



# Gunter Siegmund

PhD PEng

Director of Research, Senior Engineer

## contact

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📍 Vancouver

## expertise

Injury Biomechanics

## areas of specialization

Whiplash injury

Spine and head injuries

Helmet effectiveness

Human performance

Slip and fall injuries

Injury causation

Bicycle collisions

Dr. Gunter Siegmund is a senior engineer in MEA Forensic's Injury Biomechanics group, where he evaluates the causal relationship between a person's diagnosed injuries and the forces applied to their body during a specific event. Gunter is also the director of research at MEA and an adjunct professor in the School of Kinesiology at the University of British Columbia.

Gunter provides accurate, unbiased and defensible conclusions for clients to evaluate and, if helpful, advance their cases. He starts by working with clients to distill their questions into technical hypotheses; "I try to tease their case apart into questions that can be answered scientifically," he explains. He then reviews the available evidence and integrates the relevant scientific literature to reach his conclusions. Sometimes Gunter designs experiments to test hypotheses.

As an expert witness, Gunter helps lawyers, judges, and jurors to understand the technical aspects of a case. He views his role as that of an educator, helping others to understand the science supporting his conclusion rather than just offering ready-made conclusions. "As experts," he notes, "I believe we are more effective if we teach people how to reach a conclusion instead of simply telling them the answer."

As MEA's Director of Research, Gunter guides the firm's research projects; identifying and building useful lines of inquiry, and ensuring that the scope and methods are appropriate. As an Adjunct Professor, he works with graduate students on their injury-related research in kinesiology, mechanical engineering and biomechanics. While these research projects are varied in topic, Gunter's personal research interests involve neck and head injuries. "From whiplash injuries and concussions to quadriplegia and traumatic brain injuries, we are working to better understand the mechanics of the entire range of neck and head trauma," Gunter says.

## education

Doctor of Philosophy, Biomechanics, School of Human Kinetics, University of British Columbia, 2001.

Bachelor of Applied Science (Honours), Mechanical Engineering, University of British Columbia, 1986.

## professional status

Registered Professional Engineer

Association of Professional Engineers and Geoscientists of British Columbia, Registration No. 16388.

Professional Engineers Ontario, License No. 100089362

## professional associations

Society for Neuroscience (SFN), since 1999.

International Society of Biomechanics (ISB), since 1998.

## professional experience

### **MEA Forensic Engineers & Scientists**

Director of Research, Senior Engineer, 1986 to Present

Conducts technical investigations and research into the biomechanics of injury. Involved in over 3500 technical investigations related to motor vehicle collisions, bicycle collisions, pedestrian impacts, and slip and fall accidents. Biomechanical analyses consist of reviews of medical records and images, and assessments of injury mechanics, applied loads, and the casual relationship between the applied loads and injury. Research activities focus on the biomechanics of injury caused by motor-vehicle collisions and slip and fall accidents. Qualified as an Expert Witness in the Supreme Courts of British Columbia, Alberta, and the Yukon, the Ontario Superior Court of Justice, the Superior Courts of California, Washington State and Alaska, the Provincial Court of British Columbia, the Ontario Court of Justice, and the Coroner's Courts of British Columbia and Manitoba.

### **School of Kinesiology, University of British Columbia, Vancouver, BC**

Adjunct Professor, 2001 to Present

Conducts research into the biomechanical and neurophysiological factors related to injury. Co-supervises graduate students working on injury-related topics.

## research activities

### **EXTRA-MURAL GRANTS AND CONTRACTS**

Principal Investigator: Engineering approaches to preventing or mitigating whiplash injuries. Natural Sciences and Engineering Research Council (NSERC) Discovery Grant, \$165,000, September 2018 – August 2023. Goal: to better understand i) how females and males interact with car seats during rear-end crashes, and ii) whether a seat that can adapt to its occupant and the crash severity can control how an occupant responds during a rear-end crash.

Co-Investigator: Wearable head impact sensors for estimation of brain strain. Natural Sciences and Engineering Research Council (NSERC) Collaborative Research and Development Grant, \$32,000, September 2016 – August 2018. Goal: to quantify the time-dependent accuracy of a wearable sensor's kinematic output and brain strains predicted by those kinematics relative to the kinematics and brain strains obtained from reference sensors.

Co-Investigator: Kinematics and muscle activation of the cervical spine during impending head first impacts in motor vehicle

rollovers. Canadian Institute for Health Research (CIHR), \$486,030, May 2015 – April 2020. Goal: to quantify the intervertebral alignment and neck muscle activity immediately preceding a head first impact during a dynamic rollover event.

Principal Investigator: Gender differences in neck biomechanics relevant to whiplash injury. Natural Sciences and Engineering Research Council (NSERC) Discovery Grant, \$105,000, April 2009 – Mar 2014. Goal: to identify anatomical and biomechanical factors that explain the increased risk of whiplash injury in females compared to males.

Co-Investigator: Rear end impacts – Injury prevention through new concepts in seat design. Auto21 Network of Centres of Excellence. \$469,800, April 2012 – March 2015. Principal Investigator: Dr. Douglas Romilly (University of British Columbia). Goal: to continue development of an active seat designed to mitigate/prevent whiplash injuries.

