Centre for
Heart Lung Innovation
UBC and St. Paul's Hospital

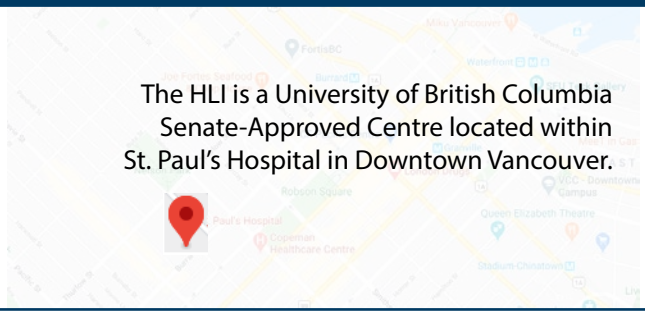
Basic, clinical, and translational research for heart, lung, and blood vessel diseases

2019 Annual Report

HLI At a Glance

Established in 1977 by Drs. James Hogg and Peter Paré

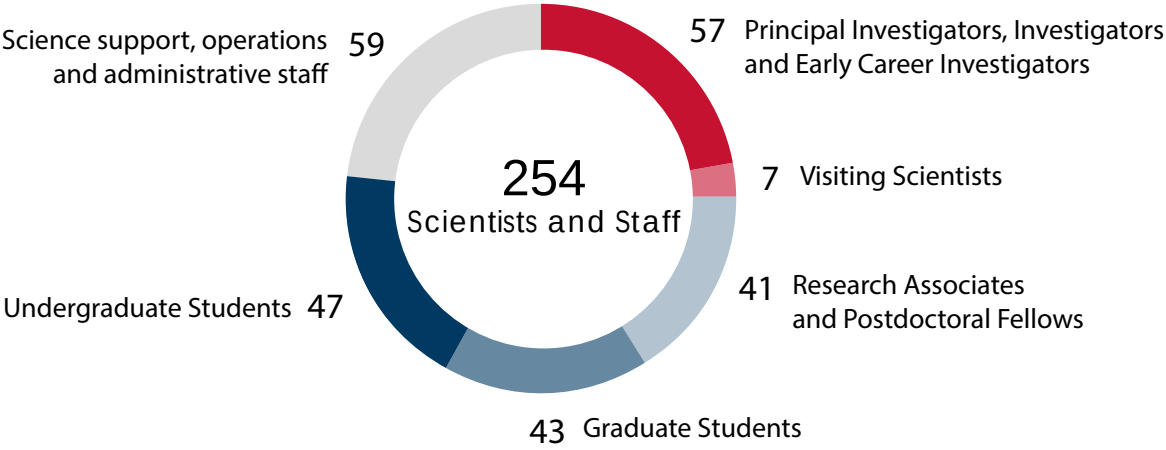
Director **Dr. Don Sin**
Associate Director **Dr. Jordan Guenette**



The HLI is a University of British Columbia Senate-Approved Centre located within St. Paul's Hospital in Downtown Vancouver.

THE UNIVERSITY OF BRITISH COLUMBIA

Providence HEALTH CARE
How you want to be treated.



- Science support, operations and administrative staff — 59
- 57 Principal Investigators, Investigators and Early Career Investigators
- 7 Visiting Scientists
- 41 Research Associates and Postdoctoral Fellows
- 43 Graduate Students
- Undergraduate Students — 47

50,000 ft² of laboratory and office space

- Cardiovascular Registry
- Lung Tissue Registry
- Cellular Imaging and Biophysics
- Graphics and Imaging
- Histology
- Molecular Phenotyping
- Pre-clinical Models
- Digital Slide Scanning

HLI PIs secured over

$15.8M

in external funding

Funding in FY 2019-2020*

Tri-Council Grants	$5.9M
Infrastructure Grants	$0.9M
Other Peer-reviewed Grants	$5.8M
Clinical Trials	$1.6M
Contracts and Agreements	$3.4M
Salary Awards**	$2.2M
Funding held at HLI	$11.9M

*April 2019 to March 2020. Details in Appendix A.
**Previous Annual Reports did not include salary awards.

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From the Director

Dear Friends and Colleagues;

I want to begin by thanking all of you for a very successful 2019 at the Centre for Heart Lung Innovation (HLI). Through your unwavering commitment and dedication to the Centre, research excellence in your field of study, and leadership in research and patient care, you have enabled HLI to be at the forefront of translational research that has improved the lives of countless number of patients with heart, lung and critical care diseases across the entire Province. This Annual Report highlights and celebrates some of these achievements.

For example, in this past year, HLI investigators discovered important molecular changes in the developmental trajectory of newborns, uncovered disease mechanisms of asthma and COPD, developed novel imaging tools and technology to evaluate cardiovascular diseases and determined new potential therapeutic targets to improve outcomes in sepsis. In aggregate, HLI investigators published 297 peer-reviewed journal articles and HLI secured over $15 million in research funding and awards in the fiscal year of 2019/2020.

This year we also celebrated the remarkable career of Dr. Bruce McManus, a renowned cardiovascular pathologist and scientist, who nearly 30 years ago, established the cardiovascular component of research at HLI and recruited many "star" cardiovascular scientists to the Centre including Drs. Granville, Luo, Yang, Bernatchez, among others, who are now international leaders in their respective fields of research. He also founded the Cardiovascular Bioregistry at HLI and created the PROOF Centre of Excellence to expand knowledge translation and commercialization capabilities at the Centre. Dr. McManus has been a true blessing to HLI and the entire UBC/PHC community; his work has contributed to HLI's world reputation as the place to be for translational heart, lung and critical care research. His legacy will live on for generations.

A notable 2019 accomplishment at the Centre has been the genesis of a training initiative entitled "Education initiative – Career Paths for Researchers", thanks in part to the largesse from the UBC Faculty of Medicine. This program will better prepare our trainees for a range of future careers in academic and non-academic research, communications, entrepreneurship, and much more.

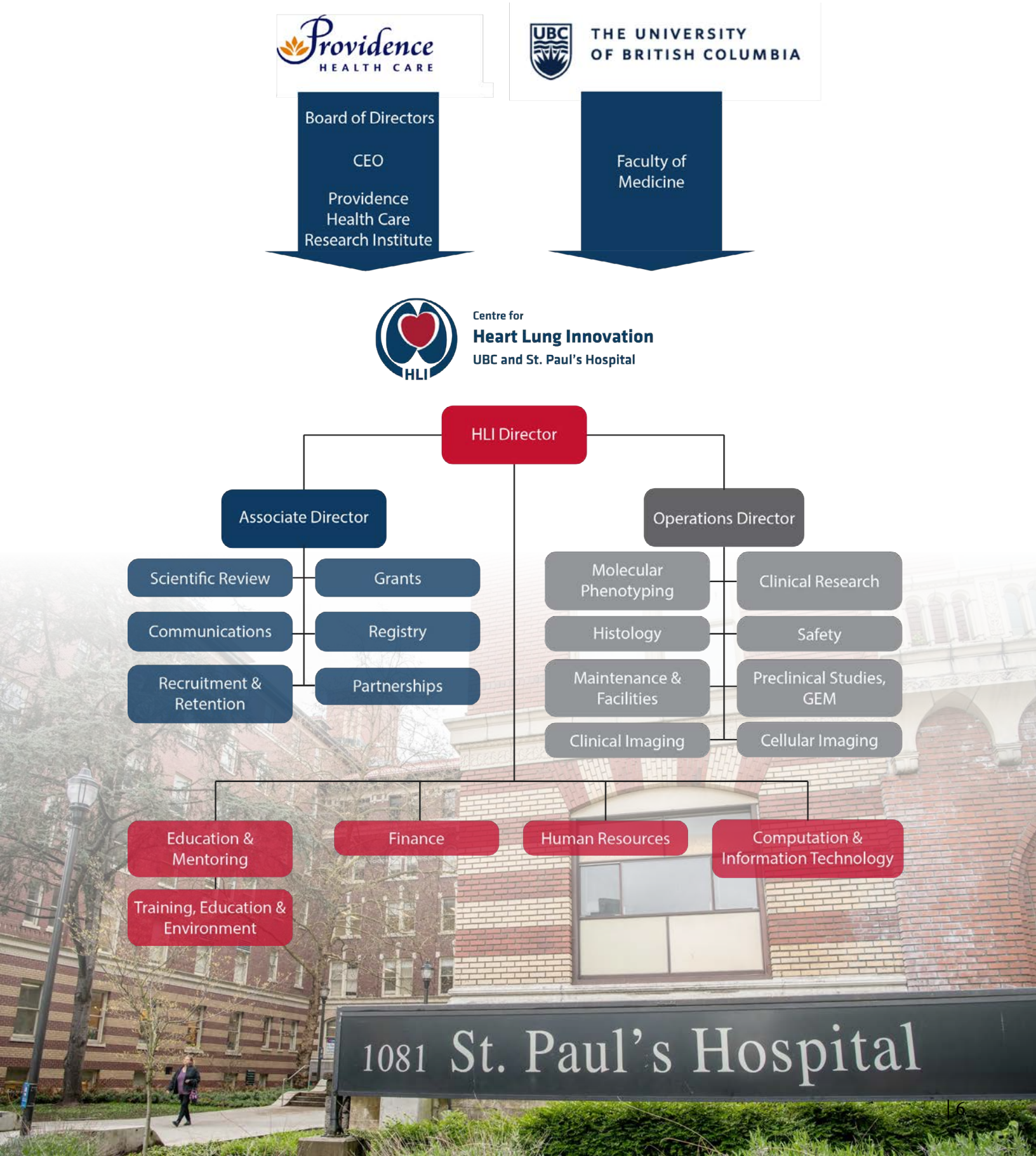
The Centre's successes are critically dependent on the continued support of our funding partners and donors. HLI scientists, trainees, and staff express our sincere gratitude to the: UBC Faculty of Medicine, Providence Health Care (PHC) and PHC Research Institute, St. Paul's Foundation, Simon Fraser University, Michael Smith Foundation for Health Research, Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Canada Foundation for Innovation, BC Knowledge Development Fund, Heart and Stroke Foundation of Canada, Canadian Lung Association, BC Lung Association, the National Institutes of Health, as well as to vendors, industry collaborators, donors, and most importantly to our patients, who are our partners in research and our inspiration in all that we do.

2020 will be a very challenging year. The COVID-19 pandemic has changed us, our communities and our country (and indeed the world) forever. The pandemic has also highlighted (with an exclamation mark!) the importance of investment in heart, lung and critical care research in Canada. The SARS-Cov2, the betacoronovirus responsible for COVID-19, infects the host through the respiratory tract and predominantly kills those with cardiopulmonary co-morbidities such as hypertension, ischemic heart disease, and COPD from sepsis, refractory hypoxemia, and multi-organ failure. To fight the current pandemic and prevent future pandemics, HLI investigators are working around the clock to generating new insights on the pathophysiology of these diseases and finding new diagnostic and therapeutic strategies. Together, we will discover, develop and translate novel solutions for our patients with heart, lung and critical care diseases.

Sincerely,

Don D. Sin, MD
Director and De Lazzari Family Chair, Centre for Heart Lung Innovation
Professor, UBC Department of Medicine

The Centre for Heart Lung Innovation (HLI, previously known as iCapture and the James Hogg Research Centre) is a University of British Columbia (UBC) Senate-approved Centre of Cardiovascular, Pulmonary, and Critical Care expertise, housed within Providence Health Care at St. Paul's Hospital. The governance and management structure of HLI in 2019 is shown below.



Research Spotlights

Top HLI research stories from 2019

Big Data Sheds Light on Developmental Changes in Newborns

The first week of a newborn's life is a time of the most rapid biological change as the baby adapts to living outside the womb, suddenly exposed to new challenges such as bacteria and viruses. Yet surprisingly little is known about these early changes. An international research study, co-led by University of British Columbia and Boston Children's Hospital, has pioneered a technique to get huge amounts of data from a tiny amount of newborn blood, allowing for the most comprehensive data analysis to date.

"We found thousands of changes over the first week of life, including changes in gene expression and parts of the immune defense pathway."

Published in Nature Communications, the researchers successfully extracted transcriptomic, proteomic, metabolomic, cytokine/chemokine, and single cell immune phenotyping data from <1 mL of blood. Using innovative integrative computational methods, the study characterized key molecular changes in newborns and discovered that two independent cohorts of newborns shared a common developmental trajectory. These results suggest that the molecular changes do not occur at random, but instead follow an age-specific pathway which may be used to monitor the impact of life-saving interventions such as vaccines.

This publication was co-first authored by PROOF Computational Biologist, **Casey Shannon**, co-authored by HLI trainees, **Daniel He** and **Dr. Amrit Singh**, and co-senior authored by HLI investigator, **Dr. Scott Tebbutt**. One of the key computational approaches that was used for this study was developed by Dr. Singh during his Ph.D. at HLI.

The study was also featured in UBC News and CBC.

Lee AH, **Shannon CP**, Amenyogbe N, Bennike TB, Diray-Arce J, Idoko OT, Gill EE, Ben-Othman R, Pomat WS, van Haren SD, Cao KL, Cox M, Darboe A, Falsafi R, Ferrari D, Harbeson DJ, **He D**, Bing C, Hinshaw SJ, Ndure J, Njie-Jobe J, Pettengill MA, Richmond PC, Ford R, Saleu G, Masiria G, Matlam JP, Kirarock W, Roberts E, Malek M, Sanchez-Schmitz G, **Singh A**, Angelidou A, Smolen KK; EPIC Consortium, Brinkman RR, Ozonoff A, Hancock REW, van den Biggelaar AHJ, Steen H, **Tebbutt SJ**, Kampmann B, Levy O, Kollmann TR. Dynamic molecular changes during the first week of human life follow a robust developmental trajectory. Nat Commun. 2019 Mar 12;10(1):1092. doi: 10.1038/s41467-019-08794-x. PubMed PMID: 30862783; PubMed Central PMCID: PMC6414553.

The Expanded Program on Immunization Consortium (EPIC) is a partnership of academic centres around the world that conducts systems biology studies in newborns and infants.

epic

HLI personnel are **bolded**.

Low Education is Linked to Risk of Cardiovascular Disease

In a study conducted around the globe, HLI principal investigator Dr. Scott Lear and co-authors found that low education was strongly associated with increased risk of major cardiovascular disease and higher case fatality rate. This large-scale study included 150,000 patients from urban and rural communities in 20 low-income, middle-income, and high-income countries.

This work was published in The Lancet Global Health and implicates improved education and access to effective health care as strategies to better cardiovascular disease outcomes. The study was also featured in CTV News.

Rosengren A, Smyth A, Rangarajan S, Ramasundarahettige C, Bangdiwala SI, AlHabib KF, Avezum A, Bengtsson Boström K, Chifamba J, Gulec S, Gupta R, Igumbor EU, Iqbal R, Ismail N, Joseph P, Kaur M, Khatib R, Kruger IM, Lamelas P, Lanas F, **Lear SA**, Li W, Wang C, Quiang D, Wang Y, Lopez-Jaramillo P, Mohammadifard N, Mohan V, Mony PK, Poirier P, Srilatha S, Szuba A, Teo K, Wielgosz A, Yeates KE, Yusoff K, Yusuf R, Yusufali AH, Attaei MW, McKee M, Yusuf S. Socioeconomic status and risk of cardiovascular disease in 20 low-income, middle-income, and high-income countries: the Prospective Urban Rural Epidemiologic (PURE) study. Lancet Glob Health. 2019 Jun;7(6):e748-e760. doi: 10.1016/S2214-109X(19)30045-2. Epub 2019 Apr 23. PubMed PMID: 31028013.

Study to Avoid Cardiovascular Events in BC

HLI investigators Drs. Liam Brunham and Simon Pimstone led a team to assess trends in the incidence, risk factors, and sex-related differences in premature atherosclerotic cardiovascular disease from 2000 to 2016. Using a provincial cardiac registry to identify young patients (men <50 years, women <55 years), the team found that despite the overall decrease in cardiovascular events and death in the general population, these trends did not extend to young patients.

To address this important health challenge, Drs. Brunham and Pimstone are enrolling patients into SAVE BC (Study to Avoid CardioVascular Events in BC), a study to identify, treat, and prevent premature heart disease.

This study was published in the Journal of the American Heart Association, and was featured in this Daily Scan article. First author Diana Vikulova is a HLI graduate student.

Vikulova DN, Grubisic M, Zhao Y, **Lynch K**, Humphries KH, **Pimstone SN**, **Brunham LR**. Premature Atherosclerotic Cardiovascular Disease: Trends in Incidence, Risk Factors, and Sex-Related Differences, 2000 to 2016. J Am Heart Assoc. 2019 Jul 16;8(14):e012178. doi: 10.1161/JAHA.119.012178. Epub 2019 Jul 8. PubMed PMID: 31280642; PubMed Central PMCID: PMC6662126.

Understanding Airway Remodeling in Asthma

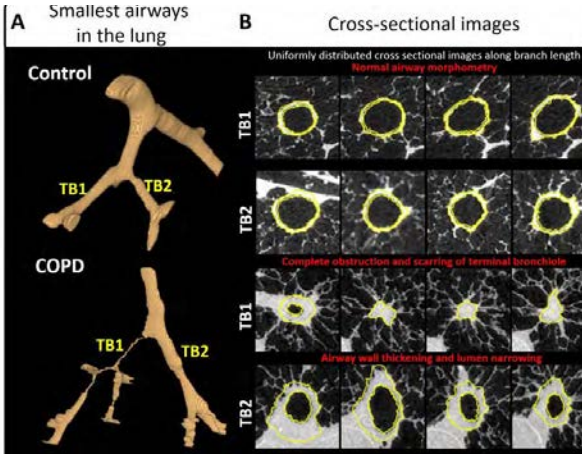
Airway remodeling, which refers to changes to the structure of the airways, occurs in asthma and is linked to reduced lung function and a greater use of asthma medications. Collagen, in particular, is an important component of the airway structure that accumulates more in asthmatic airways compared to the airways of healthy individuals.

Using state-of-the-art microscopy techniques, Dr. Tillie Hackett and her research team at the Centre for Heart Lung Innovation set out to image the collagen and elastin fibers that make up the airway in order to better understand airway remodeling. What the team discovered was that collagen fibers are more disorganized and fragmented in the airway walls of asthmatic individuals compared to individuals without asthma. This not only provides a novel drug target for asthma treatment, but also supports the use of these advanced imaging tools to monitor airway remodeling throughout disease progression and during treatment. These results were recently published in the American Journal of Respiratory and Critical Care Medicine and featured on Extracellular Matrix News.

This research was made possible by the purchase of a new non-linear optimal microscope, the first super-resolution microscope of its kind in Canada, through funds from the Canadian Foundation of Innovation and St. Paul's Hospital Foundation.

