AND INNOVATION

Faculty of Medicine | Research Office Annual Report 2018



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Research and Innovation, Faculty of Medicine Annual Report 2018



2017-2018 brought many exciting changes to the Faculty of Medicine, and it has been a real privilege to serve as the interim Vice-Dean, Research as we move towards a new horizon of research growth and opportunities. Most significantly, we applaud the appointment of Dr. Bernard Jasmin as the new Dean of the Faculty of Medicine. We thank Dr. Jasmin for his exceptional leadership as Vice Dean, Research, and look forward to working with him as he shepherds our Faculty to new heights in education, patient care and research.

Major Successes over the past year: The uOttawa Faculty of Medicine ranks among Canada's top 5 in research intensive Faculty of Medicines. Despite the many challenges brought on by 2017-2018, including ongoing restructuring at the Canadian Institutes of Health Research (CIHR), the Faculty of Medicine was able to increase the overall research funding by \$10Million. We are very proud that our faculty members continue to show outstanding research productivity, consistently ranking in the top 2-3 for Research Intensity (medical/science grants, MacLean's 2018). Over the last year, we have expanded our recruitment efforts, and together with our research institute partners, we have been able to attract world leading research talent, building on the vibrant research community in our Faculty. Our researchers received numerous prestigious awards and recognitions in 2017-18 and we will continue to nominate our Faculty to celebrate their ground-breaking achievements and exceptional leadership in research.

Continued growth and development in research: To ensure we remain highly competitive in challenging times, the Research Office has worked hard to facilitate leading edge research. The Faculty continues to support state-of-the-art core facilities, which have been expanded this year to include Metabolomics and Transmission Electron Microscopy core facilities, led by Drs. Julie St-Pierre and Baptiste Lacoste, respectively. Similarly, the Research Office held numerous grant writing workshops over the past year, many of which were open to other Faculties across the University. To promote multidisciplinary research, we continue to reach out to other Faculties at uOttawa to expand our scope and enrich our research enterprise. We have held multi-faculty brain storming sessions for large-scale granting competitions, and in collaboration with the Vice-President Research, we hosted a multi-faculty strategic planning workshop to develop Artificial Intelligence at the University. We are excited to build partnerships with our affiliated research institutes/hospitals and other faculties in this new initiative, which has the potential to transform medical research and health care.

Enhancing Clinical and Translational Research: Over the last year, we have accelerated our efforts in promoting translational research, to enhance our research teams' ability to move research discoveries towards improving clinical practice. As a Faculty of Medicine, we are in an ideal position to take advantage of our tremendous talent and promote translational research from early in the educational trajectory to established research collaborations across disciplines. Last year, the Research Office led a highly successful translational research grant program that, together with our institute/hospital partners, supported over \$400,000 in new multidisciplinary research collaborations. To further expand upon the integration of basic research and clinical practice, we are collaborating with Undergraduate and Postgraduate Medical Education to develop new 'grad-med' pairing opportunities at all levels of our educational programs. These include the creation of new research experience, a joint Dean's 'Ask me anything' networking session, the summer student research program, a joint CIP/PDF research evening, and integration of PDFs and residents in the PGY1 seminar series, among others. In the coming years, we look forward to expanding these efforts to include clinical observership opportunities for graduate students, as well as multidisciplinary research initiatives across other faculties.

Community Outreach: The Research Office continues to support numerous community outreach initiatives, including 'Let's talk Science', Canadian Medical Hall of Fame, Doors Open Ottawa, among others. We are committed to communicating the importance and excitement of research discoveries and delivering medical research knowledge to the community in an accessible way.

The Research Office Team (RO): Finally, I would like to thank the exceptional RO team, for their relentless effort and dedication to expanding the research enterprise in the Faculty of Medicine.

Thank you Dr. Jasmin



Since his appointment as Vice Dean, Research in 2009, Dr. Bernard Jasmin has actively developed policy, partnerships, facilities, and initiatives to transform the research landscape at the Faculty of Medicine. Ten years later, as he takes the reigns as Dean of Medicine, it is clear that his leadership has been a catalyst for major enhancements in Faculty-Hospital relationships; the development of major research centres, institutes and facilities; increasing funding for both research and infrastructure; and attracting new local, national, and international partners to the University. Below we highlight just a few of these outstanding accomplishments:

- 18 New Canada Research Chairs (+ 18 successful renewal applications) since 2009
- \$32 million Infrastructure Funding through the Canada Foundation for Innovation (>\$80M total project costs)
- \$20 million Internal Funding and Partnership Programs
- \$17 Million total research funding increase (2009-18)
- 3 New University Centres/ Institutes (uOBMRI, CI3, ORACLE)
- 5 New Joint International Funding Programs (Shanghai Jiao Tong University School of Medicine, Université Claude Bernard Lyon 1, Université Paris - Descartes, Shanghai Institute of Materia Medica, Hebrew University of Jerusalem)
- Development of the Core Facilities program (15 Cores active today)



Goals of the Research Office

01

Build capacity of the Research Office to support and interact efficiently with all stakeholders, including basic and clinical Faculty and trainees across the Faculty of Medicine, affiliated Research Institutes, University of Ottawa, and the broader scientific community

02

Lead and promote the growth of strategic priorities and partnerships

03

Actively promote interdisciplinary research activities within the Faculty of Medicine and across other Faculties

04

Develop translational research and promote scientific relationships between basic and clinical researchers

05

Lead and operationalize the integrated HR plan for the recruitment of tenure-track professors across Departments and affiliated Research Institutes

06

Support the development and coordination of grants, awards, and large-scale research initiatives from across the Faculty and affiliated Research Institutes

07

Advocate and coordinate capital expansion, renovation, research space allocation, and logistics

80

Enhance the visibility of ongoing research initiatives and promote communication of scientific breakthroughs

09

Support and mentor new Faculty members to ensure a smooth transition to the Faculty of Medicine, rapid and successful establishment of research laboratories, and competitiveness in research funding

10

Implement fair, transparent, efficient and comprehensive procedures to prioritize resource allocation according to strategic goals and priorities

11

Integrate and promote a culture of equity, diversity, and inclusion across all endeavours



Our Departments and Partners



- Anesthesiology
- Emergency Medicine
- Family Medicine
- Medicine
- Obstetrics and Gynecology
- · Ophthalmology
- Otolaryngology
- Pathology and Laboratory Medicine
- Pediatrics
- Psychiatry
- Radiology
- Surgery

Basic Science Departments

- Biochemistry, Microbiology and Immunology
- Cellular and Molecular Medicine
- Innovation in Medical Education
- School of Epidemiology and Public Health

Affiliated Hospital-Based Research Institutes

- Children's Hospital of Eastern Ontario Research Institute
- Élisabeth Bruyère Research Institute
- Institut de recherche de l'Hôpital Montfort
- Ottawa Hospital Research Institute
- The Royal's Institute of Mental Health Research
- University of Ottawa Heart Institute

Research Centres and Institutes

- Canadian Partnership for Stroke Recovery
- Centre for Neural Dynamics
- Centre for Neuromuscular Disease
- Kidney Research Centre
- Medical Devices Innovation Institute
- The Ottawa Institute of Systems Biology
- University of Ottawa Brain and Mind Research Institute
- University of Ottawa Centre for Infection, Immunity and Inflammation
- University of Ottawa Skills and Simulation Centre

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Research Priorities of the Faculty

Strategic, Broad-Based Research Initiatives

The Faculty of Medicine has a number of major research initiatives that are completely aligned with the University's strategic plan, Destination 2020. Building on our demonstrated track-record of research excellence, the Faculty and our affiliated Hospital-Based Research Institute partners will focus our efforts during the coming decade on the following integrated strategic areas. Our experimental approach to these strategic research areas includes Genetics, Systems Biology, Regenerative Medicine as well as Innovative Therapeutics.



The University of Ottawa Brain and Mind Research Institute

The University of Ottawa Brain and Mind Research Institute (uOBMRI) has sustained major growth and development. In the past several years, we have recruited 22 exceptional investigators in brain related research. The Institute brings basic and clinical investigators from a broad spectrum of disciplines under a unifying umbrella to provide leadership and focus for the enhancement of neuroscientific and behavioral research. The Institute's initial programs focused on development of exceptional clinical care and research of brain-related illnesses in stroke, Parkinson's disease, depression and neuromuscular disease. These initiative cut across basic, clinical and human population studies, emphasizing translation of research into practice, particularly in the development of novel therapeutics and diagnostics. In the past year, we have also initiated efforts in emerging areas: understanding concussion injury and cognitive memory processes.



Cardiovascular and Vascular Biology

The Faculty of Medicine, together with the University of Ottawa Heart Institute (UOHI) and Ottawa Hospital Research Institute (OHRI), has a strong track record of research excellence in cardiovascular disease and vascular biology. In recent years there has been a concerted effort to develop a multidisciplinary and inter-institutional initiative. The Ottawa Region for Advanced Cardiovascular Research Excellence (ORACLE) strategy, which was updated in 2018, is led by the UOHI, in collaboration with the Faculty of Medicine, and regional partners. The strategy includes the formation of regional teams of multi-disciplinary researchers known as Innovation Hubs focusing research in the priority areas of discovery to translational innovations, precision medicine, big data and artificial intelligence, and healthy diverse populations. One novel area of inquiry in collaboration with partners such as the uOttawa Brain and Mind Research Institute and the Institute for Mental Health Research, is the biological and clinical linkages between brain and heart disorders. Special emphasis is also placed on patient engagement and sex and gender analysis. Collaborative successes in 2018 include the partnered funding of 5 Faculty of Medicine Translational Research Grants in ORACLE priority areas that are currently in progress.

