2019 might go into the records as the year before everything changed, the year before the pandemic. I send my sincere wish to all of you that you, your families, friends, and colleagues are healthy and safe.

2019 was altogether different than the times we live in now, and I want to remark on two extraordinary things directly related to the Human Performance Lab (HPL) and its global reach: (i) the ranking of the Faculty of Kinesiology globally, and (ii) the Congress of the International and the American Societies of Biomechanics.

Faculty of Kinesiology Ranking: Shanghai Ranking Consultancy is an independent organization dedicated to research on higher education. It ranks special focus institutions, and among them the hundreds of schools, faculties, and departments of sport science. For 2019, the Faculty of Kinesiology at the University of Calgary was ranked 7th globally and 1st in North America in the Sport Science category. Much of this success can be traced to the excellence and dedication of faculty members, students, trainees, technicians, and research assistants of the Human Performance Lab, which in turn is a direct reflection of the investment of our faculty and the university into the HPL. Our gratitude and thanks go to them. We are proud to contribute to the success and reputation of our faculty and University.

Congress of the International and American Societies of Biomechanics: In 2016 we made the successful bid to host the 2019 congress of the International Society of Biomechanics (ISB), and exactly three years later, the opening ceremony of ISB2019 took place in Calgary’s Convention Centre. ISB2019 was joined by the annual conference of the American Society of Biomechanics, which made the event the biggest and most important for biomechanics research in 2019. Members of the biomechanics group of the HPL hosted the event, and members from other disciplines organized special symposia, helped with fundraising, and served among the contingent of over 100 volunteers that were required every day. It was a true team effort. The ISB/ASB 2019 congress was not only the biggest ever, it was also a resounding scientific and social success, and most of all, a lot of fun. Having been in self-isolation for three months now due to the coronavirus, I am reminiscent of those five days in August of last year, with crowded poster sessions and rooms filled to capacity, never ending discussions late into the night, dinners with friends, the banquet and the dancing, without fear, without restriction. That is what scientific conferences are all about. Let us hope we will meet again soon, in person and personally.

Two global events, two global successes. It was another eventful and exciting year for the HPL. My thanks go to the International and American Societies of Biomechanics for allowing us to host ISB/ASB 2019, and to the University of Calgary, the Faculty of Kinesiology, and all departments and sponsors of ISB/ASB 2019. It was a pleasure and privilege to be your host. My final thanks go to our families, friends, and supporters of the HPL. Your continued engagement and dedication, and your undeterred belief that we can be global leaders in human health wellness and performance research is needed more today than ever before.
<table>
<thead>
<tr>
<th><strong>Honour</strong></th>
<th>Preston Wiley — Calgary Booster Club, Honoured Athletic Leader Award</th>
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<tbody>
<tr>
<td><strong>Appointed</strong></td>
<td>Zachary Barrons — Informatics Officer, Footwear Biomechanics Groups</td>
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<td><strong>Appointed</strong></td>
<td>Salvatore Federico — Past President of the Canadian Society for Biomechanics (2019-2020 term)</td>
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<td><strong>Appointed</strong></td>
<td>Salvatore Federico — Member, Selection Committee, Society for Natural Philosophy (not listed in 2018)</td>
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<td><strong>Appointed</strong></td>
<td>Salvatore Federico — Member, Editorial Advisory Board, Atti dell’Accademia Peloritana dei Pericolanti</td>
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<td><strong>Appointed</strong></td>
<td>Salvatore Federico — Member, NSERC Discovery, Evaluation Group in Mechanical Engineering</td>
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<td><strong>Appointed</strong></td>
<td>Bill Wannop — Associate Editor, Footwear Science</td>
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<td><strong>Appointed</strong></td>
<td>Bill Wannop — Awards Officer, Footwear Biomechanics Group</td>
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<tr>
<td><strong>Award</strong></td>
<td>Joshua Cashaback — Alberta Innovates Health Solutions (AIHS) Postdoctoral Fellowship. Controlling and adapting our movements in the presence of muscle fatigue</td>
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<tr>
<td><strong>Award</strong></td>
<td>Mathieu Chin — 3M National Student Fellowship</td>
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<tr>
<td><strong>Award</strong></td>
<td>Carolyn Emery, Carla van den Berg, Sarah Richmond, Luz Palacios-Derflingher, Carly McKay, Patricia K Doyle-Baker, M McKinlay, Clodagh Toomey, A Nettel-Aguirre, Brent Hagel — Best Podium Presentation Awards. ‘Implementing a school prevention program to reduce injuries through neuromuscular training (isprint): a cluster-randomized controlled trial’. Third World Congress of Sport Physical Therapy, Vancouver, BC. October.</td>
</tr>
<tr>
<td><strong>Award</strong></td>
<td>Salvatore Federico — 2018-2019 Teaching Achievement Award, Schulich School of Engineering, The University of Calgary</td>
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<tr>
<td><strong>Award</strong></td>
<td>Reed Ferber — Great Supervisor Award, University of Calgary</td>
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<td><strong>Award</strong></td>
<td>Ifaz T. Haider — Tim Murray Short Term Training Award, Osteoporosis Canada</td>
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<tr>
<td>Award</td>
<td>Highlights</td>
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<tr>
<td>Award</td>
<td>Jeff Ilg — Podium Presentation Award, McCaig Summer Student Symposium, Calgary, AB</td>
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<td>Award</td>
<td>Lindsay Loundagin — Young Investigator Award, 22nd International Workshop on Quantitative Musculoskeletal Imaging</td>
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<td>Award</td>
<td>Shyamchand Mayengbam — Metabolics Association of North America, Early Career Award</td>
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<tr>
<td>Award</td>
<td>Ryan Miller — Best Poster Award, ‘Modulation of the Nervous System during an Unpredictable Posture Task’. Campus Alberta Student Conference in Health, Edmonton, AB</td>
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<tr>
<td>Award</td>
<td>Sadhiq Nazeer — Winner, Faculty of Kinesiology Award, University of Calgary Undergraduate Research Symposium</td>
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<td>Award</td>
<td>Eng Kuan Moo — Promising Young Scientist Award, International Society of Biomechanics Conference 2019, Calgary, AB</td>
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<tr>
<td>Award</td>
<td>Rob Moore — Best Presentation Award, ‘Adaptations to Novel Visuomotor Rotations After Stroke’. Alberta Biomedical Engineering Conference (Alberta BME), Banff, AB</td>
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<tr>
<td>Award</td>
<td>Jaqueline Rios — J.B. Hyne Research Innovation Award</td>
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<tr>
<td>Award</td>
<td>Jonathan Smirl — Michael Smith Foundation for Health Research: Post-Doctoral Fellowship</td>
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<td>Award</td>
<td>Baaba Otoo — David Winter Young Investigator Award (Poster), International Society of Biomechanics Conference, Calgary, AB</td>
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<tr>
<td>Award</td>
<td>Tessa VanDerVeeken — Tim Murray Short Term Training Award, Osteoporosis Canada</td>
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<tr>
<td>Award</td>
<td>Valeriya Volkova — 2019 Best Presentation Award, UBC Wearable Summer School</td>
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</tbody>
</table>
Highlights


Ph.D. Christian Clermont — Supervisor: Dr. Reed Ferber. Thesis: Making Sense of Sensor Data for Recreational and Competitive Runners: Detecting Typical and Atypical Running Biomechanics

Ph.D. Danilo Iannetta — Supervisor: Dr. Juan Murias. Thesis: Identifying Exercise Intensity “Thresholds”: Implications for Metabolic Responses, Performance, and Exercise Intensity Prescription


Ph.D. Jacqueline Lourdes Rios — Supervisor: Dr. Walter Herzog. Thesis: Exercise and Dietary Interventions in a Rat Model of Metabolic Knee Osteoarthritis

Ph.D. Rogerio Soares — Supervisor: Dr. Juan Murias. Thesis: The Use of Near-Infrared Spectroscopy for Microvascular Function Assessment in Healthy and With Obesity Individuals During Normo-and Hyperglycemia


M.Sc. Alexander Chen — Supervisor: Dr. Brian MacIntosh. Thesis: Developing Procedures and Software for Correcting Artifacts in Motion Data
## Highlights

<table>
<thead>
<tr>
<th>Degree</th>
<th>Name</th>
<th>Supervisor/Co-Supervisors</th>
<th>Thesis Title</th>
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</thead>
<tbody>
<tr>
<td>M.Sc.</td>
<td>Laura Crack</td>
<td>Supervisor: Dr. Patricia Doyle-Baker</td>
<td>CHESS: Changes in Hormones with Exposure to Student Stress</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Tessa Gallinger</td>
<td>Supervisors: Drs. Brian MacIntosh and Jared Fletcher</td>
<td>Muscle Length Adaptations to High-Speed Training in Young Adults with Cerebral Palsy</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Colin Lavigne</td>
<td>Supervisors: Drs. Guillaume Millet and Nicole Culos-Reed</td>
<td>The Effect of Radiation Therapy and a 12-week Novel Strength Training Intervention on Neuromuscular Function and Fatigability in People Diagnosed with Head &amp; Neck Cancer</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Lauren Miutz</td>
<td>Supervisor: Dr. Kathryn Schneider</td>
<td>Feasibility, Reliability and Concurrent Validity of a Field Test of Exertion in High School Students</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Ahmad Qahtan</td>
<td>Supervisor: Dr. Juan Murias</td>
<td>Effects of a Single-Leg Exercise Training Intervention on Single and Double Leg Peak Power Output, Maximal Oxygen Consumption, Gas Exchange Threshold, and the Respiratory Compensation Point</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Elysa Sandron</td>
<td>Supervisors: Drs. Carolyn Emery and Elizabeth Condliffe</td>
<td>Adapted Sport and Recreation Summer Camp: Youth with Physical Disabilities, Their Parents and Staff Perspectives on Psychosocial Outcomes and Physical Activity Participation</td>
</tr>
</tbody>
</table>
We are a growing group in the Human Performance Laboratory. Our work is focused on the mechanistic, multidisciplinary study of human sensorimotor control and learning. We combine behavioural experiments with robotics, neurostimulation, medical imaging, and computational models to examine the function of the human sensory and motor systems. Our work is focused on understanding how basic aspects of sensory processing contribute to human motor control and learning.

