Development of the brain. Brainstem
ENCEPHALON
NEURAL ENSEMBLES - NERVOUS CENTERS

• NERVOUS CENTER (morphologically, clinically) is a group of the same type of neurons with a common history, functions and connections and the obligatory presence of synapses

• SEGMENTARY CENTERS

• HAVE DIRECT CONNECTION WITH THE PERIPHERAL NERVOUS SYSTEM, WITH INNERVIBLE PERIPHERY

• PRESENTED BY THE NUCLEI OF SPINAL AND CRANIAL NERVES

• EXISTS ONLY IN THE SPINAL CORD AND BRAIN STEM

• WITH THEIR DAMAGE, REPORTING SYMPTOMS ARE IN THE STRICTLY DEFINED REGION
NUCLEI OF NERVES as SEGMENTAL CENTERS

• NUCLEUS of NERVE is a group of similar neurons with which the nerve begins or ends

• TYPES OF NUCLEUS OF NERVES (segmental centers):

• SENSITIVE NUCLEUS OF NERVES
  - Contain the bodies of associative neurons, which are the first in the CNS to receive information from the periphery through the corresponding nerve

• EXISTS ONLY IN THE COMPOSITION OF THE SPINAL CORD AND THE BRAIN STEM

• WITH THEIR DAMAGE: anesthesia (loss of sensitivity of a certain type depending on the nature of the nucleus) in the area of action of this nerve
NUCLEI OF NERVES as SEGMENTAL CENTERS

• MOTOR NUCLEI OF NERVES
• They contain the bodies of motor somatic neurons, the axons of which form the motor portion of the nerve
• Defeat of the motor nucleus: peripheral (flaccid) paralysis of muscles innervated by this nerve (muscle group):
  • atony
  • areflexy
  • atrophy
• Motor nuclei C5 - C8: .................. what is paralyzed?
• Motor nucleus V: ......................... what is paralyzed?
• Motor nuclei VII: ......................... What is paralyzed?
• Peripheral paralysis of the muscles of the lower limb - where the focus in the central nervous system?
peripheral (flaccid) paralysis
NUCLEUS of spinal nerves (main):
SENSITIVE: n. Proprius, n. Thoracicus, n. Intermediomedialis
(differences - kind of sensitivity)
MOTOR: medial (ventro- and dorso-), lateral (ventro- and dorso-)
(differences - area of innervation)
VEGETATIVE (AUTONOMOUS): n. Intermediolateralis
LAMINAE OF REXED

Figure 7-4. Nuclear and laminar patterns of the spinal cord gray matter. (A) Conventional nomenclature of the
nuclei: 1 - dorsomarginal nucleus; 2 - substantia gelatinosa; 3 - nucleus proprius; 4 - reticular nucleus; 5 -
nucleus dorsalis of Clarke; 6 - dorsal commissural nucleus; 7 - ventral commissural nucleus; 8 - intermediolateral
nucleus; 9 - intermediomedial nucleus; 10 - medial motoneuron nucleus; 11 - lateral motoneuron nucleus. (B)
Laminae of Rexed.
SUPRASEGMENTAL CENTERS

DO NOT HAVE ANY DIRECT COMMUNICATION WITH THE INNERVIBLE PERIPHERY, ACT ONLY THROUGH SEGMENTAL CENTERS OR INTERACTING WITH EACH OTHER PRESENTED IN THE brainstem AND supratruncanl part of the brain

- IN DAMAGE OF MOST OF THEM NO PARALYSIS OR ANESTHESIA TAKES PLACE, PERCEPTION AND MOTOR REACTIONS are preserved, their quality varies
  - most of them in their damage - do not demonstrate specific manifestations which would be quietly proper to every of them
  - as a rule the observed manifestations aren`t strictly localized
  - in damage of most of them the motor program will be realized but its quality will be abnormal
Development of the brain.
## Development of the brain

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Development of the brain
The brainstem includes:

- Medulla oblongata,
- Pons
- mesencephalon.
Sagittal section of the brain
Similarities of the brainstem and spinal cord

- Tube-like shape
- The central position of gray matter
- Presence of its own innervation zone
- The presence of segmental centers - nuclei of cranial nerves, with clear manifestations of their damage
Characteristics of the brainstem

1. The brainstem includes medulla oblongata, pons, mesencephalon.
2. It is responsible for innervation of the head and partly of the neck.
3. It is a phylogenetically older part of the brain (the "brain" of amphibians)
4. The segmental nerve centers, represented by the motor, sensitive and autonomic nuclei of the cranial nerves, are located in the brainstem.

5. Direct communication with the innervated periphery.

6. A clear clinical picture with lesions - peripheral (flaccid) paralysis with the symptomatic complex "AAA - areflexia, atony, atrophy" - with damage of motor segmental centers; Or anesthesia of a certain type in a strictly defined zone - with the defeat of sensitive segmental centers.

7. At the whole length of the brainstem, can be distinguish **Tectum, Tegmentum and Basis**
The ventral surface of the brainstem and diencephalon
Sagittal section of the brain
THE NUCLEI OF THE CRANIAL NERVES are the segmental centers of the brainstem.
Differences from the spinal cord:

- the tube is locally enlarged, dilated (4-th ventricle) by the developing cerebellum
- change in spatial orientation of the nuclei of the nerves - mostly following the medio-lateral line (from motor through the autonomic to the sensory nuclei)
- the nuclei of the nerves mostly are not organized in columns but are isolated from one another
- the composition of the cranial nerves, and consequently of their nuclei, is more irregular and complicated compared with the spinal nerves
- the brainstem receives the sensory information not only of the common exteroceptive, proprioceptive and interoceptive nature, like spinal cord, but also from the organs of special senses - hearing, balance, taste, vision - that's why its ability to control the rational behaviour is much greater
- in the brainstem appeared the **suprasegmental centers**
- as a result the truncal manifestations will be mostly combinations of the symptoms of damages of the segmental and suprasegmental centers
GENERAL PRINCIPLES OF THE ORGANIZATION OF THE BRAINSTEM.

- **Tectum, Tegmentum and Basis** as components of the brainstem: definitions, topography, general composition:
  - Tectum - "everything or nothing"
  - Tegmentum - all segmental centers, the greater part of the suprasegmental centers, all ascending tracts, ancient descending tracts
  - Basis - the new descending tracts
Sagittal section of the brain
IV ventriculus
brainstem (lateral and ventral surfaces), exits of cranial nerves
The brainstem (dorsal surface)

- 3 – medial eminence
- 6 – facial colliculus
- 8 – cuneate tubercle
- 9 – gracile tubercle
- 10 – cuneate fasciculus
- 11 – gracile fasciculus
The brainstem (dorsal surface)
Projection of the nuclei of cranial nerves
Similarities with the supratruncal part of the brain:

- here and there are located the suprasegmental centers

Differences from the supratruncal part of the brain:

- the latter doesn't contain the segmental centers - the nuclei of the nerves
- consequently, no symptoms of segmental centers affections in damages of the supratruncal part
THE SUPRASEGMENTAL CENTERS OF THE BRAINSTEM

- Olivary nucleus,
- Reticular formation,
- Red nucleus,
- Substantia nigra,
- Nuclei of the colliculi of the quadrigeminal lamina

The suprasegmental centers of the brainstem and cerebellum are important components of EXTRAPYRAMIDAL SYSTEM.
THE WHITE MATTER OF THE BRAINSTEM

- The spinal, medial, trigeminal, lateral lemnisci.
- The extrapyramidal and pyramidal tracts.
Transverse section at the level of the medulla oblongata
Transverse section at the level of the pons
Transverse section at the level of the mesencephalon
THE NUCLEI OF THE CRANIAL NERVES are the segmental centers of the brainstem.
Cerebellum

**Parts**
- Right and Left hemispheres
- Vermis