

Ann Mallory, PhD

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The Ohio State University
Dept of Mechanical and Aerospace Engineering
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EDUCATION

Doctor of Philosophy, Ohio State University 2014
Mechanical Engineering

- Dissertation: Measurement of Meningeal Motion Using B-Mode Ultrasound as a Step Toward Understanding the Mechanism of Subdural Hematoma
- Qualifying exam areas: Statics and Strength of Materials, Kinematics and Dynamics, Design

Master of Science, University of Southern California 2001
Biomedical Engineering

- Thesis: The Relationship Between the Material Properties of Femoral Cortical Bone and Bone Density
- Research conducted at Orthopaedic Hospital, Los Angeles
- Winner of the 2000 Grodins Graduate Research Symposium, Best Poster Presentation

Bachelor of Applied Science, University of Waterloo (Canada) 1995
Systems Design Engineering, Option in International Studies

- Graduated with First Class Honours
- Canada Scholar and University of Waterloo Entrance Scholarship
- Final year design workshop: Short-track Speed Skating Helmet Design (Winner of the 1995 Systems Design Workshop Symposium Best Presentation)
- Completed one year of degree on exchange at L'Université de Technologie de Compiègne, France (1992-1993)

PROFESSIONAL EXPERIENCE

Transportation Research Center Inc., East Liberty Ohio

Research Engineer 2003-2014
Research Scientist I 2014-2016
Research Scientist II 2016-present

- Assigned on contract to the US National Highway Traffic Safety Administration (NHTSA) Vehicle Research and Test Center (VRTC)

- Plan and execute long-term test programs to evaluate and develop test procedures, to evaluate and improve dummy design and biofidelity for the evaluation of injury risk in motor vehicle collisions, and to better understand human tolerance in impact
- Perform dynamic testing on post mortem human subjects, crash test dummies and components
- Analyze crash injury data from real-world databases including NASS CDS, NASS GES, FARS, CIREN, PCDS, and NTDB
- Currently lead engineer for multiple occupant safety research programs
 - Analysis of retrospective real-world injury data and benefits estimation of existing and future safety technologies to identify future research priorities
 - Motorcycle helmet injury criteria evaluation
 - Head injury criteria research for older occupants
- Currently support additional safety research projects
 - Analysis of real-world pedestrian data for evaluation of knee and thorax injuries, as well as to evaluate the effects of recent improvements in vehicle design
 - Development of rotational test procedures for motorcycle helmets
 - Development of test procedures to evaluate older occupant safety in side impact
- Previous experimental research programs include pedestrian protection, traumatic eye injury, out-of-position child dummy evaluation, and rear-impact dummy evaluation
- Winner of the 2008 NHTSA/VRTC Target Award for contribution to VRTC's mission
- In 2019, founded TRC WOMEN (Women Offering Mentoring, Expertise, and Networking) to organize events and initiatives to support female employees at TRC Inc.

Department of Mechanical and Aerospace Engineering, The Ohio State University, Columbus Ohio
Adjunct Assistant Professor 2017-present

- Provide mentorship on graduate projects involving experimental and epidemiological studies of human injury

Biodynamics Engineering Inc., Pacific Palisades, California, USA
Biomechanical Engineer 1995-2003

- Responsible for analysis of injury events in motor-vehicle accidents, sporting activities, job-related activities, and criminal cases
- Performed extensive literature reviews and analyses of injury mechanisms
- Inspected accident vehicles, equipment, and accident sites
- Generated test protocols, collected data, and analyzed results for a wide variety of mechanical test procedures including:
 - Dynamic impact testing of vehicle components, helmets, and safety equipment
 - Human volunteer testing in recreational, motor vehicle, and vibration environments
- Promoted to Head of Research Group in 2000

Undergraduate Co-operative Education Work Placements 1991-1994

- Automotive Plant Ergonomist, CAMI Automotive, Ingersoll, Ontario (1994)
- Ergonomist, Canada Department of Agriculture, Guelph, Ontario (1993)
- Software and Usability Tester, Spicer Corporation, Kitchener, Ontario (1992)

