

Exponent®
Engineering & Scientific Consulting

Ian Campbell, Ph.D., P.E.

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Professional Profile

Dr. Campbell provides technical expertise in injury biomechanics, injury tolerance, and human kinematics (motion), with a particular interest in ocular injuries, traumatic brain injuries, and orthopaedic and spinal injuries. He conducts research in micromobility products (including electric scooters and bicycles), airbag interactions, and analyzes specific incidents resulting in an injury.

Dr. Campbell has analyzed a variety of other transportation-related events (involving passenger vehicles, public transport vehicles, heavy trucks, agricultural equipment, and autonomous vehicles); slip, trip, and fall incidents; and claims regarding product safety (including restraint systems, industrial equipment, automotive seats, and highway safety technology). He also has background in human-robot interaction injuries and is knowledgeable about standards associated with that area. In general, his analyses include a review of known injury mechanisms and a quantitative evaluation of biomechanical loading and/or kinematics during a specific event. His analyses may include an investigation of the biomechanical effects of safety countermeasures, personal protective equipment (PPE), or alternative designs.

Dr. Campbell is especially well-versed in soft tissue biomechanics, including damage and disease processes in collagenous and neural tissue. His extensive research experience in ocular and cardiovascular biomechanics includes laboratory-based mechanical testing of biological tissue, finite element computer modeling of tissue deformations and strains, and computational fluid dynamics modeling of blood flow. Dr. Campbell has designed and conducted research in the biomechanical loads on the head and neck during activities of daily living (ADLs) using motion capture technology, accelerometers, and inertial motion units (IMUs). He has also analyzed the biomechanical loading and motion of anthropomorphic test devices (ATDs, or “crash test dummies”) in crash and sled testing.

Prior to joining Exponent, Dr. Campbell held research positions at the Department of Veterans Affairs and the Georgia Institute of Technology. He earned his Ph.D. in Biomedical Engineering from the Wallace H. Coulter Joint Department of Biomedical Engineering at the Georgia Institute of Technology and Emory University. In his work, Dr. Campbell has implemented advanced data acquisition techniques through the use of digital image analysis and mechanical sensors such as pressure transducers, IMUs, and load cells. He also has experience in the development of computational code for analysis of tissue testing data, and he has extensive quantitative medical image analysis experience, including MR, CT, OCT, and microscopy imaging modalities. In addition to his technical skills, Dr. Campbell excels at communicating scientific and technical subjects to a broader audience. For example, as an AAAS Mass Media Fellow in 2012, he worked as a science, environment, and health journalist at The Oregonian.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, Emory University, 2013

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Ph.D., Biomedical Engineering, Georgia Institute of Technology, 2013

B.A., Physics and Mathematics, St. Olaf College, 2007

Sigma Pi Sigma (National Physics Honor Society)

U.S. Department of Veterans Affairs (VA) Rehabilitation R&D Career Development Award, Level 1, 2015-2016

1st Place, PhD Podium Competition, American Society of Mechanical Engineers (ASME) Summer Bioengineering Conference, 2012

American Association for the Advancement of Science (AAAS) Mass Media Fellow, 2012

American Heart Association (AHA) Predoctoral Fellowship, 2011-2013

National Science Foundation (NSF) Graduate Research Fellowship, 2008-2011

Licenses and Certifications

Professional Engineer Mechanical, California, #39173

Professional Engineer, Georgia, #PE047098

Professional Engineer Mechanical, Texas, #142095

Certified Forklift Operator for Sit-Down Counterbalanced Forklifts

Motorcycle Safety Foundation (MSF) Basic Rider Course

PADI Advanced Open Water Scuba Certification

PADI Certified Enriched Air Diver

Northwestern University Center for Public Safety, Traffic Crash Reconstruction for Engineers

Prior Experience

Research Biologist, Department of Veterans Affairs, 2015-2016

Research Engineer I, Georgia Institute of Technology, 2015-2016

Postdoctoral Fellow, Georgia Institute of Technology, 2012-2015

Science Journalist, *The Oregonian*, 2012

Professional Affiliations

Association for Research in Vision and Ophthalmology (ARVO), Member

SAE International, Member

- Member, Powered Micromobility Vehicles Committee

ASTM International, Member

- Member, Powered Scooters & Skateboards Committee

American Society of Mechanical Engineers (ASME), Member

Publications

SG Como, M Paradiso, IC Campbell, C Garman, S Werner, & J Wishart (2022). “Crash Test Methodology for Electric Scooters with Anthropomorphic Test Device (ATD) Riders”, SAE Technical Paper 2022-01-0853.

IC Campbell, S Lovald, M Garcia, & B Coudrillier (2021). "Biomechanical Properties of the Sclera". In: I Pallikaris, MK Tsilimbaris, & AI Dastiridou (eds.), Ocular Rigidity, Biomechanics and Hydrodynamics of the Eye (pp. 77-105). Cham, Switzerland: Springer Nature Switzerland AG.

