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Evaluation of rat motor activity following spinal cord injury based on motion video analysis

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In the last 25 years of rehabilitation of patients with spinal cord injury (SCI), the positive effect of physical training on restoring patient mobility was noted. Regardless of the methods used to restore movement, an adequate system is needed to determine changes in coordination and motor ability itself, for this purpose, mainly motion capture systems are used. The aim of this study was to analyze the recovery of motor and postural function in rats after SCI of varying severity and motor training by video motion analysis. The study was carried out in compliance with bioethical norms. Three-dimensional rat gait data were obtained using 4 cameras Vicon MX (Oxford, UK). The angle of flexion of the hind limbs in the joints, the volume of movement of the limb, the height of the foot lift, the lateral deviation of the foot were determined. The results showed that physical training is able to improve the motor function of rats, contributing to the restoration of body weight-supporting locomotion, control of walking direction and the ability to maintain equilibrium in paralyzed rats. The degree of recovery depends on the severity of the SCI. Physical training promotes coordinated operation of postural mechanisms of limb and torso movement regulation and restores initial configuration of body posture when walking in rats.

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Mandibular muscle troponin of the Florida carpenter ant Camponotus floridanus: extending our insights into invertebrate Ca^{2+} regulation

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Ants use their mandibles for a variety of functions and behaviors. We investigated mandibular muscle structure and function from major workers of the Florida carpenter ant Camponotus floridanus: force-pCa relation and velocity of unloaded shortening of single, permeabilized fibres, primary sequences of troponin subunits (TnC, TnI and TnT) from a mandibular muscle cDNA library, and muscle fibre ultrastructure. From the mechanical measurements, we found Ca^{2+}-sensitivity of isometric force was markedly shifted rightward compared with vertebrate striated muscle. From the troponin sequence results, we identified features that could explain the rightward shift of Ca^{2+}-activation: the N-helix of TnC is effectively absent and three of the four EF-hands of TnC (sites I, II and III) do not adhere to canonical sequence rules for divalent cation binding; two alternatively spliced isoforms of TnI were identified with the alternatively spliced exon occurring in the region of the IT-arm alpha-helical coiled-coil, and the N-terminal extension of TnI may be involved in modulation of regulation, as in mammalian cardiac muscle; and TnT has a Glu-rich C-terminus. From the troponin subunit sequences, a structural homology model was built of *C. floridanus* troponin on the thin filament. From analysis of electron micrographs, we found thick filaments are almost as long as the 6.8 um sarcomeres, have diameter of ~ 16 nm, and typical spacing of ~ 46 nm. These results have implications for the mechanisms by which mandibular muscle fibres perform such a variety of functions, and how the structure of the troponin complex aids in these tasks.