- Usability Lab Researcher, IBM, Don Mills, Ontario (1991)
- Software Documentation, IBM, Don Mills, Ontario (1991)

PROFESSIONAL AFFILIATIONS AND SERVICE

Professional Organization Committees

- Association for the Advancement of Automotive Medicine (AAAM)
 - Scientific Program Committee, 2011-2014
 - Abbreviated Injury Scale (AIS) Content Committee, 2015-present
 - Chair, Head Region Sub-committee, 2018-present
- Ohio State University Injury Biomechanics Symposium
 - Founding Technical Committee Member, 2005-2014
 - Technical Committee Chair, 2006 and 2014
- SAE Government Industry Meeting
 - Biomechanics Session Industry Chair, 2019-2021

Memberships

- Society of Automotive Engineers, 1995-present
- Association for the Advancement of Automotive Engineers, 2009-present
- Central Ohio Injury Biomechanics Engineering Consortium (COIBEC), 2004-2015
- International Harmonization of Research Activities (IHRA) Pedestrian Research Group, 2003-2006
- National Neurotrauma Society, 2010-2011

Manuscript Reviewer

- Society of Automotive Engineers Congress (2005-2020)
- Annals of the Advancement of Automotive Medicine (2011-2014)
- Traffic Injury Prevention (2011-2020)
- Journal of Sports Engineering and Technology (2015-2016)
- SAE International Journal of Transportation Safety (2016-2019)
- Accident Analysis and Prevention (2018)
- Journal of Neurotrauma (2018, 2020)
- Journal of Biomechanics (2018-2019)

Industry and Academic Mentor

- The Ohio State University Injury Biomechanics Research Center (IBRC)
 - Angela Tesny, “Validation of ultrasound motion imaging in high-rate rotation”, ME PhD project, expected graduation 2022.
 - Alaine Wetli, “Slowing the post mortem degradation of brain tissue”, ME MS project, 2015-2017.
 - Bernie Cook, “Development of relationship between age and brain atrophy using MR imaging protocol”, BME Undergraduate research assistantship, 2016-2017.
 - Michelle Murach, “Experimental head rotation project”, BME Undergraduate research assistantship, 2013-2014.

Colleen Mismas, “Experimental head rotation project”, BME Undergraduate research assistantship, 2012-2013.

The Ohio State University College of Public Health

Abby Valek, “Trends in the Top-Three Injured Body Regions in Vehicle-to-Pedestrian Crashes, National Trauma Data Bank”, MPH Culminating Project, 2017-2018.

The Ohio State University Center for Automotive Research (CAR)

Kyle Ott, “Pedestrian Head Injury Reconstructions”, MS project, 2004-2005.

Center for Child Injury Prevention Studies, National Science Foundation Industry/University Cooperative Research Center (NSF I/UCRC)

“Pediatric Brain Injury Assessment in Real World Crashes” (2013-16), P.I. Matt Maltese

“Differences in Injury Outcome in Children and Adults” (2015-16), P.I. Mark Zonfrillo and Joel Stitzel

Intern Program, Transportation Research Center Inc.

Lucas Neuroth, The Ohio State University, School of Public Health (MPH), 2019

Projects: “Evaluation of Revised FCI (Functional Capacity Index)” and “Statistical Analysis of Brain Tissue Preservation Data”.

Avery Pasch, The Ohio State University, School of Public Health (MPH), 2018

Projects: “Development of Safety Countermeasure Models: Sobriety Checkpoints, Intersection AEB, Shifts in Transportation Mode and Traffic Jam Assist” and “Proposal for a Roadside Thermometer/Freeze Warning Sign”.

Abby Valek, The Ohio State University, School of Public Health (MPH), 2017

Project: “Apportionment of US Pedestrian Injuries by NCAP Test Procedure”

Brittany Yarnell, The Ohio State University, School of Public Health (MPH), 2016.