Co-Investigator: Prevention: Reducing occupant injury in rear end collisions. Auto21 Network of Centres of Excellence. \$334,745, April 2009 – March 2012. Principal Investigator: Dr. Douglas Romilly (University of British Columbia). Goal: to develop an active seat designed to mitigate/prevent whiplash injuries.

Co-Investigator: Defining cervical facet kinematics for combined shear, compression & axial pre-torque of vertebral motion segments; Japan Automobile Research Institute, US\$70,000, Mar 2006 – Dec 2006. Principal Investigator: Dr. Beth Winkelstein (University of Pennsylvania). Goal: to quantify the cervical intervertebral motion and facet capsular strain for loading that simulates a head-turned posture during a rear-end collision.

Mentor: Gender-specific neck musculoskeletal parameters for analysis of whiplash injury. New Investigator Training Award for Unintentional Injury, Violence Related Injury, Injury Biomechanics, and Acute Injury Care Research; CDC – National Center for Injury Prevention and Control, US\$99,173, September 2005 – August 2006. Principal Investigator: Dr. Anita Vasavada (Washington State University). Goal: to characterize geometrical differences in vertebrae and muscles between size-matched males and females and 50th percentile males, and to determine if gender-specific biomechanical models are needed to analyze whiplash injury.

Co-Investigator: Neuromuscular control of the head and neck in paraplegic spinal cord injured subjects. BC Neurotrauma Fund and ICORD, \$50,000, May 2004 – April 2005. Principal Investigator: Dr. Tim Inglis (University of British Columbia). Goal: to quantify the neck muscle responses of low and high thoracic SCI patients and control subjects exposed to whiplash perturbations, and to determine whether seat design changes can enhance the SCI patient response.

Co-Supervisor: Neuromuscular control of the head and neck in whiplash injury. Canadian Institute for Health Research (CIHR), \$110,000, April 2004 – March 2006. Michael Smith Foundation for Health Research, \$78,000, April 2004 – March 2006. Fondation Chiropratique du Québec, \$12,000, April 2004 – March 2005. Post-Doctoral Fellow: Dr. Jean-Sébastien Blouin; Other Co-Supervisor: Dr. Tim Inglis (University of British Columbia). Goal: to document the integrity of the cervicocollic, vestibulocollic, vestibulospinal and propriospinal reflexes in whiplash patients and control subjects.

Co-Investigator: Biomechanical analysis of the neck musculature in whiplash injury. Whitaker Foundation, US\$239,325, May 2003 – April 2006. Principal Investigator: Dr. Anita Vasavada (Washington State University). Goal: to use biomechanical models of the male and female necks to evaluate muscle and ligament strains due to imposed whiplash kinematics and to analyze the dynamic function of neck muscles in whiplash.

Project Manager: Crash test evaluation of low-velocity whiplash-injury risk. Insurance Corporation of British Columbia, \$100,000, February – August 2003. Goal: to better quantify the relationship between vehicle damage and the potential for neck injury in rear-end collisions by measuring the dynamic response of a BioRID dummy in 20 different vehicles.

Principal Investigator: The effect of subject awareness in assessing the probability of slip and fall accidents. Workers' Compensation Board of British Columbia, \$69,118, September 2002 – August 2004. Goal: to quantify the difference between unexpected and expected slips leading to fall-related injuries so that laboratory experiments and tribometer measurements can be properly applied to real slip and fall accidents.

Principal Investigator: The role of neck muscle response in whiplash injuries. Physical Medicine Research Foundation, \$6,028, August 1999 – July 2000. Goal: to determine how subject awareness affects the neck muscle responses of seated human subjects exposed to simulated rear-end collisions.

Project Manager: The effect of cellular phone use on critical decision-making while driving. Insurance Corporation of British Columbia, \$149,093, August 1999 – May 2000. Goal: to evaluate the effect of cellular phone use on vehicle operator's ability to respond to traffic lights, within-lane obstacles and left-turning vehicles.

Principal Investigator: Identification of injury mechanisms in low-speed rear-end automobile impacts. Science Council of British Columbia, \$163,578, February 1996 – January 1997. Goal: to quantify the kinematic, kinetic, neuromuscular, and symptomatic

responses of male and female human subjects exposed to controlled rear-end collisions at multiple severities.

Co-Manager: Fatigued-driver identification study. Insurance Corporation of British Columbia, \$103,715, December 1993 – December 1994. Goal: to determine whether vehicle-based measures (steering wheel, accelerator and vehicle movements) correlate to physiological fatigue measures (electroencephalography, heart rate and wakefulness) and to identify parameters that could be used for detecting fatigued long-haul truck drivers.

### **ONGOING INTRA-MURAL PROJECTS**

Helmet performance: currently studying i) the impact attenuation performance of motorcycle, bicycle and sport helmets over wide range of impact severities, and ii) how well head impact severity can be predicted from the residual deformation of helmet liners.

Whiplash injury: currently studying i) the superficial and deep muscle responses to whiplash perturbations, ii) how startle affects habituation to whiplash perturbations, and iii) the neck muscle reflexes under different collision directions and head-on-trunk orientations.

