

NEUROBIOLOGY EXAM I.

05-01-2016

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 bony labyrinth contains the **membranous labyrinth** which is filled by **endolymph**. Its component serving hearing is called **cochlea**. In the inner ear, the basilar membrane separates the **perilymph** and **endolymph** from each other. Vibration of the ear drum is transmitted by **malleus, incus and stapes** to the fluid compartment called **scala vestibuli**. The spreading **endolymphatic fluid wave** in the liquid result in activation of **hair** cells that are linked to neurons of the **cochlear ganglion**.

Complete the table with missing information!

5 points

Noradrenaline	
Derivative of	dopamine
Synthesizing enzyme	dopamine beta-hydroxylase
Vesicular transporter	vesicular monoamine transporter-2
Receptors	noradrenergic GPCRs (alpha 1,2; beta 1,2,3)
Inactivation	MAO, re-uptake by noradrenaline transporters

Complete the text below!

5 points

Neurosecretion is a characteristic feature of**hormone secretory**.....neurons. Magno-cellular neurons transport their hormones to the**posterior pituitary**....., where they are released into the**systemic**..... circulation. Parvicellular neurons establish connection with capillaries of the.....**portal**..... circulation. Their secretory products influence the hormone production of the**anterior pituitary**..... .

Define the following terms!

5 points

Mitral cell: **Nerve cell of the olfactory bulb that establish connections with the olfactory fibers**

Pyriform cortex: **The primary olfactory area**

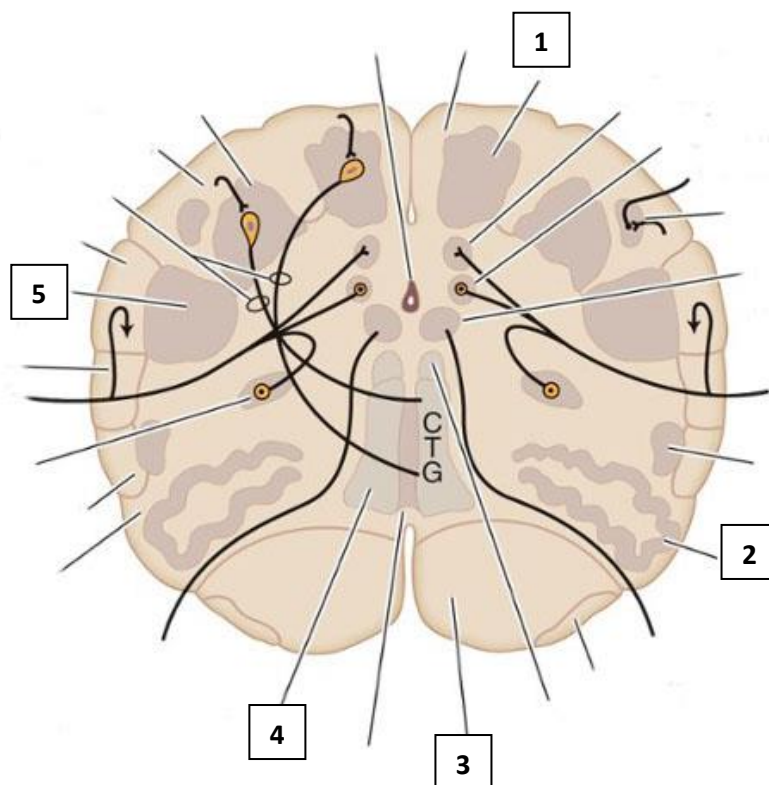
Schaffer collateral: **Axon collateral which connects the pyramidal cells of the CA1 and CA3 regions of the hippocampus**

Rhomboid fossa: **.Structure of the pons that covers the anterior surface of the 4th ventricle**

Alar plate: **The dorsal part of the neural tube which develeops into the dorsal horn of the spinal cord (during the development of the NS)**

