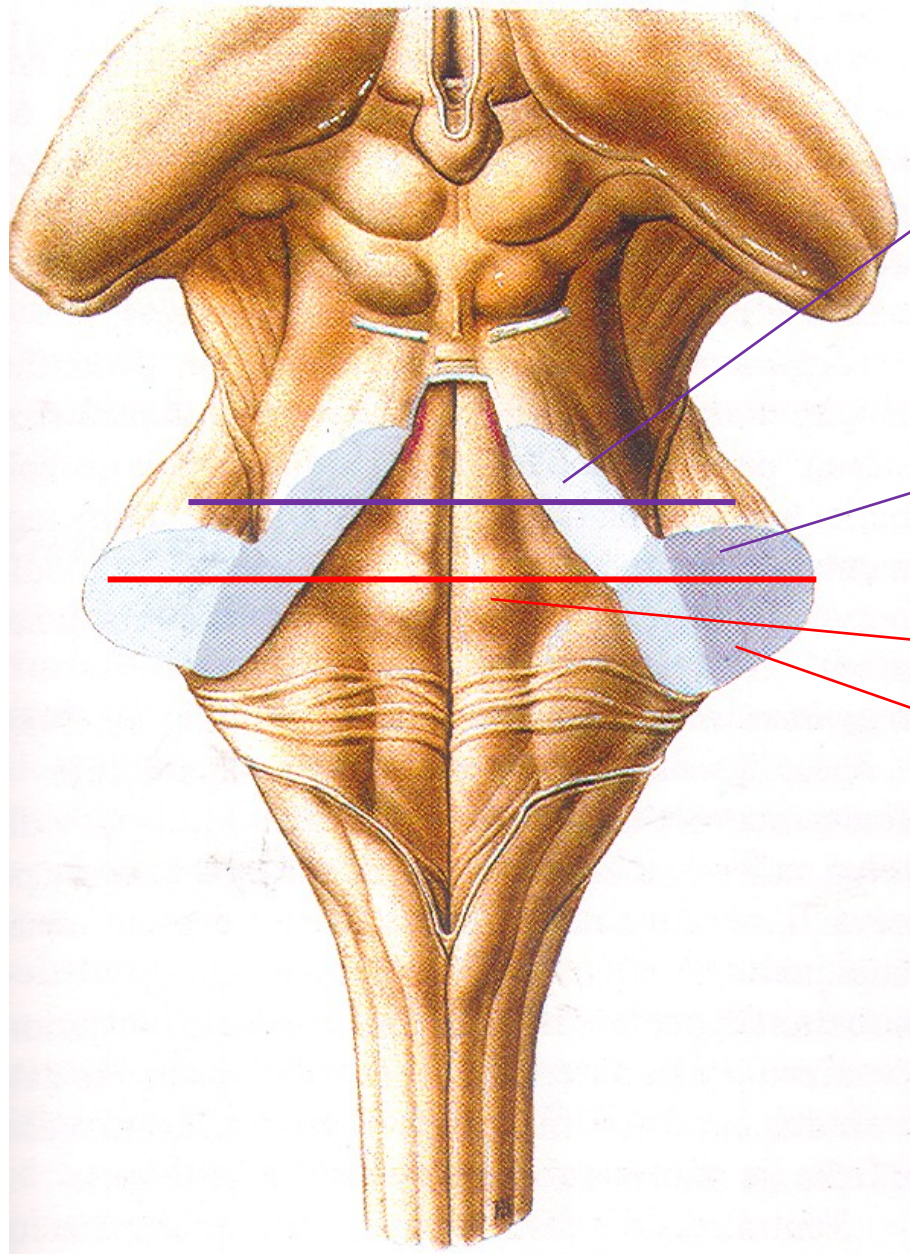
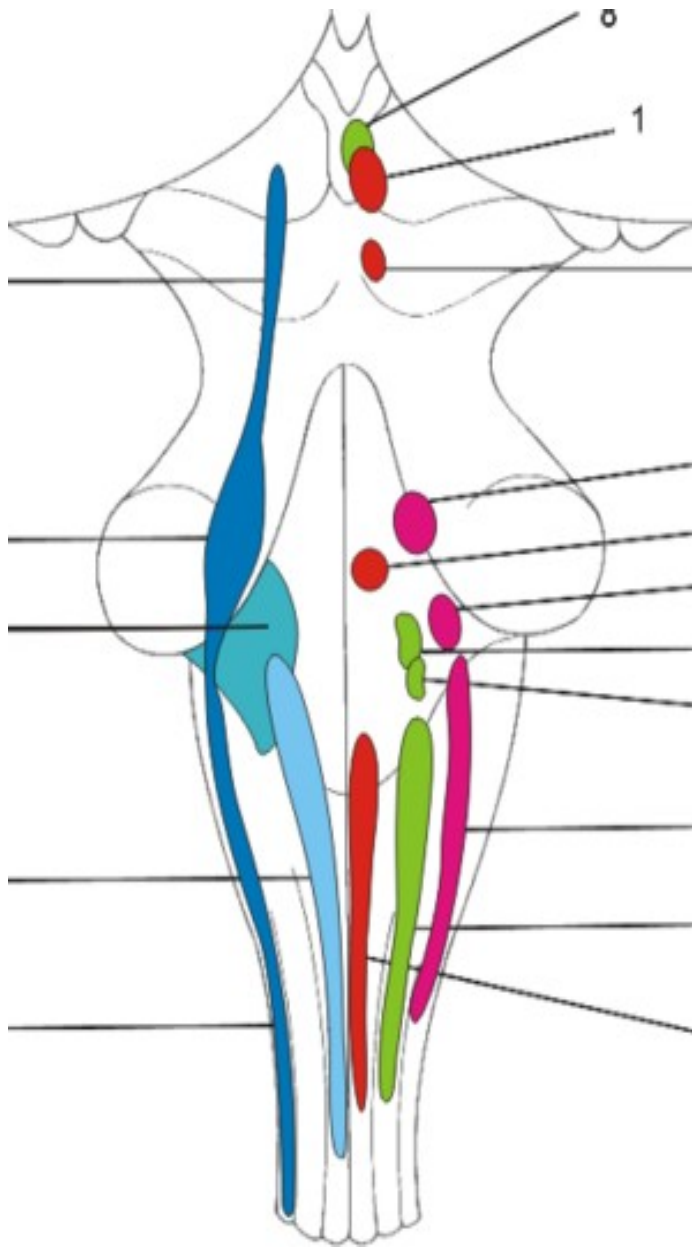
Pons Varoli



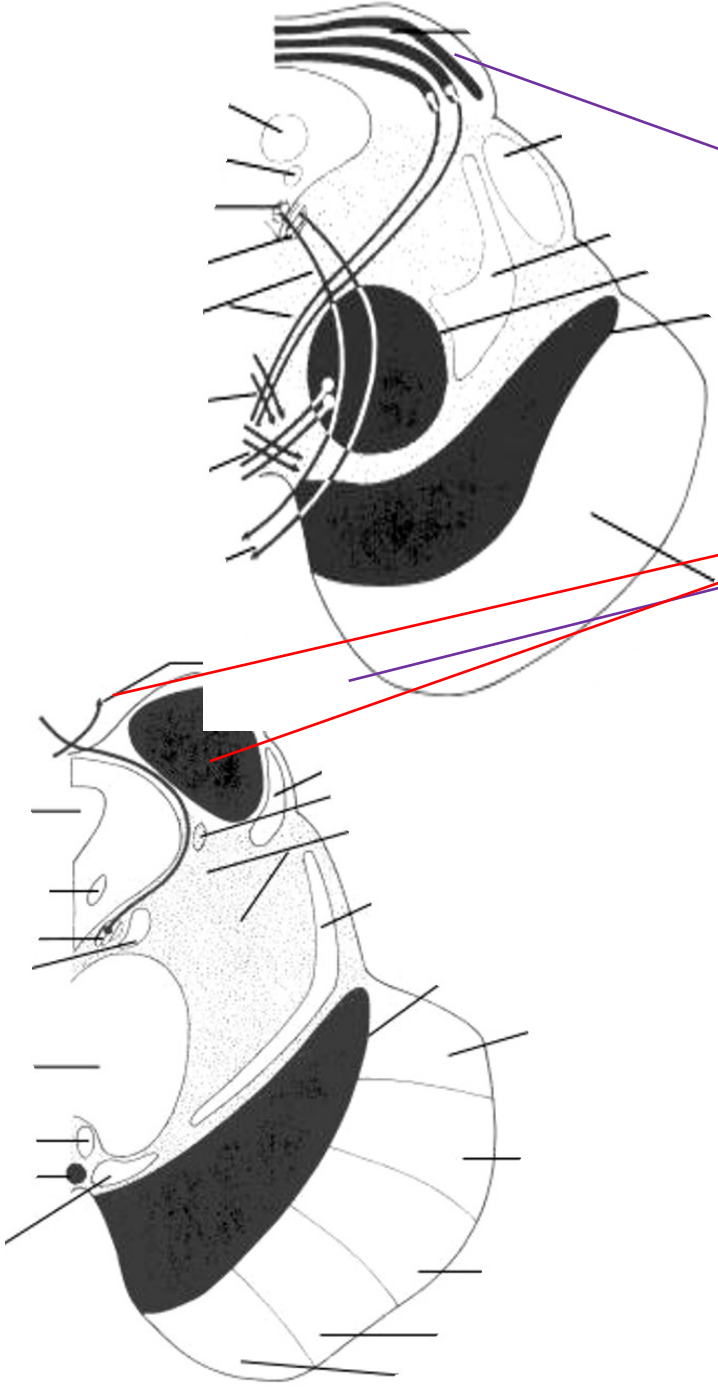
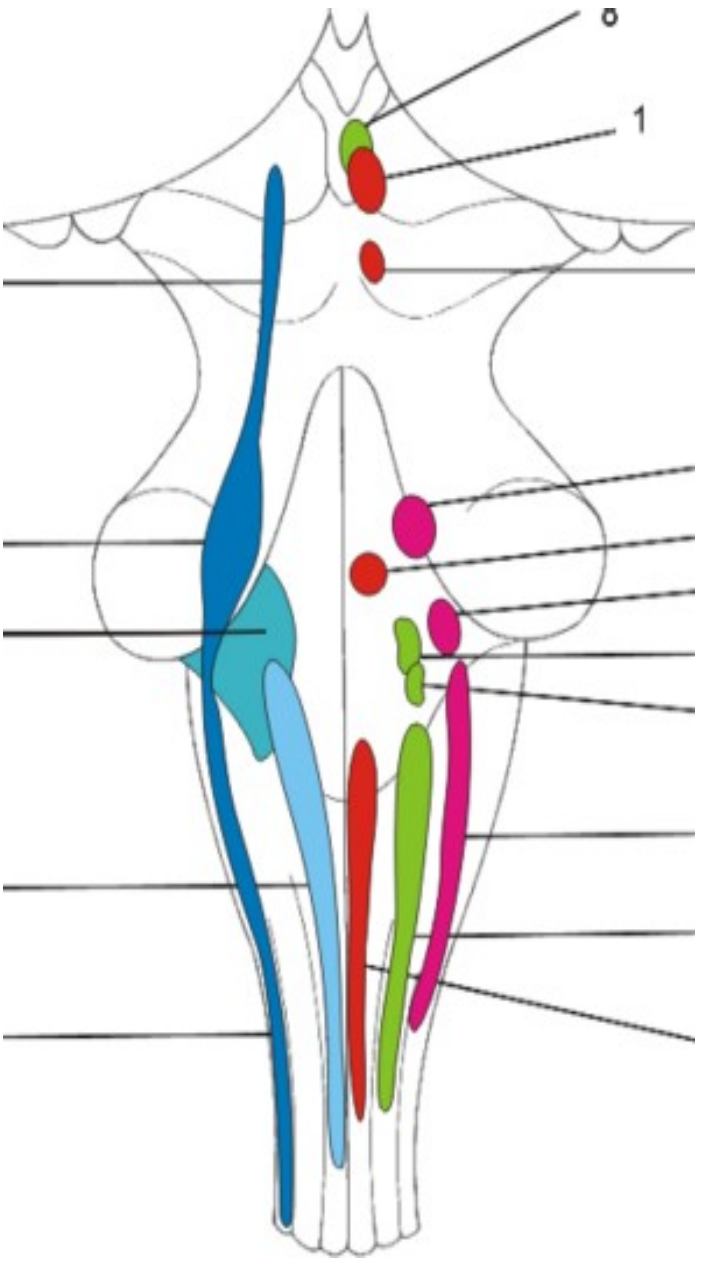
Ventral side of the pons Varoli



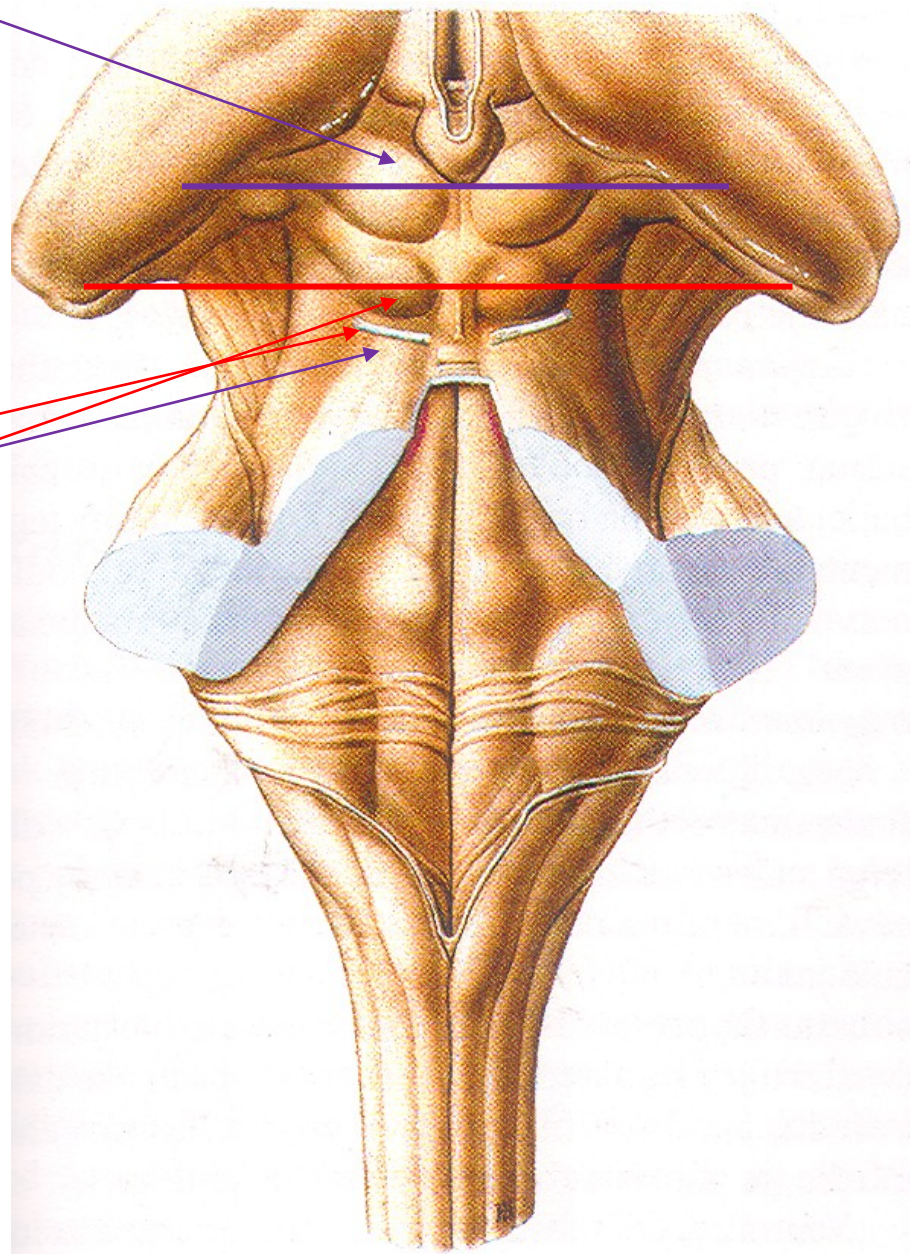
Dorsal side of the pons Varoli



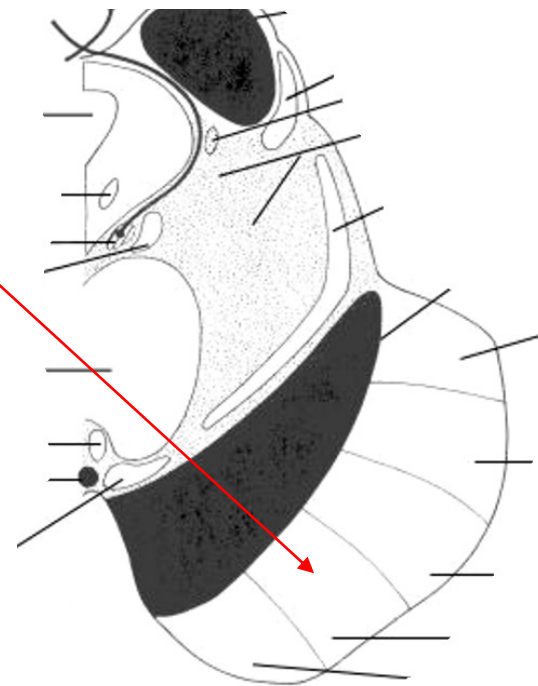
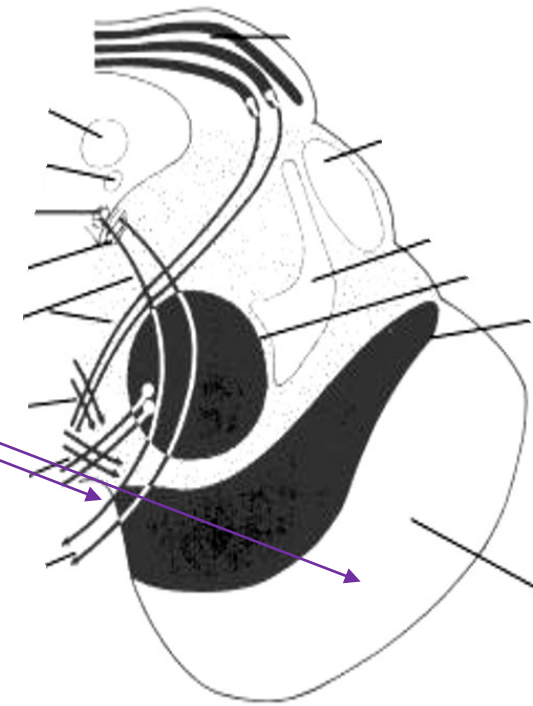
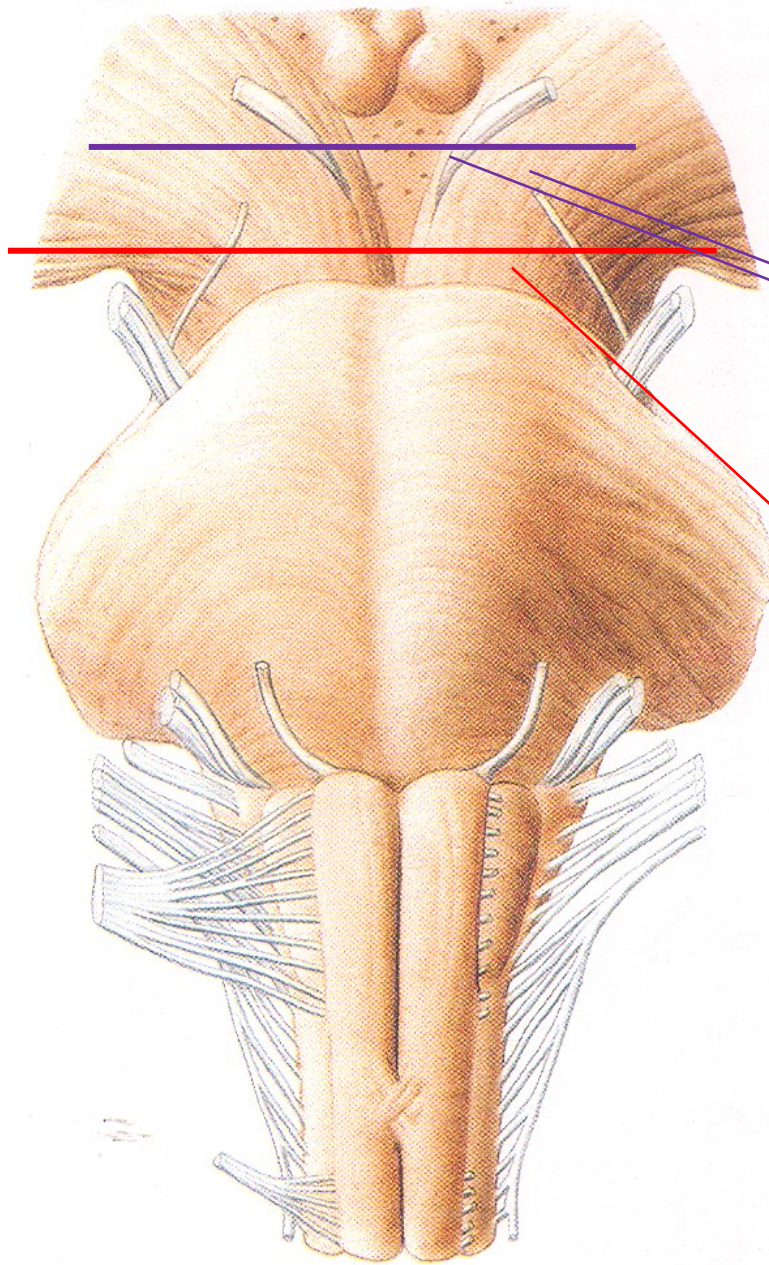
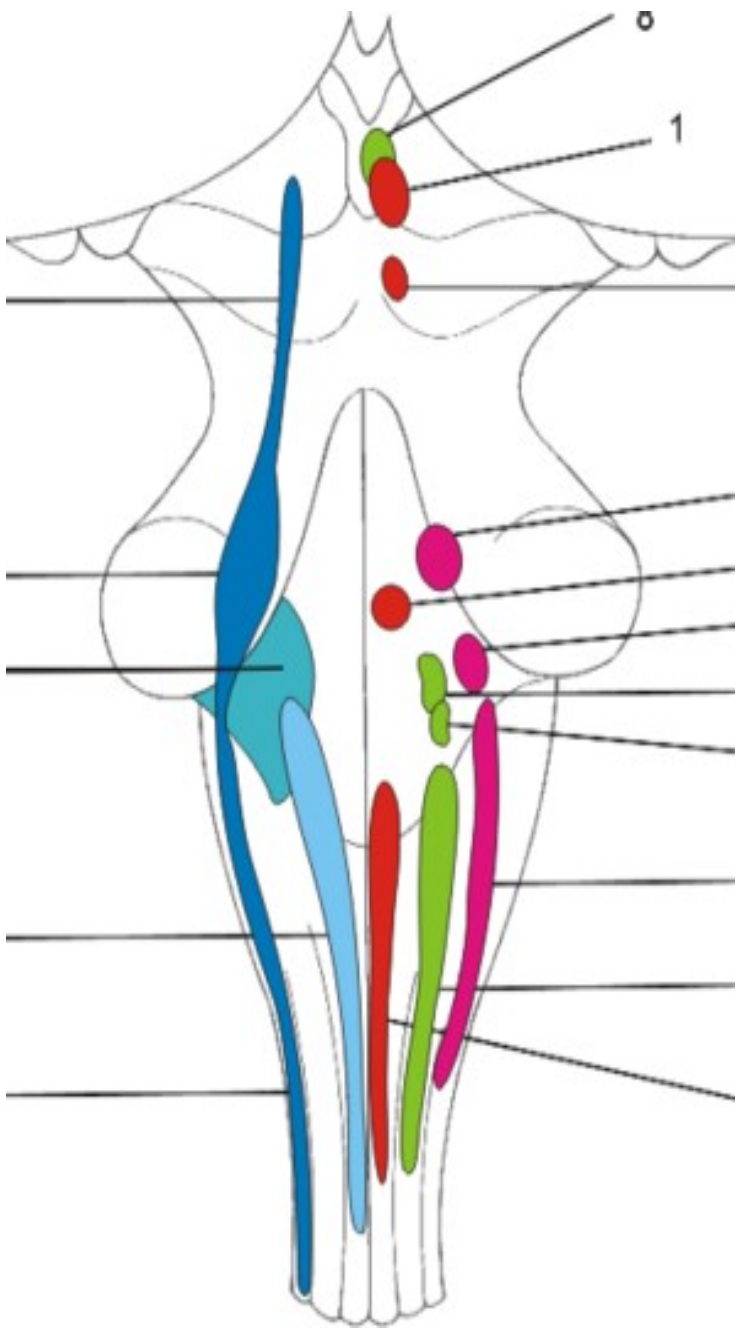
Mesencephalon



