



June 3-4, 2016 University of British Columbia Vancouver, BC, Canada





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An American Society of Biomechanics Regional Meeting





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The 2016 Northwest Biomechanics Symposium is the 12th annual regional meeting of biomechanicians in the Pacific Northwest. The symposium focuses on student learning, collaboration, and knowledge transfer. This year, the symposium returns to the University of British Columbia, and is being organized in collaboration with Simon Fraser University. We hope to host a meeting with excellent student presentations and group discussions that celebrate diverse biomechanical research from across our region.



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### Welcome!

As co-Chairs, we would like to welcome everyone to the 12<sup>th</sup> annual Northwest Biomechanics Symposium. It's clear from the submitted abstracts that we can expect two days of excellent discussion on a broad range of biomechanics topics with researchers from all over our region. We are also pleased to have a conference team this year drawn from two universities in the Vancouver area – the University of British Columbia and Simon Fraser University – there will be the opportunity to visit research facilities for either school on Saturday.

Thanks to the reviewers, moderators, discussion leaders, conference committee and volunteers who have helped to put this meeting together, and thanks to the sponsors who make this conference accessible to students.

Please come up and say hello to us during the conference! We hope you have an enjoyable and educational visit to Vancouver and UBC!

**Dr. Peter Cripton** Professor and Associate Head, Department of Mechanical Engineering UBC



**Dr. Agnes d'Entremont** Instructor, Department of Mechanical Engineering UBC



**Dr. James Wakeling** Professor, Department of Biomedical Physiology and Kinesiology Assistant Professor, School of Engineering Science SFU



### Schedule

Friday, June 3, 2016	
11:30 am – 12:30 pm	Registration
12:30 pm – 12:40 pm	Introductory Remarks
12:45 pm – 2:00 pm	Podium Session I – Gait I
2:00 pm – 2:45 pm	Round Table Discussions 1 with Coffee
2:45 pm – 4:00 pm	Podium Session II – Neuromusculature
4:00 pm – 5:30 pm	Poster Session A - Gait/Neuromusculature
5:30 pm – 6:45 pm	Podium Session III – Trauma
6:45 pm	Dinner (Engineering Student Centre)

### Saturday, June 4, 2016

9:00 am – 9:15 am	Registration
9:15 am – 10:15 am	ASB Keynote Address
10:15 am – 11:00 am	Round Table Discussions 2 with Coffee
11:00 am – 12:15 pm	Podium Session IV – Gait II
12:15 pm – 1:15 pm	Lunch
1:15 pm – 2:15 pm	Poster Session B - Trauma/Sport/Cells/Work in Progress
2:15 pm – 3:30 pm	Podium Session V – Tissue/Rolling/Cells
3:30 pm – 3:45 pm	Closing Remarks
4:00 pm	Lab Tours and Social Interaction

### **Round Table Discussions**

Locations and moderators will be announced during the conference.

#### Session 1 – June 3, 2:00 pm – 2:45 pm

- Building up your teaching résumé
- Experiences in biomechanics careers in industry
- Proactive thesis writing
- Opportunities for international fellowships and grants
- The future of biomechanics

#### Session 2 – June 4, 10:15 am – 11:00 am

- How to focus your degree to work in industry
- Choosing a post-doctoral fellowship
- Applying for, securing, and starting a faculty position
- Effective communication with your thesis supervisor



# ASB Keynote Speaker

### A swell idea: molecular views of muscle contraction and radial motions and forces Dr. Tom Daniel, University of Washington

Dr. Daniel holds the Komen Endowed Chair at the University of Washington and is Professor in the Department of Biology, the Department of Computer Science & Engineering, and the Graduate Program on Neurobiology & Behavior. He trained at Duke University (PhD), and Caltech (Postdoctoral Fellow). He is the recipient of a MacArthur "genius" Fellowship, the UW Distinguished Teaching Award, and the UW Distinguished Graduate Mentor Award. His current research interests include the molecular mechanisms of force generation in human and animal movement, the control and dynamics of animal locomotion, and sensorimotor neural engineering.

