Answer on Question #76417, Biology / Biochemistry

A person is reading a book. Outline the events that take place in the nervous system from the time an image of a word is formed on the retina to the time that word is recognized by the brain.

Solution:

The pulse from the photoreceptors passes to bipolar cells and to horizontal cells, while the activity of the inhibitory cells decreases. It should be noted that several cones converge (converge) on one bipolar cell, and in the central fossa (fovea centralis) one fovea is associated with one bipolar neuron. All this provides a good resolution of the visual fossa in the formation of a clear image of the word. From bipolar cells, the impulse passes to ganglion cells, the axons of which form the optic nerve, information on which is transmitted to the central nervous system. The visual nerves on their exit from the visual channel form a cross (chiasma) in which a part of the nerve fibers of one nerve passes to the opposite nerve and vice versa. After the chiasm, visual channels are formed, each of which contains nerve fibers coming from both eyes. The tracts go to the lateral geniculate bodies. At this level, the signal is extracted from the noise, the outlines of the object (words), its color and boundaries are emphasized. In the lateral geniculate bodies, binocular interaction begins with the retina of the right and left eyes. Here, the signals coming from the retina interact with signals from the visual cortex, the thalamus and the reticular formation, which ensures selective visual attention processes. From the lateral geniculate bodies, information enters the cerebral cortex.

Once in the cerebral cortex, the pulse passes through several fields. The primary sensory (strialnaya) cortex is localized in the occipital region (field 17). It plays a major role in the formation of visual images. Neurons of this level format the whole visual field into separate quadrants with the subsequent evaluation of the position of the object in the field of view. Further information goes to the pre-cortex (fields 18 and 19), here a voluminous mobile image is formed, possessing the properties of invariance, that is, recognizable in any size and position. In the cortex, the images from the retina of both eyes merge into a single whole, which improves the perception of the depth of space. The functions of the visual cortex are the detection of the visual stimulus, the determination of its shape, localization in space, contrast, size, color, direction of motion and the formation of the visual image. Perception of other parameters of the three-dimensional world is carried out with the participation of extrarital regions (18 and 19), parietal (7), frontal (6 and 8) and other parts of the cortex of the cerebral hemispheres. Joint work of the primary visual and listed areas of the cortex, provides recognition of visual objects, visual attention, the performance of targeted actions under visual control.

The organization of the perception of writing (reading) has its own specificity due to the difference in the signals received and processed. Text, like any other complex graphic image,

involves visual analyzers, neural networks of which are located mainly in the occipital part of the cortex of the brain. When reading, there is an increase in activity of neurons in the left occipital part of the brain. Some researchers even call the left occipital area the center of reading.