

Emily L. Lawrence

Curriculum Vitae

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emillylawrence@gmail.com

<http://sportsacademy.us/campus/staff-directory/emily/>

EDUCATION

B.S. Biomedical Engineering, May 2004

Louisiana Tech University, Ruston, LA

M.S. Biomedical Engineering, May 2006

Louisiana Tech University, Ruston, LA

Advisor: Walter G. Besio, PhD

“The effects of varying input waveform and electrode parameters on transcranial electrical stimulation of the brain with concentric ring electrodes”

Ph.D. Biomedical Engineering, May 2016

University of Southern California, Los Angeles, CA

Advisor: Francisco J. Valero-Cuevas, PhD

“Demographic and clinical covariates of sensorimotor processing”

RESEARCH INTERESTS

Sensorimotor processing
Neuromuscular training
Rehabilitation
Non-linear dynamics

Sex differences
Aging
Upper/Lower extremity function
Time series data analysis

TECHNICAL SKILLS

AutoCAD, Solidworks
Stata, R, SPSS
ANSYS, Femlab, Coventor
Pspice
Motion capture (Vicon)

Matlab/Simulink, LabVIEW, Fortran 90
Electromyography measurement (Delsys, Grass)
Electrical stimulation/H-Reflex measurement (Digitimer)
Hardware development/Prototyping
Transcranial magnetic stimulation

WORK EXPERIENCE

Sports Academy, Thousand Oaks, CA, Dec. 2015-present

Director of Biomechanics (Full-time)

Supervisor: Beau Daniels, DC, CSCS (Integrated Sports Medicine)

- Develop a proprietary numerical scoring system assessing an athlete's risk of injury encompassing the three functional domains of strength, limb coordination, and sensorimotor processing
- Develop and conduct proprietary general and sport-specific whole-body biomechanical and performance optimization analyses with a focus on non-linear dynamical analyses
- Design, conduct, and publish well-directed biomechanical research studies
- Conduct in-house product testing and evaluation
- Work closely with sports performance personnel and medical staff to develop personalized training and rehabilitation regimens for athletes

Brain-Body Dynamics Laboratory, Los Angeles, CA, Jan. 2011-May 2016

Project Specialist (Full-time)

Supervisor: Francisco J. Valero-Cuevas, PhD, (University of Southern California)

- Contributed to writing of grants, technical reports, research manuscripts, institutional review board (IRB) study applications, and documentation of study results
- Assisted in the design of study protocols and recommended methods and procedures for data acquisition, management and quality control, as well as statistical techniques for data analysis
- Developed custom hardware and software to support data collection and analysis
- Overall lab management including but not limited to schedule and accommodation organization for invited researchers, orientation for new lab members, website upkeep, regulatory inspections, and meeting preparedness

Neuroscience Motion Laboratory, Houston TX, Jan. 2007-Dec. 2010

Wyle Integrated Science and Engineering Group, Lyndon B. Johnson Space Center

Biomedical Engineering (Full-time)

Supervisor: Jacob J. Bloomberg, PhD, (NASA)

- Involved in the development of an integrated set of functional and physiological tests to determine how microgravity induced changes in sensorimotor, cardiovascular and muscle physiology impact postflight functional performance
- Participated in human subject data collections and analyses and preparation of technical reports, presentations, and manuscripts
- Independently operated and maintained software and hardware systems and equipment used in data collection
- Recommended and integrated new hardware and software systems for existing and future experiments
- Responsible for design, fabrication and implementation of mechanical systems and/or electrical circuits
- Generated 2-D and 3-D drawings/models of devices and test stations developed by the lab

NSF GK-12 Teaching Fellow, Ruston LA, May 2004-May 2006

Supervisors: David Mills/Walter G. Besio, PhD, (Louisiana Tech University)

- Attended academic workshops designed for local teachers to incorporate hands-on learning into lesson plans
- Planned and coordinated academic summer day camps for local students
- Worked with local teachers to develop educational activities that corresponded with lesson plans
- Organized and coordinated review sessions for students participating in standardized testing
- Authored grants for educational supplies for participating schools