Mostaço-Guidolin LB, **Osei ET**, **Ullah J**, **Hajimohammadi S**, **Fouadi M**, **Li X**, **Li V**, **Shaheen F, Yang CX**, **Chu F**, Cole DJ, Brandsma CA, Heijink IH, Maksym GN, **Walker D**, **Hackett TL**. Defective Fibrillar Collagen Organization by Fibroblasts Contributes to Airway Remodeling in Asthma. Am J Respir Crit Care Med. 2019 Aug 15;200(4):431-443. doi: 10.1164/rccm.201810-1855OC. PubMed PMID: 30950644. doi: 10.1161/JAHA.119.012178. Epub 2019 Jul 8. PubMed PMID: 31280642; PubMed Central PMCID: PMC6662126.

A New Way to Detect Small Airway Damage in COPD



Chronic obstructive pulmonary disease (COPD) affects over 2 million Canadians and is the major cause of hospital admissions of adult males and increasingly in females over 40 years of age in Canada.

Drs. Dragos Vasilescu, Tillie Hackett, and James Hogg at HLI and collaborators at the University of Michigan and Temple University have validated a novel non-invasive imaging biomarker that identifies airway damage in the smallest airways in the lung. This novel technique can identify at-risk COPD patients before symptoms arise and offer new insights for the development of COPD and other lung diseases.

This work was published in the American Journal of Respiratory and Critical Care Medicine and was made possible by an ultra-high resolution micro CT scanner at HLI and a unique software developed by the team. This work was highlighted in the UBC Pathology Newsletter and The Daily Scan.

Vasilescu DM, Martinez FJ, Marchetti N, Galbán CJ, Hatt C, Meldrum CA, Dass C, Tanabe N, Reddy RM, Lagstein A, Ross BD, Labaki WW, Murray S, Meng X, Curtis JL, **Hackett TL**, Kazerooni EA, Criner GJ, **Hogg JC**, Han MK. Noninvasive Imaging Biomarker Identifies Small Airway Damage in Severe Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med. 2019 Sep 1;200(5):575-581. doi: 10.1164/rccm.201811-2083OC. PubMed PMID: 30794432; PubMed Central PMCID:PMC6727153.

Genetic Studies Reveal New Regulator of Sepsis Outcomes

High density lipoprotein (HDL) is an important component of the innate immune system, and contributes to pathogen clearance by sequestering and removing pathogen lipids from circulation. During sepsis, HDL cholesterol (HDL-C) levels drop, and lower HDL-C levels are associated with worse clinical outcomes, such as prolonged hospital admission and death.

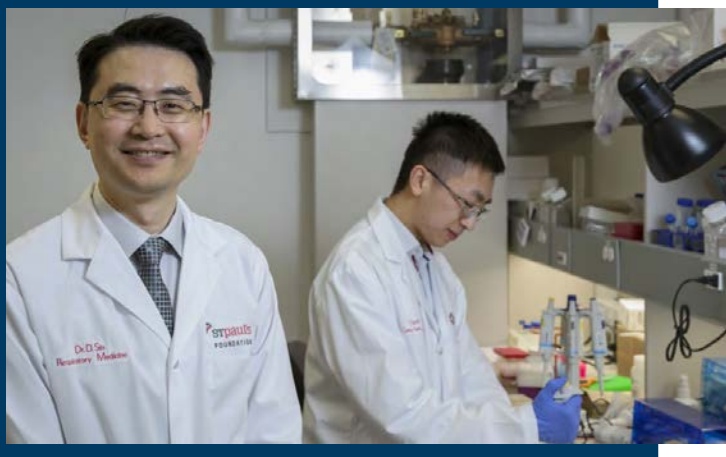
In this study published in the American Journal of Respiratory and Critical Care Medicine, Mark Trinder, a PhD candidate at HLI in Dr. Brunham's lab, and their team found that genetic variation in cholesteryl ester transferase protein (CETP) influences HDL-C levels and clinical outcomes during sepsis. More specifically, the team found that elevated CETP activity was associated with a gain-of-function CETP variant, leading to an exacerbated decline in HDL-C and lower survival rates in sepsis patients. These findings may form the basis for future studies to examine the feasibility of inhibiting CETP to increase HDL-C levels and improve outcomes for sepsis.

Trinder M, **Genga KR**, **Kong HJ**, Blauw LL, **Lo C**, **Li X**, **Cirstea M**, Wang Y, Rensen PCN, **Russell JA**, **Walley KR**, **Boyd JH**, **Brunham LR**. Cholesteryl Ester Transfer Protein Influences High-Density Lipoprotein Levels and Survival in Sepsis. Am J Respir Crit Care Med. 2019 Apr 1;199(7):854-862. doi: 10.1164/rccm.201806-1157OC. PubMed PMID: 30321485.

A novel target to reduce chronic bronchitis in COPD

Patched homolog 1 (PTCH1) variants have been identified in genome wide association studies for chronic obstructive pulmonary disease (COPD); however its biological role was unclear.

Using lung tissues from health participants and COPD patients, Dr. Anthony Tam, a postdoc in Dr. Sin's group and their team studied how the expression of PTCH1 as well as the morphology of airway epithelial cells differs between control and diseased tissues. PTCH1 was found to be upregulated in COPD airways and may upregulate mucous production, which is associated with COPD disease progression. In animal studies, knocking out PTCH1 resulted in attenuated wound closure and reduced mucous expression.



For COPD patients, excess mucous production and cough are important symptoms that are not currently targeted by available therapies. This study not only provides important insight into the underlying biological mechanism of COPD pathology, but also suggests that PTCH1 may be an important taret to reduce symptoms for COPD patients.

This study was published in Scientific Reports.

Tam A, Hughes M, **McNagny KM**, **Obeidat M**, **Hackett TL**, **Leung JM**, Shaipanich T, **Dorscheid DR**, **Singhera GK**, **Yang CWT**, **Paré PD**, **Hogg JC**, Nickle D, **Sin DD**. Hedgehog signaling in the airway epithelium of patients with chronic obstructive pulmonary disease. Sci Rep. 2019 Mar 4;9(1):3353. doi: 10.1038/s41598-019-40045-3. PMID: 30833624; PMCID: PMC6399332.

The role of blood vessels in protecting the brain during inflammation

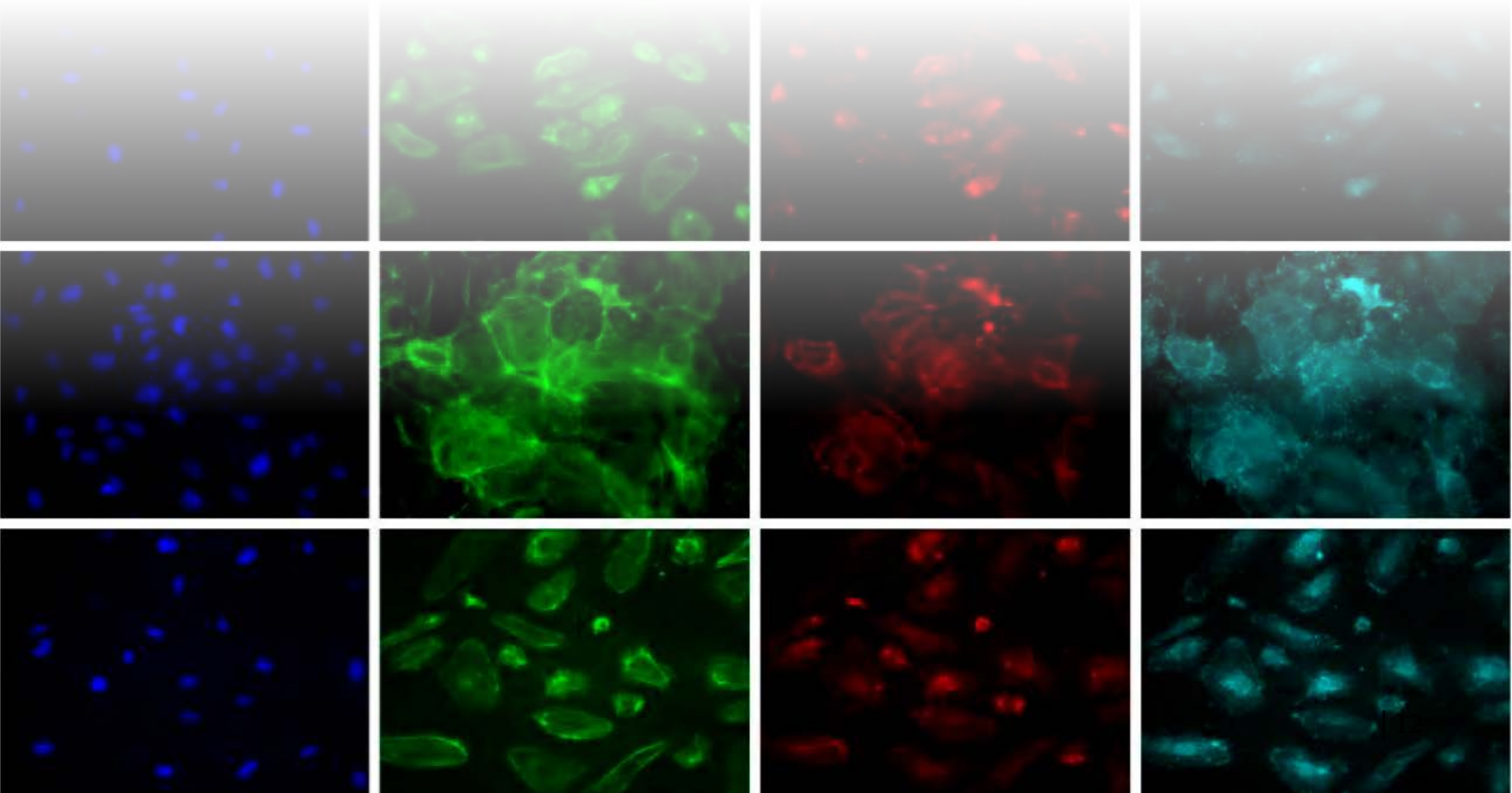
Podocalyxin is a protein that is normally expressed in blood vessels, and is particularly highly expressed in the blood vessels of the brain. In this study published in the Proceedings of the National Academcy of Sciences, HLI researcher Dr. Kelly McNagny and his team discovered the important role of podocalyxin in maintaining the integrity of the blood brain barrier during acute inflammation.

These results are significant as the blood brain barrier is tightly regulated, separating the brain from circulating blood. A healthy blood brain barrier is essential for maintaining normal brain function. Disruption of this barrier can promote the damage of brain tissue during infections and neurological diseases, such as stroke, epilepsy, and multiple sclerosis. In addition, understanding how the blood brain barrier is regulated will not only provide important insights into these neurological diseases, but may also allow researchers to effectively deliver therapeutics to the brain.

"A significant hindrance to treating neurodegenerative diseases at the moment is that most drugs can't cross the blood-brain barrier. If we are able to induce transient opening of the blood-brain barrier, that could allow us to deliver treatment directly to brain tissue."

This work was also featured in UBC News and Science and the City.

Cait J, Hughes MR, Zeglinski MR, Chan AW, Osterhof S, Scott RW, Canals Hernaez D, Cait A, Vogl AW, **Bernatchez P**, Underhill TM, **Granville DJ**, Murphy TH, Roskelley CD, **McNagny KM**. Podocalyxin is required for maintaining blood-brain barrier function during acute inflammation. Proc Natl Acad Sci U S A. 2019 Mar 5;116(10):4518-4527. doi: 10.1073/pnas.1814766116. Epub 2019 Feb 20. PMID: 30787191; PMCID: PMC6410846.



HLI Investigators

21 Named Research Chairs
9 UBC and SFU Departments

Department Affiliations:

Anesthesiology, Pharmacology, and Therapeutics
Computer Sciences
Health Sciences
Medical Genetics
Medicine
- Cardiology
- Critical Care Medicine
- Endocrinology
- Infectious Diseases
- Respiratory Medicine

Pathology and Laboratory Medicine
Physical Therapy
Radiology
Surgery

39 Principal Investigators

Michael Allard
Pascal Bernatchez
John Boyd
Liam Brunham
Pat Camp
Chris Carlsten
Harvey Coxson
Denise Daley
Mari DeMarco
Del Dorscheid
Gordon Francis
David Granville
Jordan Guenette
Tillie Hackett
James Hogg
Andrew Krahn
Zachary Laksman
Scott Lear
Jonathon Leipsic
Janice Leung
Honglin Luo
Paul Man
Bruce McManus
Kelly McNagny
Raymond Ng
Ma'en Obeidat
Peter Paré
Brad Quon
James Russell
Chris Ryerson
Andrew Sandford
Chun Seow
Don Sin
Wan Tan-Hogg
Andrew Thamboo
Scott Tebbutt
Stephan van Eeden
Keith Walley
Decheng Yang

20 Affiliated Investigators

Jamil Bashir
Sammy Chan
Karen Cheung
Ed Conway
Mark FitzGerald
Jiri Frohlich
Andrew Ignaszewski
Ismail Laher
Samuel Lichtenstein
John Mancini
Ed Moore
Simon Pimstone
Jonathan Rayment
Fabio Rossi
Robert Schellenberg
Bill Sheel
Peter Skaarsgard
Stacy Skoretz
Pearce Wilcox
Jian Ye

Investigator Profiles

Michael Allard
UBC Department of Pathology and Laboratory Medicine

Dr. Allard's research program focuses on adaptation of the heart to physiological states, such as endurance exercise, and pathological processes, such as hypertension, that result in cardiac hypertrophy. He is particularly interested in how these conditions alter substrate use by the heart and how changes in substrate use influence heart function. A major recent focus of his research has been delineation of the cellular and molecular mechanisms that account for the alterations in substrate use by the hypertrophied heart.

Pascal Bernatchez
UBC Department of Anesthesiology, Pharmacology, and Therapeutics

Dr. Bernatchez's research program is aimed at the dynamic interplay between blood vessel homeostasis and chronic diseases, such as hypertension, atherosclerosis, rare muscular dystrophies and aortic aneurysm associated with Marfan syndrome, as well as exploring novel pharmacological approaches to treat and prevent endothelial dysfunction and its consequences. Dr. Bernatchez's most recent work focuses on the novel regulation mechanism of nitric oxide bioavailability and its role in vascular disease, and how plasma lipid levels influence the loss of muscle function in dystrophic patients.

John Boyd
UBC Department of Medicine

Dr. Boyd's clinical research program is focused on defining and reversing the elements of the host response that causes sudden organ failure during severe infection. In collaboration with Dr. Robert Hancock, he recently identified a 31 gene endotoxin tolerance profile which predicts subsequent organ failure. Following the recent discovery of the role of the PCSK9 enzyme in the clearance of pathogenic bacterial and fungal lipids from the bloodstream, he collaborates with Drs. Keith Walley and James Russell to develop an anti-PCSK9 therapy as a novel treatment for sepsis.

Liam Brunham
UBC Department of Medicine
Canada Research Chair Tier 2 & MSFHR Scholar

Dr. Brunham's research focuses on genetic susceptibility to cardiovascular and metabolic diseases, specifically focusing on premature coronary artery disease and lipoprotein metabolism. He is the principal investigator of the BC Familial Hypercholesterolemia Registry, and, together with Dr. Simon Pimstone, is the co-principal investigator of the Study to Avoid cardioVascular Events in BC (SAVE BC). His laboratory uses human genetics including genome-wide association studies and next-generation sequencing to investigate the role of genetic variation in these phenotypes. His laboratory also studies genetic susceptibility to adverse drug reactions, using patient-specific induced pluripotent stem cells as a model to understand variation in drug response. Recently, his laboratory has identified an important role for high density lipoprotein (HDL) cholesterol in protecting against the risk of infections and sepsis.

Pat Camp
UBC Department of Physical Therapy

Dr. Camp's research interests focus on improving the physical activity of individuals with chronic lung disease. Currently, she has three main pillars of research: 1) rehabilitation for hospitalized patients with an acute exacerbation of COPD; 2) Indigenous lung health, including epidemiological studies of COPD in remote and rural First Nations communities in BC, and developing an Indigenous pulmonary rehabilitation program; and 3) health service delivery and quality indicators for pulmonary rehabilitation programs in Canada. Her research utilizes methodologies based in implementation sciences, health services delivery, community-based research and knowledge translation. Ultimately, Dr. Camp's research will lead to improved quality of life and physical activity for individuals with chronic lung disease.

Christopher Carlsten
UBC Department of Medicine
Canada Research Chair Tier 2

Dr. Carlsten's clinical and research interests centre on occupational airways disease, including the effects of inhaled exposures on asthma induction and exacerbation. His laboratory investigates the pulmonary-immunological health effects of inhaled environmental and occupational exposures, using diesel exhaust, western red cedar, and phthalates as model inhalants. His research addresses the fundamental question of the synergism of inhaled particles and allergens in mediating health effects. Dr. Carlsten's lab uses an interdisciplinary, team-focused approach to ask related questions on genetic, cellular, functional, and epidemiologic levels.

Harvey Coxson
UBC Department of Radiology

Dr. Coxson specializes in quantitative imaging of the lung, particularly computed tomography, with correlations to quantitative pathology and pulmonary function. Dr. Coxson's laboratory is the core imaging site for the Canadian Cohort of Obstructive Lung Disease (CanCOLD) study, a population based study of COPD, and was the core imaging analysis site for the international COPD study ECLIPSE. Dr. Coxson also works with investigators across Canada as part of the Thoracic Imaging Network of Canada and the Canadian Respiratory Research Network.

Denise Daley
UBC Department of Medicine

Dr. Daley is utilizing cutting-edge statistical, epigenetic, and bioinformatics techniques to obtain a better understanding of how inherited genetic variants and environmental exposures interact to modify the risk for developing disease. Her lab has recently completed several genome-wide association and sequencing studies to identify genetic susceptibility to common complex diseases such as asthma and COPD, and initiated new studies focused on the evaluation of the "epigenome", or the genome's response to environmental exposures. Dr. Daley's overall research goal is to better understand the etiology of disease and the modifiable environmental risk factors to identify individuals at greatest risk and develop biomarkers and public health interventions.

Mari DeMarco
UBC Department of Pathology and Laboratory Medicine
MSFHR Scholar

Dr. DeMarco is a Clinical Chemist for St. Paul's Hospital, Providence Health Care and a Clinical Associate Professor at the UBC Department of Pathology and Laboratory Medicine. Her lab's overall focus is on impacting patient care through the development of new and/or improved biofluid tests for peptide and protein biomarkers, and the translation of these tests into routine care. Dr. DeMarco was named as a Michael Smith Foundation for Health Research Scholar for her work developing biofluid diagnostic tests for Alzheimer's disease and related forms of dementia. Dr. DeMarco is an active member of her research and professional communities, for example, participating in guideline development for clinical laboratory standards for mass spectrometry assays, serving on the board of editors for the leading journal in laboratory medicine, and taking leadership roles in professional organizations such as the American Association for Clinical Chemistry, Mass Spectrometry: Applications to the Clinical Lab and the BC Association of Clinical Scientists.

