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Education

- 2010–2012 **Postdoctoral Training** in Mechanical Engineering, Queen's University
Advisor: Kevin J. Deluzio
Program: *Bone and joint health technologies*
- 2006–2010 **Doctor of Philosophy** in Kinesiology, University of Massachusetts
Advisor: Graham E. Caldwell
Dissertation: *Optimal control of human running*
- 2004–2006 **Master of Science** in Exercise & Sport Science, Iowa State University
Advisor: Jason C. Gillette
Thesis: *Lower extremity mechanics of iliotibial band syndrome during an exhaustive run*
- 2003–2005 **Master of Science** in Mechanical Engineering, Iowa State University
Advisor: Francine Battaglia
Thesis: *A numerical analysis of hemodynamics for arterial medical procedures*
- 1999–2003 **Bachelor of Science** in Mechanical Engineering, Iowa State University

Professional History

- 2012–pres **University of Maryland (College Park, MD)**
Assistant Professor, Department of Kinesiology, 2012–pres
- 2010–2012 **Queen's University (Kingston, ON)**
Research Associate, C-Motion Inc., 2011–2012
Postdoctoral Fellow, Department of Mechanical & Materials Engineering, 2010–2012
- 2006–2010 **University of Massachusetts (Amherst, MA)**
Graduate Assistant, Department of Kinesiology, 2006–2010
- 2003–2006 **Iowa State University (Ames, IA)**
Graduate Assistant, Department of Health & Human Performance, 2005–2006
Graduate Assistant, Department of Mechanical Engineering, 2003–2005

Scholarship

Journal Publications

Russell EM, **Miller RH**, Umberger BR, and Hamill J (2012). Lateral wedges alter mediolateral load distributions at the knee joint in obese individuals. *Journal of Orthopaedic Research*, accepted.

Gillette JC, Stevermer CA, **Miller RH**, Edwards WB, and Schwab CV (2012). Lower extremity joint moments during carrying tasks in children. *Journal of Applied Biomechanics* **28**, 156–164.

Miller RH, Umberger BR, and 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, and Caldwell GE (2012). Limitations to maximum sprinting speed imposed by muscle mechanical properties. *Journal of Biomechanics* **45**, 1092–1097 [**RHM: ASB Young Scientist Pre-Doctoral Award**].

Miller RH, Umberger BR, Hamill J, and Caldwell GE (2012). Evaluation of the minimum energy hypothesis and other potential optimality criteria for human running. *Proceedings of the Royal Society on London B: Biological Sciences* **279**, 1498–1505.

John D, **Miller RH**, Kozey-Keadle SL, Caldwell GE, and Freedson PS (2012). Biomechanical examination of the plateau phenomenon in ActiGraph vertical activity counts. *Physiological Measurement* **33**, 219–230.

Miller RH and Caldwell GE (2011). Practical lessons on running and jumping from computer simulations. *Track & Cross Country Journal* **1**, 38–48 [invited review; not peer reviewed].

Hasson CJ, **Miller RH**, and Caldwell GE (2011). Contractile and elastic ankle joint muscular properties in young and older adults. *PLoS ONE* **6**, e15953.

Hamill J, Russell EM, Gruber AH, and **Miller RH** (2011). Impact characteristics in shod and barefoot running. *Footwear Science* **3**, 33–40.

Miller RH, Chang R, Baird JL, Van Emmerik REA, and Hamill J (2010). Variability in kinematic coupling assessed by vector coding and continuous relative phase. *Journal of Biomechanics* **43**, 2554–2560.

Gillette JC, Stevermer CA, **Miller RH**, Meardon SA, and Schwab CV (2010). The effects of age and type of carrying task on lower extremity kinematics. *Ergonomics* **53**, 355–364.

Hamill J, Russell EM, Gruber AH, **Miller RH**, and O'Connor KM (2009). Extrinsic foot muscle forces when running in varus, valgus and neutral shoes. *Footwear Science* **1**, 153–161.

Miller RH, Caldwell GE, Van Emmerik REA, Umberger BR, and Hamill J (2009). Ground reaction forces and lower extremity kinematics when running with suppressed arm swing. *Journal of Biomechanical Engineering* **131**, 124502.

