



**CMBES/SCGB**

**Biomedical and Clinical Engineering in Canada...  
Lighting the Way to a Brighter Future**

# **ACCES23-CMBEC41**

## **JOINT CONFERENCE**

**May 8-11, 2018  
Charlottetown, PE**



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Friends and colleagues,

It is my distinct pleasure to welcome you to the ACCES 23/CMBES 41 conference here in beautiful Charlottetown, Prince Edward Island. ACCES and CMBES annual conferences are always highlights of the Biomedical/Clinical Engineering year and with this year's joint event, we the organizing committee believe we have put together an exceptional lineup of vendor exhibits, educational sessions, entertainment, and networking opportunities. The theme for this year's event, "Biomedical and Clinical Engineering in Canada . . . Lighting the Way to a Brighter Future" recognizes the ever-changing technical environment where we are called upon for the provision of expertise and leadership. As Clinical Engineering professionals, we are required to constantly scan the horizon for emerging technologies and trends in Healthcare and be ever ready to assist healthcare providers in its application at the diagnostic or treatment site. It is my firm belief that each of us will leave this conference better equipped to meet this task.

The preparation work to stage this event has involved the concerted efforts of a wonderful group of dedicated organizers. I am in awe of their commitment, ability, and energy in making this event a reality.

Your committee:

- |   |  |
|---|--|
| John Inch – Education Coordinator                     | Brendon McKenna – Entertainment/Food Coordinator |
| Nadja Bressan, Murray Rice – Academic Coordinators    | Gary Slaunwhite – Marketing Coordinator          |
| Phil Bradfield, Dave Hancock – Vendor Coordinators    | Amanda Saigeon – Budget/finance support          |
| Sarah Meades – Admin Support (such an understatement) |  |

A big thank you as well to Martin Poulin, CMBES and Brett Fraser, ACCES for their valuable work and leadership in preparation for this event.

In closing I want to express my appreciation to vendors, presenters, and delegates for your support of this conference. Delegates, please take full advantage of the vendor presentations, educational sessions, networking opportunities, and entertainment during your time in Charlottetown.

Brent MacKinnon CBET

2018 ACCES/CMBES conference chair

Welcome to ACCES23/CMBES41 Conference! Enjoy!



# Atlantic Canada Clinical Engineering Society

## **Prince Edward Island and the City of Charlottown welcome you to ACCES23/CMBES41 Joint Educational Seminars and Trade Expo**

I am very excited this year to be part of a unique conference, one which has united two quality societies. With the coming together of ACCES and CMBES, a team of individuals have combined 64 years of experience to offer one of the largest Clinical Engineering conferences ever held in Canada. This conference has been designed around this year's theme, "Biomedical and Clinical Engineering in Canada...Lighting a Way to a Better Future".

All this cannot happen without the hard work of a team of dedicated individuals, which in turn rise to the challenge each year. This year's team is comprised of individuals from multiple provinces across the country working towards the same end goal, to deliver you an outstanding experience. I applaud the committee for the extra work resulting in a 50+ vendor hall, booking world renown educational speakers, presentation of educational papers from across the country, enticing so many delegates to attend, and arranging true east coast entertainment. Thank you to the Committees for all your hard work.

Of course, our vendors play a very large part in making this event happen. Please ensure that you take time to visit all vendors to support and recognize them as well. Thank you to the vendor community for your continued support.

Finally, I would like to recognize Brent McKinnon for taking on the challenging role of conference chair. Brent started this journey last May at ACCES22 and has put in a tremendous amount of time and effort which is evident from the success of this conference. Thank you for this.

Brett Fraser

A handwritten signature in black ink, appearing to read "Brett Fraser". The signature is stylized and fluid.

President  
Atlantic Canada Clinical Engineering Society.





## **CMBES/SCGB**

### **Welcome / Bienvenue**

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On behalf of the Canadian Medical and Biological Engineering Society, I would like to welcome each of you to Charlottetown for the joint 41<sup>st</sup> CMBES and 23<sup>rd</sup> ACCES conference.

The committee organizers and countless volunteers have worked hard to put forward a great program including an impressive line-up of educational sessions.

I would like to extend my appreciation for the support of the Sponsors and Exhibitors who will be on hand Wednesday through Thursday to market their latest products and services. Please spend some time at the Exhibit Hall to see what's new and improved.

Please enjoy the learning and sharing with colleagues from across Canada over the next few days and don't forget to join us for the Gala dinner on Thursday night and the AGM on Friday at noon. I also hope you have a little bit of spare time to enjoy some of the sights around Charlottetown and PEI.

Au nom de la Société Canadienne de Génie Biomédical, j'aimerais souhaiter la bienvenue à chacun d'entre vous à Charlottetown pour notre conférence conjointe 41<sup>ème</sup> CMBES et 23<sup>ème</sup> ACCES.

Les organisateurs du comité et les innombrables bénévoles ont travaillé très fort pour mettre en avant un excellent programme qui inclut également un nombre impressionnant de sessions de formation continue.

Je tiens à exprimer ma gratitude pour le soutien des commanditaires et des exposants qui seront sur place du mercredi au jeudi pour présenter leurs plus récents produits et services. N'oubliez pas, s'il vous plaît d'en profiter pour prendre quelques minutes pour aller au salon des exposants afin de découvrir les dernières nouveautés et améliorations.

Je vous souhaite une bonne conférence et j'espère que vous profiterez de cette occasion pour apprendre et partager avec les collègues de la communauté nationale du Canada au cours des prochains jours. N'oubliez pas de nous rejoindre pour le dîner de gala du jeudi soir et l'Assemblée Générale du vendredi. Enfin, j'espère aussi que vous trouverez un peu de temps libre pour profiter de certains des attraits touristiques de Charlottetown et sa région.

Sincerely,

Martin Poulin, M.Eng., P.Eng.  
President, CMBES/SCGB



## **GREETINGS FROM MAYOR CLIFFORD LEE MAYOR OF CHARLOTTETOWN**

It is my pleasure to extend warm greetings to all delegates attending the 2018 joint Canadian Medical and Biological Engineering Society and Atlantic Canada Clinical Engineering Society conference in historic Charlottetown, “the Birthplace of Confederation”.

Charlottetown is proud to be recognized as the Birthplace of Confederation as our city is part of the very foundation from which our country has grown and developed. Charlottetown is a city steeped in history, and we feel and live it every day as we celebrate our past and plan for a prosperous tomorrow.

During your stay in Charlottetown, you will experience the spirit and pride of our community, the friendliness of our people, our warm hospitality and our beautiful landscapes. I hope that you will find your time with us to be enjoyable and that you will have the opportunity to explore our great City and Province.

On behalf of Members of City Council and all citizens of Charlottetown, Welcome and Enjoy!

Charlottetown, great things happen here!

A handwritten signature in black ink that reads "Clifford J. Lee". The signature is written in a cursive style with a large, looped initial 'C'.



## Many thanks to all of our supporting exhibitors and sponsors

### EXHIBITORS

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**ACCES and the 2018 ACCCES Planning Committee would like to acknowledge the support of each and every exhibitor that has made this event a success.**

**We would like to acknowledge the following new recipients of the Gold and Silver Exhibitor Hall status.**

## **Gold Exhibitor Hall “New” Recipients - 10 Years**

**Draeger Medical Canada Inc.  
Masimo  
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## **Silver Exhibitor Hall “New” Recipient - 5-9 Years**

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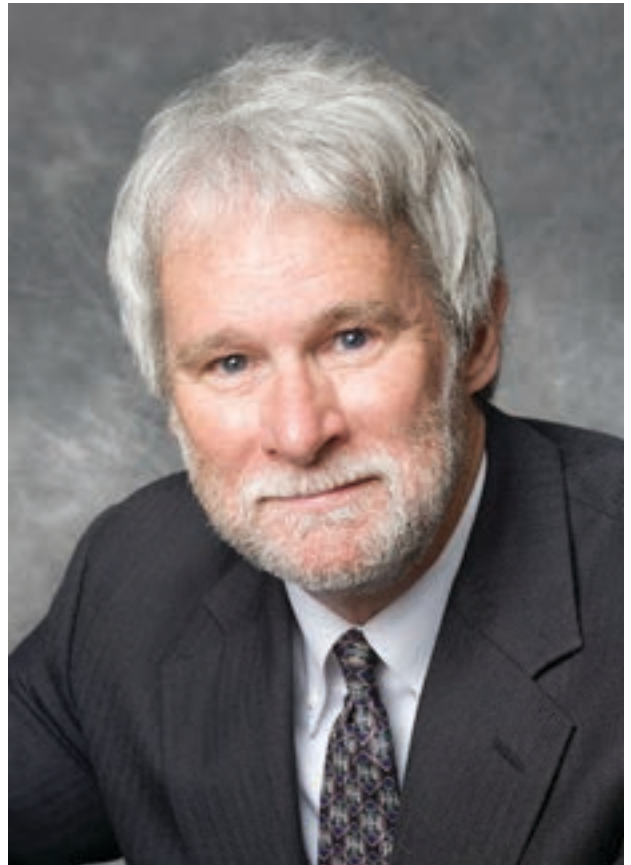
## Meet our Keynote Speaker...

### **Dr. Robert Gilmour, Jr.**

Dr. Robert Gilmour, Jr. is UPEI's Vice-President Academic and Research. His experience as an administrator spans the academic and research domains, including graduate and professional education. He currently is the university's representative to the Maritime Provinces Higher Education Commission (MPHEC) and is a member of the MPHEC Quality Assurance Committee. Dr. Gilmour also chairs the university's Academic Planning Committee and has been instrumental in creating new academic programs in engineering, mathematical and computational sciences and climate change.

As a well-published researcher who also holds several patents, Dr. Gilmour manages a diverse research portfolio encompassing multiple funding sources, while maintaining an active laboratory. Dr. Gilmour's experience in inspiring and leading multidisciplinary research teams has been an important attribute, as UPEI continues to work strategically with academic, and private- and public-sector partners to advance discovery.

Dr. Gilmour came to UPEI from Cornell University in Ithaca, New York, where he was Associate Dean for Research and Graduate Education and professor of physiology in the Department of Biomedical Sciences at the College of Veterinary Medicine. He previously was an associate professor in the Department of Medicine and the Department of Pharmacology and Toxicology at the Indiana University School of Medicine and was a research associate at the Krannert Institute of Cardiology in Indianapolis, Indiana.



# Meet our Keynote Speaker...

## Dr Gerald P. O'Hanley, MD, FRCSC.

### EDUCATION

Bachelor of Science, University of Prince Edward Island, 1969-1973  
M.D., Dalhousie University, 1973-1977  
Medical Internship, Dalhousie University 1977-1978  
Ophthalmology Residency, Dalhousie University, 1980-1983  
Medical Retina Fellowship, University of Western Ontario, 1983-1984  
Fellowship Royal College of Physicians and Surgeons of Canada, 1984  
American Board of Ophthalmology Certificant, 1985

### MEDICAL PRACTICE

Private General Practice, Charlottetown Hospital, 1978-1980  
Private Ophthalmology Practice, Queen Elizabeth Hospital,  
Charlottetown, 1984-present

### ORGANIZATIONAL MEDICINE MEMBERSHIPS/POSITIONS HELD

Medical Society of Prince Edward Island

- Treasurer
- Chairman, Committee on Health Care and Promotion

Royal College of Physicians and Surgeons of Canada

- Regional Advisory Committee 5
- Councillor
- Professional Development Committee

Canadian Medical Association

- Advisory Committee on Membership, Benefits and Services
- Council on Health Care and Promotion

Atlantic Provinces Ophthalmological Society

- President (two terms)

Canadian Ophthalmological Society

- Council on Provincial Affairs
- Chairman, Patterns of Practice Committee

Canadian Association of Internes and Residents

- Board

Internes and Residents Association of Nova Scotia

- Vice President

Dalhousie Medical Students Society

- Vice President, Medical Education
- Vice President, External
- Student Representative, Dalhousie Medical School Admissions Committee

American Academy of Ophthalmology



**THE CANADIAN MEDICAL & BIOLOGICAL ENGINEERING SOCIETY**

# 42<sup>ND</sup> ANNUAL CONFERENCE

**MAY 21-24, 2019**

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EVENT CENTRE | OTTAWA, ONTARIO**

# SAVE THE DATE!

## JOIN US IN OTTAWA

This will be the premier event for biomedical engineering professionals in Canada. This conference offers a national forum for information exchange among researchers and practitioners working in the medical technology industry and biomedical engineering in the following areas:

- Biomaterials
- Biomechanics
- Biomedical Image Processing Biosignal Acquisition and Processing Biophotonics
- Clinical Engineering Ethics and Regulations Health Informatics
- Medical Devices: Development, Evaluation and Commercialization
- Neuroengineering
- Physiological Systems / Modeling
- Rehabilitation and Assistive Devices Engineering Robotics
- Sensors and Instrumentation Software Usability Testing Telehealth
- Tissue and Cellular Engineering

## CALL FOR VOLUNTEERS

### Conference Committee

Help show colleagues from across the world how great Ottawa is. The Conference Committee is looking for individuals interested in helping with identifying conference sessions, planning and coordination of events, getting the word out, local arrangements, etc.

