



# The 16<sup>th</sup> Annual INJURY BIOMECHANICS SYMPOSIUM

PRESENTED BY:

# HONDA

INJURY BIOMECHANICS  
RESEARCH CENTER



THE OHIO STATE UNIVERSITY

## Welcome to the 2021 Virtual Injury Biomechanics Symposium!

\*All times are in Eastern Daylight Time (EDT)\*

### Sunday, May 23<sup>rd</sup>

*SpatialChat* | <https://spatial.chat/s/16thIBS>

- 6:00 PM**      **Information Session**  
Introduction to *SpatialChat* Meeting Platform
- 6:30 PM**      **Networking Event**  
Virtual rooms open & scientific posters on display

### Monday, May 24<sup>th</sup>

*SpatialChat* | <https://spatial.chat/s/16thIBS>

- 8:00 AM**      **Virtual Rooms Open**  
Technology checks  
Networking  
Scientific posters on display
- 9:00 AM**      **Opening Remarks and Orientation**  
John H Bolte IV, PhD | The Ohio State University
- 9:20 AM**      **Scientific Agenda**  
Julie Mansfield, PhD | The Ohio State University
- ORAL SESSION I – Head and Brain**  
Moderator – TBD
- 9:30 AM**      ***Preliminary Investigation of Skull and Brain Dynamics during Blast***  
Allison Nelson<sup>1</sup>, Warren Hardy<sup>2</sup>, Elizabeth McNeil<sup>1</sup>, Vivek Kote<sup>3,4</sup>, Dhananjay Subramaniam<sup>3,4</sup>, Jose Rubio<sup>3,4</sup>, Aravind Sundaramurthy<sup>3,4</sup>, Ginu Unnikrishnan<sup>3,4</sup>, Jaques Reifman<sup>3</sup>, Pamela VandeVord<sup>1</sup>  
<sup>1</sup>Department of Biomedical Engineering and Mechanics, Virginia Tech University  
<sup>2</sup>Department of Mechanical Engineering, Virginia Tech University  
<sup>3</sup>Biotechnology High Performance Computing Software Applications Institute, US Department of Defense  
<sup>4</sup>The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

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Monday, May 24 - 1



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**10:00 AM**     ***Head Impact Biomechanics by Ice Zone and Athlete Role in Youth Ice Hockey***  
Abigail G Swenson<sup>1,2</sup>, N Stewart Pritchard<sup>2,3</sup>, Logan E Miller<sup>2,3</sup>, Jillian E Urban<sup>2,3</sup>, Joel Stitzel<sup>2,3</sup>

<sup>1</sup>Department of Neuroscience, Wake Forest School of Medicine

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

<sup>3</sup>School of Biomedical Engineering and Sciences, Virginia Tech-Wake Forest University

**10:30 AM**     **BREAK | Poster Orientation**

**10:40 AM**     **POSTER SESSION I**

Moderator – TBD

***Evaluation of Ankle Range of Motion and Dynamic Stiffness for Human Foot-Ankle Surrogate Design***

Julia-Grace Polich<sup>1,4</sup>, Michael B Tegtmeier<sup>2</sup>, John H Bolte IV<sup>3</sup>, Aaron Scott<sup>4</sup>, Paula Gangopadhyay<sup>5</sup>, Per Kristian Moerk<sup>6</sup>, Kerry A Danelson<sup>1,4</sup>

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

<sup>2</sup>US Army Research Laboratory

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

<sup>4</sup>Orthopedic Surgery, Wake Forest School of Medicine

<sup>5</sup>Foot and Ankle Surgery, Wake Forest Baptist Health

<sup>6</sup>Physical Therapy, Wake Forest Baptist Health

***Ultrasound Measurement Validation Under High-Rate Rotational Motion***

Angela C Tesny<sup>1</sup>, Ann E Mallory<sup>2,4</sup>, Colton T Thomas<sup>2</sup>, Heather H Rhule<sup>3</sup>, Kevin M Moorhouse<sup>3</sup>, Yun-Seok Kang<sup>1</sup>

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

<sup>2</sup>Transportation Research Center, Inc.

<sup>3</sup>National Highway Traffic Safety Administration, Vehicle Research and Test Center

<sup>4</sup>Department of Mechanical Engineering, The Ohio State University

***Human Body Model Morphing for Biofidelic Predictions of Kinematics and Rib Fracture Risk for a Diverse Population of Occupants***

Karl-Johan Larsson<sup>1,2</sup>, Bengt Pipkorn<sup>1,2</sup>, Johan Iraeus<sup>1</sup>

<sup>1</sup>Department of Mechanics and Maritime Sciences, Chalmers University of Technology

<sup>2</sup>Autoliv Research, Sweden

***Computational Modeling of Astronaut Kinematics and Injury Risks in a Standing Posture during Lunar Launch and Landing***

Mitesh Lalwala<sup>1</sup>, Bharath Koya<sup>1</sup>, Nathaniel Newby<sup>2</sup>, Jeffrey Somers<sup>3</sup>, F Scott Gayzik<sup>1</sup>, Joel Stitzel<sup>1</sup>, Ashley Weaver<sup>1</sup>

<sup>1</sup>Center for Injury Biomechanics, Wake Forest University

<sup>2</sup>Occupant Protection Group, KBR, Inc.

