



Exponent[®]
Engineering & Scientific Consulting

Michael Prange, Ph.D., P.E.

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Professional Profile

Dr. Prange addresses issues involving human injury biomechanics and kinematics to assess the severity and mechanism of injury incurred during traumatic events. He has expertise in human injury biomechanics, specializing in head injury tolerance, pediatric biomechanics, and occupant kinematics.

Dr. Prange has evaluated the safety of a variety of different products including helmets, juvenile products, and child restraint systems. He has 20 years of experience addressing questions involving head injuries and the unique aspects of pediatric biomechanics.

Dr. Prange's work includes analysis of injuries occurring in transportation accidents; incidents involving consumer products; and a variety of accidental and inflicted injury scenarios. He has extensive expertise in adult and pediatric head and neck injury mechanisms and tolerance. His experience includes investigation of the mechanisms, tolerance, and mitigation of traumatic brain injury including concussion, intracranial bleeding, and diffuse axonal injury.

Dr. Prange has investigated the injury mechanisms and kinematics of children during automotive collisions, accidental falls, use and misuse of various child products, incidents of strangulation and asphyxiation, and child abuse. Dr. Prange has addressed issues of injury risk and product safety involving a variety of products including motorcycle, bicycle, football, and other types of helmets; child products such as cribs, infant carriers, strollers, and furniture; and vehicle child restraint systems including boosters, rear and forward facing seats, and vehicle seatbelts. Dr. Prange also has experience in neck and spine structural and failure properties, biomechanics of shaken baby syndrome, injury mechanisms during falls, injury potential of impacts from falling objects, biological material testing, viscoelastic mechanical properties of tissue, and computational models of injury prediction. Dr. Prange also has unique experience conducting research utilizing pediatric cadaveric specimens to determine pediatric head and neck structural properties and injury tolerances.

Prior to joining Exponent, Dr. Prange was a Senior Research Scientist in the Department of Biomedical Engineering at Duke University and a research assistant in the Injury Biomechanics Laboratory at the University of Pennsylvania.

Academic Credentials & Professional Honors

Ph.D., Bioengineering, University of Pennsylvania, 2001

M.S.E., Bioengineering, University of Pennsylvania, 1999

B.S., Biological Engineering, North Carolina State University, 1996

2002 Solomon R. Pollock Award for Excellence in Graduate Bioengineering Research, University of Pennsylvania

43rd Stapp Car Crash Conference Student Paper Award

Tau Beta Pi (Engineering Honor Society)

Gerber Products Scholarship

Licenses and Certifications

Professional Engineer, Pennsylvania, #PE073241

Professional Engineer, Virginia, #402055812

Prior Experience

Senior Research Scientist, Department of Biomedical Engineering at Duke University, 2002-2004

Graduate Research Assistant, Injury Biomechanics Laboratory, Department of Bioengineering at the University of Pennsylvania, 1996-2001

Professional Affiliations

Society of Automotive Engineers (member)

- SAE World Congress, Biomechanics session chair, 2007-2010

Publications

Pasquesi, S., Bruno, A., Courtney, A., Imler, S. Smedley, J. and Prange, M. Risk of Concussion in Low- to Moderate-Speed Frontal and Rear-End Motor Vehicle Collisions Evaluated Using Head Acceleration-Based Metrics. Society of Automotive Engineers, SAE 2019-01-1218, 2019. (Presented at the 2019 SAE World Congress, Detroit, MI).

Bussone, W., Olberding, J., and Prange, M., "Six-Degree-of-Freedom Accelerations: Linear Arrays Compared with Angular Rate Sensors in Impact Events," Society of Automotive Engineers, SAE International Journal of Transportation Safety 5(2):194-207, 2017. (Presented at the 2017 SAE World Congress, Detroit, MI).

Bussone W and Prange M. Measurements of non-injurious head accelerations of young children. Society of Automotive Engineers, SAE 2014-01-0493, 2014. (Presented at the 2014 SAE World Congress, Detroit, MI).

Bussone W, Prange M, Bove R, and Daniel T. Neck loads in playground activities in a pediatric population. Society of Automotive Engineers, SAE 2012-01-0560, 2012. (Presented at the 2012 SAE World Congress, Detroit, MI).

