

Michelle F. Heller, Ph.D., P.E.
Managing Engineer

Professional Profile

Dr. Michelle F. Heller is a Managing Engineer in Exponent's Biomechanics practice. Her areas of expertise include human injury biomechanics, premises liability issues, slip and fall events, pedestrian-vehicle interactions, human gait, and postural stability. She also evaluates occupant kinematics and injury mechanisms in automobile collisions, including frontal, rear-end, and lateral impacts, as well as rollovers. She has worked on medical device design, including the development of a new fabrication method for diagnostic ultrasound transducers, and has experience using animal preparations to investigate mechanical and physiological responses to various stimuli.

Dr. Heller's research has focused on various aspects of human movement and locomotion. She has worked in a gait lab and used an optical motion capture system, force plates, and electromyography (EMG) to study walking, jogging, and postural control. She has also investigated how cognitive distractions affect an individual's motion and ability to perceive details of their surroundings. Dr. Heller has also analyzed occupant motion and injury risk resulting from automotive collisions. Her research has been presented at both national and international conferences.

Prior to joining Exponent, Dr. Heller was a Research Assistant in the Department of Mechanical and Nuclear Engineering at The Pennsylvania State University and worked in the Biomechanics Laboratory.

Academic Credentials and Professional Honors

Ph.D., Mechanical Engineering, The Pennsylvania State University, 2005
M.S., Bioengineering, The Pennsylvania State University, 2002
B.S., Engineering Science (minors in Engineering Mechanics and Bioengineering),
The Pennsylvania State University, 2000

International Society of Biomechanics Dissertation Award; NASA Space Grant Consortium Fellowship; Schreyer Honors College Scholarship; Hallowell Scholarship

Licenses and Certifications

Licensed Professional Engineer, Pennsylvania, #PE076806
Licensed Professional Engineer, Maryland, #36079

Additional Training

Bloodstain Pattern Analysis for the Laboratory Scientist, The Forensic Science Training Institute at Cedar Crest College, 2009

Traffic Accident Reconstruction, Northwestern University Center for Public Safety, 2008

Publications

Heller MF, Newberry WN, Smedley JE, Eswaran S, Croteau JJ, Carhart MR. Occupant kinematics and injury mechanisms during rollover in a high strength-to-weight ratio vehicle. Society of Automotive Engineers (SAE) Technical Paper 2010-01-0516, 2010.

Heller MF, Imler SM, Zhao K, Watson HN, Corrigan CF. The effect of frontal collision delta-V and restraint status on injury outcome. Society of Automotive Engineers (SAE) Technical Paper 2010-01-0145, 2010.

Imler SM, Heller MF, Zhao K, Watson HN, Corrigan CF. The effect of side impact collision delta-V, restraint status, and occupant position on injury outcome. Society of Automotive Engineers (SAE) Technical Paper 2010-01-1158, 2010.

Heller MF, Prange MT, Ong KL, Watson HN, Iyer M, Ivarsson BJ, Fisher JL. Injury patterns among special populations involved in pedestrian crashes. Society of Automotive Engineers (SAE) Technical Paper 2010-01-1165, 2010.

Prange MT, Heller MF, Watson HN, Iyer M, Ivarsson BJ, Fisher JL. Age effects on injury patterns in pedestrian crashes. Society of Automotive Engineers (SAE) Technical Paper 2010-01-1164, 2010.

Welch TDJ, Bridges AW, Gates DH, Heller MF, Stillman D, Raasch CC, Carhart MR. An evaluation of the BioRID II and Hybrid III during low- and moderate-speed rear impact. Society of Automotive Engineers (SAE) Technical Paper 2010-01-1031, 2010.

Ong KL, Lau E, Moore T, Heller MF. Accidental falls involving medical implant re-operation. *Injury* 2009; 40(10): 1088-1092.

Heller MF, Challis JH, Sharkey NA. Changes in postural sway as a consequence of wearing a military backpack. *Gait Posture* 2009; 30(1):115–117.

Heller MF, Watson HN, Ivarsson BJ, Prange MT, Fisher JL. Using national databases to evaluate injury patterns in pedestrian impacts. Society of Automotive Engineers (SAE) Technical Paper 2009-01-1209, 2009.

Moore T, Fisher J, Heller M, Lau E, Watson H, Ong K. Occupant injury in motor vehicle collisions: Using field accident data from multiple sources. Society of Automotive Engineers (SAE) Technical Paper 2009-01-0394, 2009.