Research Priorities of the Faculty



School of Epidemiology and Public Health

The School of Epidemiology and Public Health aims to bring together applied health researchers from within the Faculty of Medicine, research institutes, and other groups into one collective with agreed upon research strategic priories and research enabling platforms (e.g., methods center, large administrative database centre, biobanking, centre for microbial diversity, assessment facilities). It will harness the collective power of researchers in the region and promote interdisciplinary, collaborative, patient-centered applied health and public health research.

The vision of the School is to be recognized as a leading contributor to research, teaching and professional training. At the local level, it aims to improve patient and population health outcomes in the population laboratory of the Champlain Local Health Integration Network (LHIN). More broadly, it carries out research on the determinants of health and disease etiology and on the development, implementation and evaluation of practices, programs and policies aimed at optimizing health and social services. The methodologies used and developed by the researchers include epidemiology, biostatistics and other quantitative evaluative sciences; methods that include complementary quantitative and qualitative approaches; health economics; policy development approaches; and engaged scholarship/knowledge translation.



Centre for Infection, Immunity and Inflammation (CI3)

Chronic infectious and inflammatory diseases are highly complex, involving multi-faceted geneenvironment interactions and substantial cross-talk between different biological systems such as the cardiovascular, immune, neurological and endocrine systems. Unravelling this complexity requires a systems biology approach, and must encompass the expertise of scientists from diverse disciplines working together on a given disease. The uOttawa Centre for Infection, Immunity and Inflammation (CI3) was created with the objective of bringing together basic and clinical scientists from across the fields of Immunology, Microbiology, Virology, Biochemistry, Neurobiology, Cardiovascular Biology, Metabolism and Pathology, who have diverse expertise, experimental models and approaches, and are interested in the development of effective solutions for infectious and inflammatory diseases. The overarching goal of CI3 is to foster multidisciplinary research across the field of infectious and inflammatory disease in order to accelerate understanding of the common principles and help establish the mechanisms that underpin chronic inflammatory states, and therefore lead us towards development of intervention strategies. The objectives of the centre are to: 1) develop new collaborative, innovative and multi-disciplinary research projects that are aimed at understanding the mechanisms of inflammation that underline various chronic diseases, 2) to develop collaborative projects that are aimed at knowledge translation and dissemination, and 3) to train next the generation of scientists in multidisciplinary research in infection, immunity and inflammation.



Tiny Predators: New Study Sheds Light on Tick Distribution and Lyme Disease

Lyme disease (LD) is a condition that manifests itself with symptoms of joint pain, fatigue, and in some cases, facial paralysis and heart conditions. A bacterial infection transmitted by black-legged ticks, it is an emerging disease in Canada due to the expanding range of its tick vector. While environmental risk maps for LD do exist, distribution of ticks has traditionally been based on rough variables such as climate, which vary little within specific regions, the level at which local public health decision-making takes place.

In a recent paper published in *Vector-borne & Zoonotic Diseases*, **Dr. Manisha Kulkarni**, Assistant Professor in the School of Epidemiology and Public Health, in collaboration with **Dr. Jeremy Kerr**, Professor in the Department of Biology and colleagues, hypothesizes that high-resolution environmental data and routinely collected passive surveillance data can be used to develop valid models for tick occurrence and provide insight into finer ecological processes affecting tick distribution. Using a maximum entropy algorithm (MaxEnt), Dr. Kulkarni and her team built a model for ticks in Ottawa using georeferenced occurrence points from passive surveillance data collected between 2013 and 2016 and high-resolution land cover and elevation data. They evaluated their model using an independent tick presence/absence dataset collected through active surveillance at 23 field sites during the summer of 2017. Their model showed a good ability to discriminate positive and negative sites for tick presence, demonstrating the value of passive surveillance data to model local-scale environmental risk. A previous study by Dr. Kulkarni and her team discovered that 1 out of 3 ticks tested in Ottawa carry Lyme disease, with an increase in the number of reported cases of LD in humans.



Can a Multiple Sclerosis Drug Be Used in Oncolytic Virotherapy? New Research Says Yes

Story credit: Mohamad Chahrour (TMM4950) and Baher Migally (TMM4950)

1 in 2 Canadians will develop cancer in their lifetime and 1 in 4 will die of the disease. Current cancer treatments range from complex surgeries, to stem cell transplant therapies. These treatments not only target the cancer cells but can inadvertently harm the surrounding healthy tissue. However, there is an alternative to all of this. Oncolytic virotherapy utilizes oncolytic viruses to target and infect tumour cells while avoiding healthy cells. The main downfall to this is the capability of tumour cells to be resistant to the virus. In previous reports, **Dr. Jean-Simon Diallo**, Assistant Professor in the Department of Biochemistry, Microbiology and Immunology (BMI) and Scientist at the Ottawa Hospital Research Institute (OHRI), discovered small molecules that can be administered at the same time as the virus, resulting in increased efficiency of oncolytic virotherapy while limiting resistance. These small molecules are called viral sensitizers.

In a recent report in *Science Translational Medicine*, Dr. Diallo, in collaboration with **Dr. John Bell**, Professor in BMI and Senior Scientist at OHRI and **Dr. Carolina Ilkow**, Assistant Professor in BMI and Scientist at OHRI, illustrates the effects of one of these viral sensitizers, Dimethyl fumarate (DMF). DMF is an FDA-approved drug that is used in the treatment of psoriasis and multiple sclerosis. The authors reported that the use of DMF can be paired up with several oncolytic viruses, improving therapeutic outcomes in resistant syngeneic and xenograft tumour models. DMF's ability to enhance viral spread is due to its ability to inhibit type I interferon production and response which causes for downstream blockade of nuclear translocation of the transcription factor nuclear factor B. Effectively, this can be used to make oncolytic virotherapy more efficient in treating a wide variety of cancers.



New Clinical Trials Provide Insight into the Optimal Treatment for Left Main Coronary Artery Disease

Story credit: Nathan Liang (TMM4950) and Narimane Ait Hamou (TMM4950)

Coronary heart disease currently afflicts over 2.4 million Canadian adults and is the second leading cause of death in the country, behind cancer. Blood flow to the heart can be severely reduced due to buildup of cholesterol plaque in the coronary arteries and can lead to heart attack, heart failure or death. Coronary artery disease is usually treated by one of two procedures. In coronary artery bypass grafting (CABG), a new artery is surgically created so as to bypass the blockage in the native coronary artery. In percutaneous coronary intervention (PCI), a minimally invasive angioplasty is performed to dilate the obstructed native artery and a stent is placed to keep it open.

Dr. Marc Ruel is a Full Professor in the Department of Surgery and the Head of the Division of Cardiac Surgery at the University of Ottawa Heart Institute. His clinical research studies outcomes of existing techniques for the treatment of coronary artery disease. In two recent opinion pieces, one in *JAMA Cardiology* and one in *Circulation*, Dr. Ruel and colleagues reviewed the optimal method for treatment of left main coronary heart disease, taking into account the results of two recent trials, EXCEL and NOBLE. The two clinical trials had conflicting results, as EXCEL found PCI to be noninferior to CABG in terms of early adverse outcomes, while NOBLE found PCI was in fact inferior to CABG. Dr. Ruel concluded that the optimal treatment depended on the patient. PCI, being less invasive and less prone to short-term complications, may be more appealing to patients with comorbidities, with shorter life expectancy, or who wish to have a quicker recovery. On the other hand, CABG shows less mortality over time, and is more suitable for patients with multivessel disease, with diabetes, or for patients who have a significant potential for long-term survival.



Elucidating the role of microRNAs in atherosclerosis – cell migration and macrophage entrapment at stake

During inflammation, macrophages – cells responsible for detecting and destroying pathogens – secrete vesicles carrying RNA, protein, and lipids as a form of extracellular communication. Previous studies on the vessel wall have shown that extracellular vesicles (EVs) are transferred between vascular cells during atherosclerosis; however, the role of these macrophage-derived EVs in atherogenesis is still unknown.

In a recent report published in Arteriosclerosis, Thrombosis and Vascular Biology, Dr. Katey Rayner, Scientist at the University of Ottawa Heart Institute and Assistant Professor in BMI, together with My-Anh Nguyen, PhD Candidate, and colleagues successfully isolated EVs from mouse and human macrophages treated with an atherogenic stimulus (oxidized low-density lipoprotein). Dr. Rayner and her team confirmed the enrichment of several microRNAs in atherogenic EVs compared with controls, demonstrating that these EVs do indeed transfer exogenous miRNA to naive recipient macrophages. Using bioinformatic pathway analysis, Dr. Rayner predicted that atherogenic EV miRNAs target genes involved in cell migration – a crucial process necessary for cells to perform their designated tasks – and adhesion pathways, and indeed observed that delivery of EVs to naive macrophages reduced macrophage migration both in vitro and in vivo. Particularly, EV-mediated delivery of miR-146a, the most enriched miRNA in these EVs, repressed the expression of target genes IGF2BP1 and HuR – genes that, when knocked down, greatly reduced macrophage migration. Conversely, Dr. Rayner found that inhibition of miR-146a reduced this inhibitory effect on migratory capacity. EV-derived miRNAs from atherogenic macrophages, in particular miR-146a, may accelerate the development of atherosclerosis by decreasing cell migration and promoting macrophage entrapment in the vessel wall. These findings highlight the importance of these EV-miRNA targets in regulating macrophage motility and as potential targets for novel therapeutic approaches.



