



A VISION for the Future of Biomedical Engineering

ACCES17/CMBEC35 JOINT CONFERENCE

The Westin Nova Scotian
Halifax, Nova Scotia
June 19 – 22, 2012



Presented by
The Atlantic Canada Clinical Engineering Society
The Canadian Medical and Biological Engineering Society



Welcome from your Conference Committee

Dear Delegates:

On behalf of the Conference Planning Committee, I am honored to have the opportunity to welcome you all to the 2012 Joint Conference of the Atlantic Canada Clinical Engineering Society and the Canadian Medical and Biological Engineering Society — CMBEC35 / ACCES17 — “A Vision for the Future”.

I would also like to take this occasion to thank some of the many groups involved that have helped make this, what I expect to be, a very successful conference, namely:

- Society Executive Teams – Both ACCES and CMBES, for their support and guidance throughout the planning for this conference.
- Presenters and Volunteers – Without whom we would not have interesting topics and sessions that are well coordinated.
- Sponsors / Vendors – Key to the success of the conference, without their support this conference would not be possible.
- Planning Committee Members – We have the following to thank for their months of hard work and dedication to the conference, the societies, our profession, and your ongoing professional development:

Paul Auffrey – FacilicorpNB, New Brunswick	Michael Barton – Capital District Health, NS
Phil Bradfield – Health Association Nova Scotia	Jeremy Dann – Health Association Nova Scotia
Murat Firat – University Health Network, Ontario	Sarah Galley – Cape Breton District Health, NS
Dave Hancock – IWK Health Centre, NS	Dee Hinson – Health Association Nova Scotia
Nick Karasko – Ontario	Sarah Kelso – Health Sciences Centre, Winnipeg
Ted MacLaggan – IWK Health Centre, NS	Sarah Meades – Health Association Nova Scotia
Martin Poulin – Vancouver Island Health Authority	Don Russell – Carlton University, Ottawa

As you visit the sessions and exhibit hall, be sure to take a moment and thank the groups and individuals above, for their participation.

Last but not least, a big thank you to all our delegates, it is through your participation and commitment to the profession that we are able to host such an event. Please take in everything that the conference, Halifax, and Nova Scotia has to offer. Be sure to make the most of it, this is your conference! See you soon!

Sincerely - on behalf of the Conference Planning Committee,

Steve Smith, Health Association Nova Scotia
Conference Planning Committee Chair



Welcome from CMBES

On behalf of the CMBES Executive Committee, I would like to welcome all delegates to the 35th Canadian Medical and Biological Engineering Conference and the 17th Atlantic Canada Clinical Engineering Society Conference.

The joint conference organizing committee, led by Steve Smith, has done an outstanding job of putting together an excellent program. I would like to express my thanks to all members of the committee for their efforts. In addition, special thanks to Dee Hinson, manager of this joint conference, for all her work in support of the conference.

In line with CMBES's vision and mission that were refreshed as part of the "Strategic Directions 2015," CMBES Executive is encouraging collaboration in our profession and promoting the expansion of our Network. Hence, we are extremely excited about this year's joint conference. I believe this year's conference will be an unprecedented event for incubating professional networking opportunities. Special thanks go to Jeremy Dann, ACCES President, for his leadership and efforts that made this event happen.

Look out for our next conference in June 2013 in Ottawa, which will be another exciting joint conference with Association des physiciens et ingénieurs biomédicaux du Québec (APIBQ) and Association des technologues en génie biomédical (ATGBM).

Sincerely,



Murat Firat M.Sc., P.Eng., CCE
President,
The Canadian Medical and Biological Engineering Society
La Société Canadienne de Génie Biomédical

Welcome from ACCES

It is with great pleasure that I extend a warm Atlantic Canadian welcome to conference delegates. The Atlantic Canada Clinical Engineering Society (ACCES) is very pleased to be undertaking this joint initiative with our national body, the Canadian Medical and Biological Engineering Society (CMBES). A year of planning for this event has forged new relationships and established a new Canada wide/regional model for collaboration. This partnership has brought a national conference back to Halifax. Many thanks go to the members from both organizations who worked so hard.

The ACCES executive is particularly excited about this year's conference. It represents a major achievement during fiscally challenging times. It has not been easy for delegates and their parent organizations to find funding to attend. Our mission to provide educational and networking opportunities for Clinical Engineering professionals is being achieved through the dedication of so many in the region. It is with great pride that we recognize that achievement and have continued extended a helping hand to those who need support.

I am also pleased to pass along that we have confirmed the 2013 conference will be held in Saint John, New Brunswick.

I look forward to seeing you all during the conference.

Most Sincerely,



Jeremy Dann, CET CBET
ACCES President



**Health and Wellness
Office of the Minister**



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June 2012

Welcome!

As Minister of Health and Wellness, it is my pleasure to welcome all of you to the joint Canadian Medical and Biological Engineering Society, and Atlantic Canada Clinical Engineering Society conference.

As the first conference of its kind in our region, it is wonderful to have so many delegates and vendors from coast to coast here in Halifax.

For those of you attending from away, I hope that you enjoy your stay in Nova Scotia and have the opportunity to discover our province. To all the attendees, I hope you take advantage of this opportunity to network and learn from colleagues in your field.

I would also like to acknowledge the hard work of those who helped to make this conference possible.

Best wishes on a successful conference.

Sincerely,

A handwritten signature in black ink, appearing to read "David A. Wilson", written in a cursive style.

David A. Wilson
Minister



Greetings from the Mayor



On behalf of Halifax Regional Council, it is my pleasure to extend warm greetings and a special welcome to the vendors and delegates attending the ACCES17/CMBES35 Joint Conference 2012 and Trade Show taking place at the Westin Nova Scotian Hotel, June 19th – 22nd.

We look forward to welcoming you to Atlantic Canada's largest city! While here you will experience the vivacity of city living, the charms of small town life and the pristine beauty of nature – all in one place! Our culturally rich and historic port city has been entertaining guests for over 260 years and we take pride in our reputation as one of the world's most hospitable destinations.

I wish to acknowledge the Canadian Medical and Biological Engineering Society and the Atlantic Canada Clinical Engineering Society for presenting the 2012 ACCES-CMBES Conference and Exhibition in Halifax Regional Municipality. We are honoured to host this combined first of its kind trade show and conference here in our region and wish you all the best as you share with and learn from each other.

While in Halifax Regional Municipality, you will encounter first hand our down-east warmth and hospitality in more than one setting. The hub of Atlantic Canada, takes pride in the diversity of our people and areas, attractions and entertainment, restaurants and nightlife, shops and boutiques all of which guarantee a truly original experience.

I encourage you to enjoy all our area has to offer our region's culture is noted for its unique blend of history and tradition, co-existing comfortably with the contemporary. Enjoy!

Respectfully, I remain

Peter Kelly
Mayor



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Institute of Biomedical Engineering

Other Sponsors

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Acknowledgements

We express a special thank you to all of our sponsors whose participation makes this annual conference possible, please take time to visit the displays and express your appreciation for their support.


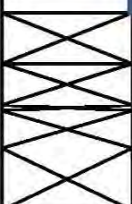
We also thank all those who gave of their time and knowledge to deliver our educational program. Clinical Engineering is continually evolving, requiring constant refreshing of our knowledge bases. Thankfully, we have professionals like you who are willing to share their expertise generously.

And thanks to Health Association Nova Scotia who have worked alongside us to handle the hundreds of details that always threaten to derail an event such as this. Please take the opportunity at the registration desk or throughout the conference to add your personal appreciation for their help.

Finally, thank you, attendees, without you there would be no conference at all. Whether you came for a day or the whole conference, your presence makes it happen.

Vendor Locations

Westin Nova Scotian
Rooms Commonwealth A & B

Fire exit									
1 Fresenius	2 Galaxy	3 T.H.E Medical	4 Braemed		5 AMT	6 Masimo	7 Philips	8 VitalSine	
	9 Vantage	10 Covidien	11 Agfa	12 HiTech	13 Pentax	14 McArthur	15 Fibretech	16 Roxon	17 Hospira
	18 ConMed	19 ConMed	20 ConMed Linvatec	21 Clear Power	22 Draeger	23 Stryker	24 MEDRAD	25 Welch Alleyn	26 Olympus
	27 GE	28 GE	29 GE	30 Baxter	31 Christie InnoMed	32 AMICO	33 Zoll	34 UPS	35 Spacelab
		36 Cook Medical		37 Physio- Control		38 Steris		39 Maquet- Dynamed	
	40 Carestream Medical	41 Lighthouse Imaging	42 High Purity Water	43 BBRaun	44 Cardinal	45 Carestream Heath	46 Karl Storz	47 Fluke/ ProMed	48 MedSet

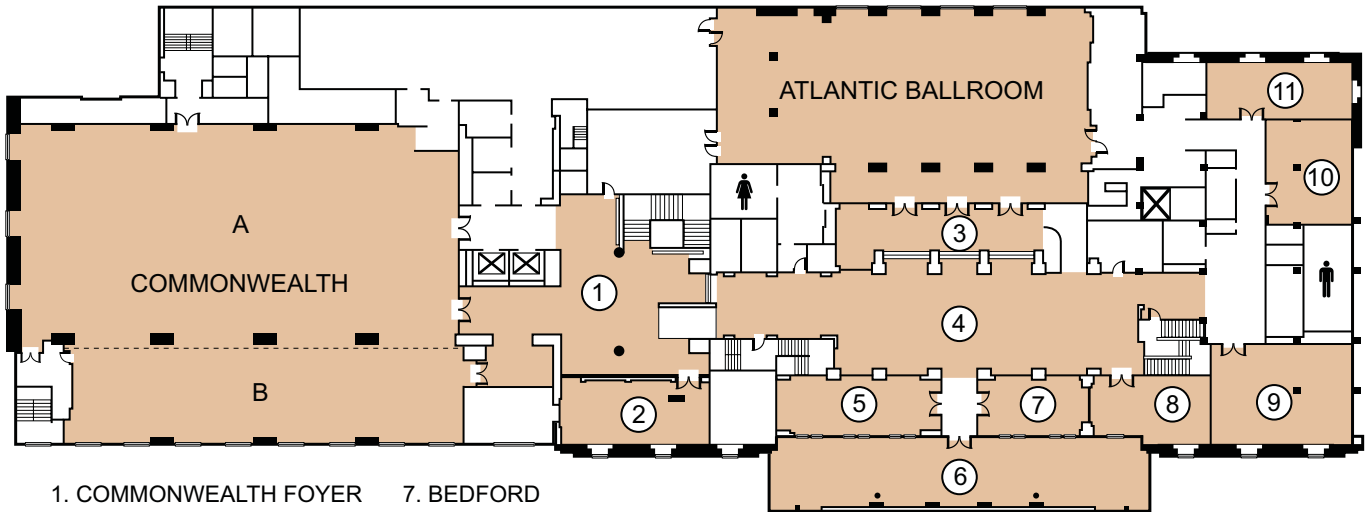
Location

WESTIN
HOTELS & RESORTS

The Westin Nova Scotian

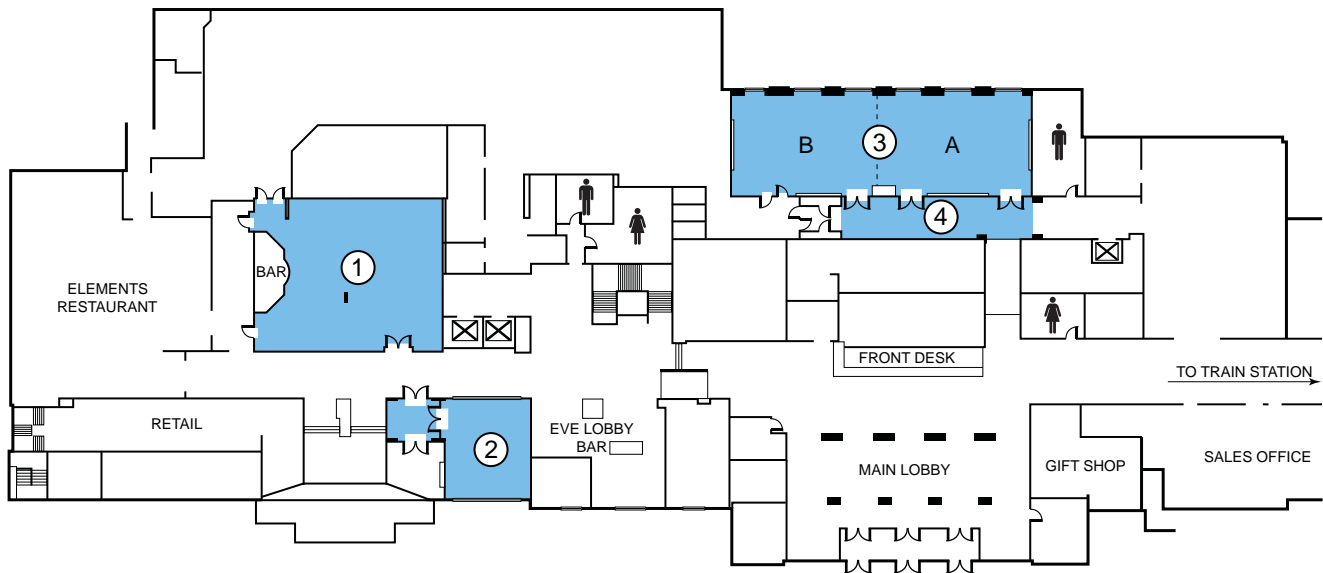
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- | | |
|-----------------------|--------------------|
| 1. COMMONWEALTH FOYER | 7. BEDFORD |
| 2. COAT CHECK | 8. FUNDY |
| 3. ATLANTIC FOYER | 9. LUNENBURG |
| 4. ATLANTIC MEZZANINE | 10. NORTHUMBERLAND |
| 5. MARITIME | 11. BOARDROOM |
| 6. TERRACE | |

CONFERENCE LEVEL



- | |
|------------------------|
| 1. TRADEWINDS |
| 2. SEAPORT |
| 3. HARBOUR SUITE |
| 4. HARBOUR SUITE FOYER |

LOBBY LEVEL



Continuing Education Schedule - Monday, June 18, 2012

7:30-8:30 am Registration: Commonwealth Coat Check

8:30-10:00 am MAQUET-DYNAMED PANDA WARMER COURSE
Seaport Room
Instructor: Mitra Soopaya

The Giraffe & Panda iRes Warmer technical education class is designed to teach service personnel the features of the warmers along with how to install, service, repair, and maintain them. Upon successful completion of the course, participants will be able to:

- Provide an overview of the warmer, the various models and a description of the features;
- Describe the power distribution through the system;
- Locate, remove and replace the hardware components according to the procedures in the service manual;
- Perform the recommended maintenance on the warmer; and
- Identify the variations of the Resuscitation Units and be able to service them.