PEER-REVIEWED PUBLICATIONS

1. **Lawrence EL**, Peppoloni L, Valero-Cuevas FJ. Evidence that lower levels of leg dexterity may be a previously unrecognized risk factor for knee ligament injury in women. *Journal of Biomechanics, In preparation, 2016*. *2016 ASB Young Scientist Pre-Doctoral Award Winner
2. **Lawrence EL**, Daniels RB. Effects of hand position and surface stability on shoulder and core muscle activity during pushups with the HELM core fitness strength training system. *Journal of Strength and Conditioning Research, In Review, 2016*.
3. Peppoloni L, **Lawrence EL**, Ruffaldi E, Valero-Cuevas FJ. Characterization of the disruption of neural control strategies for dynamic fingertip forces from attractor reconstruction. *PLOS ONE, In review, 2016*.
4. **Lawrence EL**, Cesar GM, Bromfield M, Peterson R, Valero-Cuevas FJ, Sigward SM. Strength, multi-joint coordination, and sensorimotor processing are independent contributors to overall balance ability, *BioMed Research International, Special Issue "Motor Functional Evaluation from Physiology to Biomechanics to Clinical and Training Application,"* <http://dx.doi.org/10.1155/2015/561243>, 2015.
5. Krenn O, Werner I, **Lawrence EL**, Valero-Cuevas FJ. The lower extremity dexterity test quantifies sensorimotor control for cross country skiing. E. Müller; J. Kröll; S. Lindinger; J. Pfusterschmied & T. Stöggl. *Science in Skiing VI*. p. 439-45. Meyer & Meyer Sport (UK) ISBN: 978-1-78255-066-2, 2015

- (peer-reviewed full length abstract).
6. **Lawrence EL**, Dayanidhi S, Fassola I, Requejo P, Leclercq C, Winstein CW, Valero-Cuevas FJ. Outcome measures for hand function naturally reveal three latent domains in older adults: strength, coordinated upper extremity function, and sensorimotor processing, *Frontiers in Aging Neuroscience*, Special Issue, “The Hand at Work: Effects of Aging”, 7(108), doi: 10.3389/fnagi.2015.00108, 2015.
 7. Valero-Cuevas FJ, Cohn BA, Ingvason HF, **Lawrence EL**. Exploring the high-dimensional structure of muscle redundancy via subject-specific and generic musculoskeletal models, *Journal of Biomechanics*, WCB Special Issue, 48(11): p. 2887-96, 2015.
 8. Lightdale-Miric N, Mueske NM, **Lawrence EL**, Loiselle J, Berggren J, Dayanidhi S, Stevanovic M, Valero-Cuevas FJ, Wren TAL. Long term functional outcomes after early childhood pollicization, *Journal of Hand Therapy*, 28(2): p. 158-66, 2014.
 9. Lightdale-Miric N, Mueske NM, Dayanidhi S, Loiselle J, Berggren J, **Lawrence EL**, Stevanovic M, Valero-Cuevas FJ, Wren TAL. Quantitative assessment of dynamic control of fingertip forces after pollicization, *Gait & Posture*, Best Paper Award - GCMAS 2014, 41(1): p. 1-6, 2014.
 10. **Lawrence EL**, Fassola I, Werner I, Leclercq C, Valero-Cuevas FJ. Quantification of dexterity as the dynamical regulation of instabilities: comparisons across gender, age, and disease. *Frontiers in Neurology*, 53(5), doi: 10.3389/fneur.2014.00053, 2014.
 11. **Lawrence EL**, Fassola I, Dayanidhi S, Leclercq C, Valero-Cuevas FJ. An evaluation of clustering techniques to classify dexterous manipulation of individuals with and without dysfunction. *6th International IEEE EMBS Conference on Neural Engineering*, p. 1254-7, ISSN: 1948-3546, San Diego, CA, November 6-8, 2013 (peer-reviewed full length abstract).
 12. Spiering BA, Lee SM, Mulavara AP, Bentley JR, Nash RE, **Lawrence EL**, Sinka J, Williams ME, Ploutz-Snyder LL, Bloomberg JJ. Test battery designed to quickly and safely assess diverse indices of neuromuscular function following unweighting, *Journal of Strength and Conditioning Research*, 25(2): p. 545-5, 2011.

PRESENTATIONS

Podium talks/Thematic posters

1. **Lawrence EL***, Peppoloni L, Valero-Cuevas FJ. "Evidence that lower levels of leg dexterity may be a previously unrecognized risk factor for knee ligament injury in women." *Proceedings from the 40th Annual Meeting of the American Society of Biomechanics*, Raleigh, NC, August 2-5, 2016. *2016 ASB Young Scientist Pre-Doctoral Award Winner
2. **Lawrence EL***, Peppoloni L, Valero-Cuevas FJ. "Sex differences in lower extremity sensorimotor control: Influence of athletic ability." *Proceedings from the Annual Meeting of the Organization for the Study of Sex Differences (OSSD)*, Symposium Presentation, University of Pennsylvania, Philadelphia, PA, April 23-26, 2016. *Symposium co-chair *Sex Differences in Sensorimotor Control*
3. **Lawrence EL**, Dayanidhi S, Cesar GM, Sigward SM, Valero-Cuevas FJ. "Outcome measures for hand and leg function naturally reveal latent domains of strength, limb coordination, and sensorimotor processing." *Proceedings of the 39th Annual Meeting of the American Society of Biomechanics*, Thematic Poster, Columbus, OH, August 5-8, 2015.
4. **Lawrence EL**, Valero-Cuevas FJ. "Comparison of leg vs. finger dexterity suggests sex-based differences in sensorimotor processing." *USC Graduate Research Symposium-Health Sciences Division*, Podium Presentation, Los Angeles, CA, April 10, 2014.
5. Fassola I*, **Lawrence EL***, Dayanidhi S, Ko N, Leclercq C, Valero-Cuevas FJ. "Is osteoarthritis of the thumb a strictly orthopedic condition?" *Proceedings of the 1st International Thumb Osteoarthritis Workshop*; Podium Presentation, Newport, RI, October 25-26, 2013. *denotes equal contribution
6. **Lawrence EL**, Stern V, Hu W, Lyle M, Winstein C, Requejo P, Valero-Cuevas FJ. "Reduced ability to stabilize ground contact with the leg may explain gait changes in aging." *Proceedings of the 65th Annual Gerontological Society of America Meeting*, Symposium presentation, San Diego, CA, November 11-14, 2012.

Posters

1. Nagamori A, **Lawrence EL**, Finley JM, Valero-Cuevas FJ. "The ability to dynamically regulate instabilities with the leg is susceptible to repetitive eccentric contractions." *Proceedings of the 39th Annual Meeting of the American Society of Biomechanics*, Columbus, OH, August 5-8, 2015.