### **GRADUATE STUDENT SUPERVISION**

#### **Co-Supervisor**

Jean-Sébastien Blouin, Post Doctoral Fellow, UBC School of Human Kinetics. Neuromuscular control of the head and neck in whiplash injury. April 2004 – March 2006.

Samanthi Goonetilleke, Post Doctoral Fellow, UBC School of Human Kinetics. Do our reflexes exacerbate whiplash injury? Quantifying the effect of multifidus muscle activation on cervical facet capsule strain. July 2011 – May 2012.

Harrison Brown, MSc, UBC School of Human Kinetics. Development and assessment of an objective balance assessment system. September 2010 – September 2013.

Robyn Newell, PhD, UBC Department of Mechanical Engineering. Kinematics and muscle activation of the cervical spine during vehicle rollover accidents. September 2008 – May 2014.

Patrick Forbes, Post Doctoral Fellow, UBC School of Human Kinetics, The interaction of self-generated head movements and vestibular neck reflexes. July 2014 – November 2016.

Alex Rebchuk, MSc, UBC School of Kinesiology, Investigating impact exposure and functional neurological status in collegiate football players. September 2012 – June 2016.

Hannah Gustafson, PhD Student, UBC Department of Mechanical Engineering. Axial validation of a human head and neck finite element model. September 2010 – September 2016.

Daniel Mang, PhD Student, UBC School of Kinesiology. Seat-human interface: Optimizing car seat properties to the individual for injury prevention. May 2010 – Present.

Jason Fice, PhD Student, UBC School of Kinesiology, Neck muscle activity and whiplash injury. September 2012 – Present.

Harrison Brown, PhD Student, UBC School of Kinesiology. Impairment of vestibular function following concussive injury. October 2013 – Present.

M'Beth Schoenfeld, MSc Student, UBC Department of Mechanical Engineering. Cervical intervertebral kinematics and neck muscle response during simulated dynamic rollover crashes. January 2016 – July 2018.

Emma Woo, MSc student, UBC School of Kinesiology. Vestibular mechanisms underlying adolescent idiopathic scoliosis. May 2016 – July 2018.

Manju Sivam, MSc Student, University of Alberta, Department of Mechanical Engineering. Error analysis in a wearable head impact sensor for estimating brain strain. January 2017 – Present.

Loay Al-Salehi, PhD Student, UBC Department of Mechanical Engineering. Neck muscle and intervertebral dynamics in rollover crashes – Full six degree of freedom simulations with human subjects. September 2017 – Present.

#### **Thesis/Defense Committee Member**

Tamika Heiden, PhD Student, UBC School of Human Kinetics. The effect of subject awareness in assessing the probability of slip and fall accidents. September 2002 – August 2004.

Amy Saari, MASc, UBC Department of Mechanical Engineering. Spinal cord deformation during axial impact injury of the cervical

spine. Spring, 2007.

Liyang Zheng, PhD Candidate, Washington State University. Sex differences in human neck musculoskeletal biomechanics. September 2007 – April 2011.

Daniel Mang, MSc, UBC School of Human Kinetics. Using acoustic stimuli to inhibit the startle response triggered by whiplash collisions: Implications for injury prevention. September 2007 – April 2010.

Julianne Schmidt, PhD Student, University of North Carolina at Chapel Hill, Department of Interdisciplinary Human Movement Science. The role of the cervical musculature, visual function, and anticipation in mitigating head impact severity in football. March 2012 – May 2013.

Alessa Rae Lennon, MA student, University of North Carolina at Chapel Hill, Department of Exercise and Sport Science. Measurement of head impact biomechanics: A comparison of the Head Impact Telemetry System and X2 Biosystem xPatch. March 2014 – April 2015.

Enora Le Flao, PhD Student, Auckland University of Technology. Head impact monitoring in sport: Development of new methods for analysis of acceleration signals. June 2017 – Present.

## awards

Bertil Aldman Memorial Lecture, IRCOBI Conference, 2018.

Best Student Paper, Stapp Car Crash Conference, 2001.

Natural Sciences and Engineering Research Council (NSERC) Post Graduate Scholarship B, 1999 – 2001.

University of British Columbia Grant Supplement Award, 1999 – 2001.

Finalist, Clinical Biomechanics Award, International Society of Biomechanics, 1999.

International Travel Scholarship, International Society of Biomechanics, 1999.

Mary E. Simpson Scholarship, 1998.

Science Council of British Columbia GREAT Scholarship, 1997 – 2001.

Natural Sciences and Engineering Research Council (NSERC) Post Graduate Scholarship A, 1997 – 1999.

J. William Hudson Service Scholarship, 1985.

Charles A. and Jane C.A. Banks Foundation Scholarship, 1984.

University of British Columbia Scholarship, 1984.

University of British Columbia Scholarship, 1983.

Norman MacKenzie Alumni Scholarship, 1981.

Province of British Columbia Scholarship, 1981.

George Hodgins Scholarship, 1981.

