



The 21<sup>st</sup> Annual  
INJURY BIOMECHANICS  
SYMPOSIUM



Wednesday, May 20<sup>th</sup>

**5:30 PM Welcome Reception & Cornhole Tournament** | Sponsored by Biocore, Cellbond, & UVA's Wallace H. Coulter Center for Translational Research

- Food and drinks provided
- Cornhole tournament will begin at 6:30 PM
- Transportation between the hotel and Kardinal Hall will be provided
  - 5:30 PM bus pick up from hotel



**Kardinal Hall**

722 Preston Ave #101, Charlottesville, VA 22903

<https://kardinalhall.com>

AWARDING PARTNER:



SPONSORS:

Biocore | Cellbond | DTS | IIHS | Kistler  
OrthoBioMech | SEA | Toyoda Gosei | XSENSOR  
Vector Scientific | Robson Forensic | UVA Coulter Center  
Kyowa | Nationwide Children's Hospital | SAE Virginia



Wednesday, May 20 - 1



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Thursday, May 21<sup>st</sup>



**Insurance Institute for Highway Safety**  
988 Dairy Road, Ruckersville, Virginia, 22968

- 7:30 AM** Bus departs hotel for IIHS Vehicle Research Center
- 8:00 AM** **Registration & Continental Breakfast (Lobby)** | Sponsored by Toyoda Gosei & Kyowa
- 8:45 AM** **Opening Remarks and Welcome**  
Jason Forman, PhD | Associate Professor – University of Virginia
- 8:55 AM** **Scientific Agenda**  
Becky Mueller | Senior Research Engineer – IIHS
- 9:00 AM** **Keynote: IIHS Crash Avoidance Testing**  
David Aylor | Vice President of Active Safety – IIHS

**ORAL SESSION I: PMHS Testing for Vulnerable Populations**

Moderators – Maitland Witmer | Drexel University  
Schuyler St. Lawrence | Toyota Motor North America

- 9:45 AM** **Preliminary Impact and Injury Response of Varied Anthropometry PMHS in Frontal Sled Tests**  
Mary Gallaher, John-Paul Donlon, Isabella Nazari, Logan Mann, Reagan Hollar, Sara Sochor, Junior Noss, Jason Forman  
Center for Applied Biomechanics, University of Virginia, USA

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**10:15 AM Thoracic Biomechanical Responses of Small Female PMHS in a Simplified Side Impact Condition**

Srinivas Anantharamakrishnan<sup>1</sup>, Andrew Kemper<sup>2</sup>, Gretchen Baker<sup>1</sup>, Allison Guettler<sup>1</sup>, Heather Rhule<sup>2</sup>, Yun-Seok Kang<sup>1</sup>, Amanda Agnew<sup>1</sup>

<sup>1</sup> Injury Biomechanics Research Center, The Ohio State University, USA

<sup>2</sup> Vehicle Research and Test Center, National Highway Traffic Safety Administration, USA

**IIHS TOUR**

**10:45 AM Crash Test Tour**  
Becky Mueller | Senior Research Engineer – IIHS

**11:30 AM Live Crash Test Viewing**  
*Group photos and student presenter photos*

**12:00 PM LUNCH (Lobby) | Sponsored by IIHS & Nationwide Children’s Hospital**

**ORAL SESSION II: TESTING AND VALIDATION**

Moderators – Dori Watts | Explico Inc (Wayne State University)  
Derek Jones | University of Virginia

**1:00 PM Vehicle Front-End Architecture as a Driving Factor in Occupant Injury Risk During Vehicle-Guardrail Impacts: A Hybrid III Dummy-Based Numerical Study**

Maheep Bubna<sup>1</sup>, Elijah Buckland<sup>1</sup>, Luke Riexinger<sup>2</sup>, Costin Untaroiu<sup>3</sup>

<sup>1</sup>Department of Mechanical Engineering, Virginia Tech, USA

<sup>2</sup>Insurance Institute for Highway Safety, USA

<sup>3</sup>Department of Biomedical Engineering, Virginia Tech, USA

**1:30 PM Comparison of Pelvis Injury Patterns and Loading Mechanisms in PMHS Tests and Real-World Side Impact Collisions**

Isabella Nazari, Jaehyuk Heo, Bronislaw Gepner, Jason Forman

Center for Applied Biomechanics, University of Virginia, USA

**POSTER SESSION I**

**2:00 PM Oral Descriptions of Posters in Session I**

**Assessment of Layered Seat Cushion Configurations for Underbody Blast Protection**

Katerena Sirhan<sup>1</sup>, Mark Shafer<sup>2</sup>, Cameron ‘Dale’ Bass<sup>1</sup>