### Event Staff

During the event the conference will need people to help with registration, meeting speakers, coordinating presentations, facility navigation, awards and gifts, etc.

## Questions? Interested?

Please contact [secretariat@cmbes.ca](mailto:secretariat@cmbes.ca)



**CMBES/SCGB**



# Agenda - Tuesday, May 8, 2018

7:30AM-4:00PM **REGISTRATION OPEN – WELCOME DESK**

7:30AM-8:30AM **COFFEE AND TEA FOR DELEGATES**

9:00AM-10:20AM **TRAINING COURSES**

- (1) [Masimo First Call Training Course](#) – Tom Graham, Giulia Mesiamo

10:20AM-10:40AM **REFRESHMENT BREAK**

10:40 AM-12:00PM **TRAINING COURSES CONTINUED**

- (1) [Masimo First Call Training Course](#) – Tom Graham, Giulia Mesiamo

12:00PM-1:00PM **LUNCH**

1:00PM-2:20PM **TRAINING COURSES CONTINUED**

- (1) [Masimo First Call Training Course](#) – Tom Graham, Giulia Mesiamo
- (2) Philips Intellivue First Call Training

2:20PM-2:40PM **REFRESHMENT BREAK**

2:40PM-4:00PM **TRAINING COURSES CONTINUED**

- (1) [Masimo First Call Training Course](#) – Tom Graham, Giulia Mesiamo
- (2) [Philips Intellivue First Call Training](#)

8:30PM

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TRAINING COURSES  
FOR PRE-REGISTERED  
DELEGATES

1. Brown Conference Room
2. Chandler Conference Room

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# Agenda - Wednesday, May 9, 2018

7:30AM-4:30PM	<b>REGISTRATION OPEN – WELCOME DESK</b>	<b>EDUCATIONAL STREAMS</b>  1. Academic Stream and Clinical Papers – Brown Conference Room 2. Leadership Management Stream – Gray Conference Room 3. Technical/Clinical Education – Chandler Conference Room
8:30AM-10:30AM	<b>WELCOME AND GRAND OPENING</b> Welcome – Mayor Clifford Lee Keynote Address: Dr. Gilmour and Dr. O’Hanley	
10:30AM-11:00AM	<b>REFRESHMENT BREAK FOR DELEGATES</b>	
11:00AM-12:00PM	<b>CONCURRENT SESSIONS</b> (1) <a href="#">Clinical Engineering &amp; Benchmarking</a> (A) Developing an In-House MRI Maintenance Program: The Children’s Hospital of Eastern Ontario Experience – Dr. Mark Asbil, CHEO (B) Benchmarking of Biomedical Engineering Technology Education Programs in Canada – Dr. Anthony Chan, BCIT (C) CE Departments Staffing Survey – Steve Smith, St. Mary’s University (D) Clinical Engineering Staffing Levels Across Canada – Dr. Bill Gentles, BT Consulting (2) <a href="#">Creating a Real-Time Healthcare System with Clinical Communication and Collaboration Technology</a> – Benjamin Kanter, MD, sponsored by Vocera (3) <a href="#">Anesthesia - Past, Present and Future...</a> Paul Terry, Senior Clinical Applications Specialist, sponsored by Draeger	
12:00PM-1:00PM	<b>LUNCH FOR DELEGATES</b>	
1:00PM-1:30PM	<b>BREAK</b>	
1:30PM-2:30PM	<b>CONCURRENT SESSIONS</b> (1) <a href="#">Evidence Based Maintenance</a> – Binseng Wang (2) <a href="#">Engineering Patient Safety: Design and Implementation of a Surveillance Monitoring System</a> – Sue McGrath, PHD	
2:30PM-3:00PM	<b>REFRESHMENT BREAK FOR DELEGATES</b>	
3:00PM-4:00PM	<b>BREAKOUT EDUCATIONAL SESSIONS</b> (1) <a href="#">Biomedical Instrumentation</a> (A) Development of Saliva-Based Cortisol Biosensors Using Smartphone-Based Image Analysis – Dr. Rodolfo Nino-esparza, UPEI (B) Improving Wrist Force Estimation with Surface EMG During Isometric Contractions – Gelareh Hajian, Queens University (C) In-House Design and Construction of the Toronto Lap-Nissen Simulator – Gad Acosta, University Health Network (D) Tissue Realistic Anthropomorphic Abdominal Phantom for Radiography-3D Printing- Ali Ursani, University Health Network	

# Agenda - Wednesday, May 9, 2018

- (2) [Cybersecurity – A Manufacturers Perspective](#) – Scott Bristol
- (3) [Infection Prevention and Control for Clinical Engineering Professionals](#) – Gordon Jasechko

4:00PM-7:30PM **GRAND OPENING OF EXHIBIT HALL**

9:00PM-12:00AM **CONCERT AT PEI BREWING COMPANY** – Gordie MacKeeman And His Rhythm Boys – Fundraiser for the Pediatric Clinic at QEH - PEI Brewing Company.

Each delegate who has selected the concert ticket when they registered on line for the conference will receive one complimentary ticket to the event, additional tickets can be purchased on-line at [www.Eventbrite.ca](http://www.Eventbrite.ca) or cash only tickets can be purchased at the conference registration desk or at the concert venue door while supplies last.

Transportation to the concert will be at the expense of those attending. We have arranged to have several Co-op Taxi vans waiting outside the Delta between 8:00pm and 8:30pm to take passengers to the venue for a flat rate of \$11.25 per van load based on 5 people. Outside that time line when no Taxis are waiting you can call Co-op Taxi at 902 628 8200 and they will honor the \$11.25. Likewise, after the concert they will be waiting outside the venue to take passengers back downtown.



**CMBES/SCGB**

## *Thank you for joining us at CMBEC41/ACCES23!*

We sincerely hope your experience was valuable and that you:

- Learned about current research and projects in the CE/BME field
- Were inspired by the successes of your national colleagues
- Collected some new ideas and knowledge to apply in your own work
- Connected with your national network of colleagues

**Be an official part of this growing professional network by joining CMBES now!  
Help to expand the network by inviting a colleague to join CMBES.**

This coupon entitles a new member\* to 50% off dues for a CMBES membership\*\*. To use this discount enter coupon code CMBEC41promo in the online registration system ([www.cmbes.ca](http://www.cmbes.ca)) or contact [secretariat@cmbes.ca](mailto:secretariat@cmbes.ca).

\*A new member is someone who has not held an active membership within the last 5 years.

\*\*Various membership categories exist, please see [www.cmbes.ca](http://www.cmbes.ca) for more info.

**This coupon code expires on June 30, 2018.**

**Join the premier Canadian society for engineering in medicine and biology today!**

# Agenda - Thursday, May 10, 2018

7:30AM-4:30PM **REGISTRATION OPEN – WELCOME DESK**

**--- EXHIBIT HALL OPEN FROM 8:30AM-3:30PM ---**

7:30AM-8:30AM **LIGHT BREAKFAST FOR DELEGATES**

8:30AM-9:30AM **CONCURRENT SESSIONS**

- (1) [Clinical Engineering – Decision Support 1](#)
  - (A) Database Approach to Capital Medical Device Prioritization – Martin Poulin, Island Health Authority
  - (B) Implementation of a Useful Life Reference for Medical Devices in Canada – Paul Prowse, Winnipeg Regional Health Authority
  - (C) Developing a System to Support Equipment Repair Versus Replacement Decision Making – Sarah Kelso, Winnipeg Regional Health Authority
- (2) [Toward True Professionalism: Cultivating a Workplace Environment for Self-Actualization – Part A](#) – Phil Kennedy
- (3) [Show Me the Evidence: Developing Capacity to Choose and Use Evidence to Inform Decisions – Part A](#) – CADTH – Lisa Pyke, Kaitlyn Campbell, Jennifer Boswell.
- (4) [CBET Prep Education Course \(Pre-Registration Required\)](#) – Rick Tidman

## EDUCATIONAL STREAMS

1. Academic Stream Papers – Brown Conference Room
2. Leadership Management Stream – Gray Conference Room
3. Technical/Clinical Education – Chandler Conference Room
4. CBET Training Course – McGee Steeves Conference Room

9:30AM-10:30AM **BREAKOUT EDUCATIONAL SESSIONS**

- (1) [Clinical Engineering – Decision Support 2](#)
  - (A) Medical Device Needs Setting for Long-Term Care Units – Dr. Gelareh Hajian, CISSS des Laurentides
  - (B) Volunteering at Two Central American Hospitals: A Canadian Clinical Engineer's Perspective – Parisa Bahrami, CHESO
  - (C) A Business Case for Using Real Time Locating Systems for Medical Equipment – Mario Rameriz, Hospital for Sick Children
- (2) [Toward True Professionalism: Cultivating a Workplace Environment for Self-Actualization – Part B](#) – Phil Kennedy
- (3) [Show Me the Evidence: Developing Capacity to Choose and Use Evidence to Inform Decisions – Part B](#) – CADTH-Lisa Pyke, Kaitlyn Campbell, Jennifer Boswell.
- (4) [CBET Prep Education Course \(Pre-Registration Required\)](#) – Rick Tidman

10:30AM-11:00AM **REFRESHMENT BREAK IN THE EXHIBIT HALL**

11:00AM-12:00PM **BREAKOUT EDUCATIONAL SESSIONS**

- (1) [Biomedical Modelling](#)
  - (A) Aging Effects of the Performance of a Brain-Computer Interface - Meilin Chen, University of Waterloo

# Agenda - Thursday, May 10, 2018

- (B) Development of a Complete Upper Extremity Model for Assessment of Shoulder, Elbow, Wrist and Finger Motion – Ana Paula Arantes, University of New Brunswick
- (C) Adapting Isokinetic Dynamometry for Individuals with Transradial Amputation: A New Tool – Jessica Chouinard, University of New Brunswick
- (D) Development of a Non-Invasive Point-Of-Care Hematocrit Sensor for Anemia Detection – Wyatt MacNevin, UPEI

- (2) [OR Design Thoughts and Lessons Learned](#) – Michael Barton
- (3) [Interventional Radiology- Volcano](#) – Dr. Sohrab Lutchmedical
- (4) [CBET Prep Education Course \(Pre-Registration Required\)](#) – Rick Tidman

12:30PM-1:30PM **LUNCH FOR DELEGATES**

1:30PM-2:00PM **DESSERT IN EXHIBIT HALL FOR DELEGATES AND EXHIBITORS**

2:00PM-3:00PM **BREAKOUT EDUCATIONAL SESSIONS**

- (1) **POSTERS**
  - (A) The Neura-Feat Powered Exoskeleton: Design and Control – Jak Knight, UPEI
  - (B) Improve Subthalamic Nucleus Localization During Deep Brain Stimulation Surgery – David Chao-Chia Lu, Carleton University
  - (C) Development of a Low-Cost, Portable and Non Invasive Oyster Heartbeat Monitor – Tartela Alkayyali, UPEI
  - (D) Development of a Low-Cost Portable Sensor for Detection of Tetrahydrocannabinol (THC) in Saliva – Mason Boetien, UPEI
  - (E) Daily Mental Stress Prediction Using Heart Rate Variability – Dr. Bahareh Pourbabaee, OMSignal Inc.
- (2) [An Innovative Approach to Develop and Implement a New Clinical Alarm Strategy for The New NICU Single Family Room \(SFR\) Model Case Study](#) – Marwan Abouelela, MD MHI Candidate Julie McEvoy, CET, CBET
- (3) [From Donation to Transplant: Biomedical Engineering's Role at the Regional Tissue Bank](#) – Arlette Langille, Bsc,Dip FS, CTBS - Regional Tissue Bank
- (4) [CBET Prep Education Course \(Pre-Registration Required\)](#) – Rick Tidman

3:00PM-3:30PM **REFRESHMENT BREAK IN EXHIBIT HALL FOR DELEGATES AND EXHIBITORS**

3:30PM-4:30PM **BREAKOUT EDUCATIONAL SESSIONS**

- (5) [Talking So People Will Listen and Listening So People Will Talk](#) – Dawn MacLissac
- (6) [Cytotoxic Agents](#) – Erin Wentzell, Pharmacy Practice Assistant
- (7) [CBET Prep Education Course \(Pre-Registration Required\)](#) – Rick Tidman

