BIOGRAPHICAL SKETCH

NAME: Roger M. Enoka

POSITION TITLE: Professor of Integrative Physiology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Otago, Dunedin, New Zealand	Dip. P.E.	11/1970	Physical education
University of Washington, Seattle	M.S.	06/1976	Biomechanics
University of Washington, Seattle	Ph.D.	06/1981	Kinesiology
University of Arizona, Tucson	Postdoctoral	09/1985	Neurophysiology

A. Positions and Honors

Academic Positions

1981–1993	Professor, Departments of Physiology and Exercise & Sport Sciences, University of Arizona
1993–1996	Staff Scientist, Department of Biomedical Engineering, Cleveland Clinic Foundation
1996–2003	Professor, Department of Kinesiology and Applied Physiology, University of Colorado Boulder
2001–2003	Chair, Department of Kinesiology and Applied Physiology, University of Colorado Boulder
2003–	Professor, Department of Integrative Physiology, University of Colorado Boulder
2003–2014	Chair, Department of Integrative Physiology, University of Colorado Boulder
2003–	Adjoint Professor, Division of Geriatrics, College of Medicine, Anschutz Medical Campus, University of Colorado Denver
2011–	Adjoint Professor, Department of Neurology, College of Medicine, Anschutz Medical Campus, University of Colorado Denver
2016–2017	Chair, Department of Mathematics, University of Colorado Boulder

Honors

1989–1990	President, American Society of Biomechanics
2009	Presidential Lecture, American College of Sports Medicine
2011	Muybridge Award, International Society of Biomechanics
2018	Basmajian Lecture, International Society of Electrophysiology and Kinesiology
2018	Borelli Award, American Society of Biomechanics
2023	Doctorat Honoris Causa, Université de libre Bruxelles, Brussels, Belgium

B. Selected Contributions to Science

1. **Motor unit modes**. Advances in technology during the last decade have broadened the opportunities to study motor unit physiology. Chief among these developments is high-density EMG recordings, which provides spatiotemporal recordings of motor unit activity in an underlying muscle. Critically, high-density EMG signals can be decomposed to identify the times at which concurrently active motor units generate action potentials and to estimate the neural drive (the cumulative sum of all the motor unit action potentials) from the spinal cord to muscle. Current studies on the neural drive largely focus on the structure and function of the control modules that are embedded in the cumulative sums of motor unit action potentials. These control modules, which are known as motor unit modes, are the result of shared synaptic input to many of the motor units involved in a specific task.

    a. Del Vecchio A, Germer CM, Knife TM, Nuccio S, Hug F, Eskokier B, Farina D, **Enoka RM**. The forces generated by agonist muscles during isometric contractions arise from motor unit synergies. *Journal of Neuroscience* 43: 2860-2873, 2023.

b. Feeney DF, Mani D, **Enoka RM**. Variability in common synaptic input to motor neurons modulates both force steadiness and pegboard times in young and older adults. *Journal of Physiology* 596: 3793-3806, 2018.

c. Mazzo MR, Holobar A, **Enoka RM**. Association between effective neural drive to the triceps surae muscles and fluctuations in plantar-flexor torque during steady submaximal isometric contractions. *Experimental Physiology* 107: 489-507, 2022.

d. Weinman L, Del Vecchio A, Mazzo M, **Enoka RM**. Motor unit modes in the calf muscles during a submaximal isometric contraction are changed by brief stretches. *Journal of Physiology* 602: 1385-1404, 2024.

2. **High-density EMG recordings**. In contrast to standard bipolar recordings of EMG signals, high-density recordings acquired with grid electrodes provide multiple interference signals that can be summed to compute a global amplitude or decomposed to identify the times at which concurrently active motor units discharge action potentials. Due to the multiple sources of information acquired with grid electrodes, it is possible to compare the absolute amplitude (µV) of high-density EMG recordings across time or subjects without the need to normalize the estimated amplitude. Similarly, the spatial sampling obtained with the grid electrode produces unique surface distributions of motor unit waveforms that makes it possible to track the same motor unit across experimental sessions.

   a. Avrillon S, Hug F, **Enoka RM**, Caillet AH, Farina D. The decoding of extensive samples of motor units in human muscles reveals the rate coding of entire motoneuron pools. *eLife* 13**:** RP97085, 2024.

   b. Farina D, Merletti R, **Enoka RM**. The extraction of neural strategies from the surface EMG: 2004-2024. *Journal of Applied Physiology* in press.

   c. Farina D, Negro F, Muceli S, **Enoka RM**. Principles of motor unit physiology evolve with advances in technology. *Physiology* 31: 83-94, 2016.

   d. Farina D, **Enoka RM**. Evolution of surface electromyography: from muscle electrophysiology towards neural recording and interfacing. *Journal of Electromyography and Kinesiology* 71: 102796, 2023.

3. **Force steadiness**. When a person attempts to sustain a constant force during a submaximal isometric contraction, the applied force is never constant but rather fluctuates about an average value. The coefficient of variation for force during steady submaximal contractions provides a measure of force steadiness. The dominant factor influencing the amplitude of the fluctuations in force (<10 Hz) is the variance in the modulation of discharge times within that force bandwidth, which represents the slow oscillations in motor unit discharge times. The oscillations in discharge times can be identified from the cumulative spike trains derived from high-density EMG recordings. In a recent study, we found that reductions in the time to complete a pegboard test of manual dexterity after older adults practiced the task were strongly correlated with changes in force steadiness (coefficient of variation for force). The explanatory variables for the variance in the pegboard times differed between before and after practice.

   a. Amiridis IG, Kannas T, Sahinis C, Negro F, Tryipdakis G, Kellis E, **Enoka RM**. More variability in tibialis anterior function during adduction of the foot than dorsiflexion of the ankle. *Medicine and Science in Sports and Exercise* 56: 851-859, 2024.

   b. Daneshgar S, Tvrdy T, **Enoka RM**. Practice-induced changes in manual dexterity of older adults depends on initial pegboard time. *Medicine and Science in Sports and Exercise* 55: 2045-2052, 2023.

   c. Darendeli A, **Enoka RM**. Control of motor output during steady submaximal contractions is modulated by contraction history. *Experimental Brain Research* 242: 675-683, 2024.

   d. **Enoka RM**, Farina D. Force steadiness: from motor units to voluntary actions. *Physiology* 36: 114-130, 2021.

Complete List of Published Work in My Bibliography:

http://www.ncbi.nlm.nih.gov/sites/myncbi/1FE997hbIDtQ4/bibliography/47213789/public/?sort=date&direction=ascending.