Rehabilitation of Spinal Cord Injury: Roles of Voluntary and Reflex Trunk Control and Modularity in Spinalized Rats

Simon Giszter

Drexel University
Department of Neurobiology and Anatomy

Some neonatal spinalized rats can walk as adults although the lumbosacral spinal cord is disconnected from brain control. Careful examination of the function of these rats and their neural and biomechanical interactions shows that they employ novel strategies and trunk control plays a crucial role. Such neonatal spinalized (NST) rats can achieve autonomous weight supported locomotion never seen after adult injury. Mechanisms that support function in NST rats include increased importance of cortical trunk control, and altered biomechanical control strategies for stance and locomotion. Hindlimbs are isolated from perturbations in quiet stance and act in opposition to forelimbs in locomotion in NST rats. Control of roll and yaw of the hindlimbs through the trunk interaction is crucial in their locomotion. Using these findings and others a novel experimental rehabilitation approach has been developed which seeks to aid support and teach improved trunk control to spinal transected rats, using robot rehabilitation. This strategy has some success and can be combined with other neural repair techniques. Modularity of trunk and limbs in normal and NST rats show differences which may bear on spinal cord injury and other motor problems. Our understanding of trunk control in quadrupeds is limited but such comparative information on trunk, limbs and their integration may bear strongly on how bipedal controls have evolved and develop.