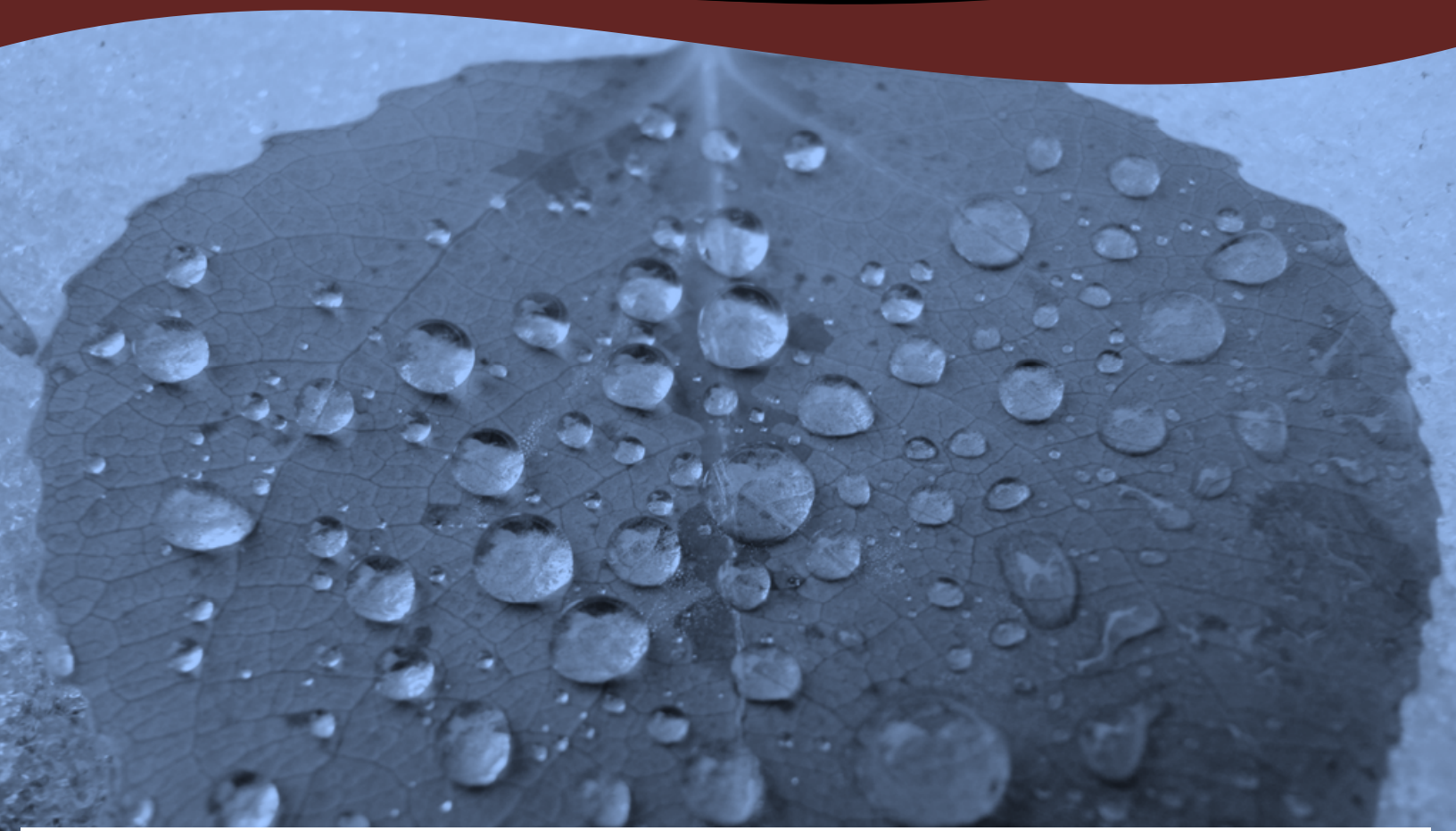
11th Annual Alberta Biomedical Engineering Conference Program

Alberta BME



October 22nd – 24th, 2010
The Banff Centre
Banff, Alberta

UNIVERSITY OF CALGARY

University of Lethbridge

UNIVERSITY OF ALBERTA

We gratefully acknowledge the support of our sponsors for making this conference a success

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11th Alberta Biomedical Engineering Conference - Banff 2010

UNIVERSITY OF ALBERTA

UNIVERSITY OF CALGARY

University of Lethbridge

October 22 – 24, 2010
The Banff Centre
Banff, AB

PROGRAMME

Podium Sessions are in the Max Bell Auditorium.
Poster Sessions are in the Max Bell Lounge ("Fishbowl") and Max Bell 253.

