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Scientific Overview on CSCI-CITAC Annual General Meeting and 2018 Young Investigators' Forum

Abstract

The 2018 Annual General Meeting (AGM) and Young Investigators' Forum (YIF) of the Canadian Society of Clinician Investigators (CSCI) and Clinician Investigator Trainee Association of Canada/Association des Cliniciens-Chercheurs en Formation du Canada (CITAC/ACCFC) was held in Toronto, Ontario on November 19–20, 2018, in conjunction with the University of Toronto Clinician Investigator Program Research Day. The theme for the meeting was “Prepare for Success—Things to Master Now for Clinician Scientists in Training”; with lectures and workshops that were designed to provide knowledge and hands-on skills to navigate life as a clinician investigator. The opening remarks were by Jason Berman (President of CSCI), Josh Abraham (President of CITAC/ACCFC) and Nicola Jones (University of Toronto Clinician Investigator Symposium Chair). The keynote speakers were Dr. Ruth Ann Marrie (University of Manitoba), who received the Distinguished Scientist Award, Dr. Davinder Jassal (University of Manitoba), who received the CSCI-RCPSC Henry Friesen Award, and Dr. Aleixo Muise (University of Toronto), who received the Joe Doupe Young Investigator Award. Dr. Minna Woo (University of Toronto), Canada Research Chair in Diabetes Signal Transduction, delivered the keynote lecture “From Onion Cells to Single Cell Seq—A Constant Change in Lenses: A perspective of an evolving clinician scientist”.

The workshops, focusing on career development for clinician-scientists, were hosted by Drs. Robert Chen, Stephen Juvet, Lorraine Kalia, Phyllis Billia, Neil Goldenberg, Nicola Jones, Srdjana Filipovic, Jason Berman, Josh Abraham, Melanie Szweras, Joseph Ferenbok and Uri Tabori. The AGM also included presentations from clinician investigator trainees from across the country, and these abstracts are summarized in this review. Over 80 abstracts were showcased at this year's meeting during the poster session, with six outstanding abstracts selected for oral presentations during the President's Forum.

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Introduction to CITAC-CSCI AGM and emerging patterns of attendance

In 2018, Canadian Society of Clinician Investigators (CSCI) and Clinician Investigator Trainee Association of Canada (CITAC) held the Annual General Meeting (AGM) and Young Investigators Forum (YIF) on November 19–20 in Toronto, Ontario. Over 120 trainees participated, including 83 MD + (MD/PhD, MD/Masters) and 44 Clinician Investigator Program (CIP) and Surgeon-Scientist attendees. The theme of this year's AGM was "Prepare for Success—Things to Master Now for Clinician Scientists in Training" and featured talks and interactive workshops that aimed to allow aspiring clinician-investigators to become more proficient in writing and reviewing grant proposals, translating research findings, and navigating the world of patent applications and intellectual property. The 2018 AGM enabled trainees across Canada to network with other trainees, receive valuable mentorship from faculty and gain further knowledge and skills to further support their pursuit of a dual career.

Attendance at the AGM fluctuates by year, with a slight decrease in 2018 compared with 2017 (Figure 1). Since the 2015 meeting, the gap in numbers between MD+/CIP and male/female attendees has increased with the split of approximately 60%/40% (MD+/CIP) and 65%/35% (male/female). About two thirds of attendees submitted abstracts (Figure 2), most of which are published in summary form in this review. Similar to previous years, the University of Toronto (UofT) had the greatest attendee count (5 year attendance range: 77–109 attendees), with the University of Calgary (UofC) steadily in second place (5 year attendance range: 11–20 attendees). In terms of attendance, other top five academic institutions are traditionally Queen's University (Queen's), McMaster University (McMaster), University of British Columbia (UBC) and Western University (Western)—four of these five schools are located in Ontario. Of particular note is the lack of representation from francophone academic institutions, which may be due to language bias in meeting design and institutional connectedness.