Post-Translational Modifications – The keys to identifying molecular pathways

Story credit: Haben Dawit (TMM 4950) and Shan Dhaliwal (TMM 4950)

Dr. Michael Downey, Assistant Professor in the Department of Cellular and Molecular Medicine (CMM), is conducting ground-breaking research that will change our scientific knowledge about protein interactions. With five papers published this year alone, Dr. Downey's findings in the emerging field of non-histone protein modifications has improved our understanding of specific protein targets in human diseases. Using high-throughput yeast analysis to look at post-translational modifications to study molecular pathways, his research can lead to improved diagnosis and novel treatment options in diseases.

In one of his most recent papers, published in *Cell Reports*, Dr. Downey and his group, in collaboration with **Dr. Adam Rudner**, Associate Professor in BMI, study a novel protein modification known as polyphosphorylation, or the addition of an inorganic phosphate chain (polyP). Dr. Downey and his group have previously associated polyP with several different functions, however its mechanism of action remained unclear. He therefore began studying the targets of polyphosphorylation to confirm it was not a random occurrence to a small subset of proteins. His findings showed that this was not the case and that this novel post-translational modification appears to play a role in a host of proteins, including a conserved network of proteins functioning in ribosome biogenesis – a crucial molecular system for protein synthesis. These findings have opened a new avenue of research regarding a potential therapeutic target to be studied later on in human diseases.



Diagnostic Tools in the Emergency Department: Road to Recovery or Quick Path to Death? New Study Sheds Light

Story credit: Tyler Smith (TMM4950) and Nayanan Nathan (TMM4950)

Sepsis is credited as being a silent killer due to difficulties in its diagnosis and screening and remains a major cause of death worldwide. The quick Sepsis Related Organ Failure Assessment (qSOFA) is a diagnostic checklist designed to determine a patient's fitness when afflicted with sepsis. Being concise and easy to perform, it allows doctors to make executive decisions in a pinch. The problem with diagnostic methods such as qSOFA is with constant use, physicians tend to become more reliant on them, often flagging at-risk patients as being safe. Despite its ubiquitous use, countless critical care physicians across Canada have uncovered its unreliability, citing several sepsis-related mortalities associated with faulty screening processes done with qSOFA.

One of these physicians, Dr. Jeffrey Perry, Professor in the Department of Emergency Medicine and Senior Scientist and the OHRI, in collaboration with Dr. Andrew Seely, Scientist at OHRI, Dr. Monica Taljaard, Senior Scientist at OHRI, Dr. Shannon Fernando, a resident in the Department of Emergency Medicine, has recently been making waves in the field of sepsis research. In a report published earlier this year in The Annals of Internal Medicine, his group synthesized data from multiple databases across the country, comparing the accuracy of the commonly used qSOFA against the more arduous yet accurate SIRS (Systemic Inflammatory Response Syndrome). The message was clear: qSOFA was inadequate as a screening tool compared to SIRS. An accompanying commentary written by the creators of qSOFA agree with Dr. Perry's findings stating that the problem is not with the tool itself, but rather with its misuse. This message has resonated with physicians across the continent, causing a paradigm shift and making physicians rethink how to screen patients for sepsis. Dr. Perry and his team are continuing their work with sepsis and are working on developing new, reliable diagnostic tools that can be used in the emergency department.



A Link Between GREB1 Expression and Ovarian Cancer Progression – Research Points to Novel Prevention and Treatment Approaches

Experimental and epidemiological evidence demonstrate a link between estrogen and ovarian tumorigenesis and cancer progression, predominately through the estrogen receptor ESR1. Growth regulation by estrogen in breast cancer (GREB1) is an ESR1-upregulated protein with linkages to estrogen action. Previous studies have demonstrated that the knockdown of GREB1 prolongs the survival of mice engrafted with cancer cell lines and prevents the hormone-driven proliferation of numerous breast cancer and prostate cancer cell lines. This led to investigations into the functional role for GREB1 in ovarian cancer.

A study published in Oncogene, by Dr. Barbara Vanderhyden, Senior Scientist at the OHRI, Corinne Boyer Chair in Ovarian Cancer Research, and Professor in CMM, and colleague Dr. Kendra Hodgkinson, past PhD student, revealed that cell proliferation and migration is enhanced by the overexpression of GREB1 in ovarian cancer cell lines. This led to a mesenchymal morphology and elevated Col1a2, responsible for encoding a collagen I subunit. Alternatively, GREB1 knockdown limited proliferation promoting an epithelial morphology with reduced Col1a2 expression. Dr. Vanderhyden and her team analyzed human tissues revealing GREB1 expression in all ESR1-expressing tissues throughout the normal female reproductive tract as well as in several non-ESR1 expressing tissues. Analysis of ovarian cancer cases also showed GREB1 expression in 75-85% of serous, endometrioid, mucinous, and clear cell carcinomas. With these cancers, ESR1 or GREB1 expression was almost always observed suggesting a potential reliance on signalling through ESR1 and/or GREB1. This body of work suggests that harnessing this dependence by targeting GREB1 may limit tumour-promoting pathways thus providing a potential novel ovarian cancer treatment strategy.



Novel Panel of Protein Biomarkers Allows More Accurate Diagnosis of IBD Subtypes in the Pediatric Population

Story and photo credit: Tasneem Abbass (TMM4950) and Natasha Jerai (TMM4950)

Inflammatory bowel disease (IBD) is a prevalent family of conditions involving chronic, relapsing, and remitting inflammation of the gastrointestinal (GI) tract. It is proposed to be caused by various factors, including abnormalities within the intestinal microbiome, immune responses against bacteria, and differential expression of certain proteins. Millions of IBD cases have been reported worldwide, 10%-25% of which are paediatric. The two main subtypes of IBD are Crohn's disease (CD) and ulcerative colitis (UC). Despite being classified within the same family, these diseases differ in their clinical presentation, complications, and treatment options.

Differentiation between CD and UC is important for early and accurate diagnosis and treatment. In a recent study published in *Gut*, **Dr. Daniel Figeys**, Professor and Chair of BMI, and colleagues Dr. **Amanda E. Starr**, Research Associate, **Dr. Alain Stintzi**, Professor in BMI, **Dr. David Mack**, Professor of Pediatrics and Director of CHEO's Inflammatory Bowel Disease Centre, **Dr. Eric Benchimol**, Senior Scientist at CHEO and Professor of Pediatrics performed proteomic analysis on mucosal biopsies from children with new onset IBD to identify proteins that enable differentiation between CD and UC. The authors constructed a 5-protein panel that can be used to differentiate between healthy and IBD-affected biopsies. Furthermore, the authors identified a 12-protein panel to classify UC- and CD-affected biopsies. The panels have accurate classification rates of 95.9% and 80%, respectively. Many of the identified biomarkers play key roles in fatty acid metabolism and were found to be elevated in CD, but not UC patients. Nine biomarker proteins are involved in binding and transporting metals, protein, and RNA. Of these, cytosol aminopeptidase and transferrin receptor protein-1 were found to have elevated expression in CD patients, whereas serotransferrin was found to be upregulated in UC patients. Overall, these protein panels can be applied in a clinical setting for differential diagnosis of IBD subtypes and proper therapeutic approaches.



A Novel Mechanism for ALS: How Common Mutations May Prevent Stress Granule Clearance by Autophagy

Story credit: Evan Lubansky (TMM4950) and Marie Esper (TMM4950)

Dr. Derrick Gibbings, Associate Professor in the Department of CMM, aims to discern the underlying molecular mechanisms that lead to Amyotrophic Lateral Sclerosis (ALS). ALS is a fatal disease afflicting 200 000 individuals worldwide and is characterized by motor neuron degeneration, leading to eventual paralysis of the muscles required for breathing and swallowing. A large proportion of ALS patients have clumps of specific proteins called inclusions in the neurons of the brain and spinal cord that are believed to be toxic and kill the neurons that act as messengers from the brain to different parts of the body, thereby causing the paralysis. These toxic inclusions in ALS patients resemble in many respects clumps of protein and RNA that cells make when they are stressed, called stress granules. Stress granules are created in response to cellular stresses and are normally cleared by the degradative process called autophagy. However, several mutations in ALS are thought to interfere with this dissolution.

In Dr. Gibbings' recent publication in *Nature Communications*, his group, including **Maneka Chitiprolu**, PhD candidate, **Dr. Jocelyn Côté**, Professor in CMM, **Dr. Jean-François Couture**, Professor in BMI, **Dr. John Woulfe**, Associate Scientist at OHRI, and **Dr. Mathieu Lavallée-Adam**, Assistant Professor in BMI revealed a novel mechanism connecting the dysregulation of C90RF72, the most commonly mutated gene in ALS, with the inability to clear stress granules. Dr. Gibbings and his group discovered that C90RF72 binds to the classic autophagy receptor p62 to mediate stress granule clearance by autophagy. This finding provides a plausible mechanism for the stress granule accumulation in ALS patients. Dr. Gibbings and his team believe that understanding the molecular context of ALS will provide the basis for life changing therapeutic design. This recent publication is a major breakthrough in ALS research and a step towards saving thousands of lives worldwide.