## publications

Head postures during naturalistic driving

The neutral posture of the human cervical spine is not unique

Neck muscle biomechanics and neural control

Variability of walkway tribometer measurements

The effect of contaminant film thickness on slip resistance

Electrical vestibular stimuli evoke robust muscle activity in deep and superficial neck muscles in humans

The Effect of Target Features on Toyota's Autonomous Emergency Braking System

The Accuracy of Toyota Vehicle Control History Data during Autonomous Emergency Braking

Brain tissue strains vary with head impact location: A possible explanation for increased concussion risk in struck versus striking football players

Damage identification on vertebral bodies during compressive loading using digital image correlation

The effect of motorcycle helmet fit on predicting head impact kinematics from residual liner crush

Age has a minimal effect on the impact performance of field-used bicycle helmets

Behavior of Toyota airbag control modules exposed to low and mid-severity collision pulses

Whiplash injury or concussion? A possible biomechanical explanation for concussion symptoms in some individuals following a rear-end collision

Dynamic response and residual helmet liner crush using cadaver heads and standard headforms

Head impact magnitude in American high school football

Laboratory validation of two wearable sensor systems for measuring head impact severity in football players

Predicting snowmobile speed from visible locked-track and rolldown marks in groomed/packed snow conditions

Comparison of the Accuracy and Sensitivity of Generation 1, 2 and 3 Toyota Event Data Recorders in Low-Speed Collisions

The impact response of traditional and BMX-style bicycle helmets at different impact severities

Comparison of strain rosettes and digital image correlation for measuring vertebral body strain

Age does not affect the material properties of expanded polystyrene liners in field-used bicycle helmets

## lectures & presentations

June 26, 2018 – Variance in walkway tribometer measurements – An update. ASTM F13 Research Subcommittee Meeting, San Diego, CA.

June 6, 2018 – Concussion Litigation – A biomechanical view. A co-presentation with Sandra Corbett, Q.C., Annual General Meeting & Conference, Canadian Defense Lawyers, Toronto, ON.

January 22, 2018 – Variance in walkway tribometer measurements. ASTM F13 Research Subcommittee Meeting, New Orleans, LA.

November 19, 2016 – Whiplash Injury. Keynote speaker. 21st Annual Scientific Conference of the Spine Research Institute of San Diego, Coronado, CA.

June 16, 2015 – Validity of head impact sensors. Invited lecture for iCORD Trainee Symposium, International Collaboration on Repair Discoveries, Faculty of Medicine, University of British Columbia, Vancouver, BC.

March 10, 2015 – Directional sensitivities in head impact sensors. Symposium on Head Acceleration Measurement Sensors, Virginia Tech, Blacksburg, VA.

November 24, 2014 – Biomechanics of whiplash injury. Lecture for MECH 436/536 Fundamentals of Injury Biomechanics, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

November 13, 2014 – Laboratory validation of head impact sensors for football. Shirtsleeves Technical Meeting, ASTM F08.53 Headgear Subcommittee, New Orleans, LA.

October 24-26, 2014 – Invited speaker, Biomechanics of whiplash injury, Alberta Biomedical Engineering Conference, Banff, AB.

November 14, 2013 – Headform repeatability on the linear impactor. Shirtsleeves Technical Meeting, ASTM F08.53 Headgear Subcommittee, Jacksonville, FL.

October 11, 2013 – Bioengineering evidence of tissue damage after whiplash injury. 8th Congress of the European Federation of IASP Chapters (EFIC). Florence, Italy.

March 8, 2013 – Introduction to biomechanics, head and neck injuries. Washington Defense Trial Lawyers Seminar on the Analysis



of Motor Vehicle Claims. Seattle, WA.

February 28, 2013 – The secret science of car seats. Secret Science Café. Vancouver, BC.

June 9, 2012 – Forensic biomechanics. Organizer of the Forensic Biomechanics session at the Canadian Society of Biomechanics conference, Vancouver, BC, June 7-9, 2012.

May 27, 2011 – The anatomy and biomechanics of acute and chronic whiplash injury. Research 2011, Chiropractic BC, Burnaby, BC.

April 6, 2011 – The anatomy and biomechanics of acute and chronic whiplash injuries. Lecture for MECH 436 – Fundamentals of Injury Biomechanics, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

March 31, 2011. Injury biomechanics – Addressing issues of injury causation. Lecture for HKIN 352, School of Human Kinetics, University of British Columbia, Vancouver, BC.

February 19-20, 2011 – What do the occupant kinematics and neuromuscular responses tell us about whiplash injury? 2011 Whiplash Symposium – How to Lessen the Transition to Chronicity, The Centre of Clinical Research Excellence in Spinal Pain, Injury and Health, University of Queensland, Brisbane, Australia.

February 8, 2011 – Slipping, Tripping and Falling on Stairs, Steps and Slopes. Canadian Defense Lawyers, Toronto, ON.

October 29, 2010 – Injury biomechanics – Addressing issues of injury causation. Ontario Trial Lawyers Association, Fall Conference, Toronto, ON.

May 14, 2010 – Biomechanics of slips & falls. Ontario Insurance Adjusters Associations, Provincial Claims Conference, Hamilton, ON.

April 8, 2010 – Forensic biomechanics. Lecture for MECH 436 – Fundamentals of Injury Biomechanics, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

April 1, 2010. Forensic engineering & injury biomechanics. Lecture for HKIN 352, School of Human Kinetics, University of British Columbia, Vancouver, BC.