<sup>3</sup>Occupant Protection Group, National Aeronautics and Space Administration (NASA)

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Monday, May 24 - 2



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**11:30 AM LUNCH BREAK / NETWORKING**

**ORAL SESSION II – Spine and Full Body**

Moderator – TBD

**12:00 PM *Preliminary Response Corridor for Combined Loading of the Lumbar Spine***

Joseph Avila<sup>1</sup>, John Humm<sup>2,3</sup>, Klaus Driesslein<sup>2,3</sup>, Frank Pintar<sup>1,3</sup>

<sup>1</sup>Joint Department of Biomedical Engineering, Medical College of Wisconsin & Marquette University

<sup>2</sup>Department of Neurosurgery, Medical College of Wisconsin

<sup>3</sup>Neuroscience Research Laboratories, Zablocki VA Medical Center

**12:30 PM *Biofidelity Assessment of a GHMC M50 in Rear-facing Seating Configuration during a High-Speed Frontal Impact***

Vikram Pradhan<sup>1</sup>, Rakshit Ramachandra<sup>2</sup>, Jason Stammen<sup>3</sup>, Kevin Moorhouse<sup>3</sup>, John H Bolte IV<sup>1</sup>, Yun-Seok Kang<sup>1</sup>

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

<sup>2</sup>Transportation Research Center, Inc.

<sup>3</sup>Vehicle Research and Test Center, National Highway Traffic Safety Administration

**1:00 PM *Validating a Device for Whiplash Motion Simulation in a Porcine Model***

Nikoo Soltan<sup>1</sup>, Peter A Crompton<sup>1,2</sup>, Mats Y Svensson<sup>3</sup>, Gunter P Siegmund<sup>4,5</sup>

<sup>1</sup>Department of Mechanical Engineering, University of British Columbia

<sup>2</sup>School of Biomedical Engineering, University of British Columbia

<sup>3</sup>Department of Mechanics and Maritime Sciences, Chalmers University of Technology

<sup>4</sup>MEA Forensic Engineers & Scientists

<sup>5</sup>School of Kinesiology, University of British Columbia

**1:30 PM BREAK / NETWORKING**

**1:40 PM POSTER SESSION II**

Moderator – TBD

***Development of an Upper Cervical Spine Model for use in an Omnidirectional Surrogate Neck***

Sarah Romani, Peter A Crompton

School of Biomedical Engineering, University of British Columbia

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Monday, May 24 - 3



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***Kinematic Model Based Sensor Fusion for Inertial Measurements Units in Injury Biomechanics***

Noah I Eckstein<sup>1</sup>, Manoj Srinivasan<sup>2</sup>, Yun-Seok Kang<sup>1</sup>

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

<sup>2</sup>Department of Mechanical Engineering, The Ohio State University

***QCT for Biomechanical Scaling***

Rhylee DeCrane, Maria Ortiz, Jason Kait, Hattie Cutcliffe, Cameron R 'Dale' Bass  
Injury Biomechanics Laboratory, Duke University

***The Effects of Combined Loading in Side Impacts***

Evan R Linton, Yun-Seok Kang, Amanda M Agnew, Gretchen H Baker, Alexander Bendig, John H Bolte IV

Injury Biomechanics Research Center, The Ohio State University

**2:30 PM**

**TRIVIA EVENT**

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**Tuesday, May 25<sup>th</sup>**

**SpatialChat** | <https://spatial.chat/s/16thIBS>

**8:00 AM**      **Virtual Rooms Open**  
Technology checks  
Networking  
Scientific posters on display

**ORAL SESSION III – Lower Extremities**  
Moderator – TBD

**9:00 AM**      ***Femoral Neck Bone Fracture Toughness and Bone Strength Relationships under High-Rate Impact Loading***  
Daniel Martel<sup>1</sup>, Daniel Dapaah<sup>2</sup>, Thomas Willett<sup>2</sup>, Andrew Laing<sup>1</sup>  
<sup>1</sup>Department of Kinesiology, University of Waterloo  
<sup>2</sup>Department of Systems Design Engineering, University of Waterloo

**9:30 AM**      ***Investigation of the Biofidelity of the MIL-Lx Foot***  
Julia de Lange<sup>1</sup>, Lindsey Wong<sup>2</sup>, Cheryl E Quenneville<sup>1,3</sup>  
<sup>1</sup>School of Biomedical Engineering, McMaster University  
<sup>2</sup>Department of Integrated Science, McMaster University  
<sup>3</sup>Department of Mechanical Engineering, McMaster University