Gordon Francis
UBC Department of Medicine

Dr. Francis's research involves understanding the mechanisms of accumulation of cholesterol in arteries in atherosclerosis, and how to remove this cholesterol to prevent coronary heart disease and stroke. Current major projects in his lab include: understanding the role of cholesterol derived from lysosomes in regulating gene expression required for cholesterol removal from cells, and whether accumulation of excess cholesterol in lysosomes is a feature of atherosclerosis; understanding the reason arterial smooth muscle cells appear to accumulate more cholesterol than arterial macrophages; and developing synthetic peptides that turn on production of the beneficial cholesterol particles, high density lipoproteins (HDL), to help remove excess cholesterol from the artery wall and thereby reduce atherosclerosis. His lab recently demonstrated that smooth muscle cells, rather than monocyte-derived macrophages, are the primary site of cholesterol overaccumulation in human and mouse atherosclerotic plaque, which may lead to a major paradigm shift in the understanding of the pathogenesis and treatment of ischemic vascular disease.

Delbert Dorscheid
UBC Department of Medicine
MSFHR Health Professional-Investigator

Dr. Dorscheid leads an active research group investigating the role of the airway epithelium in the genesis of inflammatory airways diseases. The research program studies the role for inappropriate injury-repair cycles in the development of both chronic diseases such as asthma and acute illnesses like ALI/ARDS. Specific projects include the role of glucocorticoid-induced airway epithelial cell apoptosis, novel glycoproteins and the glycomics involved in the repair of an injured epithelium, and the expression of FasL as an immune barrier for the airway.

David Granville
UBC Department of Pathology and Laboratory Medicine

Dr. Granville's research group focuses on vascular injury, inflammation and remodeling in the context of atherosclerosis, transplant vasculopathy, atherosclerosis, and ischemia and reperfusion injury. In recent years, Dr. Granville's group discovered a key pathogenic role for a family of serine proteases known as granzymes in autoimmune and/or age-related chronic diseases. Granzymes are a family of 5 serine proteases that play unique roles in tissue injury, inflammation, vascular permeability, loss of structural integrity and impaired remodeling. This has led to the filing of over two dozen patents, development of novel therapeutics, and the formation of a UBC spinoff company, viDA Therapeutics.

Jordan Guenette
UBC Department of Physical Therapy
MSFHR Scholar

The primary aim of Dr. Guenette's research program is to better understand the physiological mechanisms of dyspnea and exercise intolerance across the spectrum of health and chronic lung disease. His lab uses a number of novel measurement techniques to simultaneously assess the respiratory, cardiovascular, sensory, muscular and neurophysiological responses to exercise. His team conducts both mechanistic exercise physiology experiments and clinical trials in patients with interstitial lung disease (ILD), cystic fibrosis, and chronic obstructive pulmonary disease.

Tillie Hackett
UBC Department of Anesthesiology, Pharmacology, and Therapeutics
CIHR New Investigator and MSFHR Scholar

Dr. Hackett's research program is focused on understanding the disruption of normal repair processes within the epithelial-mesenchymal trophic unit (EMTU) of the lung and how this propagates inflammation and tissue remodeling in patients with obstructive lung disease. Her laboratory uses an innovative and targeted approach to isolate cells from donor lungs guided by Computed Tomography imaging. The goal of this research program is to further understand the airway microenvironment to determine therapeutic targets in order to prevent the initiation and perpetuation of pathological processes which contribute to obstructive airway diseases like asthma and chronic obstructive pulmonary disease.

James Hogg
UBC Department of Pathology and Laboratory Medicine
Order of Canada & Order of BC

Dr. Hogg has been on the staff of the University of British Columbia at St. Paul's Hospital since 1977 and is currently an Emeritus Professor of Pathology at UBC. He maintains an active research program focused on the inflammatory process in the lung with particular reference to the structure and function of the lungs in COPD. Very recently he and his colleagues used microCT to show that terminal and respiratory bronchioles are sequentially destroyed in COPD. Dr. Hogg collaborated with Dr. Avrum Spira's group at Boston University to demonstrate a 127 gene expression signature for emphysematous destruction that showed this signature could be reversed toward control levels by the tripeptide GHK. He began to study the lung microbiome in COPD and is currently examining the host response to this microbiome in human lung.

Andrew Krahn
UBC Department of Medicine
Sauder Family and HSF Chair

Dr. Krahn is a Professor in the Division of Cardiology at the University of British Columbia. Dr. Krahn has research funded by a Foundation grant from the Canadian Institute of Health Research through 2027, with 416 peer reviewed publications. Current research interests include investigation of genetic causes of arrhythmias, causes of loss of consciousness and implantable arrhythmia devices. Dr. Krahn is the founder of the Hearts in Rhythm Organization (HiRO, www.heartsinrhythm.ca), a Canadian network of inherited arrhythmia clinics. HiRO aims to facilitate collaborative research and engage patients and families with inherited arrhythmias, as well as ensure high quality and standardized care across Canada. He is the Sauder Family Chair and UBC Chief of Cardiology, and the Paul Brunes Chair in Heart Rhythm Disorders. He is the President of the Canadian Cardiovascular Society and second Vice President of the Heart Rhythm Society.

Zachary Laksman
UBC Division of Cardiology, SFU Department of Biomedical Physiology and Kinesiology
MSFHR Health Professional-Investigator

Dr. Laksman's reserach focus is on the genetic basis for diseases of the heart muscle, heart rhythm, and causes of sudden cardiac death. An element of Dr. Laksman's work involves using a stem cell model and growing heart cells in a dish. In doing so, Dr. Laksman's laboratory can model an individual patient's specific disease, apply medicines to it, and study the cause of the disease and the effect of treatment.

Scott Lear
SFU Faculty of Health Sciences
Pfizer/HSF Chair in Cardiovascular Prevention Research

Dr. Lear's research spans the breadth of prevention of cardiovascular disease at a population level to the management of cardiovascular disease at an individual level (www.CoHeaRT.ca). This includes the identification of environmental characteristics that may act as facilitators and barriers of healthy lifestyle habits, investigation to identify the role of ethnic background in risk for obesity, diabetes and cardiovascular disease and how technology can help improve health care access and delivery. He is an engaged scientific communicator through his blog (www.DrScottLear.com) and various commentaries.

Jonathon Leipsic
UBC Department of Radiology
Canada Research Chair Tier 2

Dr. Leipsic's research program is at the forefront of advanced imaging for structural heart disease and has helped guide the use of computed tomography in these procedures on a global scale. His team has published extensively in this realm as well as more broadly in the realm of coronary artery atherosclerosis, prognosis, and the interplay between ischemic heart and chronic obstructive pulmonary disease. Some of his work has informed and modified clinical practice on a global scale. He is extremely excited about the opportunity to continue to learn about how advanced imaging can help improve clinical practice at present, as well as allow for the potential for deeper understanding of the mechanisms and drivers of acute myocardial infarction, sudden cardiac death, and chronic pulmonary obstructive disease exacerbations.

Janice Leung
UBC Department of Medicine
MSFHR Health Professional-Investigator & CIHR-AstraZeneca Early Career Investigator

Dr. Leung is studying the clinical outcomes, manifestations, and underlying mechanisms of HIV-associated chronic obstructive pulmonary disease. In particular, she is interested in the pathogenesis of accelerated aging in the lung and has detected signs of accelerated aging using the blood and airway epithelial cells from HIV-infected patients. Platforms for this research include next generation sequencing methylomics and transcriptomics as well as the microbiome.

Honglin Luo
UBC Department of Pathology and Laboratory Medicine

The focus of Dr. Luo's research is to define the molecular and pathogenic determinants of virus-host interactions in enterovirus-induced cardiac and neurodegenerative diseases. The ongoing research projects include: 1) Understanding molecular mechanisms of impaired cardiac function in enteroviral myocarditis. This research focuses on the protein quality control system, which includes molecular chaperones and protein degradation pathways with the long-term goal of designing effective molecular therapies for this disease; (2) Determining the possible role of enteroviral infection in the development of amyotrophic lateral sclerosis (ALS); and (3) Developing coxsackievirus B3 (CVB3) as an oncolytic virus for lung cancer treatment. Using cell and mouse models, Dr. Luo's group recently found that CVB3 is an extremely potent anti-tumor virus, destroying various types of lung cancer cells with limited effects on normal cells. The present research aims to genetically engineer CVB3 to further enhance its safety and anti-tumor potency for the treatment of lung cancer.

S.F. Paul Man
UBC Department of Medicine

Dr. Man's research expertise is in clinical trials and translational research, particularly in chronic obstructive lung disease. The clinical outcomes in COPD are unexpectedly influenced by the premature development of atherosclerosis. In close collaboration with Dr. Don Sin, he has been trying to understand epidemiological observations in clinical context, and to design and execute clinical studies and trials to test specific hypotheses.

Bruce McManus
UBC Department of Pathology and Laboratory Medicine
Order of Canada & Order of BC

Professor McManus continued to serve as CEO of the Centre of Excellence for Prevention of Organ Failure (PROOF). His research program probes mechanisms, consequences, detection and prevention of injury and aberrant repair in inflammatory diseases of the heart and blood vessels. Dr. McManus works on molecular biomarker signature development which is critically enabled by computational sciences. He continues to enable the heart pathology registry function and development. He has a major focus on the multi-institutional clinical validation of the HEARTBiT rejection exclusion biomarker assay. In 2019, Dr. McManus was appointed to the Order of British Columbia and received the Cy Frank Distinguished Service Award from FCIHR.

Kelly McNagny
UBC Department of Medical Genetics
MSFHR Senior Scholar

Dr. Kelly McNagny is a Professor in the Department of Medical Genetics at the University of British Columbia (UBC). His research program is focused on hematopoietic stem cell biology, specifically in understanding the signaling networks that regulate stem cell differentiation and how these cells interact with their microenvironment. These processes have important implications in chronic allergy, asthma, and other inflammatory diseases. Dr. McNagny's research interests also include the innate immune response, kidney function, immuno- and cell-based therapies. He is a Michael Smith Foundation for Health Research Senior Scholar, a member of the Stem Cell Network of Canada, as well as the Associate Director of the AllerGen NCE network.

Raymond Ng
UBC Department of Computer Sciences
Canada Research Chair Tier 1

Dr. Ng's research focuses on data mining, which can be broadly viewed as large scale data analysis. With the advancement of computer technologies and biotechnologies, data are collected and accumulated at a phenomenal rate, however our ability to collect data far exceeds the ability to analyze them. The general focus of Dr. Ng's research is to develop tools that can help domain experts analyze their data in ways that are feasible, efficient to deal with the volume of the data, and statistically sound. One focus is to perform gene expression profiling for various heart and blood vessel diseases. A specific goal is to identify genes and pathways that are critical to the development, and hence cure, of those diseases.

Ma'en Obeidat
UBC Department of Medicine
MSFHR Scholar

Dr. Obeidat's research aims at translating multi-omics data for respiratory diseases into biologically actionable knowledge for drug and biomarker discoveries. His group uses cutting edge approaches in human genetics, multi-omics and integrative omics from multiple cell types and tissues to map causal genes and proteins underlying the risk for respiratory diseases which can be developed into therapeutic and/or biomarker solutions. To date, he has identified over 100 novel genetic loci associated with airway obstruction, and his work has resulted in 60 publications. Dr. Obeidat received fellowship awards from CIHR, Michael Smith Foundation for Health Research and the US-based Parker B. Francis Foundation. He has also recently been awarded research funding from CIHR, the BC Lung Association, the Canadian Lung Association, as well as the Michael Smith Foundation Scholar salary award.

Peter Paré
UBC Department of Medicine
Professor Emeritus

Dr. Paré is an Emeritus Professor of Respiratory Medicine and Pathology. Dr. Paré's research expertise is in the pathophysiology and genetics of asthma and COPD. Dr. Paré and colleague Dr. Chun Seow investigated the molecular and bio-mechanical events which relate broncho-constricting stimuli to the ultimate airway narrowing in asthma and other obstructive airway diseases. They examined isotonic and isometric length-tension properties, and the plastic behaviour of smooth muscle using physiologic, morphologic and biochemical approaches. With colleagues Drs. Don Sin and Ma'en Obeidat, he studied the genetic control of gene expression in the lung and blood of COPD patients.

Bradley Quon
UBC Department of Medicine
MSFHR Scholar & Gilead Sciences Research Scholar

Dr. Quon is a clinician-scientist with a primary clinical and research interest in cystic fibrosis (CF). His research focuses on bridging discoveries in the basic laboratory into the clinic to improve patient outcomes. He is currently searching for novel biomarkers of inflammation and infection to improve disease monitoring in CF. He also has expertise in clinical epidemiology and is part of an international collaboration examining health outcomes for individuals with CF living in Canada and the United States using national registry data. He is also actively involved in several clinical trials investigating new therapies in CF, several of which have transformed patient care. He is a Michael Smith Foundation for Health Research Scholar and is Medical Director of the newly formed CF Canada Clinical Trial Network (CF CanACT).

James Russell
UBC Department of Medicine

Dr. Russell has published over 285 peer-reviewed articles and editorials as well as 45 book chapters; he serves on the editorial boards of five journals. Key examples this past year were a proof of principle trial of selepressin, a novel selective V1aagonist, in septic shock. He also showed that diabetic septic shock patients have similar immune and lipid responses and outcomes as non-diabetic septic patients. He also wrote the septic shock chapter for the prestigious Goldman's Cecil Medicine. Dr. Russell has three major current themes of research (1) randomized controlled trials in patients with septic shock and (2) the genomics and pharmacogenomics of septic shock. He is now developing a new theme (3) to define the operating characteristics and predictive value of short-term versus long-term outcome measures in sepsis and their utility as primary endpoints in pivotal randomized controlled trials in sepsis and septic shock. Recently, he has also began to focus on the complex interaction of diabetes and sepsis, with ongoing studies regarding the interaction of diabetes and sepsis/septic shock using observational cohorts, trials, translational genomics and immune and lipid mechanistic studies. Diabetes is a major risk factor for sepsis; it triples the risk of getting sepsis and triples the numbers of deaths due to sepsis compared to non-diabetics.

Christopher Ryerson
UBC Department of Medicine
MSFHR Health Professional-Investigator

Dr. Ryerson specializes in interstitial lung disease (ILD), idiopathic pulmonary fibrosis (IPF), dyspnea, and pulmonary rehabilitation. His current research is focused on the diagnosis and prognostication of ILD, as well as how to best manage patients using non-pharmacological therapies. This area of research is particularly important given the lack of a cure from existing ILD pharmacotherapies. Dr. Ryerson also leads the Canadian Registry for Pulmonary Fibrosis, which is among the largest multicentre registries in the world, and has participated in numerous guideline documents on the diagnosis and management of ILD.

Andrew Sandford
UBC Department of Medicine

The focus of Dr. Sandford's research is the genetic basis of obstructive lung disease. His current work includes identification of genetic risk factors for the development of asthma and chronic obstructive pulmonary disease as well as genetic modifiers of disease severity in cystic fibrosis. He is also investigating the functional impact of genetic variants that have been associated with respiratory disease.

Chun Seow
UBC Department of Pathology and Laboratory Medicine

Dr. Seow specializes in smooth and skeletal muscle cell physiology, biochemistry, and pharmacology. His current research focus is on the mechanical function, ultrastructure and biochemistry of airway and vascular smooth muscle in health and disease. He is also interested in the mechanical function and structure of isolated lungs from sheep and human donors. His other interests include skeletal muscle mechanics, ATPase cycle associated with the crossbridge cycle, energetics of muscle contraction, and mathematical modeling of muscle structure and function.

Don Sin
UBC Department of Medicine
Canada Research Chair Tier 1 & De Lazzari Family Chair

Dr. Sin's research is geared towards biomarker discovery in COPD and related conditions such as lung cancer, ischemic heart disease and stroke. His group has shown that patients with COPD experience persistent low-grade systemic inflammation, which can be assessed by interrogating their peripheral circulation. By deploying this strategy, they found that certain pneumoproteins (proteins that are synthesized predominantly in lungs but secreted into the systemic circulation) are promising biomarkers of COPD clinical endpoints. Currently, Dr. Sin's team is using high throughput and high volume proteomics and genomics platforms to accelerate biomarker discovery in COPD.

Wan Tan
UBC Department of Medicine

Dr. Tan is a co-principal investigator of the Canadian Cohort of Obstructive Lung Disease (CanCOLD), a multi-centre cohort study conducted across Canada, dedicated to increasing the understanding of COPD and related co-morbidities, to improve its management and to reduce its burden. The objectives are to characterize the severity of COPD and patient response to disease (link of structural/physiological, clinical variables and health perception), while taking into account lifestyle risk factors (smoking and other modifiable risk factors), age and sex, and associated co-morbidities (cardiovascular diseases, osteoporosis, anxiety and depression).

Scott Tebbutt
UBC Department of Medicine

Dr. Tebbutt's research program is focused on systems biology and the use of multi-omics (genomics, transcriptomics, proteomics, metabolomics, etc.) to unravel the molecular signatures of complex disease and other health-related conditions, including asthma, allergic rhinitis, heart failure, neonatal vaccinology, and the interaction between spores of the fungus Aspergillus fumigatus with airway epithelial cells. His research combines hypothesis-driven studies of biological mechanisms with the development of advanced tools and technology (including bioinformatics and computational biology) to better facilitate basic and translational research. Dr. Tebbutt is also Chief Scientific Officer of the Prevention of Organ Failure (PROOF) Centre of Excellence, a not-for-profit organization dedicated to moving research findings into health care, and focused on non-invasive biomarkers that can diagnose and/or predict organ failure (heart, lung and kidney).

Andrew Thamboo
UBC Department of Surgery
MSFHR Health Professional-Investigator

Dr. Andrew Thamboo medically and surgically manages chronic sinusitis and sinonasal tumours at St. Paul's Sinus Centre and at Surrey Memorial Hospital. He also has a cross appointment with Vancouver General Hospital and Royal Columbian Hospital performing skull base procedures with the Neurosurgery team. He is the Research Director of the St. Paul's Sinus Centre. In collaboration with Respirologists, he has a lab associated with the Heart and Lung Institute. Dr. Thamboo has an interest in areas of unified airway hypothesis, upper airway physiology, office based rhinology and outcomes research. He is a recent recipient of the Michael Smith Foundation Health Investigator Award.

Stephan van Eeden
UBC Department of Medicine
CIHR/GSK Professorship in COPD

The focus of Dr. van Eeden's research is on the mechanisms of lung inflammation caused by infection and inhalation exposures, particularly cigarette smoking and air pollution. His group demonstrated that following exposure to ambient air pollutants, pro-inflammatory mediators are generated in the lung and spill over in the blood stream, which are responsible for the downstream adverse cardiovascular health effects. Dr. van Eeden also showed that statins, a medication commonly used to treat patients with increased blood lipid/cholesterol, significantly attenuated these adverse effects of air pollutants. These adverse effects are particularly important for subjects with underlying lung diseases such as COPD where air pollution cause exacerbations of the disease. He currently works on understanding the molecular mechanisms underlying these exacerbations and exploring novel methods for early identification and treatment of these exacerbations.