10:00-10:20 am Break

12:00-1:30 pm Lunch break

1:30-3:00 pm Course resumes

3:00-3:20 pm Break

3:20-4:30 pm Course resumes



Continuing Education Schedule - Tuesday, June 19, 2012

7:30-8:30 am	Registration
8:30-10:00 am	<p>MAQUET-DYNAMED PANDA WARMER COURSE: Seaport Room (continued from Monday)</p> <p>COVIDIEN: FORCE TRIAD TECHNICAL TRAINING: Lunenburg Room (all day) Instructor Neal Dardaine Covidien Technical Service Training is designed is to teach Biomed how to install, setup, operate, calibrate, and troubleshoot the ForceTriad™ electrosurgical generators. Biomedics will be given specific information and guidelines for maintaining this equipment, the students will be able to perform preventive maintenance procedures and rectify equipment issues. Overall, Covidien courses allow hospitals to maximize their equipment investment by minimizing equipment down time. Topics covered will include principles of electrosurgery, operation, calibrations, preventive maintenance, and software download.</p> <p>DRAEGER: NETWORK IN THE HOSPITAL ENVIRONMENT: Maritime Room (all day) Instructor Michael Beck</p> <p>CLARION MEDICAL TECHNOLOGIES: LASER TECHNOLOGIES & SAFETY ISSUES: Bedford Room (morning only) Instructor Jean-Yves Latreille This presentation will cover all aspects of a laser technology course including physics, tissue interactions, hazards and safety according to the C.S.A. standards.</p>
10:00-10:20 am	Break
12:00-1:30 pm	Lunch break
1:30-3:00 pm	Courses Resume
	<p>MAQUET-DYNAMED PANDA WARMER: Seaport Room (all day and continued from Monday) COVIDIEN: FORCE TRIAD TECHNICAL TRAINING: Lunenburg Room (all day) DRAEGER: NETWORK IN THE HOSPITAL ENVIRONMENT: Maritime Room (all day)</p> <p>VITALSINE: UPS APPLICATIONS AND SERVICE IN HEALTHCARE: Bedford Room (afternoon only) Instructor Wayne Snow</p>
3:00-3:20 pm	Break
3:20 pm	Courses Resume
4:30 pm	Courses finish for the day
5:30-6:30 pm	ACCES Executive Meet-N-Greet: Atlantic Mezzanine
6:30-8:30 pm	ACCES Annual General Meeting: Lunenburg Room

Wednesday, June 20, 2012 - Keynote Speaker

DAVE CARROLL

Dave Carroll is an award winning singer-songwriter, professional speaker, author and social media innovator from Halifax Canada. With twenty years' experience in the music business, when faced with a difficult customer service issue with United Airlines in 2009, Dave used his ability as a master storyteller to share his issue with the world. The resulting YouTube music video called "United Breaks Guitars" became an instant viral hit and today over 150 million people have been introduced to his story.

With significant impacts in the areas of customer service, social media, branding and self-empowerment Dave's career as an entertainer and songwriter has expanded. He is now a highly sought after professional speaker, a published author and he is increasingly being commissioned for songs for other people and organizations. He is also co-founder of Gripevine.com, an on-line customer complaints resolution platform that brings consumers and businesses together in a mutually beneficial way, resulting in improved service for consumers and improved results for companies.

His ability to extract the essence of a message and craft it into song is a rare gift that is attracting fans of all ages. His warm and often humorous delivery of his story and its implications is both entertaining and educational. Songwriter, performer, author, speaker and consumer advocate, Dave Carroll is said to be "one of the nicest guys in the business" and complimentary to any event.



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Wednesday, June 20, 2012 AGENDA

7:30-8:30 am	Registration at Commonwealth Coat Check window. Continental Breakfast: Atlantic Mezzanine
8:30-10:00 am	Welcoming remarks and Keynote Speech by Dave Carroll: Atlantic Ballroom
10:00-10:30 am	Break: Atlantic Mezzanine
10:30-12:00 pm	Concurrent Sessions Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level) BIOMECHANICS 1) DEVELOPMENT AND IMPLEMENTATION OF AN OPTIMIZATION - Flynn et al 2) STUDY OF RHEOLOGY AND COMPOSITION OF OSTEOARTHRITIC SYNOVIAL FLUID - Anwar adkhali 3) TOWARDS UNDERSTANDING POPULATION BEHAVIOR OF CONDUCTED ENERGY WEAPONS IN CANADA - DP Dawson 4) A BIOMECHANICAL INVESTIGATION OF WARM-UP PROCEDURES FOR MUSICIANS - Donald Russell LEAD FRAMEWORK FOR HEALTH CARE - Carla Anglehart, Health Association Nova Scotia MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level) FUTURE OF ENERGY-BASED SURGICAL TECHNOLOGY – Dave Wood, ConMed MEDICAL DEVICES: Maritime Room (Conference Level)
12:00-1:30 pm	Lunch break: Atlantic Ballroom
1:30-3:00 pm	Concurrent Sessions Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level) SENSORS AND DATA PROCESSING 1 A WEARABLE SENSOR SYSTEM FOR QUANTIFYING ISOMETRIC - Chris McGibbon 2) AMBULATORY MONITORING OF MOVEMENT PARAMETERS - Luke Russell 3) QUANTITATIVE CLINICAL ASSESSMENT OF MUSCLE SPASTICITY - Chris McGibbon 4) WIRELESS BODY AREA NETWORKS MANAGEMENT ENGINEERING - M. Balouchistani MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level) 1:30-2:15 pm NEW PATIENT MONITORING STANDARDS GE: IEC 8000:1 - Karen Delvecchio 2:15-3:00 pm SOFTWARE & MEDICAL DEVICES - Sarah Chandler, Health Canada MEDICAL DEVICES: Maritime Room (Conference Level) 1:30-2:15pm MEDICAL OPTICS - Dr. Dennis Leiner, Lighthouse Industries 2:15-3:00pm MEDICAL OPTICS - Chris Nolan, Zeiss

Wednesday, June 20, 2012 AGENDA

- 3:00-3:30 pm Afternoon Refreshment Break Sponsored by ACCES and CMBES: Atlantic Mezzanine

- 3:30-4:30 pm Concurrent Sessions
 - Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)
TBA

 - MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)
CROSS CANADA CHECKUP: Ken George and Panel

 - MEDICAL DEVICES: Maritime Room (Conference Level)
PRIVACY: Brenda MacDonald & Maria Lasheras

- 4:30-7:30 pm Grand Opening of the Exhibition Hall and Vendor Reception: Commonwealth Room

- 7:30-8:00 pm Break - Walk to the Tall Ships Quay close by - don't miss the Boat!

- 8:00-11:00 pm Harbour Queen Boat Cruise - Sponsored By CONMED Canada



A VISION for the Future of Biomedical Engineering

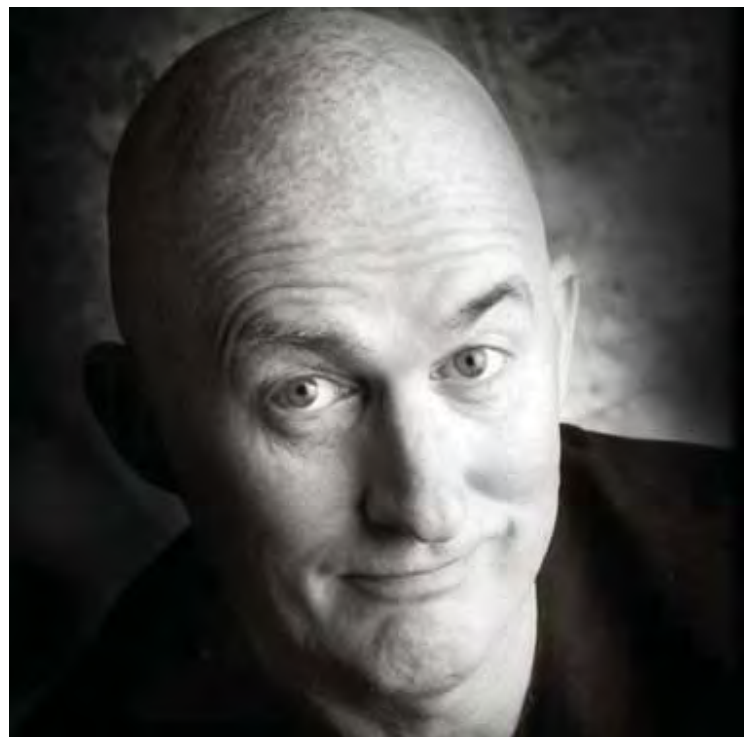
Thursday, June 21, 2012 - Banquet Master of Ceremonies

TONY QUINN

Tony Quinn's quick wit and tailored corporate shows make him a favorite at conferences, conventions, award galas and client appreciation evenings. Audiences are drawn into the show with fast paced comedy, music, and hilarious impersonations. He can stand in front of any crowd and make them feel good, and his wide variety of references and repeat clients over many years proves that.

Tony has been in the entertainment business for over thirty years. His show is versatile and has been performed for a wide variety of national and international audiences. He continues to perform regularly as an after dinner speaker and as an in demand emcee for galas and awards banquets. His new anecdotes about customer service are a hilarious and honest look at everyday experiences as consumers!

Tony also has a new show geared towards the 50 plus "Zoomer" crowd called "The Golden Years Huh?". It's a hilarious lighthearted look at life as a baby boomer. A great reason to bring him back for more! Tony played a weekly musical comedy matinee to a packed to capacity crowd on the Halifax Waterfront for 13 years. For the last 8 years, Tony has focused his efforts on his corporate shows, and MC work for galas and conferences. Tony was the host and feature comedian at the Halifax Comedy Festival, and has been a special guest of the Royal Canadian Air Farce.