FRIDAY

4:00 - 8:30 pm	**REGISTRATION and CHECK-IN – Professional Development Center Front Desk / Lounge**
7:30 pm	**Opening Reception – Kinnear Centre KC 103**
	Welcome: Dr. Michael Kallos & Dr. Samer Adeeb Kinnear Centre KC 103

SATURDAY

7:00 – 8:00 am	**BREAKFAST – Vistas Dining Room**
8:00 – 8:05 am	**Welcoming Remarks – Dr. Michael S. Kallos**
8:05 – 8:45 am	**Guest Speaker #1: Dr. Jamie Piret,** University of British Columbia "Biomedical Process Engineering for Stem Cell Science and Manufacturing" **Session Chair:** Dr. Arin Sen, University of Calgary

8:45 – 9:55 am

Student Podium Presentation Session #1

Session Chair: Dr. Albert Cross, University of Lethbridge

Quinn Thomson	01	Toward an Automatic ASPECTS Method: Classification of Ischemic Brain Tissue on Non-contrast Computed-tomography Images with Image Texture Analysis
Alisa Ahmetovic	02	Clinical feasibility of the Smart-e-Pants for prevention of deep pressure ulcers
Conrad Tang	03	Biomechanics of the Vertebral Artery during Neck Manipulative Treatments
Swathi Damaraju	04	Gap Junction Functionality in Late-Differentiated Murine Embryonic Stem Cells
Michael Lam	05	Phage Display: A Bioreactor Technology for Generating Antibody-like Binding Molecules for the Early Detection of Osteoarthritis
Nolan Swailes	06	Closed-Loop Circulation Phantom with Heart and Lung Motion for Validating Passive Catheter Tracking

9:55-11:10 am

Poster Session #1 (ODD NUMBERED POSTERS)

COFFEE/BEVERAGE BREAK
Max Bell Fish Bowl and Max Bell 253

Judges: Drs. Andrea Clark, Ross Mitchell, Janet Ronsky – University of Calgary and Drs. Samer Adeeb, Anastasia Elias, Vivian Mushahwar – University of Alberta

Chiara Bellini	01	Experimental, Analytical and Computational Assessment of the Effect of Smooth Muscle Contraction on Residual Stress in the Canine Thoracic Aorta
Grant Cechmanek	03	Effects of Common Input on Force Production
Michael Mislan	05	Residual Stress in Arteries: The role of Smooth Muscle Cells
Krishna Panchalingam	07	Bioengineering of Human Mesenchymal Stem Cell (hMSC) Production in Microcarrier Cultures for the Treatment of Diabetes
Poh Soo Lee	09	Engineering embryonic stem cell-derived articular cartilage on a novel 3D enclosed perfusion biomimetic bioreactor
Charlotte Curtis	11	Estimation of three-dimensional breast features from two-view mammograms
Anthony Killick	13	Metabolically optimal gait transitions in cross-country skate skiing
Warren Misik	15	Modeling the Ischemic Penumbra in Acute Stroke: a Novel “Balloon” Volume Approach
Kamran Bigdely-Shamloo	17	Role of T-type Calcium channel in Calcium regulation of Smooth Muscle Cells
Ryan Choo	19	Development of a somatosensory neural prostheses: Time course and percepts evoked by different patterns of electrical stimulation in human thalamus
Kathryn Boon	21	Co-culture of Mesenchymal Stem Cells and Canine Notochordal Cells for Intervertebral Disc Tissue Engineering
Mojtaba Kazemi Miraki	23	Changes in Fluid Pressurization in the Knee Joint after Meniscectomy
James Huber	25	Utilization of CAD and Metal Rapid Prototyping to Create Customized Orthopedic Fracture Plates
Brad Holinski	27	Restoring Stepping after Spinal Cord Injury using Novel Electrical Stimulation and Feedback Control Strategies

