Ronald R. Riso, J Tradit Med Clin Natur 2018, Volume:7
DOI: 10.4172/2573-4555-C1-001

Ronald R Riso
MIT Media Lab, USA

Peripheral nerve Interfacing for control of powered prostheses - Our toolbox today and beyond

Electrical interfaces to peripheral nerves allow persons with amputation to coordinate the movements of multi-DOF powered prostheses simultaneously with minimal cognitive effort. This is possible when each prosthetic actuator is controlled using the activity of the specific motor nerve that subserves the same joint motion in an intact limb. This concept is well demonstrated with TMR, where each target nerve is neurotize to a piece of viable muscle. The muscle acts as a biological amplifier that converts the feeble nerve impulses to more robust electromyograhic activity (EMG) which is then used as a prosthetic command signal. A drawback of TMR is the need to trans-locate the desired nerves to the host muscles and to remove the host muscle's native innervation.To mitigate these issues, researchers have anastomosed small pieces of excised muscle to the selected peripheral nerves. Such constructs are referred to as Regenerative Peripheral Nerve Interfaces (RPNIs), and EMG control signals are recorded from the surface of each RPNI. As a modification of this strategy, we are developing an implanted modular device containing small electrically isolated compartments. Each compartment contains integral recording electrodes and is filled with a small piece of autologos muscle. A multi-fascicle nerve can be subdivided and each fascicle assigned to a separate electrically isolated compartment which minimizes problems of signal crosstalk between recording channels. Also important for prosthesis control is to provide tactile and proprioceptive sensory feedback. Historically, electrical stimulation of sensory afferents using cuffs or inserted arrays has been the primary approach employed and more recently, micro-channel arrays are being explored. However, issues of fiber selectivity and long term functionality still need improvement. The provision of muscle-tendon proprioception information has been particularly elusive, but a strategy based on novel surgical constructs termed AMI (agonist-antagonist myoneural interface) is showing good success in persons with below-knee amputation who have reeeived this treatment. This approach re-instates a mechanical connection between the agonist and antagonist muscles that would exist around an intact joint so that contraction of the agonist acts to stretch the antagonist muscle and visa-versa.

Biography

Ronald Riso obtained a BSEE from Cornell U., and a PhD in Neuroscence from U. Rochester Sch of Med. His career has centered on neuroprostheses including FES techniques for restoring hand grasp in quadriplegia and methods for controlling prosthetic limbs (Case Western Res. U. and Aalborg U. Denmark). He is presently with the MIT Center for Extreme Bionics working on Neural Interfacing to allow persons with amputation to have full volitional control over their prosthetic limbs and enjoy restored tactile and proprioceptive sensibilities.

RRiso@Media.MIT.edu

Notes: