

Curriculum Vitae

Brian R. Umberger, Ph.D.

Associate Professor
Department of Kinesiology
School of Public Health and Health Sciences
University of Massachusetts Amherst

Education

- Ph.D. Biomechanics - Exercise Science, Arizona State University, Tempe, AZ, 2003
M.S. Biomechanics - Movement Science, Springfield College, Springfield, MA, 1997
B.S. Exercise Science, Central Connecticut State University, New Britain, CT, 1993

Professional Appointments

- 2014-present Co-Director, Biomechanics Laboratory, University of Massachusetts Amherst.
2014-present Adjunct Associate Professor, University of Western Australia.
2013 (Spring) Visiting Scholar, Department of Anatomical Sciences, Stony Brook University.
2012-present Associate Professor, Department of Kinesiology, University of Massachusetts Amherst.
2011-present Faculty Member, Graduate Program in Organismic & Evolutionary Biology, University of Massachusetts Amherst.
2006-2012 Assistant Professor, Department of Kinesiology, University of Massachusetts Amherst.
2005-present Scientific Staff (by courtesy), Shriners Hospital for Children.
2005-2006 Assistant Professor, Center for Biomedical Engineering, University of Kentucky.
2003-2006 Assistant Professor, Department of Kinesiology & Health Promotion, University of Kentucky.
1998-2003 Research Assistant, Department of Kinesiology, Arizona State University.
1997-1998 Research Assistant, Department of Orthopaedics, University of Rochester Medical Center.

Honors, Awards & Distinctions

- President-Elect, American Society of Biomechanics, 2017-2018 (President 2018-2019, Past-President 2019-2020)
Associate Editor, *Medicine & Science in Sports & Exercise*, 2016-present
Fellow, National Center for Simulation in Rehabilitation Research, Stanford University, 2014-present
Journal of Biomechanics Most Downloaded Articles. Miller RH, Umberger BR & Caldwell GE. Vol. 45, pp. 1092-1097, 2012. Ranked 22nd on Top 25 List for 2013

Journal of Biomechanics, Excellence in Reviewing Award, 2012

Outstanding Teacher Award, University of Massachusetts Amherst, School of Public Health and Health Sciences, 2010

Excellence in Research Award, American Physical Therapy Association Combined Sections Meeting, 2006

Finalist: Andrzej Komor New Investigator Award, International Symposium on Computer Simulation in Biomechanics, 2005

Finalist: American Society of Biomechanics Pre-Doctoral Young Scientist Award, 2003

National Science Foundation IGERT Fellowship, 2000

Provost's Award for Academic Accomplishment, Springfield College, 1996

Elected to Kappa Delta Pi International Honor Society, 1992

Publications

O'Neill MC, Ogihara N, Nakatuskasa M, Demes B, Thompson NE & Umberger BR. Origin of the human walking stride: lower back and pelvis effects on the three-dimensional kinematics of macaque, chimpanzee and human bipedalism. *Journal of the Royal Society Interface*. Submitted.

O'Neill MC, Umberger BR, Holowka NB, Larson SG & Reiser PJ. (2017). Chimpanzee 'super strength' and human skeletal muscle evolution. *Proceedings of the National Academy of Sciences* 114, 7343-7348.

Umberger BR & Miller RH. (2017). Optimal control modeling of human movement. In B Müller & SI Wolf (Eds.), *Handbook of Human Motion*. Berlin: Springer. 1-22.

Lim J, Schuna JM Jr., Busa MA, Umberger BR, Katzmarzyk PT, van Emmerik REA & Tudor-Locke C. (2016). Allometrically scaled children's clinical and free-living ambulatory behavior. *Medicine & Science in Sports & Exercise* 48, 2407-2416.

Young S, Gardiner B, Mehdizadeh A, Rubenson J, Umberger B & Smith D. (2016). Adaptive remodeling of Achilles tendon: A multi-scale computational model. *PLOS Computational Biology* 12, e1005106.

Erdemir A, Guess TM, Halloran JP, Modenese L, Reinbolt JA, Thelen DG & Umberger BR. (2016). Commentary on the integration of model sharing and reproducibility analysis to scholarly publishing workflow in computational biomechanics. *IEEE Transactions on Biomedical Engineering* 63, 2080-2085.

LaPrè AK, Umberger BR & Sup F. (2016). A robotic foot-ankle prosthesis with active alignment. *Journal of Medical Devices* 10, 025001.

Lee L-F & Umberger BR. (2016). Generating optimal control simulations of musculoskeletal movement with OpenSim and MATLAB. *PeerJ* 4, e1638.

Callahan DM, Umberger BR & Kent-Braun JA. (2016). Mechanisms of in vivo muscle fatigue in humans: investigating age-related fatigue resistance with a computational model. *Journal of Physiology* 594, 3407-3421.

- O'Neill MC, Lee L-F, Demes B, Thompson NE, Larson SG, Stern JT Jr & Umberger BR. (2015). Three-dimensional kinematics of the pelvis and hind limbs in chimpanzee (*Pan troglodytes*) and human bipedal walking. *Journal of Human Evolution* 86, 32-42.
- Anderson DD & Umberger BR. (2015). Forward: Special issue on symposia organized by the American Society of Biomechanics at the 7th World Congress of Biomechanics. *Journal of Biomechanics* 48, 2835-2836.
- Demes B, Thompson NE, O'Neill MC & Umberger BR. (2015). Center of mass mechanics of chimpanzee bipedal walking. *American Journal of Physical Anthropology* 156, 422-433.
- LaPrè AK, Umberger BR & Sup F. (2014). Simulation of a powered ankle prosthesis with dynamic joint alignment. *IEEE Engineering in Medicine and Biology*, 1618-1621.
- Umberger BR & Caldwell GE. (2014). Musculoskeletal modeling. In: DGE Robertson, GE Caldwell, J Hamill, G Kamen & SN Whittlesey (Eds.), *Research Methods in Biomechanics, 2nd Ed.* Champaign, IL: Human Kinetics. 247-276.
- O'Neill MC, Lee, L-F, Larson SG, Demes B, Stern JT & Umberger BR. (2013). A three-dimensional musculoskeletal model of the chimpanzee (*Pan troglodytes*) pelvis and hind limb. *Journal of Experimental Biology* 216, 3709-3723.
- Gruber AH, Umberger BR, Braun B & Hamill J. (2013). Economy and rate of carbohydrate oxidation during running with rearfoot and forefoot strike patterns. *Journal of Applied Physiology* 115, 194-201.
- Russell EM, Miller RH, Umberger BR & Hamill J. (2013). Lateral wedges alter mediolateral load distributions at the knee joint in obese individuals. *Journal of Orthopedic Research* 31, 665-671.
- Umberger BR, Augsburger S, Resig J, Oeffinger D, Shapiro R & Tylkowski C. (2013). Generation, absorption, and transfer of mechanical energy during walking in children. *Medical Engineering & Physics* 35, 644-651.
- Callahan DM, Umberger BR & Kent-Braun JA. (2013). A computational model of torque generation: neural, contractile, metabolic and musculoskeletal components. *PLOS ONE* 8, e56013.
- Miller RH, Umberger, BR, Hamill J & Caldwell GE. (2012). Evaluation of the minimum energy hypothesis and other potential optimality criteria for human running. *Proceedings of the Royal Society of London, Series B* 279, 1498-1505.
- Miller RH, Umberger BR & Caldwell GE. (2012). Sensitivity of maximum sprinting speed to characteristic parameters of the muscle force-velocity relationship. *Journal of Biomechanics* 45, 1406-1413.
- Miller RH, Umberger BR & Caldwell GE. (2012). Limitations to maximum sprinting speed imposed by muscle mechanical properties. *Journal of Biomechanics* 45, 1092-1097.
- Umberger BR & Rubenson J. (2011). Understanding muscle energetics in locomotion: new modeling and experimental approaches. *Exercise and Sport Sciences Reviews* 39, 59-67.

- Bolgia LA, Malone TR, Umberger BR & Uhl TL. (2011). Comparison of hip and knee strength and neuromuscular activity in subjects with and without patellofemoral pain syndrome. *International Journal of Sports Physical Therapy* 6, 285-296.
- Seeley MK, Umberger BR, Clasey JL & Shapiro R. (2010). The relation between mild leg-length inequality and able-bodied gait asymmetry. *Journal of Sports Science and Medicine* 9, 572-579.
- Umberger BR. (2010). Stance and swing phase costs in human walking. *Journal of the Royal Society Interface* 7, 1329-1340.
- Bolgia LA, Malone TR, Umberger BR & Uhl TL. (2010). Reliability of electromyographic methods used for assessing hip and knee neuromuscular activity in females diagnosed with patellofemoral pain syndrome. *Journal of Electromyography and Kinesiology* 20, 142-147.
- Miller RH, Caldwell GE, van Emmerik REA, Umberger, BR & Hamill J. (2009). Ground reaction forces and lower extremity kinematics when running with suppressed arm swing. *Journal of Biomechanical Engineering* 131, 124502, 1-5.
- Umberger BR. (2008). Effects of suppressing arm swing on kinematics, kinetics, and energetics of human walking. *Journal of Biomechanics* 41, 2575-2580.
- Seeley MK, Umberger BR & Shapiro R. (2008). A test of the functional asymmetry hypothesis in walking. *Gait and Posture* 28, 24-28.
- Bolgia LA, Malone TR, Umberger BR & Uhl TL. (2008). Hip strength and hip and knee kinematics during stair descent in females with and without patellofemoral pain syndrome. *Journal of Orthopedic and Sports Physical Therapy* 38, 12-18.
- Umberger BR & Martin PE. (2007). Mechanical power and efficiency of level walking with different stride rates. *Journal of Experimental Biology* 210, 3255-3265.
- Umberger BR, Gerritsen KGM & Martin PE. (2006). Muscle fiber type effects on energetically-optimal cadences in cycling. *Journal of Biomechanics* 39, 1472-1479.
- Nagano A, Umberger BR, Marzke MW & Gerritsen KGM. (2005). Neuromusculoskeletal computer modeling and simulation of upright, straight-legged, bipedal locomotion of *Australopithecus afarensis*. *American Journal of Physical Anthropology* 126, 2-13.
- Umberger BR, Gerritsen KGM & Martin PE. (2003). A model of human muscle energy expenditure. *Computer Methods in Biomechanics and Biomedical Engineering* 6, 99-111.
- Umberger BR. (2003). Comments on "Influence of pedalling rate on the energy cost of cycling in humans". *European Journal of Applied Physiology* 90, 219-220.
- Martin PE & Umberger BR. (2003). Trends in interdisciplinary and integrative graduate training: an NSF IGERT example. *Quest* 55, 86-94.
- Umberger BR & Martin PE. (2001). Testing the planar assumption during ergometer cycling. *Journal of Applied Biomechanics* 17, 55-62.

- Robertson SD, Kao JC, Wings JB & Umberger BR. (2001). Postural stability constrains the mode of bimanual coordination. In G Burton & RC Schmidt (Eds.), *Studies in Perception and Action, VI*. Hillsdale, NJ: Lawrence Erlbaum Associates. 165-168.
- Martin PE, Sanderson DJ & Umberger BR. (2000). Factors affecting preferred rates of movement in cyclic activities. In VM Zatsiorsky (Ed.), *The Encyclopedia of Sports Medicine: Biomechanics in Sport*. Oxford: Blackwell Science. 143-160.
- Nawoczenski DA, Baumhauer JF & Umberger BR. (1999). Relationship between clinical measurements and first metatarsophalangeal joint motion during gait. *Journal of Bone and Joint Surgery* 81-A, 370-376.
- Umberger BR, Nawoczenski DA & Baumhauer JF. (1999). Reliability and validity of first metatarsophalangeal joint orientation measured with an electromagnetic tracking device. *Clinical Biomechanics* 14, 74-76.
- Umberger BR, Scheuchenzuber HJ & Manos TM. (1998). Differences in power output during cycling at different seat tube angles. *Journal of Human Movement Studies* 35, 1-36.
- Umberger BR. (1998). Mechanics of the vertical jump and two-joint muscles: implications for training. *Strength and Conditioning Journal* 20, 70-74.

Grants in Preparation

Skeletal Muscle Architecture, Force and Metabolic Cost. National Science Foundation, 2018-2021. \$400,000. Role: PI.

Submitted Grants

Musculoskeletal Design and Early Hominin Walking and Running. National Science Foundation, 2018-2021. \$208,244. Role: PI.

Ontology Guided Anatomical Repositioning. SBIR Phase I: Department of Defense, Defense Health Agency, 2017-2018. \$150,000. Role: Campus PI (Industry partner: FTL Labs, Inc.)

Active Grants

Simulation Guided Design to Optimize Robotic Lower Limb Prostheses. National Science Foundation, 2015-2018. \$630,331. Role: Co-PI. (B.R. Umberger total costs \$252,132)

Creation of a 3-D Motion Freezer to Understand Human and Animal Locomotion. Armstrong Fund for Science - UMass Research Office, 2017-2019. \$30,000. Role: Co-PI.

Ultrasound Socket Fitting and Diagnostic System, SBIR Phase II. Defense Advanced Research Projects Agency, 2016-2018. \$151,773 (UMass Subcontract). Role: Co-I.

Completed Grants

Integrated Modeling and Experimental Assessment of Chimpanzee and Human Locomotion. National Science Foundation, 2009-2015. \$593,504. Role: PI.

Optimizing the Design and Control of Robotic Lower Limb Prostheses. National Center for Simulation in Rehabilitation Research, 2014-2015. \$20,000. Role: Co-PI.

The Biomechanical Effectiveness of Arc and Elliptical Exercise Trainers. Cybex, Inc., 2010-2012. \$128,456. Role: Co-PI.

A Model for Simulating Skeletal Muscle Energy Consumption. UMass Amherst Office of Research Affairs, 2008-2010. \$29,227. Role: PI.

Validation and Sensitivity Analysis of a Human Muscle-Joint Model. UMass Amherst Research Liaison & Development Office, 2008-2010. \$12,400. Role: PI.

Interrelationships Among Mechanical Work, Energy Transfer, and the Metabolic Cost of Normal and Pathological Pediatric Gait. Shriners Hospital for Children, 2006-2009. \$97,655. Role: PI.

Mechanical Energy Transfers During Normal and Pathological Pediatric Gait. Shriners Hospital for Children, 2005-2006. \$36,700. Role: PI.

A Theoretical Model for Studying Walking. University of Kentucky, Summer Faculty Research Fellowship, 2004. \$6000. Role: PI.

Arizona State University, Douglas L. Conley Memorial Research Scholarship, 2002. \$1000. Role: PI.

National Science Foundation IGERT Pre-Doctoral Fellowship, 2000-2002. \$49,500 (total award value). A component of: Musculoskeletal and Neural Adaptations in Form and Function (He, J., PI) DGR 9987619, 2000-2005.

International Society of Biomechanics, Matching Dissertation Grant, 2001. \$2000. Role: PI.

Invited Lectures

University of Arizona College of Medicine - Phoenix, Department of Basic Medical Sciences. *Basic and clinical applications of musculoskeletal modeling in human locomotion*. March 2017.

National Center for Simulation in Rehabilitation Research, Stanford University. *Webinar: Musculoskeletal modeling to study the evolution of human bipedalism*. February 2017.

Northeastern University, Action Laboratory, Department of Biology. *Energetics of human locomotion*. January 2017.

University of Calgary, Faculty of Kinesiology. *Mechanics and energetics of human locomotion*. June 2015.

Stanford University, Neuromuscular Biomechanics Laboratory, Department of Bioengineering. *Muscle energetics in human locomotion*. January 2014.

Pennsylvania State University, Department of Kinesiology. *Linking the mechanics and energetics of human locomotion*. November 2013.

University of London, Royal Veterinary College, Structure and Motion Laboratory. *Muscle energetics in locomotion*. July 2011.

Vrije Universiteit Amsterdam, Faculty of Human Movement Sciences. *Energetics of human movement: insights gained through modeling and simulation studies*. May 2009.

Stony Brook University, Department of Anatomical Sciences. *Dynamic simulation as a tool to study evolution of the human locomotor system*. February 2009.

Massachusetts Institute of Technology, The Media Lab, Biomechanics Group. *Model-based investigations of normal and pathological human walking*. April 2008.

Harvard University, Concord Field Station. *Investigating the mechanics and energetics of movement using musculoskeletal modeling and simulation*. November 2007.

Arizona State University, NSF IGERT Symposium. *Effects of muscle fiber type composition on human performance*. March 2007.

Ball State University, Division of Exercise Science. *Musculoskeletal modeling and computer simulation of human movement*. June 2006.

Kentucky Sports Medicine, ACL Research Group. *Computer simulation of jumping and landing*. December 2004.

University of Kentucky, Center for Biomedical Engineering. *Inverse and forward dynamics analyses in biomechanics*. December 2003.

University of Kentucky, Department of Kinesiology and Health Promotion. *How does cycle frequency influence the mechanics and energetics of human locomotion?* March 2003.

Local Presentations

University of Massachusetts Amherst, STEM-Ed Saturday Seminar. *Superhero Robotics - Anatomy & Biomechanics of Human Movement*. March 2017.

Amherst Science Café, UMass Amherst Organismic and Evolutionary Biology Program. *How and why we walk upright: The evolution of human locomotion*. November 2016.

University of Massachusetts Amherst, Graduate Program in Organismic and Evolutionary Biology. *Mechanics and energetics of hominin bipedal locomotion*. October 2011.

University of Massachusetts Amherst, Department of Kinesiology. *Investigating the mechanics and energetics of human walking using computer modeling and simulation*. March 2006.

Keynotes, Invited Symposia and Tutorials

- Umberger BR. Tutorial Lecture: Inverse or forward, simple or complex ... which model should I use? *American Society of Biomechanics Annual Conference*: Raleigh, NC, August 2016.
- Umberger BR. Metabolic cost: Modeling, simulation and cost minimization in movement. *Biomechanics and Neural Control of Movement Conference*: Mt. Sterling, OH, June 2016.
- Umberger BR. Tutorial: Modeling metabolic cost in whole-body simulations. *American College of Sports Medicine Annual Meeting*: Boston, MA, June 2016.
- LaPrè A, Umberger BR & Sup F. Simulation of a powered ankle prosthesis with dynamic joint alignment. *Engineering in Medicine and Biology Conference*: Chicago, IL, August 2014.
- Umberger BR, O'Neill MC & Lee L-F. Keynote Address: Using computer modeling and dynamic simulation to study the evolution of hominin locomotor biomechanics: potential and pitfalls. *World Congress of Biomechanics*: Boston, MA, July 2014.
- O'Neill MC, Lee L-F & Umberger BR. Adaptations for economical walking: Musculoskeletal model predictions of muscle-tendon power output in chimpanzee and human bipedalism. *Society for Experimental Biology Annual Meeting*: Manchester, UK, July 2014.
- Umberger BR, O'Neill MC, Demes B, Lee L-F, Thompson NE, Larson SG & Stern JT. Differences in the mechanics of chimpanzee and human bipedal walking. *International Congress of Vertebrate Morphology*: Barcelona, Spain, July 2013.
- O'Neill MC, Demes B, Thompson NE, Larson SG, Stern JT, Lee L-F & Umberger BR. Chimpanzee bipedalism: Integrating experiments and musculoskeletal modeling. *American Association of Physical Anthropologists Annual Meeting*: Portland, OR, April 2012.
- Umberger BR & Gidley AD. Modeling the efficiency of movement: from individual muscles to whole organism. *American Society of Mechanical Engineers Summer Bioengineering Conference*: Lake Tahoe, CA, June 2009.
- Umberger BR. Computer modeling of stance and swing phase costs in human walking. *Society for Experimental Biology Annual Meeting*: Marseille, France, July 2008.
- Umberger BR. Tutorial Lecture: Musculoskeletal modeling and computer simulation of human movement. *American College of Sports Medicine Annual Meeting*: New Orleans, LA, June 2007.
- Umberger BR & Caldwell GE. Simulating the independent effects of muscle fiber type composition on vertical jumping performance. *American Society of Mechanical Engineers Summer Bioengineering Conference*: Keystone, CO, June 2007.
- Umberger BR. Tutorial Lecture: Musculoskeletal modeling and computer simulation of human movement. *Annual Meeting of Southeast Chapter of American College of Sports Medicine*: Charlotte, NC, February 2006.
- Umberger BR, Martin PE & Gerritsen KGM. Muscle fiber type effects on energetically optimal cadences in cycling - a computer simulation study. *World Congress of Biomechanics*: Calgary, Alberta, Canada. August 2002.

Conference Free Communications

Wedge RD, LaPrè AK, Sup FC & Umberger BR. Gait stability in people with unilateral transtibial amputation across walking speeds. *American Society of Biomechanics Annual Conference*: Boulder, CO, August 2017.

Johnson RT & Umberger BR. Mechanics & energetics of walking with a flat center of mass trajectory. *American Society of Biomechanics Annual Conference*: Boulder, CO, August 2017.

Gidley AD & Umberger BR. Net energy transfer via biarticular muscles during pedaling flows distal-to-proximal due to hamstrings activity. *American Society of Biomechanics Annual Conference*: Boulder, CO, August 2017.

Umberger BR, LaPrè AK, Johnson RT, Wedge RD & Sup FC. Simulation of residuum-socket dynamics in walking following limb loss. *Congress of the International Society of Biomechanics*: Brisbane, Australia, July 2017.

Umberger BR. Is metabolic cost minimized in human walking? *International Symposium on Computer Simulation in Biomechanics*: Gold Coast, Australia, July 2017

O'Neill MC, Ogihara N, Nakatsukasa M, Demes B, Thompson NE & Umberger BR. Pelvis shape, lumbar column length and the origin of the hominin walking stride. *American Association of Physical Anthropologists Annual Meeting*: New Orleans, LA, April 2017.

Johnson RT & Umberger BR. Biomechanical mechanisms for modulating stride frequency in walking. *American Society of Biomechanics Annual Conference*: Raleigh, NC, August 2016.

O'Neill MC, Demes B, Larson SG & Umberger BR. Pelvis shape and hominin walking: Insights from the three-dimensional mechanics of the lesser gluteals and hamstrings in human and chimpanzee bipedalism. *American Association of Physical Anthropologists Annual Meeting*: Atlanta, GA, April 2016.

Lee L-F & Umberger BR. Generating predictive simulations of musculoskeletal movement using optimal control, MATLAB and OpenSim. *American Society of Biomechanics Annual Conference*: Columbus, OH, August 2015.

Wedge RD, LaPrè AK, Sup FC & Umberger BR. Effects of walking speed on the stump-socket interface in transtibial amputees. *American Society of Biomechanics Annual Conference*: Columbus, OH, August 2015.

Johnson RT & Umberger BR. Biomechanical determinants of muscle metabolic energy consumption in locomotion. *American Society of Biomechanics Annual Conference*: Columbus, OH, August 2015.

Smith NI & Umberger BR. Joint moment patterns during a fatiguing run. *American Society of Biomechanics Annual Conference*: Columbus, OH, August 2015.

Wedge RD, LaPrè AK, Sup FC & Umberger BR. A lower-limb amputee musculoskeletal model for quantifying stump-socket kinematics and kinetics. *Congress of the International Society of Biomechanics*: Glasgow, Scotland, July 2015.

