

**Jacob L. Fisher, Ph.D., P.E.**  
**Managing Engineer**

**Professional Profile**

Dr. Jacob L. Fisher is a Managing Engineer in Exponent's Biomechanics practice. Dr. Fisher addresses issues related to human injury biomechanics. He performs biomechanical accident reconstruction based on injury mechanisms to reconstruct the physical environment in which injury occurs and to illuminate critical timing issues regarding when and the order in which injuries occur during an accident sequence. His expertise includes injury causation and mechanisms of traumatic injuries associated with vehicular, pedestrian, occupational, and recreational accidents as well as consumer products, including analysis of alternative design proposals. His work has ranged from reconstructing high-speed pedestrian accidents to analyzing scenarios leading to falls from heights. He has investigated a wide array of motor vehicle accidents and injury and timing issues related to performance of vehicular components like air bags, seat backs, and belt restraints. Dr. Fisher also analyzes injury causation matters to assess whether the mechanisms of traumatic injury are present in an event and sufficient to be related to particular pathologies. This may include analysis of alternative injury scenarios.

Dr. Fisher's current research interests include pedestrian injury analysis and accident reconstruction, pedestrian safety and protection, occupant kinematics in low- and high-speed motor vehicle collisions, effectiveness of occupant protection systems such as seat belts and air bags, and the influences of pre-existing pathologies and occupant body size on injury mechanics. He is also knowledgeable in the areas of statics and dynamics, strength of engineering materials, mathematical modeling of biological systems, numerical methods and statistics.

Prior to joining Exponent, Dr. Fisher was a Whitaker Foundation Research Fellow in the Injury Biomechanics Laboratory at the University of Pennsylvania, where he investigated the biomechanics of ventilator-induced lung injury in alveolar epithelial cells, including the effects of mechanical strain on ionic transport, mechanotransduction leading to ionic channel modulation, and cellular membrane mechanics associated with these phenomena. Dr. Fisher continues to serve as a visiting lecturer at the University of Pennsylvania. Dr. Fisher was also an intern at the Institute for Aerospace Medicine at the German Aerospace Center in Cologne, Germany, where he analyzed biofilm sensitivity for aerospace applications. His undergraduate honors research at Penn State University analyzed backflow patterns around tilting disc heart valves.

**Academic Credentials and Professional Honors**

Ph.D., Bioengineering, University of Pennsylvania, Philadelphia, 2003  
B.S., Engineering Science and Mechanics, Penn State University (*summa cum laude*), 1996  
Minors in Bioengineering and German, Penn State University

Whitaker Foundation Graduate Student Fellowship in Biomedical Engineering  
National Science Foundation Graduate Research Fellowship  
Ashton Fellowship, University of Pennsylvania  
Student Marshall of Engineering Science and Mechanics (top of class), Penn State University  
Robert L. Waltmeyer Scholarship, Penn State University  
Wilbur and Judy Meyer Award, Penn State University  
Tau Beta Pi and Omicron Delta Kappa honor societies

### **Licenses and Certifications**

Licensed Professional Engineer, Maryland, #36778

### **Languages**

German (fluent); Mandarin Chinese (conversant)

### **Publications**

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.

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.

Fisher JL, Margulies SS. Modeling the effect of stretch and plasma membrane tension on  $\text{Na}^+/\text{K}^+$ -ATPase Activity in alveolar epithelial cells. *AJP: Lung Cell Mol Physiol* 2007; 292:40–53.

Bove RT, Fisher JL, Ciccarelli L, Cargill RS, Moore TLA. The effects of anthropometry on driver position and clearance measures. Paper 2006-01-0454 presented at the 2006 SAE World Congress, April 3–6, 2006.

Fisher JL, Levitan I, Margulies SS. Plasma membrane surface increases with tonic stretch of alveolar epithelial cells. *Am J Respir Cell Mol Biol*, 2004; 31:200–208.

Fisher JL. Mechanisms and means of Na<sup>+</sup>-K<sup>+</sup>-ATPase activation during alveolar epithelial stretch. Ph.D. Thesis, University of Pennsylvania, 2003.

Fisher JL, Margulies SS. Na<sup>+</sup>-K<sup>+</sup>-ATPase activity in alveolar epithelial cells increases with cyclic stretch. *AJP: Lung Cell Mol Physiol* 2002; 283:737–46.

### **Published Abstracts and Presentations**

Lange RL, Heller MF, Prange MT, Ivarsson BJ, Ong KL, Watson HN, Iyer M, Fisher JL (presenter). The Nationwide Inpatient Sample (NIS) as a source of data on pedestrian and cyclist injuries. SAE 2010 Government/Industry Meeting, Washington, DC, January 26–28, 2010.

Fisher JL, Bove RT, Moore TLA. Lumbar spine loads in low- and moderate-speed rear-end collisions. Proceedings, ASME Summer Bioengineering Conference, Abstract 192820, Marco Island, FL, June 25–29, 2008.

Lucas SR, Fisher JL, McGowan JC. Reconstruction and biomechanical analysis of low-speed automobile crashes. Proceedings, ASME Summer Bioengineering Conference, Abstract 192843, Marco Island, FL, June 25–29, 2008.