A VISION for the Future of Biomedical Engineering



Thursday, June 21, 2012 AGENDA

- 7:30-8:30 am Registration at Commonwealth Coat Check window
Breakfast: Atlantic Ballroom, kindly sponsored by GE
- COST AND BENEFIT OF ASSET TRACKING - Kathy Winter, GE
- 8:30-10:00 am Concurrent Sessions
- Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)
ASSISTIVE TECHNOLOGY & PROSTHETICS : Harbour Suite A (Lobby Level)
- 1) HIGH DENSITY FACIAL MAPPING- Josh Keys
 - 2) IMPROVING THE RESPONSE TIME OF MYOELECTRIC PROSTHESES - Katerina Biron
 - 3) MICRO-MINIATURE REED SWITCH SOLUTION - Albert Lockett
 - 4) SIMULTANEOUS AND PROPORTIONAL ESTIMATION OF MULTIPLE DOFS FOR MYOELECTRIC PROSTHESES - Ali Ameri
- MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)
COMMUNICATING & ACHIEVING YOUR STRATEGIC PLAN WITH KEY DECISION MAKERS - Allan Horsburgh
- MEDICAL DEVICES: Maritime Room (Conference Level)
NATURAL ORIFICE SURGERY - Olympus & Dr. Jim Ellsmere
- 10:00-10:30 am Morning Refreshment Break: Trade Show Commonwealth Room
- 10:30-12:00 pm Concurrent Sessions
- Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)
EMG: Harbour Suite A (Lobby Level)
- 1) ITERATIVE BLIND SOURCE SEPARATION OF EMG SIGNALS - Hoda Deghan
 - 2) OPTIMIZATION OF AN EMG PATTERN RECOGNITION SYSTEM - Juan Carlos González Ibarra
 - 3) QUANTIFYING POWER LINE INTERFERENCE - Nurul Abser
 - 4) REPEATABILITY IN EMG-BASED MUSCLE FATIGUE ASSESSMENT STRATEGIES - Sabeer Zaman
 - 5) SURFACE ELECTROMYOGRAPHY ACQUISITION - Adam Freed
- MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)
10:30-11:15am BIOMEDICAL ENGINEERING CERTIFICATION - Michael Walters,W.O.
11:15-12:00pm INFORMATICS - Heather Wolf, CIHI
- MEDICAL DEVICES: Maritime Room (Conference Level)
10:30-12:00pm IMPLEMENTING A CLINICAL ENGINEERING ELECTROMECHANICAL PROGRAM - Jeremy Dann, Health Association Nova Scotia
- 12:00-1:30 pm Lunch break: Trade Show Commonwealth Room



Thursday, June 21, 2012 AGENDA

1:30-3:00 pm

Concurrent Sessions

Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)

CLINICAL I

- 1) OCCLUSION PRESSURES: RETHINKING THE DEFAULTS - Andrew Ibey
- 2) AUTOMATIC ADAPTATION OF TOURNIQUET PRESSURE - Raphael Wong
- 3) CRITICAL INCIDENT INVESTIGATIONS - Andrew Ibey

MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)

- 1:30-2:15pm FUTURE TRENDS IN DI - Mike Petelin, RSTI
2:15-3:00pm FUTURE TRENDS IN DI - Mike Petelin, RSTI

MEDICAL DEVICES: Maritime Room (Conference Level)

- 1:30-3:00pm DEEP BRAIN SURGERY - Dr. Ivar Mendez, Dalhousie University

3:00-3:30 pm

Afternoon Refreshment Break Sponsored by ACCES and CMBES
Trade Show Commonwealth Room

3:30-5:00 pm

Concurrent Sessions

Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)

CLINICAL II /MEDICAL INFORMATICS: Harbour Suite A (Lobby Level)

- 1) WIRELESS DOWNLOAD FROM MAC 5500 ECG CARTS AND THE MEDICAL FIELDS USE OF EXISTING IT HARDWARE - Paul Verboom
- 2) IMPLEMENTATION OF METRICS TO ASSESS SURGICAL MICROSCOPE - Arefin Shamsil
- 3) CONCEPTUAL FRAMEWORK FOR A PERINATAL DECISION SUPPORT SYSTEM - Marry Gunaratnam

MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)

- 3:30-4:15pm: PANEL DISCUSSION ON THE FUTURE OF WIRELESS TECHNOLOGY (SMART PUMPS) - Bill Gentles (Chair), John Inch (Health Association Nova Scotia, New Glasgow NS), Martin Poulin (Victoria BC), Dave Hancock (IWK Halifax)
4:15-5:00 PANEL DISCUSSION FOR WIRELESS TECHNOLOGIES (PUMPS, MONITORS) - Kirby Farris and Panel

MEDICAL DEVICES: Maritime Room (Conference Level)

- 3:30-4:15: ICONOCLASTS - Bill Gentles
4:15-5:00 CLINICAL RESEARCH & THE FUTURE OF MEDICAL DEVICES - Dr. Monahar Bance

5:00-6:00 pm

On Your Own!

6:00-6:45 pm

Reception: Atlantic Mezzanine

7:00-9:00 pm

Banquet and Awards: Atlantic Ballroom

A VISION for the Future of Biomedical Engineering



Friday, June 22, 2012 AGENDA

- 7:30-8:30 am Information at Commonwealth Coat Check window
Breakfast: Atlantic Ballroom, kindly sponsored by Baxter
- INNOVATION THROUGH INFUSION TECHNOLOGY & DATA ANALYTICS - Marija Manojlovic and colleagues, Baxter
- 8:30-10:00 am Concurrent Sessions
- Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)
TISSUE ENGINEERING & BIOMECHANICAL MODELLING
- 1) DEVELOPMENT OF A MULTI-BODY STATISTICAL SHAPE MODEL OF THE WRIST - Anton Semechko
 - 2) BIO-FABRICATION OF SCHWANN CELL-INCORPORATED ALGINATE SCAFFOLDS- Ajay Rajaram
- MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)
GHANA BIOMEDICAL ASSOCIATION - OVERVIEW & UPDATE - Dr. Nicholas Adjabu
- MEDICAL DEVICES: Maritime Room (Conference Level)
MIS SUITES/ INTEGRATED ORS - Ryan Jones, Stryker
- 10:00-10:30 am Morning Refreshment Break: Atlantic Mezzanine
- 10:30-12:00 pm Concurrent Sessions
- Academic Stream and Clinical Papers: Harbour Suite A (Lobby Level)
TOMOGRAPHY
- 1) A PRIMAL DUAL INTERIOR POINT FRAMEWORK - Mamatjan Yasin
 - 2) AUTOMATIC IDENTIFICATION OF INFLECTION POINTS - Ravi Bhanabhai
 - 3) LINEAR OPTIMIZATION FOR ELECTRODE GEOMETRIES - Mamatjan Yasin
- MANAGEMENT ENGINEERING: Harbour Suite B (Lobby Level)
LEAN WITH FOCUS ON HEALTHCARE - Steve Skinner
- MEDICAL DEVICES: Maritime Room (Conference Level)
FUTURE OF MEDICAL TECHNOLOGY - Barbara Majchrowsky, ECRI
- 12:00-12:30 pm Closing Remarks and Prizes
- 12:30-2:00 pm CMBES AGM: Maritime Room

BIOMECHANISMS 10:30AM – 12:00PM**DEVELOPMENT AND IMPLEMENTATION OF AN OPTIMIZATION-BASED MODELING OF WEIGHT-BEARING LOADS ON THE KNEE JOINT IN PAEDIATRICS****Flynn et al**

Orthopaedic complications of the lower limb are common in overweight and obese children, with pain and joint dysfunction developing as mechanical loads exceed the load-bearing tolerance of joint structures.(1,2)Our research addresses the developmental outcomes of these cumulative loads on knee articular cartilage.(3,4) The aim of this study was to develop an optimization-based model of the knee to evaluate the magnitude and distribution of weight-bearing loads in children as a function of age and body weight.

Model description

A mathematical model of the lower limbs was created in Matlab (Mathworks, Massachusetts, USA). Experimental force and motion data, alongside digitized musculoskeletal anatomy, were used to represent the limbs as a set of moment balance equations around each joint.(5) The net joint moments of the lower limb during a standing squat were used as inputs, with unknown muscular forces and joint restraint moments magnitudes. For inverse kinematic calculations of joint moments, ground reaction forces (GRFs) were recorded for each lower limb (1000Hz; AMTI; Newton, MA) and whole-body 3D motions of the lower limbs and pelvis captured using two Optotrak 3020 position sensors (100 Hz; Northern Digital, Waterloo, Ontario). Segment positions and GRFs were exported into C-motion (Visual 3D, C-Motion Inc. Maryland, USA), and low-pass filtered (3rdorder Butterworth, double-pass; $f_c=6$ Hz for positions and 10 Hz for GRFs). An optimized solution to the system was found by minimizing an energy cost function.

Results and Discussion

For a representative 9 year-old child (height 132cm; weight 35kg), maximum compressive forces of 4-4.5x body weight were associated with high anterior shear forces between 3.8-4.2x BW. The loading profile was equal for both the descent and ascent of the squat. These peak forces exceeded reported values for adults,(6) reflecting developmental differences in neuromuscular control. Preliminary evidence supports the use of our model to investigate effects of childhood obesity on knee biomechanics.

STUDY OF RHEOLOGY AND COMPOSITION OF OSTHEOARTHRTIC SYNOVIAL FLUID**Anwar Madkhali**

Osteoarthritis (OA) is one of the most disabling degenerative diseases that is characterized by the breakdown of articular cartilage resulting in joint pain and stiffness. In healthy individuals, articular cartilage and a thin film of synovial fluid (SF) are closely linked in providing protective barrier between the ends of the bones and lubricating the joint. SF has a major role in joints lubrication, shock absorption and load bearing. A healthy SF is a viscoelastic fluid, highly viscous at low strain rate and highly elastic at high strain rate. SF is a plasma dialysate consisting mainly from hyaluronic acid (HA), proteins, water and lubricin. In an osteoarthritic joint, damage to articular cartilage causes modifications in rheological properties of the SF and its chemical composition. As a result of chemical composition changes occurring with OA, SF losses its viscoelasticity properties and becomes less effective lubricant. A thorough elucidation of the rheological properties of the SF is necessary in order to better understand its role in joint lubrication. The objective of this study is to investigate SF properties under



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both shear and extensional flow and to correlate them to SF composition.

SF samples have been collected from osteoarthritis patients who are undergoing total knee replacement surgery. SF samples came from the orthopedic reconstructive service at Vancouver Coastal Health Region in accordance with a protocol approved by the University of British Columbia Clinical Research Ethics Board and Vancouver Coastal Health Research Institute.

The study provides a comprehensive shear and extensional rheological characterization of OA SF, and it correlates the rheological properties with synovial fluid chemical composition leading to a better understanding of its lubrication properties. Based on the rheological characterization, a Phan-Thien and Tanner (PTT) fluid model has been proposed to describe the viscoelastic behavior of SF.

TOWARDS UNDERSTANDING POPULATION BEHAVIOUR OF CONDUCTED ENERGY WEAPONS IN CANADA

D.P.Dawson

Conducted Energy Weapons (CEW's), better known by the trademarked name Taser, are in widespread use by law enforcement in Canada and elsewhere in the world. CEW's are increasingly accepted as a less lethal option in the use of force spectrum by police and the military despite public uncertainty about these weapons. Electrical characterization and regular testing of CEW's in Canadian jurisdictions are becoming established as a means to validate performance of these weapons and to effectively manage their physical and operational lifecycle, including indications of failure modes. We present performance data from testing of 819 weapons in which the wave shapes were sampled at speeds of 2 MHz, 10 MHz and 50 MHz and we have developed, in collaboration with the Canadian industrial partners, a standardized testing procedure specifying standardized testing parameters and performance reporting and data requirements. Our long term goal is to develop an understanding of performance characteristics which might have effect on human health. Canadian test data demonstrates that there are significant differences in electrical performance based on the serial number order of the most common CEW in use in Canada, namely the Taser X-26. We present data based on test shots from 819 weapons fired repeatedly and over several intervals of months to demonstrate the distribution of performance parameters differentiated by serial number order. Results show that Taser performance parameters have significant variance as a function of serial number order.

A BIOMECHANICAL INVESTIGATION OF WARM-UP PROCEDURES FOR MUSICIANS

Donald Russell

Published reports indicate that the rates of physical injury in musicians are surprisingly high and costly. One approach taken to minimize the risk of injury is the use of a proper warm-up prior to either a practice session or a performance. There is a lack of consensus among musicians about the nature and components of a proper warm-up. This paper will examine warm-up for musicians (primarily pianists) from a biomechanical point of view drawing first on information from the fields of performing arts medicine and treatises on music pedagogy to summarize the typical or recommended practices for musicians. The biomechanical facets of these practices are then analyzed to assess their affect the body in the context of the forces and movements required to play an instrument. As there is little research investigating the long term effects of warm-up practices on musicians' health it is necessary to use results from analogous athletic activities to evaluate the efficacy of the components of warm-up procedures for musicians. As a result of bringing together and analyzing a range of

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data from a number of different activities we are able to suggest hypotheses regarding important components of warm-up for musicians and the impacts of these activities. The results can serve as a basis for looking at long-term effects of warm-up on musicians' health.

SENSORS AND DATA PROCESSING 1:30PM – 3:00PM

QUANTITATIVE CLINICAL ASSESSMENT OF MUSCLE SPASTICITY USING WEARABLE SENSORS

Chris McGibbon

Muscle spasticity is a major contributor to chronic mobility impairment in people with neurological injury or disease, and is characterized by involuntary tonic (velocity dependent) stretch reflex that causes the muscle to activate inappropriately during functional movements. Spasticity is also associated with abnormal tone in opposing muscles that if not managed appropriately can lead to muscle contractures, chronic pain, and difficulties with basic motor tasks required for self-care and independence. Regardless of the management approach, instruments are needed to reliably and accurately quantify spasticity. Although a number of laboratory-based technologies are available for assessing muscle spasticity, none of these technologies are feasible for clinical use. The instrument used clinically, and for the vast majority of published studies related to muscle spasticity, is the Modified Ashworth scale. Although the test is easy to administer, it is based on a limited ordinal scale (0-4) determined by subjective assessment, and therefore lacks sensitivity to change. Wearable technologies for sensing kinematics, force and muscle electromyography have the potential to detect these characteristics and deliver quantitative objective information that is of interest to the treating therapist. Wearable technologies are small, lightweight and generally unobtrusive, and could allow the clinician or researcher to perform unencumbered routine physical examinations while monitoring and collecting important clinical variables. The sensing technology required to accomplish this aim already exist. This paper describes the development and testing of a wearable sensor system capable of capturing relevant biomechanical and electrophysiological data during routine spasticity assessment in the clinic that is available to clinicians and researchers in real-time, and shows promise for improving the objective evaluation and quantification of muscle spasticity.