Electronic consultation platform to reduce unnecessary waiting time for specialist diagnostic

Story and photo credit: Charlotte Meneghin (TMM4950) and Marilyn Whelan (TMM4950)

Excessive wait times for specialist care are a serious issue in Canada. Patients often wait for months or even years to see a specialist following a referral from a primary care provider needing to confirm the right diagnostic or the right course of treatment for the patient. These delays have real consequences: providers face frustration at backlogs, the health system bears unnecessary costs for duplicated tests or conditions exacerbated by waiting for care, and, most importantly, patients experience anxiety, a reduced ability to participate in daily activities, and ultimately, poorer health outcomes.

For several years now, **Dr. Clare Liddy**, Associate Professor in the Department of Family Medicine and family doctor at the Ottawa Hospital Academic Family Health Team and **Dr. Erin Keely**, Full Professor in the Department of Medicine and Endocrinologist at the Ottawa Hospital, have been working on creating an electronic consultation platform to improve the service quality primary care providers are giving to their patients. This web-based eConsult platform, named the Champlain-BASE[™] Project (Building Access to Specialists through eConsultation) was launched in 2011. Through this platform, primary care providers can ask patient-specific clinical questions, with specialists responding in a matter of days. Drs. Liddy and Keely and their colleagues have recently published a 5-year impact study in *The Annals of Family Medicine*. The eConsult platform has been shown to greatly reduce the need for face-to-face appointments with specialists, making it easier for family doctors and nurse practitioners to make informed decisions, easing the economic burden on the health system, and of course greatly reducing patient wait times and improving their health outcomes.

Prizes and Awards

In uOttawa's bid to increase its research intensity and international recognition, research and teaching prizes and awards are becoming more and more important. Awards such as these promote a culture of research excellence and raises the visibility and profile of the institution and researchers on the national and international scene. Gaining this recognition strengthens the appeal of uOttawa as a first-class institution for study and research and encourages careers in research/academia. For more information visit: https://med.uottawa.ca/research-innovation/research-highlights/prizes-awards.

The Faculty of Medicine Research Office staff provides assistance to investigators, research teams, and educators in identifying relevant awards and prizes and preparing applications, as well as coordinating nominations with key stakeholders within and external to the University.

2018

Dr. Alison Eyre - Canadian Association for Medical Education Certificate of Merit Award

Dr. Barbara Farrell, PharmD - Ontario Pharmacists Association Exceptional Achievement in Research Award

Dr. Daniel Dubois – Canadian Anesthesiologists' Society John Bradley Young Educator Award

Dr. Dieter Poenn – Foundation for Advancing Family Medicine Reg L. Perkin Family Physician of the Year for Ontario

Dr. Hugues Loemba - Fellowship in the College of Family Physicians of Canada

Dr. Jason Malinowski - College of Physicians and Surgeons of Ontario Council Award

Dr. Jeremy Grimshaw - CIHR Barer-Flood Prize for Health Services and Policy Research

Dr. Katey Rayner – Canadian Society of Molecular Biosciences New Investigator Award

Dr. Kumanan Wilson – Partners in Research Technology and Engineering Ambassador Award

Dr. Lyne Pitre – Prix de l'ambassadeur du français en médecine Jacques Boulay

Dr. Mahsa Jessri – Royal Society of Canada Alice Wilson Award (CIHR)

Dr. Marc Ruel - Inductee of the Order of Ottawa

Dr. Marc-André Langlois – Royal Society of Canada College of New Scholars, Artists and Scientists

Dr. Ruth McPherson – Council on Arteriosclerosis, Thrombosis and Vascular Biology - American Heart Association - George Lyman Duff Memorial Lecture

Dr. Sylvain Boet — Canadian Anesthesiologists' Society Dr. R. A. Gordon Research Award for Innovation in Patient Safety

Dr. William Stanford – The Ottawa Hospital Research Institute Chrétien Researcher of the Year Award

Prizes and Awards

2017

Dr. Antoine Hakim – Canada Gairdner Wightman Award

Dr. Bernard Leduc - Order of Ottawa Inductee

- Dr. Carlos Torres National Order of Merit, Officer, Republic of Colombia
- Dr. Carlos Torres Distinguished Professor of Radiology, Henan Provincial People's Hospital Zhengzhou University

Dr. Christiane Kuntz - Ontario College of Family Physicians Regional Family Physician of the Year (Region 7)

Dr. Daniel McIsaac - Canadian Anesthesiologists' Society Career Scientist Award in Anesthesia

Dr. Darlene Kitty – Association of Faculties of Medicine of Canada May Cohen Equity Diversity and Gender Award

Dr. Gary Viner - Canadian Association for Medical Education Certificate of Merit Award

Dr. Ian Stiell - Health Research Foundation Medal of Honour

Dr. Kin Chan - Ontario Ministry of Research, Innovation and Science Early Researcher Award

Dr. Mathieu Lavallée-Adam – Council of Ontario Universities John Charles Polanyi Prize in Chemistry

Dr. Michael Rudnicki – Muscular Dystrophy Canada Dr. George Karpati Award

Dr. Mona Nemer - Canadian Society of Molecular Biosciences Arthur Wynne Gold Medal

Dr. Mona Nemer – Foreign Honorary Member of the American Academy of Arts and Sciences.

Dr. Paul Beaulé – American Academy of Orthopaedic Surgeons/Kappa Delta Foundation, Kappa Delta Elizabeth Winston Lanier Award.

Dr. Pierre Blier – Royal Society of Canada Fellow

Dr. Seymour Brownstein – American Association of Ophthalmic Oncologists and Pathologists Zimmerman Medal

Dr. Sohil Rangwala - Ontario College of Family Physicians Award of Excellence

Dr. Yannick Benoit - Ontario Ministry of Research, Innovation and Science Early Researcher Award

Listed above are the awards and prizes that the Faculty Research Office was aware of at time of publishing. Please let us know if we've missed any, as we regularly update our webpage with award recipients.

International Research Initiatives

This past summer, the Task Force on Internationalization and Global Health, chaired by **Dr. Mark Walker**, completed an inventory and assessment of all international and global health activities at the Faculty of Medicine.

Using this information, the task force has put forward a draft report to the Faculty's leadership team, recommending the best approaches for the future of our internationalization and global health portfolio, aligning it with the strategic directions of the Faculty of Medicine in terms of education, research and social accountability.

This fall, leadership shared the draft report with all Faculty of Medicine stakeholders, welcomed feedback via email, and organized town halls to engage with faculty members, learners and staff for additional planning. This consultation process is key to solidifying the report and formulating next steps.

Additionally, leadership hopes that the outcomes of these discussions will help inform the University of Ottawa's overall international policy, which has been given renewed prominence with the recent appointment of Dr. Adel El Zaïm as Chief Internationalization Officer.

"It's an exciting time to be positioning the Faculty strategically in terms of internationalization and global health," said Dr. Walker, who led this task force and is also a Professor and Chair of the Department of Obstetrics, Gynecology & Newborn Care and Senior Scientist at The Ottawa Hospital. "We cannot be a world class university without having a strong international presence. Medicine, health and medical research have a universal impact that transcends borders and cultures with benefits for all of humanity."

Recommendations by the task force for further consultation with stakeholders at the Faculty of Medicine:

- · Consistent and systematic collection of international data to monitor critical trends
- Strike a balance between short-term and long-term needs, consequences, benefits and challenges.
- Partnership evaluation and metrics.
- Leverage the Faculty's position in the nation's capital.
- Resource sharing across the University.
- Reallocate the resources and redefine the structure of the Office of Internationalization.
- Avoid the tendency to provide excessive support for individual projects.
- Support international initiatives.
- Formalize policy for international/global health PGME placements.
- Establish a Partnership Strategy in Global Health.
- Appoint a director of Global Health across Faculty of Medicine departments.
- Implement a Global Health Service Model.
- Communicate, consult and share the global health vision broadly across the Faculty.
- Establish a research network for Global Health.
- Institutionalize the Global Health Curriculum.
- Global health awareness and promotion.
- Develop more academic offerings in Global Health



International Research Initiatives

Over the past year, the Faculty of Medicine continued to expand upon existing partnerships wherein the Faculty has invested in developing joint collaborative research initiatives:

University of Ottawa Faculty of Medicine / Université Claude Bernard Lyon 1

We continue to work closely with l'Université Claude Bernard Lyon1, particularly in the area of neuromuscular disease research, where a joint collaborative research program has been launched between the University of Ottawa's Centre for Neuromuscular Disease (CNMD) and l'Université Claude Bernard Lyon 1 Institut NeuroMyoGene (INMG). Since 2017, this program has supported 8 collaborative teams made up of researchers from across both institutions in basic and clinical neuromuscular disease research.

This year, in addition to ~\$200,000 committed to partnerships projects, we are pleased to announce the signing of a formal agreement between University of Ottawa and Centre National de la Recherche Scientifique (CNRS)/University Claude Bernard Lyon 1/Institut de la Santé et de la Recherche Médicale (INSERM) to establish an International Associated Laboratory and Joint Institute for Neuromuscular Research.

The Joint Institute for Neuromuscular Research was established in recognition of the individual strengths of basic and clinical neuromuscular research taking place at the CNMD and INMG, and the exceptionally strong collaborative research history between the two groups. The new Joint Institute will employ a global institute strategy to establish a combined training program between CNMD and INMG dedicated to the neuromuscular system. The Joint Institute will promote highly-collaborative research and provide an exceptional training environment for the next generation of basic and clinician scientists dedicated to neuromuscular research, through a bi-national program which allows fluid movement of trainees, researchers and principal investigators between the two institutes.