4:30PM-5:30PM **ACCES AGM MEETING** – Chandler Room

6:00PM **BANQUET DINNER & AWARDS** - The College of Piping and Celtic Performing Arts of Canada, Harbourview Rooms



# Agenda - Friday, May 11, 2018

7:30AM-11:30AM **REGISTRATION OPEN – WELCOME DESK**

9:00AM-10:00AM **CONCURRENT SESSIONS**

- (1) [Biomedical Signal Processing](#)
  - (A) Suppression of Cariogenic Oscillations in Esophageal Pressure Signals Using Ensemble Empirical Mode Decomposition – Michael Zara, Ryerson University
  - (B) Respiration Rate Estimation From Noisy Electrocardiograms Based on Modulation Spectral Analysis – Raymundo Cassani, University of Quebec
  - (C) Myosim 2.0 – Enhancing and Validating an EMG Simulation Tool – Dawn MacLissac, University of New Brunswick
- (2) [Cross Canada Check in – Best Practices](#) - Ted MacLaggan
- (3) [Current Standards vs Best Practices in MDR/CSR/SPD Water Systems, Improving Patient Safety While Increasing Provider Productivity](#) – Mark Houghton, BaSC – Cantel

## EDUCATIONAL STREAMS

1. Academic Stream Papers – Brown Conference Room
2. Leadership Management Stream – Gray Conference Room
3. Technical/Clinical Education – Chandler Conference Room
4. CBET Training Course – McGee Steeves Conference Room

10:00AM-10:30AM **REFRESHMENT BREAK FOR DELEGATES**

10:30AM-11:30PM **BREAKOUT EDUCATIONAL SESSIONS**

- (1) [Biomedical Algorithms](#)
  - (A) Precision Health: A Personalized Approach to Active Health Management – Dr. Angela Rivoroll, UPEI
  - (B) Automated Detection of Anaerobic and Ventilatory Thresholds From Free-Form Biometric Data – Matthew Howe-Patterson
  - (C) Deep Convolutional Neural Network for ECG-Based Human Identification – Dr. Bahareh Pourbabae, OMSignal Inc.
- (2) [Cross Canada Check In – Best Practices Cont.](#) - Ted MacLaggan
- (3) [Hemodialysis Water System Design](#) - Dino Valente – MarCor

11:30PM-12:00PM **CLOSING CEREMONY AND PRIZES** – Gray Conference Room

12:00PM-2:00PM **CMBES AGM MEETING** – Johnson Conference Room

# Clinical and Academic Research Abstracts -

To view papers please go to <https://proceedings.cmbes.ca>

Wednesday, May 9, 2018

## DEVELOPING AN IN-HOUSE MRI MAINTENANCE PROGRAM: THE CHILDREN'S HOSPITAL OF EASTERN ONTARIO EXPERIENCE

Over the last seventeen years, the Clinical Engineering (CE) department at the Children's Hospital of Eastern Ontario (CHEO) has developed an imaging servicing group, starting first with the less complex modalities such as ultrasound and portable x-ray units and then gradually expanding to more complex modalities. By 2007, the only major equipment remaining on full service contract by the original equipment manufacturer (OEM) was the Hospital's two magnetic resonance imaging (MRI) units.

To start its own in-house MRI service, first, Clinical Engineering overcame concerns, and worked with Medical Imaging staff to develop a list of performance standards that would meet their expectations (Service uptime, savings, customer satisfaction and COSR). Next, CHEO leveraged an existing relationship with an experienced imaging independent service organization (ISO) for assistance on support such as: remote-monitoring tools, parts supply, and technologist support training.

The implementation plan identified the need for an extra full-time staff position. This resource can provide additional hours to bring the technical service of the OEM MRI in-house at CHEO, pursue additional regional service revenue, and give the imaging service group staffing redundancy.

This initiative to move MRI Service in-house has realized more benefits than anticipated. To date this project has achieved or surpassed all of the planned objectives of initiative. Highlights from this initiative are outlined in no particular order include: operational savings over \$230K, improved uptime and response time, high customer satisfaction, round-the-clock on-call service, flexible maintenance time booking, increased revenue generation capability and expanded service.

By careful planning, an experienced in-house imaging service group can be successful in providing in-house MRI service, and meet customer expectations by exceeding OEM performance thresholds. Through this article, CHEO Clinical Engineering Department has shown that this is achievable.

**Authors:** Mr. Mark Asbil, Mr. Bernard Boland, Mr. Martin Dussault, Mrs. Wendy Rabbie, Mrs. Marie-Ange Janvier, Ms. Y. Rachel Zhang, Mr. Kim Greenwood

## BENCHMARKING OF BIOMEDICAL ENGINEERING TECHNOLOGY EDUCATION PROGRAMS IN CANADA

The Biomedical Engineering Program at the British Columbia Institute of Technology (BCIT) completed a program review in 2016 which provided an opportunity to review the Program's relevance to the industry and services to learners. The constructive, collaborative, systematic, and research-based examination was leading to the development of an evidence-based action plan focused on program enhancements. The review included an in-depth study of the education design, industry demands and trends, student experience, quality of services, resources and facilities. Benchmarking of comparable BMET education programs was part of the process in the review.

**Authors:** Dr. Anthony Chan, Mr. Jochen Boehm

## CE DEPARTMENT STAFFING SURVEY

A recent survey of Canadian Clinical Engineering (CE) departments was conducted between the months of July 2017 to February 2018. The survey involved feedback from various managers and directors from a sample of approximately 22 CE departments from various provinces across Canada. This paper summarizes initial findings and benchmarks against a range of published and accepted CE departmental metrics.

**Author:** Mr. Steve Smith

# Clinical and Academic Research Abstracts -

## Wednesday, May 9, 2018

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### CLINICAL ENGINEERING STAFFING LEVELS ACROSS CANADA

This paper is a discussion of clinical engineering staffing levels in each of the provinces compared to a number of parameters of the health system. Data is presented on the organizational structures of clinical engineering in each province, as well as whether or not dialysis support and/or medical imaging support is provided. The staffing levels are then normalized to the number of hospital beds in each province, and to the population in each province. The average number of beds per clinical engineer across the country in 2018 is 40, but it ranges from 26 to 56 in different provinces. This paper is intended to provoke discussion as to what is the optimal way to organize clinical engineering services in a province.

**Author:** Dr. William Gentles

### DEVELOPMENT OF SALIVA-BASED CORTISOL BIOSENSORS USING SMARTPHONE-BASED IMAGE ANALYSIS

Cortisol, a steroid hormone, is important in a variety of physiological processes and follows a circadian rhythm throughout a day-night cycle [1]. Abnormal levels of cortisol can be contributed to diseases, but most notably, it is a cause of psychological and emotional stress. Therefore, cortisol is known to be a stress biomarker [1]-[3].

**Authors:** Dr. Rodolfo Nino-esparza, Dr. Angela Riveroll, Dr. Laurie Mcduffee, Dr. William Montelpare, Dr. Ali Ahmadi

### IMPROVING WRIST FORCE ESTIMATION WITH SURFACE EMG DURING ISOMETRIC CONTRACTIONS

In this paper, methods for selecting channels to improve estimated force using fast orthogonal search (FOS) have been investigated and a new method is proposed. The surface electromyogram (sEMG) signal acquired from linear surface electrode arrays, placed on the long head and short head of biceps brachii and brachioradialis during isometric contractions are used to estimate force induced at wrist using the FOS algorithm. In this paper, the effects of the sEMG signal characteristics obtained from the arrays and channels' locations on the estimated force are investigated to find channels resulting in force estimation improvement compared to using all available channels. Several methods for channel selection have been studied, showing that the sensitivity of the estimated force to the location of the channels is subject-dependent. The proposed method uses only the channels with highest mean of power spectrum density (PSD) and low cross correlations. The channels selected by this method have improved FOS force estimate compared to using all the available channels.

**Authors:** Ms. Gelareh Hajian, Dr. Behnam Behinaein, Prof. Evelyn Morin, Prof. Ali Etemad

### IN-HOUSE DESIGN AND CONSTRUCTION OF THE TORONTO LAP-NISSEN SIMULATOR

Simulators for surgical trainees are utilized to improve laparoscopic technical skills. Following the request and directions from Dr. Hideki Ujii and Dr. Kazuhiro Yasufuku's team, Maciej Bauer and Gad Acosta from the Surgical Support Group, Medical Engineering Department at the UHN, designed and constructed the Toronto Lap-Nissen Simulator.

As an in-house team, close collaboration and fluent communication was established with the clinical team, which enabled an efficient progression from the prototypes to the model used during actual training. The desired outcome was to produce an inexpensive and relevant model which would increase the comfort level of the surgical trainees who perform and assist with myotomy and fundoplication. The objective of this presentation is to illustrate the design process methods and materials used for the construction of the Toronto Lap-Nissen Simulator. The technical aspects for this device will be discussed.

**Authors:** Mr. Gad Acosta, Mr. Maciej Bauer, Dr. Hideki Ujii

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## TISSUE REALISTIC ANTHROPOMORPHIC ABDOMINAL PHANTOM FOR RADIOGRAPHY – 3D PRINTING

3D printing is an exciting tool in patient centered precision medicine. 3D printing tools have been demonstrated to be useful in medical education and for surgical planning. However, 3D printing is not commonplace in medical imaging (MI) departments. A successful 3D printing program in MI requires the close collaboration of a multi-disciplinary team that includes the radiologist, technologist, medical physicist and the biomedical engineer. This case study successfully demonstrates multi-disciplinary collaboration in designing and constructing an abdominal phantom with realistic radiological properties utilizing 3D printing methods.

**Authors:** Mr. Ali Ursani, Mr. Vahid Anwari, Ms. Shailaja Sajja, Ms. Ashley A Lai, Prof. Narinder Paul

# Clinical and Academic Research Abstracts -

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## DATABASE APPROACH TO CAPITAL MEDICAL DEVICE PRIORITIZATION

Each year in Canada, health organizations are tasked with prioritizing their capital medical devices (greater than \$5k) for replacement due to the limited capital dollars available. Many methods, algorithms and criteria have been suggested to assist with the prioritization of medical devices due for replacement. Most of these methods rely on a subjective and manual assessment. Drawing on some of these methods and the historical service data available from an online asset database (TMS), a semi-automated capital medical device prioritization algorithm was developed. This algorithm uses the data available from the asset service database to compute multiple values that factor into an overall Prioritization Value for each medical device. The method is mostly automated and only requires the user to export the data from the database to a Capital Prioritization Calculation Spreadsheet. The Spreadsheet calculates a Prioritization Value using four factors for all assets and models.

**Authors:** Mr. Martin Poulin, Mr. Cody Therrien

## IMPLEMENTATION OF A USEFUL LIFE REFERENCE FOR MEDICAL DEVICES IN CANADA

Having a reliable guideline of the length of time a medical device will provide value to the health system is useful for long term lifecycle management and replacement planning. There is no comprehensive Canadian reference for useful life of all types of medical devices. This paper describes a methodology used within the Winnipeg Regional Health Authority to establish a local standardized reference for useful life per device type. Local historical device lifespans were compared to existing literature sources to determine future expected useful lives. The final reference document establishes a common resource for replacement planning across our health authority and provides a template for calculating a national useful life for medical devices

**Authors:** Mr. Paul Prowse, Ms. Sarah Kelso, Ms. Rebecca Austman

## DEVELOPING A SYSTEM TO SUPPORT EQUIPMENT REPAIR VERSUS REPLACEMENT DECISION MAKING

As part of the life cycle management of medical devices, the Clinical Engineering (CE) Program is responsible for assessing the status of failed medical devices and determining appropriate corrective action. However, in the situation of a major equipment failure, there was no formal system in place to guide the process of deciding whether the device should be repaired (default action) or replaced. A literature review was conducted to search for established replacement policies and repair history analysis was done to learn more about the predominant failure patterns for sample fleets of medical devices. A decision-making process was developed to support CE in following



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a consistent, methodical approach to repair versus replacement decision making. This approach is intended to improve the confidence of decision makers and equipment owners, and provide adequate supporting evidence, when CE makes a recommendation to proceed with either a costly repair or equipment replacement.