AMBULATORY MONITORING OF MOVEMENT PARAMETERS AND PRESSURE USING EMBEDDED PRESSURE SENSORS AND IMU IN A PORTABLE MULTISENSORY DATA-LOGGER, PROCESSOR, AND TRANSMITTER: CURRENT AND FUTURE APPLICATIONS

Luke Russell

Home health care is a constructive component of patient care. Continuous monitoring of patients outside a clinical setting: at home, in the community, and in a person's regular daily routine, can provide a more comprehensive integration between clinical information and data collected of real-life scenarios and activities in real-time. Remote monitoring devices can play a key role in early intervention.

Realities that contributed to this expansion of home monitoring include inexpensive and low-power microcontrollers, wireless protocols and infrastructure, and miniaturization.

The Arduino-derived JeeNode board and Bluetooth radio can be used for monitoring as it is straightforward to include a variety of sensors given of the open-source nature of the electronics, the algorithm, and the code.

The small device unites home monitoring and remote monitoring. It is easy to integrate this device into daily

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living. The device collects information from an accelerometer, gyroscope, and pressure sensors, then the information collected is corroborated.

These sensors are added to the patient's shoe. It can be adapted to be utilized with the person's regular shoes and slippers. It is not cumbersome.

Literature has confirmed that determination of activity using similar sensors can occur with post-processing. This system can calculate such information as components of gait phase to be extracted on the microcontroller in real-time and transmitted to a tablet or smartphone.

The system, when paired with a Bluetooth-enabled tablet or smartphone, facilitates collection of data, and detects, and transmits data when necessary to show medical professionals the readings during daily life of the patient. The smartphone can transmit collected information to the patient's electronic health record, or if there is cause for concern, the relevant information can be transmitted directly to the patient's doctor.

Regardless of the condition, age, or application, from sports monitoring to diabetic neuropathy, pediatric mal-alignments, postsurgical gait, to fall detection in an aging population, mobility data can be acquired from the sensor system. A patient's active direct involvement with this individualized home data collection might empower them to better manage their health conditions.

A WEARABLE SENSOR SYSTEM FOR QUANTIFYING ISOMETRIC ELBOW AND KNEE JOINT STRENGTH

Chris McGibbon

Muscle strength measurement is a critical component of physical therapy and rehabilitation and sport science in general. Rehabilitation outcomes for many diseases, disorders and injuries, ranging from stroke in older populations to athletic injuries in younger populations requires assessment of muscle strength in a clinical environment. Research in rehabilitation and sport science often use muscle strength as a primary outcome, and furthermore requires measurement of "maximal voluntary isometric contraction" to normalize muscle electromyography assessments. There are currently two choices for obtaining quantitative measurement of muscle strength. Isokinetic dynamometry systems can accurately and reliably measure both isokinetic and isometric muscle strength, but very few clinical facilities have access to such equipment due to its cost of purchase and maintenance as well as its space requirements. Hand-held dynamometry systems are considerably cheaper and require far less resources to maintain, but testing of major joints (like the knee and elbow) is difficult to perform, mostly in terms of the tester stabilizing themselves against the patient's ability to generate force. As such it requires considerable training and experience, and is most often used clinically. Currently there is no strength measurement device available to the clinician or researcher that is inexpensive and portable, and that requires no external support from the therapist or other supporting structure. This paper presents an innovative and novel concept for obtaining measurement of elbow and knee joint strength using a wearable system of sensors and mechanical constraints. The system is easily donned and doffed from the arm or leg, and can measure isometric (fixed angle) strength of both flexor and extensor muscles of the joint. Validation experiments of the device are also discussed and illustrate both the potential of the device and the future design challenges that exist.

*Academic Stream Abstracts - Wednesday June 20, 2012***WIRELESS BODY AREA NETWORKS****M. Balouchistani**

Wireless Body Area Networks (WBANs) consist of small, intelligent wireless sensors attached on or implanted in the body. These wireless sensors are responsible for collecting, processing, and transmitting vital information such as: blood pressure, heart rate, respiration rate, electrocardiographic (ECG), electroencephalography (EEG) and oxygenation signals to provide continuous health monitoring with real-time feedback to the users and medical centers. Since WBANs are usually driven by a battery, power consumption is the most important factor to determine the life of WBANs [6]. The life expectancy of a WBAN for a given battery capacity can be enhanced by minimizing power consumption during the operation of the network. [4]. CS theory solves the aforementioned problem by reducing the sampling rate throughout the network. A combination of CS theory to WBANs is the optimal solution for achieving the networks with low-sampling rate and low-power consumption [2]. Our simulation results in show that sampling rate can reduce to 25% and power consumption to 35% without sacrificing performances by employing the CS theory to WBANs. This paper presents a novel sampling approach using compressive sensing methods to WBANs. First, an overview of compressed sensing is presented. Second, sparse signals in WBANs as a subset of Wireless Sensor Networks (WSNs) are investigated. Third, the simulation results on the sampling rate in ECG signals are shown.

TBA 3:30PM - 5:00PM

*Academic Stream Abstracts - Thursday, June 21, 2012***ASSISTIVE TECHNOLOGY AND PROSTHETICS 8:30AM – 10:00PM****HIGH DENSITY FACIAL MAPPING FOR ALTERNATIVE EOG ELECTRODE PLACEMENT FOR THE DISABLED****Josh Keys**

The Electrooculogram (EOG) is a biological signal originating in the eyes with a positive DC-like potential with respect from cornea to retina. This signal is used not only for diagnostic studies in clinical settings, but also for use in assistive technology (AT) as a control input for external devices for the disabled.

A large percentage of end users of EOG in AT are patients with amyotrophic lateral sclerosis (ALS) that use bilevel positive airway pressure (BiPAP) devices for breathing assistance. These devices cover a large portion of the face especially the area's most commonly used for EOG signal acquisition (immediate area surrounding the eyes).

This paper serves to present alternative possible locations for EOG acquisition through the use of electrode facial mapping. A high-density electrode array system is used to gather information on the signal integrity throughout the face and surrounding area and is weighed against the apparent benefits with respect to BiPAP obstruction or general aesthetics. These results are used as a stepping stone towards a new portable EOG device that will be applicable to any user, despite possible facial obstructions or aesthetic concerns.

IMPROVING THE RESPONSE TIME OF MYOELECTRIC PROSTHESES: A STUDY OF KALMAN FILTERING**Katerina Biron**

The goal of this study is to reduce the response time of pattern recognition based myoelectric prostheses without compromising the system's stability. This work suggests complementing conventional controls with a Kalman filter in feature space prior to classification. A linear discriminant analysis (LDA) classifier was trained in feature space to allow classification of EMG patterns collected from the forearm. The LDA was tested against non-filtered and filtered features extracted from EMG patterns collected during sequential movement of the forearm and wrist where subjects were asked to transition between the following contractions: flexion, extension, pronation, supination, hand-open, hand-close and no motion. The classification accuracies obtained for both types of features (filtered and non-filtered) were compared for various window lengths of EMG patterns. The results show that for robust classification, conventional controls require the EMG data to be windowed into patterns of 100ms, but when applying a Kalman filter prior to classification, the window length may be reduced to 20ms. In conclusion, this work shows that a Kalman filter can be used in myoelectric pattern recognition based prosthesis to reduce the system's response time by allowing smaller analysis windows without compromise to the system's classification accuracy.

MICRO-MINIATURE REED SWITCH SOLUTION FOR LOW POWER CLINICAL APPLICATIONS**Albert Lockett**

Many clinical rehabilitation cases require small, compact, and reliable solutions to help improve the lives of patients. The challenges faced by engineers and clinicians are often amplified when designing a battery-

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operated system which require a low power consumption strategy while maintaining a high level of functionality. Some of these functions, such as a wireless communication module used to configure a device, may not always be in use but will often continuously consume power. Ideally, it would be preferable to provide the clinicians with the ability to activate/deactivate some of the system's functionality without the need to disassemble the unit or to incorporate a mechanical switch that may compromise the hermetic seal. Such a feature would reduce the power consumption of a system thereby extending the unit's battery life. This paper presents a solution to this problem through the use of a series of micro-miniature reed switches in conjunction with small magnets. The switches are positioned in a patterned configuration which activate/deactivate some of the device's functions based on the proximity of specific magnetic keys. The reed switch characteristics were initially investigated prior to the design of a hermetically sealed solution that triggers the embedded microcontroller system according to the magnet configuration found within the key. The design was shown to provide robust and highly consistent results. The authors are currently investigating the application of the reed switch design in both rehabilitation and prosthetic limb applications. Initial implementation results are presented in this paper.

SIMULTANEOUS AND PROPORTIONAL ESTIMATION OF MULTIPLE DOFS FOR MYOELECTRIC PROSTHESES: A COMPARISON BETWEEN FORCE AND POSITION CONTROL PARADIGMS

Ali Ameri

This paper studies the problem of simultaneous and proportional myoelectric control of multiple DOFs for unilateral trans radial amputees. Two control strategies namely force and position estimations were investigated. In the first, a force experiment, subjects performed isometric contractions while the force applied by the limb was measured. In the second, a position experiment, limb free movements were permitted during which limb joint angle was recorded. An artificial neural network was trained to estimate force/position from EMG of the contralateral limb during mirrored bilateral contractions. This research used contractions with combined activations of three DOFs including wrist: flexion/extension, radial/ulnar deviation and forearm supination/pronation. While force estimation demonstrated excellent accuracy ($R^2=89\%$), position estimation performance was poor ($R^2=42\%$). As another test approach, subjects were asked to perform a Fitt's law test using their wrist/forearm contractions while the EMG from their forearms was being recorded and the force/position estimation based on the EMG was being projected online as the cursor position on the screen. Compared to position estimation strategy, force control showed a better performance in this test as well. In conclusion, this study provides a direct comparison between force and position control strategies and suggests that force estimation is a more efficient potential control paradigm for myoelectric prostheses.

*Academic Stream Abstracts - Thursday, June 21, 2012***EMG 10:30AM - 12:00PM****ITERATIVE BLIND SOURCE SEPARATION OF EMG SIGNALS BASED ON THE JOINT DOMAIN SPARSITY****Hoda Deghan**

Decomposition of electromyogram (EMG) signals is an important tool to detect medical abnormalities, recruitment order or to analyze human muscle movement. The received EMG signal in each sensor can be modeled as a convolutive mixture of different motor unit action potentials (MUAPs) and the number of these MUAPs is typically much more than the number of EMG signal channels. Since the number of sources is greater than the number of sensors and the convolutive mixing matrix is unknown, the problem can be considered as an underdetermined blind source separation. All motor units (MUs) of a single muscle are not active simultaneously. Therefore, EMG signals are sparse in the time domain. As such, this is applicable for light contractions for surface EMG and for invasive needle EMG. In addition, because of the limited frequency range of EMG signals, they are also sparse in the frequency domain. In this paper, a new optimization problem is presented based on the joint domain sparsity of EMG signals. The proposed iterative two-step algorithm estimates the mixing matrix and obtains the new MUAPs by solving the optimization problem, and it iterates these two steps for a small number of times. The significance of results presented in this paper lies in the fact that taking the advantages of the joint domain sparsity in both estimation of mixing matrix and the source signals can yield better estimation than treating the signal as being sparse in only one domain.

OPTIMIZATION OF AN EMG PATTERN RECOGNITION SYSTEM USING A SELECTION METHODOLOGY ELECTRODE POSITIONS BY FFT AND ANN ALGORITHMS**Juan Carlos Gonzalez Ibarra**

Nowadays a challenge in biomedical engineering is the design and fabrication of a system that could be used as human-computer interface for people with amputations or motor disabilities. The system must recognize and respond properly to their user's movement using surface electrodes as a sensing vias. In this work, we implemented the Fast Fourier Transform (FFT) and Artificial Neural Networks (ANN) to make a mathematical tool able to recognize the myoelectric signals acquired with only two surface electrodes located in strategic positions of superior limb. The experiment acquires and analyzes the surface electromyography (EMG) on eight different positions of the arm, considering points above the periferical nerves. Once the EMG signals were conditioned and filtered to prevent noise from the friction of the skin with electrodes and electromagnetic noise, we generate the coefficients in the frequency domain using the FFT by short periods of time.

Then the coefficients were used by the ANNs to recognize the movement that the patient wishes to make. The result of experiment showed that recognition rates of four voluntary movements of the arm (palmar grasp, repose, pronation and supination) were all more than 80%. We demonstrated that radial basis function ANN has better EMG pattern recognition rate and is faster than the classical back-propagation ANN. Also we found that EMG pattern recognition rate increases by more than 95% when the surface electrodes were located above the radial nerve in the brachialis anticus muscle and above the musculocutaneous nerve in the triceps outer head, which concludes that the surface electrode positions above nerve paths not muscular activity locations provide more EMG information and notoriously facilitate the EMG pattern recognition.