# Important information for attendees

#### Locations

- Presentations, poster sessions, and roundtable discussions will be in the **Fred Kaiser Building** (KAIS 2020/2030 and the KAIS atrium) and the **Engineering Student Centre** (ESC atrium)
- Dinner will be held in the atrium at the **Engineering Student Centre** (ESC)
- Conference accommodations are at Gage Residence

The free <u>UBC mobile app for iPhone</u> provides an interactive map.

#### Wifi

#### ubcvisitor (free, open)

**eduroam** (available to members of participating institutions: see eduroam.org and your institution for details) [Note that Wifi is available in the Gage Residence lobby, but not in the rooms, which have free, wired internet – be sure to bring your own network cable and any necessary connectors]

#### Food

Coffee breaks will be held in the KAIS atrium. Continental breakfast is included in housing at Gage Residence. Friday dinner and Saturday lunch are included in your registration. Gluten-free and vegetarian options will be available for both meals.

### **Podium and Poster Presenters Info**

Please keep in mind that the NWBS audience is diverse (e.g., engineering, biological sciences, exercise science, etc.) so be sure to provide the context and broad perspective of your work, explaining any terminology, abbreviations and/or concepts that may be specific to your field.

### **Podium Presentations**

- Please plan on an 8-minute presentation, followed by 3 minutes for questions. Please be respectful of your fellow presenters and adhere to the time limit.
- Bring your presentation (e.g. PowerPoint slides, videos, etc.) on a USB drive and transfer it to the Windows laptop in the presentation room during the following allotted times. A technical assistant will be available to assist you.
  - Friday presenters: Between 11:30-12:30 pm or 2:00-2:45 pm Friday
  - Saturday presenters: Either on Friday, or 8:30-9:15 am or 12:15–1:15 pm on Saturday.



- Session moderators will introduce speakers and enforce time limits on the presentations and question periods. Be sure to check in with the moderators a few minutes before the start of the session in which you are presenting.
- During the question period please repeat the question before answering it so that the audience can hear it clearly.

#### **Poster Presentations**

- Posters will be exhibited on designated display boards located in the Kaiser Atrium.
- Please hang your poster on the board corresponding to your assigned poster number (see poster lists on page 9) by 2:00 pm on Friday and take it down by the end of the conference at 4:15 pm on Saturday. Pins will be provided.
- At least one author is expected to be present at each poster throughout the poster session.
- Each poster presenter has the option to give a 2-minute oral presentation to introduce their poster to the audience at the start of their poster session. Please bring a maximum of 2 slides on a USB for upload at one of the times listed for podium presentations above.

#### Lab Tours

Lab tours to biomechanics labs at both Vancouver General Hospital (VGH; these are UBC sites) and SFU are available, following the conference.

- The VGH site is about 20 minutes away by car/30 minutes by bus. Labs on this tour will include:
  - The Orthopaedic and Injury Biomechanics Lab at ICORD, the spinal cord injury research centre.
    PIs include Dr. Tom Oxland, Dr. Peter Cripton.
    Website: http://www.injury.mech.ubc.ca, http://icord.org
  - The Bioengineering Lab at the Centre for Hip Health and Mobility, with a focus on joint mechanics, imaging, and orthopaedics. PIs include Dr. David Wilson, Dr. Antony Hodgson, Dr. Shahram Amiri, Dr. Agnes d'Entremont.
    Website: http://www.hiphealth.ca/facilities/our-labs/biomedical-engineering-laboratory/
- SFU is about 45 minutes away by car/1 hour and 30 minutes by bus/skytrain. Labs on this tour will include:
  - The Neuromuscular Mechanics Lab, with a focus on the mechanical output of skeletal muscle during locomotion. PI: Dr. James Wakeling. Website: https://www.sfu.ca/nml.html
  - The Injury Prevention and Mobility Lab, with a focus on seniors falls and fall-related injuries and concussions in hockey. PI: Dr. Steve Robinovitch.
     Website: http://www.sfu.ca/tips.html
  - The Locomotion Lab, with a focus on the mechanics, energetics, and neural control of human locomotion. PI: Dr. Max Donelan.
     Website: http://www.sfu.ca/locomotionlab

