"Evolution of new strategies for enhancing neuromotor recovery after neural injuries"

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The mammalian lumbar spinal cord has the capability to generate fictive locomotion, i.e. alternating and rhythmic flexion and extension in the absence of oscillating input from either the brain or the periphery, when stimulated pharmacologically or electrically with a tonic stimulation pattern to either the dorsum of the spinal cord or dorsal roots. Although the circuitry within the lumbosacral spinal cord undoubtedly includes those neurons responsible for central pattern generation that can interpret complex proprioceptive input, this feature is not generally recognized as one of its most outstanding. Our experiments show that the spinal circuitry can accurately perceive proprioceptive input to the lumbosacral spinal cord to detect levels of load on the hindlimbs, the speed of a treadmill belt, and the direction of the movement, can serve as the source of control of locomotion in the absence of any input from the brain. Further, repetitive use of this spinal circuitry enables the spinal circuitry to relearn how to step. These observations suggest that several concepts regarding neural mechanisms of motor control in normal movements should be reassessed.