For additional details, please see the uOttawa press release.

https://research.uottawa.ca/news/french-research-institutions-launch-satellite-office-uottawa https://twitter.com/uOttawaResearch/status/1090357167721496577

University of Ottawa Faculty of Medicine / Shanghai Institute of Materia Medica (SIMM)

In the Spring of 2017, the University of Ottawa and SIMM established the Joint Research Centre on Systems and Personalized Pharmacology. The first-of-its-kind research centre builds on the SIMM-uOttawa laboratory in mass spectrometry/proteomics created in 2012, which has already led to joint publication, cross-training of students and progressors, and symposia in Ottawa and Shanghai. The new Centre includes a substantial investment in joint research and training opportunities across the two institutions.



Research Opportunities for Medical Students



From left to right: Michael Reaume, Dylan Perry-Nguyen, Daniel Chung, William Phillips, Cristina Andronic and Dr. Jocelyn Côté, Assistant Dean, Research & Special Projects.

Summer Studentship Program 2018:

The Faculty of Medicine Research Office Summer Studentship Program is offered to students enrolled in their first or second year of training. We are pleased to offer fifty \$5,000 bursaries to students who are selected to participate. Students then spend the summer working closely with their supervisor on a specific research project followed by a poster presentation of their work in September. Winners of the poster session then go on to present once more at the Canadian National Medical Student Research Symposium in Winnipeg.

This year's winners are:

1st place: Daniel Chung Supervisor: Dr. Dar Dowlatshahi Predicting intracerebral hemorrhage expansion and outcome using acute neuroimaging

2nd place: William Phillips Supervisor: Dr. Xinni Song Clinical Outcome of Patients with melanoma brain metastases

3rd place: Dylan Perry-Nguyen Supervisor: Dr. Benjamin Hibbert Plasminogen activator inhibitor-1, diabetes, and associated vascular disease 4th place: Cristina Andronic Supervisor: Dr. Bernard Thebaud Therapeutic potential of cell-based therapies in experimental neonatal lung disease

4th place: Michael Reaume Supervisor: Dr. Peter Tanuseputro Patient Harm in the Context of Patient-Provider Language Discordance

Pairing Program:

A key goal of the Faculty of Medicine is to promote translational research in an effort to facilitate the real-life application of research discoveries to clinical practice. Toward this goal, medical students are provided the opportunity to work with leading researchers at the Faculty of Medicine.

Based on their field of interest and the type of experience they seek (research electives, volunteer observer, etc.), students are matched with professors in the Faculty who are international leaders in their fields. The students proceed to work in a research laboratory during the Fall and Winter/Spring terms.

The Pairing Program was offered in addition to the Faculty's Summer Research Work Program.



The Faculty of Medicine, with support from affiliated hospital-based research institutes and the University of Ottawa, has developed 14 cutting-edge core facilities which bring together state-of-the-art equipment, instrumentation, methodologies and expertise crucial to the success of basic and clinical research activities. These facilities are accessible to all researchers across the University of Ottawa as well as to outside communities on a fee-for-service basis. For each facility, a core Director and user committee has been appointed to ensure accountability and optimal use. Over the past 10 years, our core facilities have done a tremendous job of promoting interdisciplinary collaboration, keeping the research community at the cutting edge of research infrastructure and emerging technologies, and training faculty, students, and staff.

Animal Behavior (BEH): Dr. Diane Lagacé

The Animal Behavior core provides a state-of-the-art facility equipped to service as a time-efficient and cost-effective service for researchers in need of mouse behavioral analysis. Located within the Animal Care Vivarium, the core offers a full battery of assays relevant to learning and memory, social behavior, sensory gating, motor function, as well as anxiety and depression. In collaboration with the Animal Care Committee and Veterinary Services, the Behavioral core can provide research teams with assistance in design, execution, analysis, presentation, and interpretation of data resulting from the use of Core services.

Bioinformatics: Dr. Theodore Perkins

The Bioinformatics Core provides advice on bioinformatics research design, conducts bioinformatics analysis, provides data warehousing services, and provides support for grant proposals that involve bioinformatics (including conducting pilot studies, support/collaboration letters, methodological text, etc.)

Cell Biology and Image Acquisition (CBIA): Dr. John Copeland

The Cell Biology and Image Acquisition (CBIA) Core Facility provides state-of-the-art advanced microscopes, image analysis tools, and technical support to facilitate your microscopy research. The CBIA offers consultations to determine the most appropriate microscope for specific research needs and the proper design of your experimental set-up. Subsequently, CBIA provides comprehensive training and follow-up sessions for all users, ensuring correct and optimal use and understanding of the imaging systems. In addition, CBIA offers support for post-acquisition analysis using the broad range of 2D to 4D Image analysis software packages that are available on our high-performance computers.

Containment Level 2+ Core Facility (CL2+): Dr. Marc-Andre Langlois

The Containment Level 2+ facility offers sophisticated laboratory space for research on infectious agents of Risk Group 2. State-of-theart engineering controls, design, and mandatory procedures allow for optimal safety of laboratory personnel, the community, and the environment. Divided into two individually controlled suites, the facility can accommodate several groups simultaneously. The facility provides all basic laboratory infrastructure, and is available to both uOttawa and external research groups.

Common Equipment and Technical Core (CETC): Dr. Laura Trinkle-Mulcahy

The Common Equipment and Technical Core facility is operated by a team of four Technical Officers who are committed to providing quality technical assistance to Faculty members and research personnel within the Faculty of Medicine. The CETC encompasses a wide array of basic and/or technologically advanced shared infrastructure; optimizes technical resources; provides technical service and aims to manage and maintain Common Equipment at its optimal level of performance in order to benefit laboratories across the Faculty of Medicine.

Flow Cytometry & Virometry (FCV): Dr. Marc-André Langlois

The FCV Core Facility offers high-speed cell sorting services, magnetic cell separation, bench top flow cytometry analysis as well as training, and support to the research community. All new users are provided with training by University of Ottawa FCV Core Facility staff. The FCV Core Facility can now analyze and sort submicron size particles (down to 100nm in diameter) such as viruses, exosomes and extracellular vesicles.

Genomics (StemCore): Dr. Michael Rudnicki

StemCore Laboratories is a high-throughput genomics facility within the Ottawa Hospital Research Institute (OHRI), and is a core facility of the University of Ottawa. StemCore Laboratories is developing a world-class infrastructure for genomics and is capable of facilitating large-scale scientific research and biotechnology projects. Stemcore Laboratories seeks out projects that are challenging, cutting-edge, extend the boundaries of biological knowledge, and will positively impact the state of human health. Stemcore works closely with the Bioinformatics Core (see below) to provide end-to-end genomics services. Available services include DNA Sequencing, Next Generation Sequencing (library preparation for multiple applications), Single Cell Analysis, experimental design, statistical calculations, proof of concept studies, grant-writing support, assay development, and manuscript preparation.



Human Pluripotent Stem Cells (hPSC): Dr. William Stanford

Pluripotent stem cells are capable of differentiating into all the cells of the embryo proper and adult organism. Induced pluripotent stem cells (iPSCs) are created by reprogramming mature adult cells (such as skin cells). They offer a unique opportunity to dissect early human development, generate models of disease, and develop cellular or drug therapeutics that target a disease or target specific patients with a disease (i.e., personalized medicine). Thus, iPSCs are important tools in Regenerative/Translational/Personalized Medicine. The hPSC core facility offers training on how to differentiate iPSCs and embryonic stem cells (ESCs) to support differentiation protocols for smooth muscle cells, vascular smooth muscle cells, chondroprogenitor cells, cardiomyocytes, neural progenitor cells, neurons, neural crest cells. They have also developed robust protocols necessary to perform CRISPR/Cas9 genome editing in pluripotent stem cells.

Louise Pelletier Histology Core Facility (LP-HCF): Dr. John Veinot

The Department of Pathology's LP-HCF is a full-service histology laboratory available to faculty, researchers, clinicians and students within and outside the University of Ottawa. The facility provides efficient, high quality and cost-effective histological services for both animal, plant and human tissues. Services include paraffin processing and embedding, paraffin and frozen sectioning as well as routine and special histological staining, including immunohistochemistry. Samples can also be scanned to digital images ensuring preservation of data and facilitating automated analysis.





Preclinical Imaging (PCI): Dr. Frank J. Rybicki

The Preclinical Imaging (PCI) Core Facility provides small animal imaging equipment (MRI, ultrasound, optical, laser doppler) and an X-ray irradiator for your research. We provide training for use of these machines, except the MRI. For the latter, a dedicated MRI physicist and MRI animal technician are available to help design and execute your imaging protocol. The PCI Core Facility is located in Roger Guindon Hall at the University of Ottawa, within the Animal Care and Veterinary Service.

Protein Biophysics (PB): Dr. Jean-François Couture

This facility contains state-of-the-art infrastructure to study protein structures, including AKTA purification systems combined with sizeexclusion columns, a calorimeter for the measurement of protein-ligand thermodynamics and spectrophotomers for the study of protein secondary structures in solution. This facility also includes a crystallization robot to carry out crystallization trials with high throughput capabilities.

Proteomics Resource Centre (PRC): Dr. Daniel Figeys

The Proteomic Resource Centre has a complete series of state-of-the art mass spectrometers. They offer the research community a complete array of proteomic services from protein and post translational modification (PTM) identification to large scale quantitative proteomics. The PRC has continued to develop specific processing protocols and can analyse the metaproteome from isolates. In particular, the PRC has developed specialized metaproteomic databases for protein identification and quantitation from microbiota. The PRC has also developed new software for metaproteomics called MetaLab and iMetaLab (imetalab.ca). The tools have been accessed over 3000 times and are now installed in labs around the world including the USA, Europe, Egypt, Australia and China.