Lab tours will take place from about 4:30-6 pm on Saturday, June 4, 2016. Because of the distance between the two sites, participants will only be able to visit one set of labs. Sign-up for lab tours can be found at the registration table – **please sign up before lunch on Saturday**, to ensure we have enough participants to run each tour.



### Podium Session I – Gait I

June 3, 2016 12:45 pm – 2:00 pm Moderators: Bil Ledoux, Michael Hahn

HINDFOOT FINITE HELICAL AXIS VARIATION BETWEEN CAVUS, NEUTRALLY ALIGNED, AND PLANUS FEET Thorhauer, ED, Fassbind, MJ, Kindig, MW, Sangeorzan, BJ, and Ledoux, WR

TRANSVERSE PLANE MISALIGNMENT OF ANKLE ARTHRODESIS ALTERS CENTER OF PRESSURE IN CADAVERIC GAIT SIMULATION Cook, BK, Kindig, MW, Stender, CJ, Beuchel, MW, Pangrazzi, GJ, Sangeorzan, BJ, and Ledoux, WR

A MECHATRONIC SYSTEM FOR STUDYING GAIT OPTIMIZATION Surabhi N. Simha and J. Maxwell Donelan

THE EFFECT OF RIGID ANKLE-FOOT ORTHOTICS ON LOWER LIMB JOINT RANGE OF MOTION Wichmann, TK, Smith, SL, Pomeroy, SM, and Hahn, ME

EVALUATION OF THE ARTIFICIAL X-RAY IMAGING SYSTEM (AXIS) AS AN INTRAOPERATIVE GUIDANCE TOOL DURING ORTHOPAEDIC SURGERIES Touchette M, Newell R, Anglin C, Guy P, Amlani M, Hodgson AJ

### **Podium Session II – Neuromusculature**

June 3, 2016 2:45 pm – 4:00 pm Moderators: James Wakeling, Katherine Steele Session Sponsor: lululemon athletica

SHIFTING OUR PERSPECTIVE ON RESIDUAL FORCE ENHANCEMENT Johnston, K, Jinha, A, and Herzog, W

CAN HUMANS CONTINUOUSLY OPTIMIZE ENERGETIC COST IN MULTIPLE DIMENSIONS? Abram, SJ, Selinger, JC, Donelan, JM

INFLUENCE OF SEX ON SENSORY AND MOTOR ASSYMETRIES King, JH and Karduna, AR

MUSCLE ACTIVATION AND JOINT MOMENTS DURING STAIR CLIMBING IN THOSE WITH SYMPTOMATIC FEMOROACETABULAR IMPINGEMENT COMPARED TO ASYMPTOMATIC CONTROLS Hammond, CA, Hatfield, GL, Gilbart, MK and Hunt, MA

COUPLED OSCILLATORS AFFECT THE ENERGETICS OF BIPEDAL WALKING: A TALE OF TWO MODELS Schroeder, RT, Bertram, JEA



### **Podium Session III – Trauma**

June 3, 2016 5:30 pm – 6:45 pm Moderators: Peter Cripton, Gunter Siegmund

MAPPING THE SPATIAL DISTRIBUTION OF FALLS BY OLDER ADULTS IN LONG-TERM CARE Chang, CE, Robinovitch, SN, van Schooten, KS

MECHANCIAL CHARACTERIZATION OF NON-HUMAN PRIMATE SPINAL CORD WHITE MATTER Jannesar, Sh, and Sparrey, CJ

THE EFFECT OF SHOULDER PAD DESIGN ON HEAD IMPACT SEVERITY DURING SHOULDER CHECKS IN ICE HOCKEY Virani, S, Russell, CM, Bruschetta, M, Hua, KN, Potvin, B, Cox, D, and Robinovitch, SN