Jennifer Roycroft	29	Real-time sodium flux in chondrocytes after hypo-osmotic challenge
Mohammad Atarod Pilambaraei	31	Evaluation of the Stiffness of Ovine Stifle Joint Using a Parallel Robot
Jochen Fahr	33	Development of a Tool to Investigate the Consequences of blocked GM-CSF in Autoimmune Diseases
Ryan Lewinson	35	The effect of shaft configuration on snow shovelling kinetics and injury risks
Payam Zandiyeh	37	Active Knee Exoskeleton (Orthosis) Simulation and Control Using Neuro-Fuzzy Controller

11:10 – 12:30 pm **Student Podium Presentation Session #2**

Session Chair: Dr. Elena Di Martino, University of Calgary

Olesja Hazenbiller	07	The Effect of Mechanical Stimulation on Stem Cell Differentiation and Ex Vivo Fracture Repair
Kyle Nishiyama	08	Bone microarchitecture at the distal radius to predict fracture using in vivo HR-pQCT
Eng Kuan Moo	09	Computational Modeling of Chondrocyte Mechanics at Different Loading Rates
Taryn Hill	10	Diminished Cartilage Lubricating Ability of Human OA Synovial Fluid Deficient in PRG4: Restoration through PRG4 Supplementation
Cheng Cheng	11	Surrogate Spinal Cord for Electrodes Evaluation
Sam Dorosz	12	The Effect of Molecular Weight on Hyaluronan's Cartilage Lubricating Ability – Alone and in Combination with Proteoglycan 4
Josh Rosvold	13	Ovine Ligament Loads During Normal Gait

12:30 – 1:45 pm **LUNCH – Vistas Dining Room**

1:45 – 2:30 pm **Industry Panel:**

Sabina Bruehlmann
Director Research & Development, Zephyr Sleep Technologies
Donald Chapman
President and CEO, Kent Imaging Inc.
Roger McPherson
Vice President Engineering, Chariot Carriers Inc.

Session Chair: Dr. Nigel Shrive, University of Calgary

2:30 – 2:35 pm **BREAK – Group Pictures**

2:35-3:50 pm

Poster Session #2 (EVEN NUMBERED POSTERS)
COFFEE/BEVERAGE BREAK
Max Bell Fish Bowl and Max Bell 253

Judges: Drs. Andrea Clark, Ross Mitchell, Janet Ronsky – University of Calgary and Drs. Samer Adeeb, Anastasia Elias, Vivian Mushahwar – University of Alberta

Neal Gallagher	02	Using Complex Impedance to Establish RF Ablation Catheter Contact
Andrey Melnikov	04	Continuum Electromechanical Model of the Cardiac Muscle
Philippe Gauderon	06	Investigating Contrast Agent Concentration in DCE-MR using SPGR imaging
Arash Panahifar	08	Evaluation of Strontium Drugs as Tracers of Bone Turnover in Normal and Osteoarthritic Rats
Imad Khaled	10	Fabrication of a flexible base microelectrode array for intra-spinal micro-stimulation
Sinoj Abraham	12	Polymer-Coated Nanoparticles: Surface Chemistry Effects on Adsorbed Protein Conformation
Rui Zhou	14	Performance of Surface Myoelectric Signal Features in Classification of Motion Classes in Transradial Amputees
Estee Lee	16	Re-examination of normal and abnormal knee classification methods using vibroarthrographic signals generated during knee movement
Jan Pajerski	18	Numerical Implementation of a Non-Linear Microstructural Model of Cartilage
Anna Steinhoff	20	Low magnitude, high frequency vibration to prevent muscle and bone loss after injection with botulinum toxin
Neel Kaipatur	22	FE Modeling and *in-vivo V*alidation of Orthodontic Tooth Movement Using Mini-implants: A Pilot Study in Rats
Jason Robertson	24	A Novel Stroke Assessment Tool Measuring Individual Finger Forces and Torques
Yifan Yuan	26	Development of Inoculation and Proliferation Conditions of Human Bone Marrow-derived Mesenchymal Precursor Cells on Microcarriers
Chris Bouwmeester	28	Detailed Measurements of Pulmonary Artery Pressure and Flow
Xu Dai	30	Retrospect and Prospect of Tissue Engineering in Articular Cartilage Damage Treatment
Shivani Chandrakumar	32	Inoculation Conditions for Synovium-Derived Precursor Cells in Microcarrier Culture
John Schipilow	34	Is there a difference in bone microarchitecture between female volleyball players and recreationally active controls?
Kristen Sabourin	36	Design of an OR Pressure Measurement Procedure for Pediatric Scoliosis Surgery
Giovanna Lara	38	Shear Stress Alters Pluripotency Marker Expression in Murine Embryonic Stem Cells