CS Parenteau, EC Lau, IC Campbell, & A Courtney (2021). "Prevalence of Spine Degeneration Diagnosis by Type, Age, Gender, and Obesity Using Medicare Data", Scientific Reports, 11(1): 5389.

CMR Garman, SG Como, IC Campbell, J Wishart, K O'Brien, & S McLean (2020). "Micro-Mobility Vehicle Dynamics and Rider Kinematics During Electric Scooter Riding", SAE Technical Paper 2020-01-0935.

C Parenteau, IC Campbell, & SA Pasquesi (2020). "The Effects of Active and Conventional Head Restraints on Front Seat Occupant Responses in Rear Impacts", SAE Technical Paper 2020-01-1217.

C Parenteau, J Smedley, IC Campbell, & M Carhart (2020). "Evaluation of Laminated Side Window Glazing Coding and Rollover Ejection Mitigation Performance Using NASS-CDS", SAE Technical Paper 2020-01-1216.

ME Toney-Bolger, IC Campbell, B Miller, M Davis, & JL Fisher (2019). "Evaluation of Occupant Loading in Low- to Moderate-Speed Frontal and Rear-End Motor Vehicle Collisions", SAE Technical Paper 2019-01-1220.

A Courtney, IC Campbell, E Courtney, & S Pasquesi (2018). "Risk of Concussion Due to Head Acceleration in Rear Impact Sled Tests of Passenger Automobile Seats", Traffic Injury Prevention, 19(S2): S133-S135.

IC Campbell, JM Sherwood, DR Overby, BG Hannon, AT Read, J Raykin, & CR Ethier (2018). "Quantification of Scleral Biomechanics and Collagen Fiber Alignment". In TC Jakobs (ed.), Glaucoma: Methods and Protocols (pp. 135-159), Methods in Molecular Biology, vol. 1695. New York: Springer Science+Business Media.

IC Campbell, BG Hannon, AT Read, JM Sherwood, SA Schwaner, & CR Ethier (2017). "Quantification of the Efficacy of Collagen Cross-linking Agents to Induce Stiffening of Rat Sclera", Journal of the Royal Society Interface 14(129): 20170014.

B Coudrillier, IC Campbell, AT Read, DM Geraldes, NT Vo, A Feola, J Mulvihill, J Albon, RL Abel, & CR Ethier (2016). "Effects of Peripapillary Scleral Stiffening on the Deformation of the Lamina Cribrosa", Investigative Ophthalmology and Vision Science 57(6): 2666-2677.

B Coudrillier, DM Geraldes, NT Vo, R Atwood, C Reinhard, IC Campbell, Y Raji, J Albon, RL Abel, & CR Ethier (2016). "Phase-contrast Micro-computed Tomography Measurements of the Intraocular Pressure-

induced Deformation of the Porcine Lamina Cribrosa", IEEE Transactions on Medical Imaging 35(4): 988-999.

IC Campbell, B Coudrillier, J Mensah, RL Abel, & CR Ethier (2015). "Automated Segmentation of the Lamina Cribrosa Using Frangi's Filter: A Novel Approach for Rapid Identification of Tissue Volume Fraction and Beam Orientation in a Trabeculated Structure in the Eye", Journal of the Royal Society Interface 12(104): 20141009.

IC Campbell, JD Suever, LH Timmins, A Veneziani, RP Vito, R Virmani, JN Oshinski, & WR Taylor (2014). "Biomechanics and Inflammation in Atherosclerotic Plaque Erosion and Plaque Rupture: Implications for Cardiovascular Events in Women", PLoS ONE 9(11): e111785.

IC Campbell, B Coudrillier, & CR Ethier (2014). "Biomechanics of the Posterior Eye: A Critical Role in Health and Disease", Journal of Biomechanical Engineering. 136(2): 021005-1 - 021005-19.

IC Campbell, LH Timmins, DP Giddens, R Virmani, A Veneziani, ST Rab, H Samady, MC McDaniel, AV Finn, WR Taylor, & JN Oshinski (2013). "Computational Fluid Dynamics Simulations of Hemodynamics in Plaque Erosion", Cardiovascular Engineering and Technology. 4(4): 464-473.

IC Campbell, D Weiss, JD Suever, R Virmani, A Veneziani, RP Vito, JN Oshinski, & WR Taylor (2013). "Biomechanical Modeling and Morphology Analysis Indicates Plaque Rupture Due to Mechanical Failure Unlikely in Atherosclerosis-Prone Mice", American Journal of Physiology - Heart and Circulatory Physiology. 304(3): H473-H486.

IC Campbell (2013). Plaque Erosion and Murine Plaque Stability: A Biomechanical Examination of Exceptions to the Phenomenon of Plaque Rupture (Doctoral dissertation). Georgia Institute of Technology and Emory University.

IC Campbell, J Ries, SS Dhawan, AA Quyyumi, WR Taylor, & JN Oshinski (2012). "Effect of Inlet Velocity Profiles on Patient-Specific Computational Fluid Dynamics Simulations of the Carotid Bifurcation", Journal of Biomechanical Engineering. 134(5): 051001-1.