IMPROVING RADIATION TECHNOLOGIST EDUCATON WITH ARTIFICIAL RADIOGRAPHS GENERATED ON-THE-FLY Ngo, T, Touchètte, M, Newell, R, Anglin, C, Guy, P, Amlani, M, and Hodgson, AJ

REDUCING RELATIVE MOTION IN A RODENT DISLOCATION SPINAL CORD INJURY MODEL THROUGH THE DESIGN OF IMPROVED VERTEBRAL CLAMPS Mattucci, S, Liu, J, Fijal, P, Tetzlaff, W and Oxland, T

### Podium Session IV – Gait II

June 4, 2016 11:00 am – 12:15 pm Moderators: Daivd Suprak, Eric Rombokas

EVALUATING CHANGES IN ACHILLES LENGTH WITH VARYING STIFFNESS ANKLE FOOT ORTHOSES USING ULTASOUND AND MUSCULOSEKELTAL MODELING Choi, H, Randhawa, A, Peters, KM, Wakeling, JM, and Steele, KM

CLASSIFYING WALKING, TRANSFERRING AND SEDENTARY ACTIVITIES IN HUMANS USING AN ARRAY OF WEARABLE INERTIAL SENSORS: A MACHINE LEARNING APPROACH Aziz, O, Robinovitch, SN, and Park, EJ

STEP DOWN AND SINGLE LEG SQUAT TASKS REQUIRE GREATER HIP MUSCLE CONTRIBUTIONS THAN STEP UP TASKS IN HEALTHY INDIVIDUALS Jesse Charlton, Gillian L. Hatfield, Christopher K. Cochrane, Connor Hammond, Chris Napier, Judit Takacs, Natasha M. Krowchuk, Michael A. Hunt

EVALUATION OF THE MECHANICAL FUNCTION OF A NOVEL LOWER-LIMB BIARTICULAR PROSTHESIS Willson, AM, Richburg C, Czerniecki, JM, Steele, KM, and Aubin, PM



CONTINUOUS-TIME MODELING OF GROUND CONTACT CAN APPROXIMATE INELASTIC COLLISION EVENTS IN SIMULATED BIPEDAL WALKING Mohamed Thangal, SM, Wong, JD and Donelan JM

### **Podium Session V – Tissues/Rolling/Cells**

June 4, 2016 2:15 pm – 3:00 pm Moderators: Tom Daniel, Mostafa Hegazy

MECHANICAL PROPERTIES AS A NEW INDICATOR OF DIFFERENTIATION STATUS OF MESENCHYMAL STEM CELLS Hamidreza Soltanian, and Roza Vaez Ghaemi

MECHANICAL CHARACTERIZATION OF PEYRONIE'S DISEASE TISSUE TREATED WITH HISTOTRIPSY Brady, L, Stender, C, Wang, Y-N, Wessels, H, Schade, G, Maxwell, A, Yasser, H, Ledoux, WR

KNEE JOINT CONTACT FORCES DURING PLYOMETRIC ACTIVITIES Dowling-Medley, JJ, Sharkey, LR, and Oxland, TR

DYNAMIC MOBILITY FOR MANUAL WHEELCHAIRS Thomas, LE, Sparrey, CJ, and Borisoff, JF

MODELING CELL POLARIZATION AND INTERCALATION DURING DROSOPHILA GERMBAND EXTENSION Lim, CS, Fernandez-Gonzalez, R, and Feng, JJ