3:50 – 5:10 pm

Student Podium Presentation Session #3

Session Chair: Dr. Tannin Schmidt, University of Calgary

Melissa Lorenzo	14	Interleukin-1α Elicits a Calcium Response in Chondrocytes In situ

Stephanie Fisher	15	Use of Gellan Gum as an Injectable Biomaterial for Regeneration of the Nucleus Pulposus
Leandro Solis	16	Effects of intermittent electrical stimulation on pressure levels at the bone-muscle interface for the prevention of deep tissue injury
Maria Yamamoto	17	A-band Shortening in Isolated Myofibrils of Rabbit *Psoas* Muscles
Aliaa Rehan Youssef	18	Cartilage Degeneration in Different Models of Osteoarthritis in the New Zealand Rabbit
Allison Van Winkle	19	Mass Transfer in Human Embryonic Stem Cell Embryoid Bodies
Farhana Begum	20	Biomechanical analysis of proximal humerus fractures for cyclic loading using locking plate fixation with an intramedullary fibular autograft

6:00 – 7:00 pm **DINNER – Vistas Dining Room**

7:00 pm **"THE GREAT CHALLENGE"** Max Bell Fish Bowl

7:15 pm Joint UA, UC, UL Faculty Meeting – Kinear Centre KC 205

8:00 pm **Social – Elk and Oarsman**
119 Banff Avenue (2nd Floor, Above The Ski Hub)

SUNDAY

7:15 – 8:15 am **BREAKFAST – Vistas Dining Room**

8:15 – 8:45 am **Checkout**

8:45 – 9:25 am **Guest Speaker #3: – Dr. Peter Cripton,** University of British Columbia

"When it Comes to Biomechanics….Is Injury *Prevention* the best *Medicine?*"

Session Chair: Dr. Michael Doschak, University of Alberta

9:25 – 10:20 am **Student Podium Presentation Session #4**
Session Chair: Dr. Larry Unsworth, University of Alberta

Kelsea Fitzpatrick	21	Molecular and Mechanical Effects of Ovariohysterectomy on Ligament Healing
Robert van der Marel	22	Electrical Stimulation Training does not Prevent Strength Loss in Muscles Treated with Botulinum Toxin
Jillian Beveridge	23	Tibiofemoral Surface Interactions and Cartilage Damage in Two Sheep Models of Knee Injury
Yuchin Wu	24	Compositional and Material Properties of Rat Bone after Drug Treatment
Madiha Khurshid	25	Centrifugal Cell Loading of Decellularized Tissue to Create A Heart Patch

10:20-10:40 am

Poster Session #3 (FINALISTS ONLY)
COFFEE/BEVERAGE BREAK
Max Bell Fish Bowl and Max Bell 253

Judges: Drs. Andrea Clark, Ross Mitchell, Janet Ronsky – University of Calgary and Drs. Samer Adeeb, Anastasia Elias, Vivian Mushahwar – University of Alberta

10:40 – 11:25 am

Student Podium Presentation Session #5
Session Chair: Dr Steven Boyd, University of Calgary

Matthew Ethan MacDonald	26	Catheter Tracking using Passive Magnetic Resonance Imaging into the Ascending Aorta
Tia Gareau	27	Shear Stress Influences Pluripotency of Embryonic Stem Cells in Suspension Bioreactors
Rafael Fortuna	28	The Influence of Cyclic Concentric and Eccentric Submaximal Muscle Loading on Cell Viability in the Rabbit Knee Joint
Martin Kuhlmann	29	A Coupled Eulerian-Lagrangian Mechanical Model of the Human Breast