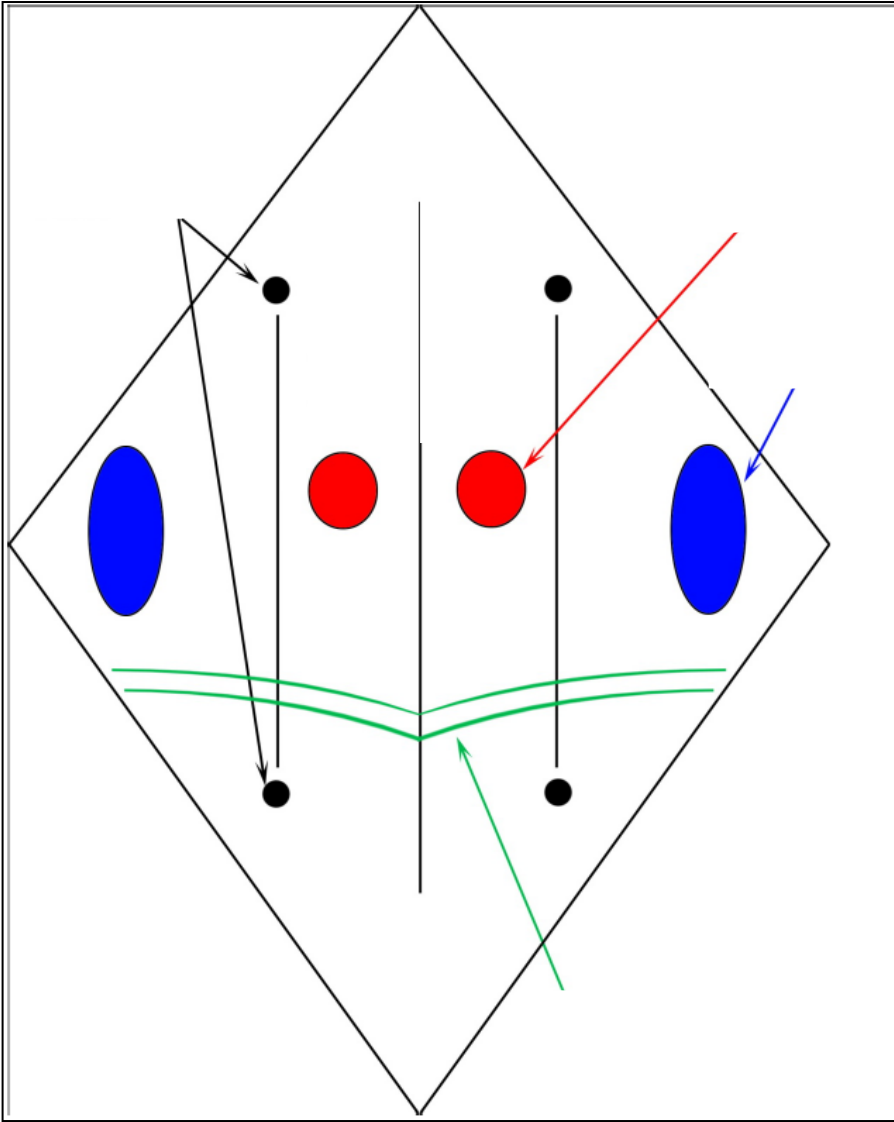
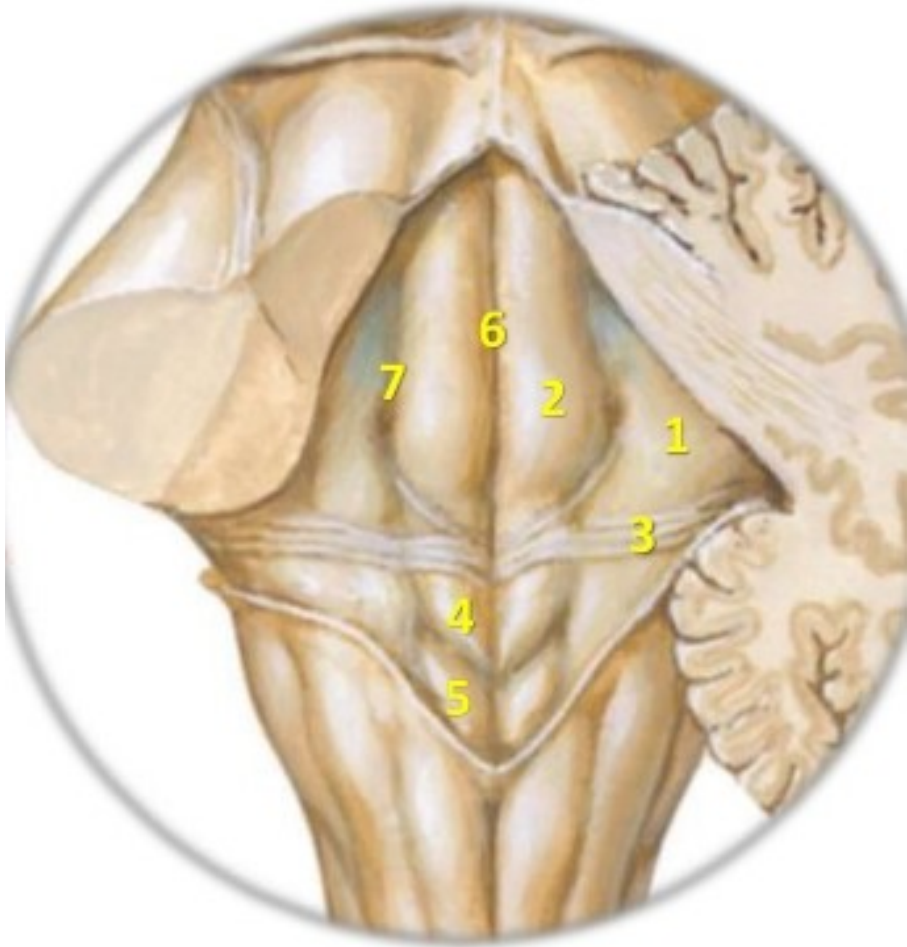
Dorsal side of the mesencephala



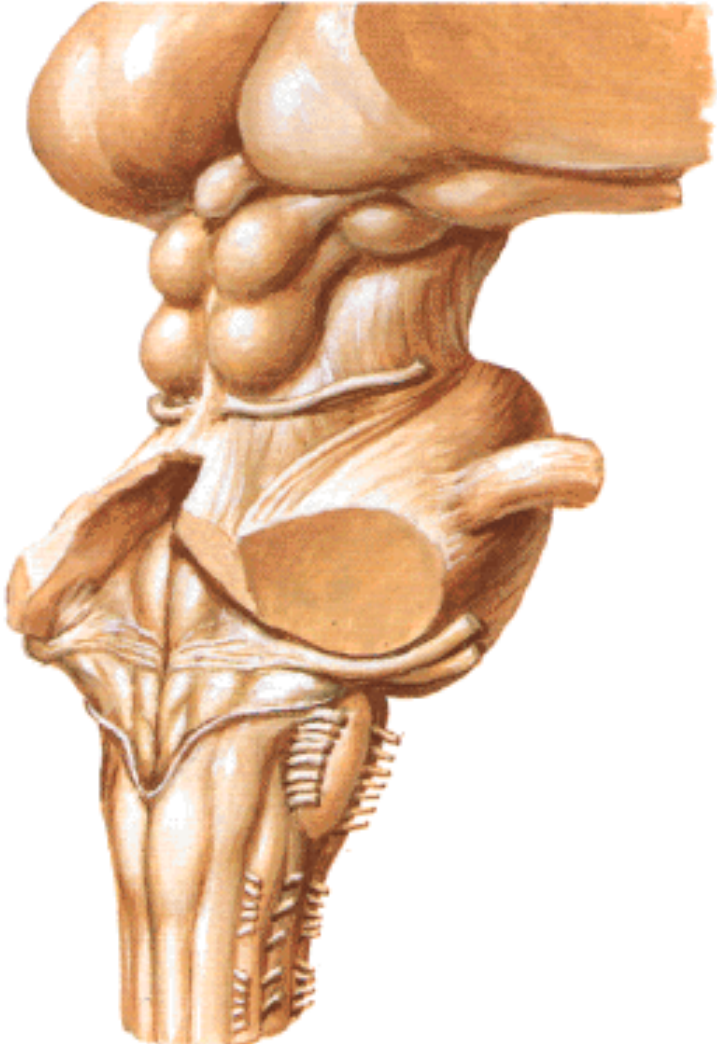
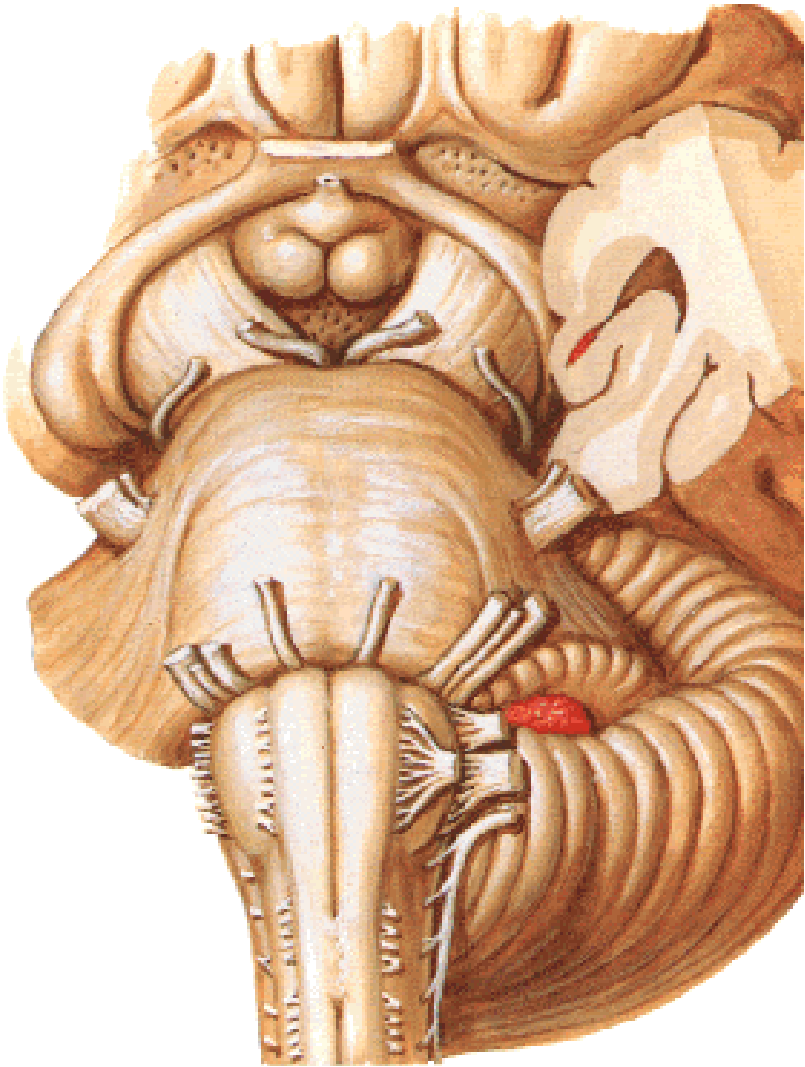
Ventral side of the mesencephala



Fossa rhomboidea

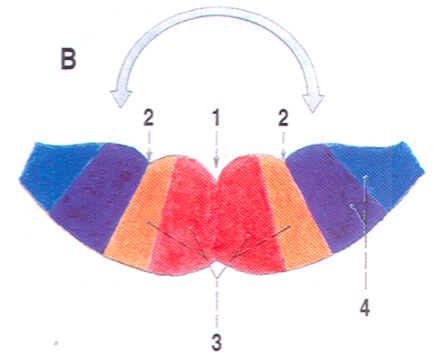
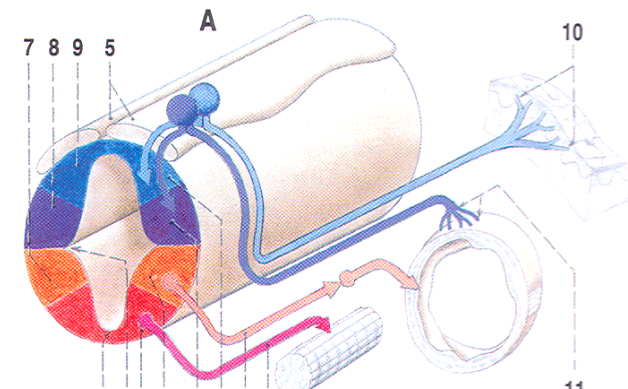
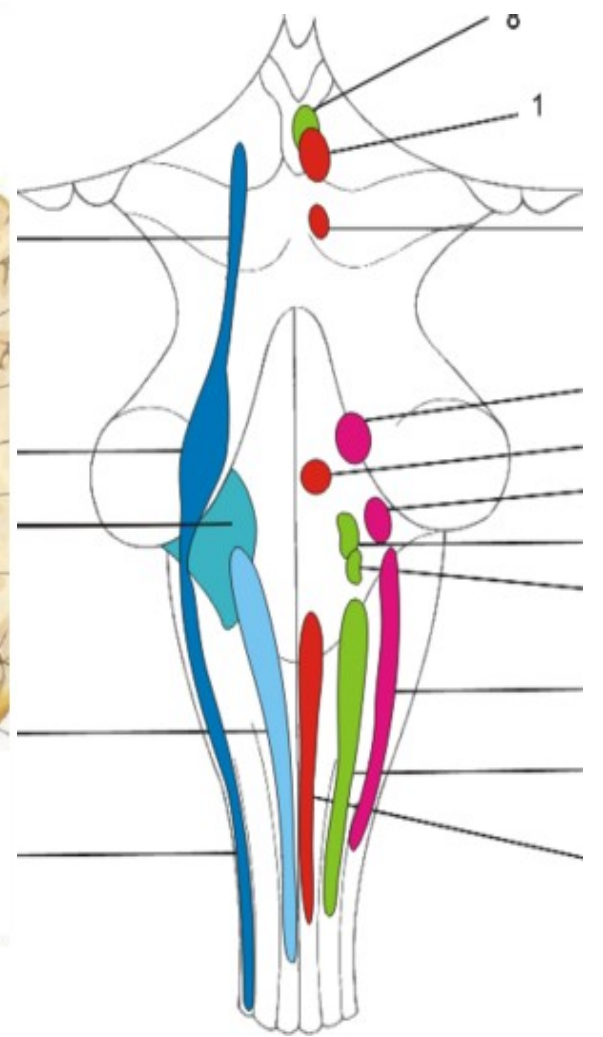
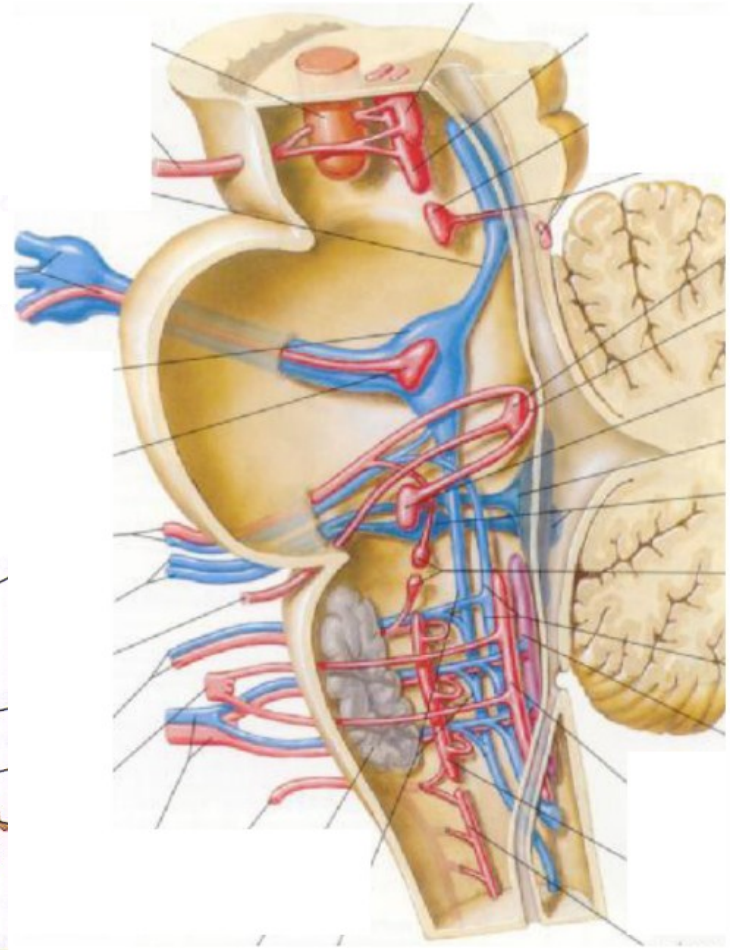
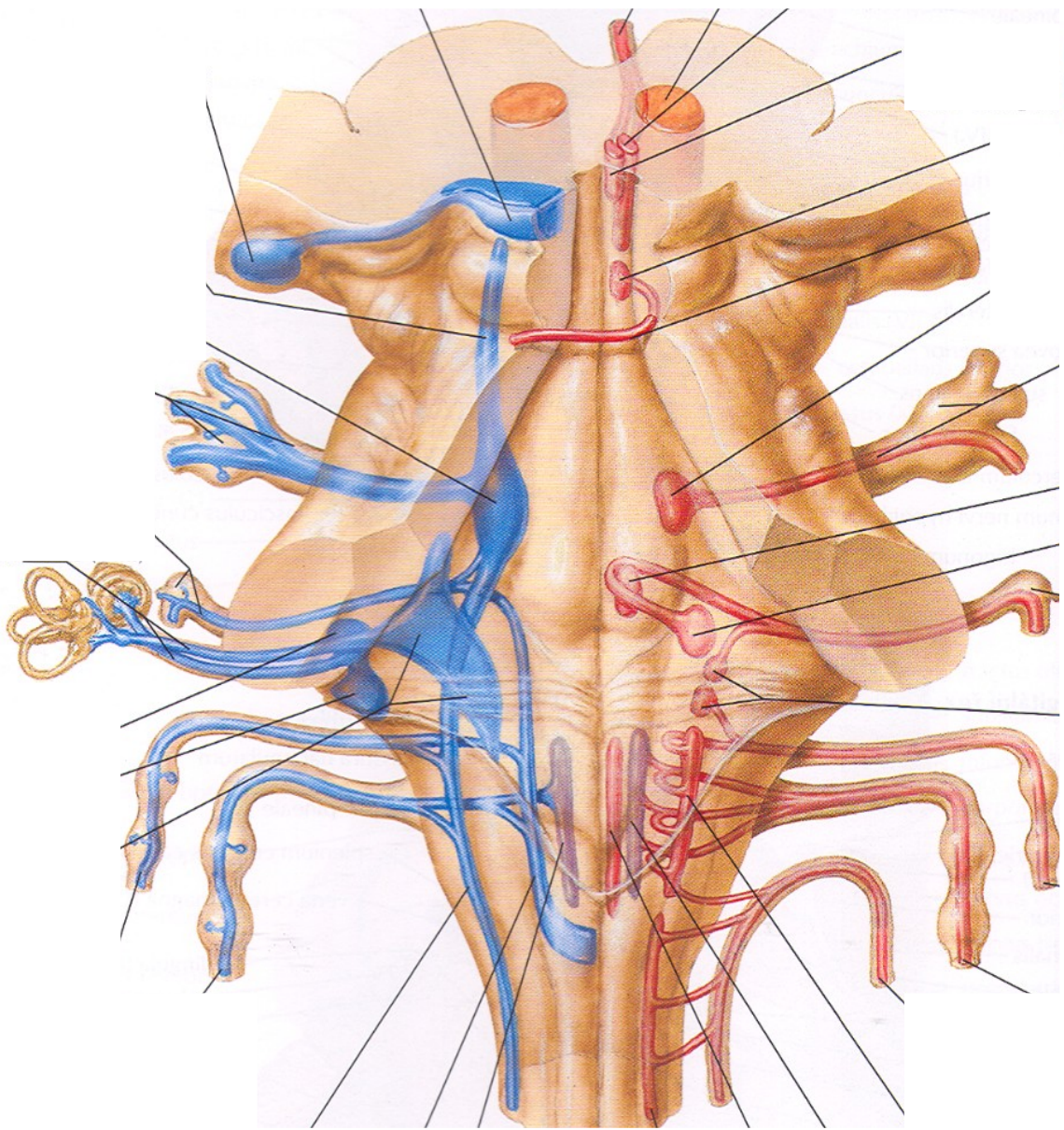