Transgenic (Tg): Dr. David Lohnes

The transgenic mouse core houses all of the necessary equipment and expertise for generation of transgenic mice. Services offered include transgenesis, cryopreservation (sperm and embryos), cryorecovery, embryonic stem cell culture and injection in CRISPR-based mutagenesis (ES cells and INDEL-mediated mutagenesis in vivo). The Tg core can also offer consultation for CRISPR, transgenic or targeting vector design, and re-derivation of embryos.

New Cores

Metabolomics: Dr. Julie St-Pierre

Metabolomics, the latest addition to the 'omics' family, allows global profiling of the metabolites of a cell. It allows the comprehensive exploration of metabolite patterns, revealing distinct metabolic signatures in health vs. disease. Metabolomics holds tremendous potential for precision medicine through the development of better biomarkers, robust predictors of drug response and disease outcome, discovery of new metabolites and pathways typical of disease pathogenesis and progression, and finally, targeted drug development. uOttawa's new Metabolomics Core Facility is built around a suite of cutting edge equipment, including GC/MS, UPLC/QTOF, and UPLC/QQQ mass spectrometers. The integration of these technologies permits a global understanding of the metabolic state of cells and tissues. Indeed, there are numerous metabolic adaptations in disease systems and they are best studied using a systems approach. This requires mass spectrometry analysis for identification of specific metabolites throughout the metabolic network as well as metabolite tracing. These targeted metabolomics approaches are complemented with discovery metabolomics to reveal novel metabolites that are differentially regulated in health and disease. Importantly, the uOttawa Metabolomics Core Facility will be part of the broader Metabolomics Innovation Resource of the Goodman Cancer Research Centre and University of Ottawa (MIRGO), which serves the broader research community by ensuring that these two facilities work synergistically to meet the growing demand for metabolomics services across Canada.

Transmission Electron Microscopy (TEM): Dr. Baptiste Lacoste

The new TEM core facility will provide broad access to TEM technology to characterize, with unprecedented resolution (atomic nanometer range), cellular and subcellular features of cells and tissues. These applications are of particular interest to research teams in neoplastic, renal, neurodegenerative, neuromuscular, infectious, and metabolic diseases, where TEM can be used to view structures at a molecular resolution in their native cellular context (e.g. mitochondrial, microtubules, sarcomeres, micro-vasculature, synapse dynamics and vesicle organization, host-pathogen interactions, immune deposits, membrane integrity). The Facility will house JEOL JEM-1400Plus system, which delivers unprecedented high-quality and high-resolution, with cryo capability for future hardware improvements and even greater resolution.

For more information, please visit med.uOttawa.ca/core-facilities/





Research Office Major Events – Distinguished Lectures

Gairdner Lecture Series

On Tuesday, October 23rd 2018, the Faculty of Medicine hosted this year's recipients of the Gairdner awards. The Canada Gairdner Awards are recognized as among the most prestigious awards in biomedical science. This year the event featured two internationally acclaimed researchers: Dr. Lewis E. Kay, Professor in the department of Molecular Genetics, Biochemistry and Chemistry (University of Toronto) and Senior Scientist at the Toronto Hospital for Sick Children and Dr. Alan D. Lopez, Melbourne Laureate Professor, Rowden-White Chair of Global Health and Burden of Disease Measurement (University of Melbourne).

Dr Kay received the 2017 Canada Gairdner International Award for his development of modern NMR spectroscopy for studies of biomolecular structure dynamics and function, including applications to molecular machines and rare protein conformations. Dr. Lopez received the 2018 John Dirks Canada Gairdner Global Health for his ground-breaking work in conceptualizing and quantifying the Global Burden of Disease.



From left to right: Dr. Ruth Slack, Interim Vice-Dean Research, Faculty of Medicine, University of Ottawa, Dr. Lewis E. Kay, Recipient of the 2017 Canada Gairdner International Award, Dr. Alan D. Lopez, Recipient of the 2018 John Dirks Canada Gairdner Global Health Award, Dr. Janet Rossant, President and Scientific Director, Gairdner Foundation

Friesen International Prize

On Tuesday, November 6th, the University of Ottawa and the friends of CIHR were pleased to host the 2018 Henry G. Friesen International Prize in Health Research Award winner, Dr. David Naylor. Dr. Naylor, Professor of Medicine and President Emeritus of the University of Toronto, physician-scientist, academic leader, creative force in health services research, and advisor to governments on health policy spoke on the topic of Emergence of health research as a data science. Dr. Naylor is the recipient of major awards and honors from national medical and surgical societies in Canada, the US, UK, and Australasia. He is a Fellow of the Royal Society of Canada (2004) and the Canadian Academy of Health Sciences (2005), an international member of the US National Academy of Medicine, and an Officer of the Order of Canada (2006). He was inducted into the Canadian Medical Hall of Fame in 2016. The Friesen Prize, established in 2005 by the Friends of Canadian Institutes of Health Research (FCIHR) recognizes exceptional innovation by a visionary health leader of international stature.



Photo credit: Friends of CIHR and Photographer Patrick Doyle From left to right: Dr. Bernard Jasmin, Dean, Faculty of Medicine, University of Ottawa, Dr. David Naylor, Emeritus President, University of Toronto, Dr. Sylvain Charbonneau, Vice-President, Research, University of Ottawa

New Professor Seminar Series



Dr. Ellen Freeman, Associate Professor, School of Epidemiology and Public Health

Dr. Freeman (SEPH) gave a presentation entitled "Reducing the burden of visual impairment and eye disease". Dr. Freeman currently is the principal investigator of a 5-year grant from the Canadian Institutes of Health Research (CIHR) looking at the association between vision and cognition in over 400 patients with either age-related macular degeneration, glaucoma, or normal vision. She also is the principal investigator of a 1-year CIHR grant to investigate the frequency of visual impairment and eye care utilization and their determinants using data from the Canadian Longitudinal Study on Aging. Dr. Freeman has also done extensive research looking at the mobility and mental health effects of living with age-related vision loss and has authored 49 peer-reviewed publications.



Dr. Stephen Ferguson, Professor, Department of Cellular and Molecular Medicine

Dr. Ferguson (CMM) gave a presentation on "Metabotropic Glutamate Receptors as Targets for Neurodegenerative Diseases". Dr. Ferguson has worked on G protein-coupled receptor signaling and the contribution of these processes to cardiovascular and neurodegenerative disease for over 20 years. He has extensive experience in preclinical models of Alzheimer's, Huntington's and Parkinson's disease. Dr. Ferguson's research focuses on reducing the pathology and disease burden of these diseases using selective metabotropic glutamate receptor negative allosteric modulators and he has co-authored over 150 peer-reviewed publications. He currently holds a Tier I CRC in Brain and Mind.



Dr. Ryan Russell, Associate Professor, Department of Cellular and Molecular Medicine

Dr. Russell (CMM), recently gave a presentation on "Analyzing and targeting the autophagy pathway in disease: current challenges and future opportunities". Dr. Russell has published 23 articles that have been cited over 3500 times on topics including autophagy, oxygen sensing, and metabolism. His current research focus is centered on understanding autophagy defects in cancer, inflammatory bowel disease, and the metabolic syndrome. New technologies currently being developed in the Russell lab include novel assays to monitor autophagy and high throughput genomic screening of CRISPR-modified genomic DNA.



Dr. Emilio Alarcon, Assistant Professor, Department of Biochemistry, Microbiology and Immunology

Dr. Alarcon (BMI) is Scientist in the Division of Cardiac Surgery at the University of Ottawa Heart Institute & Assistant Professor at BMI. Dr. Alarcon research program works to redefine translational medicine, bridging fundamental and applied sciences such as chemistry, biology, mathematics, and nanotechnology to the development of novel bionanomaterials for treating patients with failing organs and tissues. Dr. Alarcon, though early in career, has already published over 69 articles and 3 more are currently under review, a number of book chapters, and acted as a lead editor for two books; Silver Nanoparticles on Biomedicine: "Silver Nanoparticle Applications: In the Fabrication and Design of Medical and Biosensing Devices, " 2015 (Springer), and "Nanoengineering Materials for Biomedical Uses," 2019 (Springer Nature). Research at Dr. Alarcon's laboratory is funded by NSERC, CIHR, and CHRP (CIHR-NSERC partnered program).



Dr. Steven Hawken, Assistant Professor, School of Epidemiology and Public Health

Dr. Hawken (SEPH) illustrated his most recent work in a presentation titled "Postnatal gestational age estimation from newborn screening bloodspots: from linear regression to artificial neural networks". Dr Hawken is a Scientist at the Ottawa Hospital Research Institute, an Assistant Professor in the SEPHPM, and an Adjunct Scientist at ICES. He has extensive expertise in applying advanced statistical modeling techniques, including cutting-edge machine learning methods, to large administrative databases and clinical and biological data to answer important health-related questions. He is the lead Biostatistician and a co-investigator for a global preterm birth research program funded by the Bill & Melinda Gates Foundation. His research is primarily focused in the areas of newborn screening metabolomics, maternal-newborn and pediatric epidemiology.



Dr. Wenbin Liang, Assistant Professor, Department of Cellular and Molecular Medicine

Dr. Liang (CMM) gave a recent presentation on "Regulation of cardiac ion channels by Wnt signalling". Dr. Liang has worked in heart disease research for more than 10 years. He has extensive experience in both cardiac and cellular electrophysiology, cellular reprogramming and stem cell research. The goal of Dr. Liang's research is to reduce cardiac arrhythmia-induced sudden deaths in heart disease patients, through the identification of novel arrhythmia mechanisms and the development of innovative therapeutic approaches.