Decheng Yang
UBC Department of Pathology and Laboratory Medicine

Dr. Yang's research program is focused on molecular biology and the pathogenesis of coxsackievirus B3 (CVB3)-induced myocarditis. Ongoing research projects include: 1) Molecular mechanism of CVB3 replication, specifically focusing on the identification of cellular 5'TOP (Terminal oligopyrimidine tract) RNA, a group of cellular mRNAs encoding various components of the translation apparatus), in regulation of CVB3 replication, 2) Epigenetic analysis of m6A methylation profiles of viral and cellular mRNAs in determining viral replication efficiency and pathogenesis, and 3) Host response to viral infection. Using genetically modified human iPSC-derived cardiomyocytes and mice as models, Dr. Yang's group focuses on studying the host gene response to CVB3 infection. These studies are aimed to identify key genes involved in signal transduction pathways leading to cardiomyocyte injury/death or hypertrophy. The identified novel genes may serve as potential targets to design nucleic acid-based therapeutics (siRNA, artificial miRNA) for the treatment of the disease.

Keith Walley
UBC Department of Medicine

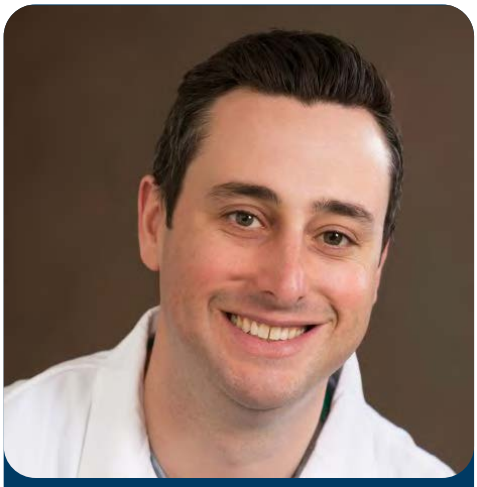
The focus of Dr. Walley's research is to investigate: (1) the mechanism of decreased left ventricular contractility and other organ failure during sepsis, and (2) the impact of genotype on patient outcomes in sepsis and systemic inflammatory states. Dr. Walley translates basic discoveries into clinical practice in the ICU. Together with Drs. Russell and Boyd, he recently demonstrated that blocking the function of PCSK9, an enzyme that inhibits the clearance of endogenous cholesterol from blood, is associated with increased pathogen lipid clearance via the LDLR, a decreased inflammatory response, and improved septic shock outcome. This important discovery facilitated the emergence of anti-PCSK9 therapies as one of the most promising treatments for sepsis.

Recognizing Research Excellence

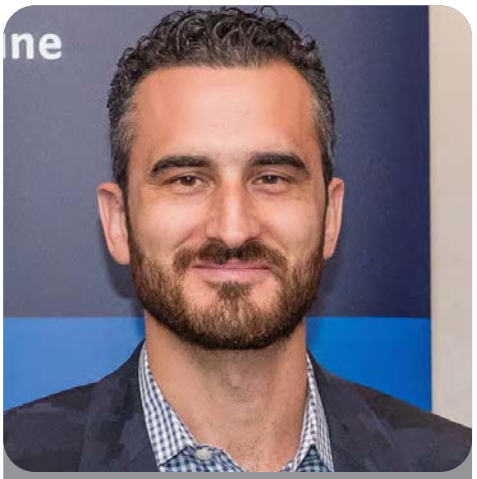
Dr. Andrew Krahn received a CIHR Foundation Grant: HiRO: Improving detection and treatment of inherited heart rhythm disorders to prevent sudden death.

Dr. Bruce McManus wasappointed to the Order of British Columbia, for building excellence in heart and lung research and care through his versatile leadership across the BC health services community. He also received **the Cy Frank Distinguished Service Award from FCIHR**, in recognition of exceptional contribution to the advancement of the FCIHR mission and goals.

Dr. Pat Camp received a CIHR Project Grant: Wildfire smoke and emergency planning for First Nation people living with lung disease in remote and rural British Columbia.



Dr. Zachary Laksman was named one of Canada's Top 40 Under 40. This recognition is awarded to outstanding young achievers, visionaries, and innovators in Canada.



Dr. Liam Brunham received a CIHR Project Grant: Improving the identification and treatments of young adults with heart disease: SAVE BC.

Dr. Jonathon Leipsic received the Gold Medal Award from the Society of Cardiovascular Computed Tomography, in recognition of being an outstanding leader who has made landmark contributions to the field of cardiovascular tomography and to society. He also received the **Jon DeHaan Foundation Award for Innovation in Cardiology**.

Congratulations All!

Dr. Brad Quon won a UBC Martin M. Hoffman Award for excellence in research. He is also recipient of the **Gilead Sciences Research Scholars Program in Cystic Fibrosis**: Molecular profiling of blood during CF pulmonary exacerbations to identify steroid-responsive endotypes.

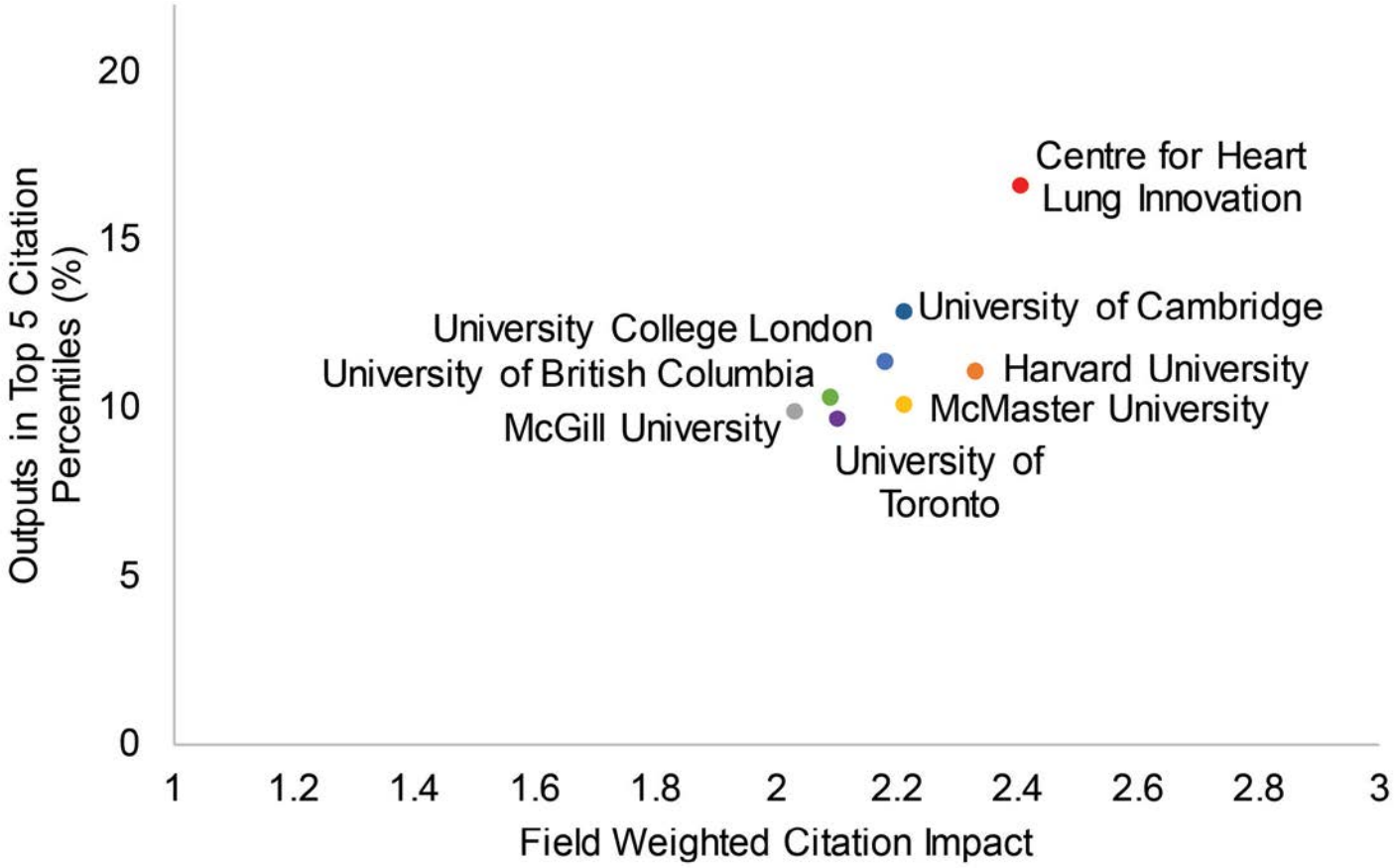
Dr. Jordan Guenette received a NSERC Discovery Grant: Sex differences in respiratory sensation and muscle function during conditions of physiological stress.

Dr. Chris Ryerson received a MSFHR Health Professional-Investigator Award: Clinical, biological, and prognostic impact of supplemental oxygen in fibrotic interstitial lung disease.

Peer Reviewed Publications

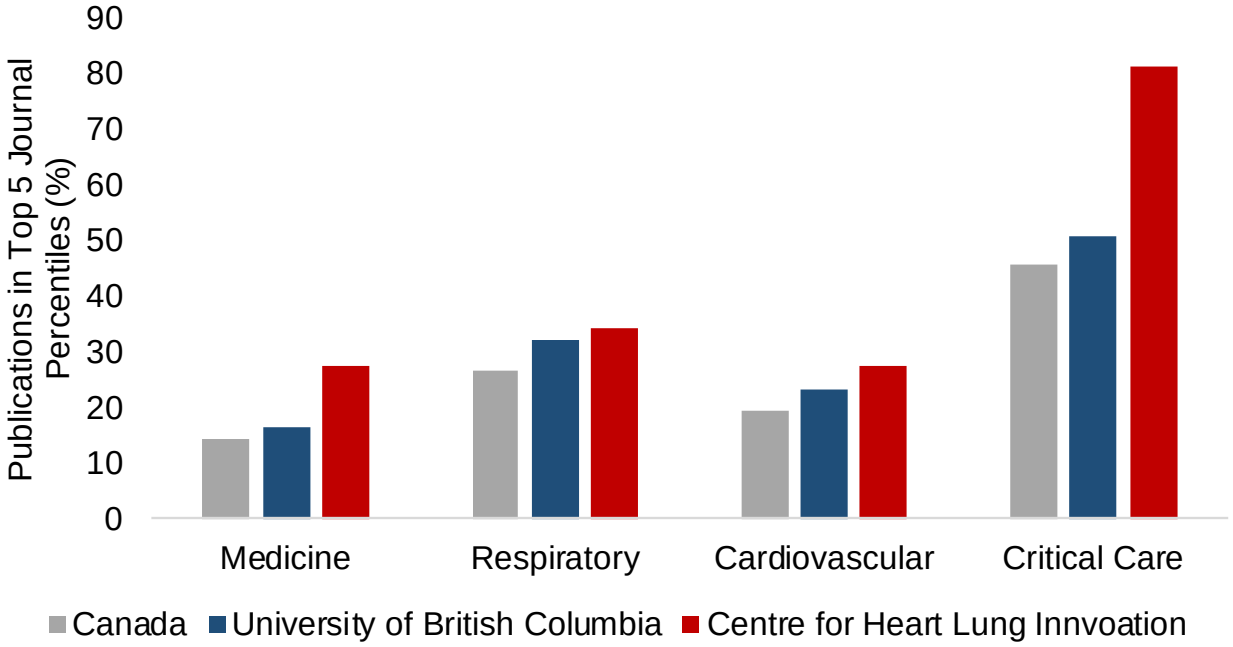
In the category of Medicine, 16.7% of publications from the Centre for Heart Lung Innovation (HLI) were in the top 5% of most cited papers.

Based on the field weighted citation impact*, publications by HLI researchers were cited ***2.4 times*** more than the average paper in a corresponding field. HLI's field weighted citation impact was higher than that of UBC and other top research institutions around the world.

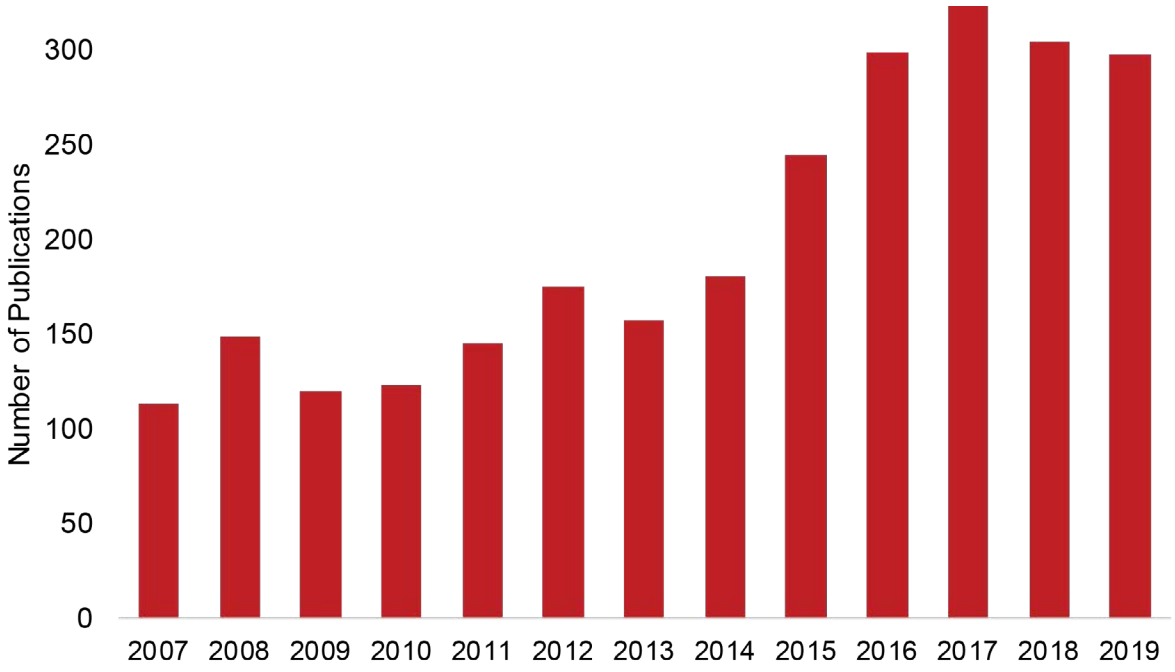


* Field weighted citation impact is a ratio of the number of citations compared to the number of expected citations for outputs of similar age, subject, and publication type. Data on peer-reviewed publications were obtained from SciVal.

HLI researchers published more frequently in the top 5% of the most cited journals in the disciplines of medicine (**27.4%**), respiratory (**34%**), cardiovascular (**27.6%**), and critical care (**81.3%**) than researchers at UBC or in Canada.



The Centre for Heart Lung Innovation's Principal Investigators and students authored **297** publications in 2019*. In the past 4 years, HLI has consistently published ~300 articles per year.



* A full list of 2019 publications by HLI Principal Investigators can be found in Appendix B.

High Impact Publications

New England Journal of Medicine

Impact Factor: 70.670

Journal Category:
Medicine, General and Internal

Rank Within Category:
1/160

Agustí A, **Hogg JC**. Update on the Pathogenesis of COPD. Reply. N Engl J Med. 2019;381(25):2484.

Agustí A, **Hogg JC**. Update on the Pathogenesis of Chronic Obstructive Pulmonary Disease. N Engl J Med. 2019;381(13):1248-56.

Criner GJ, Celli BR, Brightling CE, Agusti A, Papi A, Singh D, **Sin DD**, Vogelmeier CF, Sciurba FC, Bafadhel M, Backer V, Kato M, Ramírez-Venegas A, Wei Y-F, Bjermer L, Shih VH, Jison M, O'Quinn S, Makulova N, Newbold P, Goldman M, Martin UJ, GALATHEA Study Investigators, TERRANOVA Study Investigators. Benralizumab for the Prevention of COPD Exacerbations. N Engl J Med. 2019;381(11):1023-34.

De Backer O, Dangas GD, Jilaihawi H, **Leipsic JA**, Terkelsen CJ, Makkar R, Kini AS, Veien KT, Abdel-Wahab M, Kim W-K, Balan P, Van Mieghem N, Mathiassen ON, Jeger RV, Arnold M, Mehran R, Guimarães AHC, Nørgaard BL, Kofoed KF, Blanke P, Windecker S, Søndergaard L, GALILEO-4D Investigators. Reduced Leaflet Motion after Transcatheter Aortic-Valve Replacement. N Engl J Med. 2020;382(2):130-9.

Lancet

Impact Factor: 59.102

Journal Category:
Medicine, General and Internal

Rank Within Category:
2/160

Yusuf S, Joseph P, Rangarajan S, Islam S, Mente A, Hystad P, Brauer M, Kutty VR, Gupta R, Wielgosz A, AlHabib KF, Dans A, Lopez-Jaramillo P, Avezum A, Lanas F, Oguz A, Kruger IM, Diaz R, Yusoff K, Mony P, Chifamba J, Yeates K, Kelishadi R, Yusufali A, Khatib R, Rahman O, Zatonska K, Iqbal R, Wei L, Bo H, Rosengren A, Kaur M, Mohan V, **Lear SA**, Teo KK, Leong D, O'Donnell M, McKee M, Dagenais G. Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. Lancet. 2019:S0140-6736(19)32008-2.

Journal of the American Medical Association

Impact Factor: 51.273

Journal Category:
Medicine, General and Internal

Rank Within Category:
3/160

Adibi A, **Sin D**, Sadatsafavi M. Lowering the P Value Threshold. JAMA. 2019;321(15):1532-3.

Laterre P-F, Berry SM, Blemings A, Carlsen JE, François B, Graves T, Jacobsen K, Lewis RJ, Opal SM, Perner A, Pickkers P, **Russell JA**, Windeløv NA, Yealy DM, Asfar P, Bestle MH, Muller G, Bruel C, Brulé N, Decruyenaere J, Dive A-M, Dugernier T, Krell K, Lefrant J-Y, Megarbane B, Mercier E, Mira J-P, Quenot J-P, Rasmussen BS, Thorsen-Meyer H-C, Vander Laenen M, Vang ML, Vignon P, Vinatier I, Wichmann S, Wittebole X, Kjølbye AL, Angus DC, SEPSIS-ACT Investigators. Effect of Selepressin vs Placebo on Ventilator- and Vasopressor-Free Days in Patients With Septic Shock: The SEPSIS-ACT Randomized Clinical Trial. JAMA. 2019;322(15):1476-85.

Vincent J-L, Francois B, Zabolotskikh I, Daga MK, Lascarrou J-B, Kirov MY, Pettilä V, Wittebole X, Meziani F, Mercier E, Lobo SM, Barie PS, Crowther M, Esmon CT, Fareed J, Gando S, Gorelick KJ, Levi M, Mira J-P, Opal SM, Parrillo J, **Russell JA**, Saito H, Tsuruta K, Sakai T, Fineberg D, SCARLET Trial Group. Effect of a Recombinant Human Soluble Thrombomodulin on Mortality in Patients With Sepsis-Associated Coagulopathy: The SCARLET Randomized Clinical Trial. JAMA. 2019;321(20):1993-2002.