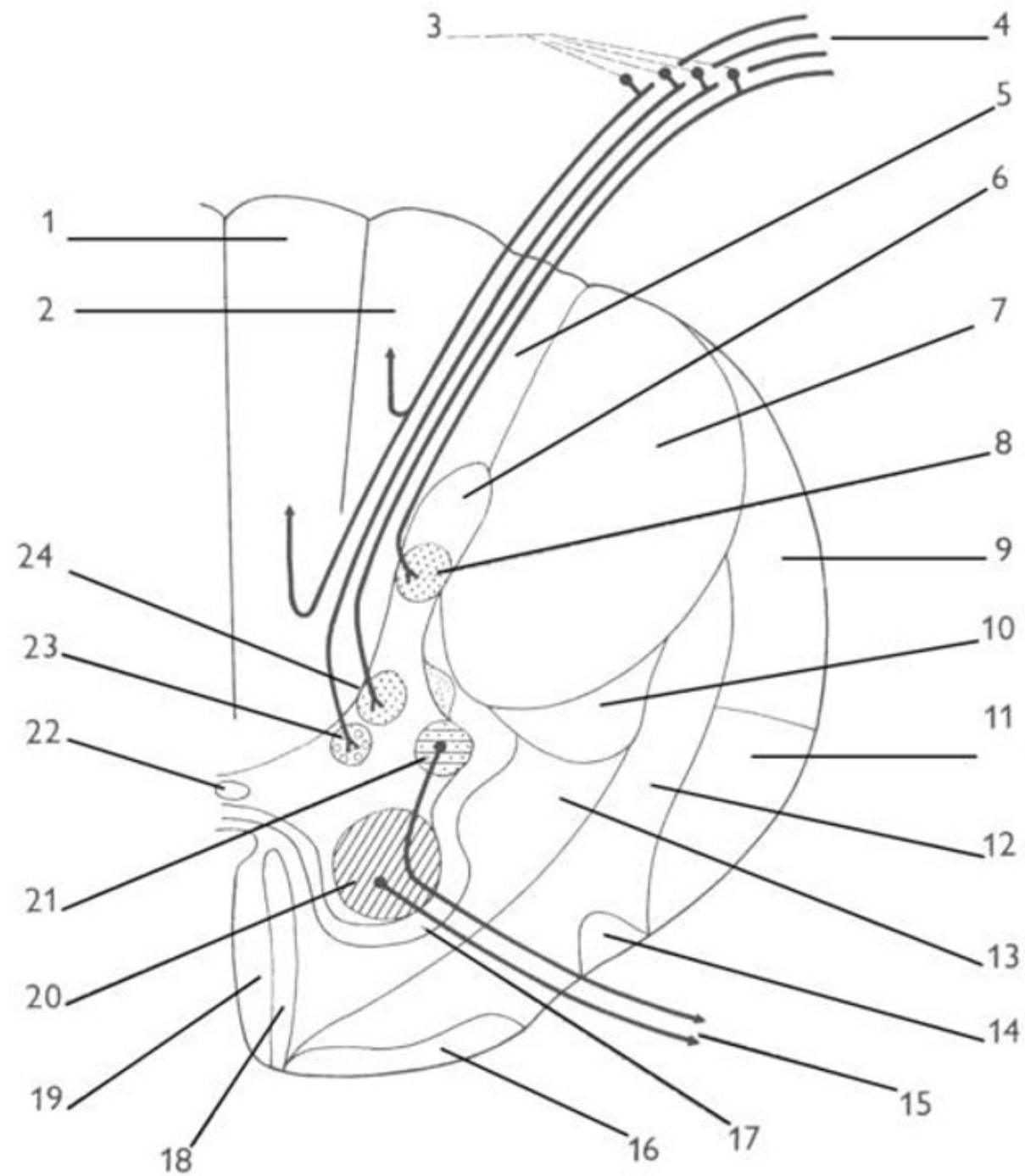
OUTPUTS OF THE CRANIAL NERVES FROM THE BRAINSTEM

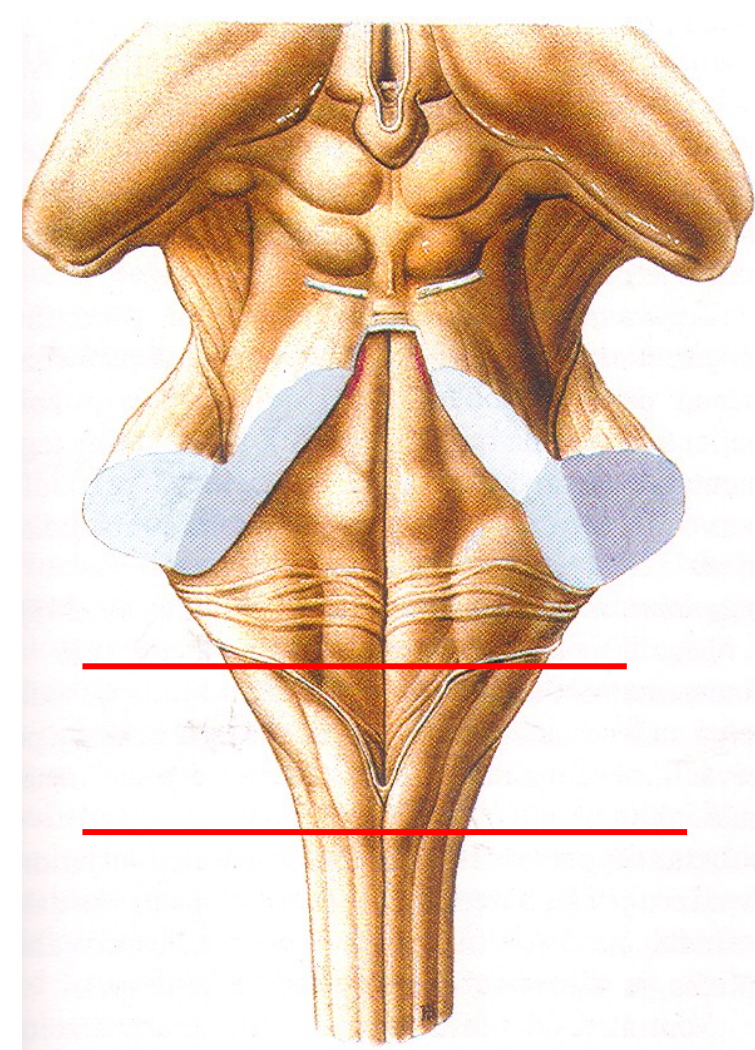
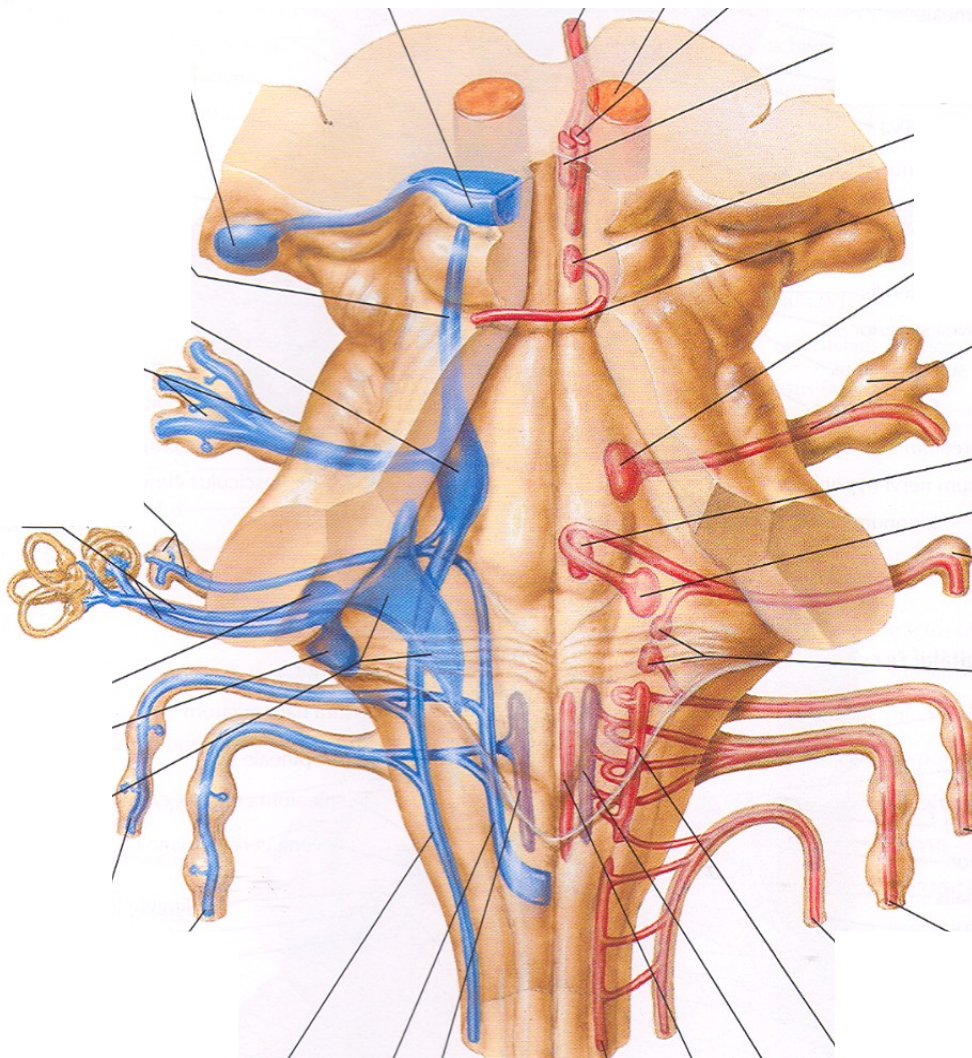
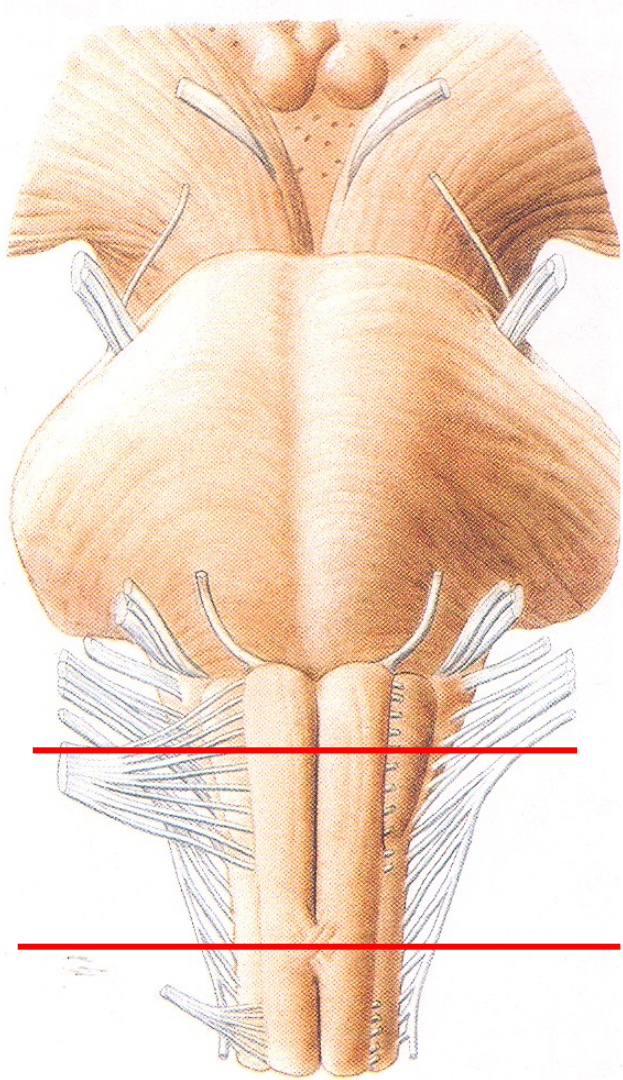


NUCLEI OF THE CRANIAL NERVES

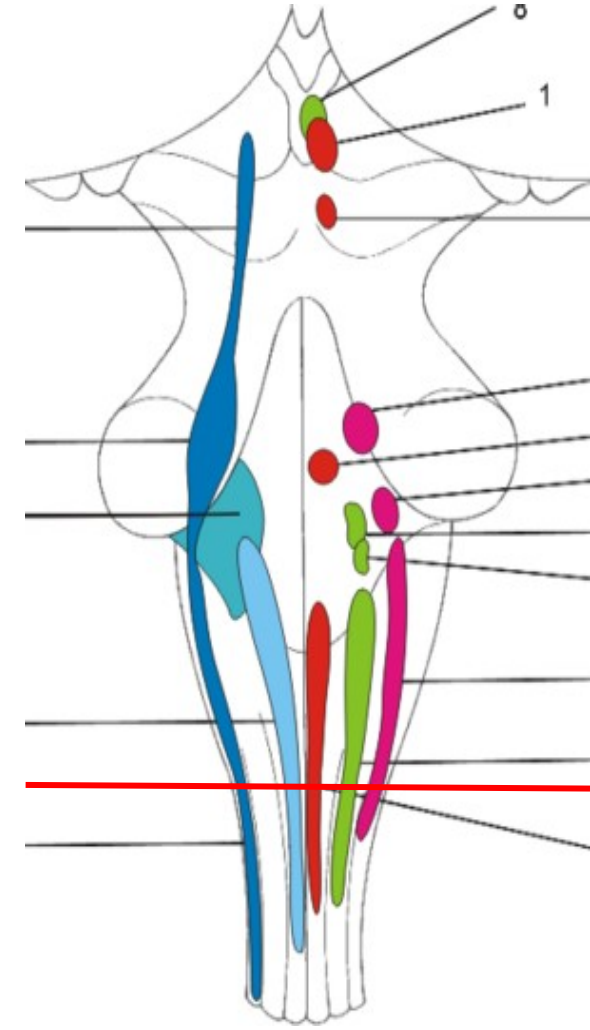
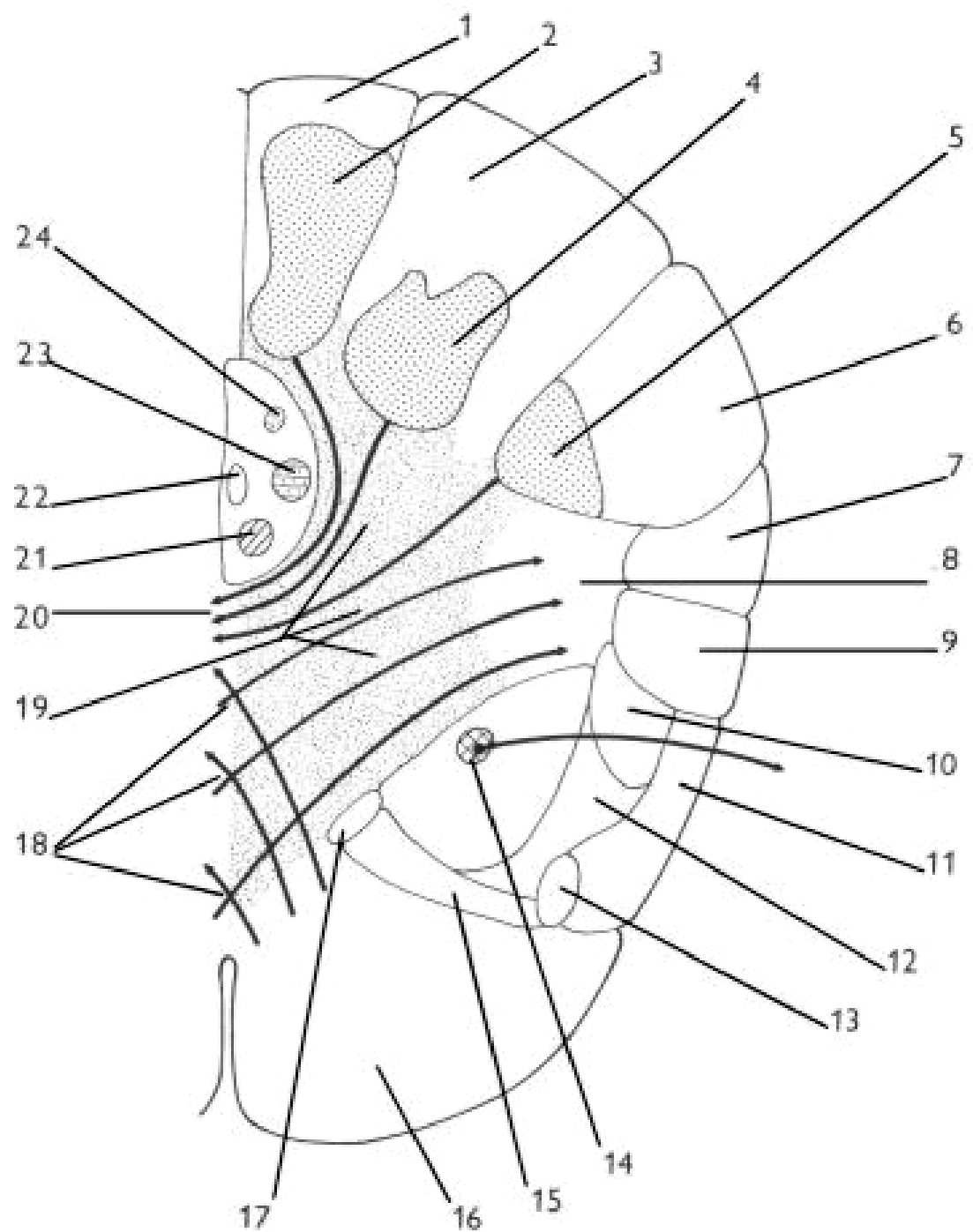
brainstem- fossa rhomboidea

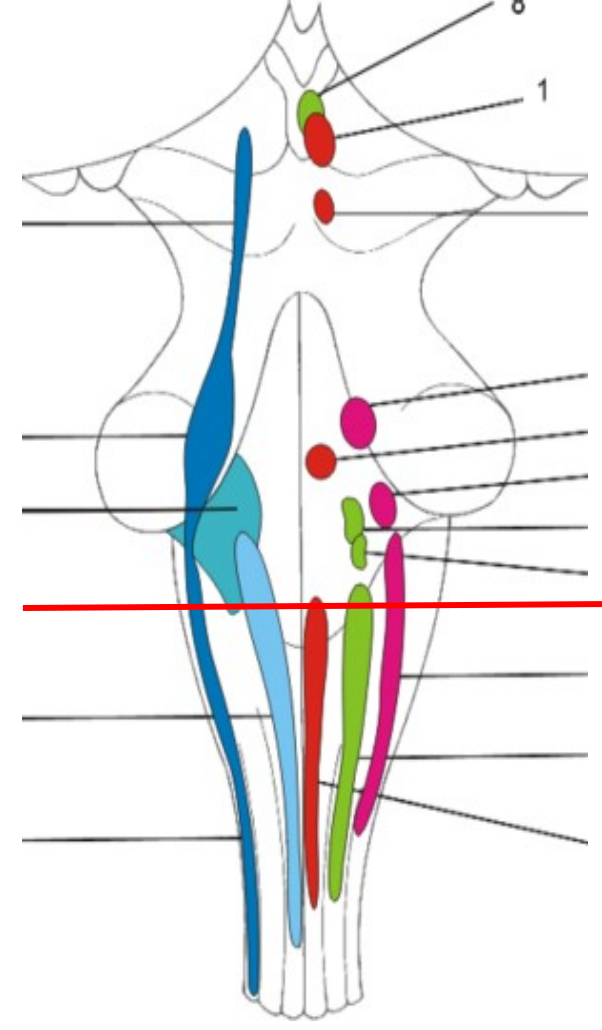
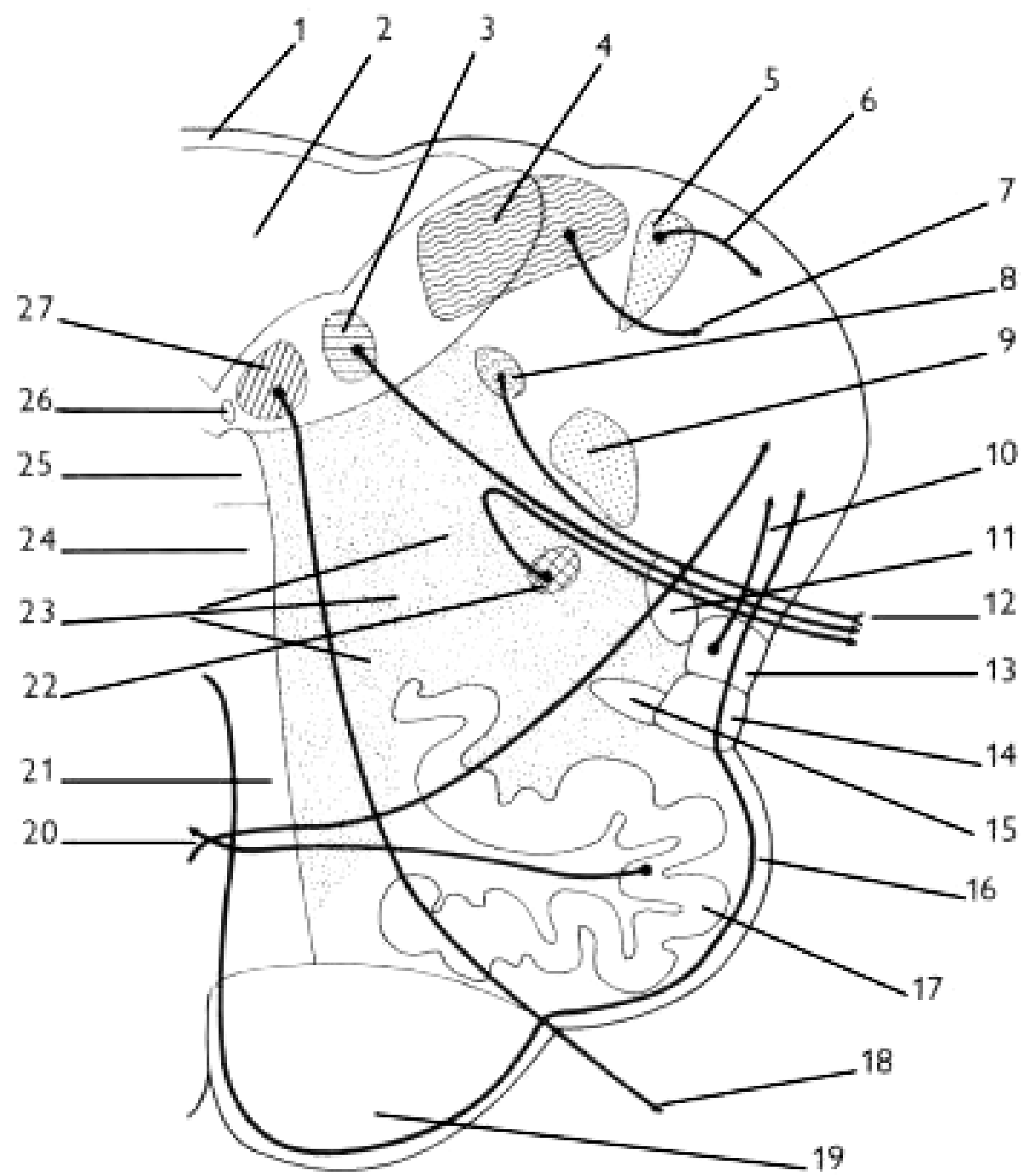


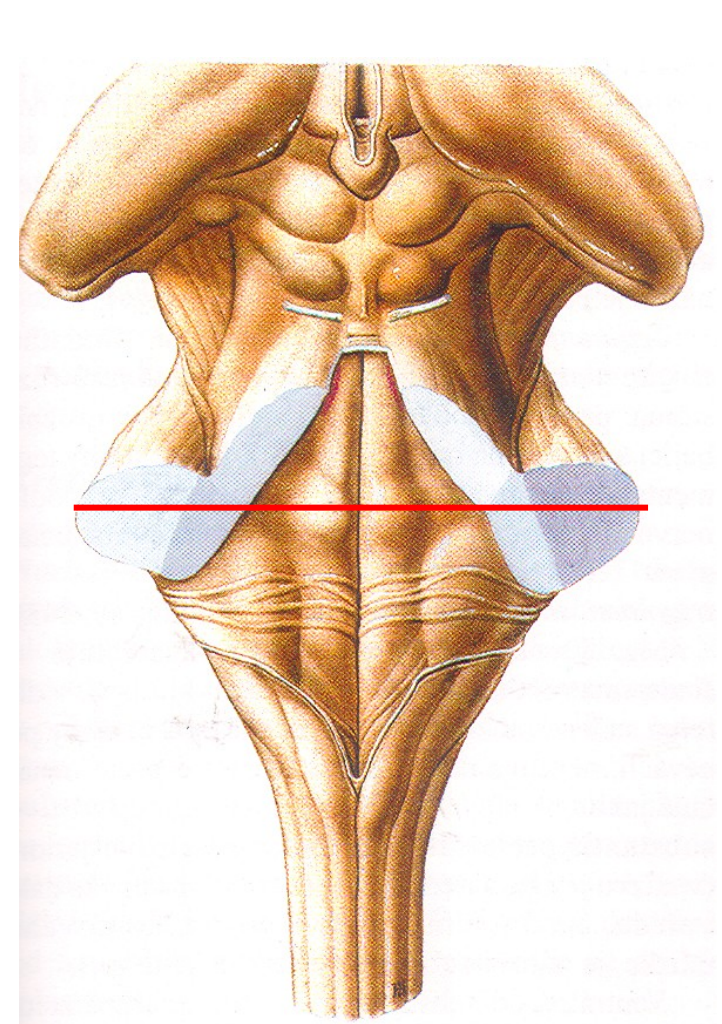
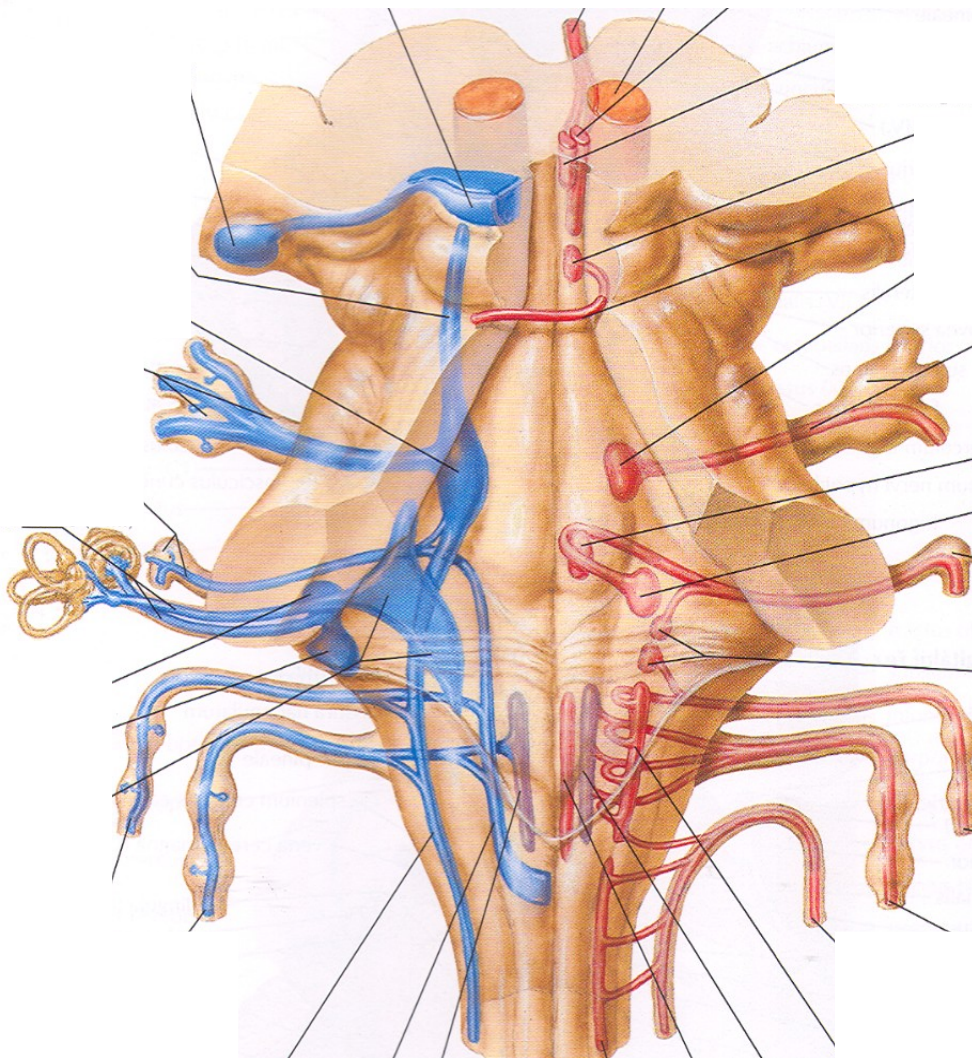
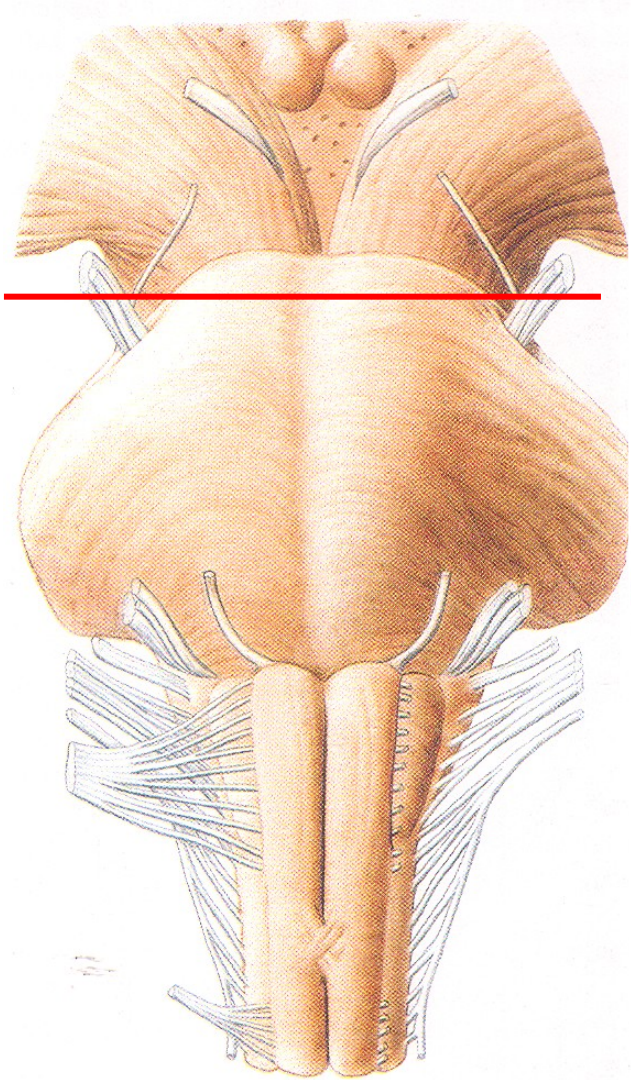