Bussone W, Bove R, Thomas R, Richards D, Prange MT. Six-degree-of-freedom accelerations: linear arrays compared with angular rate sensors. Society of Automotive Engineers, SAE 2010-01-1017, 2010. (Presented at the 2010 SAE World Congress, Detroit, MI).

Prange MT, Heller M, Watson H, Iyer M, Ivarsson B, Fisher J. Age effects on injury patterns in pedestrian crashes. Society of Automotive Engineers, SAE 2010-01-1164, 2010. (Presented at the 2010 SAE World Congress, Detroit, MI).

Heller M, Prange MT, Ong K, Watson H, Iyer M, Ivarsson B, Fisher J. Injury patterns among special populations involved in pedestrian crashes. Society of Automotive Engineers, SAE 2010-01-1165, 2010. (Presented at the 2010 SAE World Congress, Detroit, MI).

Moore T, Prange MT, Corrigan C. Inertially-induced cervical spine injuries in the pediatric population. Society of Automotive Engineers, SAE 2009-01-0395, 2009. (Presented at the 2009 SAE World Congress, Detroit, MI).

Bussone W, Moore T, Richards D, Bove R, Scher I, Prange MT. Measurements of non-injurious head accelerations of a pediatric population. Society of Automotive Engineers, SAE 2009-01-0383, 2009. (Presented at the 2009 SAE World Congress, Detroit, MI).

Van Arsdell W, Marsden A, Amirault D, Oltman S, Richards D, Prange MT. Effect of padding on child restraint performance during side impact collisions. Society of Automotive Engineers, SAE 2009-01-1244, 2009. (Presented at the 2009 SAE World Congress, Detroit, MI).

Heller M, Watson H, Ivarsson B, Prange MT, Fisher J. Using national databases to evaluate injury patterns in pedestrian impacts. Society of Automotive Engineers, SAE 2009-01-1209, 2009. (Presented at the 2009. SAE World Congress, Detroit, MI).

Luck JF, Nightingale RW, Loyd AM, Prange MT, Dibb AT, Song Y, Fronheiser L, Myers BS. Tensile mechanical properties of the perinatal and pediatric PMHS osteoligamentous cervical spine. Stapp Car Crash Journal 2008; 52:107-134. (Presented at the 52th Stapp Car Crash Conference, San Antonio, TX).

Prange MT, Moore T, Newberry W, Peterson D, Smyth B, Corrigan C. Inertial neck injuries in children involved in frontal collisions. Society of Automotive Engineers, SAE 2007-01-1170, 2007. (Presented at the 2007 SAE World Congress, Detroit, MI).

Nightingale RW, Chancey VC, Ottaviano D, Luck JF, Tran L, Prange MT, Myers BS. Flexion and extension structural properties and strengths for male cervical spine segments. Journal of Biomechanics 2007; 40(3):535-542.

Zhu Q, Prange MT, Margulies SS. Predicting unconsciousness from a pediatric brain injury threshold. Developmental Neuroscience 2006; 28(4-5):388-395.

Prange MT, Luck JL, A Dibb A, Van Ee CA, Nightingale RW, Myers BS. Mechanical properties and anthropometry of the human infant head. Stapp Car Crash Journal 2004; 48:279-299, 2004. (Presented at the 48th Stapp Car Crash Conference, Nashville, TN).

Prange MT, Coats B, Duhaime AC, Margulies SS. Anthropomorphic simulations of falls, shakes, and inflicted impacts in infants. Journal of Neurosurgery 2003; 99:143-150.

Prange MT, Margulies SS. Regional, directional, and age-dependent properties of brain undergoing large deformation. Journal of Biomechanical Engineering 2002; 124(2):224-252.

Prange MT, Meaney DF, Margulies SS. Defining brain mechanical properties: Effects of region, direction, and species. Stapp Car Crash Journal 2000; 44:205-213. (Presented at the 44th Stapp Car Crash Conference, Atlanta, GA).

Prange MT, Kiralyfalvi G, Margulies SS. Pediatric rotational inertial brain injury: The relative influence of brain size and mechanical properties. Stapp Car Crash Conference Proceedings, SAE Paper #99SC23, pp. 333-341, 1999. (Presented at the 43th Stapp Car Crash Conference, San Diego, CA). Student Paper

Award.