2. **Lawrence EL**, Werner I, Sigward SM, Valero-Cuevas FJ. "Sex differences in sensorimotor mechanisms for dynamic function of the upper and lower extremities." *Proceedings from the 22nd Annual Meeting of the Joint Symposium on Neural Control*, University of Southern California, Los Angeles, CA, May 16, 2015.
3. **Lawrence EL**, Werner I, Sigward SM, Valero-Cuevas FJ. "Sex differences in sensorimotor mechanisms for dynamic function of the upper and lower extremities." *Proceedings from the Annual Meeting of the Organization for the Study of Sex Differences (OSSD)*, Stanford University, Palo Alto, CA, April 21-23, 2015.
4. **Lawrence EL**, Cesar GM, Bromfield M, Peterson R, Sigward SM, Valero-Cuevas FJ. "Sex differences in control strategies for both static and dynamic balance in young adults." *Proceedings of the 25th Annual meeting of the Society for the Neural Control of Movement*, Charleston, SC, April 20-25, 2015.
5. Niu CM, Sohn WJ, Barradas VR, **Lawrence EL**, Valero-Cuevas FJ, Sanger TD. "Measuring the stretch response under differential activation of gamma static and dynamic on a neuromorphic cadaveric finger." *Proceedings of the 44th Annual Meeting of the Society for Neuroscience*, Washington DC, November 15-19, 2014.
6. **Lawrence EL**, Nagamori A, Valero-Cuevas FJ, Finley JM. "Prolonged immobilization and unloading leads to profound and long-lasting changes in spinal excitability." *Proceedings of the 44th Annual Meeting of the Society for Neuroscience*, Washington DC, November 15-19, 2014.
7. **Lawrence EL** and Valero-Cuevas FJ. "Can the Force-Velocity Curve Predict Realistic Muscle Forces for High-Speed Athletic Movements?" *Proceedings of the 7th World Congress on Biomechanics*, Boston, MA, July 6-11, 2014.
8. Ko N, **Lawrence EL**, Fisher B, Valero-Cuevas FJ. "While still able to manipulate unstable objects, individuals with Parkinson's disease exhibit distinct neural control strategies." *Proceedings of the 7th World Congress of Biomechanics*, Boston, MA, July 6-11, 2014.
9. Lightdale-Miric N, Mueske N, Dayanidhi S, Loisel J, Bergren J, **Lawrence EL**, Valero-Cuevas FJ. "Quantitative Assessment of Dynamic Control of Fingertip Forces After Pollicization." *Proceedings of Gait and Clinical Movement Analysis Society (GCMAS)*, Podium Presentation, Newark, DE, June 24-27, 2014.
10. **Lawrence EL**, Posch M, Melmer F, Dilitz S, Werner I, Valero-Cuevas FJ. "Comparison of leg vs. finger dexterity suggests systemic and limb-specific sensorimotor mechanisms for dynamical function." *Proceedings of the 24th Annual Society for the Neural Control of Movement Conference*, Amsterdam, Netherlands, April 22-25, 2014.
11. **Lawrence EL**, Lyle MA, Werner I, Krenn O, Lorenzi D, Kernbeiss S, Gondolatsch B, Frontull V, Zarfl M, Posch M, Valero-Cuevas FJ. "Participation in elite sports improves neuromuscular control as detected by the Lower Extremity Strength-Dexterity Test." *Proceedings of the 43rd Annual Meeting of the Society for Neuroscience*, San Diego, CA, November 9-13, 2013.
12. Ko N*, **Lawrence EL***, Dayanidhi S*, Hu W, DiConti A, Lerner J, Winstein CW, Requejo P, Fisher B, Valero-Cuevas FJ. "The Strength-Dexterity test can detect differences in dynamic control of fingertip forces between individuals with Parkinson's disease and non-disabled older adults." *Proceedings of the 43rd Annual Meeting of the Society for Neuroscience*, San Diego, CA, November 9-13, 2013. *denotes equal contribution
13. Reyes A, **Lawrence EL**, Babikian S, Liu CY, Heck CN, Valero-Cuevas FJ. "Spectral activity of cortical activity during manipulation of unstable objects reveals task-dependent spatiotemporal features." *Proceedings of the 43rd Annual Meeting of the Society for Neuroscience*, San Diego, CA, November 9-13, 2013.
14. **Lawrence EL**, Posch M, Melmer F, Dilitz S, Stern V, Werner I, Valero-Cuevas FJ. "Does long-term exposure to skiing enhance dynamical leg control in old age?" *Translational and Computational Motor Control Conference*, San Diego, CA, November 8, 2013.
15. **Lawrence EL**, Stern V, Lyle M, Winstein C, Requejo P, Valero-Cuevas FJ. "Lower extremity dynamic control declines with aging." *Proceedings of the 22nd Annual Society for the Neural Control of Movement Conference*, Venice, Italy, April 21-28, 2012.
16. Bloomberg JJ, **Lawrence EL**, Arzeno NM, Buxton RE, Feiveson AH, Kofman IS, Lee SMC, Mulavara AP, Peters BT, Platts SH, Ploutz-Snyder LL, Reschke MF, Ryder JW, Spiering BA, Stenger MB, Taylor LC, Wood SJ. "The functional task test (FTT): An interdisciplinary testing regimen to investigate the factors underlying changes in astronaut functional performance." *Proceedings of the 18th IAA Humans in Space Symposium*, Houston, TX, April 11-15, 2011.
17. Kofman IS, Reschke MF, Cerisano JF, Fisher EA, **Lawrence EL**, Peters BT, Bloomberg JJ. "Changes in jump down performance following space flight: Short and long term adaptation." *Proceedings of the 18th IAA Humans in Space Symposium*, Houston, TX, April 11-15, 2011.