Miller RH and Hamill J (2009). Computer simulation of the effects of shoe cushioning on internal and external loading during running impacts. *Computer Methods in Biomechanics & Biomedical Engineering* **12**, 481–490.

Miller RH, Gillette JC, Derrick TR, and Caldwell GE (2009). Muscle forces during running predicted by gradient-based and random search static optimisation algorithms. *Computer Methods in Biomechanics & Biomedical Engineering* **12**, 217–225.

Hamill J, **Miller RH**, Noehren B, and Davis IS (2008). A prospective study of iliotibial band strain in runners. *Clinical Biomechanics* **23**, 1018–1025.

Miller RH, Meardon SA, Derrick TR, and Gillette JC (2008). Continuous relative phase variability during an exhaustive run in runners with a history of iliotibial band syndrome. *Journal of Applied Biomechanics* **24**, 262–270.

Miller RH, Lowry JL, Meardon SA, and Gillette JC (2007). Lower extremity mechanics of iliotibial band syndrome during an exhaustive run. *Gait & Posture* **26**, 407–413.

Conference Abstracts, Proceedings, & Papers

Miller RH, Edwards WB, Morton AM, and Deluzio KJ (2013). Why don't runners get knee osteoarthritis? Peak and cumulative joint loads in human gait. *American College of Sports Medicine 60th Annual Meeting*, Indianapolis, IN, May 29–June 1, 2013 [invited Featured Science Session].

Gruber AH, Umberger BR, **Miller RH**, and Hamill J (2013). The relationship between achilles tendon moment arm length and rate of oxygen consumption in natural rearfoot and forefoot runners. *American College of Sports Medicine 60th Annual Meeting*, Indianapolis, IN, May 29–June 1, 2013.

Miller RH (2012). Why do humans walk the way we do? Evidence from dynamic simulations. *American Society of Biomechanics 36th Annual Meeting*, Gainesville, FL, August 15–18, 2012.

Miller RH, Brandon SCE, and Deluzio KJ (2012). Discriminating between knee osteoarthritis severity levels in walking using only force platform data. *American Society of Biomechanics 36th Annual Meeting*, Gainesville, FL, August 15–18, 2012.

Brandon SCE, **Miller RH**, Thelen DG, and Deluzio KJ (2012). Knee osteoarthritis subjects activate muscles to unload medial condyle. *17th Biennial Conference of the Canadian Society for Biomechanics*, Burnaby, BC, June 6–9, 2012.

Miller RH, Brandon SCE, and Deluzio KJ (2012). Predicting sagittal plane kinematics that minimize the knee joint contact force. *17th Biennial Conference of the Canadian Society for Biomechanics*, Burnaby, BC, June 6–9, 2012.

Miller RH and Caldwell GE (2012). Antagonism and the metabolic cost of simulated human locomotion. *17th Biennial Conference of the Canadian Society for Biomechanics*, Burnaby, BC, June 6–9, 2012.

Miller RH and Deluzio KJ (2012). Muscle mechanical properties should be considered when predicting knee joint loading with static optimization. *17th Biennial Conference of the Canadian Society for Biomechanics*, Burnaby, BC, June 6–9, 2012.

John D, **Miller RH**, Kozey-Keadle SL, Caldwell GE, and Freedson PS (2012). Why do ActiGraph vertical activity counts level off? A new perspective. *American College of Sports Medicine 59th Annual Meeting*, San Francisco, CA, May 29–June 2, 2012.

Miller RH and Deluzio KJ (2011). Are running and sprinting different gait modes? Evidence from forward dynamics simulations. *American Society of Biomechanics 35th Annual Meeting*, Long Beach, CA, August 10–13, 2011.

Miller RH, Umberger BR, Kent-Braun JA, and Caldwell GE (2011). Virtual aging of the muscular system and its effects on running biomechanics. *American Society of Biomechanics 35th Annual Meeting*, Long Beach, CA, August 10–13, 2011.

Miller RH, Umberger BR, and Caldwell GE (2011). Optimality criteria for human running investigated by forward dynamics simulations. *29th International Conference on Biomechanics in Sports*, Porto, Portugal, June 27–July 1, 2011.