Project “Apportionment of US Pedestrian Injuries by NCAP Test Procedure”

Kate Robinson, Purdue University, Mechanical Engineering (BS), 2016

Project “Application of Disability Measures to Crash Injury”

PUBLICATIONS AND PRESENTATIONS

Peer-Reviewed Publications

Whyte T., Stuart CA, Mallory A, Ghajari M, Plant DJ, Siegmund GP, Crompton PA. “A Review of Impact Testing Methods for Headgear in Sports: Considerations for Improved Prevention of Head Injury Through Research and Standards”, *ASME Journal of Biomechanical Engineering*, Vol 141, Number 7, 2019.

Mallory A., Stammen J., Zhu M. “Cervical and Thoracic Injury in Pediatric Motor Vehicle Crash Passengers”, *Traffic Injury Prevention*, Vol 20, Number 1, 2019.

Mallory A., Donnelly B., Liu J., Bahner D., Moorhouse K., Dupaix R., Addressing Spatiotemporal Distortion of High-Speed Tissue Motion in B-mode Ultrasound. *Biomedical Physics & Engineering Express*, Vol 5, Number 4, <https://doi.org/10.1088/2057-1976/aad925>, 2018.

Mallory A., Kender A., Moorhouse K. “Opportunities for Crash and Injury Reduction: A Multiharm Approach for Crash Data Analysis”, *Traffic Injury Prevention*, 18(sup1), S1-S8, 2017.

- Mallory A., Duffy S., Rhule H., “Head Injuries to Helmeted and Unhelmeted Motorcyclists in US Trauma Data”, Published in the Proceedings of the International Research Council on Biomechanics of Injury (IRCOBI), 2013.
- Mallory A., Rhule H., “Injury Risk Estimates: A Method for Determining Equivalent Increase in Risk of Death for Older and Younger Occupants”, Short communication published in the Proceedings of the International Research Council on Biomechanics of Injury (IRCOBI), 2013.
- Mallory A., Fredriksson R., Rosén E., Donnelly B., “Pedestrian Injuries by Source: Serious and Disabling Injuries in US and European Cases”, Presented at the Annual Meeting of the Association for the Advancement of Automotive Medicine (AAAM) and published in the Annals of the Advancement of Automotive Medicine, Vol 56, Page 13, 2012. ** Association for the Advancement of Automotive Medicine Best Scientific Paper of 2012**
- Kang Y.S., Bolte J., Moorhouse K., Donnelly B., Herriott R., Mallory A., “Biomechanical Response of PMHS in Moderate-Speed Rear Impacts and Development of Response Targets for Evaluating the Internal and External Biofidelity of ATDs”, Stapp Car Crash Journal, 2012.
- Ott K., Wiechel J., Guenther D., Stammen J., Mallory A., “Assessment of the Simulated Injury Monitor (SIMon) in Analyzing Head Injuries in Pedestrian Crashes,” International Journal of Passenger Cars-Mechanical Systems, 5(1), 487-505, 2012.
- Mallory A., “Head Injury and Aging: the Importance of Bleeding Injuries,” Presented at the Annual Meeting of the Association for the Advancement of Automotive Medicine (AAAM) and published in the Annals of the Advancement of Automotive Medicine, Vol 54, Page 51, 2010.

Conference Papers and Presentations

- Mallory A., Kender A., Hutter E., Moorhouse K., “Crashes and Injuries in 2020-2030: Preliminary Results from a Crash Data Projection Model”, Research Consortium for Crashworthiness in Automated Driving Systems (RCCADS) Public Workshop, 2020.
- Mallory A., Kender A., Hutter E., Moorhouse K., “Crashes and Injuries in 2020-2030: Development of a Crash Data Projection Model”, NHTSA International Workshop on Human Subjects for Biomechanical Research, San Antonio TX, 2019.
- Tesny A., Mallory A., Thomas C., Rhule H., Moorhouse K., Kang Y.S., “Quantifying Relative Brain Motion in a Post Mortem Human Subject”, 63rd Stapp Car Crash Conference, invited presented by Tesny, 2019.
- Tesny A., Mallory A., Thomas C., Rhule H., Moorhouse K., Kang Y.S., “Quantifying Relative Brain Motion in a Post Mortem Human Subject”, OSU Injury Biomechanics Symposium, presented by Tesny, 2019. **Winner of the Margaret Hines Best Oral Presentation**
- Kang Y.S., Wetli A., Mallory A., Rhule H., Moorhouse K., “Potential Tools for Delaying Degradation of Brain Tissue Properties in PMHS Testing”, SAE Government/Industry Meeting, presented by Kang, 2018.
- Rhule H., Stricklin J, Millis W., Suntay B., Mallory A., “Evaluation of the RibEye Multipoint Deflection Measurement System Installed in the WorldSID-50M Dummy”, SAE Government/Industry Meeting, presented by Rhule, 2017.
- Mallory A., Kang Y., Herriott R., Rhule H., Donnelly B., Moorhouse K., “High-frequency Ultrasound for the Measurement of Intracranial Motion in Head Rotation”, NHTSA International Workshop on Human Subjects for Biomechanical Research, New Orleans LA, 2015.