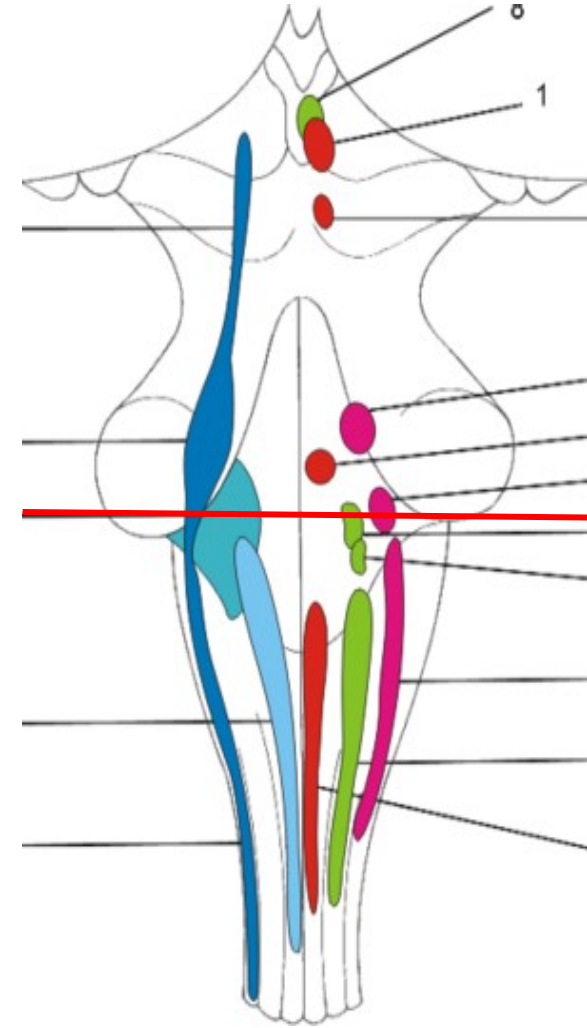
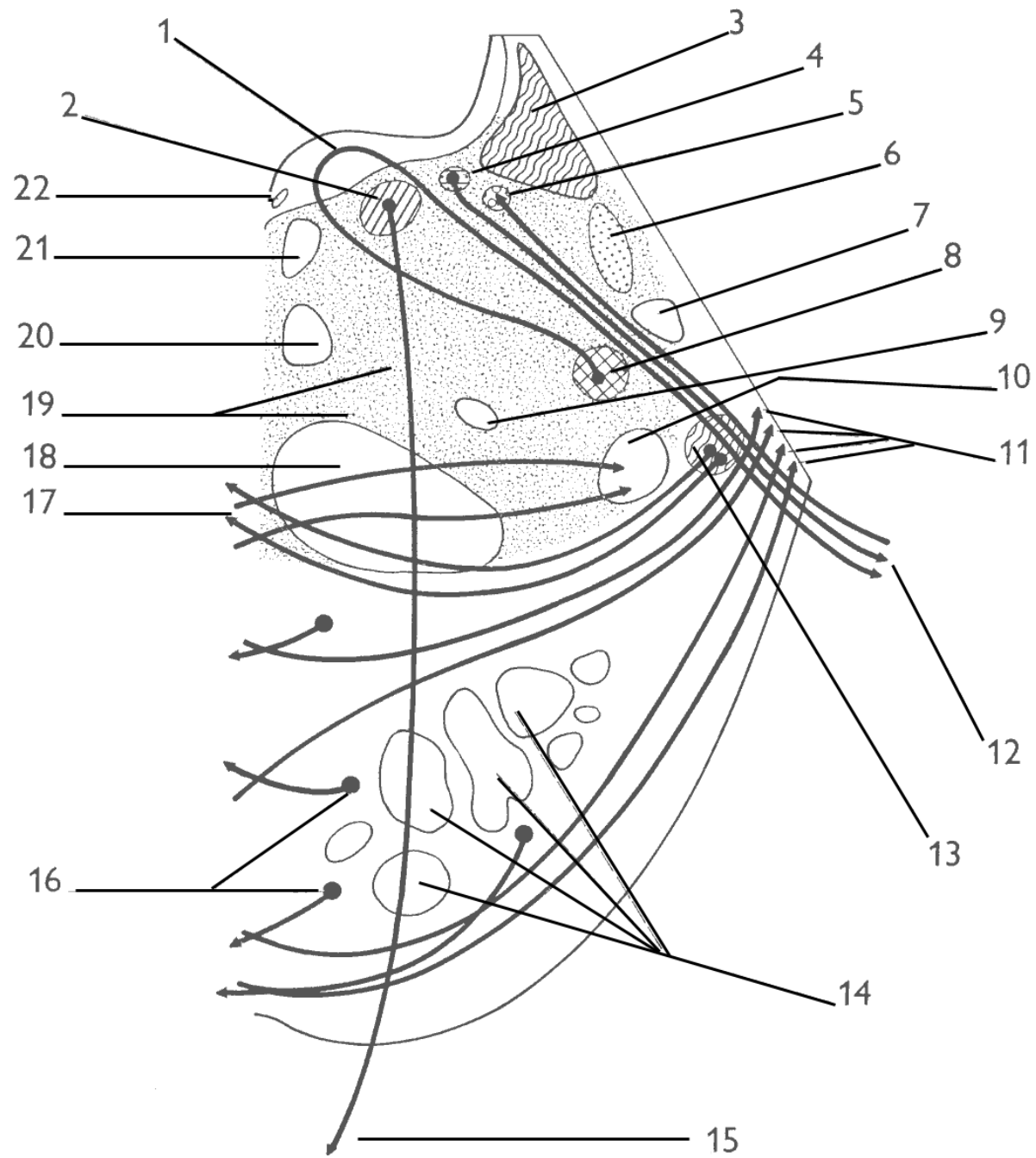
MEDULLA OBLONGATA

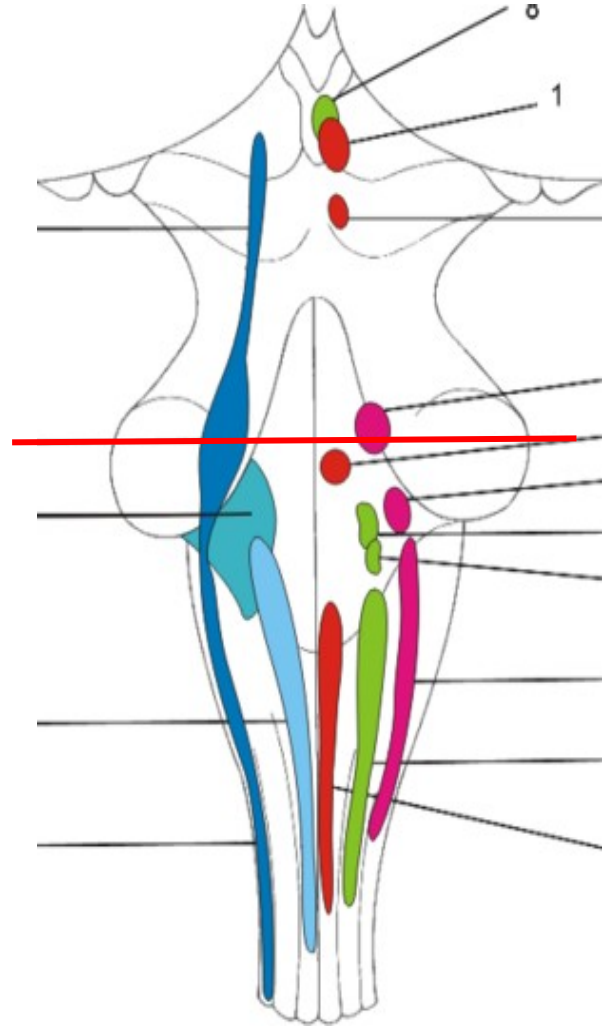
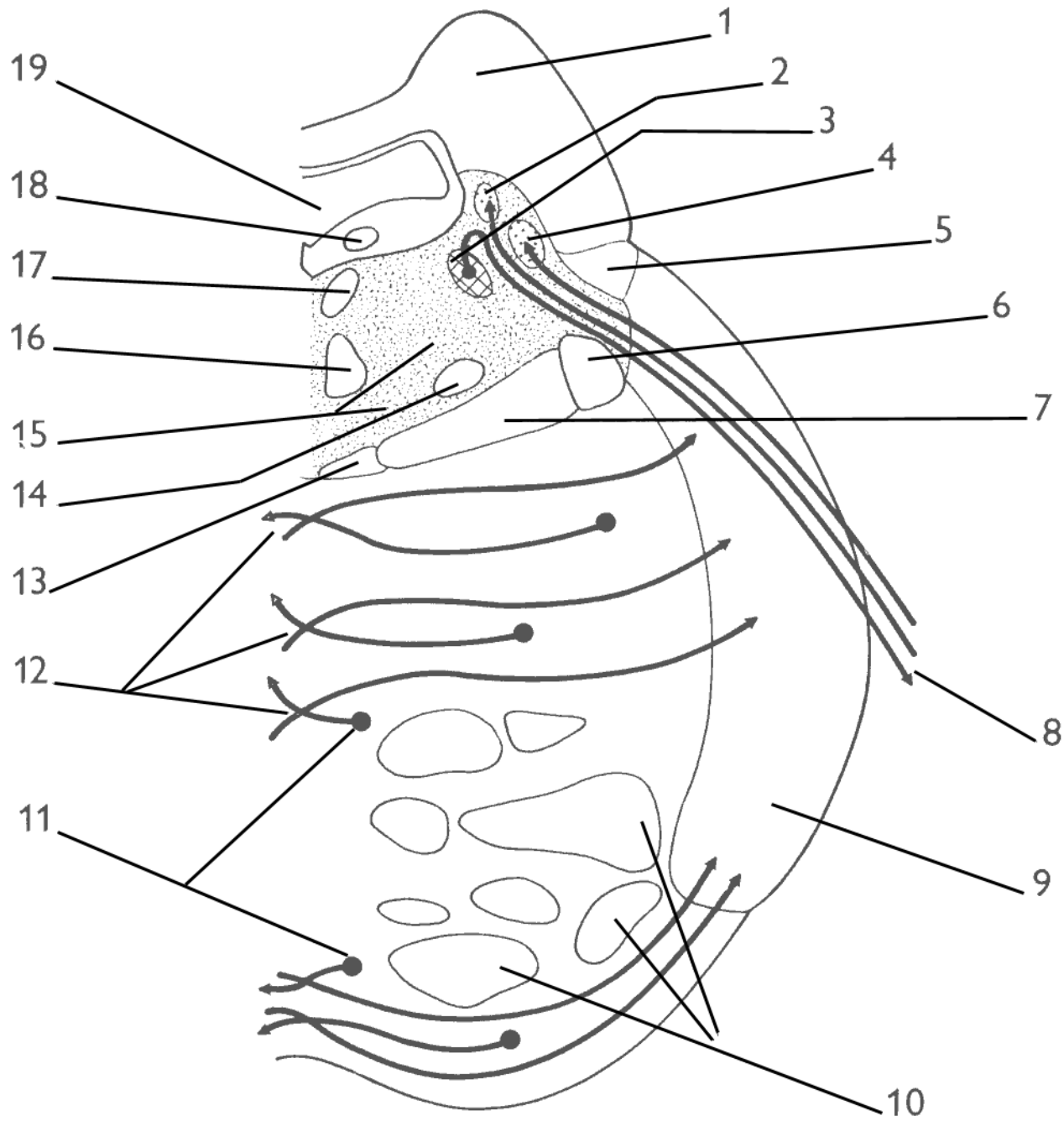


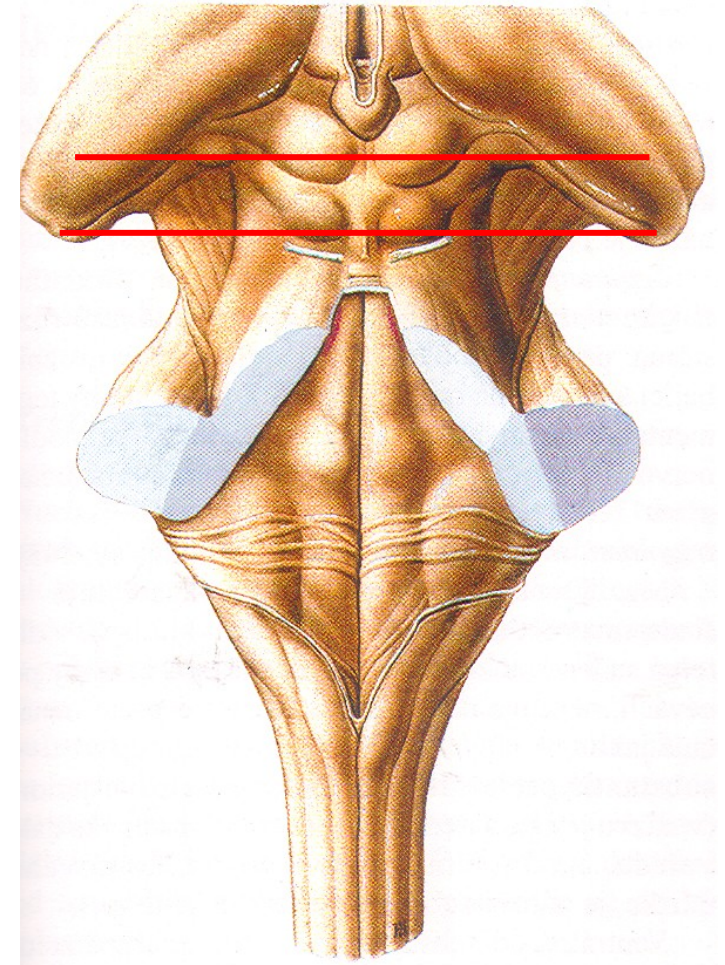
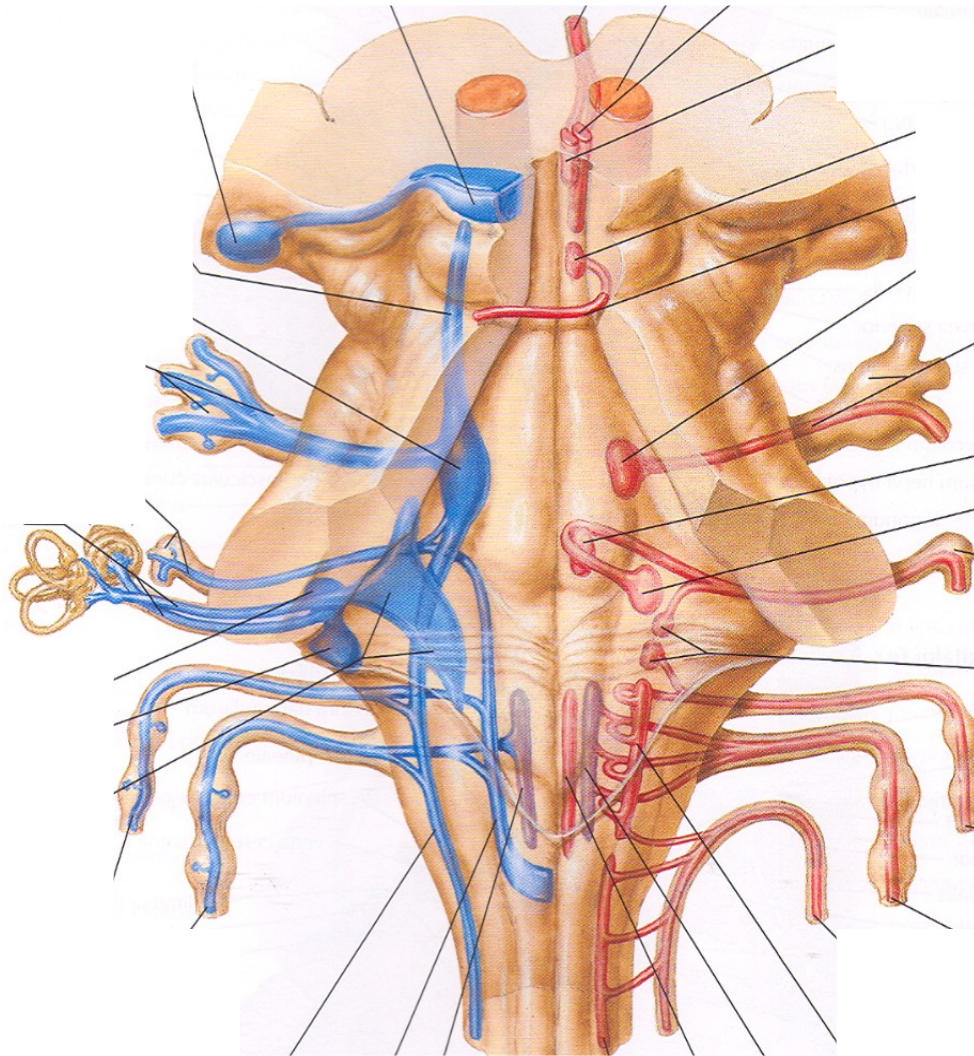
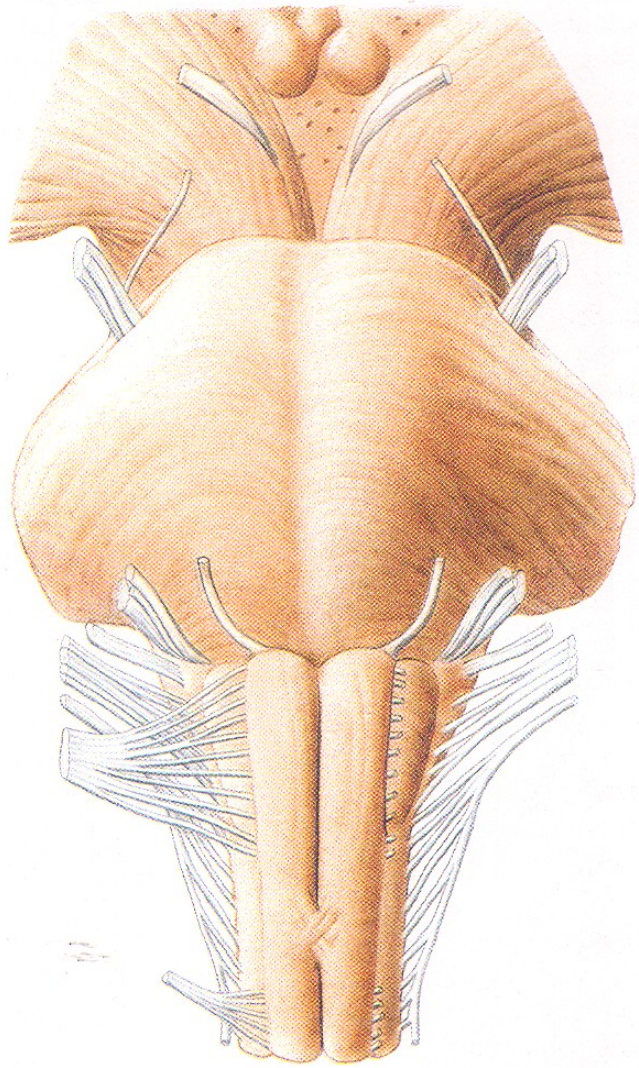




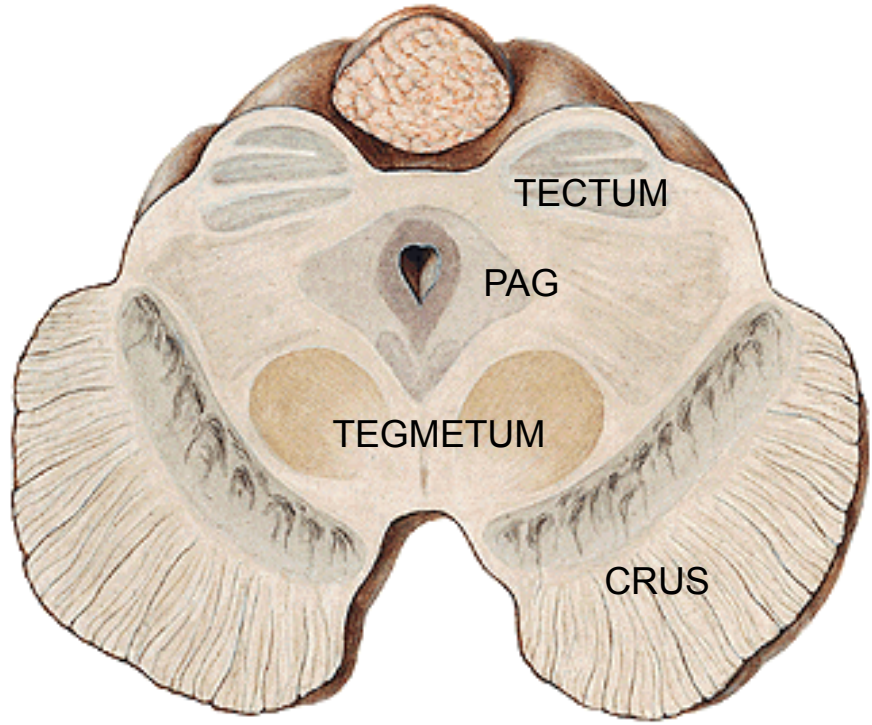
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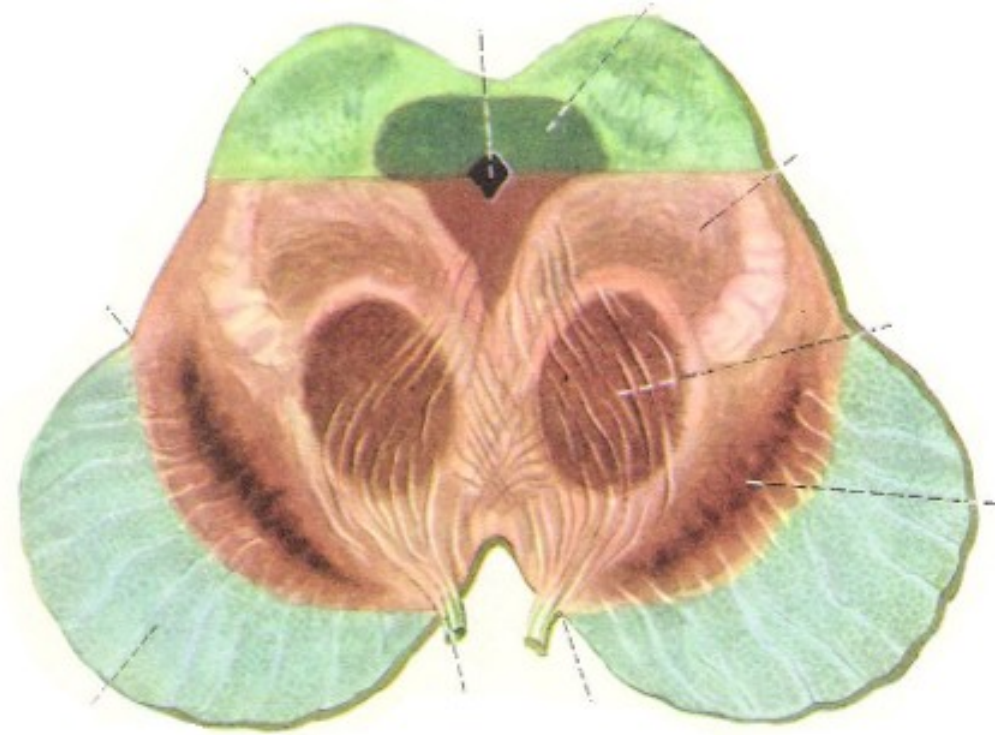