Miller RH, Umberger BR, and Caldwell GE (2010). Theoretical analysis of limitations to maximum sprinting speed imposed by muscle mechanical properties. *American Society of Biomechanics 34th Annual Meeting*, Providence, RI, August 18–21, 2010 [**RHM: ASB Young Scientist Pre-Doctoral Award**].

Hamill J, Gruber AH, Russell EM, **Miller RH**, and Van Emmerik REA (2010). Does changing footfall pattern alter running performance? *6th World Congress on Biomechanics, Singapore*, August 1–6, 2010.

Gruber AH, **Miller RH**, Van Emmerik REA, and Hamill J (2010). Does running speed alter lower extremity segment coordination? *6th World Congress on Biomechanics, Singapore*, August 1–6, 2010.

Miller RH and Caldwell GE (2010). The effect of antagonism on the calculation of muscle model parameters. *16th Biennial Conference of the Canadian Society for Biomechanics*, Kingston, ON, June 9–12, 2010.

Miller RH, Umberger BR, and Caldwell GE (2010). Effects of history dependence on the mechanics and energetics of the Hill muscle model. *American College of Sports Medicine 57th Annual Meeting*, Baltimore, MD, June 2–5, 2010 [**RHM: ACSM Biomechanics Interest Group Student Research Award**].

Gruber AH, **Miller RH**, Russell EM, Van Emmerik REA, and Hamill J (2010). Alterations in joint kinematics and ground reaction forces with running speed. *American College of Sports Medicine 57th Annual Meeting*, Baltimore, MD, June 2–5, 2010.

Russell EM, **Miller RH**, and Hamill J (2010). Walking with obesity: differences in muscle function. *American College of Sports Medicine 57th Annual Meeting, Baltimore, MD, June 2–5, 2010* [EMR: ACSM Biomechanics Interest Group Student Research Award].

Miller RH, Russell EM, Gruber AH, and Hamill J (2009). Foot-strike pattern selection to minimize muscle energy expenditure during running: a computer simulation study. *American Society of Biomechanics 33rd Annual Meeting, State College, PA, August 26–29, 2009*.

Miller RH, Umberger BR, and Caldwell GE (2009). Muscle forces in the lower limb predicted by static and dynamic optimization. *American Society of Biomechanics 33rd Annual Meeting, State College, PA, August 26–29, 2009*.

Gillette JC, Stevermer CA, **Miller RH**, Edwards WB, and Schwab CV (2009). Lower extremity joint moments during carrying tasks in children. *American Society of Biomechanics 33rd Annual Meeting, State College, PA, August 26–29, 2009*.

Gruber AH, Russell EM, **Miller RH**, Chang R, and Hamill J (2009). Segment coordination response to alterations in foot strike pattern. *American Society of Biomechanics 33rd Annual Meeting, State College, PA, August 26–29, 2009*.

Hasson CJ, **Miller RH**, Foulis SA, Kent-Braun JA, and Caldwell GE (2009). Application of musculoskeletal models to aging: obtaining subject-specific measures of muscle volume using MRI. *American Society of Biomechanics 33rd Annual Meeting, State College, PA, August 26–29, 2009*.

Russell EM, Gruber AH, **Miller RH**, O'Connor KM, Van Emmerik REA, and Hamill J (2009). Wedged footwear perturbations affect lower extremity coordination dynamics. *27th International Conference on Biomechanics in Sports, Limerick, Ireland, August 17–21, 2009*.

Van Emmerik REA, **Miller RH**, and Hamill J (2009). Dynamical systems approach to movement coordination. *27th International Conference on Biomechanics in Sports, Limerick, Ireland, August 17–21, 2009*.

Hamill J, Russell EM, Gruber AH, **Miller RH**, and O'Connor KM (2009). Extrinsic foot muscle forces when running in varus, valgus and neutral shoes. *9th Biennial Footwear Biomechanics Symposium, Stellenbosch, South Africa, July 10–12, 2009*.

Hamill J, **Miller RH**, Gruber AH, and Russell EM (2009). Extrinsic foot muscle forces during running with different footfall patterns. *22nd Congress of the International Society of Biomechanics, Cape Town, South Africa, July 5–9, 2009*.

Miller RH, Umberger BR, Hamill J, and Caldwell GE (2009). Dynamic optimization of maximum-effort human sprinting. *American Society of Mechanical Engineers Summer Bioengineering Conference, Lake Tahoe, CA, June 17–21, 2009*.