*Academic Stream Abstracts - Thursday, June 21, 2012***QUANTIFYING POWER LINE INTERFERENCE IN SURFACE EMG SIGNALS USING SPECTRAL INTERPOLATION****Nurul Abser**

A method for quantifying 50/60Hz power line interference in surface electromyography (sEMG) signals is investigated. The quantification method is based on interpolating the signal spectrum about its 50/60Hz components to estimate the signal, and then the power line interference. Once these constituents are differentiated, a signal-to-60Hz-Noise ratio may be estimated and used as a quantifying metric. When this quality assessment metric is obtained prior to acquisition, it can be used as a guiding mechanism for system set-up, to avoid collecting poor quality data if possible. When the metric is obtained after acquisition, it can be used as a guiding mechanism for signal selection, when redundant signals are acquired, or for deciding when quality is sufficient for continued analysis. Simulations are used to investigate the impact of frequency resolution of the sEMG spectrum on the quantification method, along with characteristics of the interference including amplitude, phase, and frequency jitter.

REPEATABILITY IN EMG-BASED MUSCLE FATIGUE ASSESSMENT STRATEGIES**Sabeer Zaman**

The purpose of this work was to quantify, compare and explore factors affecting the test-retest repeatability of contemporary fatigue assessment strategies. Two fatigue indices were defined, one nonparametric index tracking % drop and another regression-based index tracking slope, based on mean frequency estimates of the myoelectric signal, and based on a projection-based multivariate strategy utilizing principal component analysis. The repeatability of all four fatigue indices were expressed in absolute and relative terms. Relative repeatability was used to rank and statistically compare repeatability between all the fatigue indices. Results indicated that nonparametric indices were more repeatable than regression-based ones and that the repeatability of MF-based indices were unaffected by the condition of motion. Furthermore, electrode placement error did not significantly affect the outcome of three of four indices, as long as terminal ends of the muscle were avoided. The only exception was the regression-based index from PCA, which was sensitive to any placement error at least 5mm or greater.

SURFACE ELECTROMYOGRAPHY ACQUISITION USING THE WEARABLE EMG ANALYSIS FOR REHABILITATION (WEAR) SYSTEM**Adam Freed**

The Wearable EMG Analysis for Rehabilitation (WEAR) system was developed to facilitate surface electromyography (sEMG) signal acquisition. In contrast to conventional sEMG acquisition systems that employ single electrode pairs, positioned through anatomical measurements above the muscle of interest, WEAR employs an electrode array that is easy to apply, with the optimal electrode pair selected automatically from the array.

A prototype WEAR system was based on the ADS1298 integrated analog front end solution from Texas Instruments. The ADS1298 provides eight differential biopotential amplifiers, along with 24-bit analog-to-digital conversion. The WEAR prototype was tested with an array of Ag/AgCl electrodes (non-polarizable), an array of reusable electrodes ("dry" polarizable electrodes), and compared against a conventional EMG



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acquisition system, using Ag/AgCl electrodes. Data from isotonic, isometric contractions were used to evaluate sEMG signal quality. Results demonstrated that the WEAR system was comparable to the conventional EMG acquisition system, even with the use of reusable polarizable electrodes.

CLINICAL I 1:30PM - 3:00PM

OCCCLUSION PRESSURES: RETHINKING THE DEFAULTS

Andrew Ibey

Infusions pumps are one of the most ubiquitous medical devices found in hospitals. Even though the appearance of a pump maybe similar the default occlusion pressures maybe set radically different. It has been shown in literature that alarms resulting from occlusions should be set such that the time-to-alarm is sensitive enough to alert clinicians for response when infusing vasoactive and other critical drugs, but not too often that clinician response time is affected [1]. It has also been shown that failure to monitor inline intravenous pressure in infant and geriatric populations that have fragile and brittle veins could result in extravasation injuries at the infusion site [2]. What is also clear is that complications due to occlusion pressure settings are difficult to diagnose and are often under reported in the literature.

In clinical engineering, we have a responsibility to check occlusion alarms with every safety check on a medical device [3], but we also play an important part advising clinical areas of appropriate default occlusion pressure settings. This paper would like to report the findings of a study from St. Paul's hospital to test the operating pressures of a standard Alaris 7200 volumetric pump in laboratory conditions using standard tubing. A testing apparatus was designed and methods determined to ensure fidelity with the clinical environment. Testing was performed at flow rates between 10-600mL/h and at occlusion limit settings between 25mmHg-200mmHg. Once a particular flow rate reached steady state, a stop-cock was closed to simulate an occlusion to measure the time-to-alarm. The authors will present their findings from the empirical data and discuss how we need to rethink occlusion alarm limits. They will also discuss the particular challenges from a clinical engineering standpoint to set suitable default pressure settings for particular care areas.

AUTOMATIC ADAPTATION OF TOURNIQUET PRESSURE DURING SURGERY TO IMPROVE PATIENT SAFETY

Raphael Wong

Our objective is to determine the feasibility of improving surgical patient safety by automatically adapting the pressure of a pneumatic tourniquet system to the minimum effective pressure needed to reliably stop arterial blood-flow into a patient's limb, to facilitate surgery. That minimum quantity, called 'limb occlusion pressure' (LOP), is the minimum pressure required, at a specific time in a specific tourniquet cuff applied to a specific patient's limb at a specific location, to stop the flow of arterial blood into the limb distal to the cuff. LOP is affected by variables including: limb size, shape and tissue characteristics; physiologic parameters such as blood pressure, heart rate and temperature; and tourniquet cuff shape, width, design, position and application technique.

Some commercial tourniquet systems allow LOP to be automatically estimated preoperatively. However, LOP is known to vary intraoperatively, especially in response to intraoperative changes in blood pressure. Existing tourniquet systems do not adapt automatically to intraoperative changes in LOP. Adapting tourniquet pressure



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intraoperatively to remain at a minimum above LOP is important for patient safety because many studies have shown that higher tourniquet pressures are associated with higher probabilities of patient injuries. This study investigates the feasibility of an adaptive tourniquet by using a commercial tourniquet instrument to estimate LOP preoperatively, by periodically measuring changes in blood pressure and heart rate intraoperatively, by incorporating that blood pressure and heart rate data into an algorithm for estimating intraoperative LOP, and by comparing the algorithmically estimated LOP to actual LOP measured at the end of each surgical procedure. Detailed descriptions of the algorithm and of the surgical protocol will be included in the presentation. . To date, 30 surgical procedures have been completed following the above protocol, and it is anticipated a total of 50 surgical procedures will be completed before the presentation. Results to date indicate that the algorithm will enable a surgical tourniquet system to adapt automatically to intraoperative changes in LOP associated with intraoperative changes in blood pressure.

CRITICAL INCIDENT INVESTIGATIONS: THE REGIONAL ADVANTAGE

Andrew Ibey

Incident investigation remains a peripheral component of clinical engineering service. However, for institutions able to provide this as a core service many positive results can be had locally within the organization and perhaps even provincially, nationally or internationally. Often investigations requiring clinical engineering are triggered by critical events with patients in highly acute areas involving medical equipment or unique and expensive medical equipment that fails without patient injury, or observations of peculiar trends with equipment failure.

St. Paul's hospital incurred a high profile incident that involved all of the above scenarios combined. The authors present herein a unique case where four high frequency oscillating ventilator drivers failed before their recommended 4000hrs replacement interval and each within a span of 2 months. One of the drivers failed on a critically ill patient, another during routine testing on the ventilator, and the other two by due diligence of review on the first two failure trends. A regional investigation in the lower mainland Vancouver area uncovered a serious safety concern with similar manufactured dates for failed components, inconsistencies with the manufacturer's documentation and compromised integrity of the rubber on the ventilator driver hidden from visual inspection. The investigation reached a head with the unwillingness of the company representative to assist with our findings. Cooperation with ECRI institute provided the leverage required to obtain answers to our questions and to adequately address the serious concerns with the equipment. An alert to our findings was published by ECRI to broadcast the concerns across North America.

*Academic Stream Abstracts - Thursday, June 21, 2012***CLINICAL II/MEDICAL INFORMATICS 3:30PM - 5:00PM****WIRELESS DOWNLOAD FROM MAC 5500 ECG CARTS AND THE MEDICAL FIELDS USE OF EXISTING IT HARDWARE****Paul Verboom**

The medical instrument manufactures are increasingly relying on existing commercial and industrial IT technology in the manufacture of their products.

By going beyond the documentation provided by the manufacture we able to better understand one of the key processes in the MUSE system, the ECG Cart download. With this base of knowledge we were able to design our own wireless download system at significantly lower cost than the manufactures. Our solution also has several features not found in the manufactures solution which in our opinion make it a better solution.

This presentation outlines the solution implemented. More importantly it will explain the process that was followed to educate oneself to the point that a solution could be implemented.

The average Biomed will seldom use their soldering iron anymore; however everyday there is another piece of IT type of equipment entering the hospitals disguised as a medical device. Learning about this technology has become an increasing important part of our job. Learning how to learn about this technology is something I hope to cover by examining this working example.

There is a gap between the medical manufactures and the hospital IT department. Learning about new technology is key to allowing the Biomed to speak the language of both parties and fill this gap.

IMPLEMENTATION OF METRICS TO ASSESS SURGICAL MICROSCOPE MANOEUVRING SKILLS DURING MYRINGOTOMY**Arefin Shamsil**

Teaching and learning to manoeuvre a surgical microscope is a fundamental step in training for middle ear surgery. In the conventional training approach, there is no objective way to assess one's performance in manoeuvring the surgical microscope during skill development. This paper presents a set of implemented metrics that are used to numerically analyze the motion path of the surgical microscope during a middle ear surgery termed myringotomy. For experimentation, a fixed cadaveric head with intact ear anatomy was used to conduct the experimental myringotomies. During these surgeries, the translational and angular coordinates of the microscope's motion were captured in real-time using an optical tracker. External video cameras also were set up to capture the operator's hand motion, body posture and optical view through the microscope optics during surgery. These parameters were used to qualitatively assess the surgical performance of the operator. To collect motion data and qualitative data, a group of experienced ear-nose-throat (ENT) surgeons and a group of ENT surgical residents were invited to participate in the experiments. Each participant's motion data were recorded and numerically analysed based on numerical metrics such as microscope's motion path length, velocity, acceleration, jerk, jitter, working volume, path smoothness, motion efficiency, microscope rotation, and motion time. Theoretically, smaller numerical metric values imply higher surgical proficiency. Upon analysis of the motion data via metric computations, several discriminatory metrics were identified when comparing experienced surgeons and trainees. Our end goal is to incorporate these discriminatory metrics into a myringotomy surgical simulator. This will enable trainees to get automated feedback on their microscope manoeuvring performance and track their improvement over time.

*Academic Stream Abstracts - Thursday, June 21, 2012***CONCEPTUAL FRAMEWORK FOR A PERINATAL DECISION SUPPORT SYSTEM USING A KNOWLEDGE-BASED APPROACH****Marry Gunaratnam**

Early identification of preterm labour may lead to more efficient allocation of resources and facilitate antenatal monitoring to ensure a timely response to various medical problems which may arise during pregnancy. Prompt recognition of factors, signs and symptoms during pregnancy, and linking this information with the vast amount of medical data available within healthcare institutions via leveraging advances in technology, would facilitate the development of computational tools to assist humans in extracting useful information. Applying the concept of data mining and knowledge discovery to decipher large databases will lead to more accurate predictions and effective treatment.

This paper discusses the framework for the development of a high-quality knowledge based perinatal clinical decision support system (CDSS) to predict preterm labour. There are three main parts to this system including the knowledge base, a workflow engine, and a mechanism to communicate results. The knowledge base contains rules or associations related to the desired predictions; the workflow engine combines the rules in the knowledge base with the patient data; and the communication mechanism allows entry of the patient data into the system. The newborn patient's likely outcome will be output in the form of notifications, alerts or emails. This system will allow physicians to use the outputted information to inform families and initiate preventative care, monitoring, and treatment. The input of patient data in a stand-alone system will be manual. However, the final form of the CDSS will be integrated with electronic medical records (EMR) and thus allow for auto-population of the patient data into appropriate fields from the information available in the EMR. A web-based collaborative platform that meets the legal and regulatory accreditation standards will be used to deliver information relevant to various clinical users, ranging from physicians to nurse practitioners.

*Academic Stream Abstracts - Friday, June 22, 2012***TISSUE ENGINEERING & BIOMECHANICAL MODELLING 8:30AM - 10:00PM****DEVELOPMENT OF A MULTI-BODY STATISTICAL SHAPE MODEL OF THE WRIST****Anton Semechko**

In the last decade, increased availability of high performance computing resources has prompted a shift in the experimental approach across multiple scientific disciplines to the point where computer-based simulations are gradually becoming acceptable substitutes to traditional lab bench experiments. The field of computational biomechanics is one derivative of this technological evolution and has been successfully applied to biomedical problems such as impact and fracture mechanics of bone, load transmission through the joints, feasibility of joint replacements, investigation of joint injury mechanisms, and many others. Despite remarkable advances in this field, there remain a number of technical challenges. One of those is related to the fact that almost all biomechanical models reported in literature to date were derived from the anatomy of a single individual. This is a conceptually problematic issue because the results acquired from the simulations based on subject-specific models cannot be generalized to a wider population set.

