

NEUROBIOLOGY EXAM I.

05-01-2017

Name:

Points:

(Maximum: 100 points)

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Examiner's signature

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Student's signature

Complete the text below! 10 points

The medial lemniscus system carries sensory information associated with **discriminative touch, vibration** and **proprioception**. The first order neurons are located in the **spinal ganglia** and they project to nuclei called **nucleus gracilis** and **nucleus cuneatus**, both positioned in the **medulla oblongata**. Information transmitted by the second order neurons reaches the **ventral postero-lateral** nucleus of the **thalamus**. The final sensory perception takes place in the **primary somatosensory cortex**.

Complete the table with missing information/definition! 5 points

Acetylcholine/cholinergic signaling	
Derivative of	ester of acetic acid and choline
Synthesized by	choline acetyltransferase
Inactivated by	acetylcholinesterase
Its ionotropic receptor	nicotinic acetylcholine receptor
Packed into synaptic vesicles by	vesicular ACh transporter

Complete the text below! 5 points

The metathalamus is composed of the **medial geniculate nucleus** and the **lateral geniculate nucleus**. The medially located structure receives afferents from the **inferior colliculus** and relays the sensory information to the **primary auditory cortex** via the **acoustic radiation**.

Define the following terms! 5 points

Basket cell: **inhibitory cell which inhibits adjacent pyramidal/Purkinje cells in cortex/cerebellum**

Climbing fiber: **excitatory axons of inferior olivary nuclei, which makes parallel synapse with dendrites of Purkinje cells in cerebellum**

Apoptosis: **process of programmed cell death, while the cell contents stays in apoptotic bodies**

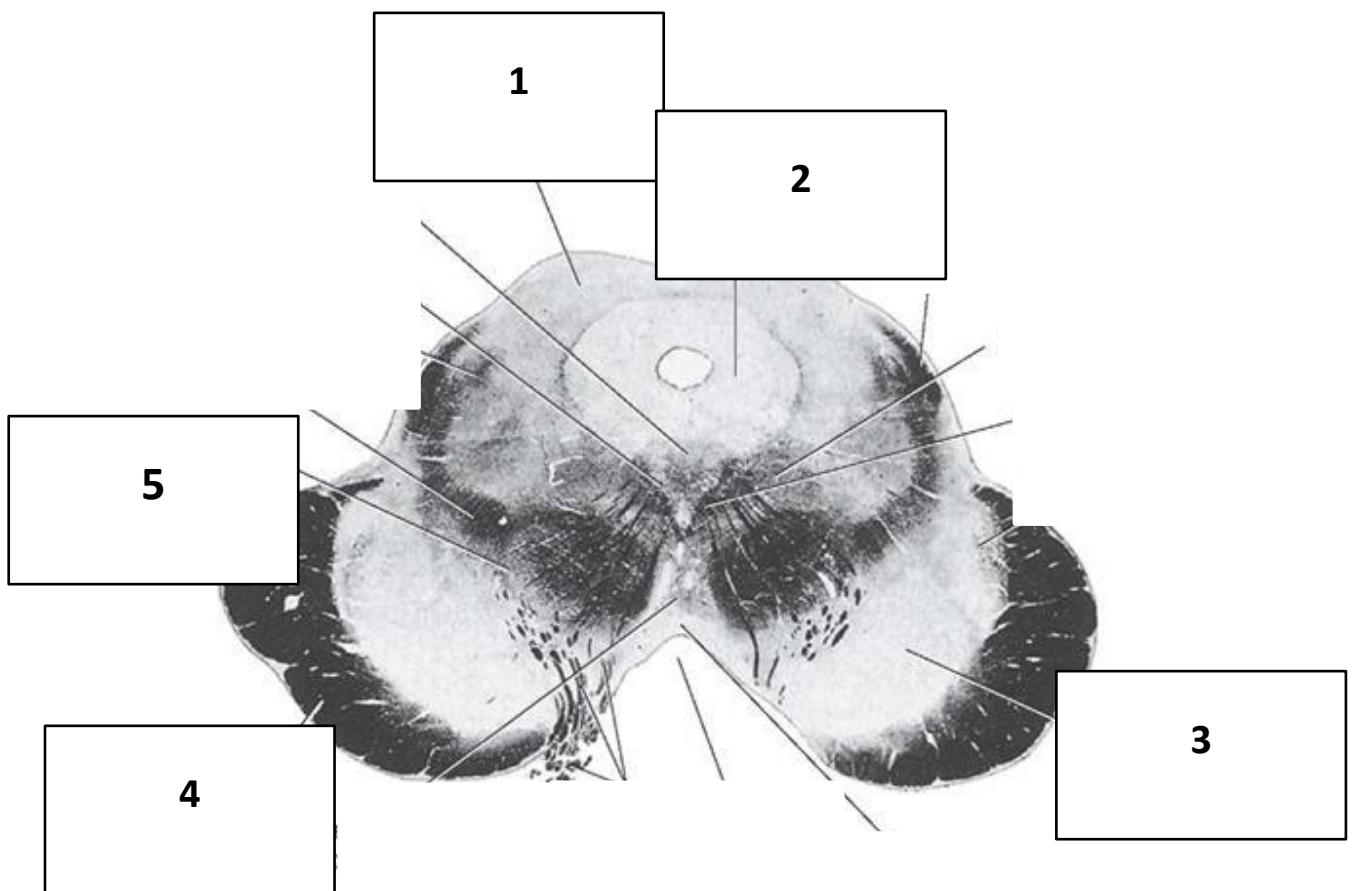
Broca area: **motor speech field on frontal lobe, regulates articulation and word forming**