March 27-28, 2009 – The anatomy and biomechanics of whiplash injury. The Essential Soft Tissue Injury Conference, Trial Lawyers Association of British Columbia, Vancouver, BC.

March 26, 2009. Forensic engineering & injury biomechanics. Lecture for HKIN 352, School of Human Kinetics, University of British Columbia, Vancouver, BC.

January 30, 2008 – Injury Biomechanics. Ontario Insurance Adjusters Association, Professional Development & Claims Conference, Toronto, ON.

April 5, 2007 – Forensic engineering & injury biomechanics. Lecture for HKIN 352 – Mechanical Properties of Tissues: from Myosin to Movement, School of Human Kinetics, University of British Columbia, Vancouver, BC.

November 2, 2006 – Whiplash injury – Vehicle seat, occupant & tissue responses. Biomechanics 435/535 lecture, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

March 31, 2006 – The biomechanics of whiplash: The latest evidence surrounding soft tissue injuries. The Essential Soft Tissue Injury Conference, Trial Lawyers Association of British Columbia, Vancouver, BC.

November 25, 2005 – Accident Reconstruction Fundamentals. Judicial Justices Fall 2005 Seminar, Vancouver, BC.

October 31, 2005 – Whiplash injury – Vehicle seat, occupant & tissue responses. Biomechanics 435/535 lecture, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

October 17, 2005 – Forensic engineering & Injury biomechanics, Mech 410/550 lecture, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

September 14, 2005 – Slip & Fall Biomechanics. Alberta Civil Trial Lawyers Association. Webex presentation to ACTLA members.

March 5-6, 2005 – Tissue injuries in whiplash. Whiplash, Spinal Trauma and the Personal Injury Case Seminar, Adler Giersch, Seattle, WA.

February 25-26, 2005 – Neck muscle neuromechanics and whiplash injury. 2nd International Whiplash Trauma Congress, Spinal

Injury Foundation, Breckenridge, CO.

November 24, 2004 – Whiplash injury – Vehicle seat, occupant & tissue responses. Biomechanics 435/535 lecture, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

November 18, 2004 – Forensic Engineering. Mech 2 lecture, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

May 13, 2004 – Slip & Fall and Tribometers. BC School Safety Association Expert Panel on Floor Slips. Vancouver, BC.

March 6-7, 2004 – Whiplash injury – Vehicle seat, occupant & tissue responses. Whiplash, Spinal Trauma and the Personal Injury Case Seminar, Adler Giersch, Seattle, WA.

October 9-10, 2003 – What human subject testing can tell us about whiplash injury. International Whiplash Trauma Congress, Spinal Injury Foundation, Denver, CO.

September 26-27, 2003 – Spinal cord injury – Environment and devices. Workshop on the Biomechanical Aspects of Spinal Cord Injury, Peter Wall Institute for Advanced Studies, University of British Columbia, Vancouver, BC.

June 20-22, 2003 – Whiplash injury – Vehicle seat, occupant & tissue responses. International Spinal Trauma Conference, American Chiropractors Association, Chicago, IL.

March 28-29, 2003 – The sheer complexity of whiplash injury. The Essential Soft Tissue Injury Conference. Trial Lawyers Association of British Columbia, Vancouver, BC.

March 27, 2003 – The role of biomechanics in personal injury cases. Admissibility of Forensic and Demonstrative Evidence for Insurance Claims, a legal seminar organized by Insight Information Co., Toronto, ON.

February 7, 2003 – Injury biomechanics. Personal Injury Cases: Winning with Experts. Continuing Legal Education. Vancouver, B.C.

February 6, 2003 – The neurophysiology and biomechanics of whiplash injury. Spring Seminar Series, Department of Biological Systems Engineering and VCAPP, Programs in Bioengineering and Neuroscience. Washington State University, Pullman, WA.

February 3, 2003- Forensic injury biomechanics. Seminar Series. Department of Mechanical Engineering, University of British Columbia, Vancouver, BC.

October 15-16, 2001 – Injury biomechanics & personal injury litigation. The Soft Tissue Injury Seminar. Alberta Civil Trial Lawyers Association, Calgary and Edmonton, AB.

May 4, 2001 – Injury biomechanics. Continuing Legal Education, Personal Injury Conference. Vancouver, BC.

March 30-31, 2001 – Injury biomechanics. The Essential Soft Tissue Injury Conference. Trial Lawyers Association of British Columbia, Vancouver, BC.

May 12, 2000 – Injury biomechanics. Continuing Legal Education, Personal Injury Conference. Vancouver, BC.

November 12, 1999 – Cervical spine muscle response during whiplash. North American Whiplash Trauma Congress, BC Chiropractors Association. Victoria, BC.

November 2, 1999 – Low speed impacts: Vehicle and human response. Canadian Bar Association (Alberta). Calgary, AB.

August 24, 1999 – Biomechanics and brain injury. ICBC Head Injury Unit. North Vancouver, BC.

August 12, 1999 – Forensic Biomechanics Forum, International Society of Biomechanics, Calgary, AB.