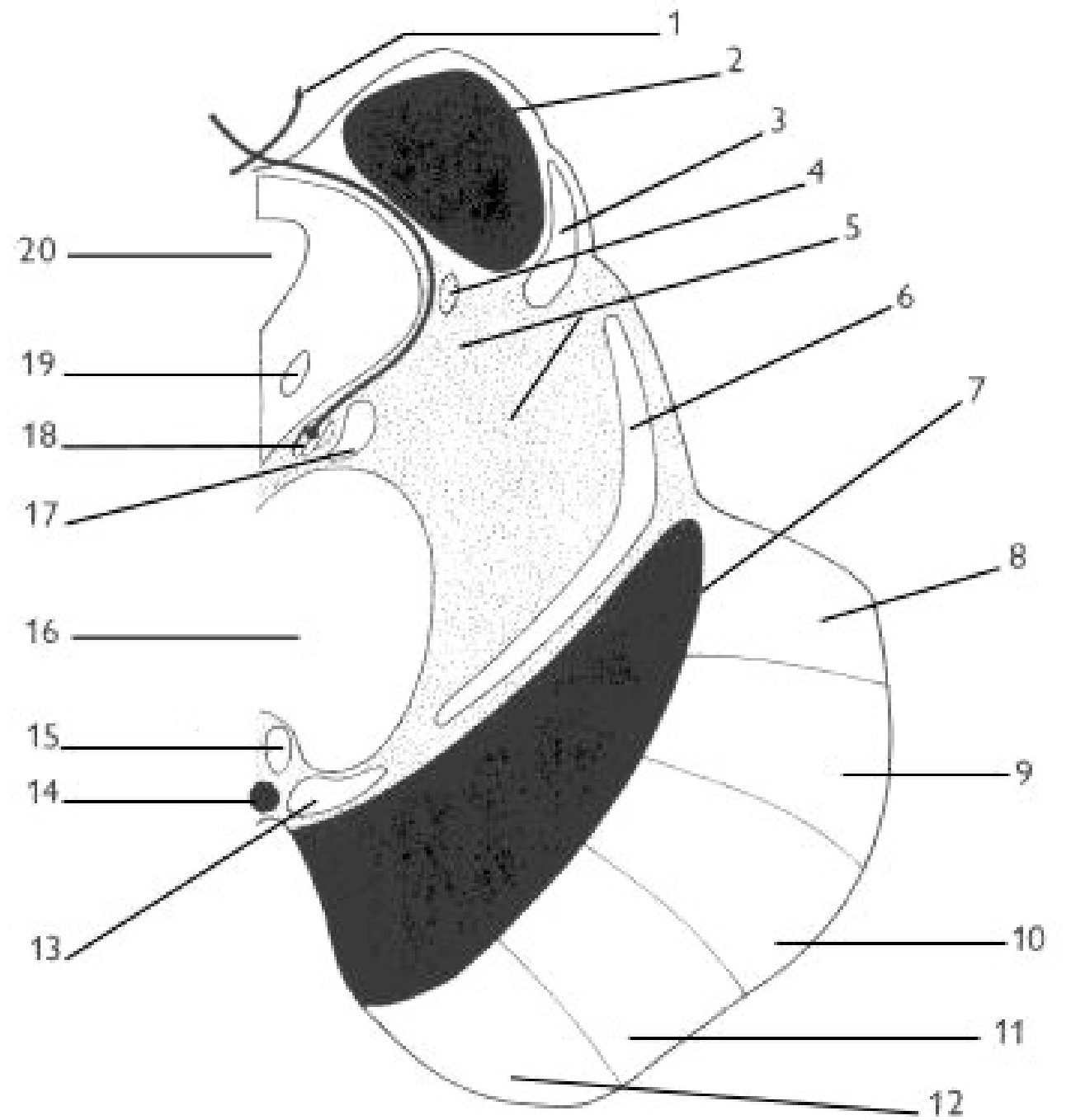
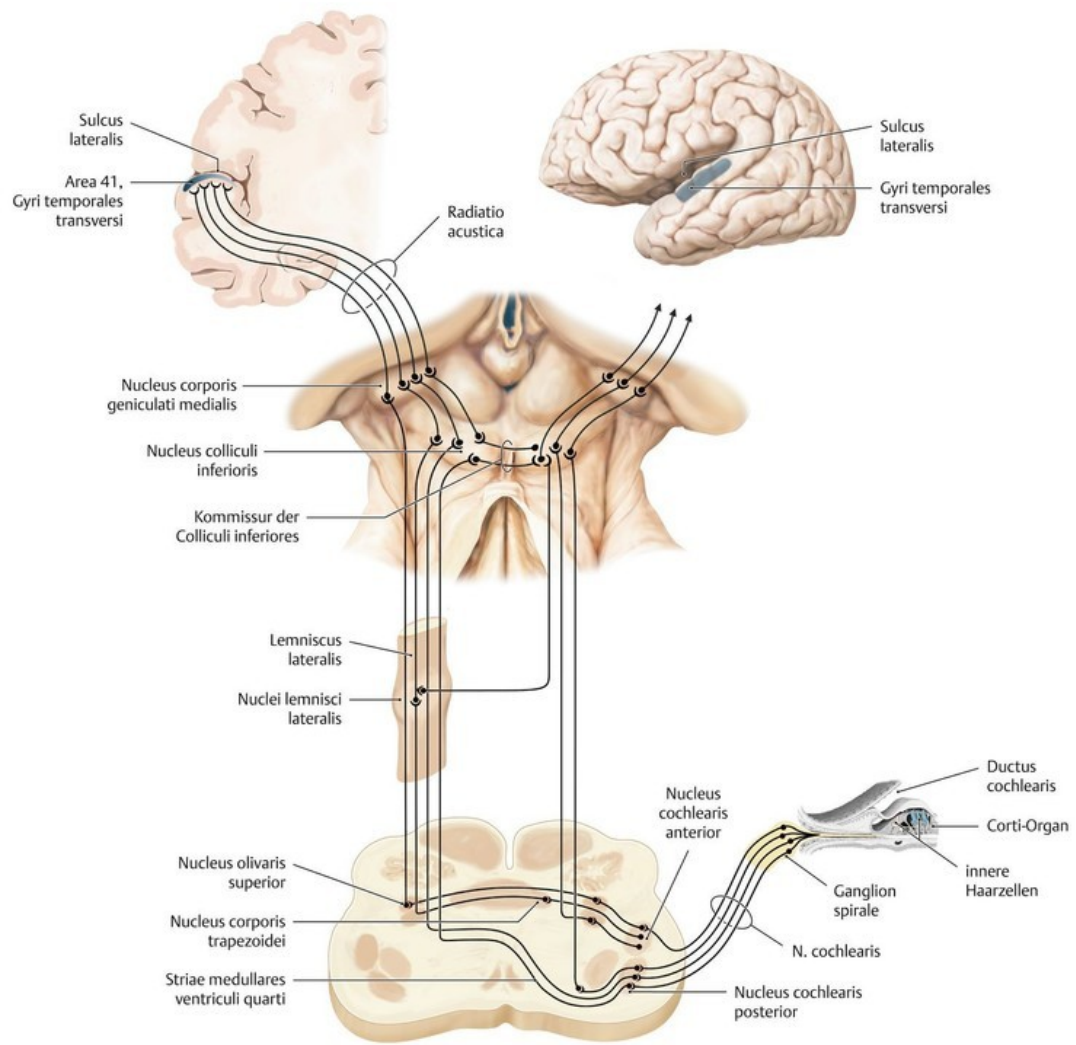


MESENCEPHALON

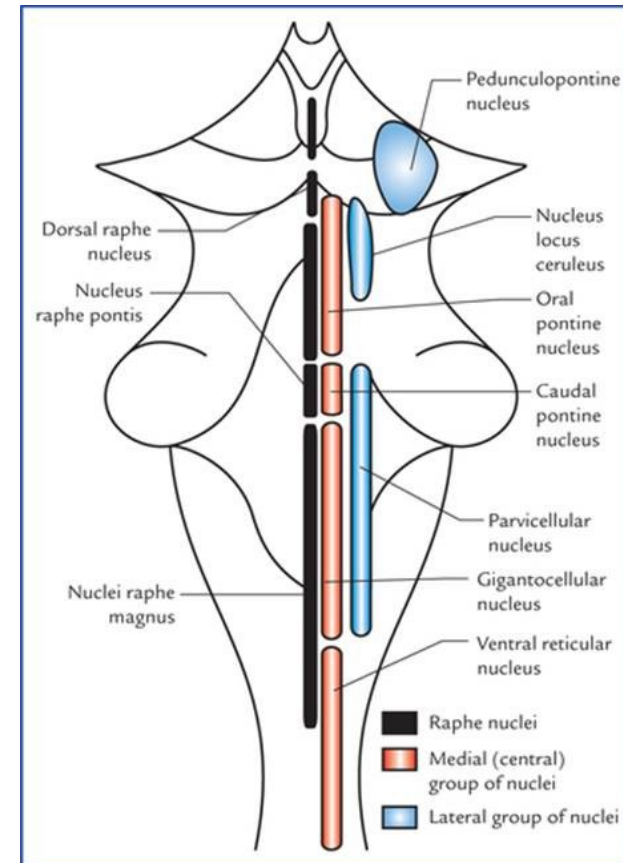
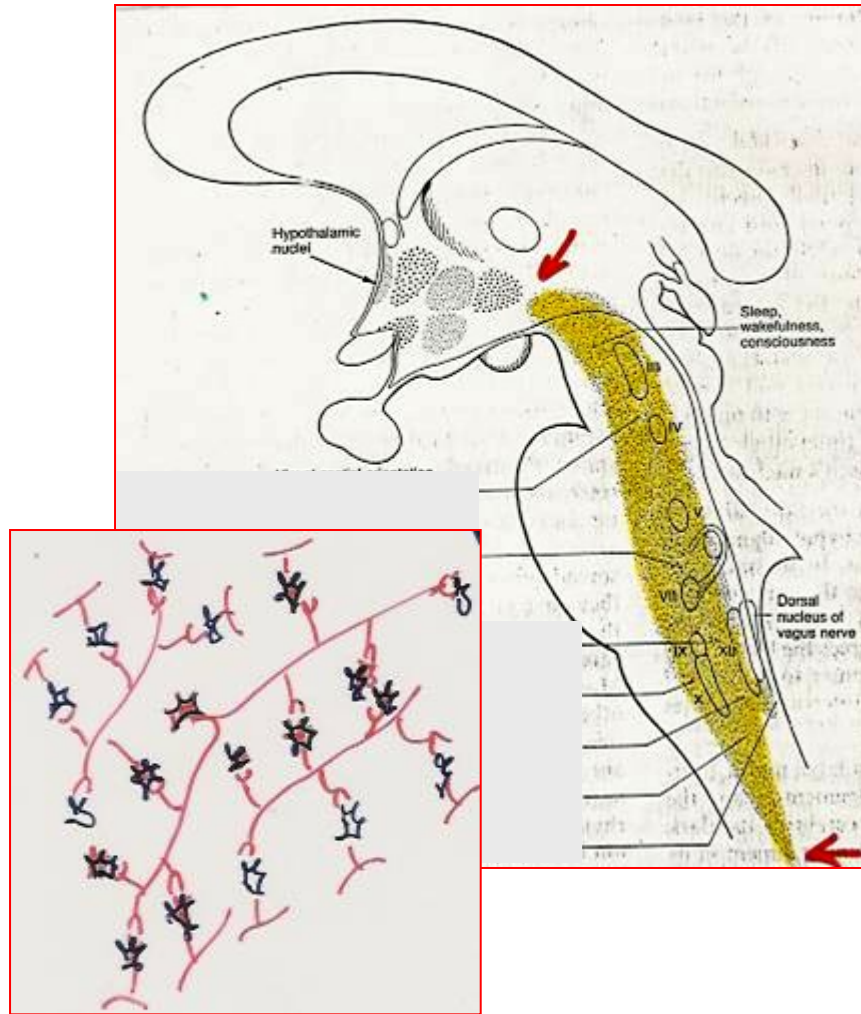


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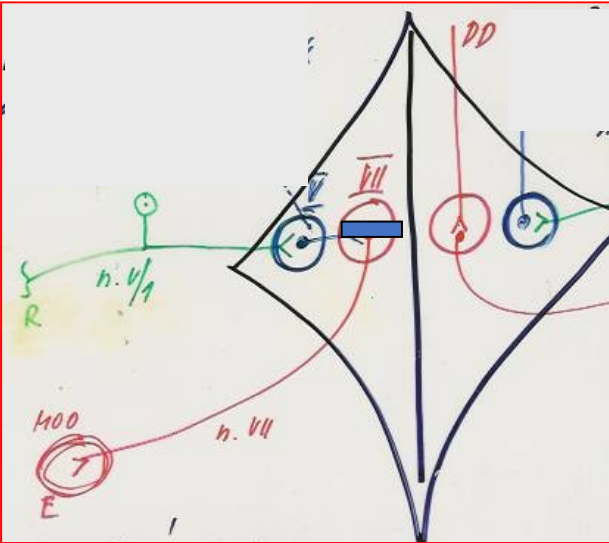
RETICULAR FORMATION (RF) OF THE BRAINSTEM



FUNCTIONS OF RF

connections of the cranial nerve s nuclei:

involvement of RF in reflexive arcs
- mediation of **defensive and vital reflexes**



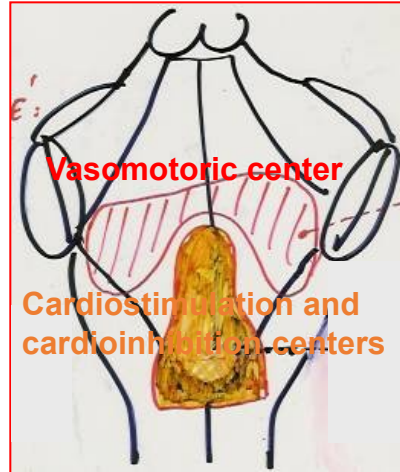
Low pain – poorly localizable

Descending system of FR

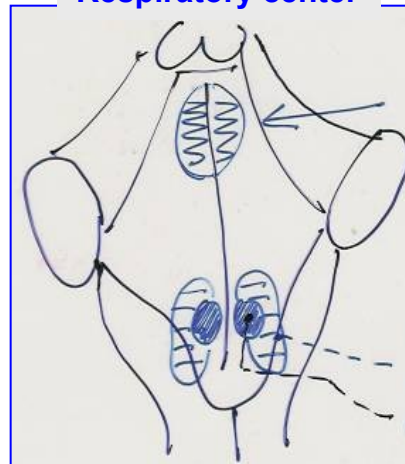
Motor system of descending long RF fibers, connected to the control of the movement. The central regulator of muscle tonus - the connections between the higher sections of the CNS affecting muscle tonus and motoneurons of the anterior horns of the spinal cord. Increases the tension of antigravity muscles (functionally extensors) while reduces the tension of flexors. It allows upright position.

Vegetative centers: to control vital functions:

breath, heart beat, blood pressure

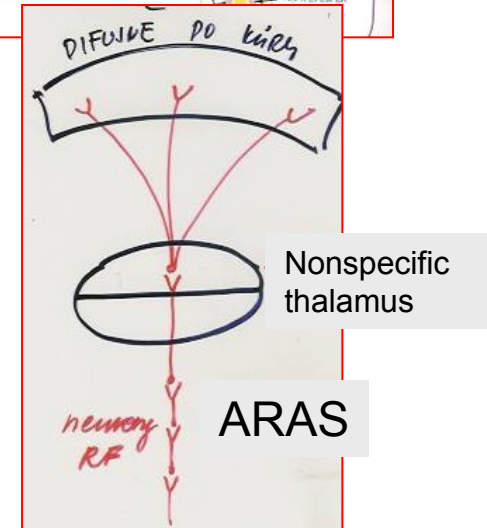
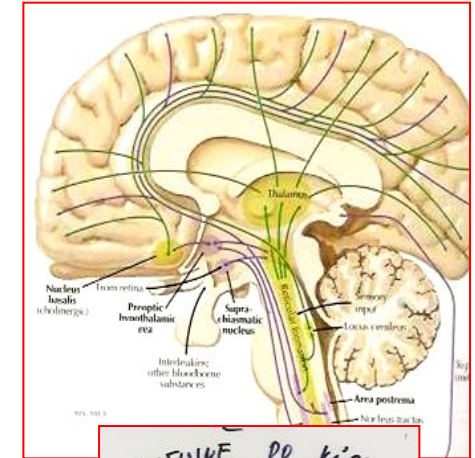


Respiratory center



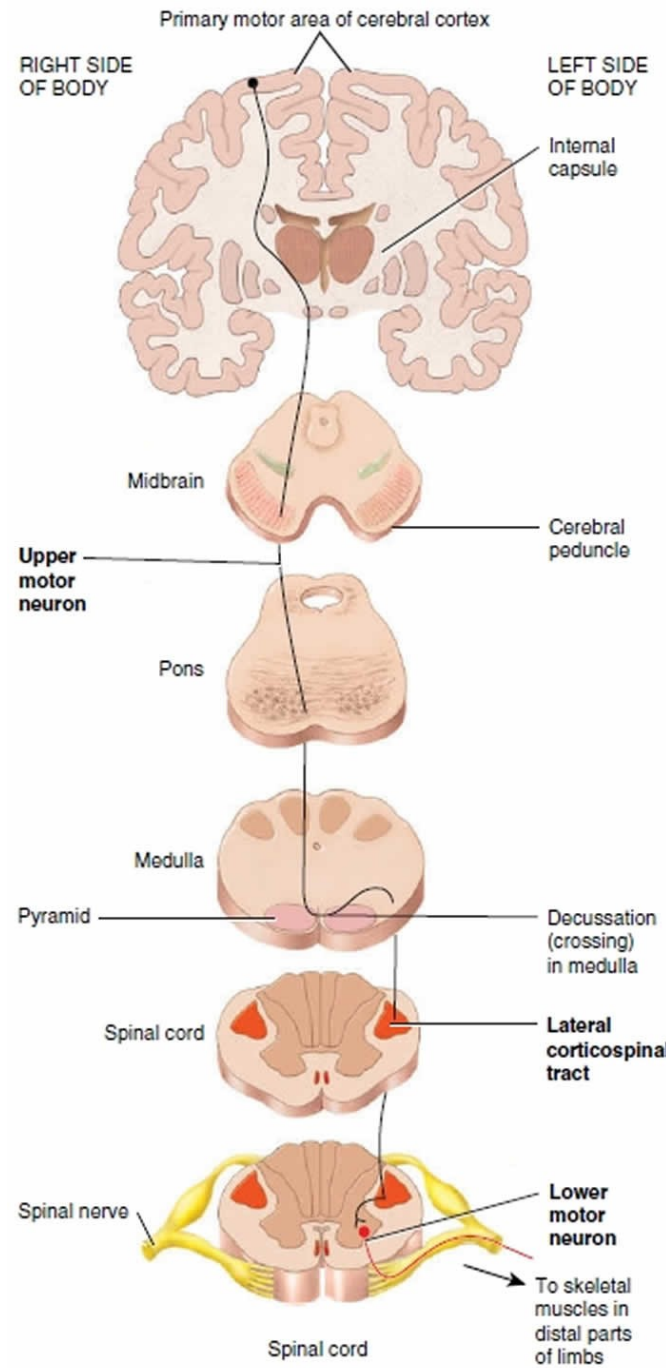
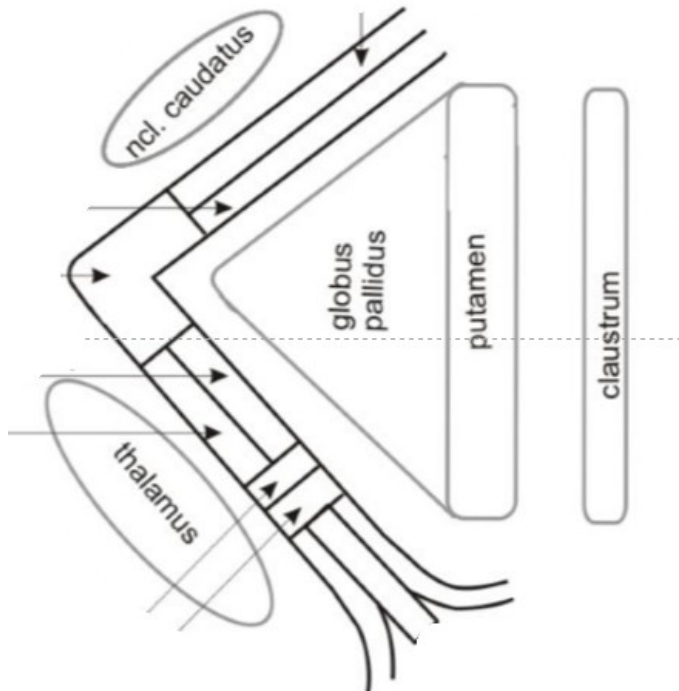
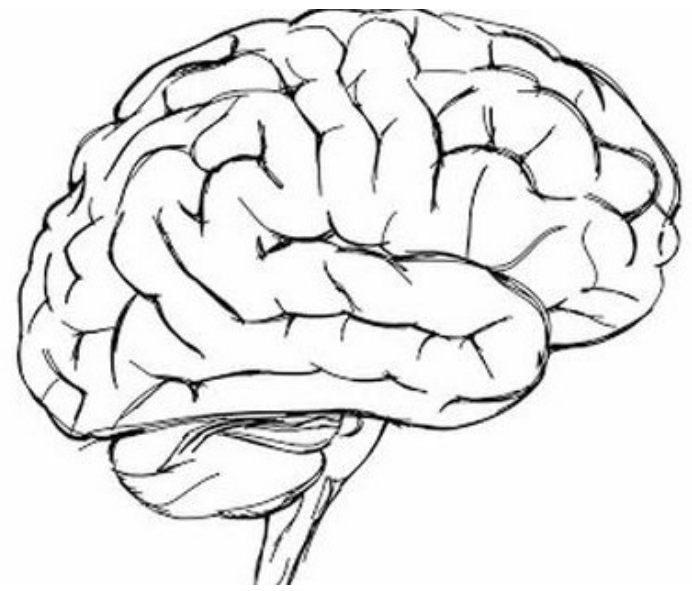
ARAS - ascending activating system

Connections with nonspecific thalamus and cortex telencephali - regulation of wakefulness and sleep

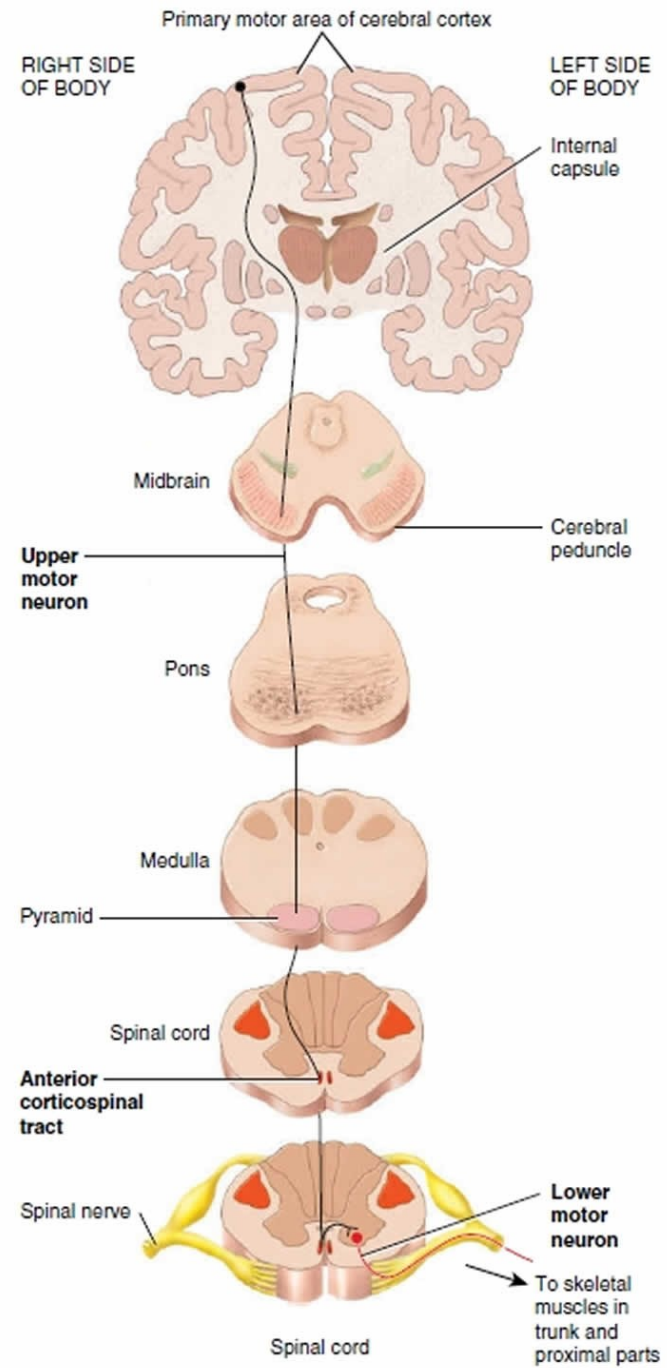


- 56. Visual tract**
- 57. Auditory tract**
- 58. Pupillary reflex (miosis and mydriasis)**
- 59. Vestibular tract (the role of the FLM)**
- 60. Protopathic sensibility (non-discriminating responsiveness to thermal, noxious stimuli)**
- 61. Epicritic sensibility (discriminant responsiveness to minute changes in sensations of touch and temperature)**
- 62. Proprioception (from the limbs, trunk, and the head)**
- 63. Pyramidal motor tract (voluntary movements tract)**
- 64. Extrapyramidal motor tracts (involuntary movement tracts, processing motor tracts)**
- 65. Olfactory and gustatory organs (organum olfactorium et gustatorium)**