**Author:** Ms. Sarah Kelso

## **MEDICAL DEVICE NEEDS SETTING FOR LONG-TERM CARE UNITS**

Healthcare facilities planning guides published by Quebec Ministry of Health and Social Services (MSSS) do not provide information on the minimum number of medical equipment required on the care units to support the mission of clinical and medical services. MSSS Technology Planning System (Actif+ Réseau) provides a standard nomenclature of medical devices and an associated management framework: service life, and replacement value. The creation in April 2015 of Integrated Centers of Care and Social Services resulted in the rapid development of the regions in terms of upgrading the technological platforms. This results in a multitude of development projects that require functional and technical programs (FTP). The list of medical equipment for an FTP is most often required in a very short term, or even a few days. Knowing that political decisions can lead to the realization of FTPs in even shorter timeframes, there is a risk of providing very partial information or an unsuitable technology; which is a risk factor for the budgeting of the project and, consequently, for the service to patients and the population. We propose here a first sketch of the distribution of equipment on a long-term care unit for patients with loss of autonomy. We hope that such an approach will lead to the creation by the MSSS of a Technology Planning Guide for health care units in Quebec healthcare facilities to standardize the level of equipment expected to ensure normal clinical and medical operations. The level of current equipment compared to the standardized target could be the basis for a technological performance indicator of health and social services institutions.

**Author:** Dr. Gnahoua Zoabli

## **VOLUNTEERING AT TWO CENTRAL AMERICAN HOSPITALS: A CANADIAN CLINICAL ENGINEER'S PERSPECTIVE**

Inaccessibility of medical equipment in low resource settings is a challenge and an obstacle to providing patient care. Some of the contributing factors to this problem are discussed in this paper based on the two-months volunteering experience of the author at two hospitals in Central America. This firsthand experience alludes to the shortage of functional equipment, impractical reliance on donated equipment, lack of equipment donation policy, inadequate healthcare technology management policies, and lack of technical resources. In order to have sustainable impact on improving accessibility of medical equipment, the clinical engineering professionals need to focus their volunteering work on developing local resources in order to increase local ownership and participation.

**Author:** Mrs. Parisa B

## **A BUSINESS CASE FOR USING REAL TIME LOCATING SYSTEMS FOR MEDICAL EQUIPMENT**

The high Census experienced by the hospital coupled with the high patient acuity, demands that health care provides have the right piece of equipment at the right time at the right place. There have been numerous instances where patient care delays occur because equipment is not located on time. Nursing personnel and other health care personnel waste valuable time as they need to search for the equipment and sometimes causes delays in patient care. The ability of health care providers to "locate" and retrieve equipment in a fast way, offered by the Real Time Locating System (RTLS), will help in the provision of excellent health care. This paper will present the development of a business case for the acquisition of an RTLS for the Hospital. It will also present some of the Use Cases that were used for developing a Request for Proposal (RFP) for an RTLS system.

**Author:** Mr. Mario Ramirez

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## **AGING EFFECTS ON THE PERFORMANCE OF A BRAIN-COMPUTER INTERFACE**

The increasingly aging demographic poses a significant challenge to the over-burdened healthcare systems, and the society in general. In recent years, there is substantial research efforts in emerging technologies address various challenges related to aging. Brain-computer interface (BCI) is one of these technologies that could play an important role in aging-related applications such as post-stroke neurorehabilitation. Currently, various signal processing algorithms for electroencephalogram (EEG) used in BCIs have been developed using data from much younger populations than the average age of stroke survivors. It is unclear how age-related changes may affect the EEG signal and consequently the applicability of these algorithms in Stroke population. This research investigated the EEG response to haptic stimulation from 11 younger ( $21.7 \pm 2.76$  year old) and 11 older ( $72.0 \pm 8.07$  year old) subjects. The results showed that the average BCI performance accuracies of a classic two-class scenario between the two groups of subjects were significantly different. The performance of older subjects was  $64.5 \pm 7.75\%$ , more than 20% lower than that of the younger subjects ( $85.3 \pm 14.1\%$ ) and statistically significantly different ( $t(20) = -4.3$ ,  $p < 0.001$ ). Future research in BCIs for aging-related applications should further investigate the reasons for such difference and find strategies to address this performance gap between the two groups.

**Authors:** Ms. Meilin Chen, Ms. Dannie Fu, Prof. Jennifer Boger, Prof. Ning Jiang

## **DEVELOPMENT OF A COMPLETE UPPER EXTREMITY MODEL FOR ASSESSMENT OF SHOULDER, ELBOW, WRIST, AND FINGER MOTION**

Upper extremity function is crucial to many activities of daily living, as well as to an individual's level of independence and quality of life. Several neurological disorders and diseases such as muscular dystrophy, spinal cord injury and stroke can negatively affect upper extremity strength and motion. According to the Public Health Agency of Canada, in 2013, approximately 741,800 Canadians were living with the effects of a stroke. It is estimated that between 50-80% of this population had to undergo some form of rehabilitation in order to regain movement and strength in upper limbs. A better understanding of human movement may improve treatment methods and evaluation of patient progress. The use of stereo-photogrammetry motion capture, for instance, can provide accurate quantitative information on upper extremity kinematics using comprehensive mechanical models. This information can help clinicians provide more effective treatment strategies. Most upper extremity kinematic models used in biomechanical and clinical research today do not include finger and thumb segments due to their complexity. In order to evaluate hand functionality, a hand kinematic model must be used separately. However, in the rehabilitation field, it has been shown that improving hand and wrist function improves how a patient moves their shoulders, and elbow. For this reason, when using motion capture to evaluate the progress of a patient with loss of hand motor ability, having a kinematic model that assesses shoulder, elbow, wrist, and finger joint motion is of paramount importance. The aim of this research was to develop and test the reliability of a complete upper extremity kinematic model, including the finger and thumb segments, that is feasible and clinically meaningful for the evaluation of upper extremity and finger motion.

**Authors:** Ms. Ana Paula Arantes, Dr. Usha Kuruganti, Dr. Victoria Chester

## **ADAPTING ISOKINETIC DYNAMOMETRY FOR INDIVIDUALS WITH TRANSRADIAL AMPUTATION: A NEW TOOL**

Upper limb amputations can have a significant impact on daily functions and affect the quality of life of an individual. There have been significant advances in the materials used to build these devices resulting in lighter and stronger artificial limbs; however, users have indicated that improved function and control strategies are desirable to become more in line with able-bodied limb function. Quantitative clinical assessment has been challenging due to the complexity of the muscle physiology of those with amputations. In addition, most clinical research has focused on studying isometric (stationary) limb movements. In order to develop more robust systems, it is critical to study muscle mechanics of those with amputations under dynamic (moving) movements. One method of safely examining

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dynamic movements is the use of isokinetic dynamometers. These machines allow measurement of upper and lower extremity isokinetic movements at controlled angular velocities while ensuring no stress is placed on the individual (even if the participant is unable to move the lever arm). For able-bodied participants, this does not present a problem. However, there is currently no commercially available isokinetic dynamometer adapter for prosthesis users. The purpose of this project was to develop an adapter that can be used by those with amputations to safely and effectively operate the dynamometer. The tool that was developed connects to the arm of the dynamometer and is adjustable for different residual limb lengths. The adapter was then used by one clinical patient to determine its effectiveness.

**Authors:** Ms. Jessica, Dr. Victoria Chester, Dr. Usha Kuruganti,

## DEVELOPMENT OF A NON-INVASIVE POINT-OF-CARE HEMATOCRIT SENSOR FOR ANEMIA DETECTION

Anemia, a condition characterized by insufficient oxygen delivery to cells and tissues within the body, affects approximately a third of the world's population. Causes of anemia can be attributed to malnutrition, low erythropoietin production, kidney disease, and forms of cancer. Current tests for anemia involve invasive blood sampling and costly diagnostic procedures to produce results. Through the development of a portable non-invasive hematocrit sensor to aid in the diagnosis of anemia at the point-of-care, detection and treatment of anemia can be improved. Using the variance of absorption of IR and red light of oxygenated hemoglobin (HbO<sub>2</sub>) and deoxygenated hemoglobin (Hb) a portable sensor was designed and created to determine oxygen saturation – the most reliable method of anemia detection.

**Authors:** Mr. Wyatt MacNevin, Ms. Haley Butler, Mr. Emad Naseri, Mr. Jorda Torrealba, Dr. Nadja Bressan, Dr. Gulrose Jiwani, Dr. Ali Ahmadi

## THE NEURA-FEAT POWERED EXOSKELETON; DESIGN AND CONTROL

Currently between 250,000 and 500,000 people globally suffer a life-changing spinal cord injury (SCI) each year increasing both the morbidity and mortality of those afflicted [1]. The design of robotic exoskeletons to support, protect and enable movement of disabled individuals have been developed for the past 35 years [2]. However, the successful design of a human like exoskeleton which act smoothly based on the person brain orders without external inputs still is a challenge. This paper presents the design of the Neuro-Feat exoskeleton which uses the brain signals through a brain computer interface to control the exoskeleton actions. The goal of this project is to help SCI people with a reliable, helpful and affordable exoskeleton help them in tackling daily life challenges without relying on others. The design requirements and the challenges for Neura-Feat evaluation comply with the regulations of the Cybathlon competition on 2020 in Zurich.

**Authors:** Mr. Jak Knight, Mr. Lucas Vanderaa, Dr. Nadja Bressan, Mr. Emad Nassere

## IMPROVE SUBTHALAMIC NUCLEUS LOCALIZATION DURING DEEP BRAIN STIMULATION SURGERY

Deep brain stimulation (DBS) is a treatment for movement disorders (e.g., Parkinson's Disease, or PD) in patients who cannot manage their symptoms with medications. DBS efficacy depends on optimal DBS electrode placement which is achieved by a laborious search of putative electrode sites requiring serial expert analysis of microelectrode recordings. Target localization can be made faster and more accurate with automation powered by machine learning. Faster and more accurate electrode placement can reduce surgical complications and improve patient outcomes.

**Authors:** Mr. David Chao-Chia Lu, Dr. Chadwick Boulay, Prof. Adrian Chan, Dr. Adam Sachs

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## DEVELOPMENT OF A LOW-COST, PORTABLE, AND NONINVASIVE OYSTER HEARTBEAT MONITOR

Aquaculture is an essential component of Prince Edward Island's economy. One portion of it is dedicated to oyster farming, which is greatly influenced by environmental conditions, such as seasonal temperatures and water salinity. These conditions affect the wellbeing of oysters and, consequently, reflect on the quality and taste of the produce. One method to characterize oysters' wellbeing is through the measurement of their heartbeats. Therefore, this paper presents the design of a non-invasive oyster heartbeat monitor that is built using off-the-shelf components to enable farmers to assess the quality of their product in real time. The paper also presents heartbeat measurements in deionized water and salt water.

**Authors:** Mrs. Tartela Alkayali, Ms. Heather Maclean, Ms. Zumer Fatima, Mr. Jean-Olivier Allaire, Dr. Nadja Bressan, Dr. Ali Ahmadi

## DEVELOPMENT OF A LOW-COST PORTABLE SENSOR FOR DETECTION OF TETRAHYDROCANNABINOL (THC) IN SALIVA

The design of a swab-based detector was developed for the detection of tetrahydrocannabinol (THC) in saliva. A gas sensor was used to differentiate among different concentrations of THC in water. The results show the initial proof of concept in detecting the presence of the THC. Further development is required to differentiate THC from other volatile organic compounds (VOC). Recommendations moving forward include integrating a microchannel and VOC filtering systems into the design to obtain a more selective device.

**Authors:** Mr. Mason Boertien, Mr. Robert Smith, Mr. Bryce Stewart, Dr. Walid Mazyan, Dr. Nadja Bressan, Dr. Ali Ahmadi

## DAILY MENTAL STRESS PREDICTION USING HEART RATE VARIABILITY

In this work, an accurate ECG-based daily mental stress level prediction strategy is presented. Multiple support vector machines (SVM) with linear kernel functions are individually trained to predict daily stress levels of women who participated in the OMSignal MyHeart project. In this study, participants are asked to answer a daily survey to determine the quality of their sleep, exercise, valence, control and rumination during the last 24-hour. Using the aforementioned items, a daily stress score was defined to be used as the target value for constructing the stress prediction model. The model is designed to use heart rate variability (HRV) metrics calculated from a 5-minute data window moving over daily ECG recordings. The features including the first five minimum and maximum values of standard deviation of the NN-intervals (SDNN) and root mean square of the successive differences between normal heart beats (RMSSD) as well as heart rate are extracted to represent each individual daily ECG record. The leave-one-out cross-validation method is used to train and validate our user-dependent SVM model. On validation data, an average accuracy of 82.25% is achieved for predicting daily stress scores of the users with sufficient number of daily survey data.