May 7, 1999 – Proving pain. Continuing Legal Education, Personal Injury Conference. Vancouver, BC.

November 18-19, 1998 – Low speed impacts: Vehicle and human response. BC Trial Lawyer Soft Tissue Injury Seminar (Continuing Legal Education). Vancouver, BC and Victoria, BC.

May 6, 1998 – Occupant and vehicle response to low-speed rear-end collisions. Grand Rounds, Department of Orthopaedics, Vancouver Hospital & Health Sciences Centre, University of British Columbia. Vancouver, BC.

February 18, 1998 – The kinematic and clinical response to whiplash. City-wide Rounds, Department of Physical Medicine and Rehabilitation, Faculty of Medicine, University of British Columbia. Vancouver, BC.

January 29, 1998 – The kinematics of whiplash. Graduate Seminar Series, School of Human Kinetics, University of British



Columbia. Vancouver, BC.

October 6-7, 1997 – Analysis of low-speed impacts, Vehicle and human response. Alberta Civil Trial Lawyers Association. Calgary, AB and Edmonton, AB.

August 18-22, 1997 – Human response to low-speed rear-end collisions. High-speed & Low-speed Impact Seminar, Richmond, BC.

August 19-20, 1996 – Human subject testing in low-speed impacts. Low-Speed Collision TopTec, Society of Automotive Engineers Professional Development Program, Richmond, BC.

March 14, 1996 – Long-haul truck driver fatigue. Pacific Traffic Safety Association, Justice Institute of British Columbia, New Westminster, BC.

January 19, 1996 – Long-haul truck driver fatigue. Seminar for the Occupational Hygiene Programme, Faculty of Graduate Studies, University of British Columbia, Vancouver, BC.

July 21-22, 1995 – Minor impact investigations: Basic fundamentals and applications of collision test data. Southwest Association of Technical Accident Investigators seminar on Low-Speed Impacts, Phoenix, AZ.

May 10, 1995 – Low-speed impacts. Washington Association of Technical Accident Investigators, Seattle, WA.

August 8-9, 1994 – Staged collisions: Roles of bumpers, estimating impact severity, and injury potential. Low-Speed Rear Impact Collision TopTec, Society of Automotive Engineers Professional Development Program, Irvine, CA.

August 1992 – Low-speed impact demonstration. Canadian Association of Traffic Accident Investigation and Reconstruction, Annual Meeting, Kelowna, BC.

February, 1991 – Seat belt use and effectiveness. Seminar for ICBC Adjusters, Southwest Marine Drive Claim Centre, Vancouver, BC.

## training and professional development

September 12-14, 2018 – International Research Council on Biomechanics of Injury, Athens, Greece.

July 25, 2018 – ASTM Standards Development Meeting of Committee F13 – Pedestrian/Walkway Safety and Footwear, San Diego, CA.

January 22, 2018 – ASTM Standards Development Meeting of Committee F13 – Pedestrian/Walkway Safety and Footwear, New Orleans, LA.

September 13-15, 2017 – International Research Council on Biomechanics of Injury, Antwerp, Belgium.

September 12, 2017 – Workshop on Safety of Automated Vehicles, Antwerp, Belgium.

June 15, 2017 – Slips, Trip, and Falls International Conference, Toronto Rehabilitation Institute, University Health Network, Toronto, ON.

June 14, 2017 – ASTM Standards Development Meeting of Committee F13 – Pedestrian/Walkway Safety and Footwear, Toronto, ON.

January 31, 2017 – ASTM Standards Development Meeting of Committee F13 – Pedestrian/Walkway Safety and Footwear, West Conshohocken, PA.

January 30, 2017 – Workshop on Multifactorial Analysis of Slip and Fall Events: Implications for Forensic and Safety Professionals. West Conshohocken, PA.

November 7-9, 2016 – 60th Stapp Car Crash Conference, Washington, DC.

November 6, 2016 – 44th International Workshop on Human Subjects for Biomechanical Research, Washington, DC.

September 14-16, 2016 – International Research Council on Biomechanics of Injury, Malaga, Spain.

September 13, 2016 – Workshop on Crash Reconstruction, Malaga Spain.

June 3-4, 2016 – Northwest Biomechanics Symposium, Vancouver, BC.

November 9-11, 2015 – 59th Stapp Car Crash Conference, New Orleans, LA.

November 8, 2015 – 43rd International Workshop on Human Subjects for Biomechanical Research, New Orleans, LA.

September 9-11, 2015 – International Research Council on Biomechanics of Injury, Lyon, France.

September 8, 2015 – Concussion Workshop, Lyon, France.

July 6, 2015 – Building Code Overview, Ontario Society of Professional Engineers, Mississauga, ON.

November 13, 2014 – ASTM Standards Development Meetings of Committee F08 – Sports Equipment and Facilities, New Orleans, LA.

November 10-12, 2014 – 58th Stapp Car Crash Conference, San Diego, CA.

November 9, 2014 – 42nd International Workshop on Human Subjects for Biomechanical Research, San Diego, CA.

October 24-26, 2014 – Alberta Biomedical Engineering Conference, Banff, AB.

July 6-9, 2014 – 7th World Congress of Biomechanics, Boston, MA.