11:25 – 11:30 am

Closing Remarks – Dr. Sameer Adeeb & Dr. Michael S. Kallos

11:30 – 12:00 pm

University of Calgary Schulich School of Engineering Undergraduate Award Presentations

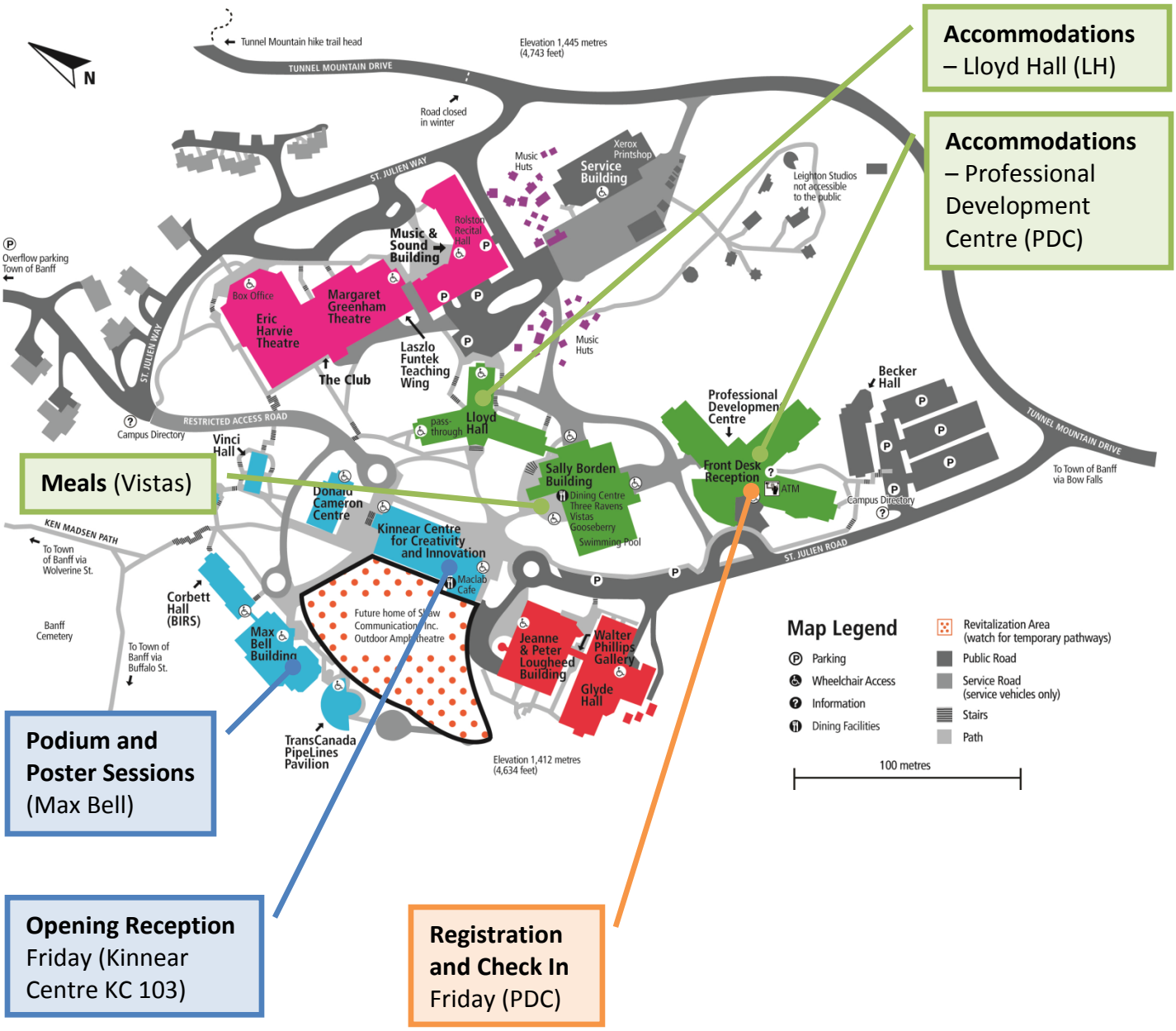
Podium and Poster Prize Presentations – Sponsored by the NSERC CREATE Training Program for Biomedical Engineers for the 21st Century