Complete the text below!**10 points**

Thalamus develops from the **diencephalon (prosencephalon)** . Its anterior nucleus receives information from the **mamillary body**. The ascending spinal sensory systems terminate in its **ventral postero-lateral** nucleus. Sensory information relayed by nuclei of cranial nerve V. is processed in its **ventral posterior-medial** nucleus. The VA and the VL nuclei receive information from the **globus pallidus** and **dentate nucleus**, pivotal parts of the motor system. Pain-related information is relayed further to the **primary somatosensory** cortex. It transmits heat- and touch-related information to the **interneurons** whose cortical columns are called in rodents as **cortical modules** . Beneath its pulvinar part, an important visual center, the **lateral geniculate** exists.

Identify the labeled structures!**5 points**

1. **Nucleus gracilis**
2. **Inferior olive**
3. **Corticospinal tract**
4. **Lemniscus medialis**
5. **Nucleus spinalis n. V.**

Complete the text below!

10 points.

In the retina, light passes through **retinal** nuclear layers before reaching the outer segments of photoreceptor cells. In the dark, **rods** and **cones** are depolarized. In the presence of light, the photo-bleaching of **rhodopsin** takes place that triggers downstream actions resulting in **hyperpolarization** of the receptors. The projecting neurons of the retina are called **optic nerves**. The image of an object appearing in the left visual hemi-field is processed in a subcortical structure called **lateral geniculate nucleus** located on the **right** side. The receptive field of neurons in this structure is **columnar/layered/franc se tudja** in shape. Information collected from a particular sector at a given angle of the visual field is processed by neurons sets organized in **ocular columns (maybe)** in V1 cortex.

Complete the text below!

10 points.

The upper control of somatomotor nuclei located the brainstem is provided by the **2nd order neural / 3rd order neural** projection originating from the **ventral posterior nucleus / somatosensory cortex**. Similar regulatory influence reaches neurons in the **dorsal horn/fasciculus (n. or tr. Gracilis + cuneatus)** of the spinal cord via the **medial lemniscus**. Its decussation takes place in the **decussatio lemniscus** resulting in the translocation of the tract to the **anterior/medial part** of the spinal cord. Members of the lower motor neuron system use the neurotransmitter **acetylcholine** in their communication with skeletal muscle fibers. The neurotransmission occurs in the **brain stem / basal forebrain**. The transmitter binds to its **iono- and metabotropic** receptors. The inactivation of the neurotransmitter is provided by **hydrolysis via acetylcholinesterase**.

Complete the text below!

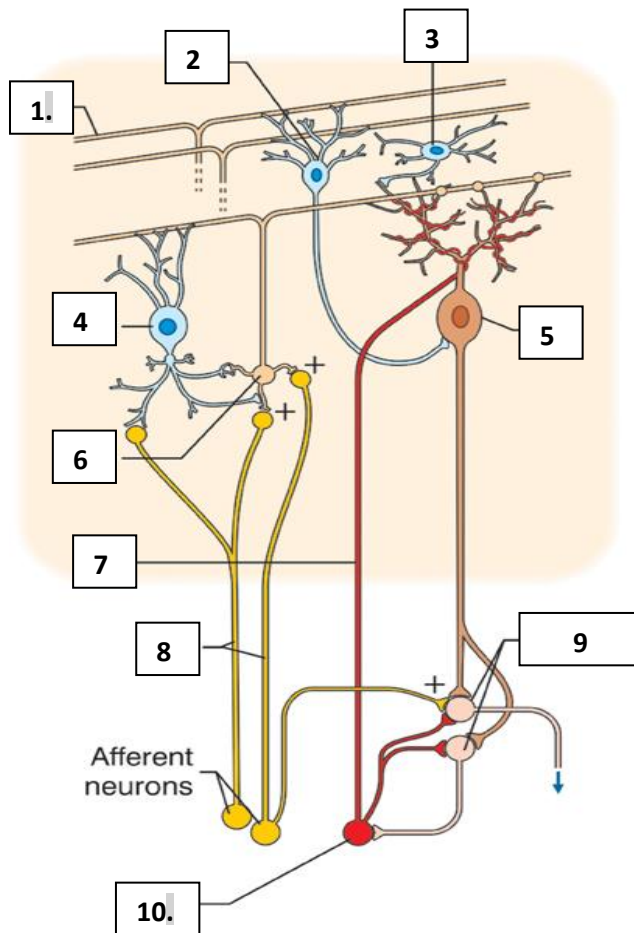
10 points.