18. Fisher EA, Reschke MF, Kofman IS, Cerisano JM, **Lawrence EL**, Peters BT, Bloomberg JJ, Harm DL. “The walk on floor eyes closed tandem step test as a quantitative measure of ataxia after space flight,” *Proceedings of the 18th IAA Humans in Space Symposium*, Houston, TX, April 11-15, 2011.
19. Arzeno, NM, Lee SMC, Stenger MB, **Lawrence EL**, Platts SH, Bloomberg JJ. “Heart rate response during mission-critical tasks after space flight,” *Proceedings of the American College of Sports Medicine Annual Meeting*, Denver, Co, May 31-June 4, 2011.
20. Spiering BA, Lee SM, Mulavara AP, Bentley JR, Nash RE, **Lawrence EL**, Sinka J, Guillems ME, Ploutz-Synder LL, Bloomberg JJ. “Reliability of a test battery designed for quickly and safely assessing diverse indices of neuromuscular function,” *Proceedings of the American College of Sports Medicine Annual Meeting*, Baltimore, MD, June 1-4, 2010.
21. Bloomberg JJ, Feeback DL, Fieveson AH, Lee SMC, Mulavara AP, Peters BT, Platts, SH, Reschke MF, Ryder J, Spiering BA, Stenger MB, Wood S, **Lawrence EL**, Arzeno N. “Physiological factors contributing to postflight changes in functional performance,” *NSBRI HRP Workshop*, NASA Johnson Space Center, Houston, TX, February 2009.
22. Bloomberg JJ, Mulavara AP, Peters BT, Richards, JT, Miller CA, Brady R, Warren LE, Ruttley TM, **Lawrence EL**. “Training and evaluation methods that optimize planetary ambulation,” *Biennial Research and Technology Development Report*, NASA Johnson Space Center, Houston, TX, December 2007.

HONORS AND AWARDS

NASA-Johnson Space Center Group Achievement Award, 2008
Wyle Manager’s Choice Award – Functional Tasks Test Project Support, June 2009
Wyle Outstanding Employee Award – Outstanding Project Support, August 2009
Bioastronautics Contract Bravo Award – Functional Tasks Test, July-December 2009
JSC Director's Innovation Group Achievement Award – Functional Tasks Test, 2010
Finalist, USC Graduate Research Symposium – Health Sciences Category, 2014
Young Scientist Pre-Doctoral Award, American Society of Biomechanics, 2016
Best Dissertation Award, USC Department of Biomedical Engineering, 2016

INVITED TALKS

- “Evidence that lower levels of leg dexterity may be a previously unrecognized risk factor for knee ligament injury in women,” Department of Biological Sciences, North Carolina State University, August 3, 2016.
- “Demographic and clinical covariates of sensorimotor processing,” Sensory Motor Performance Program Seminar Series, Rehabilitation Institute of Chicago, September 20, 2016.

ACTIVITIES

Professional Membership

Society for the Neural Control of Movement
Society for Neuroscience
IEEE Engineering in Medicine and Biology
American Society of Biomechanics
Organization for the Study of Sex Differences

Editorial Review

Medical and Biological Engineering and Computing
Frontiers in Aging Neuroscience
Journal of Biomechanics
PLOS ONE