Heller MF, Kuzel MJ, Kwasniak AM, Cuadrado J. Individuals' abilities and behaviors and current technologies in intersection crosswalks. *Institute of Transportation Engineers (ITE) Journal* 2008; 78(12):40–43.

Mkandawire C, Mazzucco D, Vijayakumar V, Scher I, Heller M, Morrison H. Head kinematics and upper neck loading during simulated low-speed lateral impact collisions. *Proceedings, FISITA 2006 World Automotive Congress, Yokohama, Japan, Paper F2006T044*, 2006.

Heller MF. Biomechanical changes in gait and posture as a result of in-shoe orthoses and external load. Ph.D. Thesis, The Pennsylvania State University, 2005.

Robert MF, Molingou G, Snook K, Cannata J, Shung KK. Fabrication of focused poly(vinylidene fluoride-trifluoroethylene) P(VDF-TrFE) copolymer 40-50 MHz ultrasound transducers on curved surfaces. *Journal of Applied Physics* 2003; 96(1):252–256.

Snook K, Rhee S, Robert M, Gottlieb E, Shung KK. Development of P(VDF-TrFE) ultrasonic transducers operating at 50-120 MHz. *Proceedings, IEEE International Ultrasonics Symposium* 2002; 2:1249–1252.

Robert MF. New fabrication techniques for poly(vinylidene-trifluoroethylene) copolymer high frequency ultrasound transducers. M.S. Thesis, The Pennsylvania State University, 2002.

Robert MF. Neuromuscular stimulation using rectified sine-wave bursts. Honors Thesis, The Pennsylvania State University, 2000.

Presentations and Published Abstracts

Heller MF, Kuzel MJ. Footwear characteristics and potential implications on worker safety. *Proceedings, American Society of Safety Engineers 2011 Safety Conference, Chicago, IL, Session 636*, 2011.

Heller MF, George J, Kuzel MJ, Kwasniak AM. Effect of ascending and descending a curb on normal gait: A review of the literature. *Proceedings, International Conference on Slips, Trips, and Falls 2011, Buxton, United Kingdom*, 2011.

George J, Heller MF, Fritton KE, Kuzel MJ. Effect of shoe type on level-ground walking in women. *Proceedings, International Conference on Slips, Trips, and Falls 2011, Buxton, United Kingdom*, 2011.

Rodowicz KA, Muhammad R, Heller M, Sala J, Mkandawire C. Biomechanical, perceptual, and cognitive factors involved in maintaining postural control while standing or walking on non-moving and moving surfaces: A literature review. *Proceedings, ASME International Mechanical Engineering Congress & Exposition, Vancouver, British Columbia, IMECE2010-39276*, 2010.

Muhammad R, Rodowicz KA, Heller M, Sala J, Mkandawire C. Biomechanical, perceptual, and cognitive factors involved in balance recovery following unexpected perturbations: A

literature review. Proceedings, ASME International Mechanical Engineering Congress & Exposition, Vancouver, British Columbia, IMECE2010-39285, 2010.

Heller MF. Biomechanical perspectives on human walking and slip, trip and fall events. Proceedings, American Society of Safety Engineers 2010 Safety Conference, Baltimore, MD, Session 566, 2010.

Heller M, Kuzel M. Fashion footwear and the risk of falling in young women. Proceedings, The International Conference on Fall Prevention and Protection, Morgantown, WV, 2010.

Heller MF, George J, Yamaguchi GT, McGowan JC, Prange MT. Linear head accelerations resulting from short falls onto the occiput in children. Annual Meeting of the American Society of Biomechanics, University Park, PA, 2009.

Kuzel MJ, Heller MF, Sala JB, Ciccarelli L, Gray R. An analysis of real-world accidents involving distracted pedestrians. Proceedings, XXth Annual International Occupational Ergonomics and Safety Conference, Chicago, IL, 2008.

Ong K, Lau E, Moore T, Heller M. Characteristics of accidental falls involving re-surgery of medical implants. Proceedings, XXth Annual International Occupational Ergonomics and Safety Conference, Chicago, IL, 2008.

Cargill RS, Heller MF. Injury biomechanics: Evaluating the evidence to determine causation. Proceedings, Summer Bioengineering Conference, American Society of Mechanical Engineers, Marco Island, FL, Paper BIO2008-193123, 2008.