Lucas SR, Fisher JL, McGowan JC. Biomechanical analysis of occupant kinematics: Interpretation of witness marks. Proceedings, ASME Summer Bioengineering Conference, Abstract 192654, Marco Island, FL, June 25–29, 2008.

Steffey DL, Bove RT, Fisher JL, Cicarelli L, Cargill RS, Moore TLA. Characterization of occupant anthropometry and clearance measures in passenger cars. Joint Statistical Meetings, Seattle, WA, August 6–10, 2006.

Fisher JL, Newberry WN, Krishnan R, Pierce J, Moore TLA. Late-phase occupant rebound after rear-end impact. Proceedings, ASME Summer Bioengineering Conference, Abstract 188080, Vail, CO, June 22–26, 2005.

Fisher JL, Margulies SS. Modeling the effects of plasma membrane stretch on Na<sup>+</sup>/K<sup>+</sup>-ATPase in alveolar epithelial cells. Biomedical Engineering Society Annual Fall Meeting, Philadelphia, PA, October 13–16, 2004 (Awarded for Outstanding Scientific and Engineering Innovation).

Fisher JL, Margulies SS. Na<sup>+</sup>,/K<sup>+</sup>-ATPase stimulation adapts to tonic stretch in alveolar epithelial cells. Biomedical Engineering Society Annual Fall Meeting, Nashville, TN, October 1–4, 2003.

Fisher JL, Levitan I, Margulies SS. Changes in alveolar epithelial cell plasma membrane surface area with static stretch. Proceedings, ASME Summer Bioengineering Conference, Key Biscayne, FL, pp. 37–38, June 25–29, 2003.

Fisher JL, Margulies SS. Changes in alveolar epithelial cell surface area and plasma membrane surface area with stretch. International Meeting of the American Thoracic Society, Seattle, WA, May 16–21, 2003.

Fisher JL, Cavanaugh KJ, Margulies SS. Lung inflation: Too much of a good thing? Biomedical Engineering Society Annual Fall Meeting, Houston, TX, October 23–26, 2002.

Fisher JL, Margulies SS. Static stretch conditions alveolar epithelial cells against cyclic stretch injury. Biomedical Engineering Society Annual Fall Meeting, Durham, NC, October 4–7, 2001 (invited).

Fisher JL, Margulies SS.  $\text{Na}^+\text{-K}^+\text{-ATPase}$  pump activity in alveolar type II cells increases with stretch. International Conference of American Thoracic Society, Toronto, Canada, 2000.

Fisher JL, Margulies SS.  $\text{Na}^+\text{-K}^+\text{-ATPase}$  activity upregulation by stretch in alveolar epithelial cells. Respiratory Research Retreat of the University of Pennsylvania, 2000 (invited).

### **Selected Invited Presentations**

Fisher JL. Applications of biomechanics to real world accidents. Graduate Student Seminar, Massachusetts Institute of Technology, Cambridge, MA, May 19, 2010.

Fisher JL. Applications of injury biomechanics. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, February 22, 2010.

Fisher JL. Applications of injury biomechanics. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, February 23, 2009.

Fisher JL. Applications of injury biomechanics. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, February 28, 2008.

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

Fisher JL. Applications of injury biomechanics. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, January 29, 2007.

Fisher JL. Injury biomechanics: determination of injury mechanisms in real-world accidents. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, March 13, 2006.

Fisher JL. Applications of injury biomechanics. Nursing 534: Forensic Science, University of Pennsylvania, Philadelphia, PA, March 21, 2005.

## **Project Experience**

Reconstructed numerous accidents involving injured pedestrians and other extra-vehicular persons (e.g., occupants who had exited a vehicle), based on physical vehicle evidence, human kinematics, and injury patterns and mechanisms.

Analyzed occupant kinematics and injury mechanisms in frontal, rear-end, side impact, and rollover automotive collisions, including analysis of high speed rear-end collisions with regard to seat back yielding and lateral impacts with regard to side air bag presence and/or deployment.

Performed accident site investigations and biomechanical analyses of automotive pedestrian accidents, and slip-and-fall / trip-and-fall premises liability cases (on- and offshore).

Designed and conducted automotive sled testing with ATDs (crash test dummies) and roll-spit testing with human surrogates in the context of biomechanical analyses of real-world crashes.

Analyzed occupant kinematics and injury mechanisms in automotive accidents involving improper use of vehicle restraints, including improper seat belt routing (e.g., lap belt under the legs, shoulder harness behind the back, or under both arms) and situations with unusual belt geometry as a result of out-of-position seating. Analyses included a differential evaluation of injury potential in misuse scenarios versus proper use.

Investigated injuries sustained in sporting activities, such as personal watercraft accidents and horseback riding.

Performed numerous analyses of low-energy automotive accidents, including sideswipes and low-speed rear-end and frontal collisions to evaluate potential injury causation, exacerbation, or mitigation. Such analyses include comparisons of motions and forces experienced in an incident with those experienced in activities of daily living.

Evaluated the effects of congenital or degenerative pathologies, such as Klippel-Feil syndrome, ankylosing spondylitis, and diffuse idiopathic skeletal hyperostosis (DISH) on potential injury mechanisms and injury tolerance.