**Authors:** Dr. Bahareh Pourbabaei, Dr. Matthew Patterson, Mr. Robert Brais, Mr. Eric Reiher, Dr. Frederic Benard



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## **SUPPRESSION OF CARIOGENIC OSCILLATIONS IN ESOPHAGEAL PRESSURE SIGNALS USING ENSEMBLE EMPIRICAL MODE DECOMPOSITION**

Several clinical parameters associated with a patient's respiratory health can be derived from esophageal pressure (Peso). However, cardiogenic oscillations (CGOs) are a major source of interference in Peso signals, which makes it difficult to accurately monitor respiratory mechanics. In this study, we present a CGO suppression scheme using Ensemble Empirical Mode Decomposition (EEMD). The proposed method was applied to clinically recorded Peso signals from four mechanically ventilated patients, and was used to decompose the tracings into their intrinsic mode functions (IMFs). Ignoring the IMFs associated with CGO during the reconstruction process resulted in a signal with significantly reduced amplitude fluctuations. The magnitude spectrum of the reconstructed signal further indicates that the higher frequency components of CGO have been removed. Preliminary results suggest that the method described in this study has the potential to be used in the clinical domain for denoising Peso signals.

**Authors:** Mr. Michael Zara, Dr. Irene Telias, Dr. Lu Chen, Dr. Takeshi Yoshida, Dr. Laurent Brochard, Dr. Sridhar Krishnan

## **RESPIRATION RATE ESTIMATION FROM NOISY ELECTROCARDIOGRAMS BASED ON MODULATION SPECTRAL ANALYSIS**

This paper presents a novel method to estimate the respiration rate (RR) from a noisy electrocardiogram (ECG) signal. The method exploits the second order periodicity of the ECG signal, caused by the influence of respiration, and relies on the so-called modulation spectral signal representation to quantify RR from the noisy ECG. The methodology is validated on two datasets, one collected at rest using medical-grade sensors and another with users wearing an off-the-shelf smartshirt throughout their workday. The paper also explores the impact of ECG recording duration on RR estimation. Results show that ECG signal recordings of 120 seconds, or longer, lead to an adequate RR estimate with error percentage <12.5%.

**Authors:** Mr. Raymundo Cassani, Prof. Shrikanth Narayanan, Prof. Tiago H. Falk

## **MYOSIM 2.0 - ENHANCING AND VALIDATING AN EMG SIMULATION TOOL**

In 2006, we presented a MATLAB tool called Myosim, which allows users simulate signals measured through surface electromyography (SEMG). Based on user input, the tool sets generative model parameter values such as the geometry of each fibre in each motor unit relative to the electrode location, the number of motor units, the number of fibres per motor unit, conduction velocity and firing statistics. Using the parameter values, the tool then outputs an SEMG signal based on a finite length model of muscle and a convolution between action potential source and tissue filter. Recently we have made updates to the tool which improve the underlying model used to generate the signal, and allow users to add instrumentation effects associated with the data capture process including baseline noise, band-pass filtering, and quantization. We have also used a genetic algorithm to select generative model parameter values which optimize matching between real and simulated signals, to validate that the tool produces output representative of SEMG.

**Authors:** Dr. Dawn MacIsaac, Mr. Shriram Tallam Puranam Raghu, Mr. Yiyang Shi

## **PRECISION HEALTH: A PERSONALIZED APPROACH TO ACTIVE HEALTH MANAGEMENT**

According to the National Institute of Health (NIH), precision medicine is "an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment and lifestyle for each person" (1). The precision medicine approach has delivered effective personalized treatment strategies tailored for the individual. In the field of pharmacogenetics, computer algorithms that integrate an individual's unique genetic code and clinical information are used to calculate more precisely warfarin dosage (2). This innovation prevents under-dosing or over-dosing, which can result in clotting or bleeding in patients respectively. However, the term precision medicine has strong connotations as a reactive treatment for existing health conditions in patients and

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is limiting as a term for representing a more prominent focus on disease prevention in healthy persons. In contrast the term precision health better reflects an emphasis on proactive health management in individuals (3). Precision health still has at its foundation a tailored approach, but emphasizes proactive versus reactive health care and focuses on how lifestyle and environmental conditions can be modified to extend well-being including health across the lifespan (4). This paper will present concepts on how key determinants such as person/client engagement, biological research including “omics”, information technology research, and translational health research can establish precision health as the gold standard in active health care management. Mechanisms to facilitate the operationalization of precision health are discussed.

**Authors:** Dr. Angela Riveroll, Ms. Katherine Thompson, Mr. Kyle Robertson, Ms. Anja Salijevec, Dr. William Montelpare

## **AUTOMATED DETECTION OF ANAEROBIC AND VENTILATORY THRESHOLDS FROM FREE-FORM BIOMETRIC DATA**

As an athlete, knowing one's ventilatory and anaerobic thresholds (VT and AT respectively) can enable a more effective training regimen. The athlete can optimize his endurance by training at his VT, he can optimize his power and speed by training over his AT. Normally, determining these thresholds requires a subject to go through an incremental exercise protocol while their volume of O<sub>2</sub> inhaled (VO<sub>2</sub> in L/min) and their total ventilation (VE in L/min) are measured. OMSignal apparel and algorithms can measure heart rate, breathing rate, and a unit-less correlate of breathing volume, providing the potential to find a subject's VT and AT without the use of a metabolic cart.

A system is presented for the automated detection of the heart rate that corresponds to a persons ventilatory and anaerobic thresholds (VT and AT). In most cases, the system is capable of providing a reasonable estimate of the AT and VT after 5 free form runs, ie. without a pre-specified protocol. The system automatically determines the AT and VT from this data, closely approximating the values determined by the previously used manual process relying on a human annotator. Due to the difficulty of analyzing free form running data, a sufficiently accurate algorithm has thus far been elusive. Using a sequence of filters and algorithms, automatic AT and VT determination is cast as a computer vision problem, and finally solved with a random forest. On a test set of 40 users, the AT and VT determined by the system were both within 10 BPM of the manually determined values in 95% of the cases, and were both within 7.5 BPM in 85% of the cases. The largest differences occurred on users that had ventilation-HR curves that showed ambiguous inflection points or low variation. Additionally, the system's AT and VT assessments were compared against ground truth values determined by a metabolic cart system on 9 users while they underwent an incremental exercise protocol. The mean absolute error of VT and AT were 3.56 BPM and 4.75 BPM respectively. The remaining errors are likely due to inherent uncertainty of using free form data as opposed to a regimented protocol. Use cases requiring more precision or reliability should use such a protocol.

**Authors:** Mr. Matthew Howe-Patterson, Mr. Eric Reiher, Dr. Matthew Patterson, Dr. Frederic Benard

## **DEEP CONVOLUTIONAL NEURAL NETWORK FOR ECG-BASED HUMAN IDENTIFICATION**

In this work, a deep convolutional neural network (CNN) is developed to identify individuals using their electrocardiogram (ECG) signals that are collected by OMSignal apparel from 33 women while doing their daily activities. The signature windows including 10 consecutive heart beats are extracted from the filtered ECG signal to be applied to the CNN model. The network performance is evaluated on validation and testing data sets. On validation and testing data sets created from different recordings of the same participants, an overall window accuracy of 95.25% and 95.95% are respectively achieved. Using majority voting classification across all collected windows, 100% of the participants with more than five ECG daily recordings are correctly identified.

One of the main advantages of this work besides high accuracy, is to simplify the feature extraction process and to remove the need for extracting hand-crafted features unlike conventional methods available in the literature.

**Authors:** Dr. Bahareh Pourbabaee, Mr. Matthew Howe-Patterson, Mr. Eric Reiher, Dr. Frederic Benard

# Speaker Bios & Abstracts - Wednesday, May 9, 2018

**Creating a Real-Time Healthcare System with Clinical Communication and Collaboration Technology** – Benjamin Kanter, MD, FCCP, Chief Medical Information Officer, Vocera Communications, Inc.

**ABSTRACT:** In an era of the Internet of Medical Things, a robust Clinical Communications and Collaboration (CC&C) platform enables clinically meaningful interoperability, while permitting administrative simplification. Additionally, the right CC&C solution provides real-time situational awareness, is device agnostic and unifies all modes of communication (both voice and text) on the same platform. With a single platform, alarm management, on-call staff scheduling, and other workflows are easily layered to streamline care team communication and collaboration. Without a CC&C solution, a Real-Time Healthcare System (RTHS) is impossible because contextual patient data is not available and cannot be acted upon. A CC&C solution effectively provides the ‘central nervous system’ for the RTHS, providing tools that enable systems and clinicians to communicate and share information quickly. In this session, learn more about the importance of real-time situational awareness and how health systems are using a single CC&C platform to speed up care team response times, reduce interruption fatigue, and increase patient care, safety and satisfaction, while elevating staff experience and well-being.



**BIO:** Benjamin Kanter, MD, FCCP, joined Vocera as Chief Medical Information Officer (CMIO) in January 2017. Prior to joining Vocera, Dr. Kanter worked as an industry consultant and thought leader with innovative healthcare IT companies, including Extension Healthcare, where he was the CMIO, Sotera® Wireless, where he served as Chief Medical Officer, and AirStrip Technologies as a consultant.

Dr. Kanter also served as the CMIO at Palomar Health in San Diego, where he spent seven years on the executive management team. He was a medical staff leader, chairing the departments of medicine at both Palomar Medical Center and Pomerado Hospital, where he was also Chief of Staff. Under Dr. Kanter’s leadership, Palomar Health achieved EMRAM level-6 at both hospitals prior to his departure in 2014.

Dr. Kanter earned his medical degree and completed internal medicine training at Northwestern University. He completed post-doctoral studies in both pulmonary disease and critical care medicine at the U.C.S.D. Medical center in California, where he remained on clinical faculty after graduation.

He is board certified in internal medicine, pulmonary disease and medical informatics. He has been a member of several corporate advisory boards, including Cisco, Nuance, AirStrip Technologies, and Spyglass Consulting. Dr. Kanter is also a published author and frequent speaker on how to seamlessly and securely integrate technology with medical practice. In 2013, Dr. Kanter was the SoCal nominee for the HIMSS Physician IT Leadership Award, and in 2015 received the Steven S. Tanaka Renaissance award from Palomar Health.

**Anesthesia – Past, Present and Future... - Paul Terry, Senior Clinical Applications Specialist, Draeger Medical Canada Inc.**

**ABSTRACT:** A brief history of anesthesia, through to the innovations in today’s marketplace with a look into the different types of anesthesia and ventilation available today.

**BIO:** Paul Terry has over 20 years of clinical experience within the Operating Room and Emergency Department settings. Paul started his career at the Queens Medical Centre Nottingham University Hospital in Nottingham, U.K. as an Operating Department Practitioner working in both the Adult & Pediatric OR’s before moving into the commercial sector with Draeger U.K. nine years ago.



# Speaker Bios & Abstracts - Wednesday, May 9, 2018

Paul was the lead clinical applications specialist for the launch of the Zeus IE anesthesia device in the U.K. and joined Draeger Medical Canada Inc. in 2013, when the Zeus IE was launched in Canada.

## **Evidence Based Maintenance – Binseng Wang, Directory, Quality & Regulatory Affairs, Greenwood Marketing, LLC**

**ABSTRACT:** After dispelling the initial false alarm of electric shocks, the clinical engineering (CE) community spent decades attempting to develop rational methods to improve medical equipment maintenance at lower costs. Analyses of data collected in the USA and UK have proven that the amount of patient incidents caused by maintenance errors is much lower than the Six Sigma quality level sought by world-class manufacturing companies. Nevertheless, many government agencies and manufacturers are still skeptical that it is possible to maintain equipment safely and effectively without following strictly manufacturers' recommendations. Several methods of planning and evaluating maintenance strategies have been proposed and tested with limited success, such as "Risk-Based Criteria" and "Reliability-Centered Maintenance (RCM)". A new one is Evidence-Based Maintenance (EBM) which has been defined as "A continual improvement process that analyzes the effectiveness of maintenance resources deployed in comparison to outcomes achieved previously or elsewhere and makes necessary adjustments to maintenance planning and implementation." EBM treats each piece of medical equipment as a "black box" and used the scientific method of detecting different outcomes caused by varying inputs to choose the most appropriate maintenance strategy. By comparing the failures causes found during repairs and scheduled maintenance (outcomes) after the adoption of different maintenance strategies (inputs), CE professionals can determine the least resource intensive maintenance strategy without sacrificing equipment safety and reliability. Results of initial EBM studies have confirmed that most manufacturers' recommendations are excessive and unnecessary and, thus it is possible to obtain appreciable reductions in labor and parts costs.