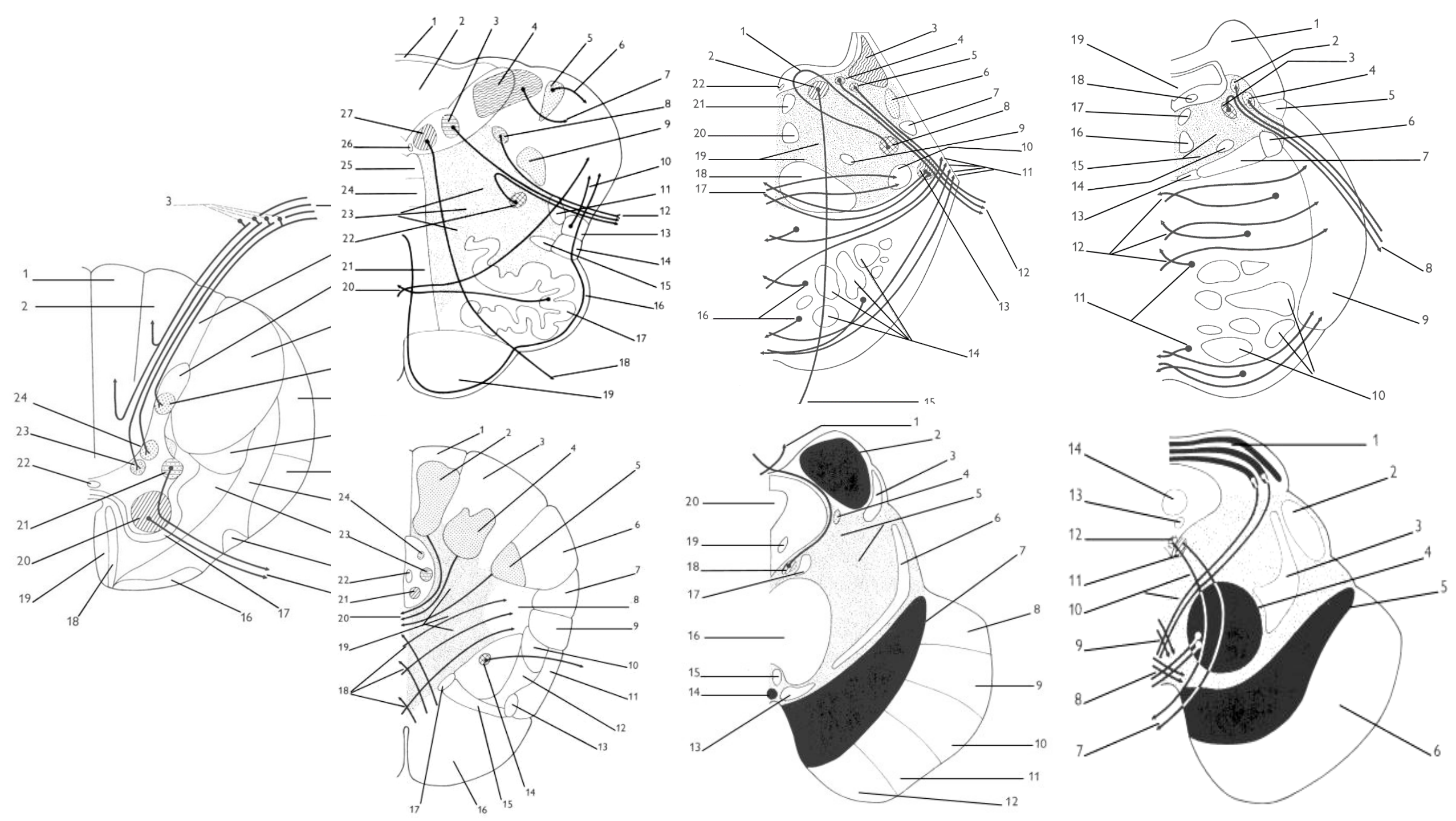
**MOTOR (DESCENDING)
PYRAMIDAL (DIRECT)**



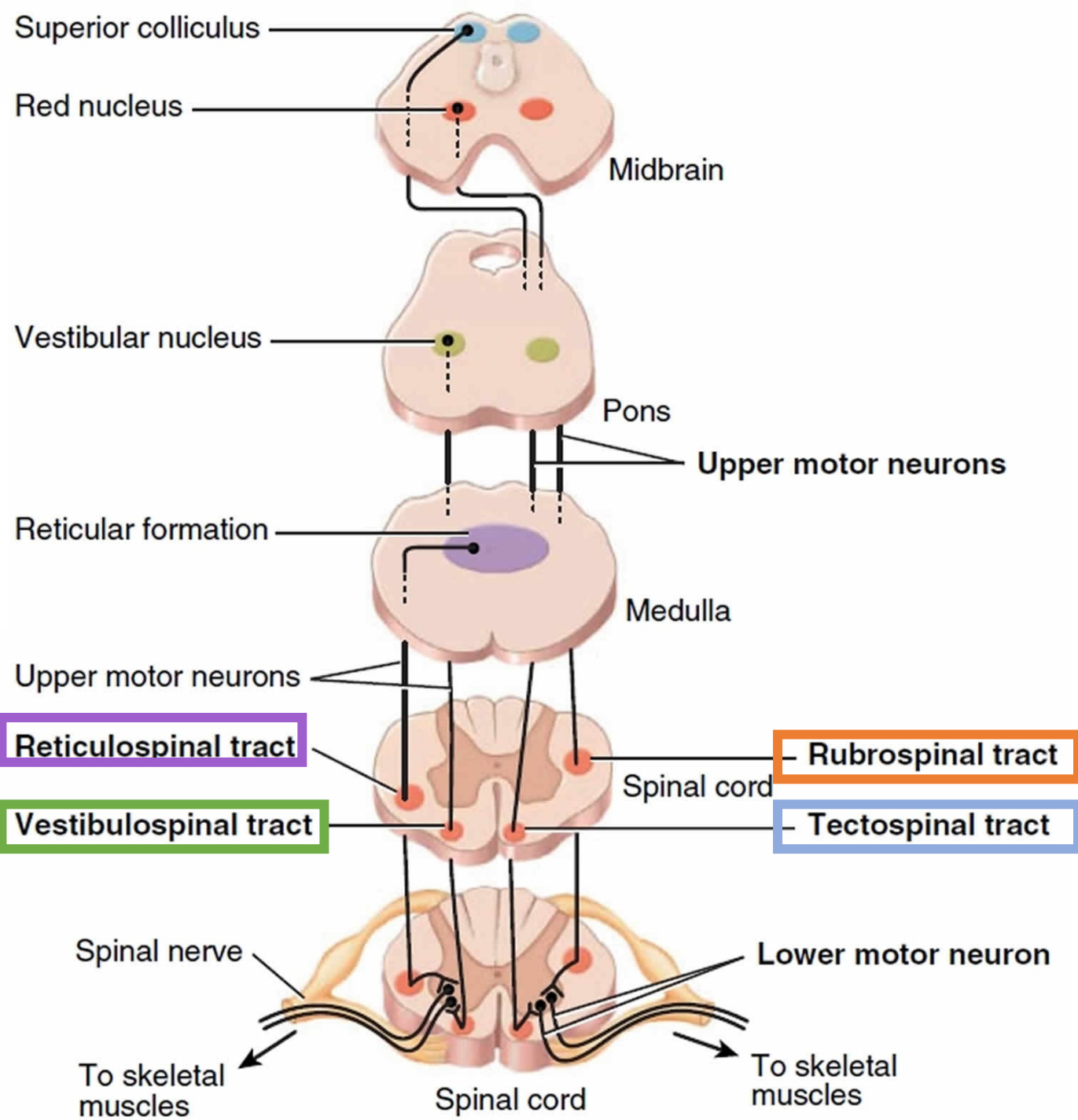
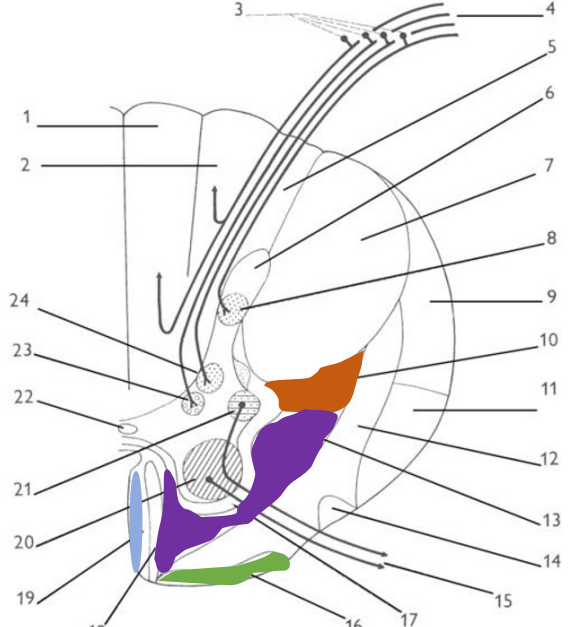
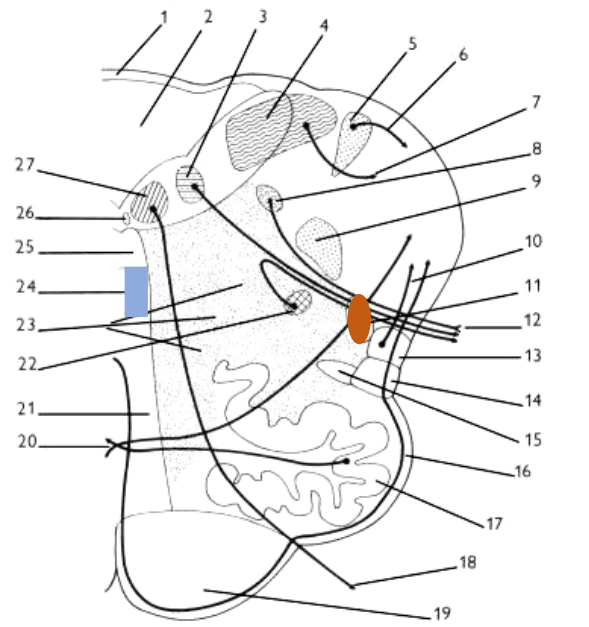
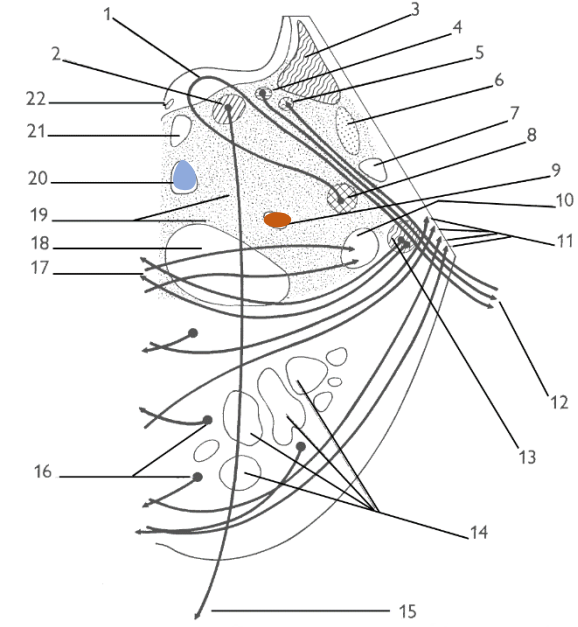
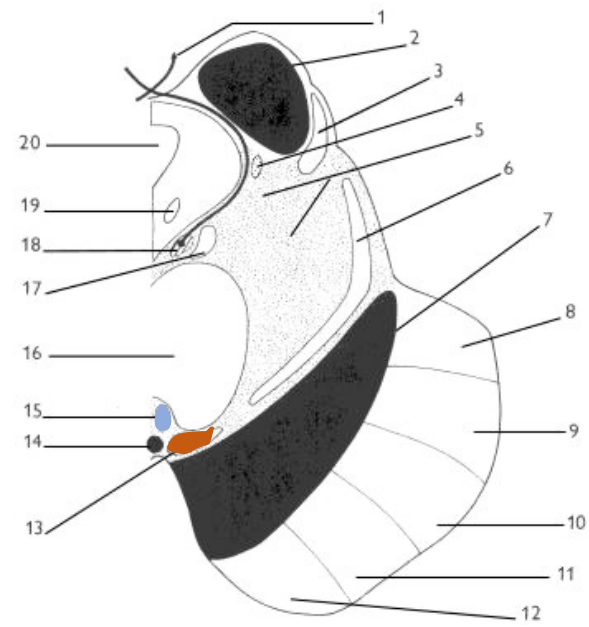
(a) The lateral corticospinal pathway