- Mallory A., Herriott R., Rhule H., Donnelly B., Liu J., Dupaix R., Kang Y. "High-frequency B-Mode Ultrasound for the Measurement of Intracranial Motion", NIH Ultrasonic Transducer Engineering Conference, Torrance CA, 2014.
- Suntay B., Mallory A., Stammen J., "NHTSA Evaluation of the Flex-GTR Legform on US Vehicles", SAE Government/Industry Meeting, Washington DC, presented by Suntay, 2012.
- Mallory A., Herriott R., Rhule H., "Subdural Hematoma and Aging: Crash Characteristics and Associated Injuries", Paper only in the Proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV), Washington DC, 2011.
- Rhule H., Mallory A., Hagedorn A., "Real World Occupant Crash Data and Sensitivity of THOR-NT and World-SID Dummy Thoraces", Presented by Rhule and published in the Proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV), Washington DC, 2011.
- Mallory A., Stammen J., Meyerson S. "NHTSA Pedestrian Testing with TRL and Flex-GTR Legforms and the Status of the GTR", presented by Meyerson at the SAE Government/Industry Meeting, Washington DC, 2010.
- Mallory A., Stammen J. "Performance of Vehicle Bumper Systems with the EEVC/TRL Pedestrian Lower Legform", presented by R. Saul and published in the Proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV), Stuttgart Germany, 2009.
- Mallory A., Stammen J. "Pedestrian Protection in US Vehicles: An Evaluation Using the TRL and Flex GT Legforms", SAE Government/Industry Meeting, Washington DC, 2008.
- Mallory A., Stammen J., Meyerson S. "Pedestrian GTR Testing of Current Vehicles.", presented and published in the Proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV), Lyon France, June 2007.
- Mallory A., Stammen J., "The Relationship Between Pedestrian Component Legform and Full Dummy Testing in Assessing Bumper Performance", SAE Government/Industry Meeting, 2006.
- Mallory A.E., Stammen J.A., Legault F. "Component Leg Testing of Vehicle Front Structures," paper only in the proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV) Washington, DC, June 2005.
- Kuppa S., Saunders J., Stammen J., Mallory A. "Kinematically Based Whiplash Injury Criterion," presented by Kuppa and published in the Proceedings of the International Technical Conference on the Enhanced Safety of Vehicles (ESV), Washington, DC, June 2005.
- Hackett, G.B., Mallory, A.E., Ward, C.C., "Central Retinal Damage Caused by Airbag Deployment," presented by Hackett and abstract in the Proceedings of the 53rd Annual Meeting of the American Academy of Forensic Sciences, Seattle, Washington, February 2001.
- Ebramzadeh E., Kramer S., Mallory A., Dorr L., "Femoral Morphological Variables that Predict Bone Mineral Density and Femur Classification", presented by Kramer and abstracted in the proceedings of the Annual Meeting of the Orthopedic Research Society, Orlando, 2000.
- Ward CC., Mallory A., DerAvanessian H., "Mechanism of Airbag-Induced Upper Cervical Spine Fractures", presented by Ward and abstracted in the proceedings of the Annual Meeting of the American Academy of Forensic Sciences, Reno, 2000.
- Mallory A., Ward, C.C., Der Avanesian H., "Airbag Risk Factors: Braking and Short Stature," presented and abstracted in the proceedings of the Annual Meeting of the American Academy of Forensic Sciences, Orlando, Florida, 1999.