FIGURE 1: Number of clinician-investigator trainees present at the CSCI-CITAC 2018 AGM

Abbreviations: CIP, clinician investigator program and surgeon scientist attendees; female, female attendees; male, male attendees; MD+: MD/PhD and MD/masters attendees

FIGURE 2: Total number of abstracts submitted for presentation at the CSCI-CITAC 2017 and 2018 AGMs

Footnote: Published abstracts were summarized and included in the Scientific Overview on CSCI-CITAC Annual General Meeting and 2017 Young Investigators' Forum and in the current publication (2018).

President's Forum Oral Presentations

Each year, six outstanding abstracts are selected for oral presentation during the President's Forum session. This year, abstracts by Moiz Hafeez (University of Calgary, UofC), Courtney Schubert (UofC), Karan (Josh) Abraham (UofI), Jeffrey Kenzie (UofC), Kevin Zuo (UofI), Siddharth Nath (McMaster) were selected.

Poster presentations

Basic science

Cardiovascular sciences

Charles Yin et al. (Western) presented their work on gene expression profiling of intima-infiltrating macrophages in initial stages of atherosclerosis. They found dysregulation in pathways involved in efferocytosis and cargo processing, and identified upregulation of the hematopoietic transcription factor GATA2 as the potential driver of this dysregulation.

Christopher McFaul et al. (UofI) are developing a light-sheet microscopy platform and quantitative image analysis that can characterize cell behaviors and molecular rearrangements in living *Drosophila* embryos. The team is also conducting a pharmacological screen for inhibitors of cardiac precursor migration. Ultimately, these novel methodologies will help identify novel pathways critical for cardiac tube formation.

Mark Chandy et al. (Stanford) presented their findings on vascular dysfunction in an induced pluripotent stem cell

(iPSC) model of insulin resistance. The authors were able to show patient-specific iPSC-derived endothelial cells to model insulin resistance and endothelial dysfunction with abnormal eNOS expression and endothelial cell function.

Tina Binesh Marvasti et al. (UofI) presented their work on the effect of pre-conditioning the myocardium with human CD34+ (hCD34+) cells through bone marrow engraftment in NSG mice. The authors found that hCD34+ cells protected the myocardium from functional decline following infarction, and concluded that restoration of aged hCD34+ cells has potential as a cell therapy for post-injury conditioning of the myocardium.

Cell and developmental biology

Madelaine R. Colden Leung et al. (McMaster) proposed a new approach to improve the efficacy of combination therapy in sepsis by inhibiting aminoglycosides-modifying and B-lactamases enzymes to restore the susceptibility of antimicrobial therapy such as aminoglycosides and B-lactamases.

Using a mouse model, Ali Zhang et al. (McMaster) showed that the combination of oseltamivir, a neuraminidase inhibitor, and broadly-neutralizing antibodies (bNAbs) designed to target the conserved hemagglutinin stalk of the Influenza A virus, was superior in preventing lethal Influenza A viral infections.

Benjamin Ewanchuk et al. (UofC) used an in vitro model to identify the role of gamma-interferon-inducible lysosomal thiol reductase (GILT) in bone resorption by osteoclasts.

This suggests an important role of anti-interferon-gamma and GILT biologics in osteoporosis and bone-related complications.

Courtney Schubert *et al.* (UofC) presented that the Pneumovax-23 vaccine against *Streptococcus pneumoniae* promoted survival of infected mice by innate B-cell-mediated tolerance of the infection, rather than by bacterial clearance. This mechanism may be crucial to future vaccine development, given that multiple clinical trials of vaccine candidates found the induction of neutralizing antibodies to be a poor correlate of vaccine protection.

Glenn Walpole *et al.* (UofI) used electron microscopy and fluorescence imaging to characterize the exocytic mechanism used by *Salmonella enterica* serovar Typhimurium in exiting infected host cells. Target disruption of bacterial effectors abolished exocytosis and allowed infected host cells to remain intact, providing important insight into systemic infection and cellular exit strategies by *Salmonella* species.