The present research study was concerned with the development of a detailed, anatomically accurate, FE model of the human hand and wrist. As a first step in this direction, we used a publicly available database of wrist bone anatomy and carpal kinematics to construct a multi-body SSM of the wrist. The resulting model provides an efficient parameterization of anatomical variations of the entire training set and can thus overcome the major shortcoming of conventional biomechanical models associated with limited generalization ability. The main contributions of this work are:

- A robust method for constructing multi-body SSM of the wrist from surface meshes.
- A novel technique for resampling closed genus-0 meshes to produce high quality triangulations suitable for FE simulations.

Additionally, all techniques developed in the course of this study could be directly applied to create an equivalent model of the tarsus.

BIO-FABRICATION OF SCHWANN CELL-INCORPORATED ALGINATE SCAFFOLDS FOR THE REPAIR OF PERIPHERAL NERVE INJURY**Ajay Rajaram**

Recent advances in fabrication techniques have enabled better development of scaffolds for the repair of injured peripheral nerves. Ideally, tissue-engineered scaffolds for the repair of peripheral nerves should be three-dimensional (3D) and have porous structures with appropriate mechanical properties. Meanwhile factors such as neurotrophins, Schwann cells and other cells could be incorporated during the scaffold manufacturing process to enhance their biological properties. For the incorporation of living cells into scaffolds, hydrogels have shown promise due to their higher permeability. However, the use of hydrogels to form a 3D scaffold structure is challenging and limited by the weak mechanical properties of the hydrogel. In the present study, a method based on bio-plotting is developed to bio-fabricate 3D alginate hydrogel scaffolds that incorporate living Schwann cells. A polycation, polyethyleneimine (PEI) is also incorporated to improve the formation of 3D structures. Specifically, solutions of alginate with Schwann cells were dispensed into the medium containing calcium chloride, glycerol and PEI, layer-by-layer to build the 3D scaffold structure. Examination of the fabricated scaffolds showed better structure in terms of the inter-connectivity of pores with the inclusion of PEI

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in the medium. Although PEI reduced cell viability in overnight cultures of Schwann cells, it was also found that there was no significant cell loss upon short-time exposure of cells to PEI during the fabrication process. Taken together, the present study illustrates that the use of PEI in the bio-fabrication of alginate hydrogel scaffolds can greatly facilitate effective formation of 3D structure, meanwhile having a minimal effect on the cell viability if the exposure time of cells to PEI is appropriately controlled.

TOMOGRAPHY 10:30AM - 12:00PM

A PRIMAL DUAL INTERIOR POINT FRAMEWORK FOR EIT RECONSTRUCTION WITH AUTOMATIC REGULARIZATION

Mamatjan Yasin

The spatial resolution of the reconstructed images in electrical impedance tomography (EIT) is low and a priori information regarding smooth conductivity changes limits reconstruction of sharp images while it is preferred in order to differentiate tissue boundaries in medical imaging. Measurement errors are another barrier that hinders a good image reconstruction. Generally L2 norms have been used commonly due to its computational convenience both for data and regularization terms which results in smooth solutions. However, the recent developments in optimisation problem – the Primal Dual-Interior Point Method (PDIPM) showed its effectiveness in dealing with the minimization problem. L1 norms on data and regularization terms in EIT image reconstruction address both problems of reconstruction with sharp edges and dealing with the electrode errors.

We demonstrated the general formulation of the Primal-Dual Interior Point framework for EIT image reconstruction. We systematically evaluated the PDIPM algorithms with L1 and L2 norm based minimization in EIT inverse problems with automatic regularization based on a balancing principle. The performance of algorithms was evaluated in following scenarios in simulation based on: (A) original numerical phantom, (B) added noise, (C) data errors (outliers), (D) adding noise and data outliers. Finally we demonstrated its applicability for medical EIT through imaging results from human lung and dog breathing experiments. The results show that the L1-minimization for EIT image reconstruction produced sharp edge and proved to be robust against measurement errors.

AUTOMATIC IDENTIFICATION OF INFLECTION POINTS IN PRESSURE AND REGIONAL EIT CURVES

Ravi Bhanabhai

Ventilator Induced Lung Injury (VILI) is a serious condition caused by sub-optimal settings of mechanical ventilation in Acute Lung Injury (ALI) patients. The main contributors to VILI are 1) cyclic opening and closing of collapsed lung tissue which occur at low pressure and 2) overdistension of lung tissue which occur at high pressures.

Reducing these within mechanically ventilated patients can lead to an increase in likelihood of survival. The key clinical measure to reduce VILI is selecting an appropriate Positive-end Expiratory Pressure (PEEP) to make a balance between keeping lung units open while not overdistending them. Electrical Impedance Tomography (EIT) provides regional lung air volume information which promises to help improve clinical selection of PEEP.



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The goal of this paper is to compare two automated methods (three-piece linear and sigmoid models) and one manual method (visual heuristics) to analyse EIT data to locate regional inflection points (IP). These IP can be used to distinguish between collapsed and overdistended regions, thus assisting in the location of a best suited PEEP. These algorithms were implemented, tested, and compared to previously suggested approaches, using a clinical database of ALI and healthy lung patients. Results varied depending on which IP was being compared. Between the linear and sigmoid methods IP differences ranged from -6.80 mbar to 1.47 mbar. Comparing the visual heuristic method with the linear spline method differences ranged from -1.507 mbar to 0.0240 mbar. The results are promising sign for the use of the linear method in IP selection.

LINEAR OPTIMIZATION FOR ELECTRODE GEOMETRIES AND CURRENT PATTERNS IN ELECTRICAL IMPEDANCE TOMOGRAPHY

Mamatjan Yasin

An advanced 3D electrical impedance tomography (EIT) system requires improving electrode geometries placed around a body surface, and correspondingly applying optimal stimulation and measurement patterns to produce maximum distinguishability. For such an EIT system, the full ensemble of measurements provides as high SNR as possible over all of the volume under investigation not only for over a certain region of interest. Due to the dynamics of environment and human body in the ICU, the electrode malfunction should also be taken into account, and adjust the current injection and voltage measurement patterns accordingly to produce better quality of images.

We vigorously investigated multi-layer electrode geometries, and stimulation and measurement patterns on a cylindrical volume resembling a human thorax. We applied linear programming methods to optimize electrode geometries and current patterns, as well as to disable the identified malfunctioned electrodes in the computation. As a case study, we also simulated a 3D two-electrode plane system using 16 different stimulation and measurement patterns for selected electrode geometries and evaluated with a real measurement system. Furthermore, we varied the distances between two electrode layers of the selected (best) electrode configuration to find the effect of the distance on the distinguishability. The initial results showed that high distinguishability values were obtained from several electrode geometries and current patterns which can consequently lead to a higher image quality.

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LEAD FRAMEWORK FOR HEALTH CARE

Carla Anglehart – Health Association Nova Scotia

Abstract:

The LEADS in a Caring Environment Leadership Capabilities Framework is a leadership talent development process designed and delivered specifically for Canadian health leaders. It draws upon the latest research and knowledge in the disciplines of leadership and leadership development; and applies the best available strategies to the unique challenges of leading a health organization in Canada.

The LEADS in a Caring Environment Leadership Capabilities Framework has been adopted by the Canadian Health Leadership Network, the Canadian College of Health Leaders, and the Health Care Leaders Association of British Columbia as a ‘standard’ defining the qualities of leadership needed to engender change in Canada’s health system.

Bio:

Carla Anglehart, Director of Organizational Development at Health Association Nova Scotia, is a dynamic facilitator and educator. Past President of the Halifax Chapter of the Canadian Association of Professional Speakers, Carla is well known for her sessions on leadership, governance, quality work-life, team building and leading organizational change. A certified/licensed facilitator of The Change Cycle™, Carla supports individuals and organizations to move away from fear of change and to embrace change with greater productivity and performance.

THE FUTURE IN ADVANCED TECHNIQUES FOR HEMOSTASIS...HANDS ON THE FUTURE !

David Wood – ConMed

Abstract:

The continuously evolving role of Biomedical Engineering requires a skilled adaptation to the dynamic world of medical and surgical technology. The same can be said regarding the field of energy-based systems where present market conditions are dictating a new era in hemostatic and dissection technologies.

ConMed Canada is focused on providing educational tools to help in the better understanding and utilization of available technologies. “The Future in Advanced Techniques for Hemostasis” program is designed to increase basic knowledge of electrosurgery including application techniques and the management of its risks during ligation procedures. With an overview of available dissection and ligation devices and their related electrosurgical techniques, this program also includes hands-on lab sessions in order to provide the attendee the opportunity to confirm discussed electrosurgical safety concepts such as thermal lateral damage, impact of heat on tissue and various ligation / dissection techniques.

This fully comprehensive presentation is designed to explore the basics of energy delivery and to discuss the science behind new emerging energy-based modalities which will mold the next decade of surgical techniques and ultimately improve clinical outcome.

Key points of discussion:

- Advanced concepts related to energy delivery
- Exploration of NEW energy-based technologies and the differences in clinical effects to facilitate surgical dissection and hemostasis



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Bio:

Originally a biomedical engineer at Montreal's Jewish General hospital David Wood has more than 15 years of experience in the medical industry. David has held a number of increasingly responsible positions within companies such as Service and Marketing Manager with Tyco Healthcare Canada where he has developed an expertise in Electrosurgery, Ventilation and OR specialty products. In his current position as Director of Marketing with ConMed Canada, David is responsible for all electrosurgical, endoSurgical, endoscopic and patient care related technologies.

IEC8000:1 GE/IT COURSE

Karen Delvecchio – GE

Abstract:

IEC 80001-1 is an international standard released in 2010, titled "Application of risk management for IT-networks incorporating medical devices." Networks and connectivity are playing an ever increasing role in the delivery of healthcare, benefiting both patients and healthcare delivery organizations. But with the increased complexity comes new risks that must be managed. The standard defines a framework for applying a risk management process to the incorporation of medical devices into shared IT networks.

Bio:

Karen Delvecchio manages the Networks Engineering team for Monitoring Solutions in GE Healthcare, developing network infrastructure and networked-client capabilities with emphasis on risk management. As a member of JWG7, the committee responsible for IEC 80001-1, Karen was very involved in the development of the standard and related Technical Reports.

OPTICS IN THE HOSPITAL WAITING ROOM

Dr. Dennis Leiner – Lighthouse Industries

Abstract:

Endoscopes are a class of optical devices for visualizing the inside of the body and are used in almost all medical specialties in the hospital. Clinical engineering departments are now being asked to track their hospital's inventory and perform preventive maintenance on these devices to assure that they are in good working order before use in minimally invasive procedures.

This presentation discusses the optics inside the surgical instruments that are utilized during endoscopic procedures. No background in physics or optical engineering is assumed by the presenter. Emphasis is given to the practical considerations in understanding the basic function/operation of all types of endoscopes. Simple quality tests are presented that will allow the clinical engineer to troubleshoot and maintain the hospital's inventory of both rigid and flexible endoscope systems.

Bio:

Dr. Leiner received his Bachelor of Science degree cum laude in Optics in 1975 from The University of Rochester's Institute of Optics. He received his Master's Degree in Optics from the Institute in 1977. From 1976 to 1978, he was employed by Galileo Electro-Optics Corporation as an optical engineer, where he

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established and managed an optical laboratory for identifying the performance characteristics of fiber optics used in communications.

Dr. Leiner returned to academia in 1978 to pursue his doctorate. He received his Ph.D. in 1981 from the University of Connecticut in Storrs after researching optical techniques for the diagnosis of middle ear pathologies.

In 1981, he accepted the position of principal optical engineer at Dyonics, Inc., the predecessor of Smith and Nephew Endoscopy, Inc. While at Dyonics, he was responsible for the development of new concepts in medical endoscopy, including the technical management of product development. During his tenure at Dyonics, he designed video endoscopic products, engineered fiberoptic illumination and sensor systems, developed new techniques for the optical characterization of endoscopes, and invented new endoscope designs, resulting in the issuance of several patents.

In 1984 and 1985, Dr. Leiner taught optics at the University of Massachusetts in Lowell while at the same time establishing a medical optics design and consulting company, Leiner Associates, Inc. He left teaching in 1985 to focus full time on the development of Leiner Associates, which was the predecessor of Lighthouse Imaging Corporation. Dr. Leiner is listed as inventor or co-inventor in 14 patents and has published more than 20 papers in the areas of medical optics and optical instrumentation.

SOFTWARE AND MEDICAL DEVICES

Sarah Chandler – Health Canada

Abstract:

This presentation will discuss licensing of medical devices in Canada with a focus on software regulated as a medical device. The presentation will discuss on the requirements Food & Drugs Act and Medical Devices Regulations, and more specifically medical device classification, quality management system requirements and the licensing process.

Bio:

I graduated from Carleton University in 2004 with a degree in Electrical Engineering. Since 2005 I have been working for the Medical Devices Bureau within Health Canada. During this time my primary responsibility has been providing regulatory advice to stakeholders regarding medical device classification, labelling, and licensing. My current position is Head of the Regulatory and Scientific Section within the Device Licensing Services Division.

ADVANCES IN OPHTHALMOLOGY

Chris Nolan – Zeiss

Bio:

Chris Nolan is 39 yrs old and has spent 6 years with Carl Zeiss Canada in the Maritimes. He resides in Halifax with his wife Paula and 3 girls and is aSt.FX grad in Business. He worked in Ireland for a year and does considerable work with Special Olympics of Nova Scotia.



