

- Brain and behaviour.
- Hematoencephalic barrier - function. Cerebrospinal fluid - function. Circumventricular organs and their functional effects.
- Neuron – morphology, functional components.
- Glial cells in nervous system and their function.
- Resting potential of the neuron (= resting membrane potential).
- Action potential – description, ionic fluxes, places of generation. Propagation of action potential in myelinated and unmyelinated axon.
- Synapses – structure and function, types according to released transmitters.
- Excitatory and inhibitory postsynaptic potentials, temporal and spatial summation.
- Neurotransmitters - excitatory, inhibitory, modulatory; receptors.
- Hierarchic organization of sensory systems, topographic maps. Sensory receptors – basic classification and characteristics; adaptation, threshold, receptive field.
- Receptor potential, coding of stimulus intensity, duration and modality.
- Smell and taste – stimuli and transduction mechanisms.
- Optical system of the eye. Common defects of the image-forming mechanism. Accommodation. Mydriatic and miotic pupillary reflexes.
- Transduction of light signal in photoreceptors. Analysis of shape, colour and movement of visual stimuli - visual cortical areas.
- Capturing of the sound and its transmission from external environment to the Corti organ. Functions of the external ear, tympanic membrane and middle ear ossicles.
- Mechanisms of transduction of auditory signal in the hair cells of Corti organ. Auditory cortical areas.
- Skin sensation - stimuli, submodalities, physiological significance. Somatosensory cortical areas.
- Nociception and pain - stimuli, physiological significance. Referred pain. Modulation of pain perception.
- Vestibular system - detection of head position due to gravity, detection of angular and linear acceleration. Mechanism of hair cells activation.
- Hierarchic organization of motor system, classes of movements. General categorization of motor pathways.
- Reflexes in motor control - monosynaptic and polysynaptic reflexes. Reflex arc. Description of stretch reflex, its function.

- Locomotion. Spinal pattern generators, basic stepping pattern, afferent information. Main CNS structures involved in locomotion.
- Voluntary movement – basic characteristic, essential CNS structures.
- Control of posture - main postural muscle groups, essential afferent information and CNS structures.
- Eye movements - basic types and their function, eliciting stimuli.
- Cerebellum - basic anatomy and function. Effects of cerebellar lesions - examples.
- Basal ganglia - basic anatomy. Role of the basal ganglia in motor control and behaviour. Examples of the basal ganglia impairments in humans.
- Parasympathetic compartment of the autonomic nervous system - localization of preganglionic and postganglionic neurons, neurotransmitters and their receptors at parasympathetic junctions. Responses of effector organs to parasympathetic stimulation.
- Sympathetic compartment of the autonomic nervous system - localization of preganglionic and postganglionic neurons, neurotransmitters and their receptors at sympathetic junctions. Responses of effector organs to sympathetic stimulation.
- Sleep-waking periodicity. Sleep cycles (non-REM, REM phases, EEG and vegetative correlates).
- Language and speech, function of hemispheres in different aspects of language. Aphasias.
- Learning and memory – non-declarative and declarative memory, corresponding CNS structures in humans. Neurophysiological mechanisms of memory storage.
- Functional specialization of the hemispheres.
- Central system of emotion and stress - major structures of limbic forebrain including amygdala. Information inputs to the limbic forebrain, projections of the limbic forebrain to effector systems. Components of a defensive response.
- Neurobiological origins of feelings.
- Regulation of emotions. A process model of emotion regulation. Top-down a bottom-up regulation of emotion. Neuronal systems of cognitive regulations.
- Electroencephalography, functional magnetic resonance imaging – simplified description of methods and their experimental use.

### **Basic anatomical terminology of the brain.**

Draw the anatomical structures into the scheme of brain:

- in sagittal, coronal or axial sections or
- in medial or lateral aspects of the brain.

frontal gyrus - superior, middle, inferior  
temporal gyrus - superior, middle, inferior  
precentral and postcentral gyrus  
central sulcus, lateral sulcus  
parahippocampal gyrus, cingulate gyrus  
angular and supramarginal gyrus

frontal, parietal, occipital and temporal lobes  
brainstem – midbrain, pons and medulla  
hypothalamus, thalamus, basal ganglia, cerebellum  
hippocampus, amygdala  
insula  
dorso-, ventrolateral prefrontal cortex  
dorso-, ventromedial prefrontal cortex  
orbitofrontal cortex  
primary motor cortex, premotor cortex, supplementary motor area,  
somatosensory cortex  
primary and secondary visual cortex  
primary and secondary auditory cortex