Mallory A., Ward, C.C., “Air Bags and Children: The Risks and the Reality,” presented and abstracted in the proceedings of the Annual Meeting of the American Academy of Forensic Sciences, San Francisco, 1998.

Mallory A., Ward, C.C., “Analysis of Severe and Fatal Injuries Produced by Air Bag Deployment,” presented and abstracted in the proceedings of the Annual Meeting of the American Academy of Forensic Sciences, New York, 1997.

Poster Presentations

Wetli A., Cook B., Mallory A., Moorhouse K., Kang Y., “Developing a Method of Slowing Brain Tissue Degradation through Temperature, Sodium Bicarbonate and Antibiotics for Traumatic Brain Injury Testing”, Ohio State Injury Biomechanics Symposium, 2017.

Cook B., Mallory A., Moorhouse K., Kang Y., “The Relationship of Brain Atrophy and Age to Aid in Subdural Hematoma Injury Risk Prediction”, Ohio State Injury Biomechanics Symposium, 2017.

Cook B., Mallory A., Moorhouse K., Kang Y., “Modeling Relationship of Relative Brain Size with Age for Scaling Subdural Hematoma Kinematics to Risk”, Biomedical Engineering Society Midwest Regional Conference, 2016.

Ramachandra R., Mallory A., Stammen J., Moorhouse K., Bolte J., “Abdominal Injury Patterns in Motor Vehicle Accidents – A NASS/CDS Database Analysis”, Ohio State Injury Biomechanics Symposium, 2013.

Ebramzadeh E., Mallory A., Sharpe F., Dorr L., “Application of Computerized Tomography for Predicting Fracture Resistance of Human Cortical Bone”, Annual Meeting of the American Academy of Orthopedic Surgeons, 2002.

Mallory A.E., Ebramzadeh E., Dorr, L. “The Relationship Between The Fracture Tolerance of Femoral Cortex and Bone Density by qCT,” 25th Annual Meeting of the American Society of Biomechanics, San Diego, August 2001.

Mallory A.E., Ebramzadeh E., Dorr, L. “The Relationship Between The Fracture Tolerance of Femoral Cortex and Bone Density by qCT,” 5th Annual Grodins Graduate Research Symposium, University of Southern California, April 2001. ****Winner of the 2000 Grodins Graduate Research Symposium Best Poster Presentation Award****

Government-Published Reports

Mallory A., Yarnell B., Kender A., Stammen J. “Relative Frequency of US Pedestrian Injuries Associated with Risk Measured in Component-Level Pedestrian Tests”, National Highway Traffic Safety Administration Report, No. DOT HS 812 658, 2019.

Mallory A., Stammen J., “Comparative Evaluation of Rear Impact Dummies: Static Seat Interaction and Dynamic Testing,” NHTSA Docket #NHTSA-2007-27986-0019, October 2007.

Mallory A., Stammen J., “Initial assessment of Target Population for Potential Reduction of Pedestrian Head Injury in the United States: An Estimate Based on PCDS Cases,” World Forum for Harmonization of Vehicle Regulations, UNECE Document No. WP29-144-03a, 2006.

Mallory A., Stammen J., “Initial Assessment of Target Population for Potential Reduction of Pedestrian Head Injury in Hood and Windshield Impacts: An Estimated Based on PCDS Cases,” World Forum for Harmonization of Vehicle Regulations, UNECE Document No. WP29-144-03c, 2006.

- Stammen, J., Mallory A., “Pedestrian Head Safety Survey of U.S. Vehicles,” World Forum for Harmonization of Vehicle Regulations, World Forum for Harmonization of Vehicle Regulations, UNECE Document No. WP29-44-03d, 2006.
- Mallory A., Stammen J., “Lower Extremity Pedestrian Injury in the US: A Summary of PCDS Data,” World Forum for Harmonization of Vehicle Regulations, UNECE Doc No. WP29-44-03e, 2006.
- Stammen, J., Mallory A., “Use of the TRL Legform to Assess Lower Leg Injury Risk,” World Forum for Harmonization of Vehicle Regulations, UNECE Document No. WP29-44-03f, 2006.