<sup>1</sup>Biomedical Engineering Department, Wayne State University, USA

<sup>2</sup>Occupant Protection Team, Ground Vehicle Survivability and Protection, USA

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**Quantifying Head Impact Exposure in Collegiate 15s Rugby and Relationship to Clinical Measures**

Lauren A. Duma<sup>1</sup>, Nicole Stark<sup>2</sup>, Steve Rowson<sup>2</sup>

<sup>1</sup>School of Neuroscience, Virginia Tech, USA

<sup>2</sup>Department of Biomedical Engineering, Virginia Tech, USA

**Elderly Fatality in CIREN Cases: A Matched Case Review**

Logan Mann, Mary Gallaher, Jason Forman

Center for Applied Biomechanics, University of Virginia, USA

**The Relationship between PAEB Pulses and Injury Risk in Child, Teen, and Adult Pedestrian Collisions**

Maitland Witmer<sup>1,2</sup>, David Kidd<sup>3</sup>, Valentina Graci<sup>1,2</sup>

<sup>1</sup>Department of Biomedical Engineering, Sciences and Health Professions, Drexel University, USA

<sup>2</sup>Children's Hospital of Philadelphia, Center for Injury Research and Prevention, USA

<sup>3</sup>Insurance Institute for Highway Safety, USA

**Quantifying Kinematic and Vibrational Responses in Hockey-Style Catcher's Mask**

Richard A. Gillespie<sup>1</sup>, Eric J. Shunk<sup>1</sup>, Mark Begonia<sup>2</sup>, Nicole Stark<sup>1</sup>, Steve Rowson<sup>1</sup>

<sup>1</sup>Department of Biomedical Engineering, Virginia Tech, USA

<sup>2</sup>Institute for Critical Technology and Applied Science, Virginia Tech, USA

**2:30 PM**      **BREAK | Posters from Session I on display**  
**SNACK | Sponsored by SAE Virginia Chapter**

**ORAL SESSION III: Lower Extremities**

Moderators – Molly Gallaher | University of Virginia  
Kerry Danelson | Wake Forest University School of Medicine

**3:00 PM**      **Associations between Vehicle Safety Systems and Pilon Fracture Severity are Revealed by Using a Novel Objective Quantitative Fracture Energy Metric**

L. Garrett Bangert<sup>1</sup>, Samuel Northrup<sup>1</sup>, William Armstrong<sup>2</sup>, Joel D. Stitzel<sup>2</sup>, R. Shayn Martin<sup>2</sup>, Kevin Dibbern<sup>3</sup>, Donald D. Anderson<sup>4</sup>, Ashley A. Weaver<sup>2</sup>, Caitlyn J. Collins<sup>1</sup>

<sup>1</sup>Department of Biomedical Engineering, Virginia Tech, USA

<sup>2</sup>Biomedical Engineering, Wake Forest University School of Medicine, USA

<sup>3</sup>Department of Pediatrics, University of Nebraska Medical Center, USA

<sup>4</sup>Department of Orthopedics and Rehabilitation, University of Iowa, USA

**3:30 PM**      **Failure Tolerance of Male and Female Lower Extremities Under Pure Bending and Combined Loading Modes**

Maria Carbon, Isabella Nazari, Timothy Edinger, Jeessoo Shin, Connor Hanggi, Jason Kerrigan, Jason Forman

Center for Applied Biomechanics, University of Virginia, USA

AWARDING PARTNER:



Collaborative Safety Research Center  
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**4:00 PM**      ***Sex and Age Effects on Tibia Biomechanical Properties in Dynamic Four-Point Bending***

Jonathon Spangler<sup>1</sup>, Amanda Agnew<sup>1</sup>, Yun-Seok Kang<sup>1</sup>, Andrew Kemper<sup>2</sup>, Gretchen Baker<sup>1</sup>, Allison Guettler<sup>1</sup>, Angela Harden<sup>1</sup>

<sup>1</sup>Injury Biomechanics Research Center, The Ohio State University, USA

<sup>2</sup>Vehicle Research and Test Center, National Highway Traffic Safety Administration, USA

**4:30 PM**      **Closing Remarks**

Jason Forman, PhD | Associate Professor – University of Virginia

**4:45 PM**      **Shuttle Back to Hotel**

**BANQUET** | Sponsored by DTS, Kistler, & XSENSOR



**THREE NOTCH'D**  
BREWING COMPANY | CHARLOTTESVILLE, VA

520 2nd St SE, Charlottesville, VA 22902, USA

<https://threenotchdbrewing.com/pages/cville>

- 6:15 PM**      Bus to banquet available
- 6:30 PM**      Banquet dinner and drinks
- 8:00 PM**      Team Trivia
- 9:30 PM**      Shuttles available to return participants to the hotel