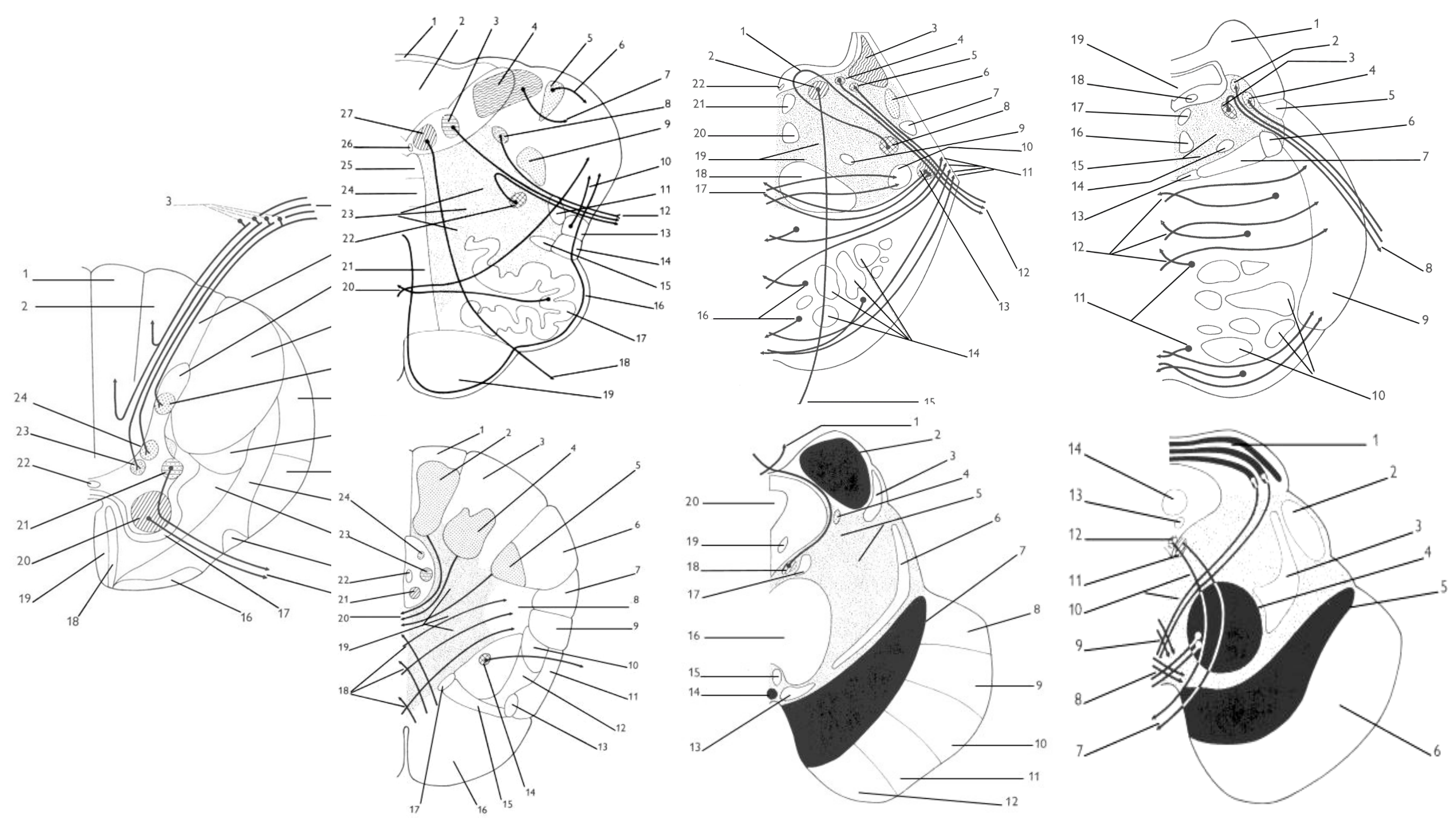


(b) The anterior corticospinal pathway

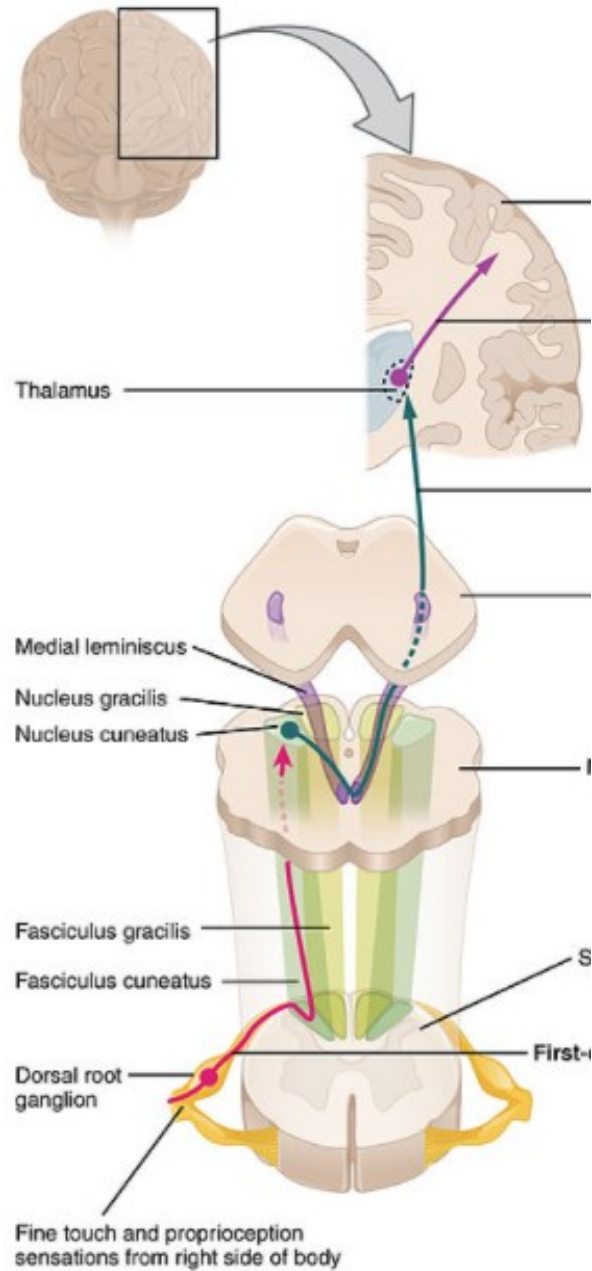


**MOTOR (DESCENDING)
EXTRAPYRAMIDAL (INDIRECT)**

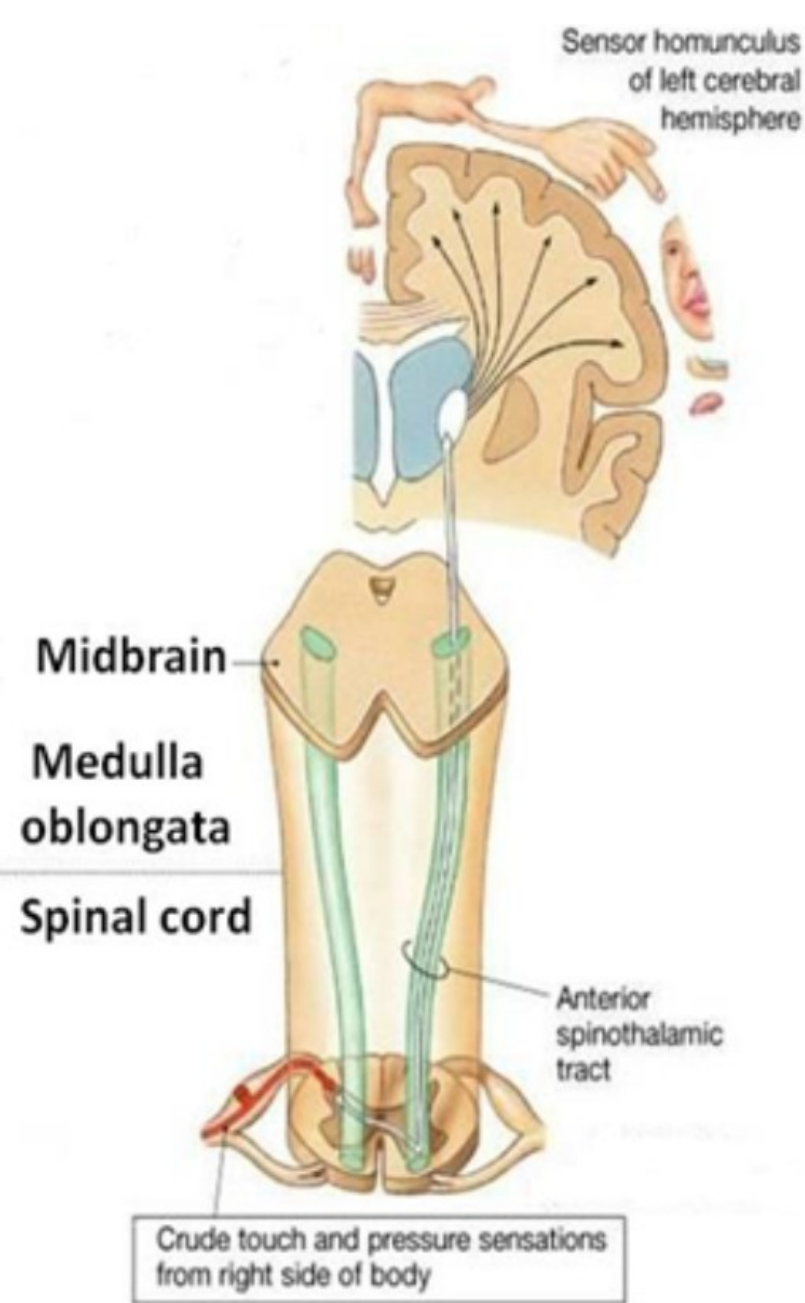




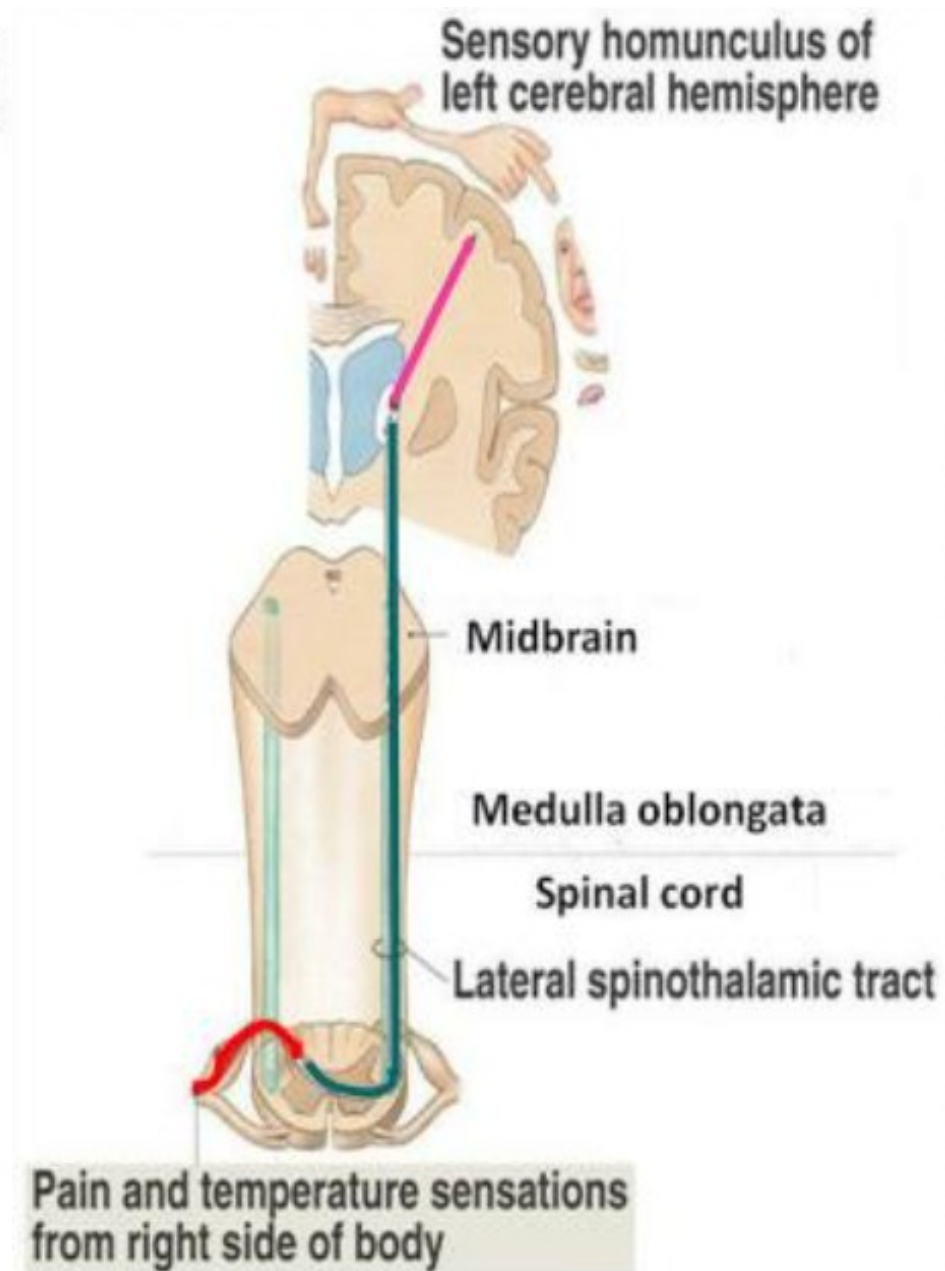
SENSORIC (ASCENDING) EPICRITIC AND PROTOPATHIC SENSATION



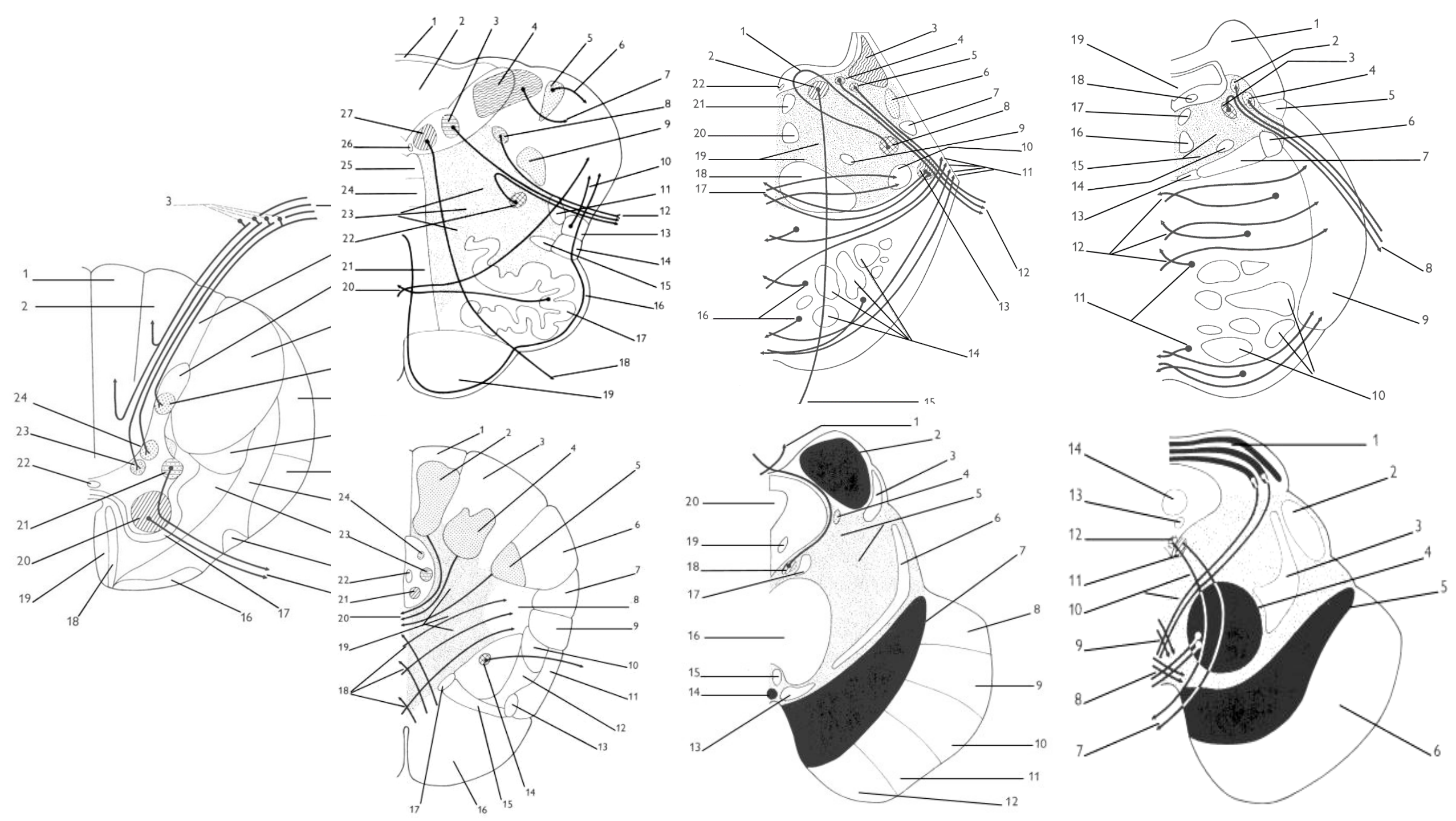
Dorsal column system

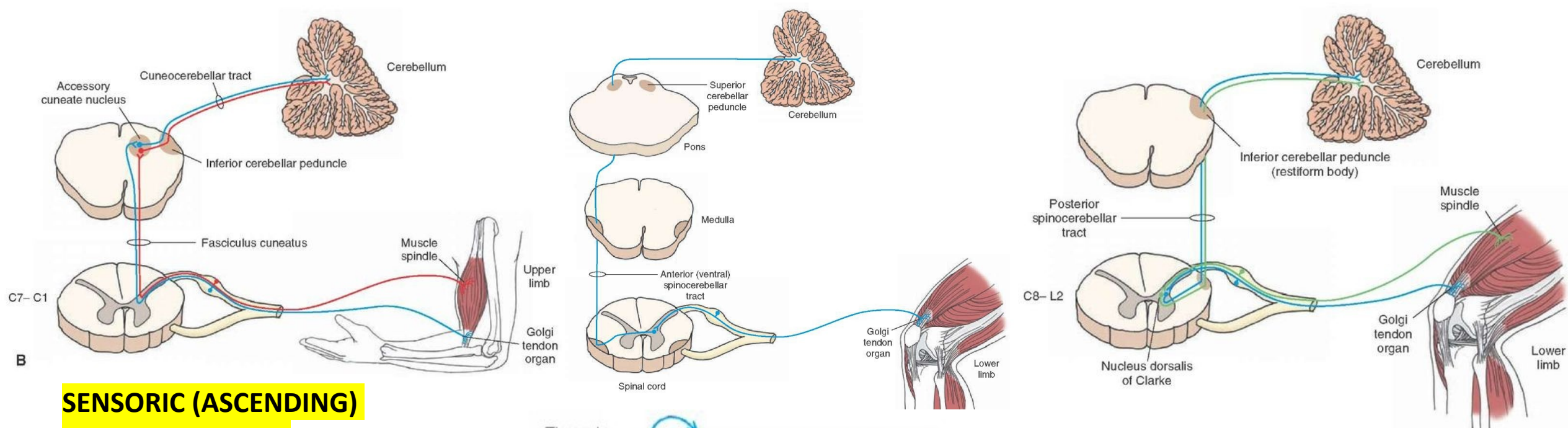


Crude touch and pressure sensations from right side of body

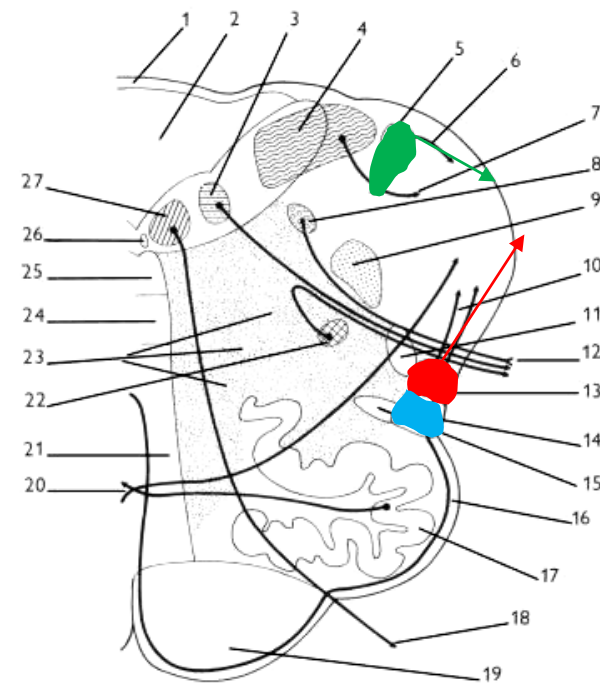
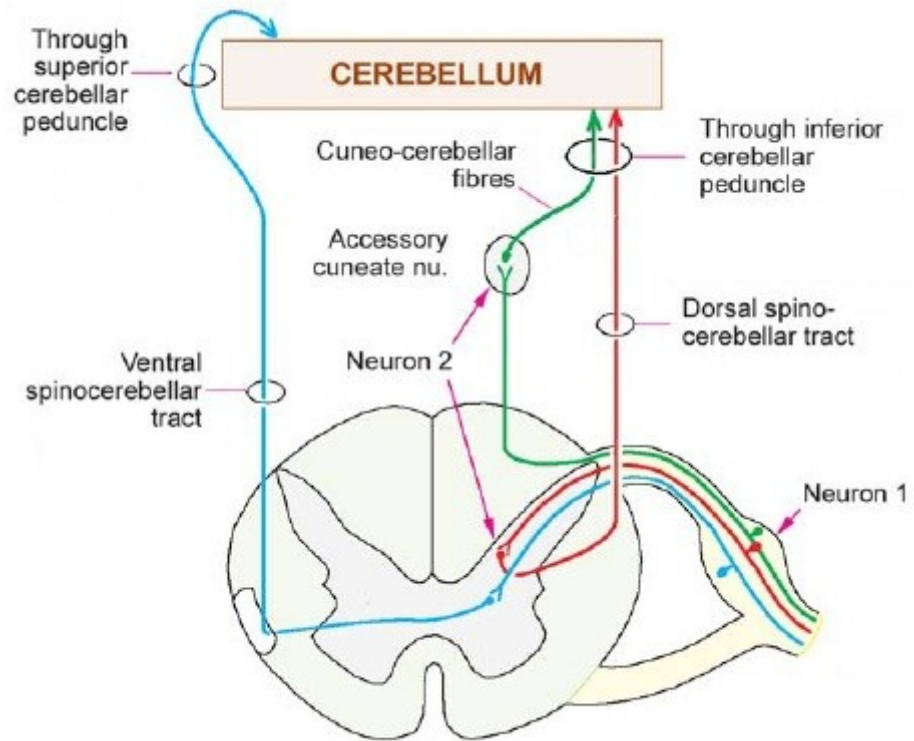
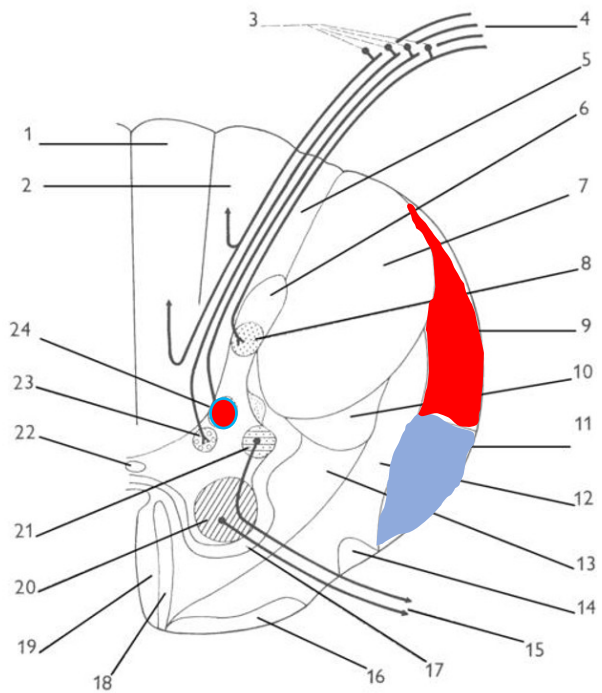


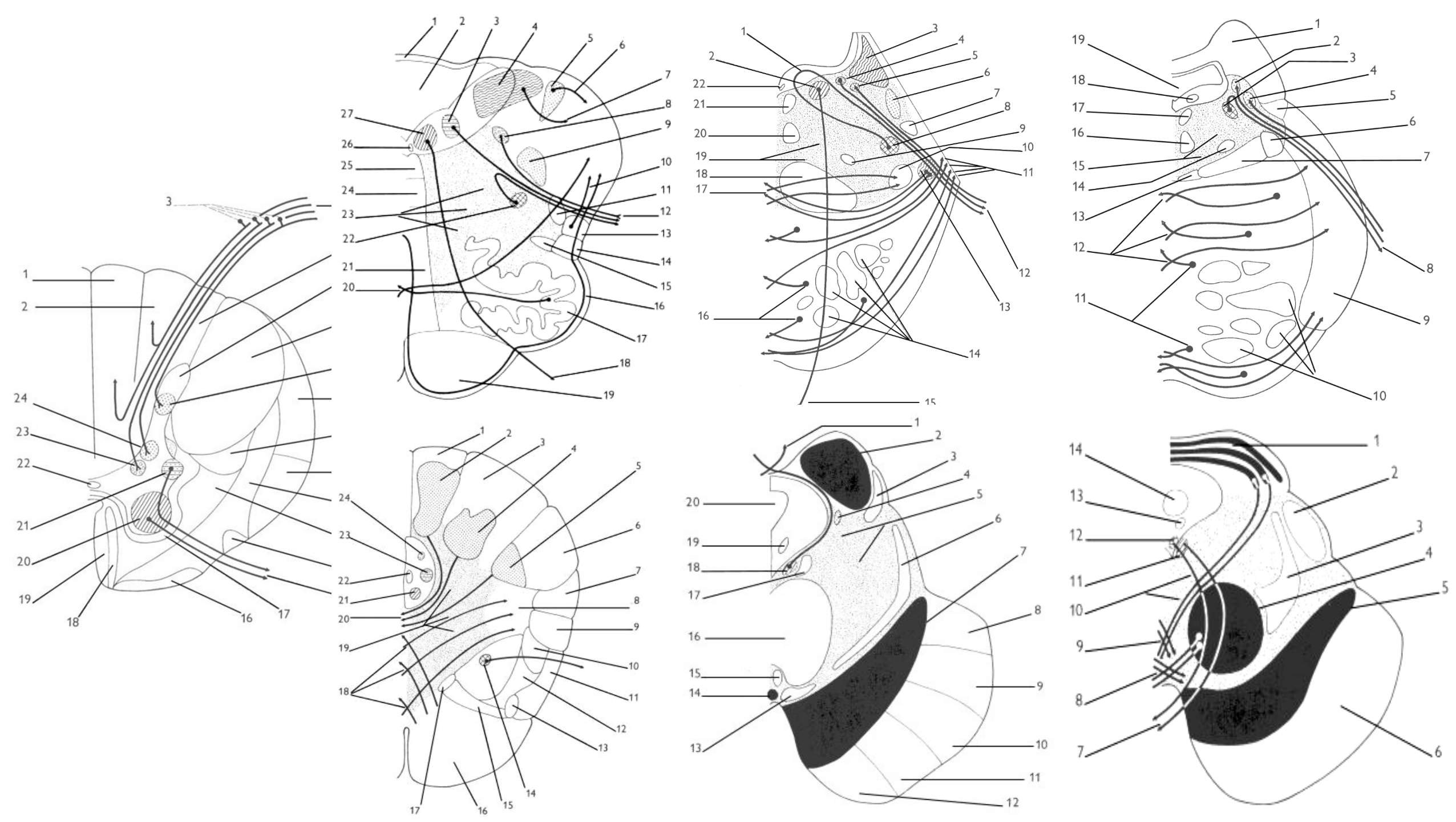
Pain and temperature sensations from right side of body