Dr. Monique Potvin Kent, Assistant Professor, School of Epidemiology and Public Health

Dr. Potvin Kent, (SEPH) an Assistant Professor in the School of Epidemiology and Public Health, gave a presentation entitled Keeping Big Food Honest: Monitoring the Practices of the Canadian Food and Beverage Industry to Influence Food and Nutrition Polices and Improve Public Health. Dr. Potvin Kent is an applied multi-disciplinary public health researcher and currently conducts research on food and nutrition policies that influence rates of obesity and other diet-related non-communicable diseases in the population. She is an expert in unhealthy food and beverage marketing to children and adolescents, and has accessed children's exposure to this type of marketing on television, in digital media, and in schools over the past 10 years. She has also evaluated the impact of various food marketing policies and developed the monitoring framework to help assess the impact of a new law designed to restrict unhealthy food marketing to children in Canada. She has received funding from CIHR, NSERC, the Heart and Stroke Foundation, and the Canadian Cancer Society and frequently collaborates with governments and non-governmental health organizations.



Dr. Carolina Ilkow, Assistant Professor, Department of Biochemistry, Microbiology and Immunology

Dr. Ilkow, (BMI) gave a presentation on "Biotherapeutics for cancer treatment". Dr. Ilkow's experience in virology and virus engineering has been shaped by her graduate research work, where she identified novel interactions of pathogenic RNA viruses with their host cells. In recent years, Dr. Ilkow research focus shifted to develop a more comprehensive understanding of how viruses can be used as targeted bio-weapons to treat cancer. In particular, her research has focused on characterizing the impact of the reciprocal cellular crosstalk within the tumour microenvironment on oncolytic virus (OV) and exosome-based immunotherapies.

University of Ottawa/ **Université Claude Bernard** Lyon 1 Symposium

On October 4th & 5th the Faculty of Medicine hosted the Université Claude Bernard Lyon 1. Three researchers from l'Institut NeuroMyoGène met with our top researchers and each gave a lecture to a packed room.

PGY1 Symposium Series

The Faculty of Medicine is organizing events to increase interactions and collaboration between basic science and clinical trainees. In order to facilitate this process, the Faculty is opening the Post Graduate Year 1 (PGY1) symposium series, offered to first year residents, and to postdoctoral fellows who would be interested in participating in these events. The PGY1 seminar program offers many sessions that would benefit all trainees such as time management, communication skills, etc. This will provide an excellent opportunity to interact with clinician colleagues while gaining valuable professional skills.

The first session of our inspirational talks took place on September 25, 2018 at the Ottawa Hospital, Civic Campus Amphitheatre and featured Dr. Marc Ruel, Cardiac Surgeon and Clinical Researcher, University of Ottawa Heart Institute. Learners got to hear on the importance of Translational Research and Innovation, and the impact it has on advancing health care. The second session took place on December 4th 2018 and featured Dr David Moher who discussed presumed predatory journals and publishers: diagnosis and management and ended with an exercise on how to spot predatory journals.

UNIVERSITY OF OTTAWA/ UNIVERSITÉ DE LYON 1: INTERNATIONAL SEMINAR

October 4, 2018 - Roger Guindon, Room 2022 Metabolic regulations of adult muscle

> stem cell fate Dr. Rémi Mounier Pl. Researcher, Group leader

Control of cortical axons development through mitochondria trafficking and function Dr. Jullen Courchet



Université d'Ottawa University of Ottawa

Pl. Researcher, Group leader Muscle Nuclear & Cytoskeleton Arc

Researcher, INSERM 2-45pm

minars will be given in english only Faculty of Medicine Research Office (2033)

613-562-5800 x8116 | resmed@uOttawa.ca med.uOttawa.ca



1:00 - 3:00 - The Norman Paterson Amphitheatre (Norman Paterson Education Centre), Civic Campus ws and Post Graduate Year T residents (except family medicine) are inv fellows may register using the following link (space is limited): https://www.surveymonkey.com/r/pgmepi portant information: Use P1 Parking off MacFarlane Ave. Intercampus shuttles, car pooling and Taxi/Ube mended as parking is limited In English only **Faculty of Medicine** Research Office (2033) 🟛 uOttawa 613-562-5800 x8116 | resmed@uOttawa.ca ned.uOttawa.ca

TRANSLATIONAL RESEARCH:

ersité d'Ottawa | University of Ottawa

FROM BENCH TO BEDSIDE





eptember 25, 2018

edicine) are invited to register for this event at the

🛍 uOttawa

Information Sessions/Workshops

The Faculty of Medicine hosted a number of information sessions, networking events, and grant writing workshops in 2018. The goal of these sessions was to enhance communication and networking opportunities across the Faculty and Institutes, and to give a concise overviews/ tips for success from the perspective of international experts, recent peer-reviewers and committee Chairs, and agency representatives.

Workshops included:

- CIHR Grant Writing Workshop
- NSERC Discovery Grant Writing Workshop
- Early Researcher Award Workshop
- Predatory Journals Information Session
- New Professor Orientation Session
- MITACs Information Session
- Canada Foundation for Innovation Brainstorming Session
- Open Consultation on Medical Artificial Intelligence
- National Research Council Networking Event
- CIP Translational Evening
- Dean's "Ask me anything" Networking Event



New Initiatives

Translational Research Grant

Translational research coordinates the application of novel discoveries in biological sciences to practical uses in pharmaceutical or clinical settings. The Translational Research Grant (TRG) program promotes such research and collaboration between basic science and clinical researchers throughout the Faculty, providing seed funding to test new, innovative ideas and facilitating future grant support.

Basic scientists and clinicians teamed up to submit joint applications as co-Pls on specific research projects. Each grant is made up of matching funds from each partner: the basic science department or research institute, and the clinical department.

Congratulations to the recipients of the 2018 University of Ottawa, Faculty of Medicine Translational Research Grants:

Team: Dr. Robert deKemp (PhD) and Dr. Jakov Shlik (MD) Faculty of Medicine Department(s)/Research Institute(s): University of Ottawa Heart Institute & Division of Cardiology/ Department of Psychiatry Title: Imaging Myocardial Innervation in Post-Traumatic Stress Disorder

Team: Dr. Steven Hawken (PhD), Dr. Shannon Bainbridge (PhD), Dr. Dina El Demellawy (MD), and Dr. David Grynspan (MD) Faculty of Medicine Department(s)/Research Institute(s): Ottawa Hospital Research Institute/Department of Obstetrics and Gynecology/Department of Pathology and Laboratory Medicine Title: The missing link: Integrating placental pathology into existing pregnancy, birth and childhood health repositories

Team: Dr. Carolina Ilkow (PhD) and Dr. Hesham Abdelbary (MD)

Faculty of Medicine Department(s)/Research Institute(s): Department of Biochemistry, Microbiology and Immunology/Department of Surgery & the Division of Orthopaedic Surgery Title: A tailored antimicrobial strategy for prosthetic joint infections caused by Staphylococcus aureus biofilm: combining the powers of bacteriophages and antibiotics

Team: Dr. Kyoung-Han Kim (PhD) and Dr. Peter Liu (MD)

Faculty of Medicine Department(s)/Research Institute(s): Department of Cellular and Molecular Medicine/University of Ottawa Heart Institute & Division of Cardiology Title: Metabolic reprogramming in heart failure to ketone utilization—Unraveling the enigma of cardiac cachexia

Team: Dr. Kori LaDonna (PhD) and Dr. Glenn Posner (MD)

Faculty of Medicine Department(s)/Research Institute(s): Department of Innovation in Medical Education/Department of Obstetrics and Gynecology Title: Assessing physician communication skills: validating the 'secret shopper' scorecard

Team: Dr. Wenbin Liang (PhD) and Dr. Darryl Davis (MD)

Faculty of Medicine Department(s)/Research Institute(s): Department of Cellular and Molecular Medicine/University of Ottawa Heart Institute & Division of Cardiology Title: Cellular and Molecular Mechanisms Underlying Cardiac Sinus Node Dysfunction

New Initiatives

Team: Dr. Lynn Megeney (PhD) and Dr. Lisa Mielniczuk (MD) Faculty of Medicine Department(s)/Research Institute(s): Ottawa Hospital Research Institute/University of Ottawa Heart Institute & Division of Cardiology Title: Evaluation of Right Ventricular Adaptation in the SU5416-Hypoxia Rat Model of Pulmonary Arterial Hypertension

Team: Dr. Benjamin Rotstein (PhD) and Dr. David Messika-Zeitoun (MD) Faculty of Medicine Department(s)/Research Institute(s): Department of Biochemistry, Microbiology and Immunology/University of Ottawa Heart Institute & Division of Cardiology Title: Imaging valvular matrix remodeling to predict progression of aortic stenosis

Team: Dr. Alain Stintzi (PhD) and Dr. Juthaporn Cowan (MD)

Faculty of Medicine Department(s)/Research Institute(s): Department of Biochemistry, Microbiology and Immunology/Department of Medicine

Title: The effect of immunoglobulin treatment on lung and gut microbiome in patients with Chronic Obstructive Pulmonary Disease