- Demes B, Thompson N, O'Neill MC & Umberger BR. Chimpanzee bipedal gait mechanics and early hominin gait evolution. *American Association of Physical Anthropologists Annual Meeting*: St. Louis, MO, April 2015.
- Gidley AD, Marsh AP & Umberger BR. Performance-based cost functions for simulating submaximal pedaling. *World Congress of Biomechanics*: Boston, MA, July 2014.
- Baird JL, Umberger BR, Hamill J & van Emmerik R. Arm swing, thorax-pelvis coordination and angular momentum regulation during walking. *World Congress of Biomechanics*: Boston, MA, July 2014.
- Gruber AH, Boyer KA, Derrick TR, Umberger BR & Hamill J. Foot posture in human running: energetics, muscle actions, and ground reaction forces. *World Congress of Biomechanics*: Boston, MA, July 2014.
- Caldwell GE, Frayne D, Muir B & Umberger BR. Biomechanical characteristics of exercise machine training. *World Congress of Biomechanics*: Boston, MA, July 2014.
- O'Neill MC, Lee L-F, Larson SG, Stern JT Jr, Demes B, Thompson N & Umberger BR. Individual muscle function in chimpanzee bipedalism II: Musculoskeletal model predictions based on static optimization. *American Association of Physical Anthropologists Annual Meeting*: Calgary, Alberta, Canada, April 2014.
- Larson SG, Stern JT Jr, Demes B, O'Neill MC & Umberger BR. Individual muscle function in chimpanzee bipedalism: I. EMG patterns. *American Association of Physical Anthropologists Annual Meeting*: Calgary, Alberta, Canada, April 2014.
- Gruber AH, Umberger BR & Hamill J. Energy expenditure of the triceps surae during rearfoot and forefoot running. *American Society of Biomechanics Annual Conference*: Omaha, NE, August 2013.
- Baird JL, Umberger BR, Hamill J & van Emmerik R. Angular momentum and thorax-pelvis coordination in walking. *American Society of Biomechanics Annual Conference*: Omaha, NE, August 2013.
- Lee L-F, O'Neill MC, Demes B, Confer MD, Thompson NE, Larson SG & Umberger BR. The mechanics of economical walking: Insights from chimpanzee and human bipedalism. *American Society of Biomechanics Annual Conference*: Omaha, NE, September 2013.
- Gruber AH, Umberger BR & Hamill J. Triceps surae elastic energy utilization during human running with rearfoot and forefoot patterns. *Congress of the International Society of Biomechanics*: Natal, Brazil, August 2013.
- Gruber AH, Umberger BR, Miller RH & Hamill J. The relationship between achilles tendon moment arm length and rate of oxygen consumption in natural rearfoot and forefoot runners. *American College of Sports Medicine Annual Meeting*: Indianapolis, IN, June 2013.
- O'Neill MC, Lee L-F, Demes B, Thompson NE, Larson SG, Stern JT & Umberger BR. Stance and swing phase joint mechanics in chimpanzee bipedal walking. *American Association of Physical Anthropologists Annual Meeting*: Knoxville, TN, April 2013.
- Lee L-F, O'Neill MC, Demes B, LaBoda MD, Thompson NE, Larson SG, Stern JT & Umberger BR. Joint kinematics in chimpanzee and human bipedal walking. *American Society of Biomechanics Annual Conference*: Gainesville, FL, August 2012.

- Callahan DM, Umberger BR & Kent-Braun JA. A computational model of neuromuscular function that predicts age-related fatigue resistance. *American College of Sports Medicine Annual Meeting*: San Francisco, CA, June 2012.
- Thompson NE, O'Neill MC, Larson SG & Umberger BR. Passive joint motion of the chimpanzee knee, ankle and foot. *American Association of Physical Anthropologists Annual Meeting*: Portland, OR, April 2012.
- Callahan DM, Umberger BR & Kent-Braun J. A computational model of neural activation, force generation and intracellular bioenergetics during muscle fatigue. *Experimental Biology*: San Diego, CA, April 2012.
- Umberger BR, O'Neill MC, Larson SG, Demes B & Stern JT. A model of chimpanzee hindlimb musculoskeletal geometry. *American Society of Biomechanics Annual Conference*: Long Beach, CA, August 2011.
- Miller RH, Umberger BR, Kent-Braun JA & Caldwell GE. Virtual aging of the muscular system and its effects on running biomechanics. *American Society of Biomechanics Annual Conference*: Long Beach, CA, August 2011.
- Gruber AH, Umberger BR, Jewell C, del Pilar S & Hamill J. Achilles tendon forces in forefoot and rearfoot running. *American Society of Biomechanics Annual Conference*: Long Beach, CA, August 2011. [Selected for Student Poster Competition]
- Umberger BR, Callahan DM, Gidley AD, LaBoda MD & Kent-Braun JA. Validation of a model for predicting muscle energy consumption: maximal voluntary isometric contractions. *Congress of the International Society of Biomechanics*: Brussels, Belgium, July 2011.
- Busa MA, Umberger BR, Hamill J & van Emmerik REA. Multiscale entropy identifies complexity changes of postural control in multiple sclerosis. *Congress of the International Society of Biomechanics*: Brussels, Belgium, July 2011.
- Umberger BR, Gidley AD & LaBoda MD. Multi-phase determination of subject-specific parameter values for an ankle joint musculoskeletal model. *International Symposium on Computer Simulation in Biomechanics*: Leuven, Belgium, July 2011.
- Miller RH, Umberger BR & Caldwell GE. Optimality criteria for human running investigated by forward dynamics simulations. *International Society of Biomechanics in Sports Annual Conference*: Porto, Portugal, June 2011.
- O'Neill MC, Larson SG, Demes B, Stern JT & Umberger BR. A 3D musculoskeletal model of the chimpanzee for movement analysis. *American Association of Physical Anthropologists Annual Meeting*: Minneapolis, MN, April 2011.
- Miller RH, Umberger BR & Caldwell GE. Theoretical analysis of limitations to maximum sprinting speed imposed by muscle mechanical properties. *American Society of Biomechanics Annual Conference*: Providence, RI, August 2010. [RHM: Pre-Doctoral Young Scientist Award]
- Gidley AD, LaBoda MD & Umberger BR. Sensitivity of predicted peak isometric ankle dorsiflexion torque to musculoskeletal model parameter values. *American Society of Biomechanics Annual Conference*: Providence, RI, August 2010.