NSERC CREATE Prize presentations for Most Outstanding Student Posters
Best Overall Poster, Most Creative Poster, Clearest Message Poster

NSERC CREATE Prize presentations for Most Outstanding Podium Presentations
First Prize, Second Prize, Third Prize

Canadian Society of Biomechanics/Société candienne de biomécanique
Podium Presentation Prize
Poster Presentation Prize

Map and Meeting Location



Directions to Elk and Oarsmen (Saturday Social)

119 Banff Avenue (2nd Floor, Above The Ski Hub)

Guest Speaker #1 – Dr. James M. Piret

Professor, Michael Smith Laboratories and Department of Chemical & Biological Engineering, University of British Columbia

"Biomedical Process Engineering for Stem Cell Science and Manufacturing"

Abstract

Since the reported derivation of human embryonic stem cells in 1998, a decade of major developments in regenerative medicine research has revolutionized our perspectives on the feasibility of cell-based therapies. In particular, advances in adult stem cell research have led to cells being tested as therapeutic agents in a wide array of clinical trials. We can hope for great advances in the treatment of major illnesses that currently afflict millions and are major economic burdens (ranging from cancer to cardiac and degenerative diseases).

There is now a great need for novel technologies to accelerate stem cell science and to develop improved cell manufacturing technologies. I will describe examples of engineering contributions to improving stem cell culture technology as well as developing microfluidic devices that can satisfy the demanding requirements of stem cell systems. Emerging cellular therapies present many new opportunities for high impact engineering contributions.

Brief Bio

Dr. Piret is a Professor in the Michael Smith Laboratories and the Department of Chemical & Biological Engineering at the University of British Columbia. He graduated with an Applied Math to Biochemistry bachelors of arts from Harvard University in 1981, followed by Chemical Engineering master's and doctoral degrees from MIT in 1986 and 1989. Dr. Piret has been the Stem Cell Bioengineering theme leader of the Stem Cell Network since 2001 and is a Fellow of the Chemical Institute of Canada.

Since 1989, at the University of British Columbia, his research has been primarily focused on developing process and device technology for the optimization of mammalian cell culture protein or stem cell production. This multi-disciplinary research ranges from molecular biology to bioreactor engineering and often includes collaborative work with biologists and industry.

Guest Speaker #2 – Dr. Peter Cripton

Associate Professor of Mechanical Engineering, Associate Faculty Department of Orthopaedics, University of British Columbia

"When it Comes to Biomechanics….Is Injury *Prevention* the best *Medicine*?"

Abstract

I will discuss the historically separate fields of injury and orthopaedic biomechanics in order to make a case for the importance of injury biomechanics research. In injury biomechanics we are primarily focused on preventing injuries and this is a historically smaller field of research than that work which focuses on the biomechanical efficacy of clinical devices or the study of normal and pathologic biomechanics in humans or animals. There is presently little injury biomechanics research in North America relative to the field of orthopaedic biomechanics and I will argue that this presents a great opportunity for growth and high-impact research for young biomedical engineers today. I will profile several projects from my own laboratory and put them each in the context of real-world injury prevention. I will also touch on the role of injury biomechanics in real-world injury reconstructions.

Brief Bio

Dr. Cripton is co-Director of the UBC Orthopaedic and Injury Biomechanics Group. He is an Associate Professor in the Department of Mechanical Engineering, an Associate Faculty Member in the Department of Orthopaedics and a Principal Investigator at ICORD at the University of British Columbia. He obtained his PhD from Queen's University and did postdoctoral work at Yale University. Prior to coming to UBC in 2003 he worked as a consulting engineer at Exponent, Failure Analysis Associates in Philadelphia, PA. At UBC he established the UBC Injury Biomechanics Laboratory. This laboratory was merged into the Orthopaedic and Injury Biomechanics lab in the summer of 2009. Dr. Cripton is a member of the American Society for Testing Materials, the Society of Automotive Engineers, the International Society of Biomechanics and the Orthopaedic Research Society. He is also a Principal Investigator in the Center for Hip Health and Mobility, a research centre focused on the prevention of injury and pathology at the hip.