Siraj Zahr *et al.* (UofT) characterized the transcriptional landscape of radial glial precursors in the murine embryonic cortex to study how these cells differentiate and form the distinct layers of the cortex. They identified 4E-T-Pum2 as a key protein complex in superficial-layer neurons that represses deep-layer neuronal identity mRNAs during neurogenesis.

Using live-cell imaging, Henry Ogbomo *et al.* (UofC) found that natural killer cells require Eg5-kinesin to kill *Cryptococcus neoformans*. This mechanism may be impaired in HIV-infected patients, contributing to the risk of fungal meningitis.

Christopher Newell *et al.* (UofC) found mitochondrial DNA (mtDNA) in cell-free plasma and successfully used next generation sequencing to identify mtDNA related to mitochondrial diseases. This development may lead to the future use of blood samples for monitoring responses to mitochondrially-targeted therapies or stem cell transplantation.

Hannah Kozlowski (UofT) presented their work on hepatitis B virus genotyping using multiplexed recombinase polymerase amplification and quantum dot barcode technology. They demonstrated that this technology could be used as an easy alternative diagnostic technique for hepatitis B virus, with future studies investigating point-of-care diagnostic platforms.

Cancer biology

Daniel Kwon *et al.* (UBC) developed a radiotracer that images matrix metalloproteinases (MMP) within tumors. Future work will focus on optimization with the goal of

using intratumoral MMP tracking to provide prognostic information.

Sachin Kumar *et al.* (UofI) identified a U1-spliceosomal small nuclear RNA (snRNA) recurrent hotspot mutation in Shh-Medulloblastomas. They found that this mutation mediates alternative splicing, which inactivates tumor suppressor genes and activates oncogenes and highlights its potential as a therapeutic target.

Sara Mirali *et al.* (UofT) found that chemical and genetic inhibition of the mitochondrial protease, neurolysin (NLN) is selectively cytotoxic to acute myeloid leukemia (AML) cells. Mechanistically, they found that NLN interacts with the respiratory chain and promotes respiratory chain supercomplex formation. These findings highlight the therapeutic potential of targeting NLN in AML.

Sivakami Mylvaganam (UofT) studied the role of the immune cell transmembrane picket, CD44. They found that CD44 is enriched in the apical membrane and that selectin mobility increased in the absence of CD44. These findings build upon our understanding of how circulating leukocytes are recruited to sites of infection or injury.

In a cell line model of glioblastoma, Alice Yuan *et al.* (UofC) demonstrated that co-treatment with a PARP-1 inhibitor prevented the development of resistance to temozolomide (TMZ). As virtually all MGMT-methylated tumors develop resistance to TMZ, PARP-1 inhibition may be crucial to preventing or delaying disease progression in patients with glioblastoma undergoing TMZ therapy.

Ethan Malkin *et al.* (UofT) presented their findings on developing a method to quantify cell-free DNA (cfDNA) within neutrophils extracellular traps (NETs), with the aim of understanding how oxidized cfDNA from NETs promotes metastasis.

Jina Nanayakkara *et al.* (Queen's) generated miRNA expression profiles from 7,714 clinical samples from various tissues, cell lines and body fluids by barcoded small RNA sequencing. Future work will focus on creating an atlas of human miRNA expression and defining the tissue specificity of each miRNA.

Kevin Fan *et al.* (UBC) used whole genome and whole transcriptome sequencing of patients with metastatic cancer to identify biomarkers that predict response to checkpoint inhibitors. They found novel targets that are resistant to checkpoint inhibitors. This work highlights the potential of sequencing to better prescribe checkpoint inhibitors.

Tony Chen *et al.* (McMaster) presented their work on designing an shRNA screen to identify gain-of-function splice changes in myelodysplastic syndrome (MDS). The goal of the study is to identify spliced exons essential to MDS viability and to explore their potential as therapeutic targets.

Alvin Qiu et al. (UBC) studied the mechanism of the fusion oncoprotein SS18-SSX in primary human and mouse synovial sarcomas. They found that KDM2B binds hypomethylated CpG islands and recruits SS18-SSX and BAF to drive tumorigenesis.