- LaBoda MD, Gidley AD, Hasson CJ, Caldwell GE & Umberger BR. Subject-specific, group-mean, and generic musculoskeletal models for predicting isometric ankle dorsiflexion torque. *American Society of Biomechanics Annual Conference*: Providence, RI, August 2010.
- Miller RH, Umberger BR & Caldwell GE. Effects of history dependence on the mechanics and energetics of the Hill muscle model. *American College of Sports Medicine Annual Meeting*: Baltimore, MD, June 2010.
- Gidley, AD & Umberger, BR. Effects of tendon morphology on muscular work and efficiency. *American Society of Biomechanics Annual Conference*: State College, PA, August 2009.
- Miller RH, Umberger BR & Caldwell GE. Muscle forces in the lower extremity predicted by static and dynamic optimization. *American Society of Biomechanics Annual Conference*: State College, PA, August 2009.
- Theroux-Jones M, Royer TD & Umberger BR. A computer simulation model for predicting optimal prosthesis inertial parameters. *American Society of Biomechanics Annual Conference*: State College, PA, August 2009.
- Miller RH, Umberger BR, Hamill J & Caldwell GE. Dynamic optimization of maximum-effort humans sprinting. *American Society of Mechanical Engineers Summer Bioengineering Conference*: Lake Tahoe, CA, June 2009.
- Bolgia LA, Malone TR, Umberger BR, Akinwuntan A & Uhl TL. Predictor variables for identifying females with and without patellofemoral pain syndrome. *International Patellofemoral Joint Research Retreat*: Baltimore, MD, May 2009.
- Umberger BR, Resig J, Augsburger S, Oeffinger D, Shapiro R & Tylkowski C. Interrelationships among work, energy transfer, and the cost of walking in children. *Gait and Clinical Movement Analysis Society Annual Meeting*: Denver, CO, March 2009.
- Umberger BR, Resig J, Augsburger S, Oeffinger D, Shapiro R & Tylkowski C. Mechanical energy generation, absorption, and transfer during walking in children. *Gait and Clinical Movement Analysis Society Annual Meeting*: Denver, CO, March 2009.
- Umberger BR, Resig J, Augsburger S, Oeffinger D, Shapiro R & Tylkowski C. Regulation of mechanical energy generated during walking in healthy children. *North American Congress on Biomechanics*: Ann Arbor, MI, August 2008.
- Seeley MK, Umberger BR & Shapiro R. Are asymmetries in joint kinetics related to limb dominance? *North American Congress on Biomechanics*: Ann Arbor, MI, August 2008.
- Miller RH, Caldwell GE, van Emmerik REA, Hamill J & Umberger BR. Does restraining arm motion alter ground reaction forces in running? *North American Congress on Biomechanics*: Ann Arbor, MI, August 2008.
- Miller RH, Umberger BR & Caldwell GE. Optimal control solutions for a simple model of human jumping. *American Society of Mechanical Engineers Summer Bioengineering Conference*: Marco Island, FL, June 2008. [Selected for Student Poster Competition]
- Umberger BR. Trade-offs in performance associated with muscle fiber type composition. *American Society of Biomechanics Annual Conference*: Stanford, CA, August 2007.

- Seeley MK, Umberger BR & Shapiro R. Can electromyographic asymmetries during gait be explained by limb dominance? *American Society of Biomechanics Annual Conference*: Stanford, CA, August 2007.
- Scholz MN, Umberger BR, Bobbert MF & van Soest AJ. Metabolic energy cost of in vivo stretch-shortening cycles. *Congress of the International Society of Biomechanics*: Taipei, Taiwan, July 2007.
- Umberger BR. The cost of swinging the leg in human walking. *American Society of Biomechanics Annual Conference*: Blacksburg, VA, September 2006.
- Seeley MK., Umberger BR & Shapiro R. A test of the functional asymmetry hypothesis in walking. *American Society of Biomechanics Annual Conference*: Blacksburg, VA, September 2006.
- TenBroek TM, Hinrichs RN & Umberger BR. The effect of shoe midsole thickness on ankle kinematics and kinetics during cutting maneuvers. *Biennial Conference of the Canadian Society for Biomechanics*: Waterloo, ON, August 2006.
- Umberger BR. Effects of arm swing on energetic and kinetic descriptors of human gait. *American College of Sports Medicine Annual Meeting*: Denver, CO, June 2006.
- Bolgia LA, Malone TR, Uhl TL & Umberger BR. Reliability of evaluation tools for assessing patellofemoral pain syndrome. *National Athletic Trainers' Association Annual Meeting*: Atlanta, GA, June 2006.
- Bolgia LA, Malone TR, Uhl TL & Umberger BR. Hip and knee strength, EMG activity, and kinematics in subjects with patellofemoral pain syndrome. *American Physical Therapy Association Combined Sections Meeting*: San Diego, CA, February 2006. [Excellence in Research Award]
- Umberger BR & Martin PE. Mechanical efficiency during walking at different stride rates. *Congress of the International Society of Biomechanics*: Cleveland, OH, August 2005.
- Seeley MK, Clasey J, Umberger BR & Shapiro R. The effect of mild limb length inequalities on able-bodied gait asymmetries: A preliminary analysis. *Congress of the International Society of Biomechanics*: Cleveland, OH, August 2005.
- Umberger BR. Constraints necessary to produce realistic simulations of vertical jumping and the effects on jump height. *International Symposium on Computer Simulation in Biomechanics*: Cleveland, OH, July 2005. [Nominated for Young Scientist Award]
- Umberger BR, Gerritsen KGM & Martin PE. Dependence of muscle energy expenditure on stride rate in walking. *American College of Sports Medicine Annual Meeting*: Indianapolis, IN, June 2004.
- Umberger BR & Martin PE. Mechanics and energetics of walking at different stride rates. *American Society of Biomechanics Annual Conference*: Toledo, OH, September 2003.
- Hunter RD, Martin PE & Umberger BR. Gender differences in muscle recruitment patterns during landing. *American Society of Biomechanics Annual Conference*: Toledo, OH, September 2003.
- Smith J, Wilkerson J & Umberger BR. Relationship between linear wrist velocity and impulse during fastball pitching in Collegiate baseball pitchers. *World Congress of Biomechanics*: Calgary, Alberta, Canada. August 2002.

- Umberger BR, Martin PE & Gerritsen KGM. A theoretical study of the energetic cost of human walking. *Earth and Life Sciences Graduate Symposium - Arizona State University*: Tempe, AZ, February 2002.
- Umberger BR, Gerritsen KGM & Martin PE. A model of human muscle energy expenditure. *American Society of Biomechanics Annual Conference*: San Diego, CA, August 2001.
- Martin PE, Sanderson DJ & Umberger BR. Power and cadence effects on muscle activity in cycling. *Congress of the International Society of Biomechanics*: Zurich, Switzerland. July 2001.
- Umberger BR, Nagano A & Gerritsen KGM. Predicting power output in simulated vertical jumping. *American College of Sports Medicine Annual Meeting*: Baltimore, MD, June 2001.
- Robertson SD, Kao JC, Wings JB & Umberger BR. The relationship between preferred upper extremity interlimb coordination and postural stability. *North American Society for the Psychology of Sport & Physical Activity Annual Meeting*: St. Louis, MO, June 2001.
- Umberger BR & Martin PE. Testing the planar assumption during ergometer cycling. *American College of Sports Medicine Annual Meeting*: Indianapolis, IN, June 2000.
- Umberger BR, Nawoczenski DA & Ludewig PM. Rotation sequence effects on clinical interpretation of 3-D hallux motion. *Congress of the International Society of Biomechanics*: Calgary, Alberta, Canada. August 1999.
- Umberger BR, Nawoczenski DA & Baumhauer JF. Reliability and validity of first metatarsophalangeal joint orientation measured with an electromagnetic tracking device. *North American Congress on Biomechanics*: Waterloo, Ontario, Canada. August 1998.
- Umberger BR, Scheuchenzuber HJ & Manos TM. Differences in power output during cycling at different seat tube angles. *American College of Sports Medicine Annual Meeting*: Orlando, FL, June 1998.

