

## Spinal and supraspinal postural networks.

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Maintenance of the basic body posture – upright in humans and dorsal-side-up in quadrupeds – is a non-volitional activity based on the in-born neural mechanisms. An efficient control of the basic posture is equally important for standing and during walking, as well as for providing support of voluntary limb movements. Inability to maintain the upright body posture and equilibrium is one of the major motor disorders following traumatic spinal cord injury (SCI). Selection of appropriate rehabilitation strategies for postural deficits caused by SCI depends largely on an elucidation of the relative contribution of spinal and supraspinal mechanisms to the control of posture.

Postural control system responsible for stabilization of the basic body posture in the transversal plane as well as spinal and supraspinal postural networks underlying its operation were studied in two mammals (rabbit and cat). Experiments performed on intact animals, decerebrated preparations, and SCI-subjects led to the following conclusions: (i) Lateral stability of the anterior and posterior parts of the body is maintained by two sub-systems driven by somatosensory inputs from the corresponding limbs. Each sub-system can effectively stabilize the corresponding part of the body when operates alone. The reflex mechanism of an individual limb generates a part of the corrective response to postural perturbation; another part is produced on the basis of crossed influences. (ii) A number of motor centres (including motor cortex, brainstem and spinal cord) participate in stabilization of trunk orientation in the transverse plane. Each of them operates on the feedback principle and generates corrective motor commands if the trunk orientation is perturbed. The integrity of pathways located in the ventral funiculi of the spinal cord is critically important for the operation of this system. (iii) The spinal cord contains neuronal networks underlying spinal postural limb reflexes, which contribute to trunk stabilization in intact animal. In acute spinal animals, these networks can be activated by electrical and pharmacological stimulation, suggesting that, in intact animals, the network is activated by the supraspinal tonic excitatory drive. (iv) Over time, the spinal networks deprived of supraspinal influences, undergo considerable changes. As a result, the factors (means) restoring limb reflexes in the acute state become less effective.

The goal of future studies is to find the means which, when regularly applied in the spinal animal, will increase the efficacy of spinal postural reflexes to such a level that they will be able to cause postural corrections and maintain the lateral stability of the body.

### References.

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