Hamill J, **Miller RH**, Noehren B, and Davis IS (2008). A prospective study on iliotibial band syndrome. *11th Annual International Conference on Foot Biomechanics & Orthotic Therapy, Vancouver, BC, October 24–26, 2008*.

Miller RH, Caldwell GE, and Kent-Braun JA (2008). Fatigue in a Hill-based muscle model of human tibialis anterior. *American Physiological Society Intersociety Meeting: The Integrative Biology of Exercise V, Hilton Head, SC, September 24–27, 2008*.

Edwards WB, Sealine BJ, **Miller RH**, Gillette JC, and Derrick TR (2008). Static optimization of muscle forces during drop landings: a comparison of cost functions. *4th North American Congress on Biomechanics, Ann Arbor, MI, August 5–9, 2008*.

Hasson CJ, **Miller RH**, and Caldwell GE (2008). Determination of subject-specific mechanical properties of individual ankle joint muscles. *4th North American Congress on Biomechanics, Ann Arbor, MI, August 5–9, 2008*.

Miller RH and Hamill J (2008). Computer simulation of internal structural loading: application to overuse running injuries. *4th North American Congress on Biomechanics*, Ann Arbor, MI, August 5–9, 2008.

Miller RH, Hasson CJ, and Caldwell GE (2008). Subject-specific force-length parameters of the ankle plantarflexors in young adults. *4th North American Congress on Biomechanics*, Ann Arbor, MI, August 5–9, 2008.

Miller RH, Caldwell GE, Van Emmerik REA, Hamill J, and Umberger BR (2008). Does restraining arm motion alter ground reaction forces during running? *4th North American Congress on Biomechanics*, Ann Arbor, MI, August 5–9, 2008.

Miller RH, Umberger BR, and Caldwell GE (2008). Optimal control solutions for a simple model of human jumping. *American Society of Mechanical Engineers Summer Bioengineering Conference*, Marco Island, FL, June 25–29, 2008.

Gillette JC, Stevermer CA, **Miller RH**, and Schwab CV (2008). Effects of asymmetric carrying tasks on lower extremity kinematics in farm children. *National Institute for Farm Safety International Meeting*, Lancaster, PA, June 22–26, 2008.

Russell EM, **Miller RH**, and Hamill J (2008). Stride length influences knee joint moments and contact forces during walking in obese women. *American College of Sports Medicine 55th Annual Meeting*, Indianapolis, IN, May 28–31, 2008 [[EMR: ACSM Biomechanics Interest Group Student Research Award](#)].

Hamill J, **Miller RH**, Noehren B, and Davis IS (2007). Strain in the iliotibial band: a cause of injury? *44th Annual Technical Meeting of the Society of Engineering Science*, College Station, TX, October 21–24, 2007.

Hamill J, **Miller RH**, Noehren B, and Davis IS (2007). A strain model of the iliotibial band. *25th International Conference on Biomechanics in Sports*, Ouro Preto, Brazil, August 23–27, 2007.

Miller RH, Caldwell GE, and Derrick TR (2007). Determining vertical ground reaction forces without a force platform using a mass-spring-damper model. *American Society of Biomechanics 31st Annual Meeting*, Palo Alto, CA, August 22–25, 2007.

Miller RH, Gillette JC, and Derrick TR (2007). Sensitivity of muscle force predictions during over-ground running to choice of optimization algorithm. *American College of Sports Medicine 54th Annual Meeting*, New Orleans, LA, May 31–June 3, 2007.

Meardon SA, **Miller RH**, Derrick TR, and Gillette JC (2006). Lower extremity coupling variability during an exhaustive run in individuals with iliotibial band syndrome. *American Society of Biomechanics 30th Annual Meeting*, Blacksburg, VA, September 6–9, 2006.

Miller RH and Battaglia F (2006). A novel computational approach for modeling stent reconstruction of an aortic bifurcation. *American Society of Mechanical Engineers Joint US-European Fluids Engineering Division Summer Meeting*, Miami, FL, July 17–20, 2006.

Meardon SA, Gillette JC, Stevermer CA, **Miller RH**, Derrick TR, Schwab CV, and Freeman SA (2006). Age and condition related differences during carrying tasks in farm youth. *American College of Sports Medicine 53rd Annual Meeting*, Denver, CO, May 30–June 2, 2006.