Ongoing projects in the lab focus on four topics: 1) the role of sensory feedback in the selection, planning, and control of voluntary movements, 2) basic principles of sensory processing and how they impact individual patterns of human motor behaviour, 3) probing the function of neural circuits that support motor behaviour, and 4) identifying how impairments in sensory and motor function caused by stroke and concussion influence sensorimotor control and learning. Through our basic science program and ongoing collaborations, we hope to generate tools that allow us to better assess, monitor and diagnose deficits in sensory and motor function.

**Brent Edwards**

Mechanical fatigue of load bearing biological tissue is an inevitable consequence of physical activity. Over time, habitual loading of the musculoskeletal system causes microdamage accumulation that reduces the overall quality of the tissue and leads to a reduction in stiffness and an increase in mechanical strain with continued loading. Without adequate tissue repair and adaptation, the evolution and accumulation of microdamage may eventually lead to musculoskeletal injury. Mechanical fatigue is believed to play a predominant role in the pathophysiology of musculoskeletal injuries such as bone stress fracture as well as Achilles and patellar tendinopathy. Our research combines biomechanical experimentation with advanced medical imaging and computational modeling to investigate tissue damage and fatigue in response to mechanical loading.
Our unique approach allows us to estimate in vivo tissue mechanics in a non-invasive and subject-specific manner. The work in our group spans multiple dimensional scales, from basic experiments at the tissue-level that enhance our understanding of the mechanical fatigue process, to applied experiments at the whole-body level for the development of treatments and interventions to improve tissue quality and decrease injury risk.

**Salvatore Federico**

*Continuum Biomechanics Group*

Continuum Mechanics is the study of matter at a length-scale at which the existence of the atomic structure can be neglected, and matter can be treated as continuous rather than discrete. Research in our group is devoted to the mathematical foundations of Continuum Mechanics and its applications to the Biomechanics of Soft Tissue. In particular, we are interested in modelling soft tissue accounting for its structural elements, i.e., collagen fibres, cells, non-fibrous extracellular matrix and fluid. Most phenomena of structural rearrangement in a biological tissue can be described under the umbrella of growth and remodelling. Structural damage is what can initiate injury and disease.

A main theme is the modelling of articular cartilage. Articular cartilage is the thin layer of connective tissue covering the end of bones in our joints: for the span of a lifetime, it provides stress redistribution and an extremely low-friction contact. When the tissue degenerates because of diseases such as osteoarthritis, it cannot perform its function properly and this results in pain, limitation of mobility, and ultimately a decrease in quality of life. Understanding the relationship between the tissue structure and its function, remodelling and damage processes may shed light on the causes of the initiation of degeneration, and suggest possible treatments to prevent disease.

**Reed Ferber**

*Running Injury Clinic*

I am a clinical biomechanist and my research is aimed at optimizing rehabilitation and predicting injuries. Overall, my group is engaged in two streams of research: clinical gait analysis and wearable sensors.

My group has successfully established an international and growing gait analysis research network currently consisting of 15 researchers and over 100 clinical partners. Each centre is linked to the world’s largest research database of biomechanical gait and clinical data. They are transforming the biomechanics
In the area of muscle contraction mechanisms, we showed unequivocally that cardiac muscle possesses residual force enhancement properties, a fact disputed previously in the literature. In the area of bone and joint biomechanics, we found that aerobic exercise and a fibre diet intervention can prevent the onset of metabolic knee joint osteoarthritis, but only if the interventions are timed properly, otherwise they have no effect. Finally, in our applied biomechanics research, we have collected data that should provide a final answer to the question if chiropractic spinal manipulation can damage vertebral arteries, thereby initiating/causing strokes.

**Art Kuo**

My laboratory studies the biomechanics, energetics, and neural control of human movement. We develop computational models of the human body dynamics, and apply them to simulations and analyses of locomotion and upper extremity reaching movements. We also perform experiments to test model predictions of stability, motion trajectories, and energy expenditure. Ongoing projects include studies of human walking on uneven terrain, use of inertial measurement units to record locomotion in the real world, energetics of human reaching, and modeling of neural central pattern generators for locomotion. These
projects are intended to reveal basic mechanisms of locomotion and other movements, with applicability to neural rehabilitation and diagnosis of movement impairments.

**Benno M. Nigg & Sandro Nigg**

Our group concentrates on topics that are health and performance related with special considerations for footwear, apparel and equipment. This last year, we made significant progress in our understanding of 1) the biomechanical effects of altering midsole bending stiffness, 2) applying machine learning tools to identify the underlying principles of human locomotion, and 3) to better understand the intercoordination of segment motion during human locomotion.

Midsole Bending Stiffness: The effect of modifying the longitudinal bending stiffness of a sports shoe has many biomechanical and physiological effects. Specifically, we have studied the effects of increased longitudinal midsole bending stiffness of sport shoes on running mechanics. The focus has been on how increased midsole bending stiffness can be used to redistribute lower limb joint work during running, and how this increased stiffness affects the amount and velocity of muscle and muscle-tendon unit shortening. Our research aims to provide a deeper functional understanding as to why running in stiff shoes can improve running performance by applying ultrasound imaging and musculo-skeletal modelling. Furthermore, we have developed the teeter-totter concept to explain the positive physiological effect of a curved midsole stiffness on running performance.

Machine Learning and Human Locomotion: The objective is to better understand the underlying principles of human locomotion with the application of machine learning techniques. Specifically, our group has harvested extensive inertial measurement unit data to automatically detect movements of interest (e.g. sprint stride, crossover stride) in large continuous data sets. Further algorithms have been created with the ability to classify the skill level of novice and elite hockey players executing these specific movement tasks. These accomplishments establish the foundation to provide real time feedback to an individual’s skating technique.

Inter-Coordination of Segment Motion: Our group is investigating how the movement of segments of the foot and the lower extremities are affected by changes in muscle activity, integrity of ligaments or various footwear characteristics using novel technologies such as dual fluoroscopy. The results determined using these techniques allow for a better interpretation
of results than using traditional motion analysis techniques. The results are further used to determine the movement coupling between lower limb segments during running.

**Ryan Peters**

**Integrative Sensorimotor Neuroscience Laboratory**

Our laboratory investigates the neural basis of human movement using a variety of physiological, behavioural, and computational techniques in concert. There are both basic and applied streams of research currently ongoing in the lab. Within the basic science stream, we study the complex interaction between sensory and motor neurons during voluntary movement. We specialize in microneurography: the only method for directly recording the activity of human somatosensory neurons (muscle spindles, Golgi tendon organs, skin and joint receptors). We are currently focused on the functional properties of the muscle spindle’s fusimotor system, which remains poorly understood to-date, particularly in humans. In the applied research stream, we are translating our basic science into the development of new vibration-emitting wearable technologies for remote neurological diagnostics and monitoring. Both healthy older adults and individuals suffering from neurological disorders (e.g., diabetic- and chemotherapy-induced peripheral neuropathy) experience a decline in somatosensory function that is associated with impairments in manual dexterity and balance. Standard clinical tests of neuropathy are arduous for clinicians and not well-controlled – vibration-emitting wearable technologies offer a promising alternative approach. These new wearable technologies will enable frequent and accurate assessments of neurological function to be performed outside of the clinical setting, freeing-up valuable clinician time, and improving the quality of patient care.

**Darren Stefanyshyn**

The general research interests of our group focus on questions related to human locomotion, sport performance and sport injury biomechanics. Our research extends to functional sport equipment with a goal of tuning the properties of the equipment to specific athlete characteristics in order to maximize the athlete’s performance and minimize the risk of injury. Performance research involves developing a basic understanding of the mechanics of human movement during various locomotor and athletic movements. The goal is to determine the mechanical factors dictating an athlete’s performance and how performance can be improved by manipulating these particular
General Comments

In 2019 we extended our industry work on identifying methods of matching sport equipment to individual athletes. We also continued to investigate the internal mechanisms that explain successful athlete-equipment interactions and in 2019 expanded our capabilities to study Achilles tendon mechanics using ultrasound measurements. We also began work with personalization of footwear and insoles, working with 3D foot scans and 3D printing of insoles and footwear.

Injury research involves identifying potential injury factors such as global loading characteristics associated with ankle and knee sport related injuries as well as developing an understanding of the role played by equipment. This past year we gained valuable insight on the role of sport surface characteristics as well as traction of rugby boots on lower extremity joint loading.