May 27-28, 2014 – AUTO21 Conference, Niagara Falls, ON.

May 16-17, 2014 – Northwest Biomechanics Symposium, Salem, OR.

November 13-15, 2013 – ASTM Standards Development Meetings of Committee F08 – Sports Equipment and Facilities, Jacksonville, FL.

November 11-13, 2013 – 57th Stapp Car Crash Conference, Orlando, FL.

November 10, 2013 – 41st International Workshop on Human Subjects for Biomechanical Research, Orlando, FL.

October 9-11, 2013 – 8th Congress of the European Federation of IASP Chapters (EFIC). Florence, Italy.

May 22-23, 2013 – AUTO21 Conference, Toronto, ON.

November 14-16, 2012 – ASTM Standards Development Meetings of Committee F08 – Sports Equipment and Facilities, Atlanta, GA.

November 13, 2012 – Symposium on the Mechanism of Concussion in Sports, Atlanta, GA

October 29-31, 2012 – 56th Stapp Car Crash Conference, Savannah, GA.

October 28, 2012 – 40th International Workshop on Human Subjects for Biomechanical Research, Savannah, GA.

September 12-14, 2012 – International Research Council on the Biomechanics of Injury (IRCOBI) conference, Dublin, Ireland.

September 11, 2012 – Pedestrian and Cyclist Injury Workshop, Dublin, Ireland.

September 10, 2012 – ISN Workshop on Biomechanical Experiments with Human Subjects, Dublin, Ireland.

June 7-9, 2012 – Canadian Society of Biomechanics conference, Vancouver, BC.

November 7-9, 2011 – 55th Stapp Car Crash Conference, Dearborn, MI.

November 6, 2011 – 39th International Workshop on Human Subjects for Biomechanical Research, Dearborn, MI.

September 24, 2011 – Not “Just A Concussion”, Brain Research Centre, Vancouver, BC

November 13-17, 2010 – Society for Neuroscience, 40th Annual Meeting, San Diego, CA.

November 3-5, 2010 – 54th Stapp Car Crash Conference, Phoenix, AZ.

November 2, 2010 – 38th International Workshop on Human Subjects for Biomechanical Research, Phoenix, AZ.

February 22-27, 2010 – 62nd Annual Scientific Meeting of the American Academy of Forensic Sciences, Seattle, WA.

November 2-4, 2009 – 53rd Stapp Car Crash Conference, Savannah, GA.

November 1, 2009 – 37th International Workshop on Human Subjects for Biomechanical Research, Savannah, GA.

May 25-28, 2009 – Combined Automotive Parts Manufacturers’ Association (APMA) and AUTO21 Conference, Hamilton, ON.

November 3-5, 2008 – 52nd Stapp Car Crash Conference, San Antonio, TX.

November 2, 2008 – 36th International Workshop on Human Subjects for Biomechanical Research, San Antonio, TX.

January 20-22, 2008 – World Congress on Neck Pain, Los Angeles, CA.

October 29-31, 2007 – 51st Stapp Car Crash Conference, San Diego, CA.

October 28, 2007 – 35th International Workshop on Human Subjects for Biomechanical Research, San Diego, CA.

October 26-27, 2007 – 4th International Whiplash Trauma Congress, Miami, FL.

May 9, 2007 – Bloodstain Pattern Analysis Seminar, Vancouver, BC.

November 6-8, 2006 – 50th Stapp Car Crash Conference, Dearborn, MI.

November 5, 2006 – International Workshop on Human Subjects for Biomechanical Research, Dearborn, MI.

July 29 – August 4, 2006 – 5th World Congress of Biomechanics, Munich, Germany.

June 6, 2006 – Tribometer Workshop, sponsored by the ASTM Committee F-13 on Pedestrian/Walkway Safety and Footwear, Pasadena, CA.

June 1-2, 2006 – 3rd International Whiplash Trauma Congress, Portland, OR.

May 12-13, 2006 – Northwest Biomechanics Symposium, Vancouver, BC.

November 12-16, 2005 – Society for Neuroscience, 35th Annual Meeting, Washington, DC.

November 9-11, 2005 – 49th Stapp Car Crash Conference, Washington, DC.

November 8, 2005 – 33rd International Workshop on Human Subjects for Biomechanical Research, Washington, DC.

June 27-29, 2005 – 19th Annual International Occupational Ergonomics and Safety Conference, Las Vegas, NV.

February 25-26, 2005 – 2nd International Whiplash Trauma Congress, Breckenridge, CO.

November 1-3, 2004 – 48th Stapp Car Crash Conference, Nashville, TN.

October 31, 2004 – 32nd International Workshop on Human Subjects for Biomechanical Research, Nashville, TN.

October 23-28, 2004 – Society for Neuroscience, 34th Annual Meeting, San Diego, CA.

October 27-29, 2003 – 47th Stapp Car Crash Conference, San Diego, CA.

October 26, 2003 – 31st International Workshop on Human Subjects for Biomechanical Research, San Diego, CA.

October 9-10, 2003 – International Whiplash Trauma Congress, Denver, CO.

September 26-27, 2003 – Workshop on the Biomechanical Aspects of Spinal Cord Injury, Vancouver, BC.