Neuroscience

Jasmine Khan (UofO) presented their work on elucidating the metabolism of the protein parkin in the human brain through characterization of new monoclonal antibodies. Parkin antibodies were created and validated for specificity in various in vitro models; studies are ongoing to validate their ability to detect parkin in the brain.

By administering the neuroactive bacteria, *Lactobacillus rhamnosus* (JB-1), to mice under different stress conditions, Aadil Bharwani, et al. (McMaster) investigated the influence of microbiota on stress-induced behavioural and neural changes. They found that JB-1 attenuated deficits in social and anxiety-like behaviours produced by chronic stress and activated serotonergic and noradrenergic nuclei.

To better understand the role of microglial P2X7 receptor (P2X7R) in both opioid tolerance and hypersensitivity in neuropathic pain, Heather Leduc-Pessah et al. (UofC) used a rat model of peripheral nerve injury (PNI) and blocked a tyrosine phosphorylation site on the receptor in vivo. They discovered that this blockade attenuated the development of morphine tolerance and reversed established allodynia.

Kirill Zaslavsky et al. (UofI) designed a coculture system to study the connection between autism spectrum disorder (ASD) and synaptic scaffolding gene, SHANK2 mutation. After generating cortical neurons from induced pluripotent stem cells (iPSCs), derived from neurotypic and ASD-affected donors, they observed striking increases in total synapse number and dendrite complexity, as well as increased excitatory synapse function, in SHANK2 compared with control neurons. Their results support SHANK2 as being a negative regulator of connectivity in developing human neurons.

Wissam Nassrallah et al. (UBC) are investigating the relationship between sigma-1 receptors (S1Rs), which reside in the endoplasmic reticulum and regulate calcium levels, and Huntington's disease. They are utilizing an array of techniques, and a YAC128 HD mouse model, to investigate whether S1R agonist can rescue impairments in motor learning.

Hailey Pineau et al. (UofA) are using a prion organotypic slice culture assay (POSCA) to model strain-specific pathology in prion disease. They intend to assess the usefulness of POSCA for whole-brain coronal slices and for

modeling strains of Alzheimer disease (AD). Developing a whole-brain strain-specific ex vivo model will help advance the field of AD and prion research toward identifying effective treatments for these diseases.

Nicole Burma et al. (UofC) sought to specify the role of microglial pannexin-1 (Pannx1) channel, a novel therapeutic target in opioid withdrawal, in other aspects of opioid usage. Using mice in which Pannx1 was deleted from microglia, they found that Pannx1 has no effect on the development of analgesic tolerance or hyperalgesia induced by opioid usage.

Yining Chen et al. (Queen's) induced strokes in *Cynomolgus* macaques that were trained on a visually guided reaching task on the Kinesiological Instrument for Normal and Altered Reaching Movements (KINARM). Using robotic assessment tools enabled them to accurately measure the deficits in the non-human primates' chronic stroke state compared with pre-stroke performance, highlighting the potential usefulness of these tools for measuring function in stroke patients.

Engineering

Amanda Khan et al. (UofI) presented their work on the investigation of compressive forces on gastrointestinal organs during laparoscopic surgery. They designed a compression apparatus to objectively measure crush pressure on stomach and bowel samples obtained from patients as part of their standard surgical procedure. Two blinded pathologists identified increasing tissue damage as corresponding to increasing crush pressure, forming the evidence base for further investigation in vivo with a larger sample size.

Clinical research

Epidemiological studies

Jennifer Watt et al. (UofI) presented their work on the efficacy of pharmacological and non-pharmacological interventions for aggressive and agitated behaviors in patients with dementia. Their work suggests that non-pharmacological interventions such as outdoor activities, recreation, massage and touch therapy are more efficacious than pharmacological interventions.

Jonathan S. Zipursky et al. (UofI) investigated the epidemiology of poisoning events in pregnant women reported to the Ontario Poison Center and the associated risk factors. They concluded that early pregnancy and younger age of the mother are potential factors for intentional overdose in pregnancy. Larger population-based studies are needed to further elucidate all the risk factors.