British Medical Journal

Impact Factor: 27.604

Journal Category:	Rank Within Category:
Medicine, General and Internal	5/160

O'Donnell M, Mente A, Rangarajan S, McQueen MJ, O'Leary N, Yin L, Liu X, Swaminathan S, Khatib R, Rosengren A, Ferguson J, Smyth A, Lopez-Jaramillo P, Diaz R, Avezum A, Lanas F, Ismail N, Yusoff K, Dans A, Iqbal R, Szuba A, Mohammadifard N, Oguz A, Yusufali AH, Alhabib KF, Kruger IM, Yusuf R, Chifamba J, Yeates K, Dagenais G, Wielgosz A, **Lear SA**, Teo K, Yusuf S, PURE Investigators. Joint association of urinary sodium and potassium excretion with cardiovascular events and mortality: prospective cohort study. BMJ. 2019;364:l772-l.

Nature Genetics

Impact Factor: 25.455

Journal Category:	Rank Within Category:
Genetics & Hereditary	2/173

Sakornsakolpat P, Prokopenko D, Lamontagne M, Reeve NF, Guyatt AL, Jackson VE, Shrine N, Qiao D, Bartz TM, Kim DK, Lee MK, Latourelle JC, Li X, Morrow JD, **Obeidat M**, Wyss AB, Bakke P, Barr RG, Beaty TH, Belinsky SA, Brusselle GG, Crapo JD, de Jong K, DeMeo DL, Fingerlin TE, Gharib SA, Gulsvik A, Hall IP, Hokanson JE, Kim WJ, Lomas DA, London SJ, Meyers DA, O'Connor GT, Rennard SI, Schwartz DA, Sliwinski P, Sparrow D, Strachan DP, Tal-Singer R, Tesfaigzi Y, Vestbo J, Vonk JM, Yim J-J, Zhou X, Bossé Y, Manichaikul A, Lahousse L, Silverman EK, Boezen HM, Wain LV, Tobin MD, Hobbs BD, Cho MH, SpiroMeta Consortium, International COPD Genetics Consortium. Genetic landscape of chronic obstructive pulmonary disease identifies heterogeneous cell-type and phenotype associations. Nat Genet. 2019;51(3):494-505.

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Impact Factor: 24.889

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Respiratory System	2/63

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JACC-Cardiovascular Imaging

Impact Factor: 10.975

Journal Category:	Rank Within Category:
Cardiac & Cardiovascular Systems	8/136
Radiology, Nuclear Medicine & Medical Imaging	1/129

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Thorax

Impact Factor: 10.307

Journal Category:	Rank Within Category:
Respiratory System	5/63

Chen W, Safari A, FitzGerald JM, **Sin DD**, Tavakoli H, Sadatsafavi M. Economic burden of multimorbidity in patients with severe asthma: a 20-year population-based study. Thorax. 2019;74(12):1113-9.

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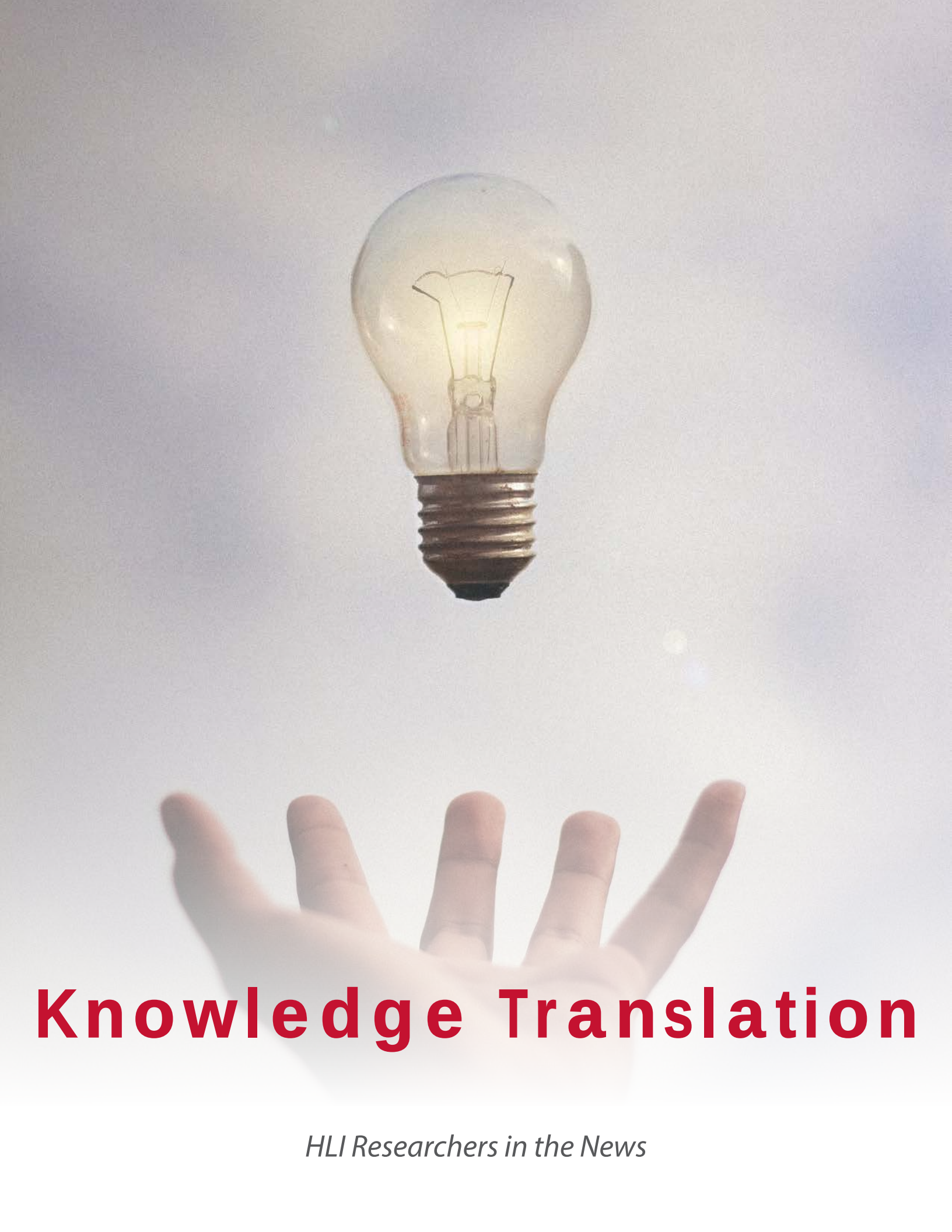


Knowledge Translation

HLI Researchers in the News

HLI Investigators Comment on Vaping Trend

Vaping, or the act of inhaling aerosols generated by e-cigarettes, is quickly increasing in popularity. Although initially marketed as a smoking cessation tool and a safer alternative to tobacco, the use of vaping products has now extended to youth, likely due to the large variety of available flavours and discreet vaping devices. In fact, experts in this Global News interview say that up to 1 in 5 adolescents have vaped in the last month – more than the number of youth who have ever tried cigarettes. However, the impact of vaping on lung health is still not completely understood.

Dr. Chris Carlsten, a Principal Investigator at the HLI and Head of the Respiratory Medicine division at UBC, warns about the potential toxicities and consequences associated with vaping.

"I fear that it may be smoking 2.0. We're inhaling into our lungs chemicals that are not chemicals that the lungs typically see, many of which are known to be toxic."

By September 2019, a CTV News report indicated that six people have died from vaping-related illnesses, with hundreds more hospitalized. Shortly after, a Daily Scan article reported that the death toll had reached 12, and the first Canadian case of a vaping-related lung illness was reported in Montreal.

Although it is unclear why and exactly how these fatal respiratory diseases occured, **Dr. Carlsten** and colleague, **Dr. Don Sin** (Director of HLI and Canada Research Chair in Chronic Obstructive Pulmonary Disease) believe it has to do with certain chemicals in the vaping liquids. Individuals with pre-existing conditions like asthma may also be more susceptible to vaping-related lung injuries.

"It may be that the nicotine and other chemicals in the vaping fumes are causing an inflammatory reaction, particularly in asthmatics, that may be very harmful to the lungs."

While further research is warranted, experts agree that stricter regulations are needed to prevent further adverse health outcomes, particularly for new users and youth.

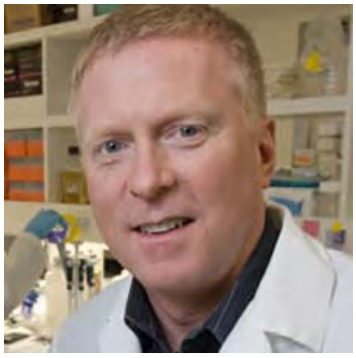
Read more in Global News, Toronto CityNews, and the Vancouver Sun.

Leading the way to changes in lipid blood tests in BC

The presence of high levels of cholesterol in the blood is the strongest modifiable risk facor for coronary heart disease. As such, measuring blood lipid levels is a standard and important part of cardiovascular risk assessment. Previously, patients who got lipid profiling tests were required to fast, in order to avoid variability in the results caused by eating. However, more recent evidence showed that nonfasting lipid profiles can actually better predict coronary disease and risk of stroke, and removes risks associated with fasting for diabetic or frail patients.

The Canadian Cardiovascular Society and College of Family Physicians of Canada currently recommend nonfasting testing for complete lipid profiles. However, these changes were only recently accepted by the BC Ministry of Health. Spearheading this policy change is HLI Principal Investigator, **Dr. Gordon Francis**, who is also the Director of the Healthy Heart Program Prevention Clinic at St. Paul's Hospital.

"This is so much more convenient for patients and now there is no need to wait at all to get your blood work done. For example, a patient can go straight from their doctor's office to the lab, rather than sitting on a lab requisition at home for months because of the hassle of fasting."



Dr. Francis was interviewed on this subject by CTV News and The Daily Scan.

Getting in shape to improve surgery outcomes

It is becoming increasingly evident that adopting a moderate exercise regiment before surgery can have a postivie impact on patient outcomes and help avoid complications.

Dr. Jordan Guenette, an exercise physiologist and the Associate Director of HLI, comments on the benefits of peroperative exercise therapy on aerobic fitness, quality of life, post-operative complications, and length of hospital stay in an article in The Daily Scan.

"In individuals undergoing surgery for lung cancer, preoperative exercise can decrease post-operative complication rates by almost 50 percent, and length of hospital stay for three days."

IMPACT AD: Advancing Diagnostics for Alzheimer's Disease

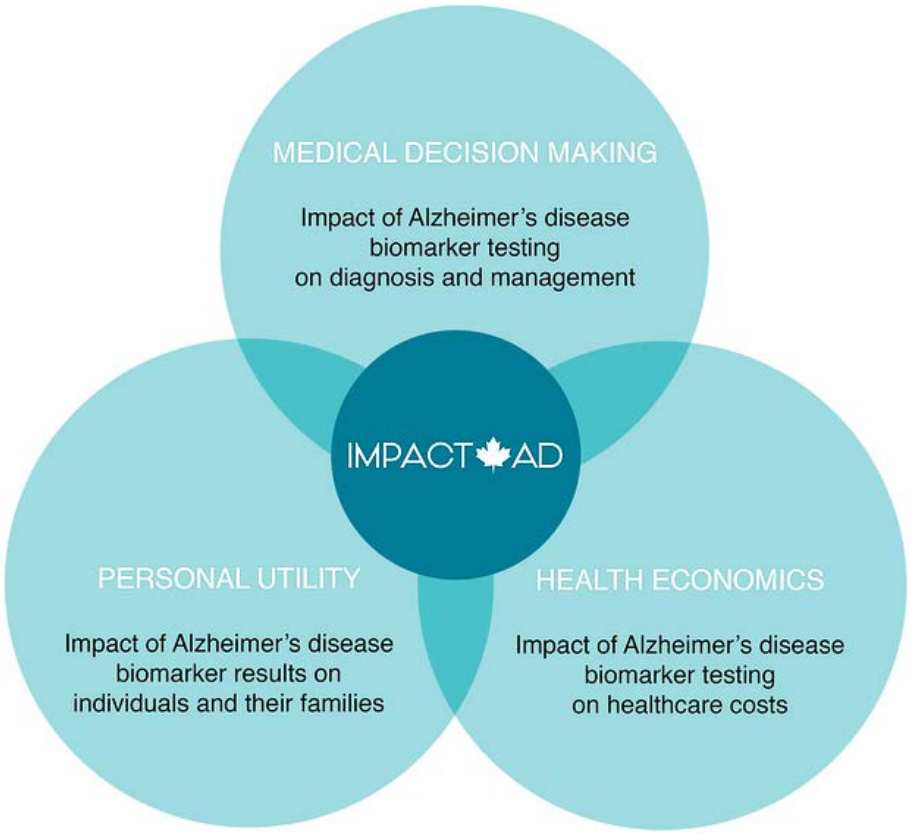
Alzheimer's disease is a progressive, degenerative brain disease that causes memory impairment and deterioration of thinking ability. Current diagnosis depends on physician evaluation of the signs and symptoms of neurodegeneration, coupled with traditional imaging. By the time most people are diagnosed, they often already have significant mental decline and cognitive impairment. Accurate and timely diagnosis is important to ensure that a patient receives the right treatment (which is most effective if provided early), and that, together with family and caregivers, they have the ability to plan for the future.

Measuring the levels of two proteins (amyloid-beta and tau) in cerebrospinal fluid has been shown to help correctly identify those with Alzheimer's disease. Such testing, which can be performed early-on in the disease course, can predict whether mild symptoms are likely to progress to dementia. Although in many countries, measuring amyloid-beta and tau is now part of routine practice, in Canada, there still exist barriers that prevent implementation of this test in routine care.

HLI Principal Investigator **Dr. Mari DeMarco** is the lead investigator on IMPACT-AD, a Canada-wide study that aims to bridge the gap between diagnostic accuracy studies and clinical utilization and implementation of these biomarker tests. IMPACT-AD will determine how the testing for these Alzheimer's disease biomarkers impacts medical and personal decision making, as well as health care costs. The goal of the study is to inform positive change in the health care system and improve care and support for patients living with Alzheimer's, and their families.

If results are positive, this could pave the way for biomarker testing to become part of routine Alzheimer's disease care in Canada. Learn more about the study in The Daily Scan: here and here. For more information, visit: https://www.impactad.org/

The IMPACT-AD study is supported by a three-year grant from Brain Canada, the Michael Smith Foundation for Health Research, the UBC Djavad Mowafaghian Centre for Brain Health and the Faculty of Medicine, the Women's Brain Health Initiative, and the St. Paul's Foundation.



World Sepsis Day: Raising Awareness for Sepsis

Sepsis, a condition that results from the body's immune system reacting to severe infection, is the number one killer worldwide. Even in Canada, sepsis causes more deaths than heart attacks. **Dr. Keith Walley**, a Principal Investigator at the Centre for Heart Lung Innovation and physician in the St. Paul's Hospital Intensive Care Unit, helps raise awareness on World Sepsis Day in this interview with Global News.

"The thing that has made the biggest difference in reducing the number of deaths due to sepsis is awareness in the medical community"

World Sepsis Day also aims to raise awareness of sepsis among patients and the public. Patients who are able to recognize the signs of sepsis and seek medical attention earlier have improved outcomes. Another important strategy to decreasing the mortality of sepsis is vaccinations, which prevents infections from happening in the first place.

The Science Behind Spring Allergies

Seasonal allergies caused by airborne pollens, also known as allergic rhinitis, is a common condition that can have significant impact on quality of life. Allergy sufferers often experience cold-like symptoms such as runny nose, sneezing, and itchy, watery eyes. **Dr. Robert Schellenberg**, HLI Investigator and Head of Allergy and Immunology at St. Paul's Hospital discusses the science behind spring allergies in this Daily Scan article.

Allergy symptoms are caused by pollen binding to allergen-specific IgE (the allergic antibody) that are attached to mast cells in the nose, eyes, and lungs. This binding triggers the release of histamine and several other compounds that cause allergy symptoms. The likelihood for developing seasonal allergies is hereditary, but is also linked to an individual's microbiota (collection of bacteria that colonizes the gut, lungs, and skin) and environmental factors.

Many treatment options are available for symptom relief. In addition to over-the-counter medications, patients with severe allergies may be prescribed nasal sprays and eye drops. To truly provide long term benefit, patients may undergo immunotherapy (allergy shots) to decrease the allergic antibody and build protective immunity. The latest advances in allergy research may actually target the allergic antibody IgE to decrease its production in the body. However, the high costs of these new biologic treatments will likely limit these strategies for severe asthma or eczema.

Public Forum for Familial Hypercholesterolemia

Familial hypercholesterolemia (FH) is a genetic condition that results in high blood cholesterol levels. This common condition affects one in every 250 people; yet up to 90% of these people remain undiagnosed. In most cases, FH has no symptoms until it causes something serious such as a stroke or heart disease.

Dr. Liam Brunham, a Principal Investigator at HLI and a physician in the St. Paul's Hospital Healthy Heart Program Prevention Clinic, leads a research proram to identify and find treatments for FH patients. In an effort to raise physician and public awareness of FH, Dr. Brunham and the Healthy Heart Clinic organized a public forum in November 2019 for FH patients and their family members. During this event, patients and their families were informed of the latest developments in FH research, and hear from patient champions about their own stories and experiences of living with FH.

This event was funded by a Michael Smith Foundation for Health Research Reach Award. Read more in this Daily Scan article.

Education at HLI

Training the next generation of researchers

The HLI prides itself on its success in attracting international trainees and research personnel from all over the world. In the past 5 years, the HLI has hosted trainees and research personnel from **39 countries** and **6 continents**.

HLI Summer Student Research Program (SSRP)

Throughout the year, numerous undergraduate students are trained at the HLI through co-operative education programs, directed studies programs or various employment opportunities. Our busiest time of year is May to August when undergraduate students participate in our Summer Student Research Program (HLI-SSRP). Students are mentored by a senior professor and an immediate supervisor, and gain hands-on basic science laboratory experience while working on a research project. Not only does each student learn, in detail, one or two technologies per four-month or eight-month fellowship, but, more importantly for this formative period of development, students learn the critical logic of complementary technologies and when to employ them to experimental advantage.

In addition to technical and scientific training, students learn to present their original work at the Summer Student Research Day, a one-day conference featuring both oral and poster presentations by student researchers.

In 2019, the HLI hosted **33 summer students** through our Summer Student Research Program.

Summer Student Research Day

The annual Summer Student Research Day took place on August 23, 2019 at the UBC Robson Square Conference Centre. During this one-day event, summer students – mostly undergraduates and a few high school students – had the opportunity to present their research findings to their peers and other researchers at the Centre. For many students, this is one of their first opportunities to showcase their most exciting research findings to a large audience.

This year, a total of 16 students gave oral presentations in three categories: heart, lung, and innovation. An additional 15 students presented their research in "3 Minute Thesis" format. Topics ranged from basic science research on asthma and chronic obstructive pulmonary disease (COPD), to clinical studies on heart disease.