Teaching Experience

- UNIV 197K *The Limits of Human Performance*. University of Massachusetts Amherst. Fall 2009. Instructor for a one-credit seminar course, targeted at first-year students.
- KIN 236 *Neuromechanics of Human Motion*. University of Massachusetts Amherst. 2009-2016 (taught four times). Instructor for undergraduate integrative course on the biomechanics and control of human movement employing a problem-based learning approach.
- KIN 430 *Biomechanics*. University of Massachusetts Amherst. 2007-2017 (taught 16 times). Instructor for lab-based undergraduate course on biomechanical aspects of human movement.
- KIN 530 *Mechanical Analysis of Human Motion*. University of Massachusetts Amherst. Fall 2008-2013 (taught twice). Instructor for a graduate course on biomechanics of human movement.
- KIN 697R *Biomechanics and Motor Control Journal Club*. University of Massachusetts Amherst. 2006-2017 (taught 22 times). One of five instructors who coordinate a journal club every semester for graduate students in biomechanics and motor control.

KIN 797U *Computer Simulation of Human Movement*. University of Massachusetts Amherst. 2007-2016 (taught five times). Instructor for advanced graduate course on musculoskeletal modeling and computer simulation of human movement.

KHP 515 *Anatomical & Mechanical Kinesiology*. University of Kentucky. 2003-2006 (taught six times). Instructor for lab-based undergraduate course on anatomical and mechanical aspects of human movement.

KHP 610 *Motor Control I*. University of Kentucky. Fall 2004. Instructor for graduate survey course on control and coordination of human movement.

KHP 615 *Biomechanics of Fundamental Movements*. University of Kentucky. 2004-2005 (taught three times). Instructor for graduate course on biomechanics of human movement and related measurement techniques.

KHP 781 *Computer Methods in Exercise Science*. University of Kentucky. Fall 2005. Instructor for graduate course on computer systems and programming topics for students in the movement sciences.

EPE 510 *Introduction to Biomechanics Research Methods*. Arizona State University. Fall 2000. One of two instructors for a team-taught graduate course on biomechanics of human movement and related measurement techniques.

EPE 335 *Biomechanics*. Arizona State University. Summer 2000. Instructor for undergraduate course on mechanical aspects of human movement.

670-31000 *Human Anatomy (Lower & Upper Limbs)*. Ithaca College. Summer 1998. One of three instructors for a team-taught gross anatomy course with dissection.

PHED 362 *Skeletal Biomechanics*. Springfield College. Spring 1997. Instructor for graduate course on biomechanics of the musculoskeletal system.

PHED 119 *Kinesiology*. Springfield College. Spring 1997. Instructor for undergraduate course on anatomical and mechanical aspects of human movement.

Professional Affiliations

American Association for the Advancement of Science, 2009-present

American Society of Biomechanics, 1999-present

International Society of Biomechanics, 1999-present

American College of Sports Medicine, 1994-present

Mentoring & Supervisory Experience

Postdoctoral

Leng-Feng Lee, PhD, NSF Postdoctoral Fellow. 2011-2015

Matthew O'Neill, PhD, NSF Postdoctoral Fellow. 2010-2011

Graduate Students - Committee Chair

Jonaz Moreno, MS/PhD student. Anticipated graduation - 2021
Russell Johnson, PhD student. Anticipated graduation - 2019
Ryan Wedge, PhD student. Anticipated graduation - 2018
Kristen Murphy, MS student. Graduated - 2017
Kasey Kellard, MS student. Graduated - 2016
Alexis Gidley, PhD student. Graduated - 2016
Shelby Wozmak, MS student. Graduated - 2015
Nathan Smith, MS student. Graduated - 2015
Russell Johnson, MS student. Graduated - 2015
Jennifer Ladd, MS student. Graduated - 2014
Laura Poore, MS student. Graduated - 2014
Ansel Garvey, MS student. Graduated - 2014
Michael Busa (co-chair), PhD student. Graduated - 2014
Natalie Pavlov, MS student. Graduated - 2013
Alicia Caswell, MS student. Graduated - 2013
Allison Gruber (co-chair), PhD student. Graduated - 2012
Aisha Visram (co-chair), MS student. Graduated - 2012
Nicole Hammond, MS student. Graduated - 2012
Mark Lebeda, MS student. Graduated - 2012
Michelle LaBoda, MS student. Graduated - 2011
Nicole Lovejoy, MS student. Graduated - 2011
Jenae McClusky, MS student. Graduated - 2010
Michael Welch, MS student. Graduated - 2010
Danielle Pelissier, MS student. Graduated - 2010
Paul Cacolice, MS student. Graduated - 2010
Lacy Yager, MS student. Graduated - 2009
Christopher Martin, MS student. Graduated - 2009
Kristen Wilson, MS student. Graduated - 2008
Matt Seeley, PhD student. Graduated - 2006*
Gabe Fendley, MS student. Graduated - 2005*
* Supervised while at the University of Kentucky

Graduate Students - Committee Member or External Examiner

Sangsoo Park, PhD student. Anticipated graduation – 2018
David Hill, PhD student (Massachusetts Institute of Technology). Anticipated graduation - 2018
Scott Brennan, PhD student (University of Queensland). Anticipated graduation - 2017
Scott Ducharme, PhD student. Graduated - 2017
Andrew LaPre, PhD student (Mechanical Engineering). Graduated - 2016
Yi-Fen Lin, PhD student (Biology). Graduated - 2016
Abhijit Kadrolkar, PhD student (Mechanical Engineering). Graduated - 2016