### **Poster Session A – Gait/Neuromusculature**

June 3, 2016 4:00 pm – 5:30 pm

### Gait

- 1. HINDFOOT KINEMATICS AND CENTER OF PRESSURE OF A HEALTHY SUBJECT IN A BIPLANE FLUOROSCOPY SYSTEM Pepin, NR, Kindig, MW, laquinto, JM and Ledoux, WR
- 2. ACTIVE ANKLE FOOT ORTHOSES MAY REDUCE ENERGY COSTS OF WALKING IN INDIVIDUALS WITH CROUCH GAIT. Rosenberg, MC, Steele, KM
- 3. VARIABLE PRACTICE AND TRANSFER OF A NOVEL ASYMMETRICAL SPLIT-BELT WALKING PATTERN Hinkel-Lipsker, JW, and Hahn, ME
- 4. TEXTING WHILE WALKING: IMPACT ON CADENCE WITH AND WITHOUT THE PRESENCE OF OBSTACLES Chichkine, N, Cordua-von Specht, A, and Swain, MK
- 5. A PRELIMINARY STUDY OF INFANT VIBRATION EXPOSURE IN CHILD BICYCLE TRAILERS B. Gribbons, C. Bzovey, J. Dowling-Medley, J. Speidel, M. Cohen, S. Sadaram, A. d'Entremont
- 6. FABRICATING AND EVALUATING ADJUSTABLE STIFFNESS 3D-PRINTED ANKLE FOOT ORTHOSIS MacConnell, MB, Eckert ES, Ly, KK, Choi, H and Steele, KM
- 7. GRAVITATIONAL TORQUE PARTIALLY ACCOUNTS FOR PROPRIOCEPTIVE ACUITY Ostrander, T. Ettinger, L



8. CENTER OF MASS DISPLACEMENT IN HEALTHY INDIVIDUALS WHILE WALKING WITH A RIGID ANKLE-FOOT ORTHOTIC Smith, SL, Wichmann, TK, Pomeroy, SM, and Hahn, ME

#### Neuromusculature

- 9. DOES ENERGY OPTIMIZATION REQUIRE OUR CONSCIOUS ATTENTION? Halipchuk, RLB, Selinger, JC, and Donelan, JM
- 10. BIOMECHANICAL SIMULATION AND CONTROL OF HANDS Sachdeva, P, Sueda, S, Bradley, S and Pai, DK
- 11. LOADING EFFECTS ON CALF MUSCLES David Ryan, Norman Stutzig, Tobias Siebert, and James Wakeling
- 12. FUNCTIONAL IMPLICATIONS OF HELICAL BRE TRAJECTORIES IN SKELETAL MUSCLE Sebastian Dominguez, Ruoyan Kong, Nilima Nigam, David Ryan, Hadi Rahemi, and James Wakeling
- 13. RUNNING SHOE FOREFOOT BENDING STIFFNESS AFFECTS CALF MUSCLE EMG Alcantara, RS, Trudeau, MB, Brüggemann, GP, Hamill, J, Rohr, E
- 14. FORCE MATCHING SENSE: AN IPSILATERAL SHOULDER STUDY INVESTIGATING THE EFFECT OF TORQUE AND ELEVATION ANGLE Trousset K, Phillips D, Karduna A
- 15. MUSCLE CONTRACTILE BEHAVIOUR DEPENDS ON TISSUE INERTIA DURING SUBMAXIMAL CONTRACTIONS Ross, SA and Wakeling, JM
- 16. BIOMECHANICAL MODELING AND CONTROL OF FACIAL MUSCLES Neog, DR, and Pai, DK
- 17. VALIDITY AND RELIABILITY OF AN IPOD TOUCH IN MEASURING KNEE JOINT POSITION SENSE Lyons, SM, Cordell, J, Gossage, J, Suprak, DN, San Juan, JG
- 18. ESTABLISHING UNIMPAIRED BIMANUAL HAND USE WITH ACCELEROMETERS TO INFORM CEREBRAL PALSY TREATMENT Covelli CJ, Nuguru N, Peters KM, Steele KM
- 19. ULTRASOUND IMAGING AS A TOOL WITH WHICH TO ASSESS DIFFERENCES IN SUPRASPINATUS ACTIVATION BETWEEN SYMPTOMATIC AND ASYMPTOMATIC SHOULDERS Maloney, Lauren, Temes, Bill, Karduna, Andrew
- 20. EMG NORMALIZATION TO AN INDIVIDUALIZED SUBMAXIMAL FORCE Cooper, JC, and Karduna, AR