Exercise Physiology and Nutrition in Health and Sport

Saied Jalal Aboodarda

Exercise Neurophysiology Laboratory

The research that we conducted in our lab in 2019 was the continuation of the outstanding research environment that Prof. Guillaume Millet established in the Faculty of Kinesiology. We measured acute and chronic neuromuscular and cardiovascular adaptations in response to different exercise interventions. Our work concentrated on neurophysiological adaptations that occur in the structure and function of the motor network (from the brain to the skeletal muscles) in response to different modes of upper and lower limb exercises. With application of non-invasive techniques such as transcranial magnetic stimulation of the brain, transmastoid and thoracic electrical stimulation of the spinal cord as well as peripheral nerve electrical stimulation of the skeletal muscles, we investigated the relative contributions of central (i.e. the brain and spinal cord) and peripheral nervous system (i.e. skeletal muscles) to the development of neuromuscular fatigue in healthy individuals and people with clinical conditions. We published our work in the flagship journals of our field including The Journal of Physiology, Brain Sciences, Journal of Experimental Biology.
General Comments

**PATRICIA K. DOYLE-BAKER**

**APPLIED PHYSIOLOGY AND PREVENTION THROUGH LIFESTYLE AND EXERCISE**

The Doyle-Baker lab continued this past year with a focused interest in hormonal levels and hormone shifts that affect aerobic performance and heart rate variability, muscle and bone, and perceived fatigue and stress levels. We employed human and animal model research, and lab and field work studies. To measure hormone levels (estrogen, progesterone and testosterone) several biomarkers need to be employed so that the variability in hormonal shifts during each menstrual cycle can be identified. This means physically tracking the cycle length and using both salivary and urine samples to determine when ovulation occurs. The population inclusive to those individuals taking exogenous hormones such as oral contraceptives. Our collaborations with other exercise physiology lab groups in the HPL has very importantly contributed to the research surrounding menstrual cycle phases and exercise performance. The Doyle-Baker lab also places importance on field testing because many athletes do not have access to laboratory testing and gaps in field research in sports, such as cross-country skiing, are common in Canada. Field testing, although in a familiar environment for the athlete, is challenging for the researcher because of the influence of changing weather conditions on testing days. Conversely, field testing can also be exciting as often there is an outcome that can be translated quickly to a target audience such as coaches. We look forward to publishing our research related to the menstrual cycle phase influence on performance after a HIIT (high intensity training session) in cross-country skiers. Lastly, in collaboration with groups in the HPL and University of Alberta we recently completed a study investigating the influence of eccentric training with and without bisphosphate drug in an older female rabbit model. The long-term goal of this research program is to employ a sex specific complex training strategy that will ensure bone strength is maintained across the life span.

**JOHN HOLASH**

**EXERCISE PHYSIOLOGY LABORATORY**

In my new instructor’s role in the faculty, I am currently working on updating, developing, and modifying courses, and instructional materials within the Exercise Physiology group so that we can leverage new technologies and instruments for course delivery. In this role I have participated in a specialized focus group for Video Technologies in Classroom
(Yuja) at the University of Calgary this spring and summer of 2019, and I currently represent the faculty on the current “Learning Technologies Advisory Committee”. I also hope over the next few years to develop a subgroup within the exercise physiology umbrella, with hopes to integrate and develop the use of state-of-the-art computer-based methods for measuring, recording, and analyzing these potentially very large data sets of physiological variables. The ultimate goal of this subgroup will be to enhance the student experience with opportunities for experience with: product development, rapid prototyping, machine learning, and data processing, and potentially some entrepreneurship opportunities that revolve around leveraging digital technologies and scaling them.

**MARTIN MACINNIS**

**EXERCISE AND ENVIRONMENTAL PHYSIOLOGY LABORATORY**

We are an integrative physiology laboratory interested in understanding how humans respond to acute and chronic exercise and the extent to which these responses are influenced by nutrition, sex, and the environment. Our research group launched in 2018, and our ongoing projects investigate (i) adaptations in the skeletal muscle, cardiovascular, and hematological systems to different exercise training programs; (ii) the mechanisms underpinning the plasticity of these physiological systems; (iii) the development of non-invasive methods to assess skeletal muscle fitness; (iv) the influence of oxygen availability on aerobic metabolism, neuromuscular fatigue, and exercise performance; and (v) the use of wearable technologies to improve exercise testing and prescription. We employ a wide breadth of techniques, ranging from the biochemical and molecular analysis of human tissue (e.g., blood and muscle) to whole-body measures of exercise metabolism, tolerance, and performance (e.g., pulmonary gas analysis and femoral nerve stimulation). The overall aim of our research program is to understand how molecular and physiological mechanisms regulate physiological systems in humans, with goals to trans-
late and apply this research to improve the health and fitness of individuals ranging from athletes to those with chronic disease and disability.

**BRIAN MACINTOSH**

**APPLIED MUSCLE PHYSIOLOGY GROUP**

The central theme of research in my laboratory is the study of force modulation in skeletal muscle. This includes the study of force-velocity, force-frequency and force-length relationships, and the interactions of these with and without prior activity. Prior activity can be an acute modifier, as in potentiation or fatigue. Alternatively, prior activity can be a chronic modifier, as in training, illness or disuse atrophy. A new theory of muscle fatigue has been proposed which states that fatigue is a consequence of the elegant regulation of excitation-contraction coupling in skeletal muscle to prevent depletion of adenosine triphosphate. Recent work has evaluated the potential role of changes in calcium sensitivity at physiological temperature contributing to muscle potentiation and fatigue. We are continuing the work on warm-up and post-activation potentiation. Work on understanding the slow component has revealed that it does not represent a rising energy cost of exercise, but a slow switch from anaerobic to aerobic energy supply. Prior heavy exercise performed as a warm-up results in acceleration of the aerobic contributions to subsequent exercise and smaller anaerobic requirements. A structurally realistic computer model of a sarcomere has been created, and the impact of myofilaments at different sarcomere lengths on calcium diffusion has been evaluated. Our research group uses a number of approaches to study the contractile properties of skeletal muscle including: (1) in vitro single intact or skinned fibers and fiber bundles; or (2) in situ whole muscle and intact human subjects performing in vivo with isolated muscle or muscle group contractions or performing whole body exercise.

**JUAN MURIAS**

**CARDIOVASCULAR EXERCISE PHYSIOLOGY GROUP**

I am interested in determining the effectiveness of exercise training programs for promoting health as well as for improving performance. The main goal of my research relates to the use of exercise training interventions as “medicine” to prevent or alleviate the detrimental effects of aging and disease on cardiovascular function, as well as to improving performance. Although my laboratory examines both central and peripheral cardiovascular adaptations to exercise training,
a current direction of my work is focusing on the vascular side of these adaptive responses. More specifically, I am interested in the role of the endothelium in the control and distribution of blood flow and the effects of endurance training exercise in preventing or alleviating the age-related reduction in endothelium-dependent vasodilation, and the associated limitation in O2 transport to the sites of metabolic need.

Some of the measures commonly assessed in my laboratory include: Breath-by-breath VO2 and near-infrared spectroscopy (NIRS) to estimate blood oxy- and deoxygenation within the area of NIRS “inspection”. The use of this technique combined with measurements of VO2 can provide an estimate of the matching of muscle O2 delivery to O2 utilization. Additionally, Doppler Ultrasound is used to estimate blood flow, vascular conductance and flow mediated dilation responses at rest and during exercise, and to obtain morphological measures to derive the lumen-to-wall ratio in different arteries.

Nutrition, Metabolism and Genetics

Raylene Reimer

Our research focuses on understanding how nutrition and the bacteria that live in our intestine (called gut microbiota) interact to affect our risk of developing chronic diseases such as obesity, type 2 diabetes and fatty liver disease. This year we examined how exposure to antibiotics in early life (mother during pregnancy or early infancy) increases obesity risk and how diet can be used to lessen this risk. Specifically we are showing that prebiotic fiber, a unique type of dietary fiber that increases healthy bacteria in the intestine, when given at the same time as antibiotics can reduce the risk of obesity. We have also been examining how to bring human infant formula closer to the nutritional gold standard of breastmilk. This work is examining how supplementing early life diet with human milk oligosaccharides (which act like fiber in mother’s milk and feed the healthy bacteria in the gut) can improve gut microbiota profiles and lifelong metabolic health. We are also very involved in translating animal studies into human clinical studies. We are currently evaluating: (1) the effect of prebiotic fiber on liver health in patients with non-alcoholic fatty
liver disease; (2) the effect of prebiotic fiber supplement on pain and function in individuals with knee osteoarthritis and obesity; and (3) how gut microbiota differ in youth with obsessive compulsive disorder compared to healthy control youth. Ultimately our goal is to design and evaluate new food ingredients and diets aimed at body weight management and optimal gut microbiota profiles.

**Injury Prevention, Sport Medicine and Rehabilitation**

**AMANDA BLACK**

The injury prevention, clinical intervention, and implementation science research group is a new group in the Sport Injury Prevention Research Centre. Core projects focus on: 1) injury surveillance and epidemiology, 2) evidence-based practice and knowledge translation, and 3) theory-driven implementation, behaviour change and evaluation. Ongoing projects include examining the implementation of concussion guidelines, education and management protocols for sporting organizations and high schools, examining the context for implementation for injury prevention initiatives, and injury surveillance in high school and university athletic populations.