The 2019 SSRD was once again a huge success, thanks to these generous sponsors: St. Paul's Hospital Foundation, Providence Health Care Research Institute, and the HLI. At the end of the day, awards were presented to the following students, as judged by a panel of senior investigators at the HLI.

2019 Dr. Bruce McManus Presentation Awards

Award	Recipient	HLI Supervisor
Top Heart Oral Presentation	Roopal Rai	Liam Brunham
Top Lung Oral Presentation	Brian Li	Brad Quon
Top "Beyond Heart and Lung" Oral Presentation	Sean La	Keith Walley
3 Minute Thesis Winner	Tony Guo	Del Dorscheid

Heart + Lung FEST 2019

The annual Heart + Lung Health FEST is an activity of, developed by, and hosted by the community-wide umbrella organization, the Institute for Heart + Lung Health. FEST is an opportunity for HLI trainees to present their ongoing research and engage and learn alongside professionals from all relevant heart and lung domains. The 2019 FEST was held February 7 - 8th at the Pinnacle Hotel Harbourfront. Distinguished presenters included: Drs. Shawn Aaron (U. Ottawa), John Webb (UBC Cardiology), Santa Ono (UBC President), Richard Leigh (U. Calgary) and many more.

HLI Trainee Research Day

On June 20, 2019, HLI's newly formed Trainee Association hosted the 3rd Annual Trainee Research Day at UBC Robson Square. Over 30 graduate students and postdoctoral fellows presented their research in 10 minute oral and 3-minute thesis style presentations. The day featured opening remarks from Dr. Jordan Guenette and a keynote presentation by Dr. Bruce McManus, entitled "Lessons and Learnings: Science and Medicine for a Better Society." With over 120 faculty, students, and staff in attendance, the event was a huge success!

Trainees presented in three categories, titled after HLI Principal Investigators: Team McManus, Team Paré, and Team Walley. In addition, those not presenting an oral presentation participated in a 3 Minute Thesis Competition.
The winners of each category were:

Oral Presentation - Team McManus
1st prize: Yasir Mohamud (Luo lab)
Runner-up: Daniela Castillo-Saldana (Ryerson lab)

Oral Presentation - Team Paré
1st prize: Mark Trinder (Brunham lab)
Runner-up: Emmanuel Osei (Hackett lab)

Oral Presentation - Team Walley
1st prize: Tim Xue (Luo lab)
Runner-up: Simran Samra (Tebbutt lab)

3 Minute Thesis Competition
1st prize: Alyson Wong (Ryerson lab)
Runners-up: Stephen Milne (Sin lab) and Minhee Jim (Sin lab)

Thank you to our generous sponsors: the Providence Health Care Research Institute, St. Paul's Foundation, and Michael Smith Foundation for Health Research; and congratulations to all trainee award winners, organizers and participants.

HLI Career Day

Every year the HLI holds a Career Day for trainees. In 2019 Career Day focused on providing trainees with useful information about career options in science and research.

Talks about preparing posters and writing scientific journal articles were also offered.

High School Science Week

For one week in spring and fall each year, high school students participate in the High School Science Week hosted at the HLI. Eight students are invited to participate in various laboratory sessions and seminars. This program is a very unique opportunity for students to get real hands-on biomedical lab experience that can help shape their education and career paths.

Students who participate in the High School Science Week are eligible to apply for the **Peter D. Paré Scholarship,** an eight-week summer internship at the HLI (valued at $2,000).

The Peter D. Paré Scholarship recipient for 2019 was **Delaram Maftoun**. Delaram worked in Dr. Tillie Hackett's lab together with Dr. Emmanuel Osei investigating fibroblast - extracellular matrix interactions and their potential role in airway remodelling in asthma. She presented her research at the 2019 HLI Summer Student Research Day.

Weekly Seminars

The Centre for Heart Lung Innovation holds two weekly seminars, the Research in Progress Seminar Series and the HLI Friday Seminar Series, both of which run from September through June each year.

The HLI Friday Seminar Series features invited experts in specific fields from all over the world to give talks which encourage education and collaboration. Detailed information about the 2019 HLI Friday Seminars can be found in Appendix C. The Research in Progress seminar series gives graduate students and post-doctoral fellows at the HLI the opportunity to present their ongoing research to other HLI researchers. The idea behind these seminars is for a critical, but supportive, audience to give feedback at the conceptual or analytic stage of the trainees' research program. Detailed information about the 2019 Research in Progress Seminars can be found in Appendix D.

New Initiative in 2019: Career Paths for Researchers (CPR)

In 2019, supported by the Faculty of Medicine Strategic Investment Fund (FoM SIF), the HLI's training program was expanded by creating "Career Paths for Researchers" (CPR). CPR was designed to expose and prepare graduate students at the HLI for careers beyond academia through tailored professional development workshops and networking opportunities with non-academic partners.

Over the course of the year, CPR organized 5 tours of local biotechnology and pharmaceutical companies, including Aurora Biomed, Chinook Therapeutics, IKOMED, Xenon Pharmaceuticals and Aspect Biosystems. Eight seminars with a total of 14 speakers from diverse fields, ranging from industrial research to health policy and funding agencies, were also hosted. CPR also sponsored Kimia Shahangian (Sin lab) and Daniel He (Tebbutt and Ryerson lab) to attend "Beyond the Professoriate", an online career conference for PhDs.

Clockwise from upper left:

CPR members visiting Aurora Biomed, Chinook Therapeutics, and Xenon Pharmaceuticals.

HLI Trainee Association

Established in 2018, the HLI Trainee Association's mission is to enhance the academic experience of all trainees by providing an environment to foster enhanced collaboration, education, professional growth, and career success. The Association is chaired by Daniel He (PhD Candidate), overseen by Dr. Scott Tebbutt, HLI's Educational Director, and includes all graduate students and postdoctoral trainees at the HLI.

In 2019, the Trainee Association organized several major events at the Centre, including the annual Trainee Research Day in June, as well as several pub nights and outdoor events like hiking, a beach potluck, and a soccer game. These events not only welcomed new trainees to the Centre and allowed trainees from different research groups to socialize, but more importantly, created a sense of community to support trainees as they pursued their own research projects.

Trainee Fellowships and Scholarships in 2019

Name	Award	Awarding Body
Alyson Wong	Robert Davidson Fellowship Award	Canadian Pulmonary Fibrosis Foundation
Andrew Ramsook	Respiratory Rehabilitation Fellowship	BC Lung Association
Anthony Tam	ATS Abstract Scholarship	National Emphysema Foundation
Arash Tehrani	Graduate Award	UBC Faculty of Medicine
Brian Li	Summer Student Research Program	UBC Faculty of Medicine
Daniel He	Doctoral Award	Canadian Institutes of Health Research
Elodie Sauge	Graduate Award	UBC Faculty of Medicine
Elodie Sauge	International Tuition Award	UBC
Emmanuel Osei	Research Trainee Fellowship	Michael Smith Foundation for Health Research
Fernando Studart	ATS Abstract Scholarship	National Emphysema Foundaton
Frank Chou	Summer Student Research Program	UBC Faculty of Medicine
Grace Lam	Fellowship	Cystic Fibrosis Canada
Ji-Young Kim	Research Trainee Fellowship	Michael Smith Foundation for Health Research
Katrina Besler	CGS-M	Canadian Institutes of Health Research
Kelly Genga	Research Trainee Fellowship	Michael Smith Foundation for Health Research
Lena Hozaima	Respiratory Rehabilitation Fellowship	BC Lung Association
Meng Wang	Accelerate Fellowship	MITACS
Michele Schaeffer	Research Trainee Fellowship	Michael Smith Foundation for Health Research
Paul Hanson	Young Investigator Award	Society of Cardiovascular Pathology
Srijen Subedi	Summer Student Research Program	UBC Faculty of Medicine
Stephanie Sellers	Fellowship	Canadian Institutes of Health Research
Steve Booth	Dr. K. Leighton Graduate Award	UBC Pharmacology and Therpeutics
Tony Guo	Summer Student Research Program	UBC Faculty of Medicine
Yannick Molgat-Seon	Fellowship	Canadian Institutes of Health Research

Other Trainee and Staff Awards in 2019

Name	Award	Awarding Body
Anthony Tam	Travel Award	CIHR - Institute Community Support
Arash Tehrani	Poster Competition WInner	American Society for Pharmacology and Therapeutics Annual Meeting
Arash Tehrani	Travel Award	American Society for Pharmacology and Therapeutics Annual Meeting
Arash Tehrani	Young Investigator Travel Award	CVN/Canadian Hypertension Congress
Arash Tehrani	Top Oral Presentation Award	UBC Department of Anesthesiology, Pharmacology and Therapeutics Research Day
Daniel He	Travel Award	CIHR - Institute Community Support
Feng Xu	ATS Abstract Award	ATS Foundation
Fernando Studart	Travel Award	CIHR - Institute Community Support
Nancy Yang	Travel Award	CIHR - Institute Community Support
Paul Hanson	Trainee Travel Award	American Society for Investigative Pathology
Stephanie Sellers	Top Oral Presentation Award	UBC Radiology Research Day

Trainee Career Paths

Here are some of the impressive scientific career paths our graduate students and postdocs moved on to after completing their training at the HLI.

Trainee	Supervisor(s)	HLI End Date	Degree/Study Level	Present Position
Aida Eslami	Denise Daley	June 2019	Postdoctorate	Assistant Professor, Université Laval
Yannick Mol-gat-Seon	Jordan Guenette	June 2019	Postdoctorate	Assistant Professor, University of Winnipeg
Junyan Shi	Mari DeMarco	May 2019	Postdoctorate	Clinical Chemistry Fellow, University of Washington
Emma Zheng	Mari DeMarco	June 2019	Postdoctorate	Clinical Chemist, Fraser Health Authority
Serena Singh	Mari DeMarco	August 2019	Postdoctorate	Postdoctoral Fellow, University of Toronto
Adeleke Fowokan	Scott Lear	August 2019	PhD	Postdoctoral Fellow, York University
Amy Nguyen	Mari DeMarco	August 2019	Master's	Student, UBC Bachelor of Computer Science degree (Integrated Computer Science Program)
Kyle Boyle	Jordan Guenette	June 2019	Master's	Research Associate, ETH Zurich
Kimia Shahangian	Don Sin	May 2019	Master's	Scientific Marketing Specialist, STEMCELL Technologies

HLI Operations

Centre Operational Highlights

Clinical Research Support Centre (CRSC) - The CSRC will be the future home of HLI at the new St Paul's. Many of our members, including Operations, Principal Investigators, staff and students contributed significantly to functional programming with the CSRC team and look forward to further progress towards occupying the new site in 2026.

Our maintenance and facilities manager successfully handled over 112 work request tickets, providing ongoing maintenance service to staff and students in over 50,000 square feet of office, wet and dry lab space. Some highlights from our core service group are:

Molecular Phenotyping Core Laboratory (MPCL)

During 2019, the MPCL team, core manager Beth Whalen and core technician, Basak Sahin, provided sample processing support to 5 clinical research biobanks. These biobanks support research projects on chronic kidney disease, outcomes in kidney transplantation, heart rhythm disorders as well as auto immune disorders such as systemic sclerosis. The team also created SOP's and Laboratory Manuals for many of the groups. A large project initiated in 2019, was the transition of over 69,000 samples from the BC Centre for Substance Use, which is carrying forward into 2020 and required the creation of SOP's, training and a BIMS.

In collaboration with Miltenyi Biotech the MPCL sponsored a Lunch & Learn session on tissue dissociation and cell separation. Various techniques and reagents were discussed to help improve sample collection for downstream flow cytometric applications.

MPCL staff attended the 34th Annual Congress for the International Society for Advancement of Cytometry in Vancouver and the 10th Annual ImmunoBC retreat. They will translate knowledge gained on the latest test developments in flow and image cytometry to future core services.

They also co-authored two manuscripts:

1. Whole blood vs PBMC: compartmental differences in gene expression profiling exemplified in asthma. He D, Yang CX, Sahin B, Singh A, Shannon CP, Oliveria JP, Gauvreau GM, Tebbutt SJ. Allergy Asthma Clin Immunol. 2019 Nov 21;15:67. doi: 10.1186/s13223-019-0382-x. eCollection 2019.PMID: 31832069Free PMC article.

2. Smooth Muscle Cells Contribute the Majority of Foam Cells in ApoE (Apolipoprotein E)-Deficient Mouse Atherosclerosis. Wang Y, Dubland JA, Allahverdian S, Asonye E, Sahin B, Jaw JE, Sin DD, Seidman MA, Leeper NJ, Francis GA.Arterioscler Thromb Vasc Biol. 2019 May;39(5):876-887. doi: 10.1161/ATVBAHA.119.312434.PMID: 30786740

Histology Core

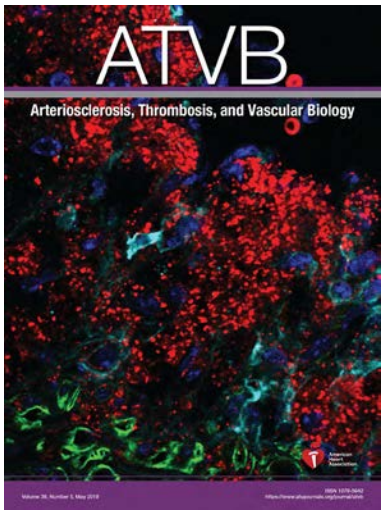
The Histology Core Facility, led by Amrit Samra, a certified histologist with an extensive clinical background, initiated a number of collaborative projects throughout 2019. Work was completed for many new user groups, including the UBC Departments of Gastroenterology, Oral Biological and Medical Science and the UBC Prostate Centre. Projects were successfully carried out for the BC Children's Hospital and local biotechnology companies. The core also reported a marked increase in equipment use, particularly in the area of immunostaining and looks forward to expanding its clientele base further in 2020.

Cellular Imaging and Biophysics Core (CIB)

Under the Scientific Direction of Dr. Dragos Vasilescu, and led by Core Manager Dr. Aaron Barlow, the Cellular Imaging and Biophysics Core (CIB) is a multi-user facility that supports research groups within the HLI, providing access to cutting-edge imaging technology and expertise. Feature instruments include the Zeiss LSM 880 confocal microscope with super-resolution and multiphoton capabilities, and the Nikon XTH 225-ST high-resolution microCT scanner.

In 2019, CIB imaging instruments have contributed in a significant way to at least 10 peer reviewed publications, 6 conference reports, and one completed PhD dissertation.

Research highlights



- Confocal microscopy images from the CIB were featured on the cover of Arteriosclerosis, Thrombosis, and Vascular Biology in a high-profile work by the Francis group that highlighted the important role of foam cells in atherosclerosis. [1]
- Using multiphoton microscopy, the Hackett group was able to show that fibrillar collagen disorganization and airway remodelling are hallmark features of asthma. [2]
- Ongoing work by the Hogg group is using microCT imaging of over 200 samples from patients with COPD matched with gene expression profiling to understand the cause and mechanism of COPD.
- In addition, the Hogg group is using microCT to study the airway and parenchymal structures of lung tissues from patients with idiopathic pulmonary fibrosis (IPF). A recent study was published in the Lancet Respiratory Medicine. A follow-up study, is using microCT to characterize the micro-pathology features in IPF at targeted locations in the lung, and relate these to the Fleischner Society guidelines used by radiologists on clinical CT images to diagnose and determine the underlying pathologies of interstitial lung diseases. Dr. Vasilescu was awarded a 3-year Parker B. Francis fellowship for his continuing work on this project.

Recent work by Drs. Jonathon Leipsic and John Webb have used microCT images to scan 30 surgical heart valves to assess if overexpansion of the valve [3], or valve-in-valve replacement could lead to failure.

[1] Wang, Y. et al. (2019). Arterioscler. Thromb. Vasc. Biol. 39(5). 876-887,
[2] Mostaco-Guidolin, L. B., et al. (2019). Am J Respir Crit Care Med. 200 (4) 431-443.
[3] Sathananthan, J, et al. (2019). JACC-Cardiovascular Interventions. 12 (1). 65-75.

Information Technology (IT)

The IT Team had a busy year in 2019 with upgrading or adding more than 20 projects supporting research at Providence Health, throughout BC and across Canada. Many of these projects led to additional funding for expanded and new studies for our researchers in 2020. Expansion of our research platform allowed us to keep pace with both our growing registries and analysis requirements. Upgrades included our 15 year old freezer biospecimen monitoring system, which allowed us to keep pace with a greater than 20% growth rate in our biobanking and allow for support of future biobanking needs on site.

Preclinical Services (GEM Facility)

The Preclinical Services Group, also known as the Genetically Engineered Models (GEM) Team made significant contributions to developing new therapeutic strategies for a number of research initiatives at HLI. Among these were progress with an Amyotrophic Lateral Sclerosis model, further work on understanding Marfan's Syndrome and cardiopulmonary disease mechanisms. The team completed studies involving Coxsackievirus B infection which causes myocarditis and H1N1, a respiratory pathogen. They were also instrumental in the success of a local educational research symposium and were honoured with an award for their efforts.

Right: GEM Team members, Lubos Bohunek, Tatjana Ponomarev and Claire Smits (absent Lynne Carter) received the Perotech Team Spirit Award 2019 ($500) at the CALAS/ACSAL National Symposium.

Health and Safety

The Health and Safety Committee had an active year. They continued to meet monthly to advise on and facilitate all matters of health and safety at HLI. As HLI now has representation on the SPH Joint Occupational Health and Safety Committee, (JOHSC) it is important to align our policies with PHC. To further that goal, the team updated the following policies:

- Domestic Violence Policy
- CODE White Policy
- Respect in the Workplace Policy
- Violence in the Workplace Policy
- Fatigue Policy

UBC selected 4 HLI Labs holding Biosafety Permits to undergo a Post Approval Monitoring inspection. All completed the inspection with success. The Team also completed Local Safety Team and Transportation of Dangerous Goods Training. Coincidentally, a visit from Transport Canada in October found all to be in order. Several members of the committee were invited to join the Faculty of Medicine JOHSC Committee. The committee oversaw the decommissioning of the Atherosclerosis Specialty lab to prepare it for renovation and the removal of 321 kg (706 lbs) of waste chemicals from the centre. The New Worker Orientation Manual was updated and 2020 projects include updating the Safety manual and webpage.

Celebrating Diversity and Inclusivity

Healthy Workplace Initiative

In 2019, the HLI held numerous social events to celebrate the diversity of our centre, promote inclusivity and understanding, and gather together for some good food and cheer.

Funded by UBC THRIVE'S Healthy Workplace Healthy Initiatives Program, an HLI "Team Health Challenge" was created where HLI personnel were challenged to develop healthier habits to take care of their mind and body. Events were organized where the importance of drinking enough water and exercising were emphasized.

In addition, several potlucks were organized where people were encouraged to share home cooked food and exchange recipes. These events fostered intercultural learning and communication as each event celebrated a specific culture and its culinary tradition.

Everyone loved socializing around the events, talking about personal strategies to stay healthy and sharing their cultures.

HLI members wear colourful garments and smiling faces to celebrate Vaisakhi and Nowruz.