Kamini Raghuram et al. (UofT) presented their work on automated video-based movement analysis that predicted motor impairments in high-risk infants such as preterms. The technology needs to be studied further for clinical applications.

Eric Wong et al. (UofT) examined reporting bias of serious adverse effects by randomized controlled trials (RCTs) included in two network meta-analyses. They concluded that serious adverse effects reporting by RCTs was inconsistent between the trial registry data and the publications. It is thus crucial to include trial registry data for meta-analysis and/or network meta-analysis.

A systematic review and meta-analysis conducted by Siddharth Nath et al. (McMaster) revealed that there were significant reductions in the incidence of mild and severe postdural puncture headache (PDPH), any headache, nerve root irritation and hearing disturbance, when atraumatic needles were used instead of conventional needles.

Sophie Hu et al. (UofC) developed a mild behavioural impairment (MBI) checklist to assess motivation, mood, impulse control and social appropriateness in pre-dementia patients, in whom MBI is an at-risk state for dementia.

Alanna Weisman (UofO) presented work on the validation of algorithms used to identify type 1 diabetes in an electronic medical record database and Ontario administrative data. Future work includes descriptive statistics of patients by diabetes type and derivation of automated search algorithms to predict type 1 diabetes.

Alice Cavanagh (McMaster) presented an evaluation of the program contours of the Ontario Basic Income Pilot vis à vis the economic principles postulated in consumer choice theory. They concluded that the concepts underpinning the program remain untested in the “real world”. The program’s premature cancellation represents a fundamental disruption in the lives of participants and invalidates the utility of the data gleaned.

Tim Rappon et al. (UofT) investigated the sustainability of quality improvement (QI) initiatives employed in our healthcare system utilizing a novel combination of structured coding, thematic analysis and a Kohonen self-organizing map. They concluded that QI initiatives are sustainable if they demonstrate ongoing benefits to stakeholders, continued staff education and occur in QI-friendly contexts.

Cardiovascular sciences

Kevin Kim et al. (McMaster) presented their findings in patients with end-stage renal disease (ESRD). They demonstrated that mechanical valves were associated with lower long-term mortality risk, despite increasing risk of

bleeding and stroke, and concluded that higher quality evidence is needed to determine optimal valve choice.

Due to recent centralization of vascular surgeries in Ontario, Konrad Salata et al. (UofT) examined the trends of elective and ruptured abdominal aortic aneurysm (AAA) repair by practice setting in Ontario 2003–2016. The team found that endovascular aortic repair increased in both teaching and community hospitals, and that this increase in community hospitals caused the decentralization of AAA repair.

Rodolfo Rocha et al. (UofT) presented their work on assessing the positive predictive value of endovascular and open thoracoabdominal aortic aneurysm (TAAA) repair coding in Ontario health administrative databases. Endovascular TAAA repair was identifiable via a single Canadian Classification of Health Interventions (CCI) code, while open TAAA repair was identifiable via a combination of CCI and Ontario Health Insurance Plan (OHIP) codes. Collectively, these findings highly facilitate population-based studies through the use of administrative data.

Bastein Rioux et al. (UMontreal) presented an interesting case report to demonstrate the significance of elevated C-reactive protein levels in stratifying occult malignancy risk after an ischemic stroke. Their findings may help guide cost-effective investigation and facilitate earlier management to prevent stroke recurrence.

Using Illumina MiSeq-targeted sequencing, Mark Trinder et al. (UBC) examined mutation status as a risk factor for cardiovascular disease in familial hypercholesterolemia. Mutation status was found to be an important diagnostic and prognostic tool independent of low-density lipoprotein-C (LDL-C) measurement, and can be used to stratify patients according to composite cardiovascular disease outcomes.

Cancer biology

Brandon Maser et al. (UofT) adapted a validated framework previously developed by the Global Fund to develop a toolkit for assessing childhood cancer programs in low- and middle-income countries (LMIC). This toolkit has been piloted in LMIC and future case studies will further identify the key determinants impacting health system-integrated childhood cancer programs in LMIC.

