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Joseph E. Olberding, Ph.D., P.E.

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Professional Profile

Dr. Olberding applies mechanics and engineering principles to the human body to answer biomechanical questions related to how or if injuries occur, and how to prevent injuries. He analyzes human motion, how forces are applied to the human body, and the forces and mechanisms required to produce specific injuries for a variety of scenarios, with an emphasis on motor vehicle collisions, computational modeling, and pediatric injuries. In addition, he performs engineering evaluations of the safety of product designs regarding their role in injury mechanisms, and how modifications or alternative designs affect the risk of injury.

More specifically, Dr. Olberding investigates and reconstructs from a biomechanical perspective incidents involving motor vehicle collisions, particularly in the context of child restraint systems; children's and juvenile products; slips/trips and falls; falling objects; head impacts in athletics; pool diving and related underwater impacts; and the occupational environment. Dr. Olberding specializes in using computational modeling (such as MADYMO and other computational platforms) when appropriate in order to simulate the motions of and the forces on the human body. Similarly, he is experienced in evaluating the accuracy and validity of others' simulations on these same platforms. His project work also includes the development, conduct, and interpretation of specialized testing. The clients he has served include individuals, property groups, municipalities, utilities, law firms, insurance companies, and industry manufacturers (e.g., automotive, juvenile products, helmets, technology devices, pharmaceuticals, and other consumer products).

Dr. Olberding's recent research interests include the head-neck response, injury potential, and head protection in athletics-involved head impacts; the computational modeling of head impacts by everyday objects, the computational simulation of occupant responses to occupant restraint system designs; and methods for filtering accelerometer and other instrumentation data.

Dr. Olberding's academic background is in computational and experimental biomechanics, with particular emphasis in the nonlinear elasticity, viscoelasticity, and anisotropy of biological tissue and their relation to tissue injury, growth, and remodeling. This included the study of the solid-fluid viscoelastic mechanisms in traumatic brain injury by simulating high-speed impact using a finite-element based computational model, and the development of experimental and computational methods for the multiphasic constitutive characterization of very soft hydrated materials (such as brain tissue).

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, University of Michigan, Ann Arbor, 2010

M.S., Biomedical Engineering, Tulane University, 2004

B.S., Engineering, Biomedical Engineering, Tulane University, summa cum laude, 2003

Rackham Graduate Predoctoral Fellowship

National Institutes of Health Regenerative Sciences Training Grant

Second Place, 2004 Student Paper Competition (Masters Level), Bioengineering Division, ASME IMECE

William C. and Joyous Van Buskirk Graduate Scholarship in Biomedical Engineering

Biomedical Engineering Society Scholarship Award, Senior with Highest Scholastic Average, Biomedical Engineering Class of 2003, Tulane University

Rita Schaffer Award, Biomedical Engineering Society, Tulane University

Dean's Honors Scholarship, School of Engineering, Tulane University

Licenses and Certifications

Licensed Professional Engineer, Michigan, #6201061376

Motorcycle Safety Foundation Basic Rider Course

Motorcycle Safety Foundation Advanced RiderCourse

MADYMO Introductory Training

Prior Experience

Research Fellow, University of Michigan Department of Mechanical Engineering, 2010

Graduate Student Instructor, University of Michigan Department of Mechanical Engineering, 2008-2009

Lab Instructor, Tulane University School of Engineering, 2003

Summer Research Associate, Tulane University School of Engineering, 2003

Professional Affiliations

American Society of Mechanical Engineers

Biomedical Engineering Society

Publications

Rodowicz KA, Olberding JE, Rau AC. Head injury potential and the effectiveness of headgear in women's lacrosse. Annals of Biomedical Engineering 2014; 43(4):949-957.

Ambrosi D, Ateshian GA, Arruda EM, Cowin SC, Dumais J, Goriely A, Holzapfel GA, Humphrey JD, Kemkemer R, Kuhl E, Olberding JE, Taber LA, Garikipati K. Perspectives on biological growth and remodeling. Journal of the Mechanics and Physics of Solids 2011, 59(4):863 883.