Muscle spindle: **first order sensory neurons in PNS, receptor of stretch reflex**

Complete the text below! 10 points

Tissue damaging stimuli are sensed by **nociceptors (heat and pain receptors)**. At the spinal level, the primary afferents inform neurons located in the **dorsal horn**. The projecting neurons convey the information to the subcortical processing center via the crossed **spinothalamic tract**. The organism protects itself from harmful stimuli by the **flexor crossed extensor reflex** which is **polysynaptic** in nature. Accordingly, the afferents synapse on **interneurons**. The gate-keeper neurons receive excitatory inputs from **corticospinal tract???**. The spinal center of the reflex arc is formed by **interneurons and alpha motoneurons** that communicate with **flexor** (*functional type*) muscles on the side of the stimulus. The compensatory action on the contra-lateral side involves the simultaneous contraction of the **extensor muscle** groups.

Identify the labeled structures in the cross-section of the brain stem! 5 points



1. **superior colliculus**
2. **central grey matter**
3. **substantia nigra**
4. **crus cerebri**
5. **red nucleus**

Complete the text below! 10 points.

Linear acceleration excites **hair** (*type of*) sensory neuroepithel cells in the **utricle** and **sacculle** of the inner ear. Bipolar neurons of the **vestibular ganglion** convey the information to vestibular nuclei that in turn inform the cerebellum. Vestibulocerebellar fibers excite neurons within **vestibulocerebellum**, one of the deep cerebellar nuclei and also **granule** cells within the cerebellar cortex. The latter neurons relay further the information toward **Purkinje** neurons. The interneuronal communication is executed via **cross-over** type synapses. The cerebellar cortex sends **inhibitory** type command to deep cerebellar nuclei. The vestibulocerebellum is formed by the **flocculus** unit.

Complete the text below! 10 points.

The neural regulation of different organs in the human body is accomplished by the **autonomic nervous** system. Conservation of energy is achieved via the **parasympathetic** wing of the system whose central regulatory units are situated in the **brainstem** and the caudal part of the spinal cord. Glands and smooth muscle receive this regulatory tone directly from **postganglionic fibers** that are linked to the central units. The efferent segment of the pupillary reflex belongs to this system. Activation of the center called **Edinger-Westphal** nucleus and its downstream ganglion called **ciliary ganglia** result in **constriction** of the pupil after focusing light on the eye. The afferent wing of the reflex arc arises from the **ganglion** cell layer of the retina and reaches the mesencephalic center via the **optic nerve and tract**.

Complete the text below! 10 points.

Layer **IV** of the striate cortex receives visual information from the ipsilateral **lateral geniculate body** (*a relay station of the visual pathway*), which processes the images of the **contralateral** visual hemi-field. The projection is called **optic radiation** whose damage results in **homonym hemianopsia**. The striate cortex is composed by modular units called **cortical modules**. Commissural afferents terminate in the **first (molecular)** layer/s of this structure. The primary visual cortex is situated in the **occipital** lobe, in the vicinity of the **calcarine sulcus** (*one of distinguished sulci*). Color, depth, motion of the objects are processed in neighboring **visual association** centers.