**CAROLYN EMERY**

**SPORT INJURY PREVENTION RESEARCH CENTRE (SIPRC)**

I am the Chair of the Sport Injury Prevention Research Centre (SIPRC), 1 of 11 International Olympic Committee Research Centres for Injury Prevention of Injury and Protection of Athlete Health (2019-2022). Evaluation of prevention strategies to reduce the burden of injuries and their consequences in youth sport is the focus of my research program. Our group continues to build on national body checking policy change in 11-12 year old ice hockey to demonstrate a 56% reduction in all injuries (including concussions) in non-elite 13-14 year old leagues following policy disallowing body checking (preventing 6386 injuries nationally each year). My research team evaluated a neuromuscular training (NMT) warm-up program implementation in junior high school physical education in a 3-year randomized controlled trial (RCT), demonstrating a 46% reduction in injury risk in girls. Through a National Basketball Association General Electric partnership grant, the SIPRC team is contributing to a greater understanding of patellar and Achilles tendinopathies in youth basketball players including workload and other risk factors and informing prevention strategies. Canadian Institutes of Health
Research funded Surveillance in High Schools to Reduce Injuries and their Consequences in Youth Sport (SHRed Injuries) focuses on the prevention of musculoskeletal injuries and their consequences in multiple youth sports and communities (e.g., indigenous). An RCT in young adults is underway to evaluate an exercise intervention to prevent early osteoarthritis following sport-related knee injury in youth. A National Football League Scientific Advisory Board funded program, SHRed Concussions, is a pan-Canadian program of research aiming to inform best practice in concussion prevention, detection, diagnosis, prognosis, management and rehabilitation across multiple youth sports. Through the Vi Riddell Pediatric Rehabilitation Research Program, her team strives to inform evidence-based rehabilitation strategies and adapted physical activity programs for children with cerebral palsy, joint injuries, juvenile idiopathic arthritis, and concussion.

**Nick Mohtadi**

My research activities at the University of Calgary, Sport Medicine Centre (SMC) involve: Osteoarthritis, knee injury, shoulder research, sport injury prevention and clinical trials. In 2019 a randomized clinical trial comparing three different anterior cruciate ligament (ACL) techniques was published in the Journal of Bone and Joint Surgery and was one of the top 10 most read articles in 2019. This is the largest randomized trial on ACL surgery ever published with 330 patients and 95% follow-up at 5 years.

The International Hip Outcome Tool (iHOT) was primarily developed at the SMC and as of 2019, has been translated into five languages with more in the works for 2020. This outcome measure has been used in clinical trial and studies worldwide to evaluate young and active patients with hip-related disorders. Further partnerships continue with the McCaig Institute in the area of bone density and x-ray evaluation in patients with ACL injury and long-term outcomes of ACL surgery are on-going.

In 2019 the STABILITY-1, ACL surgical multi-centre trial, received awards at the International Society of Arthroscopy Kneed Surgery and Sports Medicine conference. This clinical trial was established at Western University in London, ON and included centres in England, Belgium and multiple sites in Canada. This trial is now the largest randomized trial ever conducted in the world with 626 patients. The SMC Acute Knee Injury Clinic contributed 10-20% of the surgical patients
and are now working on the next ACL study, the STABILITY-2 trial. This has support from the CIHR and the NIH and will be recruiting 1200 patients.

The Sport Medicine Centre continues to provide healthcare services based on the research conducted in the area of knee and shoulder injuries and sport concussion.

**Kati Pasanen**

My research program is focused on research of sport injuries, including epidemiological, clinical, biomechanical and experimental studies. Our ongoing studies focus on: 1) development of novel methods for monitoring movement patterns and training load by using wearable technology in youth soccer, 2) identification of risk factors for lower extremity injuries in youth team sports, and 3) development and evaluation of neuromuscular training programs to decrease the risk of injuries in youth team sports. We also have four collaboration studies in Finland – four of them in team sport and one in professional ballet (Principal investigator: K Pasanen). Knowledge generated from our research work and collaboration could ultimately lead to better understanding of causes and mechanisms of lower extremity injuries which could allow us to develop current injury prevention strategies, promote lifelong sport participation, and lower the public health care costs related to sport injuries.

**Kathryn Schneider**

**Concussion Prevention, Detection and Rehabilitation Lab**

Our lab focuses on the prevention, detection and rehabilitation of concussion with a special interest in the role of the cervical spine and balance systems. We use clinical and technological tests that evaluate multiple different areas of sensory and motor function, ultimately gaining insight into changes that may occur following a concussion. Additionally, with the use of technological tests alongside clinical tests we are gaining a better understanding of how to best evaluate various components of function.

Ongoing projects in the lab focus on: 1) the role of neuromuscular training and sensorimotor training in the prevention of concussion 2) changes that occur in measures of cervical spine, vestibular and sensory function with growth and development 3) changes that occur in measures of cervical spine, vestibular and sensory function following a concussion, 4) optimizing rehabilitation techniques to enhance recovery and inform clinical care and 5) Evaluating implementation of concussion protocols. Our program of clinical research involves collaboration with multiple
General Comments

clinicians and researchers across the University of Calgary and other national and international institutions, ultimately enabling clinically meaningful questions to be evaluated and translated back to the clinic.

**Jonathan Smirl**  
**Cerebrovascular Concussion Research Laboratory**

We are a newly established group in the Sport Injury Prevention Research Centre and the Human Performance Laboratory. Our work is focused on understanding the basis of the physiological and autonomic disruptions which occur following concussion. We aim to use this knowledge base to develop informed interventions (exercise, physiological and pharmacological) which can be used to aid in the recovery process during both the acute and chronic symptom periods.

Our group is currently leading the exercise-based measures in the Pan-Canadian Surveillance in High Schools to REDuce (SHRed) Concussions project. Additionally we are actively collaborating with other Canadian institutions on objectively quantifying the extent concussed athletes rest and exercise following concussions. We are excited to have our new lab space operational early in 2020 and will be adding numerous other physiologically informed projects to our mandate throughout the year. Through our integrative approach to concussion research and collaboration network, we aim to create new approaches and interventions which will enable us to objectively assess physiological disruptions following concussion and improve outcomes for individuals following this traumatic injury.
Presentations

Patricia K. Doyle-Baker — *Bikes and Bike Share: What is the benefit of e-Bikes?*

The Bone Academy Mexico. Puerto Vallarta, Mexico. March.
Brent Edwards — *Biomechanics of atypical femoral fracture.*

Siksika Community. November.

Amanda Black — *Concussion Recognition, Accommodations, and Management.*

Chinook Rotary Club. Calgary, Canada. October 2.
Kathryn Schneider — *Concussion: Who, What, Where, When and What’s Next?*

Juan Murias— *Exercise intensity prescription: How close (or how far) are we from getting it right?*

Juan Murias— *Exercise intensity prescription: How close (or how far) are we from getting it right?*

Preston Wiley — *Hip Anatomy and Soft Tissue Injury.*

Calgary Youth Science Fair. Calgary, Canada. April 5.
Kathryn Schneider — *How Science Has Impacted My Life.*

Kathryn Schneider — *Models of prevention (of concussion).*

Retirement Presentation, Faculty of Kinesiology, University of Calgary. Calgary, Canada. October 3.
Brian MacIntosh — *Reflections and illuminations: with a little help*
Public Engagement

...from my friends (students).

University of Sao Paulo. Ribeirao Preto, Brazil. October 22.
Walter Herzog — Reflections on muscle: how do muscles contract?

Patrician Doyle-Baker — Talk, Knowledge and Outcome: Communicating the value of sport.

Academic Education Day in Rheumatology. Cumming School of Medicine, University of Calgary. Calgary, Canada. November.
Reed Ferber — Using wearable sensor data to inform clinical care.

Reed Ferber — Wearable Technology in Injury Prevention and Rehabilitation.

Reed Ferber — Wearable technology in injury prevention and rehabilitation.

Brian MacIntosh — Where you come from will determine what you see: a fresh look at the slow component of oxygen intake.

Workshops, Panels, & Booths

Cervical spine and vestibular considerations following sport-related concussion. — Kathryn Schneider

Concussion Harmonization IMPlementation and Evaluation in Canada workshop. — Kathryn Schneider, Amanda Black
National Sport Organizations. October 31 & December 2.

Concussion Harmonization IMPlementation and Evaluation in Canada (CHAIMP) study. — Kathryn Schneider, Amanda Black
Audience: National Sport Organization (NSO) stakeholders including health care professionals, administrators.
In collaboration with:
Parachute and Own the Podium (OTP). October 31;

Managing our healthy ‘selves’ is a leadership challenge. — Patricia K. Doyle-Baker
Student and enrolment services professional day workshop.
University of Calgary, Calgary, Canada. June 27.

Models of prevention (of concussion). — Kathryn Schneider
Canadian concussion prevention meeting. SIRC meeting,
Ottawa, Canada. June 10.

Neuromuscular Training. — Kati Pasanen
Presentation and practical session at the 5th IOC Sport Medicine Diploma Program.