Jordan Levy et al. (UofT) identified demographic factors that predict surgical intervention and success in the treatment of pancreatic cancer. Among 88,599 patients with pancreas adenocarcinoma, there were disparities in the rates of intervention and overall survival based on age, marital status and geographic region. Though surgery reduced the hazard of death by 58% at 1 year and 23% at 3 years, et al. surgery remains underutilized in eligible patients.

Marco Mascarella et al. (McGill) developed a risk index based on a retrospective review of 31,399 operations to aid in the risk stratification of older adults that may be candidates for head and neck cancer surgery. This index of 12 patient factors predicted major adverse events or death with a sensitivity of 0.63, specificity of 0.84 and accuracy of 0.84.

Catalina Leoveanu et al. (UofC) compared the outcomes of acute myeloid leukemia (AML) patients with primary induction failure that went on to receive a bone marrow transplant (BMT) and those who did not. They found that AML patients that received a BMT after complete remission had greater overall and event-free survival compared with patients who achieved complete remission but did not receive a BMT.

Paul Kudlow et al. (UofT) conducted a 4-week single blinded randomized controlled trial to study how promotion of academic articles in a distribution channel called TrendMD affects article saved on the online reference manager Mendeley. They found that articles randomized to TrendMD had a 77% increase in Mendeley article saves compared with the control arm, suggesting that TrendMD may be used to increase citations of scientific articles.

Nora Hutchinson et al. (McGill) presented their work assessing the burden of oncology trials on human welfare by applying a novel measure: the number of patients required to develop a new cancer drug. Their pilot project concluded that 7,091 patients are required to develop a new cancer drug, which is underestimated by investigators, regulators and patients.

Neuroscience

Allen Champagne et al. (Queen's) presented a study investigating transient cerebral metabolism changes after repeated, sub-concussive collisions in collegiate football players. Using magnetic resonance imaging, a significant increase in cerebral metabolic rate of oxygen was measured mid-season, in comparison with imaging taken pre- and post-season. Additionally, a significant reduction in cerebral blood flow was detected in players one month after the end of the season, suggesting hemodynamic changes persisting after acute exposure.

Dennis Dimond et al. (UofC) presented their pixel-based analysis of MRI comparing autism spectrum disorder patients to developmentally normal, age-matched controls. These findings demonstrated a reduced fibre density in multiple white matter tracts, as well as a global reduction in white matter volume. This analysis also found a correlation between severity of social impairment and lower fibre density in the splenium of the corpus callosum.

Hayden Danyluk et al. (UofA) presented a new imaging approach for visualization of the trigeminal nerve, which combined diffusion tensor imaging and fluid-attenuated inversion (FLAIR). Compared with standard diffusion tensor imaging, this method increased the signal-to noise ratio and quality of trigeminal nerve imaging. These findings may lead to significant improvement in the treatment of trigeminal neuralgia, a condition resulting from neurovascular compression of the trigeminal nerve.

Irene Harmsen et al. (UofT) presented their findings on the use of 10,000 Hz high-frequency brain stimulation to improve motor function in six patients with movement disorders. The clinical safety and efficacy of high-frequency stimulation of the ventral intermediate thalamic nucleus or subthalamic nucleus was evaluated, and treatment was found to significantly increase motor function while decreasing rates of stimulation-induced paresthesia, compared with stimulation at 130 Hz.

Jeffrey Kenzie et al. (UofC) presented their analysis on the correlation between decreased neural connectivity in the parietal lobe and impaired proprioception in stroke patients. Proprioception was analyzed using a KINARM robotic exoskeleton in conjunction with functional MRI, and patient data were compared with the analyses of age-matched controls. Disruptions in resting-state functional connectivity within sensorimotor association areas were the most heavily implicated in proprioception deficits in post-stroke patients, which may provide a target for neurostimulation therapy.

Sawayra Owais et al. (McMaster) presented their work on evaluating recovery from postpartum depression in Indigenous and non-Indigenous women and its association with differences in offspring emotional regulation at one and two years postpartum. The anticipated results could demonstrate a correlation between recovery from postpartum depression and improvement in infant emotional regulation.