Matthew Furtney, MS student (Massachusetts Institute of Technology). Graduated - 2016
Andrew LaPre, PhD student (Mechanical Engineering). Graduated - 2016
Haohan Zhang, MS student (Mechanical Engineering). Graduated - 2014
Devon Frayne, MS student. Graduated - 2013
Luis Rosado, MS student. Graduated - 2013
Scott Kuindersma, PhD student (Computer Science). Graduated - 2012
Jennifer Baird, PhD student. Graduated - 2012
Damien Callahan, PhD student. Graduated - 2011
Pedro Rodrigues, PhD student. Graduated - 2011
Elizabeth Russell, PhD student. Graduated - 2011
Ross Miller, PhD student. Graduated - 2011
Melanie Scholz, PhD student (Vrije Universiteit Amsterdam). Graduated - 2009
Christopher Hasson, PhD student. Graduated - 2009
Molly Wilson, PhD student. Graduated - 2008*
Ann Livengood, PhD student, Graduated - 2008*
Lori Bolgla, PhD student. Graduated - 2005*
John Crawley, MS student. Graduated - 2005*
Jeff Buhr, MS student. Graduated - 2005*
Brandon Ray, MS student. Graduated - 2004*

* Supervised while at the University of Kentucky

Undergraduate Students - Honors Theses & Research Projects

Kiichi Ash, 2017-2018
Aidan Burke, 2017-2018
Kevin Anton, 2016-2017
Carmine Taglienti (Mechanical Engineering), 2016-2017
William Klunk, 2011-2012
Nicolas Ioannou (Computer Science), 2011-2012
Courtney Chaulk, 2010-2011
Jillian Champagne, 2010-2011
Lisa Coppola, 2009-2010
Sean Driscoll, 2008-2009
Adam Iwanski (Mechanical Engineering), 2008-2009
Marisa Theroux-Jones (Mechanical Engineering), 2007-2008

Institutional Service (at University of Massachusetts)

Committee Member, Faculty Search Committee: Founding Head, Biomedical Engineering Dept, 2017
Committee Member, Faculty Search Committee: Kinesiology Asst/Assoc Professor, 2015
Chair, Department Personnel Committee, 2014-present

Chair, Faculty Search Committee: Kinesiology Assistant Professor, 2014
Committee Member, School Personnel Committee, 2014-2016
Committee Member, Faculty Search Committee: Kinesiology Assistant Professor, 2013
Chair, School By-laws Committee, 2012-2013
Chair, Faculty Search Committee: Kinesiology Assistant Professor, 2011
Acting Associate Graduate Program Director, Department of Kinesiology, 2011
Committee Member, Faculty Search Committee: Kinesiology Instructor, 2010
Judge, School of Public Health & Health Sciences Research Day, 2008-2010
Webmaster, UMass Amherst Human Imaging (MRI) Group, 2009-2010
Committee Member, Faculty Search Committee: Kinesiology Instructor, 2009
Committee Member, School By-laws Committee, 2008-2012
Committee Member, Department Curriculum Committee, 2008-2011
Coordinator, Graduate Athletic Training Concentration, 2007-2015
Abstract Reviewer, Annual Massachusetts Undergraduate Conference, 2007-2010
Committee Member, Department Personnel Committee, 2006-2014

Institutional Service (at University of Kentucky)

Committee Member, College Task Force on Inclusiveness, 2004-2006
Committee Member, Department Web Site Committee, 2004-2006
Committee Member, Undergraduate Exercise Science Committee, 2004-2006
Committee Member, Kirkpatrick Scholarship Committee, 2004-2006
Committee Member, Faculty Search Committee: Kinesiology - Pedagogy, 2004
Committee Member, Graduate Exercise Science Committee, 2003-2006

Service to Professional Societies

American Society of Biomechanics

Executive Board, 2017-2020 (President), 2012-2014 (Program Chair)
Panelist, Junior Faculty Mentoring Roundtable, 2013
Student Mentoring Program, 2011-present
Program Committee, 2012-2013, 2015
Conference Abstract Review Committee, 2008-2011, 2016
Annual Conference Session Moderator, 2008, 2009, 2012, 2013, 2015

World Council of Biomechanics, World Congress Symposium Organizer, 2014, 2018

International Society of Biomechanics, Biennial Congress Session Moderator, 2017

American College of Sports Medicine Annual Meeting, Abstract Review Committee, 2010-2012, 2015-2016

American College of Sports Medicine Biomechanics Interest Group, Awards Committee, 2009

Gait & Clinical Movement Analysis Society, Annual Meeting Program Committee, 2007-2013

Annual Symposium on 3D Analysis of Human Movement, Program Committee, 2010

Editorial Positions

Associate Editor, *Medicine & Science in Sports & Exercise*. 2016-present.

Editorial Board, *Journal of Applied Biomechanics*. 2017-present.

Guest Editor, *Journal of Biomechanics*. 2015, Special issue (vol. 48, no. 11) highlighting American Society of Biomechanics symposia from the 2014 World Congress of Biomechanics.

Manuscript Review (Ad Hoc)

Journal of Biomechanics

Journal of Applied Biomechanics

Journal of the Royal Society Interface

Journal of Experimental Biology

Proceedings of the National Academy of Sciences

Journal of Applied Physiology

Medicine and Science in Sports and Exercise

Exercise and Sport Sciences Reviews

Journal of Biomechanical Engineering

Journal of Human Evolution

Evolutionary Anthropology

Biological Cybernetics

Gait and Posture

Clinical Biomechanics

International Journal of Sports Medicine

IEEE Transactions on Biomedical Engineering

IEEE Transactions on Neural Systems & Rehabilitation Engineering

Sports Biomechanics

Annals of Biomedical Engineering

Grant Review Panels

U.S. National Science Foundation - Integrative Organismal Systems Division, 2016

Grant Proposal Review (Ad Hoc)

U.S. National Science Foundation - Integrative Organismal Systems Division

U.S. National Science Foundation - Behavioral and Cognitive Science Division

American Institute of Biological Sciences

The Canada Foundation for Innovation

Michael Smith Foundation for Health Research (British Columbia, Canada)

American Heart Association - Bioengineering and Biotechnology Study Group

External Reviewer for Tenure and/or Promotion

Department of Kinesiology, The Pennsylvania State University
College of Health Professions, Medical University of South Carolina