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CROSS CANADA CHECK

Ken George
Murat Firat
Martin Poulin
Kyle Eckhardt
Ted MacLaggan

Abstract:

Does life seem busier than ever for you? Do you wonder if this is the norm? Wish you knew what's happening in the Atlantic Provinces, Ontario/Quebec, Prairie Provinces, or BC? Come join us for an hour at the Cross Canada Checkup session where we'll get brief updates on what's happening across Canada in Clinical Engineering, share ideas and questions and hopefully learn a bit while satisfying our curiosity. We'll also squeeze in an introduction by Murat Firat to the new CMBES Website which is replacing the present biomed listserv we've had for many years.

CMBES NETWORK AND DISCUSSION FORUM

Murat Firat
Michael Hamilton

Abstract:

Without a doubt we are at the dawn of a new era: "The Social Age." CMBES Strategic Directions-2015 embraces the new era by making the "CMBES Network" its highest priority initiative. The core of "CMBES Network" is the new CMBES discussion forums that are moderated by subject-matter experts: Biomedical/Clinical Engineering professionals working in the field. You and your colleagues could/will be these CMBES experts. You will share your knowledge and expertise with others, spark discussions, answer questions. Together we will build a deep and reliable knowledge base and a platform for incubating new ideas. Join this session to learn more about the network and how you can become part of this national/global professional collaboration!

PERSONAL HEALTH INFORMATION ACT (PHIA) IN NOVA SCOTIA – WHY DOES IT MATTER?

Brenda MacDonald - Nova Scotia Government
Maria Lasheras - Nova Scotia Government

Abstract:

In December 2010, the Nova Scotia government passed the Personal Health Information Act (PHIA). This new health information privacy and access legislation is intended to ensure that personal health information management rules in the health sector are clear, consistent, and under provincial jurisdiction, and relevant to the electronic health information systems being implemented in Nova Scotia. The purpose of PHIA is to balance the right of individuals to protect their personal health information and the need of the health sector to collect, use and disclose personal health information to provide, support and



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manage health care. The legislation was developed specifically for health care in Nova Scotia, including direct patient care, public health, planning and management of the health system, and research.

Although PHIA is specific to Nova Scotia, it is consistent with the Pan-Canadian Health Information Privacy and Confidentiality Framework, signed by the Deputy Minister of the Nova Scotia Department of Health and Wellness in January 2005. This Framework was drafted by provincial/territorial health departments and Health Canada:

- to provide recommendations for those provinces that had not yet developed health information legislation; and
- to provide guidance for the jurisdictions that had legislation but were scheduled for a mandatory review of their acts.

PHIA is consistent with the Canadian Standards Association (CSA) Model Code for the Protection of Personal Information principles.

PHIA information practice requirements are quite extensive. One important tool for assessing privacy risks and mitigation strategies related to the collection, use, disclosure and retention of personal health information is a Privacy Impact Assessment (PIA). A PIA is an analysis of the impact of an activity on an individual's privacy and assists to identify and mitigate any privacy risks. The assessment can also determine whether a project, program, service, technology or information system meets privacy legislation and best practices.

This presentation will provide an overview of PHIA and its foundation. The PIA will be discussed as one tool which can be used by biomedical experts to assess a project or new technology for compliance with applicable privacy legislation as well as to identify privacy risks and mitigation strategies.

Bio:

Maria has been working with the NS Government in the field of protecting privacy and managing access since 2000. She currently holds the position of Director, Health Privacy and Access at the NS Department of Health and Wellness. Maria's primary responsibilities are: leading initiatives where legislation, current and new, as well as related policies and processes may impact new technologies associated with electronic health records and electronic information systems. Maria provides consultation and advisory services to the Department and Health and Wellness, represents the Department in interprovincial initiatives, and contributes to legislation development. Maria works with multiple stakeholders, always with the objective to ensure that privacy is protected while facilitating access to information and data.

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COST AND BENEFITS OF ASSET TRACKING

Kathy Winter – GE

Bio:

With more than 20 years of health service management and consulting experience, Kathy Winter has demonstrated considerable leadership in operations management, strategic and systems planning, health services evaluation, facilitation and change management across the healthcare continuum.

She has worked for public and private sector clients, provincial governments and associations, where she regularly consults with clinicians, senior healthcare leaders and board members.

With GE Healthcare, Ms. Winter leads a team of consultants providing operations, strategy, program evaluation, performance improvement and sustainability support for clients who are focused on improving quality, cost and access. Her previous experience includes IBM Business Consulting and PricewaterhouseCoopers, where she was national clinical services optimization leader. Ms. Winter has taught strategic planning at McMaster University and has held an appointment as an Associate Professor at the University of Toronto, in what was the Department of Biostatistics and Epidemiology. She is guest faculty at the Cleveland Clinic Leadership Academy and has published in a number of peer reviewed journals.

Ms. Winter's first degree is in nursing and she has an MBA. She holds Lean Healthcare Black Belt and Six Sigma certification.

COMMUNICATING AND ACHIEVING YOUR STRATEGIC PLAN

Allan Horsburgh

Abstract:

Through Allan's roles as a Ministry of Health CFO, and most recently, as a pediatric & women's hospital (IWK Health Centre) CFO in NS, Allan has had the privilege of being one of the decision making audience members where many demands and requests for funding resources (staff, equipment, supplies, etc.) come in. He has experienced firsthand, processes and approaches that work well, but unfortunately many more which have failed miserably. As professionally trained experts in the field of biomedical engineering, it is often you and your colleagues who are at the centre of defining the needs for some of the most expensive single items in the field of healthcare. These expert roles, are the cornerstone (or not) to the success in securing funding for these items in how the issue is managed, addressed, brought forward, presented, etc. Allan's goal for this session, is to share some best practices and lessons learned from the target audience perspective, to help develop the necessary skillsets for this group, and to enable future successes in your respective agendas in your home province & hospitals.

Bio:

As a professionally trained Chartered Accountant, Allan has spent his entire business career in the field of Healthcare. He has been the past CFO at the Nova Scotia Department of Health, and is now the VP/CFO for the IWK Health Centre in Halifax – an Atlantic Canada academic health centre for pediatrics and specialized women's care. Allan also teaches in the Master's of Health Administration at Dalhousie University and in various other healthcare leadership programs, enjoys speaking nationally on health system business issues,



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and is an award winning visual artist. A proud parent of two children, his youngest being born at the IWK 13 years ago at one pound, five ounces, with all the life threatening issues and incredible care that went along with that, Allan enjoys his roles in healthcare at a very personal level to try and help make a difference for other families, the way the system did for he and his wife, and his now very healthy family.

NATURAL ORIFICE SURGERY

Dr Jim Ellsmere – QE11 Health Center

Bio:

Dr. Ellsmere is a general and gastrointestinal surgeon at the Queen Elizabeth II Health Sciences Centre with a special interest in laparoscopy and therapeutic endoscopy. He attended Dalhousie University for medical school and his general surgery residency before completing fellowship training in advanced laparoscopy and therapeutic endoscopy at Harvard Medical School. Dr. Ellsmere also has a master's degree in medical informatics from the Massachusetts Institute of Technology. His research interests are in biomedical engineering work developing improved techniques for the diagnosis and treatment of gastrointestinal disease.

EMERGENT TECHNOLOGIES IN ENDOSCOPIC AND LAPAROSCOPIC APPLICATIONS

Jeff Daniels – Olympus

Abstract:

Emerging Technologies in Endoscopic and Laparoscopic Applications

Innovations and disruptions in the medical device industry will continue to increase the level of care provided by clinicians. The purpose of this presentation is to highlight recent and near future advances in endoscopic and laparoscopic technologies. Attention will be given to the evolution of integrated imaging platforms and therapeutic technologies delivered via lesser invasive methods. This review will range from devices currently entering commercialization to product ideas in the evaluation and development stages. Key considerations such as the advantages and disadvantages of flexible versus rigid design methodology will be identified. An understanding of the efficacy and application of these technologies in the clinical environment will be important to the introduction and adoption of new devices.

The topic will be presented as a multimedia presentation via powerpoint and video.

Bio:

Mr. Jeff Daniels is the Director, International Marketing, for Olympus' medical and surgical businesses, headquartered in Center Valley, Pennsylvania. His responsibilities include leading the product life cycle management, marketing, and communications efforts for these businesses. Jeff's team is focused on the management of advanced endoscopy and surgical products within the Canadian and Latin America markets. Mr. Daniels has over 10 years' experience in marketing and product management in the medical device industry. Before joining Olympus in 2005, Mr. Daniels served in marketing and sales roles at Ethicon, Inc. He also served in as an officer in the United States Air Force.

Mr. Daniels earned a Bachelor of Science in Management from the United States Air Force Academy in Colorado Springs, Colorado, and a Master in Business Administration from Wright State University in Dayton, Ohio.



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BIOMEDICAL ELECTRONICS TECHNOLOGISTS

W.O. Michael Walters

Abstract:

A look at an occupation that works behind the scene in a medical community to ensure medical equipment is always operational to meet the needs of the patient.

ON BEING SAFE: HUMAN COMMUNICATION IN A MECHANICAL WORLD

Heather Wolf , Canadian Patient Safety Institute

Abstract

Heather will explore the mechanistic-humanistic divide in the context of patient safety in health care. Technologies and the system in place do not always support those actually working in the system. With high adverse event rates, health care requires strong communication practices and effective teamwork to prevent harm. Practical considerations for all members of the health care team to consider will be presented.

Bio:

Based out of Nova Scotia, Heather Wolfe joined the CPSI team in October 2011 as a Safety Improvement Advisor for the Atlantic Provinces. Heather is a registered nurse who has worked in various leadership roles including Manager of Quality and Decision Support, Site Manager of Lillian Fraser Memorial Hospital, Stroke Program Coordinator for Cumberland and Colchester East Hants Health Authorities and Manager of Inpatient Surgery. Heather is currently the vice-chair for the Bluenose Chapter of the Canadian College of Health Leaders and has recently achieved the Certified Health Executive designation. Heather has dedicated herself to enhancing quality patient care and her experience with root cause analysis, failure mode and effects analysis, combined with her quality improvement and project management skills, make her a committed and enthusiastic member of the CPSI team. As emergency nursing continues to be one of Heather's passions, she works casual shifts in a local emergency department to ensure sustained contact with frontline patient care. Heather holds a Bachelor of Science in Nursing and a Master of Nursing from the University of Toronto.

ELECTROMECHANICAL PROGRAM

Jeremy Dann – Health Association Nova Scotia

Abstract:

The investigation of a lift incident in 2002 led to the development of the Electromechanical program within Health Association Nova Scotia's Clinical Engineering service. Ten years later the program has become a major component of CE and has dramatically increased in volume and scope since its launch. A wide range of technology is now supported by a team of eight frontline technicians. The originally included inventory of beds, wheelchairs, lifts, and stretchers has been augmented through the addition of OR tables and Lights, Integrated OR booms, SPD sterilizers, washers and disinfectors, UPSs, chairs, exam tables and growing list of other non-diagnostic non-therapeutic equipment.



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Of particular focus in the last three years are ceiling lifts; High risk devices that require careful attention to detail. Clinical Engineering professionals are ideally suited to meet this emerging challenge. The Association's CE service is now testing more than 2000 lifting devices annually.

This presentation will focus in the following areas, an overview of the electromechanical program, with special attention to Lifting technology. Real world experience and evidence will be presented surrounding the importance of routine testing and incoming inspections; Why we should test lifts, standards and regulations, lift loads and test equipment, inspection results, track installation, why we need better labels, why tracks fail inspections, why tracks and motors fall from ceilings.

Bio:

Jeremy Dann has been with the Health Association Nova Scotia since 1982. Until the spring of 2010 he managed the clinical engineering services provided to Health Care facilities in Western Nova Scotia. Currently his duties have shifted toward service development for HANS as a whole. He has been certified through the Society of Certified Technicians and Technologists of Nova Scotia since 1981 and achieved CBET certification in 1993. Jeremy was recognized as the Outstanding Canadian Biomedical Engineering Technologist of the year in 2004 by the Canadian Medical and Biological Engineering Society (CMBES). He has completed the Health Services Management program through the Canadian Healthcare Association. Jeremy has served on the CMBES Executive Board, as chairman of the CMBES Awards Committee, and provided support to the Canadian Biomedical Engineering Certification Board.

FUTURE TRENDS IN DI

Mike Petelin – RSTI

Abstract:

This course is designed to inform the attendee about current and future trends in the DI community as seen by RSTI. We will follow what has been happening, is happening, and will happen over the next few years as it relates to the following:

- X-ray service - OEM, In-house, ISO
- Multi level integration

If you are a Biomedical Equipment Technician or Imaging Service Engineer what does this mean to you? Service organizations, when you call a company for parts are you purchasing from your competitor? This presentation will answer these questions and many more.

Bio:

Mike joined RSTI as an Instructor in February 2005. His experience in communications design and engineering sales and technical support qualified him to update and teach our mammography curriculum. In addition to his duties as an Instructor, Mike is in charge of RSTI's graphics department to include newsletter and schedule layout and design.