Neuromuscular Warm-up Program. — Larissa Taddei, Carla van den Berg
Workshops for soccer coaches for approximately 80 coaches from the Minor Soccer Association. November.

Physical activity and aging. — Meghan McDonough, Juan Murias, Patricia K. Doyle-Baker, Graduate Students.
Approximately 50 older adults and stakeholders from Calgary. public event hosted by the Aging PEEPS. May 16.

Preventing and managing head injuries in sport — Rehabilitation after concussion: multidisciplinary approach. — Kathryn Schneider, Carolyn Emery

Primary prevention in youth sport: Time to get on with it! — Carolyn Emery

Recent research using wearable sensor data. — Reed Ferber
Video conference with Rothesay Netherwood School, New Brunswick. May.

Shoulder check: The causes and treatment for non-arthritic shoulder
Public Engagement

*pain.* — Nicholas Mohtadi, Richard Boorman, Aaron Bois, Ryan Shields, Martin Zacharias
Free public forum. September 23.

*SHRed concussions: Moving upstream to the prevention of sport-related concussion in youth.* — Carolyn Emery

*Small group learning presentation on exercise performance and development in master’s athletes.* — John Holash

*The basic function of the heart.* — David Montero
Workshop for 25 students. Discovery Day of Health Sciences, Canadian Medical Hall of Fame.

*The role of an exercise specialist in chronic disease management.* — Patricia K. Doyle-Baker

*The stickiness factor: Do we have it.* — Patricia K. Doyle-Baker
Panel presentation, ActiveCITY Summit, Winsport, Calgary, Canada. September 18.

*Tips for hips: How to manage non-arthritic hip pain.* — Nicholas Mohtadi, Preston Wiley, Alex Rezansoff, David Lindsay
Free public forum. April 8.

*Wearable Technology Research And Collaboration (We-TRAC).* — Reed Ferber
Annual Workshop, Calgary, Canada. November.

**MEDIA & INTERVIEWS**

*6000 fewer injuries when bodychecking pulled from some bantam hockey: study.* — Carolyn Emery
CBC News Calgary, David Bell. November 7.

*A weighty subject: How the obesity epidemic is taking a toll on our bones and joints.* — Raylene Reimer
UCalgary News, Nancy Whelan, McCaig Institute for Bone and...

*Are High Priced Shoes Worth the Cost?* — Darren Stefanyshyn, Bill Wannop

*Are High Priced Shoes Worth the cost? Testing Adidas, Nike and Under Armour.*

*Shoe Wars: High Cost vs. Low Cost.*

*Ban on bodychecking in non-elite Bantam ice hockey significantly reduces injury.* — Carolyn Emery
UCalgary news, Stacy McGuire, Faculty of Kinesiology. November 12.

*Boxing deaths could have been prevented.* — Ryan Peters
Calgary Sun, Michael ‘Mr. Boxing YYC’ Short. August 12.

*Calgary researcher faces off against concussions in young athletes.* — Carolyn Emery
Calgary Journal, on-line, Bill Atwood. September 11.

*Carbon fibre plate tech: the Calgary connection.* — Darren Stefanyshyn

*Citizen scientists with wearable tech needed for UCalgary project.* — Reed Ferber
UCalgary news. September 18.

*Here’s What Proper Running Form Actually Is and How Much You Should Care About.* — Reed Ferber

*How do you eat to feed trillions? Food and the health of our gut microbiomes.*
— Raylene Reimer
Explore UCalgary, Doug Ferguson. December 17.

*How does research make better policy? Public policy and the dance of democracy.* — Kathryn Schneider
Explore UCalgary, Jane Chamberlain. May 1.

*In Conversation with Kathryn Schneider, Renowned Clinician Scientist.* — Kathryn Schneider
The Muse, Modeline Longjohn. April 10.
Public Engagement

*Markin undergrad looks at link between exercise intensity and prevention of cardiovascular disease* — Juan Murias
UCalgary News, Stephanie Vahaaho, Markin USRP in Health and Wellness. April 1.

*Massive Open Online Course (MOOC).* — Kathryn Schneider
University of Calgary says “come one, come all” to free sports concussion course.
  - Calgary Herald
  - National Post
  - Nanaimo News
  - Battlefords Now
  - PG Citizen

University of Calgary making free sports concussion course available to anybody who is interested.
  - Global News

University of Calgary offers “groundbreaking” free online course on sports concussions.
  - CBC News
  - University of Calgary offers free course on concussions.
  - The Star
  - University to offer free concussion prevention course.
    - 660 News, Derek Craddock. February 5.

*Concussion Training at U of C.*

*Massive Open Online Course on Concussion.*
CityTV, Josh Ritchie. February 4.

Online course allows anyone, anywhere to learn about concussions.

*Kinesiology researcher partners with Universite Laval on free concussion course.*

*M Powrx announces launch of BellyCrush - a new way to manage your weight.* — Raylene Reimer

*New study looks at injuries and concussions in minor hockey.* — Carolyn Emery
Public Engagement

Researchers gaining yards against concussions (CIHR). — Kathryn Schneider

Riding a Lime e-Bike. — Patricia Doyle-Baker

Should You Do Single-Leg Cycling Drills? — Juan Murias

UCalgary researcher passionate about this emerging sport, along with
understanding ways to prevent injury in all sport. — Kati Pasanen
UToday. May 30.

GROUP HOSTING, TOURS & EVENTS

Bishop Grandin High School — March 18 (20 students), December 9 (20
students)
40 sport medicine students toured the University of Calgary
and attended a lecture on injury prevention, concussion, and
neuromuscular training warm-ups.

Concussion and injury prevention research demonstrations and education
— 12 visits throughout 2019
8 high schools (12 visits with 20-100 students per visit) hosted by the
Sport Injury Prevention Centre.

Heritage Youth Researchers Summer Program (HYRS) — August 19
34 students with the Heritage Youth Researchers Summer Program
visited six stations presented by various groups in the HPL.

XXVII Congress of the International Society of Biomechanics (ISB2019)
and the 43rd Annual Meeting of the American Society of
Biomechanics (ASB2019) — July 31 - August 4
Over 2100 attendees, representing more than 40 countries.

Nelson Mandela High School — January 9 (60 students), January 11 (60
students), October 22 (66 students)
186 sport medicine students toured the University of Calgary
and attended a lecture on injury prevention, concussion and
neuromuscular training warm-ups..
Public Engagement

Operation Minerva — May 12
14 female junior high students visited stations and attended a lecture featuring female scientists in the HPL and faculty.

Sanofi BioGenius — April 18
11 students visited 5 research demonstration stations, presented by various groups in the HPL.

IBM STEM4Girls — August 14
28 students visited 5 stations, presented by various groups in the HPL

Shad Valley Tour 2019 — July 15
64 students enrolled in the sport medicine program visited 9 stations, presented by various groups in the HPL

St. Mary’s High School — June 11
35 students enrolled in the sport medicine program visited 6 stations, presented by various groups in the HPL

Western Canada High School — November 25
30 sport medicine students toured the University of Calgary and attended a lecture on injury prevention, concussion, and neuromuscular training warm-ups.
**Blog Posts**

**Free MOOC on concussion at the University of Calgary.**
— Kathryn Schneider, Pierre Fremont

**Life is short: don’t take your health for granted.**

**The wisdom of students: future health leaders.**

**Public Health Matters: Three decades later my career is still sweet.**

**Other Knowledge Translation Activities**

**Concussion Management: A Toolkit for Physiotherapists.**
— Kathryn Schneider, L. Loranger, Codi Isaac, Catherine Ross, Carol Miller

**Discussing the AIM study (Adiposity, Influenza and Men). A common experience to the influenza vaccine: wouldn’t it be nice!**
— Patricia K. Doyle-Baker

**Influenza vaccine response may be influenced by lifestyle factors in highly active young men.**
— Patricia K. Doyle-Baker, A Stewart
Canadian Society for Exercise Physiology, Knowledge Translation communiqué. August 21.