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Thursday, May 21 - 4



The 21<sup>st</sup> Annual  
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Friday, May 22<sup>nd</sup>



**Rice Hall (RICE 130)**  
85 Engineer's Way, Charlottesville, Virginia, 22903

- 7:30 AM** Depart the hotel for Rice Hall at the University of Virginia  
You may walk through the scenic campus (map provided on IBS website) or  
a bus will depart the hotel at 7:45 AM
- 8:00 AM** **Continental Breakfast** | Sponsored by OrthoBioMech & Vector Scientific
- 8:45 AM** **Keynote: NHTSA Crash Injury Research - Data, Experiments and Tools**  
Matthew Craig | Acting Director of Vehicle Crashworthiness – National Highway Traffic  
Safety Administration (NHTSA)

**POSTER SESSION II**

- 9:30 AM** **Oral Descriptions of Posters in Session II**  
Moderators – Samuel Northrup | Virginia Tech  
Eric Heitkamp | Honda

***Incorporating Cortical Bone Property Variability into Simulations of Isolated Ribs  
under Anterior-Posterior Bending***

Cristian Saenz-Betancourt<sup>1,2</sup>, Dustin Draper<sup>1</sup>, Philipp Wernicke<sup>1</sup>, Yun-Seok Kang<sup>3</sup>,  
Steffen Peldschus<sup>2</sup>, Amanda Agnew<sup>3</sup>

<sup>1</sup>BMW Group, Germany

<sup>2</sup>Ludwig-Maximilians-Universität München, Germany

<sup>3</sup>Injury Biomechanics Research Center, The Ohio State University, USA

***Lacrosse Ball Impacts on Women's Headgear***

Katie Metrey, Nicole Stark, Steve Rowson

Department of Biomedical Engineering, Virginia Tech, USA

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***Mechanical Characterization of the Liver and Kidney: A Systematic Review***

Anna Morris<sup>1,2</sup>, Junior Noss<sup>2</sup>, Jason Forman<sup>2</sup>

<sup>1</sup>Department of Physics and Engineering, Washington and Lee University, USA

<sup>2</sup>Center for Applied Biomechanics, University of Virginia, USA

***Quantifying Changes in Mouthguard–Dentition Fit to Support Head Impact Measurement Validity***

Daniel Chong, Daniel Kye, Elizabeth Dimbath, Mitchell Z. Abrams, Jason F. Luck

Department of Biomedical Engineering, Injury Biomechanics Laboratory, Duke University, USA

***Whole-Body MRI to Assess Perfusion Success and Soft Tissue Injuries in PMHS Subjected to High-Rate Loading***

Dori Watts<sup>1,2</sup>, Wajahat Mohammed<sup>3</sup>, Yongsheng Chen<sup>4</sup>, Karin Rafaels<sup>5</sup>, Cynthia Bir<sup>2</sup>

<sup>1</sup>Explico Inc, USA

<sup>2</sup>Biomedical Engineering, Wayne State University, USA

<sup>3</sup>Detroit Medical Center/Wayne State University, USA

<sup>4</sup>Neurology, Biomedical Engineering, MR Core Research Facility, Wayne State University, USA

<sup>5</sup>US Army Combat Capabilities Development Command Army Research Laboratory, USA

**10:00 AM**    **BREAK** | Posters from Session II on display

**ORAL SESSION IV: Combat Helmets**

Moderators – Srinivas Anantharamakrishnan | The Ohio State University

Nicole Stark | Virginia Tech

**10:30 AM**    ***Behind Helmet Blunt Trauma Deformation Geometry under Different Helmet Materials***

Derek Pang<sup>1</sup>, Robert Salzar<sup>2</sup>, Brian Boggess<sup>3</sup>, Cameron ‘Dale’ Bass<sup>1</sup>

<sup>1</sup>Department of Biomedical Engineering, Wayne State University, USA

<sup>2</sup>University of Virginia, USA

<sup>3</sup>S-E-A Limited, USA

**11:00 AM**    ***Influence of Blast Directionality, Intensity, and Combat Helmet Use on Head Surface Pressure Responses***

Allison Nelson<sup>1</sup>, Ethan Burt<sup>1</sup>, Joseph Hamilton<sup>2</sup>, Kenny Espinoza<sup>2</sup>, Joseph Magallanes<sup>2</sup>, Pamela VandeVord<sup>1,3</sup>