Prange MT, Margulies SS. Anisotropy and inhomogeneity of the mechanical properties of brain tissue at large deformation. 9th Injury Prevention Through Biomechanics Symposium Proceedings, 1999.

Prange MT, Meaney DF, Margulies SS. Directional properties of gray and white matter. 8th Injury Prevention Through Biomechanics Symposium, pp. 65-74, 1998.

Arbogast KB, Prange MT, Meaney DF, Margulies SS. Properties of cerebral gray and white matter undergoing large deformation. 7th Injury Prevention Through Biomechanics Symposium, pp. 33-40, 1997.

Book Chapters

Prange MT, Myers BS. Pathobiology and biomechanics of inflicted childhood trauma—Response. In: *Inflicted Childhood Neurotrauma*, American Academy of Pediatrics, pp. 237-243, 2003.

Abstracts and Presentations

Prange MT, Bussone W, Heller M. The biomechanics of brain injury. The 2010 Annual Governor's Luncheon & Educational Seminar of the Brain Injury Association of Delaware, Wilmington, DE, 2010.

Heller M, George J, Yamaguchi G, McGowan J, Prange M. Linear head accelerations resulting from short falls onto the occiput in children. Annual Meeting for the American Society of Biomechanics, State College, PA, 2009.

Moore T, Prange MT, Newberry W, Peterson D, Smyth B, Corrigan C. Inertial neck injuries in children involved in frontal collisions: Sled testing using the 6-year-old ATD. American Society of Mechanical Engineers Summer Bioengineering Conference, Keystone, CO, 2007.

Zhu Q, Prange MT, Margulies SS. Predicting unconsciousness from a pediatric brain injury threshold. 5th World Congress of Biomechanics, Munich, Germany, 2006.

Luck JF, Nightingale RW, Loyd A, Dibb A, Ottaviano D, Prange MT, Myers BS. Tensile mechanical properties of the pediatric human osteoligamentous cervical spine. 5th World Congress of Biomechanics, Munich, Germany, 2006.

Prange MT, Margulies SS. Predictions of infant brain injuries in minor falls and inflicted events. 4th World Congress of Biomechanics, Calgary, Canada, 2002.

Prange MT. Adult neck injuries and helmets. Review of pediatric head and neck injury. Sponsored by Snell Memorial Foundation, Philadelphia, PA, 2003.

Prange MT, Coats B, Raghupathi R, Duhaime AC, Margulies SS. Rotational loads during inflicted and accidental infant head injury. Neurotrauma Society Symposium, San Diego, CA, 2001.

Duhaime AC, Prange MT, Christian C, Margulies SS. Smarter dummies: Infant head injury thresholds from improved anthropomorphic modeling. American Association for Neurosurgeons - Pediatric Division, 2001.

Prange MT, Coats B, Duhaime AC, Margulies SS. Biomechanics of accidental and inflicted head injuries in the infant. Biomedical Engineering Society Conference, Durham, NC, 2001

Prange MT, Margulies SS. Tissue strain thresholds for axonal injury in the infant Brain. American Society of Mechanical Engineers Summer Bioengineering Conference, Snowbird, UT, June 2001.

Prange MT, Margulies SS. Biomechanics of pediatric brain injury: Work in progress. CNS Injury

Conference, Philadelphia, PA, 2000.

Prange MT, Margulies SS. Large Deformation material properties of white and gray matter. 3rd World Congress of Biomechanics, Sapporo, Japan, 1998.

Prange MT, Meany DF, Margulies SS. Directional properties of gray and white brain tissue undergoing large deformation. International Mechanical Engineering Congress and Exposition, Anaheim, CA, 1998.

Peer Reviews

Journal of Biomechanics

Journal of Biomechanical Engineering

Annals of Biomedical Engineering

Annual Review of Biomedical Engineering

Journal of Applied Bionics and Biomechanics

Journal of Neurotrauma

Pediatrics

Society of Automotive Engineers

National Institutes of Health Musculoskeletal Rehabilitation Sciences Study Section