**10:00 AM**      ***A Novel Method for Observing Hip Fracture during Impact Simulating a Sideways Fall***  
Emily Bliven<sup>1</sup>, Pierre Guy<sup>2</sup>, Peter A Cripton<sup>1</sup>  
<sup>1</sup>School of Biomedical Engineering, University of British Columbia  
<sup>2</sup>Department of Orthopaedics, University of British Columbia

**10:30 AM**      **BREAK / NETWORKING**

**10:40 AM**      **POSTER SESSION III**  
Moderator – TBD

***Variability in Fracture Force and Cross-Sectional Geometry between Male and Female Tibiae in Lateral Impacts***

Angela L Harden, Yun-Seok Kang, Randee L Hunter, Alexander Bendig, John H Bolte IV, Noah I Eckstein, Adam GF Smith, Amanda M Agnew  
Injury Biomechanics Research Center, The Ohio State University

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## ***Assessment of Occupant Response in Frontal Bus Crash Sled Scenarios to Investigate Public Transportation Safety***

Christopher Pastula, Kathy Tang, Donata Gierczycka, Duane Cronin  
Department of Mechanical Engineering, University of Waterloo

## ***Investigation into the Injury Severity of Unmanned Aerial System (UAS) Impacts on Non-Participating Public***

Nathaniel Baum, Russel Baldrige, Rodrigo Marco, Luis Gomez, Gerardo Olivares  
Advanced Virtual Engineering Testing (AVET) Lab, National Institute for Aviation Research (NIAR), Wichita State University

## ***Methodology Dependent Variation in Volumetric Bone Mineral Density***

Zachary Haverfield, Amanda M Agnew, Randee L Hunter  
Injury Biomechanics Research Center, The Ohio State University

## ***Characterization of Video-Recorded Falls Involving Children in a Childcare Setting***

Danielle Cory<sup>1</sup>, Gina Bertocci<sup>1</sup>, Angela Thompson<sup>2</sup>, Bret Hilt<sup>1</sup>, Craig Smalley<sup>1</sup>, Nathan Brown<sup>1</sup>, Raymond Dsouza<sup>1</sup>, Karen Bertocci<sup>1</sup>, Keyonna McKinsey<sup>1</sup>

<sup>1</sup>Department of Bioengineering, University of Louisville

<sup>2</sup>Department of Engineering Fundamentals, University of Louisville

**11:30 AM LUNCH BREAK / NETWORKING**

### **ORAL SESSION IV – Epidemiology**

Moderator – TBD

### **12:00 PM *The Lack of Sex, Age, and Anthropometric Diversity in Neck Biomechanical Data***

Gabrielle R Booth<sup>1,4,5</sup>, Gunter P Siegmund<sup>2,3</sup>, Peter A Cripton<sup>1,4,5</sup>

<sup>1</sup>Orthopaedic and Injury Biomechanics Laboratory, University of British Columbia

<sup>2</sup>MEA Forensic Engineers & Scientists

<sup>3</sup>School of Kinesiology, University of British Columbia

<sup>4</sup>International Collaboration on Repair Discoveries, University of British Columbia

<sup>5</sup>School of Biomedical Engineering, University of British Columbia

### **12:30 PM *Female vs. Male Relative Fatality Risk in Fatal Crashes: 1975-2018***

Mitchell Z Abrams, Cameron R 'Dale' Bass  
Injury Biomechanics Laboratory, Duke University

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## ORAL SESSION V – Thorax

Moderator – TBD

### 1:00 PM ***Behind Armor Blunt Trauma (BABT) Indenter Simulating High-Velocity Impacts from Rifle Rounds on Hard Body Armor***

J Op 't Eynde<sup>1</sup>, CP Eckersley<sup>1</sup>, RS Salzar<sup>2</sup>, BD Stemper<sup>3</sup>, BS Shender<sup>4</sup>, TB Bentley<sup>5</sup>, C R 'Dale' Bass<sup>1</sup>

<sup>1</sup>Injury Biomechanics Laboratory, Duke University

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

<sup>3</sup>Joint Department of Biomedical Engineering, Medical College of Wisconsin & Marquette University

<sup>4</sup>Naval Air Warfare Center Aircraft Division

<sup>5</sup>Office of Naval Research

### 1:30 PM ***Protecting Children Against Commotio Cordis in Baseball by Understanding the Effects of Impact Locations over the Heart***

Grant J Dickey<sup>1</sup>, Kewei Bian<sup>1</sup>, Habib R Khan<sup>2</sup>, Haojie Mao<sup>1,3</sup>

<sup>1</sup>Department of Mechanical and Materials Engineering, University of Western Ontario

<sup>2</sup>Department of Cardiology, London Health Sciences Center, University of Western Ontario

<sup>3</sup>Department of Biomedical Engineering, University of Western Ontario

### 2:00 PM **BREAK / NETWORKING**

### 2:10 PM **AWARDS AND WRAP-UP**

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