Internal Government and Client Reports

- Mallory A., Kender A., Hutter E., and Moorhouse K., “Crashes & Injuries in 2020-2030: A projection based on current technology and interventions”, VRTC Report, June 2019.
- Mallory A., Kender A., and Moorhouse K., “Severity and Frequency of Injury in US Crashes: Data from NHTSA’s Injury Databases in Support of the Identification of Biomechanics Research Topics”, VRTC Report, June 2015.
- Mallory A., “Severity and Frequency of Injury in US Crashes: Data from NHTSA’s Injury Databases in Support of the Identification of Biomechanics Research Priorities (1999-2009)”, VRTC Applied Biomechanics Note, July 2011.
- Mallory A., “Severity and Frequency of Injury in US Crashes: Data from NHTSA’s Injury Databases in Support of the Identification of Biomechanics Research Priorities (1999-2008)”, VRTC Applied Biomechanics Note, July 2010.
- Mallory A., Rhule H., “Head injury and age: Head injuries sustained by older occupants in NASS/CDS”, VRTC Applied Biomechanics Note, March 2010.
- Mallory A., “Severity and Frequency of Injury in US Crashes: Data from NHTSA’s Injury Databases in Support of the Identification of Biomechanics Research Priorities (1999-2007)”, VRTC Applied Biomechanics Note, December 2009.
- Mallory A., “Severity and Frequency of Injury in US Crashes: Data from NHTSA’s Injury Databases in Support of the Identification of Biomechanics Research Priorities”, VRTC Applied Biomechanics Note, December 2008.
- Stammen J., Mallory A., “Preliminary Assessment of Benefits Afforded by the Head Portion of the Pedestrian Global Technical Regulation (GTR),” VRTC Applied Biomechanics Note, February 2006.
- Stammen J., Mallory A., “Preliminary Assessment of Benefits Afforded by the Leg Portion of the Pedestrian Global Technical Regulation (GTR),” VRTC Applied Biomechanics Note, February 2006.
- Mallory A., Stammen J., “Applicability and Potential Benefit of a U.S. Pedestrian Head Impact Standard: A Method for Evaluating Proposed Test Procedures,” VRTC Applied Biomechanics Note, January 2005.
- Injury Case Analysis Reports (75+) for clients at Biodynamics Engineering Inc., including analyses of injuries to motor vehicle crash occupants, motorcyclists, pedestrians, cyclists, as well as occupational and sports injuries and injuries to victims of violence.

Research and Seminar Presentations

- “Experimental Methods for Investigating the Mechanism of Subdural Hematoma”, Injury Biomechanics Research Laboratory Quarterly Research Seminar, Ohio State University, June 2013.
- “Investigation of the Mechanism of Subdural Hematoma Using High-Speed Ultrasound”, Injury Biomechanics Research Laboratory Quarterly Research Seminar, Ohio State University, December 2012.
- “Head Injury in the Elderly: The importance of subdural hematoma”, Injury Biomechanics Research Laboratory Quarterly Research Seminar, Ohio State University, December 2009.
- “An Overview of NHTSA’s Injury Databases: Use in Biomechanics Research,” Injury Biomechanics Research Laboratory Quarterly Research Seminar, Ohio State University, October 2008.
- “Eye Impact: Development of a Test Technique for Dynamic Measurement of Intraocular Pressure”, Injury Biomechanics Research Laboratory Quarterly Research Seminar, Ohio State University, April 2004.
- “US Crash Databases in Biomechanics Research: A Primer”, Central Ohio Injury Biomechanics Engineering Consortium, Columbus, 2004.

Invited Lectures

- “Experimental Testing in Eye Trauma”, Ohio State University, Department of Optometry, 2006.
- “Biomechanics of Eye Trauma”, Ohio State University, Department of Anatomy, 2005.
- “Airbag Associated Injuries”, California Association of Criminalists, 2002.