Mike earned his B.S. in Electronic Engineering from University of Akron, May 2001.

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DEEP BRAIN SURGERY

Dr Ivar Mendez – Director, Neurotransplantation Center, Dalhousie University

Abstract:

Over the past decade we have been working in three emerging technologies that have a great potential to shape the future of neurosurgery and health care delivery. The ability to use cell-replacement therapies such as stem cells to reconstruct neuronal circuitries will be crucial in the treatment of brain and spinal cord injury as well as neurodegenerative conditions such as Parkinson's disease. New surgical instruments to deliver cell safely and accurately into the human brain such as the Halifax Injector are being developed.

The use of robotic systems in the operating room and to deliver health care at a distance is in the horizon. Advances in telecommunications technologies have made possible the pioneering use of remote presence service for point-of care diagnosis and to deliver health care to remote communities in both the developed and developing world. We have particularly hearted in the use these emerging technologies to narrow the gap of inequality in health care delivery in the world. This presentation will be centered in the work done in Halifax on those three areas of technological innovation and their perspectives for the future.

Bio:

Dr. Ivar Mendez is Professor of Neurosurgery and Director of the Neural Transplantation Laboratory at Dalhousie University and the Queen Elizabeth Health Sciences Centre. Dr. Mendez received his MD and PhD in Anatomy from the University of Western Ontario, London, Ontario where he also completed his post-graduate training in Neurosurgery. After completion of his neurosurgical residency, Dr. Mendez was awarded the Resident Research Prize by the American Congress of Neurological Surgeons and the William P. Van Wagenen Fellowship by the American Association of Neurological Surgeons. His research Fellowship was done at the Department of Medical Cell Research, University of Lund, Sweden.

Dr. Mendez is a Fellow of the Royal College of Physicians and Surgeons of Canada and the American College of Surgeons. As a Clinician/Scientist, Dr. Mendez' research focus is in functional neurosurgery, brain repair, stem cells, robotic neurosurgery and computerized systems in neurosurgical applications. His laboratory research has been supported by peer-reviewed funding from a number of sources including the Canada National Centers of Excellence, Canadian Institutes of Health Research, Canada Foundation for Innovation, Nova Scotia Health Research Foundation, Atlantic Innovation Fund, and Parkinson's Disease Foundation of USA. He is recognized internationally as an expert in his field, having over 200 international and national presentations as well as over 200 scientific publications. For the past decade he has worked in the use of remote-presence robots for medical care in neurosurgery and primary care in remote First Nation communities in the Canadian Arctic. In 2002, Dr. Mendez and his team performed the first long distance telementoring neurosurgery in the world.

Dr. Mendez has taken an active role in humanitarian and global health issues. He has been instrumental in establishing and equipping neurosurgical units in several developing countries. He has extensive contacts and collaboration with academic and medical institutions around the world and has established humanitarian programs for nutrition, dental care and education in remote communities of the Bolivian Andes.

For his pioneering work in the use of remote presence devices to deliver health care to underserved populations, Dr. Mendez received the 2010 Canadian Red Cross Humanitarian of the Year award and the 2011 Health Canada Award for Contribution to the Improvement of the Health of Canadians.

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PANEL DISCUSSION ON THE FUTURE OF WIRELESS TECHNOLOGY

Jean Ngoie

Abstract:

Although the implementation of computerized medical device Technology such as Smart technology continue to presents new challenges for Biomedical/Clinical Engineers, Hospital Information Technology departments (IT) and Manufacturers or vendors of these technologies. It is time to recognize that the expansion and integration of wireless and other IT technologies will continue to provide Clinical and Biomedical Engineering better ways of managing medical devices.

A panel discussion consisting of Ted MacLaggan, Manager of Biomedical Engineering Department at IWK Health Centre; Jean Ngoie, Technical Service Manager, Smiths Medical Canada; David Gretzinger, Director of Clinical Engineering Department at UHN and Mount Sinai Hospital; chaired by Mario Ramirez, Director of Medical Engineering Department at The Hospital for Sick Children. The team will look at how these technologies are changing the Landscape of Healthcare in general and shaping up the future of Biomedical/ Clinical Engineering in particular.

The aim of this session is to open up a discussion, share experience, exchange ideas and identify common practices that may help to improve collaboration between teams during implementation of medical Device Technology with Information technology input in order to reduce turnaround time, reduce project cost and improve patient safety.

ICONOCLASTS

Bill Gentles

Abstract:

An Iconoclast is someone who seeks to overthrow popular views.

This session will consist of a debate between two teams of Iconoclasts who will argue different sides of a controversial issue related to medical technology, using humour to advance their arguments. The topic is presented in the form of a resolution. The audience votes on where they stand on the resolution before the presentations.

- The presenters each have 5 minutes each to present their arguments.
- Audience members are invited to challenge the views presented.
- There is a second vote by audience members.
- The team who sways the most votes to their side wins a prize.

Bio:

Bill Gentles is chair of the International Outreach committee of CMBES. He also serves as administrator of the global HTM/Clinical Engineering email listserv, Infratech. Bill first became interested in international work in 1984 when he was invited to lecture in Taiwan and China. Since then he has lectured or participated in workshops in Malaysia, Cuba, Chile, Ecuador, Nicaragua Kosovo and Ghana. Bill is currently vice president of BT Medical Technology Consulting (www.btmtc.com). He is the former Director of Biomedical Engineering at Sunnybrook Health Sciences Centre in Toronto. He served in that position from 1972 - 2001.

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CLINICAL RESEARCH & THE FUTURE OF MEDICAL DEVICES

Dr. Monahar Bance – Dalhousie University

Abstract:

Medical devices development is in evolution. While both the diagnostic and therapeutic arms of the device industry are equally active, in this talk I will focus on the need for better diagnostic devices for progress in medicine. Technology has the potential to improve our granularity of understanding of the differences between patients, and the changes due to disease. We will, in the future, focus more and more on the interactions between systems, and develop alternate ways to provide sensory information if the primary sensory system is damaged, and become more cognisant of how any given deficit is impacted by the other systems it works with. This provides new opportunities for device development, differentiation, and optimization. Many devices will become useful beyond just restoring a deficit, but actually be able to augment functionality beyond that of normal, by providing access to tools such as GPS, or music or other internet based information.

I will review how these factors are playing out in the hearing and balance devices we are developing, and how they might apply more generally.

Bio:

Dr. Manohar Bance is an Otolologist/Neurotologist at Dalhousie University in Halifax, Nova Scotia, Canada. He graduated MB, ChB in Manchester, UK, and then did his residency and FRCS in Toronto Canada, as well as MSc in Vestibular Neurophysiology. Currently he is a Full Professor at Dalhousie University, and Acting Head of the Division of Otolaryngology. He is Director of the EAR program, which includes cochlear implantation, skull base, BAHA and middle ear programs. He is also Director of the Ear and Auditory Research Laboratory (EAR Lab) at Dalhousie University, and the Sensory Encoding and Neurosensory Engineering (SENSE) laboratory there. He has Cross Appointments as Full Professor to the Dept. of Anatomy and Neurobiology, School of Biomedical Engineering and School of Human Communication Disorders.

Dr. Bance is coordinator of the Halifax Hearing and Balance research cluster, and has received over \$7 million in funding, as PI or co-applicant over the last 8 years. He is a Professor to the Chair in Hearing Disorders at King Saud university in Saudi Arabia, Supervisor for an international Fellowship in Otology, and serves on the editorial board of several journals.



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INNOVATION THROUGH INFUSION TECHNOLOGY AND DATA ANALYTICS

Marija Manojlovic – Baxter

Tania Marvski

Michelle Santos

Abstract:

Baxter's infusion systems portfolio has evolved to become about much more than just the infusion hardware. During this session, we will be sharing with you the growth and evolution of Baxter's Enterprise Infusion Systems, encompassing novel infusion technology and an innovative data analytics tool that drives patient safety through empirical data.

GHANA BIOMEDICAL ASSOCIATION – OVERVIEW AND UPDATE

Dr. Adjabu – CMBES International Outreach

Mario Ramirez– CMBES International Outreach

Jim Renshaw– CMBES International Outreach

Abstract:

This session will introduce the CMBES International Outreach committee, and describe its objectives. We will present a roundtable discussion on the experiences and setbacks thus far in developing a new initiative for supporting the advancement of local health technology management (HTM) skills in a developing country, specifically Ghana.

Hospital equipment maintenance practice started in Ghana in the early 1950s, but it was not until the 1980s that the importance of a vigorous hospital engineering practice was accepted. By the 1990s Biomedical engineering had been established in the Ministry of Health in Ghana. Clinical engineering activities continued to gain ground in Ghana from the mid-2000s up to the present day.

The partnership between HTM professionals in Ghana and Canada began on March 2, 2009, when a 5-day Advanced Clinical Engineering Workshop (ACEW) on Health Technology Management (HTM) was presented at Valley View University in Accra, Ghana. This session will be the start of an ongoing collaborative partnership between CMBES and the Ghana Biomedical Association.

Bios:

Nicholas Adjabu is currently employed as Deputy Director, Clinical Engineering Department, Ghana Health Service, Accra, Ghana. He is an experienced and qualified Medical Practitioner and Clinical/Biomedical Engineer with sixteen years working experience. He has a Bachelor of Medicine and Bachelor of Surgery (MB, ChB, Legon), University of Ghana Medical School, Accra, Ghana and an MSc. in Medical Electronics and Physics from Queen Mary, University of London. He is a founding member of the Biomedical Engineering Association of Ghana. He is a member of the Expert Advisory Group on Health Technology, Global Initiative on Health Technologies, World Health Organization, Geneva, Switzerland.

Mario Ramirez is Director of Medical Engineering at the Hospital for Sick Children in Toronto.

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Jim Renshaw, President of Aim Instrumentation is a Biomedical-Technologist who started AIM 38 years ago. Jim is past President of the Rotary Club of Burnaby & gives a great deal to Rotary projects around the world. He has been on two projects in Africa and is working on a project in Indonesia. This vision of combining many years of Bio- Medical experiences and connections to the biomedical industry to the improvement of Health care through the world has become the new mission statement for the AIM group of companies.

LEAN WITH FOCUS ON HEALTHCARE

Steve Skinner

Abstract:

- History of Lean
- The 5 key principles of Lean
- The Lean Transformation Model
- The 4 Main Components of Lean
- Some Key Lean Tools and their uses
- Value Stream Maps
- 5S (Sort, Set in order, Shine, Standardize & Sustain)
- More Lean Tools and Applications

Bio:

Steven Skinner, PEng, is an industrial engineer working for the South Shore District Health Authority. He graduated from Dalhousie University, TUNS campus and has been working in healthcare for the past 8 years in various quality improvement roles. Steven has also completed the required coursework to achieve a Lean Black belt designation. Steven has worked in hospitals in both Nova Scotia and Ontario as an industrial engineer, project manager, Lean trainer and a quality improvement coach and advisor. In his various roles he has worked on projects that created significant change in various healthcare systems, has facilitated conflict resolution sessions with senior leaders and trained countless healthcare staff members on the Lean approach and how to implement the concepts and philosophies in various healthcare departments / environments

MIS SUITES/ INTEGRATED OR'S

Ryan Jones – Stryker

Abstract:

The advancement of Minimally Invasive Surgery has created an increased demand for Integrated Operating Rooms. Most operating room renovations or new construction implement some form of an integrated Operating Room system. Whether it's just adding boom arms to create a more ergonomic surgical suite, or creating a state of the art fully integrated OR theatre, there are countless configurations to choose from based on needs and budget. Ryan will discuss the various components that make up an integrated operating room including but not limited to: Equipment/Anesthetic Booms, Surgical Lights, video switching/routing systems,

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digital capture devices, video conferencing equipment etc. Ryan will also discuss the future of the integrated Operating Room including Hybrid Suites, Cardiovascular Suites, etc. Various design considerations that go into an integrated operating room project will also be explored.

Bio:
Ryan Jones is based out of Halifax, NS and has been working with Stryker Canada since January of 2004. Ryan's product portfolio includes Rigid Endoscopy Systems, Micro Electric Power Tools, Operating Room Lights as well as Integrated Operating Rooms for the Atlantic Region.

FUTURE OF MEDICAL TECHNOLOGY

Barbara Majchrowski – ECRI

Abstract:
Health technology is rapidly evolving and changing to meet new demands and workflows. As technologies become more integrated and systems-oriented, they require new management techniques. This presentation will describe some of these emerging technologies, their effect on clinical workflow, their effect on technology management, and lessons learned from early adopters.

Bio:
Ms. Majchrowski is a Senior Project Engineer with ECRI Institute and she is responsible for evaluating medical equipment for their safety, efficacy, and usability. She provides content on various healthcare technology topics for ECRI Institute's journal "Health Devices". As a subject matter expert, Ms. Majchrowski participates in numerous consulting projects and medical device-related incident investigations. She received the Association for the Advancement of Medical Instrumentation's Biomedical and Instrumentation & Technology (BI&T) Outstanding Paper Award in 2010 for the article "Medical Software's Increasing Impact on Healthcare and Technology Management".