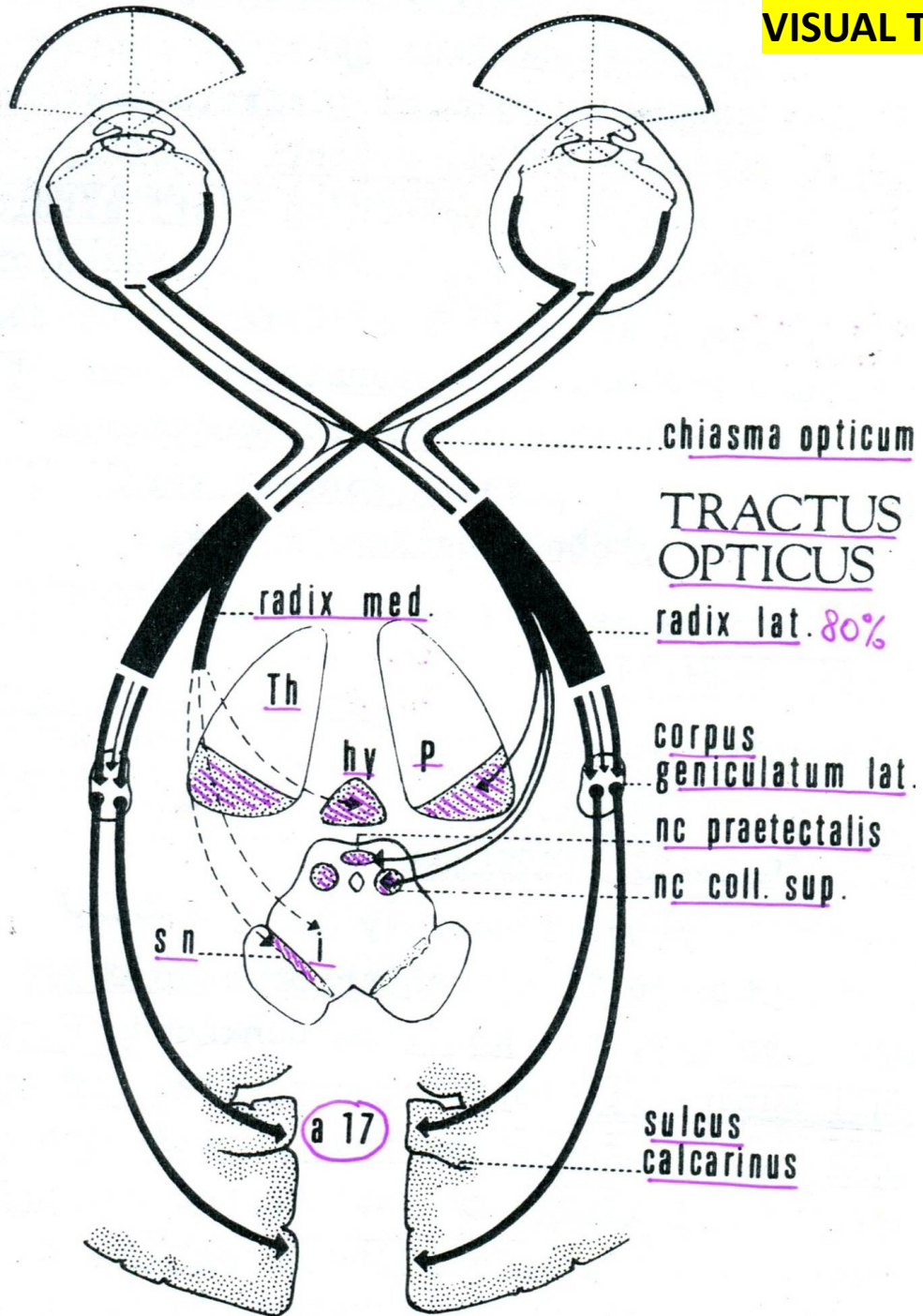


**SENSORY (ASCENDING)
PROPRIOCEPTION**

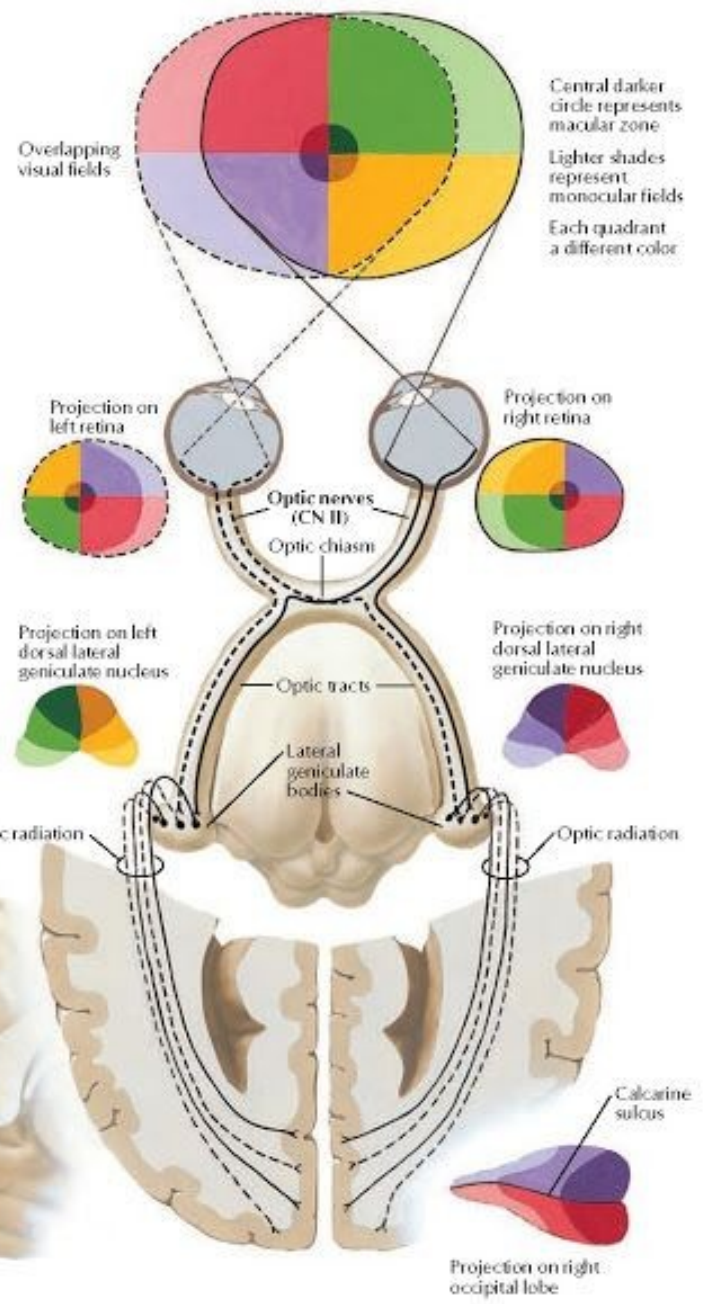


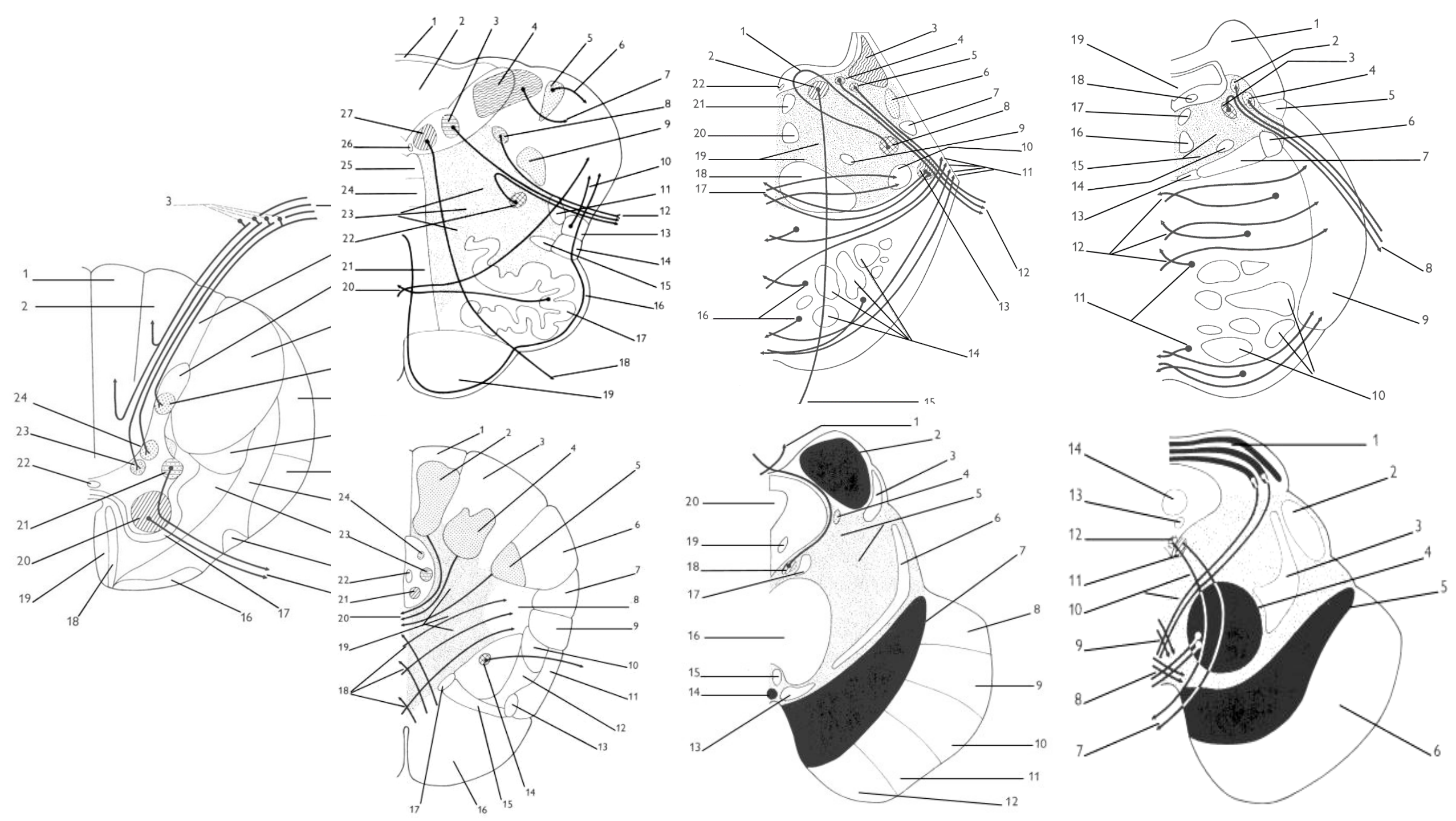


VISUAL TRACT

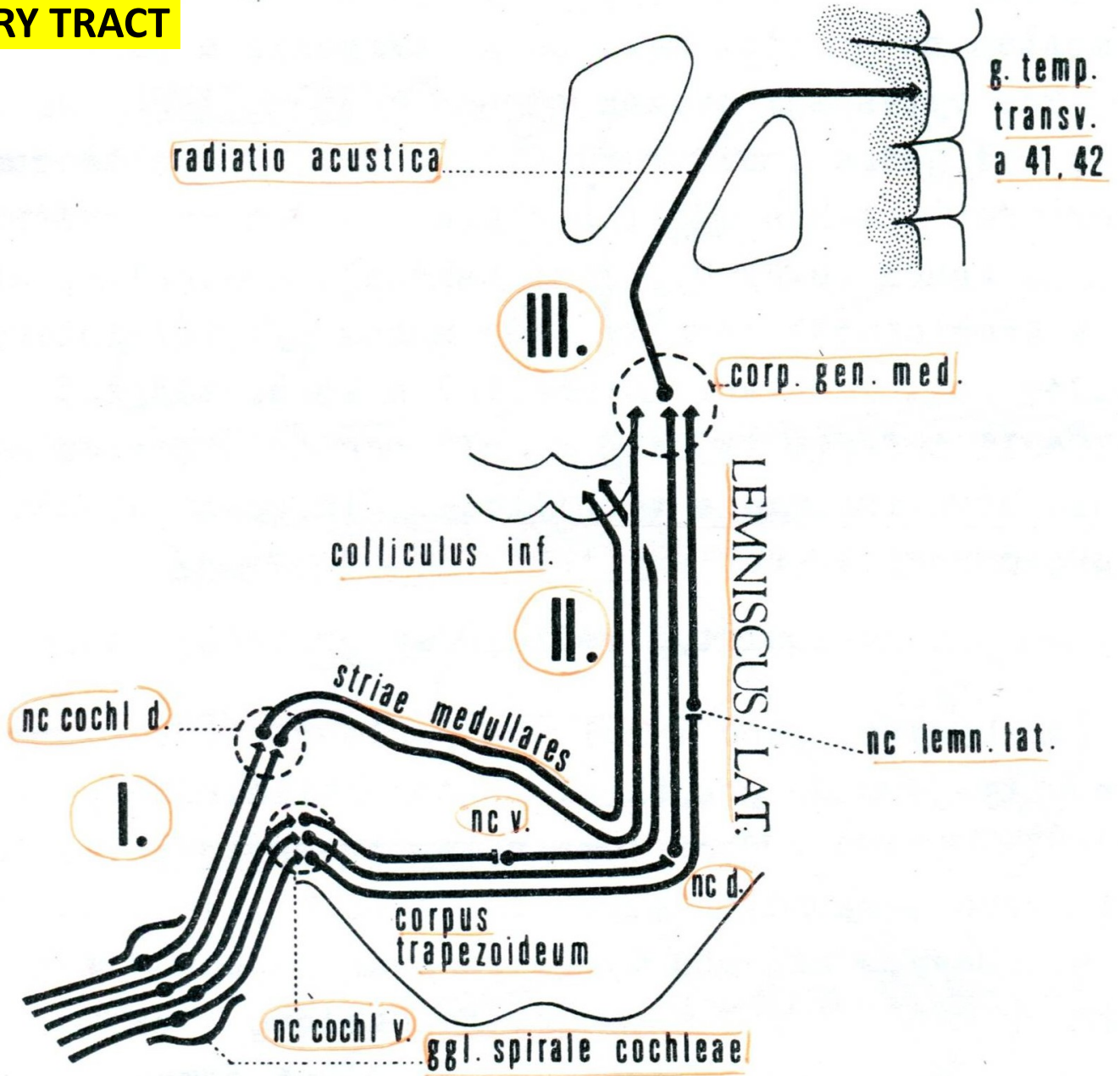
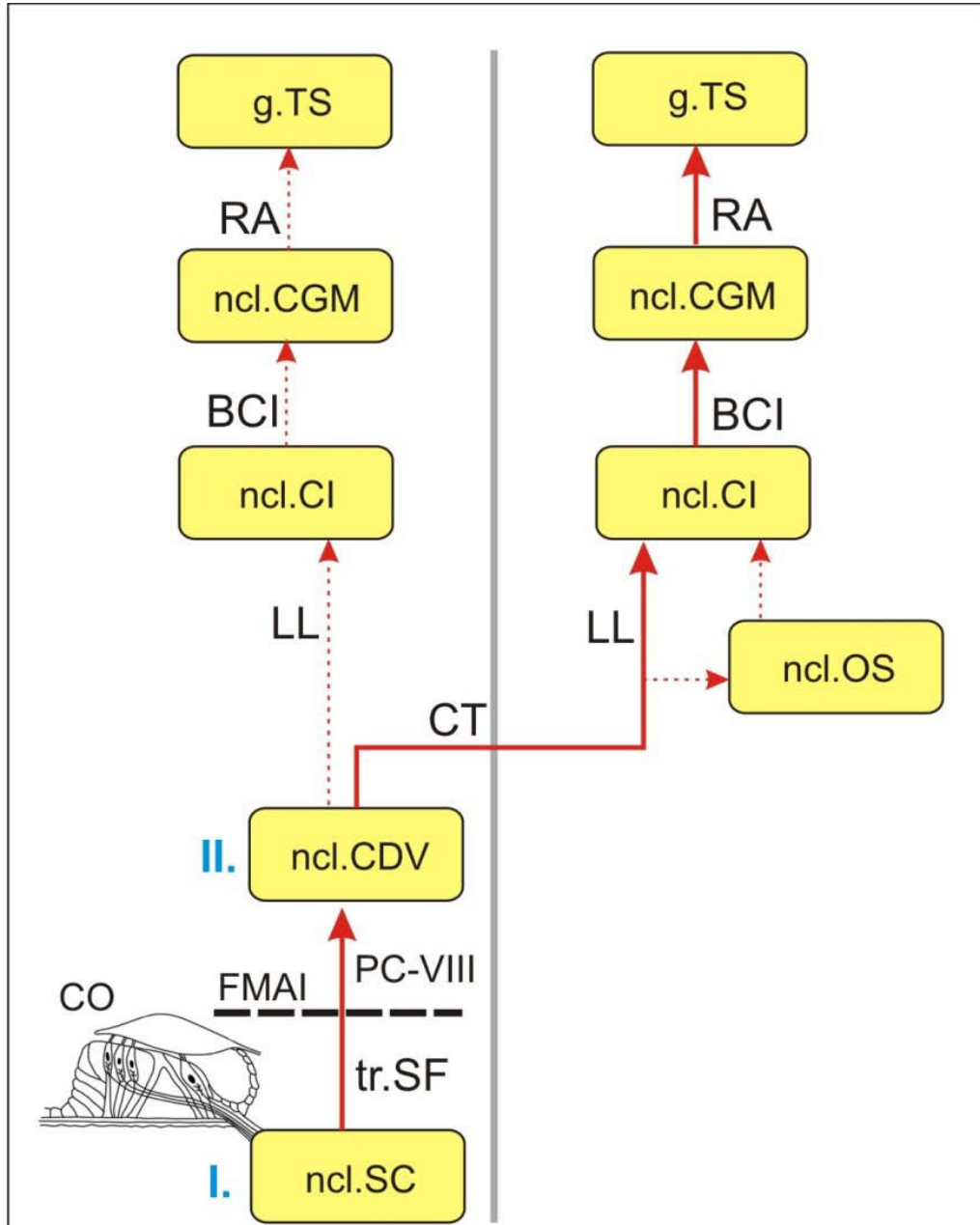


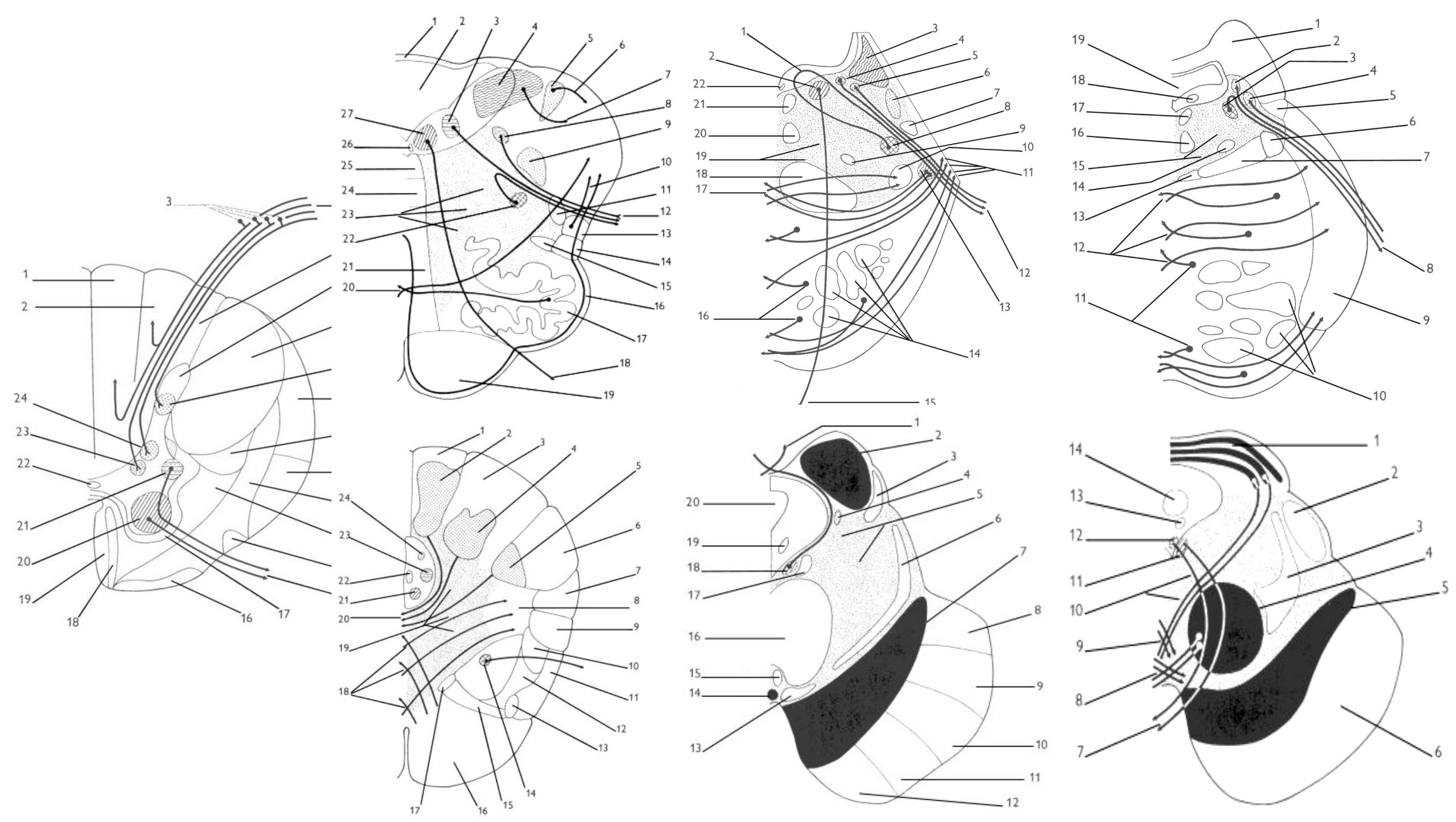
- Structure of retina: schema
- A Amacrine cells
 - B Bipolar cells
 - C Cones
 - G Ganglion cells
 - H Horizontal cells
 - P Pigment cells
 - R Rods



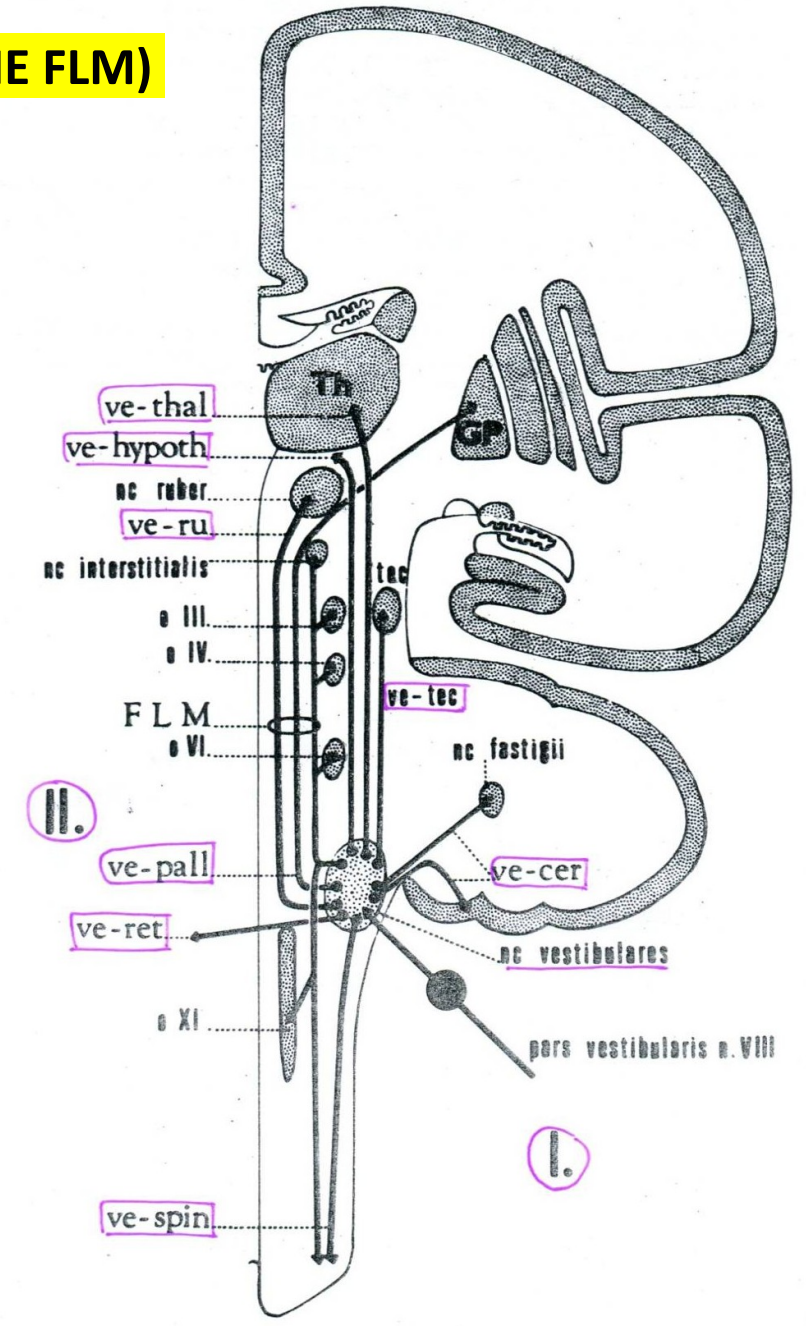
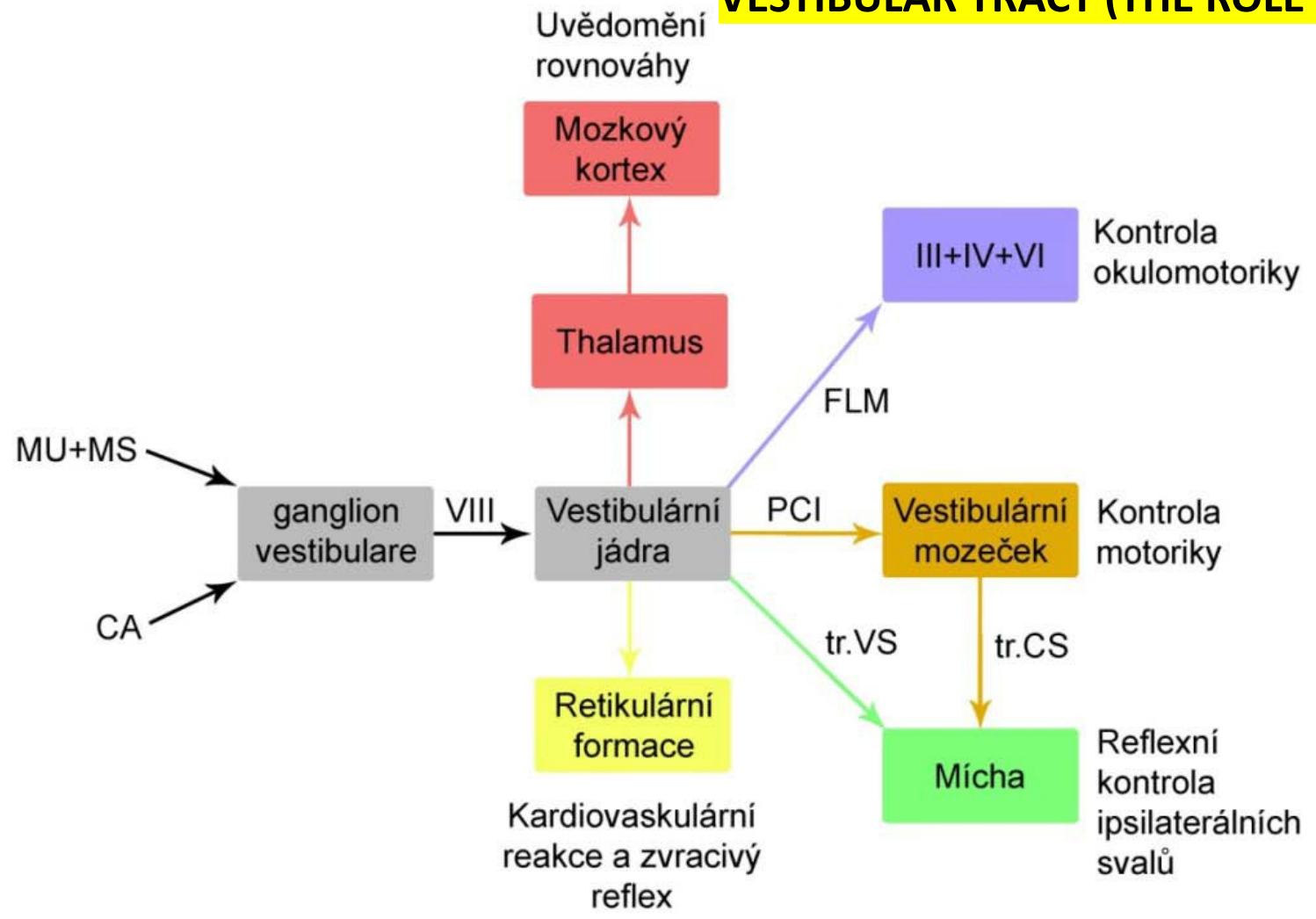


AUDITORY TRACT

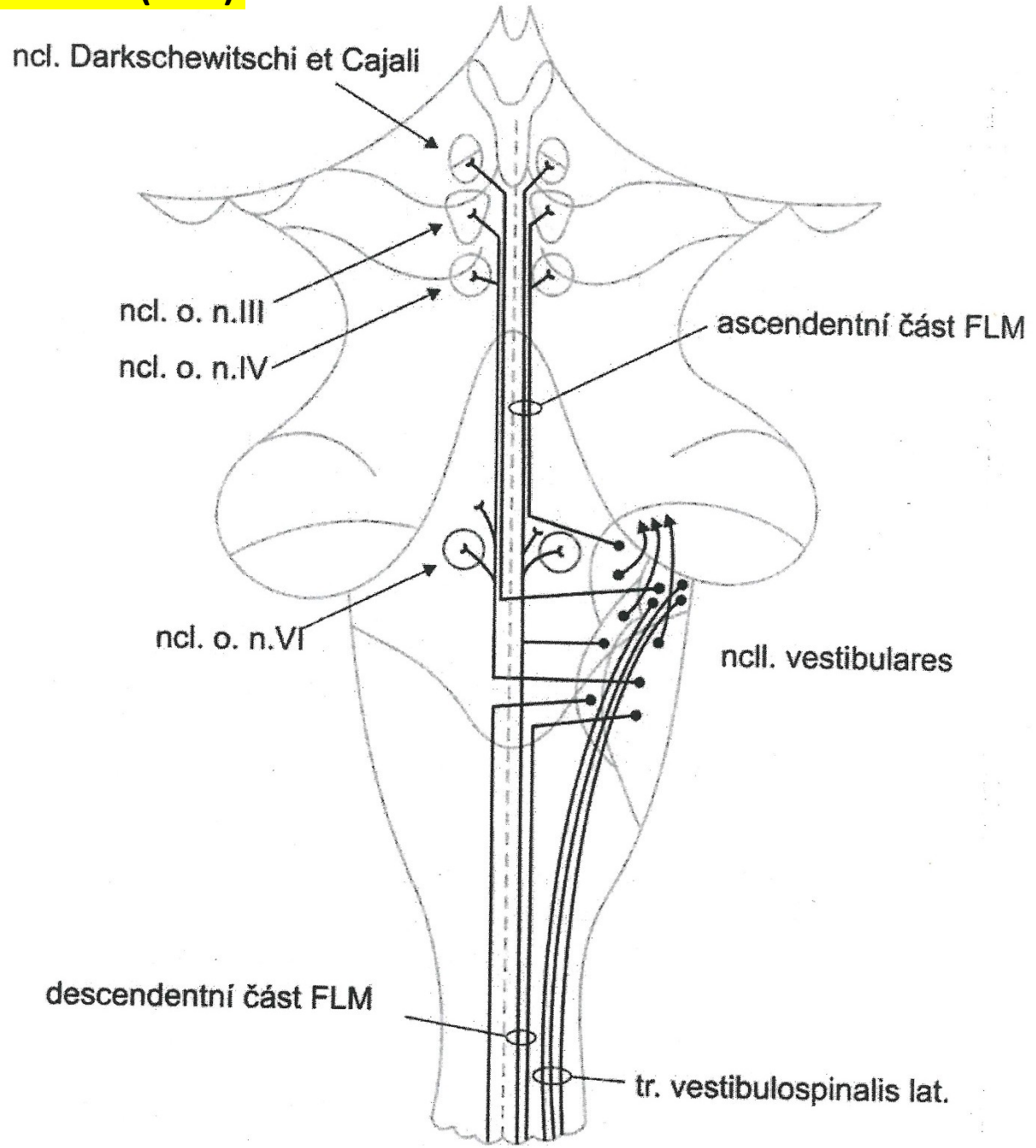


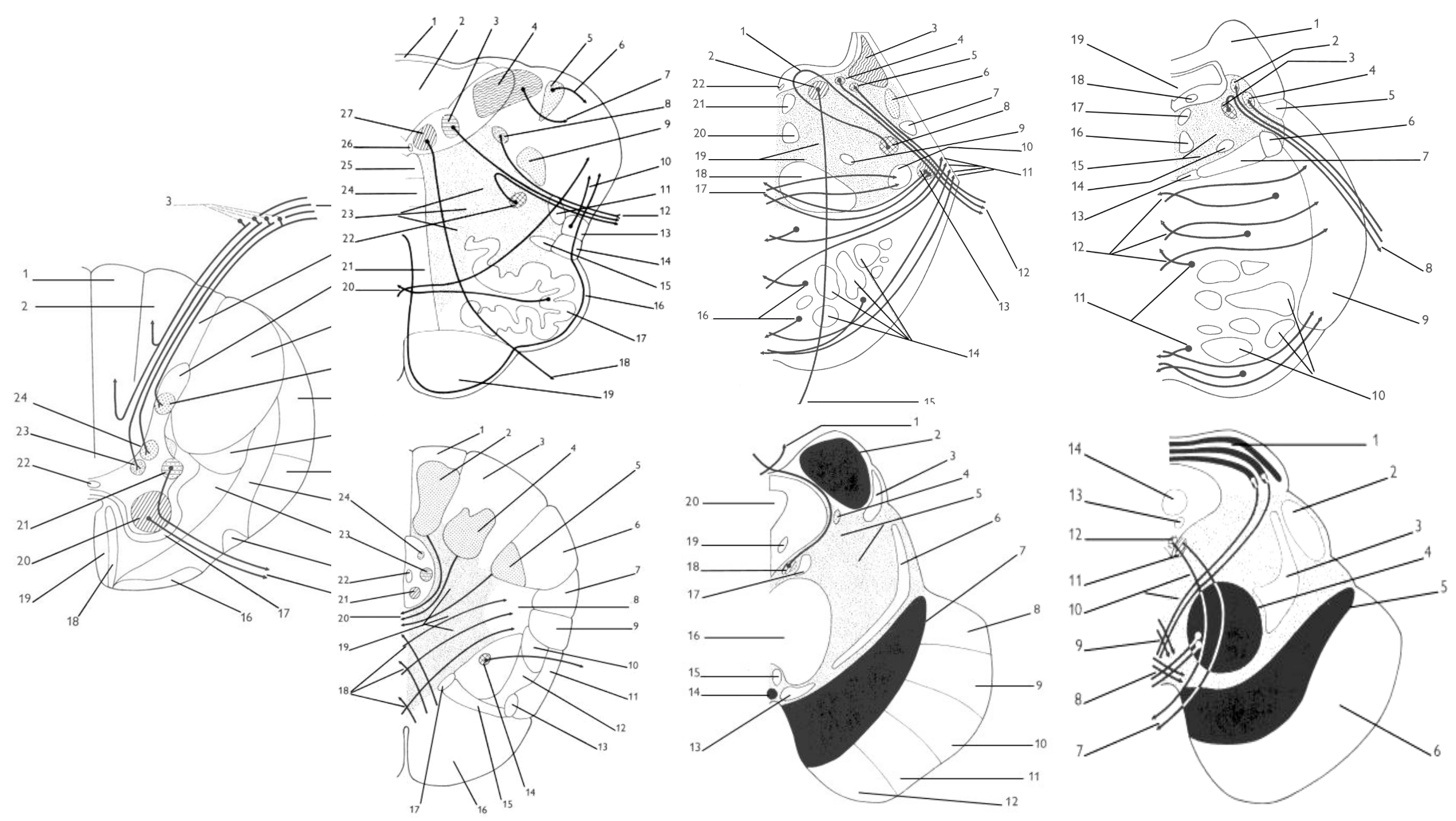


VESTIBULAR TRACT (THE ROLE OF THE FLM)



FASCICULUS LUNGITUDINALIS MEDIALIS (FLM)





OLFACTORY TRACT