Heller M, DiJorio S, Kuzel M, Ciccarelli L, Carhart M. Effect of shoe type on stair negotiation in women. Proceedings, International Conference on Contemporary Ergonomics, Nottingham, United Kingdom, Paper W0109, 2008.

Kuzel M, Heller M, DiJorio S, Gray R, Straughn S. Perception and cognition during walking while concurrently using a cellular phone. Proceedings, International Conference on Contemporary Ergonomics, Nottingham, United Kingdom, Paper W0108, 2008.

Heller MF, Mkandawire C, Gloeckner DC, Bussone W, Scher I, Cargill RS. Head motion in the coronal plane during low-speed lateral impact collisions. XIth Congress of the International Society of Biomechanics, Taipei, Taiwan; Journal of Biomechanics 2007; 40(S2):S90.

Heller MF, Sharkey NA. Hindfoot flexibility and orthotic interventions as determinants of ankle kinematics during jogging. XIth Congress of the International Society of Biomechanics, Taipei, Taiwan; Journal of Biomechanics 2007; 40(S2):S135.

Cargill RS, Scher I, Bussone W, Heller MF. Current trends in amusement industry biomechanics: Introduction to biomechanics and rider kinematics. IAAPA Attractions Expo Education Programs, Atlanta, GA, 2006.

Heller MF, Sharkey NA. Foot type as a determinant of jogging kinematics. Proceedings, Summer Bioengineering Conference, American Society of Mechanical Engineers, Amelia Island, FL, Paper BIO2006-157602, 2006.

Heller MF, Challis JH, Sharkey NA. The effects of external weight carriage on postural stability. Proceedings, XXth Congress of the International Society of Biomechanics, Cleveland, OH, p. 574, 2005.

Sommer HJ, Heller MF, Challis JH, Sharkey NA. Postural control related to flexibility of the hindfoot when bearing heavy loads. Proceedings, XXth Congress of the International Society of Biomechanics, Cleveland, OH, p. 372, 2005.

Heller MF. The Bjork-Shiley convexo-concave artificial heart valve. Proceedings, The Pennsylvania State University 2005 Engineering Research Symposium, University Park, PA, 2005.

Heller MF, Sharkey NA. In-shoe orthoses and external load as modulators of local bone strain. Proceedings, The Pennsylvania State University 2005 Engineering Research Symposium, University Park, PA, 2005.

Robert MF, Shung KK. New fabrication techniques for poly(vinylidene-trifluoroethylene) copolymer high frequency ultrasound transducers. 5th Annual Ultrasonic Transducer Conference sponsored by the NIH Resource on Medical Ultrasonic Transducer Technology, Los Angeles, CA, 2003.

Robert MF. Neuromuscular simulation using rectified sine-wave bursts. National Conference for Undergraduate Research, Lexington, KY, 2001.

Invited Lectures and Seminars

Heller MF. Biomechanics in the sports and entertainment industries. Presented at Princeton University, Princeton, NJ, April 14, 2009.

Heller MF. Biomechanics of pedestrian-vehicle interactions. Presented at the School of Biomedical Engineering, Drexel University, Philadelphia, PA, April 3, 2009.

Heller MF. Human motion analysis and practical applications. Presented at Temple University, Philadelphia, PA, February 9, 2009 (with J. Day) and February 28, 2011.

Heller MF. Roof strength and injury potential in rollover collisions. Presented at the American Society of Mechanical Engineers Student Section, Widener University, Chester, PA, November 17, 2008.

Heller MF. Slips, trips, falls, and similar issues in personal injury. Presented at Columbia University, New York, NY, October 22, 2007.

Heller MF, Fisher JL. Biomechanics of motor vehicle collisions. Presented at the American Society of Mechanical Engineers Student Section, Widener University, Chester, PA, April 2, 2007.

Heller MF. Equilibrium and stability: Utilizing free body diagrams in biomechanics. Presented at California State University, Fullerton, CA, October 17, 2006.

Heller MF. Injury biomechanics: Using engineering and medical evidence to determine causation. Presented at The Pennsylvania State University, University Park, PA, April 21, 2006.

Peer Reviewer

- Society of Automotive Engineers—SAE

Professional Affiliations

- International Society of Biomechanics (member)
- American Society of Mechanical Engineers (member)
- Society of Automotive Engineers (member)