Canada Research Chairs

Tier 1 Dr. Michael Rudnicki (2001) Chair in Molecular Genetics

Dr. Peter Tugwell (2002) Chair in Health Equity

Dr. Jeremy Grimshaw (2002) Chair in Health Knowledge Transfer and Uptake

Dr. Julian Little (2005) Chair in Human Genome Epidemiology

Dr. Georg Northoff (2009) Chair in Mind Brain Imaging and Neuroethics

Dr. William Stanford (2011) Chair in Integrative Stem Cell Biology

Dr. Stephen Ferguson (2015) Chair in Brain and Mind

Dr. Damien D'Amours (2017) Chair in Chromatin Dynamics and Genome Architecture

Dr. Julie St-Pierre (2018) Chair in Cancer Metabolism Tier 2

Dr. Marc-André Langlois (2010) Chair in Molecular Virology and Intrinsic Immunity

Dr. Ian Colman (2011) Chair in Mental Health Epidemiology

Dr. Marceline Côté (2015) Chair in Molecular Virology and Antiviral Therapeutics

Dr. Patrick Giguère (2015) Chair in Molecular Pharmacology and Drug Discovery

Dr. Simon Chen (2016) Chair in Neural Circuits and Behaviour

Dr. Mireille Ouimet (2017) Chair in Cardiovascular Metabolism and Cell Biology

Dr. Kin Chan (2017) Chair in Molecular Basis of Cancer Mutagenesis

Dr. Mireille Khacho (2018) Chair in Mitochondrial Dynamics and Regenerative Medicine

Dr. Maxime Rousseaux (2018) Chair in Personalized Genomics of Neurodegeneration



University Research Chairs

Dr. David Moher University Research Chair (2006) Chair in Systematic Reviews Dr. Beth Potter University Research Chair (2016) Health Services for Children with Rare Diseases

Dr. Steffany Bennett University Research Chair (2011) Chair in Neurolipidomics Dr. Mary-Ellen Harper University Research Chair (2016) Mitochondrial Bioenergetics

Endowed and Sponsored Chairs

Dr. Benjamin Chow Saul & Edna Goldfarb Chair in Cardiac Imaging Research

Dr. Barbara Vanderhyden Corinne Boyer Research Chair Ovarian Cancer

Dr. Catherine Tsilfidis Donald and Joy MacLaren Chair for Vision Research

Dr. Ciarán Duffy Endowed Chair Pediatrics

Dr. Daniel Krewski Population Health Risk Assessment Dr. Duncan Stewart Evelyn and Rowell Laishley Chair for the OHRI CEO and Scientific Director

Dr. Sudhir Sundaresan Wilbert J. Keon Chair of the Department of Surgery

Dr. Eve Tsai Suruchi Bhargava Brain & Cord Regeneration

Dr. Frans Leenen Pfizer Research Chair Hypertension

Dr. Ian Lorimer A.&E. Leger Memorial Fund for Oncology Research Chair Dr. Marc Ruel Chair Cardiac Surgery Research

Dr. Marc Ruel Michael Pitfield Chair Cardiac Surgery

Dr. Marino Labinaz Chair Interventional Cardiology Leadership

Dr. Michael Schlossmacher Bhargava Research Chair for Neurodegenerative Diseases

Dr. Pierre Blier Endowed Chair of Research Mood and Anxiety Disorders Dr. Rodney Breau Urology Oncology Research Chair

Dr. Ruth McPherson Merck Frosst Canada Chair Atherosclerosis

Dr. Seymour Brownstein Les Amis Research Chair

Dr. Sood Manish Siv L. Jindal Chair for Kidney Disease Prevention Research

Dr. Steven Gilberg Chair of the Eye Institute

Endowed and Sponsored Chairs

Dr. Daniel Krewski NSERC/SSHRC/McLaughlin Chair

Dr. David Birnie Endowed Chair in Electrophysiology

Dr. Dean Fergusson OHRI/uOttawa Clinical Epidemiology Program Endowed Chair Dr. Ian Stiell Emergency Medicine

Dr. Lyall Higginson Donald S Beanlands Chair Cardiology Education Dr. Robert Beanlands Vered Chair of Cardiology

Dr. Robert Beanlands Saul and Edna Goldfarb Chair in Cardiac Imaging Research Dr. Susan Lamb Jason Hannah Chair for the History of Medicine

Dr. Thierry Mesana Gordon F. Henderson Chair Leadership

Dr. Thierry Mesana Chair Cardiac Surgery Valve Research

Clinical Research Chairs

Dr. Shawn Aaron Department of Medicine Tier 1 Chair in Obstructive Lung Disease

Dr. Rob Beanlands Department of Medicine Tier 1 Chair in Cardiovascular Imaging Research

Dr. David Birnie Department of Medicine Tier 1 Chair in Cardiac Arrhythmia Research

Dr. Gregory Knoll Department of Medicine Tier 1 Chair in Clinical Transplantation Research Dr. Gonzalo Alvarez Department of Medicine Tier 2 Chair in Tuberculosis in Canadian Aboriginal Communities

Dr. Rebecca Auer Department of Surgery Tier 2 Chair in Perioperative Cancer Therapeutics

Dr. Kym Boycott Department of Pediatrics Tier 2 Chair in Neurogenetics

Dr. Marc Carrier Department of Medicine Tier 2 Chair in Cancer and Venous Thromboembolism Dr. Lisa Mielniczuk Department of Medicine Tier 2 Chair in Heart Failure and Pulmonary Hypertension Research

Dr. Amy Plint Department of Pediatrics Tier 2 Chair in Pediatric Emergency Medicine

Dr. Giorgio Tasca Department of Psychiatry Tier 2 Chair in Psychotherapy Research

Dr. Christian Vaillancourt Department of Emergency Medicine Tier 2 Chair in Emergency Medicine

Clinical Research Chairs

Dr. Grégoire LeGal Department of Medicine Tier 1 Chair in Diagnosis VTE

Dr. Alex MacKenzie Department of Paediatrics Tier 1 Chair in Rare Neurologic Disease Therapeutics

Dr. Marc Alan Rodger Department of Medicine Tier 1 Chair in Venous Thrombosis and Thrombophilia

Dr. Ian Stiell Department of Emergency Medicine Tier 1 Chair in Acute Cardiac Conditions

Dr. Jeffrey Perry Department of Emergency Medicine Tier 1 Chair in Emergency Neurological Research Dr. Darryl Davis Department of Medicine Tier 2 Chair in Cardiac Regeneration

Dr. David Dyment Department of Pediatrics Tier 2 Chair in Translational Epilepsy Research

Dr. Claire Liddy Department of Family Medicine Tier 2 Chair in Family Medicine

Dr. Kusum Menon Department of Pediatrics Tier 2 Chair in Pediatric Shock

Dr. Leanne Marie Ward Department of Pediatrics Tier 2 Chair in Pediatric Bone Health

Dr. Roger Zemek Departments of Pediatrics and Emergency Medicine Tier 2 Chair in Pediatric Concussion



Junior Clinical Research Chairs

Dr. Angel Arnaout Department of Surgery Junior Clinical Research Chair in "Window of Opportunity" Clinical Trials in Surgical Oncology

Dr. Lise Bjerre Department of Family Medicine Junior Clinical Research Chair in Pharmacoepidemiology and Medication Appropriateness

Dr. James Bonaparte Department of Otolaryngology Junior Clinical Research Chair in Otolaryngology

Dr. Innie Chen Department of Obstetrics and Gynecology Junior Clinical Research Chair in Reproductive Population Health and Health Services Dr. Warren Cheung Department of Emergency Medicine Junior Clinical Research Chair in Medical Education with the Department of Emergency Medicine

Dr. Girish Dwivedi Department of Medicine Junior Clinical Research Chair in Vascular Inflammation and Atherosclerosis Research

Dr. Rustum Karanjia Department of Ophthalmology Junior Clinical Research Chair in Neuro-ophthalmology

Dr. Matthew Lines Department of Pediatrics Junior Clinical Research Chair in Mitochondrial Disorders Dr. Daniel McIsaac Department of Anesthesiology Junior Research Chair in Perioperative Health Systems and Outcomes Research

Dr. Abigail Ortiz Department of Psychiatry Junior Clinical Research Chair in Mood Disorders

Dr. Nicola Schieda Department of Radiology Junior Clinical Research Chair in Radiology

Dr. Jodi Warman Chardon Department of Medicine Junior Clinical Research Chair in Novel Gene Discovery in Neuromuscular Disease

Distinguished Research Chairs

Dr. Daniel Figeys (2018) Distinguished Research Chair in Proteomics and Systems Biology Dr. Ronald Labonté (2018) Distinguished Research Chair in Globalization and Health Equity

Research Funding

UNIVERSITY OF OTTAWA | FACULTY OF MEDICINE | 2017-2018

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RESEARCH FUNDING		AMOUNT
	Tricouncil	\$41,113,896
	Other Government Sources	\$33,596,728
	Other Sources	\$30,226,502
	Not-For-Profit	\$15,091,353
	Industry	\$12,937,721
	International	\$11,026,657



Rankings and Performance

The Faculty of Medicine, University of Ottawa is proud to be among the world's top 150 Universities (QS World University Rankings 2019 (Medicine).

In addition:

#2-3 – Consistently Research intensity Medical/Science grants (MacLean's 2019)

#4 – Not-for-profit Research Partnerships (2018 Research InfoSource)

#5 – Impact in Canada (2018 CWTS Leiden Rankings)

#47 – Impact in North America (2018 CWTS Leiden Rankings)

#78 – Worldwide for Clinical Medicine (NTU Ranking 2018, up 17 places since 2014)

#102 – Impact in the World (2018 CWTS Leiden Rankings)

International \$11,026,657



Research Office

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