Keeping the message simple: Energy expenditure of restaurant servers.
— Patricia K. Doyle-Baker
Patents & Licenses

Lens-attached tissue cell pressurization device.
Inventors: Han SK, Herzog W, Shin HJ

Pea fibre supplementation for obesity and metabolic syndrome.
License (through Innovate Calgary).
Inventors: Reimer RA, Vena J, Tunnicliffe J, Parnell J
Acknowledgements

Active & Safe Central (BC)
adidas International
Alberta Alpine Ski Association
(AASA)
Alberta Ballet School
Alberta Basketball
Alberta Bone and Joint Health Institute
Alberta Bone and Joint Strategic Clinical Network
Alberta Children’s Hospital (ACH)
Alberta Children’s Hospital Foundation (ACHF)
Alberta Children’s Hospital Research Institute (ACHRI)
Alberta College and Association of Chiropractors
Alberta Graduate Excellence Scholarship
Alberta Health Services (AHS)
Alberta Heritage Foundation
Alberta High School Athletics Association
Alberta Injury Prevention Centre
Alberta Innovates
Alberta Spine Foundation
Amgen Inc
Ariat International
Arthritis Research UK Centre for Sport, Exercise and Osteoarthritis
Arthritis Society
Banff Alpine Racers (BAR)
Basketball Canada
BC Agriculture Investment Fund
BC Hockey
BioRad Laboratories Inc
Brain Canada Foundation
Brenda Strafford Centre on Aging
Calgary Board of Education
Calgary Catholic Board of Education
Calgary Health Trust
Calgary Minor Soccer Association
Calgary of Health Trust
Canada Foundation for Innovation (CFI), John R. Evans Leaders Fund (JELF)
Canada High School Sport
Canada Research Chair Program (CIHR)
Canada Research Chair Program (NSERC)
Canadian Academy of Sport and Exercise Medicine (CASEM)
Canadian Athletic Therapy Association
Canadian Cancer Society Research Institute (CCSRI)
Canadian Chiropractic Research Foundation
Canadian Institutes for Health Research (CIHR)
Canadian Musculoskeletal Rehabilitation Research Consortium
Canadian Physiotherapy Association
Canadian Soccer Association
Canadian Sport Institute Calgary
Canadian Traumatic Brain Injury Research Consortium (CTRC)
CCM Hockey
CHILD-BRIGHT
Chinese Speed Skating Association
City of Calgary
City of Calgary Recreation
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Acknowledgements

David Hart
Department for Women and Gender Equality (WAGE)
Dr. Benno Nigg Research Chair
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Ever Active Schools
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Faculty of Kinesiology, University of Calgary
Fieldturf
Fila
FitFlop Research Footwear
Fitter International Inc.
Football Canada
Foothills Soccer Club
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Fox Head
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General Electric
General Mills Inc
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Harvest Half Marathon Society
Heart and Stroke Foundation of Canada
Henry M. Jackson Foundation for the Advancement of Military Medicine Inc
Highmark Innovations Inc
Hockey Alberta
Hockey Calgary
Hockey Canada
Hockey Edmonton
Hotchkiss Brain Institute, University of Calgary (HBI)
Infinit Nutrition
Integrated Concussion Research Program (ICRP)
International Olympic Committee (IOC)
International Olympic Committee Medical and Scientific Commission
International Paralympic Committee
Japanese Society for the Promotion of Science
Kids Brain Health Network
Kids Cancer Foundation of Alberta
Killam Foundation
Killam Research Fellowships – Canada Council for the Arts
makeCalgary
Marco Vaz
Markin Undergraduate Student Research Program (USRP) in Health and Wellness, Allan Markin
Maternal Newborn Child & Youth Strategic Clinical NetworkTM (MNCY SCNTM) Health Outcomes Improvement (HOI) Fund
McCaig Institute for Bone and Joint Health, University of Calgary
McGill University
Michael Smith Foundation for Health Research (MSFHR)
Mitacs
Mizuno
Momentum Health Mission
Movember Foundation
National Basketball Association (NBA)
National Basketball Association (NBA)/GE Healthcare, Orthopedics and Sports
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Natural Sciences and Engineering Research Council of Canada (NSERC)
NFL Scientific Advisory Board
NSERC Collaborative Research and Training Experience (CREATE)
NSERC CREATE CONNECT!
Queen’s University
O’Brien Institute of Public Health, University of Calgary
Ontario Neurotrauma Foundation
Osteoarthritis Research Society International (OARSI)
Own The Podium
Parachute
Patricia Pennock
PolicyWise for Children and Families
Program for Undergraduate Research Experience (PURE), University of Calgary
Prostate Cancer Canada (PCC)
Public Health Agency of Canada
Reebok
Rugby Canada
Salomon
Scientific Council of City of Tampere, Finland
Scientific and Technological Research Council of Turkey (TUBITAK)
Section of Orthopaedic Surgery, Department of Surgery, University of Calgary
Simpson Family Endowment
Sinneave Family Foundation
Skate Canada
Snyder Institute for Chronic Diseases, University of Calgary
Soccer Canada
Social Science and Humanities Research Council (SSHRC)
Speed Skating Canada
Sport Canada
Sport Injury Prevention Research Centre (SIPRC), University of Calgary
Sport Medicine Centre, University of Calgary
Sport Science Association of Alberta (SSAA)
Superfeet
Talisman
Taylor Institute for Teaching and Learning, Teaching Scholars Program, University of Calgary
TCR Sport Lab Calgary
Thrive Centre Leadership Team and volunteers
Thrive Health Services
Tom Baker Cancer Centre
U SPORTS
Under Armour
United States Department of Agriculture, National Institute of Food and Agriculture
United States National Institute of Health, National Institute for Deafness and other Communication Disorders
University of Alberta
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University of Southampton
University of Toronto
US Army Medical Research and Materiel Command (USAMRMC), Department of Defense (DoD)
Acknowledgements

Vanier Canada Graduate Scholarships (Vanier CGS)
Vera A. Ross Graduate Scholarship
VERT
Vi Riddell Foundation
Volleyball Canada
W. Brett Wilson
W. Garfield Weston Foundation, The
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World Rugby
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<tr>
<th>Name</th>
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<td>Benson, Lauren</td>
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<td>Cashabak, Joshua</td>
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<td>Clermont, Christian</td>
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<td>Mayengbam, Shyam</td>
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<td>Noye Tuplin, Erin</td>
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<td>Iannetta, Danilo</td>
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<td>Ruusinen, Anu</td>
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Whittaker, Jackie
Wigglesworth, Anthony
Wilkes, Matthew
Wilson, James
Yeates, Keith
Zemek, Roger
Publications

Behling, A. V., Nigg, B. M. (2020). Relationships between the foot posture Index and static as well as dynamic rear foot
and arch variables. Journal of biomechanics, 98, 109448.
Pronation or foot movement – what is important. Journal of Science and Medicine in Sport.
Benson LC, Ahamed NU, Kobsar D, Ferber R. 2019. New considerations for collecting biomechanical data using wearable sensors: Number of level runs to define a stable running pattern with a single IMU. J Biomech, DOI: 10.1016/j.jbiomech.2019.01.004
Publications

10.1136/bjsports-2019-101011


Publications


Emery CA, Whittaker JL, Mahmoudian A, Lohmander LS,


Fortuna R, Goecking T, Seiberl W, Herzog W. 2019. Force depression following a stretch-shortening cycle depends on the amount of residual force enhancement established in the initial stretch phase. Physiol Rep, DOI: 10.14814/phy2.14188


Fukutani A, Leonard T, Herzog W. 2019. Does stretching...
Publications

Haider IT, Baggaley M, Brent Edwards W. 2019. Subject-specific finite element models of the tibia with realistic boundary conditions predict bending deformations consistent with in vivo measurement. J Biomech Eng, DOI: 10.1115/1.4044034


Iannetta D, Passfield L, Qahtani A, MacInnis MJ, Murias
Publications


Inglis EC, Iannetta D, Murias JM. 2019. Evaluating the NIRS-derived microvascular O2 extraction “reserve” in groups varying in sex and training status using leg blood flow occlusions. PLoS ONE, DOI: 10.1371/journal.pone.0220192


Kowalsky DB, Rebula JR, Ojeda LV, Adamczyk PG, Kuo AD. 2019. Human walking in the real world: Interactions between terrain type, gait parameters, and energy
Publications

expenditure. bioRxiv, DOI: 10.1101/2019.12.29.890434


Labrecque L, Smirl JD, Brassard P. 2019. Letter to the editor: On the need of considering cardiorespiratory fitness when examining the influence of sex on dynamic cerebral autoregulation. Am J Physiol Heart Circ Physiol, DOI: 10.1152/ajpheart.00152.2019


Lishchynsky JT, Rutschmann TD, Toomey CM, Palacios-Derflingher L, Yeates KO, Emery CA, Schneider KJ. 2019. The association between moderate and vigorous physical activity and time to medical clearance to return to play
following sport-related concussion in youth ice hockey players. Front Neurol, DOI: 10.3389/fneur.2019.00588
Logan LM, Semrau JA, Cluff T, Scott SH, Dukelow SP. 2019. Effort matching between arms depends on relative limb geometry and personal control. J Neurophysiol, DOI: 10.1152/jn.00346.2018
Rebuttal from Martin MacInnis, Lauren Skelly and Martin Gibala. J Physiol, DOI: 10.1113/JP278328
Last word from Martin MacInnis, Lauren Skelly, and Martin Gibala. J Physiol.