Ayan Dey et al. (UofT) presented their data on age-related cerebral small vessel disease and its effect on executive function. The results show that compared with healthy controls, the magnitude of attention modulation in patients with cerebral small vessel disease predicted performance on executive function tasks and processing speed. These findings could improve the efficacy of cognitive rehabilitation programs.

Gavin Elias et al. (UofT) presented their findings comparing deep brain stimulation of the anterior nucleus of the thalamus versus surgical resection for the treatment of medically refractory epilepsy. Their results indicate that surgical resection was associated with a 5% reduction in the contralateral hippocampus volume and 9.5% reduction in

mammillary body volume, while deep brain stimulation resulted in larger hippocampal and mammillary body volumes in 60% and 80% of patients respectively.

Lucy Church Barker *et al.* (UofT) presented their study on decision making on antidepressant use in the preconception period. They demonstrated that preconception women were similarly likely to plan to use antidepressants in pregnancy compared with pregnant women; however, preconception women lacked decision-making support, in particular, and had higher decisional conflict and lower access to psychiatric care compared with pregnant women.

Hasan Abdullah *et al.* (UofC) demonstrated that suboptimal adherence to medications such as methotrexate therapy, potentially due to language barriers, can be improved by simply providing patients with a medication information sheet in their native language. This provides a simple solution to adherence problems and the care for all patients.

Sara Ahmed (UofT) presented work on the use of quantitative ultrasound blob features to differentiate muscles in patients with myofascial pain syndrome (MPS). They found a potential association between blob area and muscle stiffness, providing evidence for the utility of quantitative ultrasound as a diagnostic method for MPS.

Aram Abbasian *et al.* (UofT) proposed a bottom-up approach to developing a new protocol to assess whether fornix deep brain stimulation has an effect on synaptic plasticity applicable for the treatment of Alzheimer disease.

Medical education

Ian MacNairn *et al.* (UofC) presented their work on a case study in decision-making, value-space and autonomy of one's body. The patient case was an ultramarathon runner who sustained multiple major injuries requiring emergency surgery, eventually leading the patient to elect to have his leg amputated. Thematic analysis of two interviews with the patient highlight diverse conclusions intersecting autonomy, decision-making, value-space and identity in the face of a major surgical intervention.

Sydney McQueen *et al.* (UofT) presented their exploration of stress in surgical performance and the development of a theoretical framework to help understand the relationship between surgeons and stress. They found that stress is both a contributor to, and a product of surgical performance; to better understand the role of stress in surgical performance, consideration must be given to the psychological, cognitive, emotional, and sociocultural position of the surgeons experiencing stress.

Christine Moon *et al.* (Queen's) presented their work on the exploration of healthism and discussed its relevance for clinicians, particularly for clinician-scientists. Concepts explored included the term "culture" and why it is important to understand, how health has become the all-encompassing religion in our lives, and how moving forward we can best recognize, confront and collaborate with the idea of healthism.

Adam Pietrobon *et al.* (UofO) presented a student survey on the MD/PhD program at UofO. They found tuition support to be an essential element in accepting the admission offer, the vast majority of respondents are interested in taking courses designed for clinician-scientist trainees and the current resources for career planning are insufficient.

Concluding remarks

The joint CSCI-CITAC 2018 AGM was among the most successful to date, where clinician-investigator trainees and faculty from all across Canada came together for research dissemination, skills and knowledge acquisition, networking and inspiration. Outstanding medical research was showcased at the meeting, further illustrating the breadth of novel and exciting avenues pursued by young Canadian clinician-investigators at the interface of health and science.

The CSCI-CITAC AGM continues to be one of the most important events for the clinician-investigator community in Canada, and it is important for the CITAC executive committee members to reflect on some of the emerging patterns of attendance. Specifically, it will be important to address any barriers and/or inequities to promote fair opportunities for francophone, female, CIP and non-Ontario academic institution trainees to disseminate their research.

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