The annual Lunar New Year celebration at the HLI featured a delicious lunch potluck, celebrating the many diverse cultures of our centre.

HLI Celebrates Pink Shirt Day

On February 27th, 2019, HLI researchers and staff came out in record attendance and in various shades of pink to support Pink Shirt Day. This worthy event was initiated in 2007 in Berwick, Nova Scotia, and has since become an international campaign raising anti-bullying awareness in schools and in the workplace.

Pink shirt day organizer Basak Sahin was also featured in Providence Health Care News

Supporting Scleroderma Research

Conceived by HLI technician Basak Sahin, a fundraiser for Scleroderma Research was held on June 14th, 2019. HLI researchers and staff sweated it out in a cardio-dance class and their efforts were rewarded with a spread of baked goods. All proceeds from the class and bake sale went to support the Annual Ride for Scleroderma Research on June 16th, 2019.

Lights of Hope Campaign

The St. Paul's Hospital Foundation's Lights of Hope campaign raises critical funds for the greatest needs of patients, caregivers, residents, and families. The HLI once again achieved a Gold Star on the annual Lights of Hope display.

In 2019, the HLI community raised **$27,312** for the 22nd annual fundraiser.

Partnerships and Acknowledgements

The HLI is grateful to our funding partners: Canada Foundation for Innovation, British Columbia Knowledge Development Fund, Providence Health Care, University of British Columbia, Heart and Stroke Foundation of BC and Yukon, BC Lung Association, the St. Paul's Hospital Foundation and many vendors and industrial collaborators, for their crucial support of our ongoing programs.

We wish to thank our current partners:

Adiga Life Sciences Inc.
Agartee Technology Inc.
AllerGen
Alpha-1 Foundation
Alzheimer Society of Canada
Amarin Pharma Inc.
AMGEN Canada Inc.
Asahi Kasei Pharma America
AstraZeneca Canada Inc.
Bayer AG
Boehringer Ingelheim (Canada) Ltd.
British Columbia Knowledge Development Fund (BCKDF)
British Columbia Lung Association
British Columbia Proteomics Network
Canada Foundation for Innovation
Canada Research Chairs
Canadian Diabetes Association
Canadian Foundation for AIDS Research
Canadian Institutes of Health Research (CIHR)
Cyon Therapeutics Inc.
Cystic Fibrosis Canada
Cystic Fibrosis Foundation (US)
Genentech Inc.
Genome British Columbia
Gilead Sciences Inc.
GlaxoSmithKline
Grifols Shared Services North America Inc.
Heart and Stroke Foundation of British Columbia and Yukon
Heart and Stroke Foundation of Canada
Hoffmann-La Roche Ltd. (Canada)
Networks of Centres of Excellence (NCE)
Industry Canada
Interior Health Authority
InterMune Inc.
Ionis Pharmaceuticals, Inc.
Janssen Inc.
Juvenile Diabetes Research Foundation International
La Jolla Pharmaceutical Company
Leading Biosciences Inc.
MedImmune LLC
Merck Sharp & Dohme Corp.
Michael Smith Foundation for Health Research
National Institutes of Health
National Research Council
Natural Sciences and Engineering Research Council of Canada (NSERC)
Novartis Pharmaceuticals Canada Inc.
Octapharma Canada Inc.
Pfizer Canada Inc.
Pharmaxis Ltd.
ProMetic Life Sciences Inc.
PROOF Centre of Excellence
Providence Health Care Research Institute (PHCRI)
Province of British Columbia
Respivert Ltd.
RxSource Corp.
sanofi-aventis Canada Inc.
St. Paul's Hospital Foundation
The Lung Association
Trius Therapeutics Inc.
UBC Department of Medicine
UBC Department of Physical Therapy
University of Calgary
Vertex Pharmaceuticals Inc.
viDA Therapeutics Inc.

We are grateful to the following individuals for their assistance in the creation of this report: Katherine Adolphs, Vivienne Chan, Claire Smits, Chris Robinson, Gwen Sin, Bryan Wong, Ivan Leversage, Dr. Don Sin and all the HLI Principal investigators.

Supporting Our Fight Against Heart and Lung Diseases

Heart and lung diseases combined are still the world's number one cause of death and disability. Help us win this fight.

The Centre for Heart Lung Innovation has been extremely successful at attracting infrastructure grants and government research dollars. However, attracting funds to allow us to retain our expertly trained staff and purchase new equipment remains a challenge. We actively seek interest and donations from private and individual donors whose interests are in alignment with our research, with the help of the following organizations.

St. Paul's Foundation
178 – 1081 Burrard Street
Vancouver, BC V6Z 1Y6
Phone (for residents of Metro Vancouver): 604-682-8206
Phone (toll-free number for residents of rest of BC): 1-800-720-2983
sphfoundation@providencehealth.bc.ca
www.helpstpauls.com

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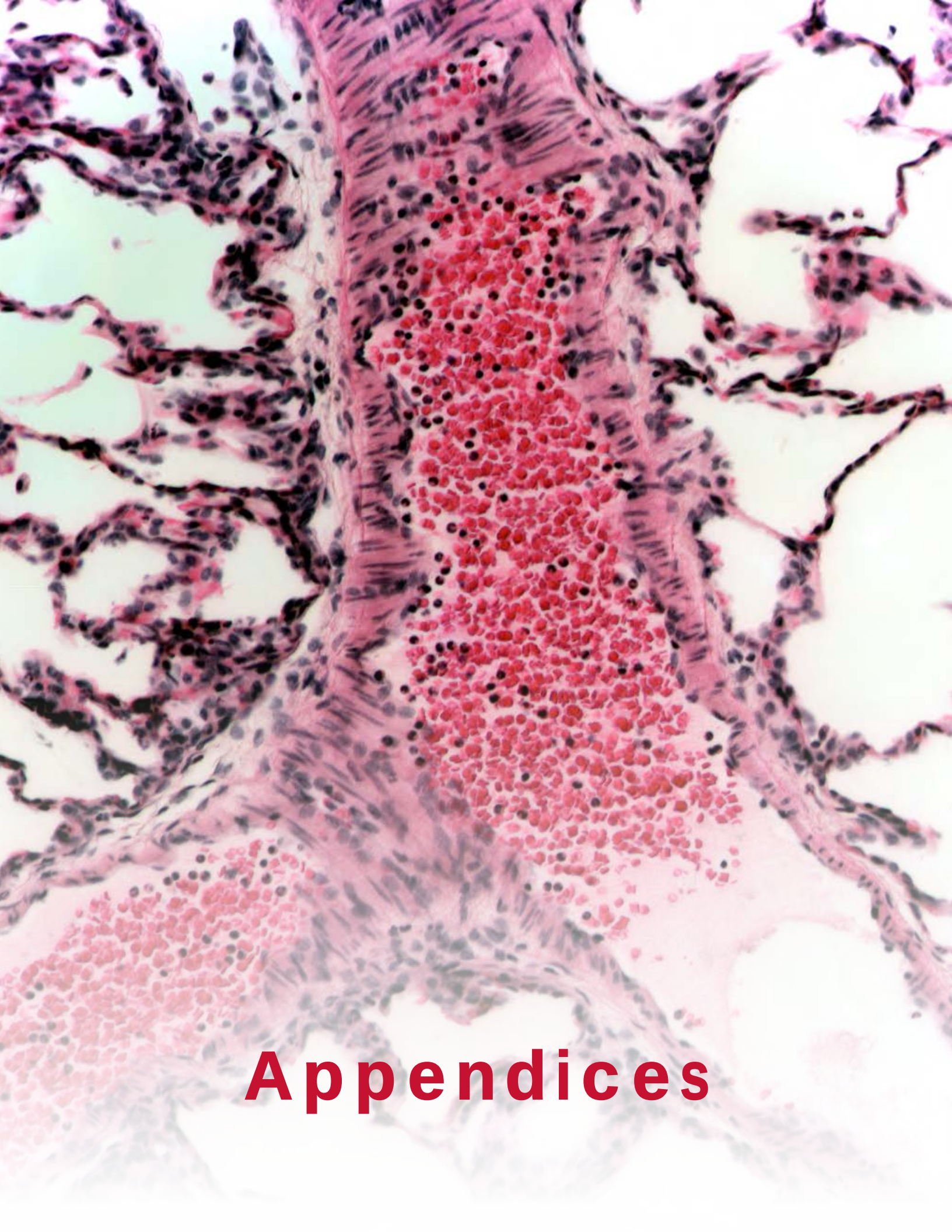
Vancouver, BC Canada V6T 1Z3
Phone: 604-822-8900
info@startanevolution.ubc.ca
https://startanevolution.ubc.ca/category/projects-by-faculty/faculty-of-medicine



Appendices

Appendix A: HLI Grants, Contracts, Clinical Trials, Agreements, and Salary Awards* (April 2019 - March 2020)

Principal Investigator	Funding Agency	Yearly Amount	Project Title	Award Type	Funding Held
Bernatchez, Pascal	Canadian Institutes of Health Research (CIHR)	$1,000	Pleiotropic activation of endothelial function by angiotensin II receptor blockers is crucial to their protective anti-vascular remodeling effects	Grant	HLI
Bernatchez, Pascal	Heart and Stroke Foundation of Canada	$71,000	Activating the anti-atherosclerotic properties of endothelial function: from cells to humans	Grant	HLI
Bernatchez, Pascal	Innovation, Science and Economic Development Canada	$22,333	Optimization of angiotensin II receptor type 1 blockers (ARBs) in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Bernatchez, Pascal	Providence Health Care	$37,000	Optimization of angiotensin II receptor type 1 blockers (ARBs) in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Bernatchez, Pascal	Province of British Columbia	$22,333	Optimization of angiotensin II receptor type 1 blockers (ARBs) in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Boyd, John	Canadian Institutes of Health Research (CIHR)	$100,980	Organ donation after cardiac death: optimizing the donor heart.	Grant	HLI
Boyd, John	Canadian Institutes of Health Research (CIHR)	$25,000	SONRIS: Sepsis Outcome Network to improve survival	Grant	HLI
Boyd, John	Janssen Research and Development, LLC	$6,820	A phase 3 randomized, double-blind, placebo-controlled, multicenter study to evaluate the efficacy and safety of pimodivir in combination with the standard-of-care treatment in adolescent, adult, and elderly hospitalized patients with influ	Clinical Trial	HLI
Boyd, John	Michael Smith Foundation for Health Research	$38,042	The role of PCSK9 in the clearance of bacterial lipids and the development of anti-PCSK9 treatment for sepsis	Grant	HLI
Brunham, Liam	Canada Research Chairs	$100,000	Precision Cardiovascular Disease Prevention	Salary Award	HLI
Brunham, Liam	Michael Smith Foundation for Health Research	$90,000	Cardiovascular genetics: phenotypes, genotypes, and cellular mechanisms	Salary Award	HLI
Brunham, Liam	Canadian Institutes of Health Research (CIHR)	$116,280	Investigating pharmacogenetic mechanisms of doxorubicin-induced cardiotoxicity in human pluripotent stem cell-serviced cardiomyocytes	Grant	HLI

* Previous HLI Annual Reports did not include Salary Awards.

Brunham, Liam	Canadian Institutes of Health Research (CIHR)	$130,815	Improving the identification and treatment of young adults with heart disease: the Study to avoid vascular events in British Columbia	Grant	HLI
Brunham, Liam	Canadian Institutes of Health Research (CIHR)	$1,000	Premature atherosclerotic cardiovascular disease: Cardiovascular risk and primary prevention eligibility	Grant	HLI
Brunham, Liam	Michael Smith Foundation for Health Research	$15,000	Familial Hypercholesterolemia - Patient Engagement Forum	Grant	HLI
Brunham, Liam	Providence Health Care Research Institute (PHCRI)	$17,500	2019 ECI Award	Grant	HLI
Brunham, Liam	Stem Cell Network, Inc.	$67,200	Pipeline towards stem cell driven personalized medicine for atrial fibrillation	Grant	HLI
Brunham, Liam	The Medicines Co.	$13,437	An open label, active comparator extension trial to assess the effect of long term dosing of inclisiran and evolocumab given as subcutaneous injections in subjects with high cardiovascular risk and elevated LDL-C (ORION-3)	Clinical Trial	HLI
Camp, Pat	Canadian Institutes of Health Research (CIHR)	$120,650	Niwh Yizt'iyh Hilht'iz Nets'eelh'iyh - Strengthening our Bodies: A Community-based Research Project to Create Pulmonary Tele-Rehabilitation in Remote and Rural First Nations Communities in Northern British Columbia	Grant	HLI
Camp, Pat	Canadian Institutes of Health Research (CIHR)	$128,355	Bayis ll Tus - a strong breath: a community-based research to identify the prevalence of and contributors to chronic obstructive pulmonary disease in remote and rural First Nations communities in British Columbia	Grant	HLI
Camp, Pat	Canadian Institutes of Health Research (CIHR)	$70,000	Wildfire smoke and emergency planning for First Nations people living with lung disease in remote and rural British Columbia	Grant	HLI
Carlsten, Christopher	Health Canada	$220,000	The role of stress and stress reactivity in mediating impacts of air pollutants on the brain and lungs	Grant	VCHRI
Carlsten, Christopher	Canadian Institutes of Health Research (CIHR)	$63,750	Development, evaluation, and dissemination of novel clinical tools for predicting occupational asthma	Grant	VCHRI
Carlsten, Christopher	Genome BC	$125,000	Epigenetic health benefits of budesonide (Project Ace)	Grant	VCHRI
Carlsten, Christopher	Canadian Institutes of Health Research (CIHR)	$168,300	Does Traffic-Related Air Pollution Reduce the Effectiveness of Corticosteroids in Asthma Treatment (DIGR)	Grant	VCHRI

Carlsten, Christopher	British Columbia Lung Association	$25,000	Does air pollution reduce inhaled corticosteroid effectiveness through modulating epigenetics?	Grant	VCHRI
Carlsten, Christopher	Worker's Compensation Board of Manitoba	$66,133	Workplace diesel exhaust exposure: Defining a biosignature to support prevention	Grant	VCHRI
Carlsten, Christopher	Genome BC	$122,877	Relationship between external and internal microbiomes in normal and compromised airways	Grant	VCHRI
Carlsten, Christopher	Canadian Institutes of Health Research (CIHR)	$37,000	Molecular adaptation to allergen exposure: sex-related differences in asthma	Grant	VCHRI
Carlsten, Christopher	Health Canada	$120,000	Interaction between Gene Variants and Air Pollution in AQHI Panel Studies Participants	Grant	VCHRI
Carlsten, Christopher	AllerGen Network Centre of Excellence	$117,143	Air Pollution – Gene-Environment Interactions ("GxE4")	Grant	VCHRI
Carlsten, Christopher	AllerGen Network Centre of Excellence	$57,143	Air Pollution – Epigenetics ("REEGLE")	Grant	VCHRI
Carlsten, Christopher	Michael Smith Foundation for Health Research	$59,444	Career Investigator Award	Grant	VCHRI
Carlsten, Christopher	Canadian Institutes of Health Research (CIHR)	$100,000	Analysis of multiomic Data to Accelerate Personalized health interventions against inhaled Toxicants (ADAPT)	Grant	VCHRI
Carlsten, Christopher	GlaxoSmithKline (Canada) Inc.	$234,298	Nasal Epithelium Interventions for Traffic-Related Air Pollution (NEIT)	Grant	VCHRI
DeMarco, Mari	Canada Foundation for Innovation (CFI)	$300,000	TORCH: Towards Omics and imaging to Revolutionize COPD and asthma Health	Grant	HLI
DeMarco, Mari	Michael Smith Foundation for Health Research	$20,000	Biomarker tests to diagnose and prognose acute exacerbations of chronic obstructive pulmonary disease	Grant	Department of Pathology and Laboratory Medicine
DeMarco, Mari	Brain Canada	$246,486	IMPACT-AD (Translating research into practice: Investigating the impact of Alzheimer's disease diagnostics in Canada)	Grant	Department of Pathology and Laboratory Medicine
DeMarco, Mari	Michael Smith Foundation for Health Research	$90,000	Advancing Healthcare Diagnostics for Neurodegenerative Disorders	Salary	Department of Pathology and Laboratory Medicine
Dorscheid, Delbert R.	Michael Smith Foundation for Health Research	$90,000	IgE-mediated inflammation generated by the airway epithelium is antigen-independent - a cause of a novel asthma phenotype	Salary Award	HLI

Dorscheid, Delbert R.	AstraZeneca Canada Inc.	$41,744	A Multicenter, Randomized, Double-blind, Parallel Group, Placebo-controlled, Phase 3b Study to Evaluate the Safety and Efficacy of Benralizumab 30 mg sc in Patients with Severe Asthma Uncontrolled on Standard of Care Treatment	Clinical Trial	HLI
Dorscheid, Delbert R.	AstraZeneca Canada Inc.	$19,634	PONENTE: A Multicenter, Open-label, Phase 3b Efficacy and Safety Study of Benralizumab 30 mg Administered Subcutaneously to Reduce Oral corticosteroid Use in Adult Patients with Severe Eosinophilic Asthma on High-Dose Inhaled Corticosteroid	Clinical Trial	HLI
Dorscheid, Delbert R.	British Columbia Lung Association	$25,000	IgE-mediated inflammation generated by the airway epithelium is antigen independent - a cause of a novel asthma phenotype	Grant	HLI
Dorscheid, Delbert R.	Gala Therapeutics, Inc.	$138,835	A Feasibility Study: A Safety Evaluation of the Gala Airway Treatment System on Patients with Chronic Bronchitis in Canada	Clinical Trial	HLI
Dorscheid, Delbert R.	GlaxoSmithKline (Canada) Inc.	$354	A randomized, double-blind, parallel group, multicenter, stratified study evaluating the efficacy and safety of repeat doses of GSK3772847 compared with placebo in participants with moderately severe asthma	Clinical Trial	HLI
Dorscheid, Delbert R.	Novartis Pharmaceuticals Canada Inc.	$7,320	A 2-treatment period, randomized, placebo-controlled, multicenter parallel-group study to assess the safety of QAW039 when added to existing asthma therapy in GINA steps 3, 4 and 5 patients with uncontrolled asthma	Clinical Trial	HLI
Dorscheid, Delbert R.	Optimum Patient Care Global Ltd.	$750	International Severe Asthma Registry: Protocol	Clinical Trial	HLI
Dorscheid, Delbert R.	Sanofi-Aventis Canada Inc.	$9,959	Open-label, interventional, cohort study to evaluate long-term safety of dupilumab in patients with moderate to severe asthma who completed the TRAVERSE-LTS12551 clinical trial	Clinical Trial	HLI
Francis, Gordon A.	Alzheimer Society of Canada	$75,000	The role of smooth muscle cell metabolism of amyloid beta in cerebral amyloid angiopathy	Grant	HLI
Francis, Gordon A.	Canada Foundation for Innovation	$186,529	Molecules to human: enhanced phenotyping for discovery, prevention, & treatment of heart, lung, & blood vessel disease	Grant	HLI