Mauracher, ME., Asmussen, MJ., Nigg S., Omu, O., Jarvis, SE. (2019) “Reliability and Validity of a Novel Dynamometer to
Publications

Mayengbam S, Mickiewicz B, Trottier SK, Mu C, Wright DC, Reimer RA, Vogel HJ, Shearer J. 2019. Distinct gut microbiota and serum metabolites in response to weight loss induced by either dairy or exercise in a rodent model of obesity. J Proteome Res, DOI: 10.1021/acs.jproteome.9b00304
Mildren RL, Peters RM, Carpenter MG, Blouin JS, Timothy Inglis J. 2019. Soleus single motor units show stronger coherence with achilles tendon vibration across a broad bandwidth relative to medial gastrocnemius units while standing. J Neurophysiol, DOI: 10.1152/jn.00352.2019
Hypovolemia and reduced hemoglobin mass in patients with heart failure and preserved ejection fraction. Physiol Rep, DOI: 10.14814/phy2.14222


Nettleton JE, Cho NA, Klancic T, Nicolucci AC, Shearer J, Borgland SL, Johnston LA, Ramay HR, Noye Tuplin E,


Register-Mihalik JK, Guskiewicz KM, Marshall SW,


statement on sports-related concussions in youth sports using a modified delphi approach. JAMA Pediatrics, DOI: 10.1001/jamapediatrics.2019.4006


Sant’ Ana J, Franchini E, Murias JM, Diefenthaler F. 2019. Validity of a taekwondo-specific test to measure VO2peak and the heart rate deflection point. J Strength Cond Res, DOI: 10.1519/JSC.0000000000002153


Soares RN, de Oliveira GV, Alvares TS, Murrias JM. 2020. The
effects of the analysis strategy on the correlation between the NIRS reperfusion measures and the FMD response. Microvasc Res, DOI: 10.1016/j.mvr.2019.103922


Townsend LK, Gandhi S, Shamshoum H, Trottier SK, Mutch DM, Reimer RA, Shearer J, LeBlanc PJ, Wright DC. 2020. Exercise and dairy protein have distinct effects on indices of liver and systemic lipid metabolism. Obesity (Silver Spring), DOI: 10.1002/oby.22621


Wannop JW, Nigg S, Edwards WB. 2019. From Canmore to Kananaskis: where has the last 20 years in Footwear Sci brought us? Footwear Sci, DOI: 10.1080/19424280.2019.1606348


Whatman C, Toomey C, Emery C. 2019. Visual rating of


Technical Reports


Buettner, M., Nigg, S., Nigg, B. Consulting Work Related to Dr. Scholl’s Custom 3D Printed Inserts. Industry report for Dr. Scholl.

Büttner, M., Hoitz, F., Nigg, B. Classification of Human Movements with Artificial Neural Networks. An Industry report for Biomechanigg.

Cigoja, S., Nigg, SR., Nigg, BM. (2019) Varus Score. adidas AG


Dourthe, B., Nigg, S., Nigg, B. Highlights of the Fourteenth Footwear Biomechanics Symposium. Industry report for Dr. Scholl.


Krafft, F., Honert, E., Von Tscharner, V., Nigg, SR., Nigg, BM. Electromyography based Deviation Metrics in Runners.
Industry Report for Brooks.
Manz, S., Nigg, S., Nigg, BM. Athlete Assessment Running: Grouping Approaches. Industry report for adidas.
Manz, S., Von Tscharner, V., Nigg, SR., Nigg, BM. Athlete Assessment Running: Phase 2. Industry report for adidas.
Manz, S., Vienneau, J., Hoitz, F., Nigg, S., Nigg, BM. Third party competitor evaluation. Industry report for CCM.
Ratka, D., Cigoja, S., Asmussen, MJ., Fletcher, JR., Nigg, SR., Nigg, BM. (2019) Does increased midsole bending stiffness decrease the redistribution of positive lower limb joint work during an exhaustive run? Biomechanigg Sport & Health Research Inc.
Technical Reports


Books & Book Chapters

Emery C. What’s New in Concussion Research. See the Line Community Symposium 2019, London ON. August 15. (Keynote)
Federico S. Damage and Remodelling in Recruitment-Based Models for Biological Tissues. Korea Institute of Industrial Technology, Seoul, South Korea. December 9
Herzog W. Cross-country skiing as a model for human movement analysis. 8th International Congress on Science and Skiing, Vuokatti, Finland. March 14. (Keynote)
Herzog W. Of muscle force magnitude, direction and synergies in sports. International Society of Biomechanics in Sports, Oxford, Ohio, USA. July 22. (Keynote)
Herzog W. Reflections on muscle contraction: the evolution of a new paradigm for muscle contraction. 17th International Conference on Biomedical Engineering, Singapore. December 11. (Plenary)

Herzog W. Rhythm in biomechanics: from randomness to rhythm to synchrony. Multidisciplinary Symposium of 2018 Killam Prize Winners, Montreal QC. December 5.

Joumaa V. Towards a better understanding of muscle contraction. 4th Rocky Mountain Muscle Symposium (rMMSs), Canmore AB. July 28.

Kuo AD. The leg bone doesn’t connect with the arm bone (in optimal control of movement). BIRS Optimal Neuroethology of Movement and Motor Control (19w5235), Banff AB. May 20.

MacIntosh BR. Intensity of Exercise Prescription: What is moderate to vigorous exercise? 2019 Exercise is Medicine National Student Research and Medical Conference, Calgary AB. June 27.

Murias JM. Exercise prescription for cardiovascular health: how close (or how far) are we from getting it right? Canadian Association of Cardiovascular Prevention & Rehabilitation (CACPR) Fall Conference 2019, Montreal QC. October 25.


Pasanen K & van den Berg C. Keeping them in the game – an evidence based injury prevention warm-up for your athletes. CATA 2019 National Conference, Calgary, June 1.

Pasanen K. Primary Prevention of Joint Injury in Sport. 2019 OARSI World Congress on Osteoarthritis. Pre-Congress Workshop ’Approaches to Preventing Post-Traumatic OA
in Sport and the Military. Toronto, ON, Canada May 2.
Pasanen K. Upscaling NMT programmes in youth sport.
Reimer RA. Prebiotics and gut microbiota: how they work together to affect metabolic health. Food & Nutrition Conference & Expo (FNCE) 2019, Philadelphia PA, USA. October 26. (Keynote)
Schneider K. Prevention of concussion in ice hockey. 3rd Annual Injury Prevention Symposium, Vail CO, USA. May 2.
Wannop, B. Running Shoe Design and Biomechanics. 2019 Canadian Academy of Sport and Exercise Medicine, Calgary, AB. September 14.
Official Research Related Functions

Amanda Black

Board Member
Canadian Athletic Therapy Association Education Committee
Pediatric Research in Sport Medicine Society Education Committee

Grant Reviewer
Partnership for Research in Innovation in the Health System (PRIHS), Alberta Innovates, Internal Peer Reviewer

Membership
Hotchkiss Brain Institute
Alberta Children’s Hospital Research Institute
Canadian Athletic Therapy Association
Pediatric Research in Sport Medicine Society
American College of Sports Medicine

Tyler Cluff

Conference Reviewer
International Society of Biomechanics Conference, Calgary, AB. February 2019.

Grant Reviewer
University Research Grants Committee (URGC), University of Calgary
Markin USRP Competition, University of Calgary

Membership
Society for Neuroscience

Tish Doyle-Baker

Committee Member
Alberta Prevents Website Project Alberta, Ca Prevention Legacy Fund Project, Co-Lead

Conference Organization
Walk 21 Conference Committee
Exercise Perspectives in Exercise, Health, and Fitness Conference Committee

Conference Reviewer
Official Research Related Functions

European College of Sport Science
EDITORIAL/ADVISORY BOARD MEMBER
International Journal of Kinesiology and Sport Science
Annals of Applied Sport Science
GRANT REVIEWER
CIHR Foundation Grant Program
Markin Undergraduate Student Research Program, University of Calgary
Graduate Award Competition, University of Calgary
MEMBERSHIP
Alberta Centre for Active Living
Alberta Children’s Hospital Research Institute (ACHRI)
American College of Sports Medicine
Canadian Society of Exercise Physiology
European College of Sport Science
O’Brien Institute for Public Health

BRENT EDWARDS
CONFERENCE ORGANIZATION
XXVII Congress of International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, Calgary, AB. July 31 - August 4, 2019. Special Symposia and Invited Speakers Chair.
14th Footwear Biomechanics Symposium, Kananaskis, AB. July 28-30, 2019. Scientific Program Chair.
EDITOR
Footwear Science, Supp 1, Proceedings of the 14th Footwear Biomechanics Symposium, Kananaskis, AB. July 2019. Guest Editor
EXECUTIVE BOARD MEMBER
International Society of Biomechanics, Secretary General
Advisory/Editorial Board Member
Scientific Reports
JBMR Plus
GRANT REVIEWER
The Institute of Translational Health Sciences (ITHS) Pilot Awards, External Reviewer
NSERC Discovery Grants, External Reviewer
MEMBERSHIP
American College of Sports Medicine
Official Research Related Functions

American Society of Biomechanics
American Society of Bone and Mineral Research
Canadian Society of Biomechanics
International Society of Biomechanics
Orthopaedic Research Society

CAROLYN EMMERY

COMMITTEE MEMBER
Massive Open Online Course (MOOC) in Concussion Leadership Committee
Osteoarthritis Research Society International: Sport, Exercise, Physical Activity and Osteoarthritis Prevention Discussion Group, Co-lead
Osteoarthritis Research Society International Scientific Committee
Parachute Canada Concussion Awareness Advisory Committee
Chair in Pediatric Rehabilitation and Director Vi Riddell Pediatric Rehabilitation Program, Alberta Children’s Hospital

EDITOR
British Journal of Sport Medicine, Deputy Editor

GRANT REVIEWER
Canadian Institutes of Health Research College of Reviewers, Project Grant Review, Social & Developmental Aspects of Children’s & Youth’s Health Committee Partnership for Research and Innovation in the Health System (PRIHS), Cumming School of Medicine Grant Review CIHR Population Health Project Medicine Grant Review Panel