**BIO:** Binseng Wang is Directory, Quality & Regulatory Affairs for Greenwood Marketing, LLC formerly WRP32 Management Inc. A medical device management and manufacturing company located in White Plains NY, USA. Previously, he worked as:

- VP, Quality & Regulatory Affairs for Sundance Enterprises Inc. (a manufacture of devices for pressure ulcer prevention and treatment)
- Adjunct Professor with the Biomedical Eng. Program - Dept. Electrical Eng. & Computer Science, Milwaukee School of Engineering (MSOE)
- VP, Quality & Regulatory Compliance for Aramark Healthcare Technologies (the largest independent service organization in the US at that time)
- VP, Quality Assurance & Regulatory Affairs for MEDIQ/PRN Life Support Services, Inc. (The largest medical equipment company in the US at that time)
- Visiting scientist with the National Institutes of Health and Special Adviser on Medical Equipment to the Secretary of Health's in Sao Paula State, Brazil
- Earned a Doctor of Science degree from the Massachusetts Institute of Technology (MIT) and is certified as a Clinical Engineer and ISO 9001 Auditor.
- Fellow of the American College of Clinical Engineering (ACCE) and American Institute of Medical & Biological Engineering (AIMBE)
- Received the 2010 Association for the Advancement of Medical Instrumentation(AAMI) Clinical/Biomedical Engineering Achievement Award and the ACCE Lifetime Achievement award in 2015. Inducted into the CE Hall of Fame in 2017.



# Speaker Bios & Abstracts - Wednesday, May 9, 2018

## **Engineering Patient Safety: Design and Implementation of a Surveillance Monitoring System - Sue McGrath, PHD**

**BIO:** Dr. McGrath has a B.S. in Electrical Engineering from Drexel University and M.S. and Ph.D. in Biomedical Engineering from Rutgers University. She worked for the Naval Air Warfare Center from 1984-1997 and Lockheed Martin from 1998-2000, where her research focused primarily on intelligent software development for military applications. Dr. McGrath was at the Thayer School of Engineering at Dartmouth College from 2000-2011, where as a faculty member she developed and taught courses in electrical, computer, and biomedical engineering and led research in mobile computing and intelligent software applications for biomedical, emergency management, and command and control applications. McGrath joined Dartmouth-Hitchcock Medical Center in 2011. In her role as Director of Performance Improvement she led the development and operation of the Value Institute until 2014. She is a certified Lean Six Sigma Blackbelt. McGrath continues to lead design and development of patient safety systems as Director of Research in the AHRQ-supported Patient Safety Learning Laboratory. The laboratory is currently focused on failure to rescue systems and early detection of patient deterioration. She was chair of the Chair of the D-H Clinical Monitoring Committee from 2014-2017, serves on the Department of Anesthesiology Research Committee, and is an Associate Professor at The Dartmouth Institute for Health Policy and Research at Dartmouth College.

## **Medical Device Cybersecurity: A Manufacturer's Perspective. A look inside at a Manufacturer's Challenges, Activities and Strategy for Building a Robust Cybersecurity Strategy - Scott Bristol**

**ABSTRACT:** A look inside at a manufacturer's challenges, activities and strategy for building a robust cybersecurity strategy.

**BIO:** Scott has been a professional in the Information Technology field for over 18 years, working as a System Engineer and well as in management. He has experience in corporate IT; consulting; data center and hosting; commercial software support; and medical device and IT products. Scott currently works for Draeger Medical as their Product Security Manager, where he is the Subject Matter Expert responsible for defining and realizing the global cybersecurity strategy for all current and future Draeger products to ensure that they will meet the growing cybersecurity requirements of customers and regulatory agencies. He is also provides direction to development teams regarding implementation of and compliance to secure development Lifecycle (SDL) practices.



## **Infection Prevention and Control for Clinical Engineering Professionals - Gordon Jasechko**

**ABSTRACT:** This session is co-presented by a biomedical engineer and an Infection Prevention and Control Practitioner. We'll discuss best practices for a Biomedical Engineering Department to keep the Biomed staff safe from infectious hazards encountered in the course of their work, as well as how they can recognize situations and equipment problems that might contribute to hospital acquired infections. Topics include:

- Summary of infectious organisms important in the clinical environment
- Summary of cleaning, disinfection, and sterilization methods and products
- Relevant organizational policies and procedures
- Infection Prevention and Control principles as applied to the work environment
- Hand Hygiene
- Maintaining a safe workplace
- Effective use of personal protective equipment
- Disassembly or inspection of grossly contaminated supplies or devices
- Standards for medical devices when returned to clinical service, stored, transported, or retired



## Speaker Bios & Abstracts - Wednesday, May 9, 2018

- Recognizing and reporting conditions that might result in cross-infection
- Promoting the purchase of and design of cleanable medical devices
- Collecting and sharing information related to the cleaning and disinfection of medical devices

Participants will be better prepared to reduce hospital acquired infections within their hospital.

**BIO:** Gordon graduated from Carleton University with a Bachelor of Engineering (Electrical) when Fortran programs were still loaded into computers using punched cards. Upon graduation Gordon worked at Nortel as a customer engineer. In this role, he could be found at the top of a telephone pole in the cold Winnipeg winters. He met the perfect girl, got married and left the wintry Ottawa climate to move to sunny Hamilton where Gordon completed his Master of Biomedical Engineering. Upon graduation, Gordon began working as a biomedical engineer for the Vancouver Island Health Authority and continues to do so. He believes Biomedical Engineering plays an important role in infection prevention and control. Gordon enjoys mentoring students and considers biomedical engineering one of the most fascinating and rewarding careers.

## Speaker Bios & Abstracts - Thursday, May 10, 2018

### **Toward True Professionalism: Cultivating a Workplace Environment for a Self-Actualization – Phil Kennedy**



**ABSTRACT:** Through lecture, discussion, and group work participants will understand the nature of the current professionalism crisis in North America. Participants will also learn how professionalism traits and characteristics are fundamentally associated with 'self-actualization', and how egotism is a major barrier to the process of self-actualizing. Participants will also learn strategies for cultivating a work environment that facilitates personal growth toward self-actualization, and which therefore promotes the development of truly professional traits and characteristics in employees and team members over time.

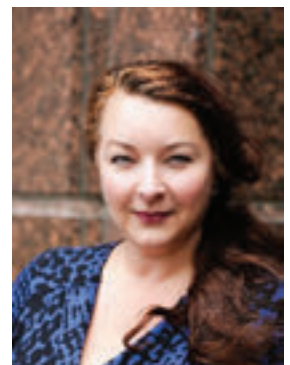
#### **BIO:**

- Radiological Technologist presently residing and working in Saint John, New Brunswick
- Attended University of New Brunswick and graduated from the Saint Joseph's Hospital School of Radiological Technology, in 1989
- Graduated from St. Francis Xavier University with a Certificate in Adult Education in 2006
- Has been program director for the Saint John School of Radiological Technology since 2005 and teaches a Health Care Professionalism course to new radiography students
- Recently authored an article published in the Journal of Medical Imaging and Radiation Sciences entitled, "Professionalism and Ego Management: Proposed Strategies for Understanding Professionalism and Dealing with Its Current Accelerating Decline"

### **Show Me the Evidence: Developing Capacity to Choose and Use Evidence to Inform Decisions – CADTH - Lisa Pyke, Kaitlyn Campbell, & Jennifer Boswell**

Lisa Pyke - Manager Implementation Support Team - Eastern Canada

**BIO:** Lisa Pyke is Manager with CADTH's Implementation Support Team in Eastern Canada. In this role, Lisa works with a team of passionate health care professionals dedicated to transforming how we manage health technologies in Canada, supporting better health and better value and a strong and healthy Canada. Lisa is trained as a Magnetic Resonance Imaging Technologist and Medical Radiation Technologist, Lisa also holds a Master's Degree in Health Leadership from Royal Roads University and is a certified Health Care Executive with the Canadian College of Health Leaders.



# Speaker Bios & Abstracts - Thursday, May 10, 2018

Kaitlyn Campbell - Research Information Specialist

**BIO:** Kaitlyn Campbell is a Research Information Specialist at the Canadian Agency for Drugs and Technologies in Health (CADTH), and a part-time Assistant Professor at the Department of Health Research Methods, Evidence, and Impact (HEI), McMaster University. Kaitryn is a healthcare researcher and an expert searcher, with nearly 20 years of experience in participating in the conduct of health technology assessments and systematic reviews of health sciences topics. Ms. Campbell provides instruction on health research methods on an ongoing basis to graduate students, industry, and the health sciences community. She holds undergraduate and teaching degrees from Queen's University, a Master of Library and Information Science (MLIS) degree from the University of Western Ontario, and a Master of Science (MSc) in Health Research Methodology from McMaster University.



Jennifer Boswell - Research Information Specialist

**BIO:** Jennifer Boswell is the CADTH Liaison Officer for Prince Edward Island and Veterans Affairs Canada. In this role, Jennifer supports health care decision-makers in her jurisdictions with making evidence-informed decisions about health technologies. Jennifer is a pharmacist who has worked in community and hospital settings. The majority of Jennifer's career has been spent working in the hospital setting in areas including the pharmacy dispensary, critical care, pharmacy clinical coordination, special projects, and antimicrobial stewardship.



**ABSTRACT:** Biomedical Engineers and other health leaders are increasingly tasked to review best available evidence and to be skeptical of the information provided, but what is the best way of doing this? How do you know if evidence is reliable? Is the source unbiased? Is the evidence based on high-quality methodology? How do you make decisions when evidence is sparse? How do you navigate controversial evidence? How do you do all of this in a context of high expectations and restricted resources?

Evidence comes in many forms, ranging from large trials to single case reports, and includes grey literature; each evidence type has its strengths and limitations. Some forms of evidence may contain bias, outdated information, or be based on opinion. Not all content or summarized research interpretations may be accurate or relevant. Finding quality evidence is another challenge - some websites have greater credibility, structure, and pre-screening for validity than others. With increased access to information and use of web-based information, professionals need a simplified approach to critically appraise evidence to determine quality and value. This interactive workshop session will provide a straight-forward, step-by-step approach to finding, interpreting and critically appraising evidence. Several real case examples will be used throughout the workshop to illustrate common issues that are unfortunately more common than we realize!

## **CBET Prep Education Course - Rick Tidman**

**ABSTRACT:** Biomedical Technicians and Technologists attending this course will review the information required for the successful completion of the BMET certification examination. The format of the exam will be discussed, as well as general study tips and techniques that will aid in preparation for the exam.

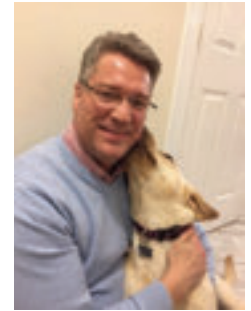
**BIO:** Rick has worked for more than 35+ years in the Biomedical Engineering technology field, including: in-house service, private sector service, private sector consultant and education. Currently he is Professor and Program Coordinator of the Biomedical Engineering Technology and Honours Bachelor of Health Care Technology Management programs at Durham College.



# Speaker Bios & Abstracts - Thursday, May 10, 2018

## OR Design Thoughts and Lessons Learned – Michael Barton

**ABSTRACT:** Regardless of the money spent on your equipment and renovation, ignoring fundamental room design elements will virtually guarantee dysfunction in your operating room (OR). Your architect can produce good designs, but only if he/she has all information. In fact, everyone on the design team has but a limited scope so, it is critical that everyone contributes during the design process. Biomedical Engineering has a key part to play in design as well as equipment selection/installation.



Being able to communicate expert level knowledge of how the various technologies for surgical lighting /booms as well as surgical services like MedGas, surgical video routing, etc are used is one of the key ways Biomedics can contribute to this design team. The clinical team should be able to focus on how they need to deliver care and the rest of the design team needs to bring them solution options to help them treat their patients. Complementary services like Biomedical Engineering need to be able to apply their hybrid skills that incorporate both the technical and clinical perspectives and work with the diverse design / implementation team to achieve a robust OR solution. We all share care responsibility for the patient on the OR table.

This talk will review some of the key considerations for room design, equipment options, and installation. Biomedical Engineering often is involved in room design as well as equipment selection / installation so, an appreciation for room flow and building system practicalities is critical. The CSA standards are the starting point and suggestions will be provided on how to customize to suit your clinical team's more specific needs. Equally important is a review of some of the different surgical technologies available today and how they can be incorporated. How do I help my clinical folks read a surgical light spec and select the light that will work best for them? What are some of the practicalities of implementing 4K video and then supporting it throughout its useful life? Should I have everything on booms or what should I keep as mobile and modular?

**BIO:** Michael has been involved in all areas of Biomedical Engineering in the hospital setting since 1998. He has had considerable exposure to the perioperative portfolio and has participated in or managed several dozen operating room renovations of many different scales. In addition to BScE and MScE degrees from UNB in Electrical and Computer Engineering (sub-specializing in Biomedical Engineering), Michael is also an accomplished artist. He always enjoys having the technical and creative realms complement each other for a richer and superior solution. "Form follows function" as they say, but sometimes form is the function when you are looking at how an operating room functions and flows!