Miller RH, Lowry JL, and Gillette JC (2006). Prediction of iliotibial band strain during running. *American College of Sports Medicine 53rd Annual Meeting*, Denver, CO, May 30–June 2, 2006.

Miller RH, Battaglia F, and Olsen MG (2005). A computational and experimental investigation of flow in an intracranial side-wall aneurysm. *American Society of Mechanical Engineers Fluids Engineering Division Summer Meeting*, Houston, TX, June 19–23, 2005.

Invited Presentations

Miller RH (2012). Gait biomechanics and the prevention of knee osteoarthritis. *9th Annual Orthopaedic Care Conference*, Kingston, ON, October 26, 2012.

Miller RH (2012). New questions on the mechanics, energetics, and motor control of human walking. *University of Maryland*, College Park, MD, March 26, 2012.

Miller RH (2012). Curiosity and clinically motivated questions on the biomechanics of human walking. *University of Massachusetts Amherst*, Amherst, MA, February 15, 2012.

Miller RH (2011). Optimality criteria for predictive simulations of human running. *Queen's University*, Kingston, ON, February 9, 2011.

Miller RH (2010). Computer simulation of human running. *Mount Holyoke College*, Holyoke, MA, April 12, 2010.

Book Chapters

Van Emmerik REA, **Miller RH**, and Hamill J (2012). Dynamical systems methods for the analysis of movement coordination. In: Robertson DGE, Caldwell GE, Hamill J, Kamen G, and Whittlesey SN (eds.), *Research Methods in Biomechanics* 2nd Ed. Champaign: Human Kinetics.

Hamill J, Gruber AH, and **Miller RH** (2012). Footwear effects on running kinematics. In: Goonetilleke RV (ed.), *The Science of Footwear*. Boca Raton: CRC Press.

Grantsmanship

Statistical models for establishing a control data set for biomechanical gait analysis (2012). Natural Sciences & Engineering Research Council of Canada (EGP 437693-12). Funding: CAD\$25,000 over six months. Role: co-investigator. Status: active.

Integrating OpenSim with high-performance computing to predict optimal walking gaits (2012). National Center for Simulation in Rehabilitation Research (Visiting Scholars Program). Funding: \$1,500 over one week. Role: principal investigator. Status: declined (unable to make travel dates).

Neuromuscular contribution to contact forces in knee osteoarthritis subjects (2011). National Center for Simulation in Rehabilitation Research (Pilot Projects Program) Funding: \$5,000 over one year. Role: co-investigator. Status: completed.

Insights into human running through computer simulations (2008). University of Massachusetts Amherst (Graduate School Fellowship) Funding: \$12,500 over one year. Role: principal investigator. Status: completed.

A subject-specific musculoskeletal model of the iliotibial tract (2007). American Society of Biomechanics (Graduate Student Grant-In-Aid) Funding: \$863 over one year. Role: principal investigator. Status: completed.

Service

Professional Memberships

2007–pres American Society of Biomechanics
2004–2011 American Society of Mechanical Engineers

Professional Service

- 2013 Abstract reviewer – American College of Sports Medicine Annual Meeting
- 2012–pres Abstract reviewer – American Society of Biomechanics Annual Meeting
- 2010–pres Associate Editor – *Track & Cross Country Journal*

Manuscript reviewer for *European Journal of Applied Physiology*, *Footwear Science*, *Journal of Applied Biomechanics*, *Journal of Biomechanical Engineering*, *Journal of Biomechanics*, *Journal of Foot & Ankle Research*, *Journal of Physiology*, *Journal of Sports Sciences*, *Kinesiology Review*, *Medicine & Science in Sports & Exercise*, *Sports Biomechanics*

Service at Maryland

Department of Kinesiology

- 2012–pres Member, graduate program and admissions committee

Awards & Honors

- 2010 American Society of Biomechanics – Young Scientist Pre-Doctoral Award
- 2010 American College of Sports Medicine – Biomechanics Interest Group Student Research Award
- 2005 Iowa State University – Teaching Excellence Award
- 2003 Iowa State University – Premium for Academic Excellence
- 2003 Iowa State University – Graduation with Distinction

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