

Biomedical Engineering

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Core Faculty Profile

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Research Interests

My research focuses on the multi-joint control of movement and posture in able-bodied individuals and individuals with neuromotor pathologies. Specifically, I am interested in understanding the relative roles of intrinsic muscle properties, limb geometry and neural activation in the control of whole limb mechanics. Generating voluntary movements and interacting with our physical environment is fundamental to carrying out the tasks of daily living, as evidenced by the severe limitations that beset those with movement disorders. Due to its importance, there is a long history of movement-related research, though few studies have attempted to understand the interactions between muscle properties, limb geometry and neural control. Because each of these systems contributes to the functional capabilities of a limb, the relative importance of each is best understood in the context of how these systems interact during typical motor tasks. Therefore, my research plan has three interdependent components: examining the role of muscle properties in the neural control of movement; determining how individual muscles contribute to whole limb biomechanics in the 6 degrees of freedom (DOF) relevant to functional tasks; and evaluating how spinal reflexes coordinate the actions of the multiple muscles within a limb. Understanding the functional interdependence of these often separately studied systems is critical to developing effective rehabilitative strategies for restoring motor function when one or more of these systems is compromised.

Selected Publications

1. Krutky, MA, **Perreault EJ** (2007) *Motor cortical measures of use-dependent plasticity are graded from distal to proximal in the human upper limb*. J Neurophysiol 98: 3230-3241.
2. Lewis GN, **Perreault EJ** (2007) *Side of lesion influences interhemispheric inhibition in subjects with post-stroke hemiparesis*. Clin Neurophysiol 118: 2656-2663.
3. Pohlmeier EA, Solla SA, **Perreault EJ**, Miller LE (2007) *Prediction of upper limb muscle activity from cortical discharge during reaching*. J Neural Eng 4: 369-379.
4. Lewis GN, **Perreault EJ** (2007) *Side of lesion influences bilateral activation in chronic, post-stroke hemiparesis*. Clin Neurophysiol 118: 2050-2062
5. Cui L, **Perreault EJ**, Sandercock TG (2007) *Motor unit composition has little effect on the short-range stiffness of feline medial gastrocnemius muscle*. J Appl Physiol 103: 796-802

6. Lewis GN, Mackinnon CD, **Perreault EJ** (2006) *The effect of task instruction on the excitability of spinal and supraspinal reflex pathways projecting to the biceps muscle*. *Exp Brain Res* 174: 413-425

7. **Perreault EJ**, Litt M, Saterbak A (2006) *Educational methods and best practices in BME laboratories*. *Ann Biomed Eng* 34: 209-216

8. Westwick DT, Pohlmeier EA, Solla SA, Miller LE, **Perreault EJ** (2006) *Identification of multiple-input systems with highly coupled inputs: application to EMG prediction from multiple intracortical electrodes*. *Neural Comput* 18: 329-355

9. Lewis GN, **Perreault EJ**, MacKinnon CD (2005) *The influence of perturbation duration and velocity on the long-latency response to stretch in the biceps muscle*. *Exp Brain Res* 163(3):361-369.

10. **Perreault EJ**, Kirsch RF and Crago PE (2004) *Multijoint dynamics and postural stability of the human arm*. *Exp Brain Res* 157: 507-517.

11. **Perreault EJ**, Day SJ, Hulliger M, Heckman CJ, Sandercock TG (2003) *Summation of motor unit forces in cat soleus during experimentally simulated recruitment*. *J Neurophysiol* 89: 738

12. **Perreault EJ**, Heckman CJ, Sandercock TG (2003) *Hill muscle model errors during movement are greatest within the physiologically relevant range of motor unit firing rates*. *J Biomech* 36: 211-218

13. **Perreault EJ**, Kirsch RF and Crago PE (2002) *Voluntary control of static endpoint stiffness during force regulation tasks*. *J Neurophysiol* 87: 2808-2816.

14. **Perreault EJ**, Crago PE and Kirsch RF (2001) *Postural arm control following cervical spinal cord injury*. *IEEE Trans. Neural Systems and Rehab. Eng.* 9: 369-377.

15. **Perreault EJ**, Kirsch RF and Crago PE (2001) *Effects of voluntary force generation on the elastic components of endpoint stiffness*. *Exp Brain Res* 141: 312-323.

16. **Perreault EJ**, Crago PE, Kirsch RF (2000). *Estimation of intrinsic and reflex contributions to muscle dynamics: a modeling study*. *IEEE Trans Biomed Eng* 47(11): 1413-21.

17. **Perreault EJ**, Kirsch RF, Acosta AM (1999) *Multiple-input, multiple-output system identification for the characterization of limb stiffness dynamics*. *Biol Cybern* 80:327-337.



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