## Interventional Radiology – Volcano – Dr. Sohrab Lutchmedial

**BIO:** Dr. Sohrab Lutchmedial is an interventional cardiologist at the New Brunswick Heart Center and the director of the centre's Research Initiative. Born in Quebec, he received his Bachelor's degree from Queens University in the field of biology and went on to study medicine at McGill University. After further training at McGill in internal medicine and cardiology, he was certified as a Fellow of the Royal College of Physicians and Surgeons of Canada in both fields in 1996 and 1999, respectively. Dr. Lutchmedial has been at the New Brunswick Heart Centre since 2000, with a focus on inpatient interventional cardiology. He was recently appointed the director of the Cardiac Catheterization Laboratory, and has many other roles at the NBHC including Editor in Chief of the yearly Heartbeat newsletter and a member of the Horizon Research Ethics Board. Research interests for Dr. Lutchmedial include Acute Coronary Syndromes, adolescent cardiac risk factors and disease, and coronary physiology.





# Speaker Bios & Abstracts - Thursday, May 10, 2018

## **An Innovative Approach and Technology Solution to Managing Clinical Alarms in the NICU at the IWK Health Centre – Marwan Abouelela, MD MHI Candidate, Julie McEvoy, CET, CBET**

Marwan Abouelela, MD, MHI Candidate

Clinical Informatics | Project Coordinator | Biomedical Engineering | IWK Health Centre

**BIO:** Marwan is a clinical informatics project coordinator at IWK Health Centre. He functions as a liaison between clinical teams, biomedical engineering and provincial IT teams to pilot and fully implement the newly developed clinical alarm strategy in the Neonatal and Pediatric Intensive Care Units (NICU, PICU). Marwan has a clinical background as a physician and is pursuing a master of health informatics at Dalhousie University. Marwan has more than a decade of project management practice in multinational pharmaceutical corporations. He is inspired to create integrated up-to-date information technology solutions into the current healthcare systems to pave the way to a more efficient and safe healthcare environment.



Julie McEvoy, CET, CBET Biomedical Engineering Technologist

**BIO:** Julie is a Biomedical Engineering Technologist at the IWK Health Centre in Halifax and where she supports neonatal, pediatric and women's services. Prior to coming to Halifax in 2010 she worked at SickKids Hospital in Toronto where she was a Biomedical Engineering Technologist and Team Leader. Julie is a graduate from the Electronics Technology program at RCC Institute of Technology and the Biomedical Technology program at Fanshawe College. She is a Certified Engineering Technologist (CET) with Tech Nova, a Certified Biomedical Engineering Technologist (CBET) and currently serves on the Canadian Board of Examiners for Biomed Certification in Canada. Julie is a mother to two daughters and in her spare time is a competitive curler.



**ABSTRACT:** Research confirms that more than 70% of clinical alarms are unnecessary. This exposes clinicians to a high volume of undesirable alarms. This alarm fatigue can be associated with an increased risk to patients. Nonetheless, some clinical alarms will signal care providers to life threatening situations requiring urgent intervention. As the IWK Health Centre embarked on redevelopment project to convert its old open bay NICUs to new single family room care environments, there was a need to develop a new clinical alarm management strategy. The key objective was to ensure patient safety which required us to balance robust response to actionable alarms, reduction of non-actionable alarms, limitations of care provider response, effective communication between team members, and maintenance of an appropriate healing environment. Join us to learn about alarm fatigue and how the NICU Alarm Management Task Force developed and implemented a strategy to manage clinical alarms in a new single family room environment in the NICU. We will discuss the technologies we integrated in our effort to ensure safe patient care, staff confidence, and family satisfaction.

## **From Donation to Transplant: Biomedical Engineering's' Role at the Regional Tissue Bank - Arlette Langille, Bsc, Dip, FS, CTBS**

**ABSTRACT:** An overview of tissue donation highlighting the equipment, instruments, and technology that enable the Regional Tissue Bank to provide the safest and most effective tissue to patients across the country. A brief look at the grafts we produce, how those grafts benefit patients, and what challenges we are currently facing.

**Bio:** Arlette moved to Halifax from the tiny village of River John, Nova Scotia, to attend Saint Mary's University. She graduated cum laude with a Bachelor of Science in Biology as well as a Diploma in Forensic Sciences. From there she started her career at the QEII Health Sciences Centre working in the Department of Pathology and Laboratory Medicine. Several years later, her fascination with postmortem anatomy led her to accept a position with the Regional Tissue Bank, where she is currently a Certified Tissue Bank Specialist. Her roles include the screening of





# Speaker Bios & Abstracts - Thursday, May 10, 2018

tissue donors, procurement of donated tissues, as well as the processing and distribution of the resulting tissue grafts. In addition, she provides support to the Bone Marrow Transplant Program through the processing and subsequent transplant of stem cell products.

## **Talking so People Will Listen and Listening So People Will Talk – Dawn MacIassac**

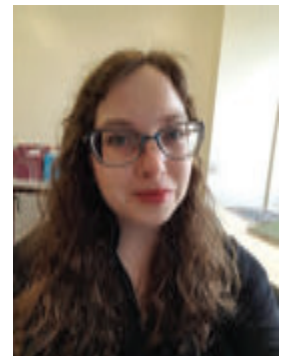
**ABSTRACT:** Reaching the people you work with is most effective when you all share a common ground. This can seem challenging given the diversity in current workplaces, especially in the clinical environment where engineers are working side-by-side with a diverse group of medical professionals including nurses, doctors, technicians and others. In this presentation we will explore different ways to establish common ground through respectful, inclusive and expressive communication strategies.

**BIO:** As a professor in both the Computer Science Faculty and Engineering Faculty at the University of New Brunswick (UNB), Dawn MacIassac has more than 18 years of experience teaching others how to communicate in a broad range of technical environments. An avid researcher with UNB's Institute of Biomedical Engineering, Dawn is co-director of the Health Technologies Lab which supports projects aimed at building collaborations between engineers and medical professionals.

## **Cytotoxic Agents – Erin Wentzell, Pharmacy Practice Assistant (Webinar Presentation)**

**ABSTRACT:** A very brief history of chemo – accidental discovery, major advances, treatments then and now. Types of cytotoxic drugs used in local hospital settings and what they treat/ how treatments work. PPE used by chemo prep technicians and nurses administering doses PPE for medical equipment maintenance. Deactivation of chemo and decontamination of equipment, including chemo spills

**BIO:** I graduated from Eastern College in 2012 and was licensed as a Registered Pharmacy Technician in 2015. I've been working for NSHA at the Victoria General Hospital since 2012, starting in the inpatient dispensary and quickly moving to the central CIVA/IVAD (sterile compounding) program. I've been compounding chemotherapy since 2013 and spent most of the last 5 years in a chemo hood. In early 2018 I moved to the Nova Scotia Cancer Care Program, working with the Systemic Therapy Program as a central coordinator for the Take-Home Cancer Drug Fund and the New Cancer Drug Fund.



# Speaker Bios & Abstracts - Friday, May 11, 2018

## **Cross Canada Check in – Best Practices – Ted MacLaggan**

**ABSTRACT:** Provide a cross country view & update from each provincial region. Generate an environment that encourages networking and allows attendees to get to know each other. Opportunity to learn & share best practices, efficiencies, and innovative ideas.

**BIO:** Tedford MacLaggan, MScE, P.Eng., began working in the field of Biomedical & Clinical Engineering in 1999 as a part-time student engineering technologist (Dr. Everett Chalmers Hospital - Fredericton N.B.) while completing his Undergraduate Degree in Electrical & Computer Engineering from the University of New Brunswick. Deciding to specialize in the field of Biomedical & Clinical Engineering, Mr. MacLaggan pursued a Master's Degree in Electrical Engineering as a student resident at the Institute of Biomedical Engineering, University of New Brunswick. Following graduation, Mr. MacLaggan participated in a 3



# Speaker Bios & Abstracts - Friday, May 11, 2018

month mission trip to Bembereke, Benin located in West Africa where he assisted in the repair/service of medical equipment.

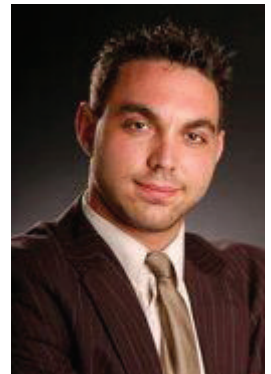
Mr. MacLaggan has had the opportunity to develop and advance his career in the following hospitals and organizations:

- Health Associations of Nova Scotia – Clinical Engineering Safety Officer, 2005-2007
- Capital District Health Authority – Clinical Engineer, 2007-2010
- IWK Health Centre – Manager, Biomedical Engineering, 2010-2016
- Vancouver Island Health Authority – Manger, Biomedical Engineering, 2016-present

In the past year, Mr. MacLaggan provided project management and leadership to the installation of medical equipment and the opening of two new acute care hospitals located in Campbell River, BC (Sept 10, 2017) and Comox Valley, BC (October 1, 2017). In addition to managing and leading Vancouver Island's Central & North Island Biomedical Engineering teams, Mr. MacLaggan provides leadership & oversight to Alerts & Recalls, Provincial Preventative Maintenance Program, and Co-Chairs Biomedical Engineering's Medical Imaging Sub-committee.

## **Current Standards vs Best Practices in MDR/CSR/SPD Water Systems, Improving Patient Safety while Increasing Provider Productivity – Mark Houghton, BaSC – Cantel**

**ABSTRACT:** The program is a review of material published by CSA (Z314) and AAMI (TIR:34) on the subject of water treatment for use in medical device reprocessing. This will include a comparison between the current CSA Z314 standard, the AAMI TIR 34 report and the upcoming / updated CSA Z314 which closed for public comment in September of 2017. Other topics of discussion will include challenges with MDR water system design, design/installation elements to avoid, and the various use cases for differing water qualities as well as recommended testing protocols and frequency. Additionally, the rational for use of purified water in medical device reprocessing will be explored in detail with particular attention paid to the potential consequences, both direct and indirect, stemming from a lack of sufficient water quality. Beyond the repercussions of poor water quality and current literature, a practical review of necessary design elements and best practices will be presented so that providers can properly assess any new or existing water system for its suitability in the production of “critical” grade water. Finally, an open question period will allow the audience to ask questions particular to their given situation and allow for meaningful discussion on the challenges department operators and managers face with their current water systems/treatment regimen.



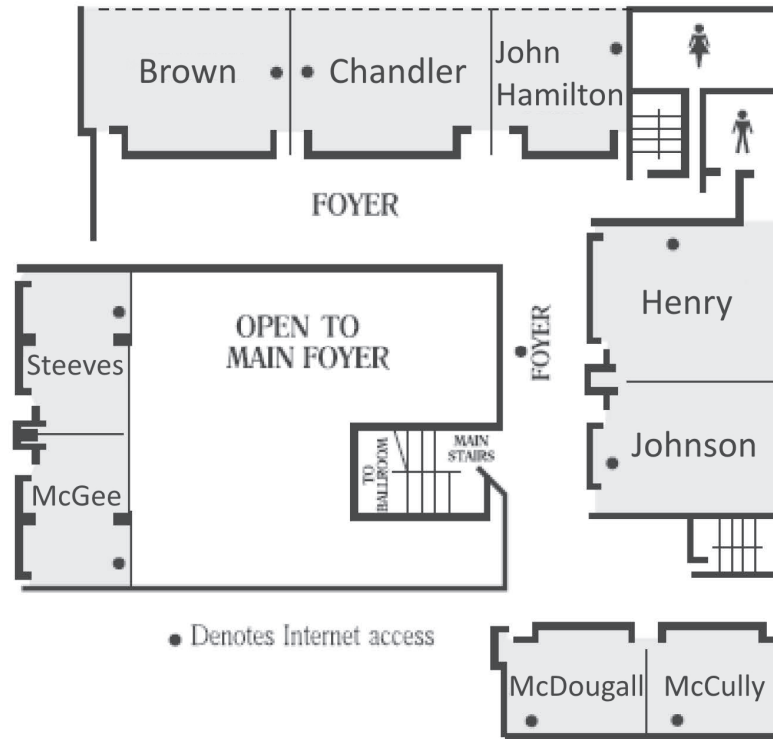
## **Hemodialysis Water System Design – Dino Valente-MarCor**

Bio: Dino Valente is a mechanical engineer (P. Eng) out of Concordia University with an extensive background in high purity water. Fort past 15 years with MarCor Purification, he has acquired an in-depth knowledge of the design of water purification systems which service the medical, pharmaceutical and other industries which use purified water.