Dr. Cripton's research interests include injury prevention, spine biomechanics, hip biomechanics, impact biomechanics, spinal cord injury and spinal implant biomechanics. In addition to developing a helmet to prevent spinal cord injuries during head first impacts in sports called the Pro-Neck-Tor™ helmet, Dr. Cripton and colleagues perform research focused on preventing hip fractures. Other specific projects focus on preventing spinal injuries in the vulnerable geriatric and pediatric populations, developing improved mechanical surrogates for injury experiments (i.e. crash test dummy necks and physical models of the spinal cord), and using advanced MRI imaging techniques to better understand spinal cord injury.

Industry Panel

Sabina Bruehlmann, Director Research & Development, Zephyr Sleep Technologies

Company Info

Zephyr is a medical device company that develops products and services in the area of sleep medicine. Our portfolio of products is designed to monitor sleep, analyze sleep performance and treat some sleep disorders. Zephyr is working with our community of sleep researchers, sleep clinics, sleep technicians and medical professionals – all to ensure people are sleeping better.

Brief Bio

Sabina Bruehlmann graduated from the University of Calgary with a PhD in Biomedical (mechanical) engineering in 2004. She went on to manage a two year Research and Development initiative between a Silicon Valley venture fund and researchers at the Joint Injury and Arthritis Research Group at the University of Calgary with a mandate to verify and validate a new medical device technology. This foray into industry led her to University Technologies International (UTI) the University of Calgary's technology commercialization arm where she managed the commercialization activities for a portfolio of over 100 medical devices, as a Project Manager for Licensing and Business Development. As Director of Partnerships at UTI, Sabina worked with a number of campus groups on the application and/or installation process for the NCE Centres of Excellence Program. Recently, she has left UTI to help in the formation of Zephyr Sleep Technologies – a medical device company focused on the science of sleep.

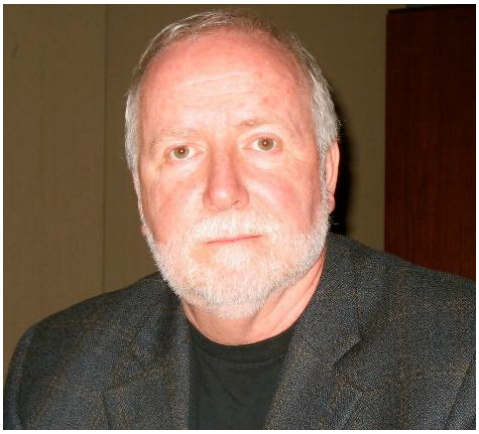
Industry Panel

Donald Chapman, President and CEO of Kent Imaging Inc.

Company Info

Donald Chapman is President and CEO of Kent Imaging Inc., a privately held medical device company headquartered in Calgary, Alberta. Founded in 2006, Kent is a developing a specialized imaging system that will enable emergency doctors and surgeons to survey injured or reconstructed tissue and determine the state of health of the tissue. This novel platform is based upon intellectual property licensed from the National Research Council of Canada's Institute of Biodiagnostics.

Brief Bio



Mr. Chapman is a serial entrepreneur; having founded, over the past 35 years, seven successful companies, lost 2 companies and served as president of three others, all in high-tech space. His personal experience is a combination of multidimensional skills, from raising seed money and assembling business teams, to evaluation of market potential, and managing company forces. With a constant view to market driven, he has hands-on experience in developing product and services pricing strategies, negotiation of both national and international contracts and extensive insight into the strategies and objectives of dealers/distributors. Mr. Chapman has been a guest lecturer at the University of Calgary in the MBA program on business practices and start-ups, as well as to the international business students at both U of C, NAIT, BCIT, SAIT and U of M. He is a regular fixture in entrepreneur training camps across the prairies, emphasizing the development of selling skills. As an active member of both Venture Alberta and Deal Generator, he is presently invested in several companies, Chairman of the board of the Alzheimer's Innovation Institute and Chairman of the Board & CEO of Kent Imaging Inc, a medical device company.

Industry Panel

Roger McPherson, Vice President Engineering, Chariot Carriers Inc.

Company Info

There are very few companies in the world who solely dedicate themselves to the outdoor transportation of children. Chariot Carriers Inc. is one of them, and has been specializing in this field for more than seventeen years. Chariot is a privately-held business who, through intense focus and determination, has earned the distinction of being the market leader in North America and many European countries. Parents around the world choose Chariot carriers, citing the quality and innovation of their products, as well as their attention to detail and customer care.