MEMBERSHIP
Royal Society of Canada, College of New Scholars Canadian Academy of Health Sciences Osteoarthritis Research Society International Hotchkiss Brain Institute, University of Calgary Centre for Hip Health and Mobility, University of British Columbia O’Brien Institute of Public Health, University of Calgary McCaig Institute for Bone and Joint Health, University of Calgary
Alberta Children’s Hospital Research Institute for Child Health, University of Calgary
American College of Physiotherapists
Alberta Physiotherapy Association
Canadian Physiotherapy Association, Sport Physiotherapy Division
Canadian Physiotherapy Association, Research Division
Canadian Physiotherapy Association, Orthopaedic Division
Canadian Physiotherapy Association, Pediatric Division

**SALVATORE FEDERICO**

**COMMITTEE MEMBER**
Past President, Canadian Society for Biomechanics (2019-2020 term)
Selection Committee Member, Society for Natural Philosophy
Evaluation Group Member, Mechanical Engineering, Natural Sciences and Engineering Research Council of Canada (2019-2023 term)

**EDITORIAL/ADVISORY BOARD MEMBER**
Atti dell’Accademia Peloritana dei Pericolanti, Classe di Scienze
Mathematics and Mechanics of Solids Matematiche, Fisiche e Naturali

**REED FERBER**

**EDITORIAL/ADVISORY BOARD MEMBER**
Prosthetics and Orthotics International
Journal of Sport Rehabilitation
Journal of Athletic Training

**SCIENTIFIC ADVISORY BOARD MEMBER**
Biotricity Inc., Redwood City, CA
Fitbit Inc., San Francisco, CA

**WALTER HERZOG**

**CONFERENCE ORGANIZATION**
XXVII Congress of International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, Calgary, AB. July 31 - August 4, 2019. Conference Chair, 2016-2019.
Official Research Related Functions

Rocky Mountain Muscle Symposium, Canmore, AB. Conference Chair.
International Society in Science and Sports, Vuokatti, Finland. March 2019. Young Investigator Award Committee Member.
European Society of Biomechanics Congress, Warsaw, Poland. Scientific Committee Member.

EDITOR
Journal of Sport and Health Science, Co-Editor in Chief
Exercise and Sports Science Reviews, Associate Editor
IEEE Transactions in Neural Systems and Rehabilitation Engineering, Associate Editor

EDITORIAL/ADVISORY BOARD MEMBER
Chiropractic & Manual Therapies
The Current Issues of Sport Science (CISS)
Journal of Functional Morphology and Kinesiology
Biomechanics and Modeling in Mechanobiology
BMC Biomedical Engineering
International Journal of Mechanical and Materials Engineering
Muscles, Ligaments and Tendons Journal
Sports Orthopaedics and Sports Traumatology
Molecular and Cellular Biomechanics
Journal of Biomechanics
Journal of Electromyography and Kinesiology
Journal of Manipulative and Physiological Therapeutics
Journal of the Canadian Chiropractic Association
Sportverletzung Sportschaden
Motor Control Group, International Society of Biomechanics, Vice-Chair
Nike Sports Research
German Journal of Sport Sciences
Sportwissenschaft Journal
Sportorthopädie Sporttraumatologie, International Board Member

GRANT REVIEWER
NSERC (1990-present)
CIHR Foundation Grant Program
CIHR Movement and Exercise Peer-review Panel
Official Research Related Functions

**JOHN HOLASH**

**COMMITTEE MEMBER**
- New Learning Technology Platform Panel for Yuja Learning Technologies Advisory Committee

**ARTHUR KUO**

**COMMITTEE MEMBER**

**CONFERENCE ORGANIZATION**
- XXVII Congress of International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, Calgary, AB. July 31 - August 4, 2019. Organizing Committee.

**GRANT REVIEWER**

**MARTIN MACINNIS**

**COMMITTEE MEMBER**
- Canadian Society for Exercise Physiology (CSEP) Knowledge Translation Committee

**GRANT REVIEWER**
- NSERC Discovery Grants
- Markin Undergraduate Student Research Program, University of Calgary
- NSERC Postgraduate Scholarships (Doctoral), University of Calgary
- Graduate Award Competition, University of Calgary

**MEMBERSHIP**
- Canadian Society for Exercise Physiology
- American Physiology Society

**BRIAN MACINTOSH**

**EDITOR**
- Journal of Muscle Research and Cellular Motility; Special
Official Research Related Functions

Edition on Muscle Energetics, Guest Editor

**GRANT REVIEWER**
NSERC, Peer Review Panel Member

**MEMBERSHIP**
Canadian Society for Exercise Physiology
American College of Sports Medicine
American Physiological Society
European College of Sport Science

**JUAN MURIAS**

**EDITOR**
PlosOne

**GRANT REVIEWER**
NSERC Discovery Grant, External Reviewer
Canada Foundation for Innovation (CFI), John R. Evans Leaders Fund, External Reviewer

**BENNO NIGG**

**CONFERENCE ORGANIZATION**
XXVII Congress of International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, Calgary, AB. July 31 - August 4, 2019. Organizing Committee.

**EDITORIAL/ADVISORY BOARD MEMBER**
Brazilian Journal of Biomechanics, (2000-ongoing)
Orthopädische Zeitschriften, (2005-ongoing)
Footwear Science, (2008-ongoing)
International Scholarly Research Notices (ISRN)
Biomedical Engineering, (2012-ongoing)

**KATI PASANEN**

**COMMITTEE MEMBER**
FSPA Congress “Injury Prevention Works - Mission Possible”, Finnish Sports Physiotherapists Association, Session Chair
Finnish Strength and Conditioning Coaches Association, InBoard of Directors

**EDITORIAL/ADVISORY BOARD MEMBER**
Healthy Dancer program, Finnish National Ballet
Finnish Coaches Association
Official Research Related Functions

MEMBERSHIP
  International Society of Biomechanics
  European Society of Biomechanics
  Osteoarthritis Research Society International
  Canadian Association of University Teachers
  Finnish Sports Physiotherapists Association
  Finnish Association of Physiotherapists
  HEPA Europe Injury Prevention Group
  Finnish Strength and Conditioning Coaches Association
  Finnish Coaches Association
  Society of Sport Science

RAYLENE REIMER

COMMITTEE MEMBER
  Canadian Nutrition Society Awards Committee
  Canadian Nutrition Society, University of Calgary Faculty Advisor
  Working Group Member: Canadian Museum of Nature Microbiome Exhibit
  Data Monitoring Committee: FMT in Major Depression

EDITORIAL/ADVISORY BOARD MEMBER
  Applied Physiology, Nutrition and Metabolism, Associate Editor
  BioRad Laboratories Inc., Research Consultant
  General Mills Inc. Research Consultant
  InovoBiologic Inc. Research Consultant
  Beneo GmbH, Research Consultant

GRANT REVIEWER
  CIHR College of Reviewers
  CIHR Banting Postdoctoral Fellowships Selection Committee

MEMBERSHIP
  College of Dieticians of Alberta
  The Obesity Study
  Canadian Nutrition Society
  American Society for Nutritional Sciences
  Obesity Canada
  Obesity Canada, Calgary Chapter
KATHRYN SCHNEIDER

CONFERENCE ORGANIZATION
- 6th International Consensus Conference on Concussion in Sport, Scientific Committee
- Sport Physiotherapy Canadian Concussion Symposium, Co-Organizer

EDITORIAL/ADVISORY BOARD MEMBER
- Medical Sub-Committee of the Canadian Committee of Combative Sports Association
- Federal Working Group on Concussion in Sport, Surveillance Initiative Co-Lead with Dr. Charles Tater
- Alberta Rehabilitation Research Counsel
- Parachute Canada Expert Advisory Group on Concussion
- Federal Working Group on Concussion in Sport, Canadian Concussion Collaborative Representative
- Canadian Concussion Collaborative, Representative for the Canadian Physiotherapy Association

GRANT REVIEWER
- CFI SUPPORT Research Infrastructure Programs Committee
- SSHRIC Insight Grant

MEMBERSHIP
- Hotchkiss Brain Institute
- Alberta Children’s Hospital Research Institute
- Canadian Physiotherapy Association, Orthopaedic Division
- Canadian Physiotherapy Association, Sports Physiotherapy Division
- Canadian Physiotherapy Association, Neurological Division
- Canadian Physiotherapy Association, Paediatric Division
- Canadian Academy of Manipulative Therapists
- Physiotherapy Alberta College + Association
- Vestibular Disorders Association
**Official Research Related Functions**

**JONATHAN SMIRL**

**COMMITTEE MEMBER**
- International Cerebral Autoregulation Research Network Steering Committee

**CONFERENCE ORGANIZATION**
- Cerebral Autoregulation Research Network Annual Meeting, Leuven, Belgium
- Canadian Society for Exercise Physiology (CSEP)

**GRANT REVIEWER**
- Mitacs

**MEMBERSHIP**
- Cerebral Autoregulation Network (CARNet)
- Canadian Traumatic Brain Injury Research Consortium (CTRC)
- American Physiological Society (APS)
- The Physiological Society (Phys Soc)
- Canadian Society for Exercise Physiologists (CSEP)

**DARREN STEFANYSHYN**

**COMMITTEES**
- NFL Engineering Committee

**CONFERENCE ORGANIZATION**
- IXXVII Congress of International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, Calgary, AB. July 31 - August 4, 2019. Organizing Committee.

**EDITOR**
- Footwear Science, Associate Editor
- Editorial/Advisory Board Member
- European Journal of Sport Science