The basal ganglia system contributes to the motor regulation by its main constituents, the **caudate nucleus** and the **lentiform nucleus**.

It receives a **dopaminergic** neuronal input from the substantia nigra. The efferent outflow of the system is gathered from its medial subdivision called **Globus Pallidus**. It contributes to the regulation of skilled movements via the **subthalamic-thalamic (?)** projection. For execution of extrapyramidal commands, the basal ganglia system hires the **extrapyramidal (?)** system. The striatum and the **pallidum** surround an important passageway of the brain called **internal capsule**. In the knee region of this structure, the vulnerable descending **corticobulbar tract** exist. In its posterior wing the **lateral geniculate nucleus** projects to the visual cortex.

Identify the labeled structures in the depicted neuronal network!

10 points



1. Parallel fibers
2. Basket cell / local circuit neuron
3. The same?
4. Golgi cell
5. Purkinje cell
6. Granule cell body
7. Climbing fiber
8. Mossy fibers
9. Deep cerebellar nuclei neuron
10. Climbing fiber cell body?

Complete the table with the missing information!

5 points

Peptide transmitters	
Synthesized in	Presynaptic perikaryon (cell body)
Transported in	Dense core vesicles / granules
Transported via	Anterograde transport
Released by	Exocytosis
Type of receptors used	Metabotropic

List five essential constituents/properties of the symmetric synapse!

5 points

1. Both pre- and post synaptic densities are equal in thickness
2. Typically inhibitory
3. Flattened vesicles in presynaptic axon
4. Initiates hyperpolarization in post-synaptic cell
5. Also called Gray's 2 type synapse OR commonly uses GABA and Glycine as NTs

List the name of the mandatory structures of the proprioceptive reflex arc!

5 points

Receptor: **Muscle spindle**

Afferent system: **Axons of sensory ganglia**

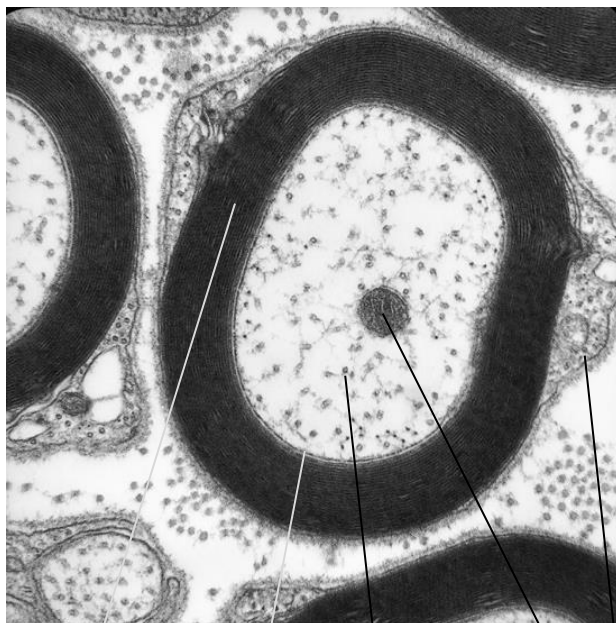
Neural center: **Ventral horn of SC**

Efferent structure: **Axons of alpha motoneurons**

Target element: **Extrafusal muscle fibers**

Identify the labeled structures!

5 points



- 1
- 2
- 3
- 4
- 5

1. Myelin sheath
2. Axon / cell membrane
3. Microtubules / vesicles
4. Mitochondria
5. Oligodendrocyte/schwann cell