IC Campbell & WR Taylor (2010). "Flow and Atherosclerosis". In TK Hsiai, B Blackman, & H Jo (Eds.), Hemodynamics and Mechanobiology of Endothelium (pp. 1-38), Hackensack, NJ: World Scientific.

IC Campbell, R Jacobel, B Welch, & R Pettersson (2008). "The Evolution of Surface Flow Stripes and Stratigraphic Folds within Kamb Ice Stream - Why Don't they Match?" Journal of Glaciology. 54(186): 421-427.

Selected Presentations and Published Abstracts

J Molnar, S Easley, IC Campbell, & S Lovald (2025). Safety Standards and Risk Evaluation for Physical Human-Robot Interaction, Poster and Spotlight Presentation at the Workshop on Public Trust in Autonomous Systems, 2025 IEEE International Conference on Robotics & Automation, Atlanta, GA, May 19, 2025.

C Parenteau, D Viano, & IC Campbell (2022). Occupant Age and Size Characteristics by Seating Location in Tow-Away Crashes Involving Light Vehicles in the United States, IRCOBI, September 14-16, 2022. Paper No. IRC-22-76.

CS Parenteau, A Courtney, IC Campbell, & E Lau (2021). An Update on Front-Seat Occupant Injury Rates in Frontal Crashes: Focus on Modern Vehicles. IRCOBI, September 8-10, 2021. Paper No. IRC-21-50.

JL Isaacs, IC Campbell, H Watson, & ME Toney Bolger (2021). Head and Neck Loading Trends in IIHS Side Impact Testing. Topic Key Note Presentation, Fédération Internationale des Sociétés d'Ingénieurs

des Techniques de l'Automobile (FISITA) World Congress, Prague, Czech Republic (virtual), September 14-16, 2021. Outstanding Paper Award.

JL Isaacs, ME Toney Bolger, & IC Campbell (2019). Cervical Spine Loading During Asymmetrical Non-Injurious Physical Activities. Podium Presentation, XXVII Congress of the International Society of Biomechanics (ISB) /43rd Annual Meeting of the American Society of Biomechanics (ASB), Calgary, Canada, August 2019.

BG Hannon, IC Campbell, AT Read, & CR Ethier (2017). Evaluating the Efficacy of Crosslinking the Posterior Rat Sclera. Podium Presentation June 2017 at Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Tucson, AZ.

IC Campbell, BG Hannon, AT Read, JM Sherwood, P Gonzalez, & CR Ethier (2016). Quantification of Scleral Stiffening in Rat Eyes as a Function of Glyceraldehyde Concentration and Age. Podium presentation July 2016 at Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), National Harbor, MD.

B Coudrillier, DM Geraldes, N Vo, IC Campbell, J Albon, RL Abel, & CR Ethier (2015). Phase-Contrast Micro-Tomography Measurements of Intraocular Pressure-Induced Deformation of the Porcine Lamina Cribrosa. Podium presentation June 2015 at Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Snowbird, UT.

FA Bräu, IC Campbell, B Coudrillier, & CR Ethier (2015). A Parametrized Model of the Lamina Cribrosa for Studying Oxygen Transport. Podium presentation June 2015 at Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Snowbird, UT.

IC Campbell, B Coudrillier, RL Abel, & CR Ethier (2014). Connective Tissue Orientation and Microstructure in the Sclera and Optic Nerve Head: Computational Modeling and Implications for Glaucoma. Podium presentation July 2014 at World Congress of Biomechanics, Boston, MA.

CR Ethier, B Coudrillier, IC Campbell, & RL Abel (2014). Optic Nerve Head Biomechanics in Glaucoma. Keynote presentation June 2014 at Society of Experimental Mechanics Annual Conference & Exposition on Experimental and Applied Mechanics, Greenville, SC.

IC Campbell, WWL Koh, J Mensah, H Jones, E Sander, J Albon, R Abel, MJA Girard, & CR Ethier (2013). Effects of Connective Tissue Orientation on Optic Nerve Head Biomechanics in Glaucoma. Oral presentation October 2013 at International Society for Eye Research Molecular Mechanisms in Glaucoma Conference, Sarasota, FL.

IC Campbell, D Weiss, R Virmani, RP Vito, JN Oshinski, & WR Taylor (2012). Histology-Based, Lesion-Specific Modeling of Relative Stress Distributions Indicates Plaque Rupture Unlikely in Mice. Oral presentation June 2012 at American Society of Mechanical Engineers Summer Bioengineering Conference, Fajardo, Puerto Rico.

Peer Reviews

Journal of Biomechanics

Biomechanics and Modeling in Mechanobiology

PLoS ONE

Journal of the Royal Society Interface

Journal of Applied Physiology

Investigative Ophthalmology and Vision Science (IOVS)

Translational Vision Science & Technology

Experimental Eye Research

Cardiovascular Engineering and Technology

Computer Methods in Biomechanics and Biomedical Engineering

Journal of Chemical Neuroanatomy

Summer Biomechanics, Bioengineering, and Biotransport Conference (SB^3C)

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