### **Poster Session B – Trauma/Sport/Cells/Work in Progress**

### June 4, 2016

### 1:15 pm – 2:15 pm

### Trauma

- 21. OPEN-SOURCE 3D-PRINTED HAND ORTHOSES FOR SPINAL CORD INJURY Portnova, AA, Mukherjee, G, Peters, KM, Yamane, A, and Steele, KM
- 22. IMPLANTABLE MECHANISMS FOR ORTHOPEDIC SURGERY: VALIDATION USING BIOMECHANICAL SIMULATIONS IN CHICKEN FOOT Casebier, Justin, James, Francis, and Ravi Balasubramanian

### Sport

- 23. JOINT STIFFNESS AND POWER GENERATION IN THE LOWER EXTREMITY DURING THE WALK-TO-RUN TRANSITION Jin, L, and Hahn, ME
- 24. JOINT REACTION FORCES FROM ALPINE SKIING AND ALPINE TOURING Campbell, JR, Scher, IS, and Ching, RP
- 25. EFFECTS HAND POSITION DURING A PUSH-UP ON SCAPULAR KINEMATICS Tylre M. Arens, David N. Suprak, Jun G. San Juan, Lorrie Brilla



- 26. A STANDING LONG JUMP COMPARISON OF TWO-FOOT AND ONE-FOOT LANDING MECHANICS: A PILOT STUDY Crickmore, KN, Connor, KR, Cogswell, TM, and Hegazy, MA
- 27. VARIATIONS IN ANKLE KINEMATICS ACROSS RUNNING VELOCITIES: INDICATORS FOR SUBJECT-SPECIFIC RESISTANCE TRAINING? Day, EM, Jin, L and Hahn, ME
- 28. A COMPARISON OF STANDING LONG JUMP ONE- AND TWO- FOOT LANDINGS IN DANCERS: A PILOT STUDY Connor, KR, Crickmore, KN, Cogswell, TM, and Hegazy, MA

### Cellular

- 29. SUBSTRATE STIFFNESS DIRECTED DIFFERENTIATION OF INDUCED PLURIPOTENT STEM CELLS TO CARDIOMYOCYTE SUBTYPES Chu, A, Zhao, E, Chiao, M, and Lim, CJ
- 30. A BIOMECHANICAL MODEL FOR BACULOVIRUS PROPULSION BASED ON ACTIN POLYMERIZATION IN ITS WAKE Roza Vaez Ghaemi, Brian Merchant and James Feng

#### Work in Progress

- 31. CALIBRATION AND IMPLEMENTATION OF AN ELECTROMAGNETIC TRACKING SYSTEM TO MEASURE INTERVERTEBRAL MOVEMENTS Granda A., Hodgson A. J
- 32. CHANGES IN MUSCLE ACTIVATION AND JOINT KINETICS WITH A RIGID ANKLE-FOOT ORTHOTIC Pomeroy, SM, Wichmann, TK, Smith, SL, and Hahn, ME
- 33. VISUAL AND TACTILE TOUCH CONSISTENCY EXPERIMENT USING VIRTUAL REALITY David E. Caballero, and Eric Rombokas
- 34. DIFFERENTIATION OF FOOT CONTACT PARAMETERS BETWEEN SITTING, STANDING, AND WALKING Merry, K.M, Sparrey, C.J
- 35. THE EFFECT OF A SENSORY FEEDBACK SYSTEM FOR LOWER LIMB PROSTHESIS ON STAIR DESCENT Astrini Sie, Jonathan Realmuto, and Eric Rombokas

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