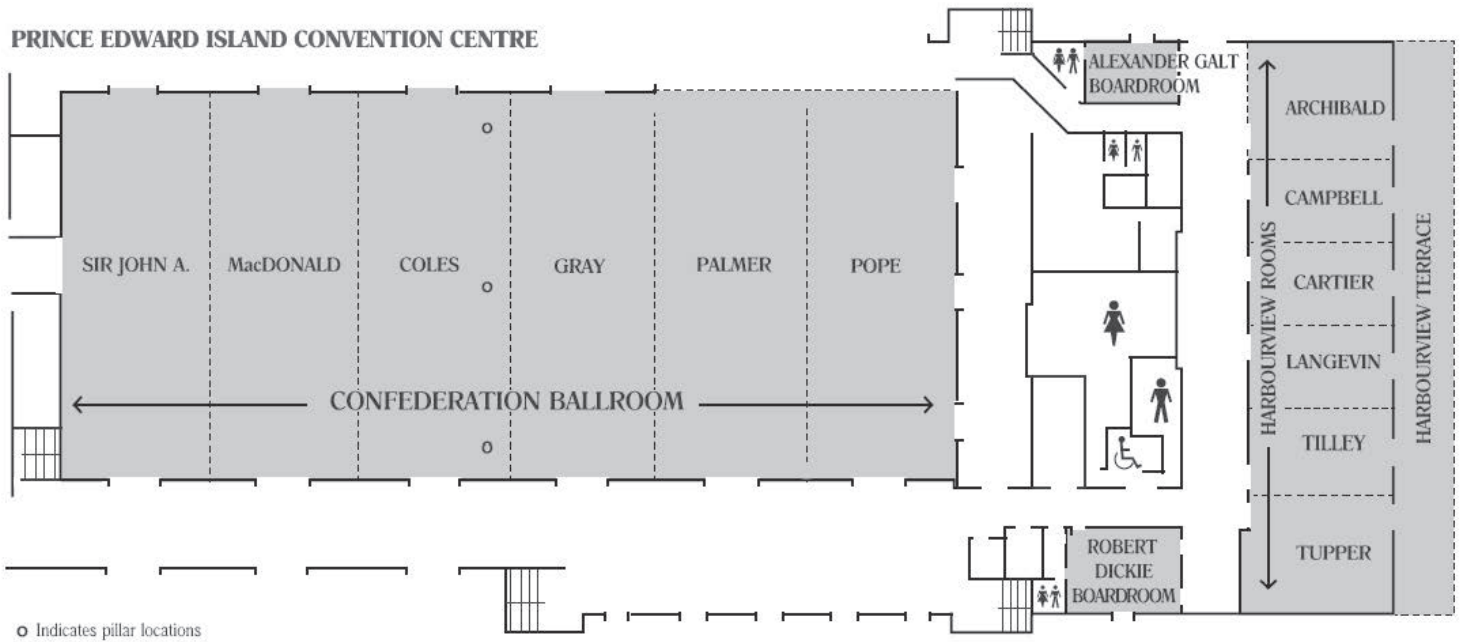


# Conference Map

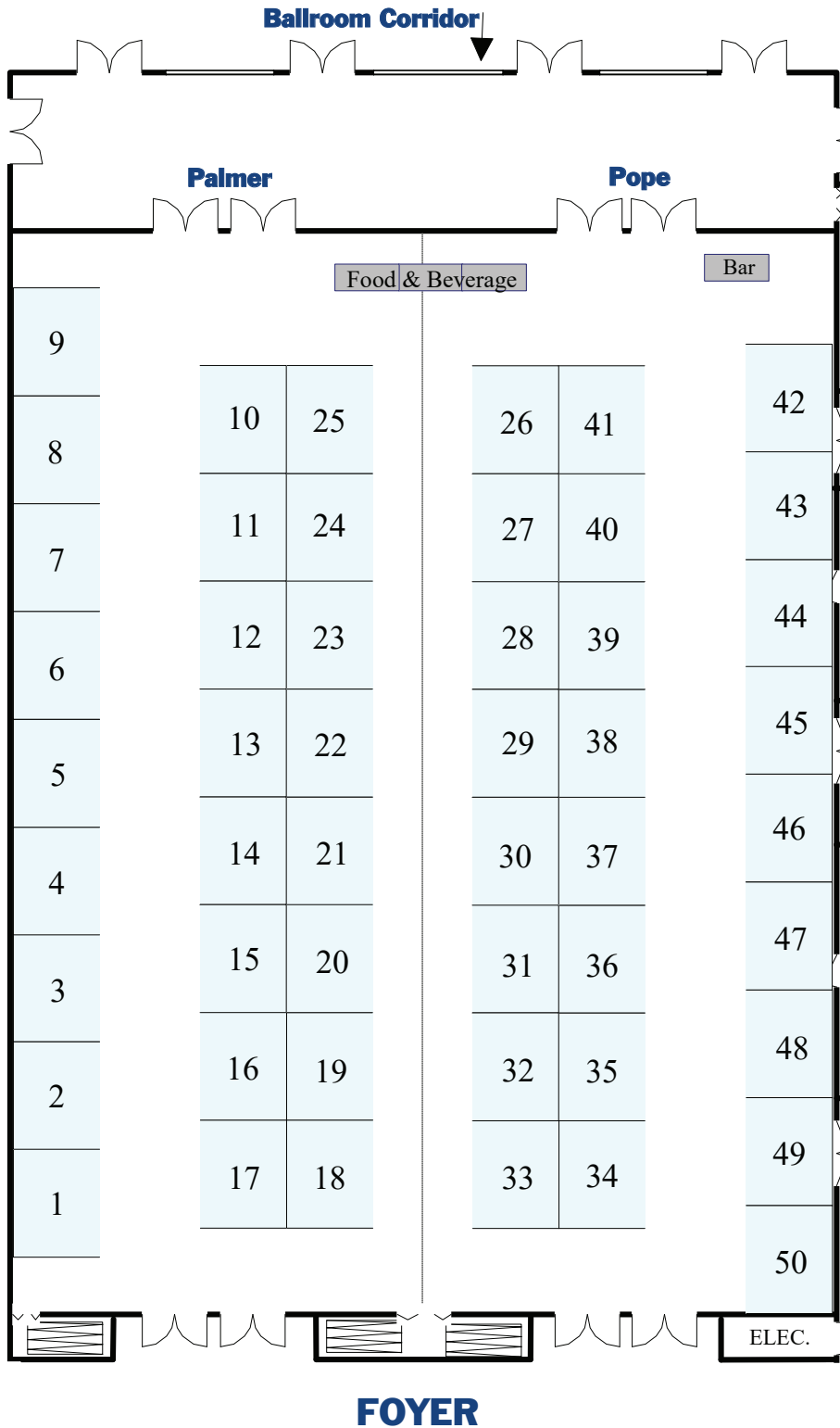
## DELTA PRINCE EDWARD - MEZZANINE LEVEL



## PRINCE EDWARD ISLAND CONVENTION CENTRE



# Exhibitor Floor Plan



## COMPANY WITH BOOTH NUMBER

- 1 Draeger Medical Canada Inc.
- 2 Draeger Medical Canada Inc.
- 3 Globestar Systems Inc. (Connexall)
- 4 BMES
- 5 GCX
- 6 ICU Medical
- 7 CSI Canada Inc.
- 8 ProMed Technologies
- 9 Philips Canada
- 10 Fresenius Medical Care Canada
- 11 AMICO Corporation
- 12 Valley Medical
- 13 Stryker
- 14 Stryker
- 15 B. Braun
- 16 Fresenius Kabi Canada Ltd.
- 17 Clear Power Solutions
- 18 MedSet Specialties Ltd.
- 19 Smiths Medical
- 20 Braemed
- 21 Umano Medical
- 22 Biolantic Services Inc.
- 23 BOMImed
- 24 BOMImed
- 25 Cantel Medical
- 26 Vantage Endoscopy
- 27 SciCan Ltd.
- 28 Fibertech
- 29 Cycom Canada Corporation
- 30 Getinge Canada
- 31 Getinge Canada
- 32 Canadian Hospital Specialties
- 33 Roxon MEDI-TECH Ltd.
- 34 Masimo
- 35 Hill-Rom
- 36 MISR/ANDA Medical
- 37 Medtronic
- 38 Atlantic Alarm & Sound
- 39 USOC Medical
- 40 Trudell Medical Marketing Limited
- 41 Can-Med Healthcare
- 42 Baxter
- 43 Vocera
- 44 Bracco Imaging Canada
- 45 Spacelabs Healthcare
- 46 Olympus Canada Inc.
- 47 BCL X-Ray Canada Inc.
- 48 Megamation Systems Inc.
- 49 Pacific Medical
- 50 GE Healthcare
- 51 Health Canada
- 52 Canadian Medical Equipment Protection Plan



## Entertainment... Gordie MacKeeman

Join us for an energetic evening of traditional East Coast music and help support the Pediatric Clinic at the Queen Elizabeth Hospital. Proceeds will go towards the purchase of much needed children's respiratory therapy equipment.

This will be the first 2018 PEI local show for the Prince Edward Island based combo coming off a month and a half Australia and Western Canada tour.

Gordie MacKeeman exemplifies the term natural showman. An ace fiddle player nicknamed “crazy legs” for his frenetic loose-limbed step- dancing, he just loves to perform. Combine that exuberance and onstage dynamism with the stellar musicianship of his multi-instrumentalist comrades His Rhythm Boys, and you have an unstoppable roots music force. That potent combination has made the group highly sought-after performers on the international roots music circuit, thrilling audiences from Adelaide, Australia, to Edinburgh, Scotland.

The hard-working combo has regularly delighted audiences at such major international festivals as Glastonbury, WOMAD, Celtic Connections, and the Orkney, Shrewsbury and Woodford Folk Festivals. In 2012, they won the Galaxie Super Nova Award at the Ottawa Folk Festival for their electrifying performance, while their 2015 and 2016 Music PEI Awards for Entertainer of the Year are also attributable to their performance prowess. Their first two albums collected multiple East Coast Music and Music PEI Awards in the roots categories, while Laugh, Dance & Sing won 2016 Music PEI Awards for Album, Group Recording, and Roots Traditional Recording of the Year.





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patient support equipment that we service is  
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# 2018 ACCES23/CMBEC41 Joint Conference Organizing Committee

Brent MacKinnon – Conference Chair  
Brett Fraser – ACCES President  
Martin Poulin – CMBES President  
Brendon McKenna – Entertainment/Menu  
Coordinator  
Phil Bradfield – Vendor Coordinator  
David Hancock – Vendor Coordinator

Gary Slaunwhite - Marketing Coordinator  
John Inch – Education Coordinator  
Nadja Bresson – Academic Coordinator  
Murray Rice – Academic Coordinator  
Amanda Saigeon – Budget/Finance Support  
Sarah Meades – Administrative Support

## Organizing Committee Subgroups:

Kyle Eckhardt – Vendor Group  
Gordon Jasechko – Education Group  
Ted MacLaggan – Education Group  
Pierre Caissie – Education Group

Robert Martin – Education Group  
Michael Barton – Education Group  
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Our Mission is to support clinical engineering professionals working in Atlantic Canada. We strive to develop and promote opportunities for continuing education, personal growth, sharing of experience, adoption of standards of practice and certification. We will represent our members to government and promote the profession within the healthcare community.

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## Special Thanks...

- ACCES23/CMBEC41 Joint Conference would like to thank the sponsors for the Pediatric Unit Fund Raising Concert Gordie MacKeeman and His Rhythm Boys. The support of the following sponsors has made the fund-raising event possible and significantly elevated the proceeds that will go towards much needed respiratory therapy equipment for the Pediatric Unit and in turn helping many children for years to come. Concert sponsors:
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- Thanks to the sponsors above, every dollar for every ticket after the first 40 tickets we sold is going directly to the Pediatric Unit. Proceeds will go directly towards the purchase of much needed respiratory therapy equipment.
- A great big thank you to the fabulous Alex Cross from Health Association Nova Scotia for all her work making this conference look great!
- A special thanks to the reviewers, judges, and session chairs who volunteered their time to the Academic and Paper Research part of the program: Michael Capuano, Murat Firat, Michael Hamilton, Andrew Ibey, Kelly Kobe, Andrea Saigeon, Dr. Ali Ahmadi, Dr. Kaaren May, Dr. Amy Hsiao, Dr. William Montelpare, Dr. Angela Riveroll, Brian Smyth, Brett Fraser and Brent MacKinnon.
- A very special thank you to all the volunteers who help make this event a success.
- Thank to the staff at the Delta, Freeman Audio and Global Convention Services for all their assistance with planning over the past year.
- Thank you to Natalia Kaliberda from The Willow Group for her assistance. It was greatly appreciated.







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