Chariot believes its purpose is to produce the most innovative, the safest, and the highest quality child carrier products on the market. A Chariot Carrier is a multi-functional child carrier. Each model can be converted to a variety of modes including jogging, strolling, cycling, skiing and hiking. This allows families to continue to engage in an active outdoor lifestyle with their young children as early as a few months old. As well, a wide selection of accessories enhances the Chariot experience by improving child comfort and user convenience.

Every Chariot Carrier is designed in Calgary, and to this day many of their products continue to be produced in the Calgary facility. A skilled and energetic team of approximately one hundred people meticulously design, produce, and support Chariot's that are enjoyed worldwide.

Brief Bio

Roger McPherson has served as Vice President of Engineering at Chariot for the past 4 years. Over those 4 years, the Engineering team has grown from 2 to 10 individuals who work to develop new and innovative products for Chariot's future. Prior to coming to work at Chariot, Roger spent 8 years in Southern California working within the medical device manufacturing industry as a Manufacturing Engineer, Design Engineer and Director of Engineering. While specializing in the design and manufacture of high precision tools and instrumentation, primarily within the orthopaedic and dental industries, Roger developed a love of all aspects of the manufacturing world especially within the medical device industry as it is always full of variety with every new project bringing a unique set of challenges. Roger Graduated in 1989 from Mechanical Engineering at the UofC, followed in 1993 by an MSc in Civil Engineering (Biomechanics) under Dr. Nigel Shrive.

Roger is married and has two children (8 & 11), who are both dual citizens and has a long family history in the Calgary Area. Roger enjoys spending time with his family, being outdoors, traveling (to anywhere warm) and anything hockey related.

NOTES:

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UNIVERSITY OF CALGARY

University of Lethbridge

October 22 – 24, 2010
The Banff Centre
Banff, AB

SUMMARY

Total conference attendance = 178 Registration Records (including guests/spouses/speakers & UTI)

University of Alberta	**Attendance**
Faculty Members	9
Graduate Students	18
Undergraduate Students	2
TOTAL Attendance	**29**

University of Calgary	**Attendance**
Faculty Members	19
Graduate Students	73
Undergraduate Students	37
TOTAL Attendance	**129**

University of Lethbridge / University of Saskatchewan	**Attendance**
Faculty Members	1
Graduate Students	0
Undergraduate Students	0
TOTAL Attendance	**1**

TOTAL = 159
(does not include guests/spouses/other special guests)

Guest Speakers / Industry Panel = **5**

Dr. Peter Cripton, U of BC
Dr. James Piret, U of BC

Industry Panel –

Sabina Bruehlmann, Director Research & Development, Zephyr Sleep Technologies
Don Chapman, President and CEO of Kent Imaging Inc.
Roger McPherson**,** Vice President Engineering, Chariot Carriers Inc.

Attending sponsors:

NSERC CRSNG – NSERC CREATE Training Program for Biomedical Engineers for the 21st Centre
TENET Medical Engineering
BOSE, Electro Force Systems Group
University of Calgary, BME Graduate Program
Schulich School of Engineering, CBRE
Life Technologies
UTI University Technologies International
University of Lethbridge

Non-attending sponsors:

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Special Attendees

Ambrose University College
TU Dresden

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Societies offering student presentation awards: Canadian Society for Biomechanics – 2 awards

Award Recipients:

Canadian Society for Biomechanics Award (Podium) – Kelsea Fitzpatrick, U of Calgary
Canadian Society for Biomechanics Award (Poster) – TIE - Brad Holinski, U of Alberta & Chris Bouwmeester, U of Calgary

Most Outstanding Podium Awards

1st place – Taryn Hill, U of Calgary
2nd place – Kyle Nishiyama, U of Calgary
3rd place – Madiha Khurshid, U of Calgary

Poster Awards

Clearest Message Poster – Anna Steinhoff, U of Calgary
Most Creative Poster – Chiara Bellini, U of Calgary
Best Overall Poster – TIE - Chris Bouwmeester, U of Calgary & Brad Holinski, U of Alberta

Number of student podium presentations = 29

Number of student poster presentations = 38