Olberding JE. Growth and remodeling in engineered soft tissue. Doctoral Dissertation, University of Michigan, 2010.

Olberding JE, Thouless MD, Arruda EM, Garikipati K. The non-equilibrium thermodynamics and kinetics of focal adhesion dynamics. PLoS One 2010; 5(8):e12043.

Garikipati K, Olberding JE, Narayanan H, Arruda EM, Grosh K, Calve S. Biological remodelling: Stationary energy, configuration change, internal variables and dissipation. Journal of the Mechanics and Physics of Solids 2006; 54(7):1493-1515.

Olberding JE, Suh JKF. A dual optimization method for the material parameter identification of a biphasic poroviscoelastic hydrogel: Potential application to hypercompliant soft tissues. Journal of Biomechanics 2006; 39(13):2468-2475.

Olberding JE. Validation studies for the dual-optimization of indentation creep and stress relaxation of biological soft tissues using biphasic poroviscoelasticity: Potential Application for the mechanical analysis of brain tissue. Master's Thesis, Tulane University, 2004.

Abstracts

Olberding JE, Garikipati K, Grosh K, Larkin LM, Arruda EM. Role of oxygen content on the brogenesis of bone marrow stromal cells. Proceedings, Biomedical Engineering Society 2009 Annual Fall Scientific Meeting, Pittsburgh, PA, October 2009.

Olberding JE, Thouless MD, Arruda EM, Garikipati K. A theoretical study of the thermodynamics and kinetics of focal adhesion dynamics. Proceedings, IUTAM Symposium on Cellular, Molecular and Tissue Mechanics, Vol. 16, pp. 181-192, Springer, New York, NY, 2010.

Olberding JE, Thouless MD, Arruda EM, Garikipati K. Focal adhesion dynamics: Reaction domination. Proceedings, Biomedical Engineering Society 2007 Annual Fall Meeting, Los Angeles, CA, September 2007.

Olberding JE, Grosh K, Arruda EM, Garikipati K. Quantification of collagen fibril reorientation in volumetric image data by confocal microscopy. Proceedings, Biomedical Engineering Society 2006 Annual Fall Meeting, Chicago, IL, October 2006.

Olberding JE, Garikipati K, Arruda EM, Garikipati K. Fibroblast-mediated collagen fibril reorientation in three dimensions using confocal reaction microscopy. Proceedings, 15th U.S. National Congress on Theoretical and Applied Mechanics, Boulder, CO, June 2006.

Olberding JE, Garikipati K, Kuhl E, Grosh K, Arruda EM. Thermodynamic considerations for remodeling in biological tissue. Proceedings, 8th U.S. National Congress on Computational Mechanics, Austin, TX, July 2005.

Olberding JE, Garikipati K, Kuhl E, Narayanan H, Arruda EM, Grosh K, Calve S. Constitutive relations for fibril reorientation in embryonic tendon: Thermodynamic admissibility and restrictions. Proceedings, 2005, Summer Bioengineering Conference, Vail, CO, June 2005.

Olberding JE, Garikipati K, Kuhl E, Narayanan H, Arruda EM, Grosh K, Calve S. Remodeling of biological tissue: Collagen fibril reorientation in tendon under uniaxial extension. Proceedings, 2005 Joint ASCE/ASME/SES Conference on Mechanics and Materials, Baton Rouge, LA, June 2005.

Olberding JE, Suh JKF. Validation studies for the dual-optimization of indentation creep and stress relaxation of biological soft tissues using biphasic poroviscoelasticity: Potential method for brain tissue. Proceedings, 2004, ASME International Mechanical Engineering Congress, Anaheim, CA, November 2004.

Olberding JE, Suh JKF. A comparative study of viscoelastic and biphasic poroviscoelastic computational models of the brain for simulating traumatic injury. Proceedings, 11th Annual Pre-ORS Symposium, New Orleans, LA, February 2003. Department of Biomedical Engineering, Tulane University; Orthopaedic Research Society (invited).

Peer Reviewer

IUTAM Symposium on Cellular, Molecular and Tissue Mechanics

Journal of Biomechanical Engineering, Transactions of the ASME