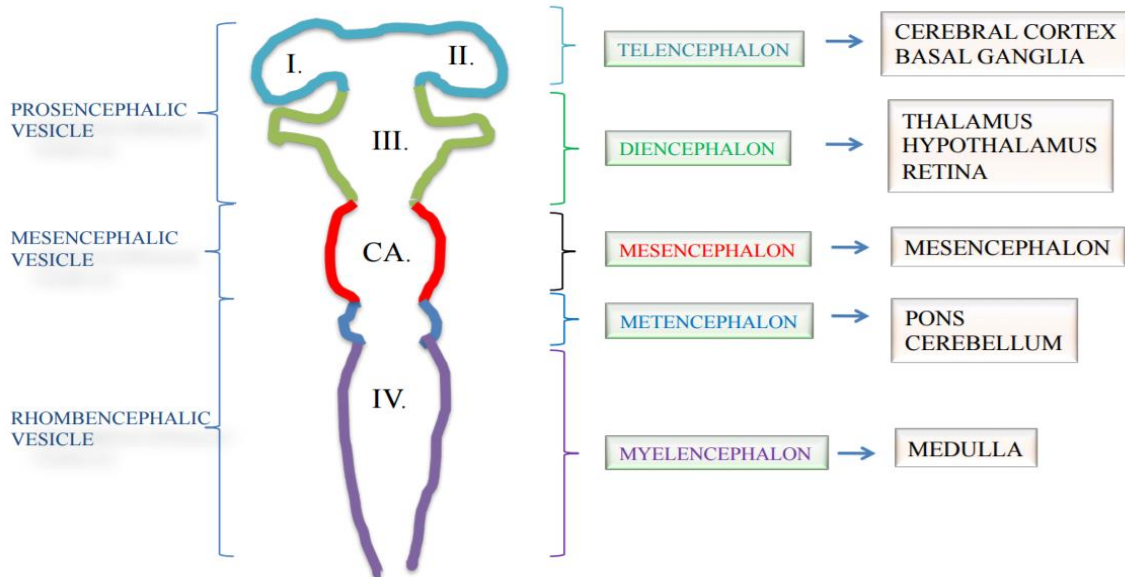
Complete the text below! 5 points.

Axons forming the perforant path arise from **entorhinal cortex** and terminate on dendrites of **hilar mossy (granule) cells of dentate gyrus** (*region and cell type*). The latter neurons communicate via **mossy fibers** with pyramidal neurons of the **CA3** sector of the hippocampus. Schaffer collaterals target **pyramidal cells of CA1 sector** (*region and cell type*).

List five upper motoneuron pathways descending to the spinal cord! 5 points.

1. **rubrospinal tract**
2. **vestibulospinal tract**
3. **reticulospinal tract**
4. **lateral/anterior corticospinal tract**
5. **olivospinal tract**
- +6. **fasc. longitudinalis medialis**

Make a schematic drawing of the developing neural tube depicting the forming brain vesicles (derivatives of the three basic vesicles) (Label them by numbers (1-5)! Name these structures below! 5 points.



1.
2.
3.
4.
5.

List at least 3-3 basic constituents of the olfactory and cerebellar glomeruli! 6 points.

Components	Olfactory	Cerebellar
Incoming afferents	olfactory nerve filaments	mossy fiber
Recipient cells	mitral cell	granule cell
Modulator cells	periglomerular cell	Golgi cell

Complete the text below! 4 points.

Peripheral somato-motor axons are insulated by Schwann glia cell. It is a derivative of **neuroepithel** cells. In its formation the **myelin sheath** is an important structure that wraps around the axon. The action potential is propagated in a **saltatory** fashion.

Give five significant, short statements about the corpus striatum reflecting its structural organization, networking and function! 5 points

1. **part of basal ganglia, composed of the striatum and the globus pallidus (pallidum)**
2. **gets information from cerebral cortex**
3. **communicates with substantia nigra back and forth**
4. **gets information from thalamus (intralaminar)**
5. **part of the upper motor pathway**