June 29, 2003 – Tribometer Workshop, sponsored by the ASTM Committee F-13 on Pedestrian/Walkway Safety and Footwear, Pasadena, CA.

June 28, 2003 – Symposium on the Biomechanics of Slip and Fall, sponsored by the ASTM Committee F-13 on Pedestrian/Walkway Safety and Footwear, Pasadena, CA.

June 20-22, 2003 – International Spinal Trauma Conference, Chicago, IL.

November 10-12, 2002 – 46th Stapp Car Crash Conference, Jacksonville, FL.

November 9, 2002 – 30th International Workshop on Human Subjects for Biomechanical Research, Jacksonville, FL.

August 4-9, 2002 – 4th World Congress of Biomechanics, Calgary, AB.

November 14-16, 2001 – 45th Stapp Car Crash Conference, San Antonio, TX.

November 13, 2001 – 29th International Workshop on Human Subjects for Biomechanical Research, San Antonio, TX.

November 11, 2001 – Society for Neuroscience, 31st Annual Meeting, San Diego, CA.

September 3-6, 2001 – Movement and Sensation, International Symposium, Cairns, Australia.

March 8-10, 2001 – International Congress on Whiplash-Associated Disorders, Berne, Switzerland.

November 9, 2000 – 10th Injury Prevention through Biomechanics Symposium, Atlanta, GA.

November 6-8, 2000 – 44th Stapp Car Crash Conference, Atlanta, GA.

November 5, 2000 – Society for Neuroscience, 30th Annual Meeting, New Orleans, LA.

November 4, 2000 – The principles and practice of modern light microscopy. A short course presented in conjunction with the Society for Neuroscience Annual Meeting.

October 25-27, 1999 – 43rd Stapp Car Crash Conference, San Diego, CA.

October 24, 1999 – 27th International Workshop on Human Subjects for Biomechanical Research, San Diego, CA.

October 22-23, 1999 – Electromyography: Fine-wire techniques, Motion Analysis Laboratory, Children’s Hospital, San Diego, CA.

August 8-13, 1999 – International Society of Biomechanics XVIIIth Congress, Calgary, AB.

February 7-11, 1999 – Invited Faculty, Session Chair, and Reviewer for the World Congress on Whiplash Associated Disorders, Vancouver, BC.

November 8, 1998 – Society for Neuroscience, 28th Annual Meeting, Los Angeles, CA.

November 5-6, 1998 – Whiplash '98 Symposium, Phoenix, AZ.

November 3-4, 1998 – 42nd Stapp Car Crash Conference, Phoenix, AZ.

September 16-18, 1998 – International IRCOBI Conference on the Biomechanics of Impact, Göteborg, Sweden.

September 15, 1998 – Committee meeting: Recommended practices for the proper use the proposed Neck Injury Criterion (NIC), chaired by Dr. O. Boström, Göteborg, Sweden.

September 15, 1998 – Whiplash-associated disorders. A short course on whiplash, including epidemiology, injury biomechanics, seat design and other safety systems, occupant modeling, and injury criteria. Department of Injury Prevention, Chalmers University of Technology, Göteborg, Sweden.

November 15, 1997 – 25th International Workshop on Human Subjects for Biomechanical Research, Lake Buena Vista, FL.

November 13-14, 1997 – 41st Stapp Car Crash Conference, Lake Buena Vista, FL.

November 4-6, 1996 – 40th Stapp Car Crash Conference, Albuquerque, NM.

November 3, 1996 – 24th International Workshop on Human Subjects for Biomechanical Research, Albuquerque, NM.

October 6-9, 1996 – 40th Annual Conference of the Association for the Advancement of Automotive Medicine, Vancouver, BC.

August 22-24, 1996 – 9th Biennial Conference of the Canadian Society of Biomechanics, Simon Fraser University, Burnaby, BC.

August 21, 1996 – Principles of surface and intramuscular electromyography collection and analysis. A short course presented in conjunction with the 9th Biennial Conference of the Canadian Society of Biomechanics, Simon Fraser University, Burnaby, BC.

August 21, 1996 – The biomechanics of ligaments and kinematics of joints. A short course presented in conjunction with the 9th Biennial Conference of the Canadian Society of Biomechanics, Simon Fraser University, Burnaby, BC.

February 26-29, 1996 – International Congress and Exposition, Society of Automotive Engineers, Detroit MI.

November 13-15, 1995 – International Truck & Bus Meeting & Exposition, Society of Automotive Engineers, Winston-Salem, NC.

November 11-12, 1995 – Accidental Injury: Biomechanics and Prevention, School of Medicine, University of California, San Diego, CA.

November 8-10, 1995 – 39th Stapp Car Crash Conference, San Diego, CA.

June 21-22, 1995 – PC-Crash Workshop, 2-day course on accident simulation and reconstruction software.

March 15-17, 1995 – Annual Intelligent Transportation Society (ITS) America conference, Washington, DC.

June 14-16, 1993 – Canadian Multidisciplinary Road Safety Conference VIII, Saskatoon, SK.

November 7-8, 1993 – 37th Stapp Car Crash Conference, San Antonio, TX.