<sup>1</sup>Department of Biomedical Engineering, Virginia Tech, USA

<sup>2</sup>Karagozian & Case Inc., USA

<sup>3</sup>Veterans Affairs Medical Center, USA

**11:30 AM**    **LUNCH (Rice Commons)** | Sponsored by SEA & Robson Forensic

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**ORAL SESSION V: Head Impacts**

Moderators – Maria Carbon | University of Virginia  
Michelle Fowler | Transportation Research Center

**12:30 PM** *Deriving Representative Head Impact Profiles in Contact Sports: A Shape-Based Clustering Approach*

Eleni Koumantou<sup>1</sup>, Emily Yik Kwan Chan<sup>1</sup>, Chris M. Jones<sup>2,3</sup>, Kieran Austin<sup>3</sup>, Mike Loosemore<sup>2,3</sup>, Mazdak Ghajari<sup>1</sup>

<sup>1</sup>Dyson School of Design Engineering, Imperial College London, UK

<sup>2</sup>The Institute of Sport, Exercise and Health, UK

<sup>3</sup>Sports and Wellbeing Analytics, UK

**1:00 PM** *Influence of Helmet Surface Protrusions on Youth Bicycle Helmet Impact Performance*

Caitlyn Jung, Nicole Stark, Steve Rowson  
Department of Biomedical Engineering, Virginia Tech, USA

**POSTER SESSION III**

**1:30 PM** **Oral Descriptions of Posters in Session III**

*Quantitative CT and MRI-based Modeling Assessment of Spine Injury Risk Following Long-Duration Spaceflight*

Talia E. Busquets<sup>1</sup>, Karan S. Devane<sup>1</sup>, Joel D. Stitzel<sup>1,2</sup>, Jaehyeon Park<sup>1,3</sup>, Diana A. Madrid<sup>1</sup>, Luis F. Poveda<sup>1</sup>, Drew D. DiSerafino<sup>2</sup>, Ashley A. Weaver<sup>1</sup>

<sup>1</sup>Biomedical Engineering, Wake Forest University School of Medicine, USA

<sup>2</sup>Elemance, LLC, USA

<sup>3</sup>Department of Mechanical Engineering, The Cooper Union for the Advancement of Science and Art, USA

*An Investigation of Local Accelerator Pedal Geometry Effects on Ankle Motion*

Stacey Webb, Junior Noss, Jason Forman  
Center for Applied Biomechanics, University of Virginia, USA

*How Do Different Human Body Models Affect Occupant Impact Responses and Restraint Design Optimizations in Frontal Crashes?*

Yatin Shankar Narayanan<sup>1,2</sup>, Sumukha Shrouthy<sup>1,2</sup>, Kyle Boyle<sup>1</sup>, Renuka Jagadish<sup>4</sup>, Tushar Arora<sup>4</sup>, Jingwen Hu<sup>1,2,3</sup>

<sup>1</sup>University of Michigan Transportation Research Institute, USA

<sup>2</sup>Department of Mechanical Engineering, University of Michigan, USA

<sup>3</sup>Department of Industrial and Operations Engineering, University of Michigan, USA

<sup>4</sup>Humanetics, USA

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***The Potential Effects of Youth Hockey Helmet Shell Add-Ons***

Andrew Calis, Nicole Stark, Steve Rowson

Department of Biomedical Engineering, Virginia Tech, USA

***Evaluation of Surrogate Soft Tissue Candidates for Biofidelity and Durability***

Morgan Pluim<sup>1</sup>, Georgia Campbell<sup>2,3</sup>, Grace Kemper<sup>4</sup>, Cheryl E. Quenneville<sup>1,3</sup>

<sup>1</sup>School of Biomedical Engineering, McMaster University, Canada

<sup>2</sup>Integrated Biomedical Engineering, McMaster University, Canada

<sup>3</sup>Department of Mechanical Engineering, McMaster University, Canada

<sup>4</sup>Health Sciences, McMaster University, Canada

**2:00 PM**      **BREAK** | Posters from Session III on display

**2:30 PM**      **Awards & Closing Remarks**  
Jason Forman, PhD | Associate Professor – University of Virginia  
Becky Mueller | Senior Research Engineer – IIHS

**3:30 PM**      **University of Virginia Center for Applied Biomechanics Open House**  
All are welcome, but transportation will not be provided (accommodations can be made).  
4040 Lewis and Clark Dr, Charlottesville, VA 22911

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