Francis, Gordon A.	Canadian Institutes of Health Research (CIHR)	$181,951	The unrecognized importance of smooth muscle foam cells in atherosclerosis development and treatment	Grant	HLI
Francis, Gordon A.	Canadian Institutes of Health Research (CIHR)	$102,510	Relative deficiency of lysosomal acid lipase in arterial smooth muscle cells as a novel target for atherosclerosis treatment and prevention	Grant	HLI
Francis, Gordon A.	Ionis Pharmaceuticals, Inc.	$18,236	An Open-Label Extension Study of Volanesorsen Administered Subcutaneously to Patients with Familial Chylomicronemia Syndrome (FCS)	Clinical Trial	HLI
Granville, David	Canadian Institutes of Health Research (CIHR)	$250,000	Granzymes in Injury, Inflammation and Repair	Grant	ICORD
Granville, David	ICORD, Rick Hansen Foundation	$10,000	Repurposing antibiotic sulfaphenazole into a novel therapy for pressure injuries	Grant	ICORD
Granville, David	Ezcema Society of Canada	$10,000	A Novel Therapeutic Approach for Atopic Dermatitis	Grant	ICORD
Granville, David	UBC Faculty of Medicine	$41,481	Discovery to Commercialization (D2C) Training Program	Grant	ICORD
Granville, David	Muscular Dystrophy of Canada	$50,000	Profiling granzymes in inflammatory neuromuscular diseases	Grant	ICORD
Guenette, Jordan A.	Michael Smith Foundation for Health Research	$90,000	Mechanisms of dyspneoa and exercise intolerance in patients with chronic respiratory diseases	Salary Award	HLI
Guenette, Jordan A.	British Columbia Lung Association	$25,000	Investigating the role of skeletal muscle dysfunction on dyspnoea and exercise intolerance in interstitial lung disease	Grant	HLI
Guenette, Jordan A.	Canadian Institutes of Health Research (CIHR)	$5,000	Investigating the role of skeletal muscle dysfunction on dyspnoea and exercise intolerance in interstitial lung disease	Grant	HLI
Guenette, Jordan A.	Canadian Institutes of Health Research (CIHR)	$10,000	Investigating the role of skeletal muscle dysfunction on dyspnoea and exercise intolerance in interstitial lung disease	Grant	HLI
Guenette, Jordan A.	Michael Smith Foundation for Health Research	$3,500	Investigating the role of skeletal muscle dysfunction on dyspnea and exercise intolerance in interstitial lung disease	Grant	HLI
Guenette, Jordan A.	Michael Smith Foundation for Health Research	$24,208	The effects of 60% oxygen during exercise training in patients with fibrotic interstitial lung disease	Grant	HLI
Guenette, Jordan A.	Natural Sciences and Engineering Research Council of Canada (NSERC)	$40,000	Sex-differences in respiratory sensation and muscle function during conditions of physiological stress	Grant	HLI

Guenette, Jordan A.	Natural Sciences and Engineering Research Council of Canada (NSERC)	$47,000	Sex-differences in respiratory sensation and muscle function during conditions of physiological stress	Grant	HLI
Hackett, Tillie Louise	Canadian Institutes of Health Research (CIHR)	$60,000	Molecular Determinants of Small Airways Obstruction in COPD	Salary Award	HLI
Hackett, Tillie Louise	Michael Smith Foundation for Health Research	$90,000	Molecular Determinants of Small Airways Obstruction in COPD	Salary Award	HLI
Hackett, Tillie Louise	Canada Foundation for Innovation	$9,375	CFI Infrastructure Operating Fund	Grant	HLI
Hackett, Tillie Louise	Canadian Institutes of Health Research (CIHR)	$16,667	Multimodal characterization of airway remodeling with label-free nonlinear optical imaging and spectroscopy	Grant	HLI
Hackett, Tillie Louise	Canadian Institutes of Health Research (CIHR)	$135,068	The Role of Small Airways Disease Heterogeneity in Asthma	Grant	HLI
Hackett, Tillie Louise	Innovation, Science and Economic Development Canada	$17,500	Airway-On-A-Chip: Development and in vitro validation of a microfluidic cell culture model for chronic obstructive pulmonary disease (COPD)	Grant	HLI
Hackett, Tillie Louise	Michael Smith Foundation for Health Research	$5,250	Assessing small airway disease heterogeneity in asthma to determine novel therapeutic targets	Grant	HLI
Hackett, Tillie Louise	Providence Health Care	$33,333	Airway-On-A-Chip: Development and in vitro validation of a microfluidic cell culture model for chronic obstructive pulmonary disease (COPD)	Grant	HLI
Hackett, Tillie Louise	Province of British Columbia	$17,500	Airway-On-A-Chip: Development and in vitro validation of a microfluidic cell culture model for chronic obstructive pulmonary disease (COPD)	Grant	HLI
Hogg, James C.	British Columbia Lung Association	$25,000	Analysis of airway pathology in idiopathic pulmonary fibrosis using a combination of computed tomography, micro-computed tomography, histology, and gene expression	Grant	HLI
Hogg, James C.	National Institutes of Health	$22,271	Parametric response mapping in COPD	Agreement	HLI
Hogg, James C.	National Institutes of Health	$1,933	Genomic Analysis of Tissue and Cellular Heterogeneity in IPF	Agreement	HLI
Hogg, James C.	National Institutes of Health	$70,718	Novel quantitative emphysema subtypes in MESA and SPIROMICS	Agreement	HLI
Krahn, Andrew	Canadian Institutes of Health Research (CIHR)	$565,430	Hearts in Rhythm Organization (HiRO): Improving detection and treatment of inherited heart rhythm disorders to prevent sudden death	Grant	HLI

Krahn, Andrew	Canadian Institutes of Health Research (CIHR)	$182,776	Impact of Early Repolarization on Long QT Syndrome: Canadian Genetic Heart Rhythm Network	Grant	HLI
Laksman, Zachary	Michael Smith Foundation for Health Research	$90,000	Developing personalized anti-arrhythmic drug therapy for atrial fibrillation	Salary Award	HLI
Laksman, Zachary	Stem Cell Network	$43,000	Pipeline towards stem cell driven personalized medicine for atrial fibrillation	Grant	HLI
Laksman, Zachary	Canadian Institutes of Health Research (CIHR)	$22,000	Next generation arrhythmia modeling: the role of pluripotent stem cells and future of personalized medicine	Agreement	HLI
Laksman, Zachary	St. Paul's Foundation	122,807	Research and administrative costs account	Grant	HLI
Lear, Scott	Canadian Institutes of Health Research (CIHR)	$150,000	Promoting Brain Health to Prevent Dementia: Roles of Covert Vascular Brain Injury and Cognitive Reserve in Age-Related Cognitive Decline	Grant	SFU
Lear, Scott	Robert Wood Johnson Foundation (via University of Texas Houston)	$308,553	Establishing a North America research hub to evaluate and accelerate spread of the Cities Changing Diabetes initiative to reduce type 2 diabetes	Grant	SFU
Lear, Scott	Canadian Institutes of Health Research (CIHR)	$375,000	Delivery of self-management through a peer-support telehealth intervention in patients with cardiovascular disease: The Healing Circles Project	Grant	SFU
Leipsic, Jonathon	Canada Research Chairs	$100,000	Advanced Cardiopulmonary Imaging	Salary Award	Department of Radiology
Leipsic, Jonathon	Canadian Institutes of Health Research (CIHR)	$33,333	Structural valve degeneration in bioprosthetic heart valves	Grant	HLI
Leipsic, Jonathon	Canadian Institutes of Health Research (CIHR)	$5,000	Structural valve degeneration in bioprosthetic heart valves	Grant	HLI
Leipsic, Jonathon	Michael Smith Foundation for Health Research	$6,375	Structural valve degeneration in bioprosthetic heart valves	Grant	HLI
Leung, Janice	Michael Smith Foundation for Health Research	$90,000	Understanding the ageing HIV lung from dysbiosis to cell injury	Salary Award	HLI
Leung, Janice	Canadian Institutes of Health Research (CIHR)	$35,000	An 'Omics Approach to Understanding COPD Phenotypes and Endotypes	Salary Award	HLI
Leung, Janice	British Columbia Lung Association	$25,000	Primed for damage: Interactions between human immunodeficiency virus and the small airway epithelium	Grant	HLI
Leung, Janice	Canadian Institutes of Health Research (CIHR)	$73,657	Epigenetic and transcriptomic disturbances in HIV-associated COPD	Grant	HLI

Leung, Janice	National Institutes of Health	$4,273	Sphingolipids in HIV-associated chronic obstructive pulmonary disease	Agreement	HLI
Luo, Honglin	British Columbia Lung Association	$25,000	Engineering coxsackievirus B3 for KRAS-driven lung cancer therapy	Grant	HLI
Luo, Honglin	Canadian Institutes of Health Research (CIHR)	$257,218	Role of enteroviral infection in amyotrophic lateral sclerosis	Grant	HLI
Luo, Honglin	Heart and Stroke Foundation of Canada	$75,750	Enteroviral control of autophagy: Relevance to heart failure	Grant	HLI
Luo, Honglin	Innovation, Science and Economic Development Canada	$22,500	Development of coxsackievirus B3 as an oncolytic virus for KRAS-mutant lung cancer treatment	Grant	HLI
Luo, Honglin	Natural Sciences and Engineering Research Council of Canada (NSERC)	$44,000	Understanding the interplay between coxsackieviruses and the host ubiquitin-proteasome system	Grant	HLI
Luo, Honglin	Province of British Columbia	$22,500	Development of coxsackievirus B3 as an oncolytic virus for KRAS-mutant lung cancer treatment	Grant	HLI
Luo, Honglin	Virogin Biotech Canada Ltd.	$22,500	Development of coxsackievirus B3 as an oncolytic virus for KRAS-mutant lung cancer treatment	Grant	HLI
Luo, Honglin	Virogin Biotech Canada Ltd.	$22,500	Development of coxsackievirus B3 as oncolytic virus for KRAS-mutant lung cancer treatment	Grant	HLI
McManus, Bruce M.	Canada Foundation for Innovation	$16,770	CFI Infrastructure Operating Fund	Grant	HLI
McManus, Bruce M.	Canadian Institutes of Health Research (CIHR)	$436,050	HEARTBiT: A novel multi-marker blood test for management of acute cardiac allograft rejection	Grant	HLI
McManus, Bruce M.	Michael Smith Foundation for Health Research	$41,500	Development and validation of blood-based biomarkers for improved heart failure managemnet	Grant	HLI
McManus, Bruce M.	Michael Smith Foundation for Health Research	$34,000	Personalizing myocarditis diagnostics through novel biomarkers	Grant	HLI
McNagny, Kelly	Canadian Institutes of Health Research (CIHR)	$64,260	Targeting ovarian carcinoma using the cell surface glycoprotein podocalyxin	Grant	Department of Cellular and Physiological Sciences
McNagny, Kelly	Canadian Institutes of Health Research (CIHR)	$152,900	Innate Lymphoid cells and RAR-related orphan receptor alpha (RORa) as therapeutic	Grant	Biomedical Research Centre

McNagny, Kelly	Canadian Institutes of Health Research (CIHR)	$66,657	An epigenetic link between the gut microbiome and the immune response in asthma	Grant	Department of Microbiology and Immunology
McNagny, Kelly	Canadian Institutes of Health Research (CIHR)	$191,250	Modulation of Innate Immune Responses as a Therapy for Muscular Dystrophy	Grant	Biomedical Research Centre
McNagny, Kelly	UBC Faculty of Medicine	$75,000	Investigating mechanisms of disease and identifying diagnostic biomarkers in focal segmental glomerulosclerosis (FSGS) and nephrotic syndromes	Grant	Biomedical Research Centre
McNagny, Kelly	Aurinia Pharmaceuticals	$161,428	Evaluation of Voclosporin Treatment in a Mouse Model of Proteinuric Kidney Disease (MAST)	Agreement	Biomedical Research Centre
Ng, Raymond	Canada Research Chairs	$200,000	Data Science and Analytics	Salary Award	Department of Computer Science
Ng, Raymond	NSERC Natural Sciences and Engineering Research Council of Canada (NSERC)	$48,000	Sensor Analytics for Diverse Applications	Grant	Department of Computer Science
Ng, Raymond	Canada Foundation for Innovation	$181,071	MERIDIAN: Marine Environmental Research Infrastructure for Data Integration and Application Network	Grant	Department of Computer Science
Ng, Raymond	Microsoft Research	$330,000	Cascadia Data Discovery Initiative	Grant	Department of Computer Science
Obiedat, Ma'en	MSFHR Scholar	$90,000	Integrative genomics to identify novel therapeutics and biomarkers for COPD	Salary Award	HLI
Obeidat, Ma'en	British Columbia Lung Association	$25,000	The interaction of genes and sex in COPD	Grant	HLI
Obeidat, Ma'en	Canadian Institutes of Health Research (CIHR)	$75,000	Gene by sex interactions in COPD	Grant	HLI
Quon, Bradley	Gilead Sciences	$64,563	Molecular profiling of blood during CF pulmonary exacerbations to identify steroid-responsive endotypes	Grant	HLI
Quon, Bradley	Michael Smith Foundation for Health Research	$90,000	The development of novel blood protein biomarkers to enable precision care in cystic fibrosis	Salary Award	HLI
Quon, Bradley S.	Boehringer Ingelheim (Canada) Ltd.	$22,680	A randomised, double-blind, placebo-controlled and parallel group trial to evaluate efficacy and safety of twice daily inhaled doses of BI 1265162 delivered by Respimat® inhaler as add-on therapy to standard of care over 4 weeks in patients	Clinical Trial	HLI

Quon, Bradley S.	British Columbia Lung Association	$25,000	TH2 inflammation during cystic fibrosis pulmonary exacerbations	Grant	HLI
Quon, Bradley S.	Canada Foundation for Innovation	$68,582	Blood protein signatures to enable personalized care in cystic fibrosis	Grant	HLI
Quon, Bradley S.	Canada Foundation for Innovation	$7,176	CFI Infrastructure Operating Fund	Grant	HLI
Quon, Bradley S.	Canadian Institutes of Health Research (CIHR)	$13,125	Improving cystic fibrosis care in British Columbia epidemiological, clinical and economic trends - a model for other highly complex chronic conditions	Grant	HLI
Quon, Bradley S.	Corbus Pharmaceuticals	$280	A Multicenter, Randomized, Double-Blind, Placebo-Controlled Phase 2 Trial to Evaluate Efficacy and Safety of Lenabasum in Cystic Fibrosis	Clinical Trial	HLI
Quon, Bradley S.	Cystic Fibrosis Canada	$21,327	Randomized Controlled Trial of Prednisone in Cystic Fibrosis (CF) Pulmonary Exacerbations (PIPE Study)	Clinical Trial	HLI
Quon, Bradley S.	Cystic Fibrosis Canada	$96,207	PIPE-CF Biomarker Study	Grant	HLI
Quon, Bradley S.	Cystic Fibrosis Canada	$50,000	Cystic Fibrosis Canada Accelerating Clinical Trials Network (CFCanAct)	Grant	HLI
Quon, Bradley S.	Cystic Fibrosis Canada	$75,000	Clinical Fellowship	Grant	HLI
Quon, Bradley S.	Cystic Fibrosis Foundation (US)	$11,871	Host RNA biosignatures to predict imminent CF pulmonary exacerbations	Grant	HLI
Quon, Bradley S.	Innovation, Science and Economic Development Canada	$7,500	Identification of blood-based biomarkers predictive of pulmonary exacerbations in cystic fibrosis	Grant	HLI
Quon, Bradley S.	Laurent Pharmaceuticals	$15,731	A double-blind, randomized, placebo-controlled, phase II study of the efficacy and safety of LAU-7B in the treatment of cystic fibrosis in adults	Clinical Trial	HLI
Quon, Bradley S.	PROOF Centre of Excellence	$15,000	Identification of blood-based biomarkers predictive of pulmonary exacerbations in cystic fibrosis	Grant	HLI
Quon, Bradley S.	Proteostasis Therapeutics, Inc.	$56,864	A Multi-Center, Randomized, Placebo-Controlled, Phase 1, Two-Part Study Designed to Assess the Safety, Tolerability, Pharmacokinetics, Food Effect, and Drug-Drug Interactions of PTI-801 in Healthy Volunteers, and Safety, Tolerability, and Pharmacokinetics of PTI-801 in Subjects with Cystic Fibrosis	Clinical Trial	HLI
Quon, Bradley S.	Province of British Columbia	$7,500	Identification of blood-based biomarkers predictive of pulmonary exacerbations in cystic fibrosis	Grant	HLI

Quon, Bradley S.	Vertex Pharmaceuticals (Canada) Inc.	$23,289	A Phase 3, Open-label, Rollover Study to Evaluate the Safety and Efficacy of Long-term Treatment WithVX-661 in Combination With Ivacaftor in Subjects Aged 12 Years and Older With Cystic Fibrosis, Homozygous or Heterozygous for the F508del-C	Clinical Trial	HLI
Quon, Bradley S.	Vertex Pharmaceuticals (Canada) Inc.	$84,549	A Phase 3, Open-label Study Evaluating the Long-term Safety and Efficacy of VX-445 Combination Therapy in Subjects With Cystic Fibrosis Who Are Homozygous or Heterozygous for the F508del Mutation	Clinical Trial	HLI
Quon, Bradley S.	Vertex Pharmaceuticals (Canada) Inc.	$39,051	A phase 3, randomized, double-blind, controlled study evaluating the efficacy and safety of VX-445 combination therapy in subjects with cystic fibrosis who are heterozygous for the F508del mutation and a gating or residual function mutation	Clinical Trial	HLI
Quon, Bradley S.	Vertex Pharmaceuticals Inc.	$23,303	A Phase 3, Randomized, Double-blind, Controlled Study Evaluating the Efficacy and Safety of VX-445 Combination Therapy in Subjects With Cystic Fibrosis Who Are Heterozygous for the F508del Mutation and a Minimal Function Mutation (F/MF)	Clinical Trial	HLI
Russell, James A.	Canadian Institutes of Health Research (CIHR)	$255,970	Host response mediators in coronavirus (COVID-19) infection	Grant	HLI
Ryerson, Chris	Michael Smith Foundation for Health Research	$90,000	Clinical, biological and prognostic impact of supplemental oxygen in fibrotic interstitial lung disease	Salary Award	HLI
Ryerson, Chris	Boehringer Ingelheim (Canada) Ltd.	$915,114	The Canadian Cohort for Pulmonary Fibrosis	Clinical Trial	HLI
Ryerson, Chris	British Columbia Lung Association	$25,000	Quantitative computed tomography in hypersensitivity puenmonitis	Grant	HLI
Ryerson, Chris	Galapagos NV	$8,832	Randomized, Double-Blind, Parallel-group, Placebo-controlled, 52-week, Phase IIb Study to Assess Efficacy and Safety of GLPG1690 on Top of Pirfenidone or Nintedanib in Patients with Idiopathic Pulmonary Fibrosis	Clinical Trial	HLI
Ryerson, Chris	Hoffmann-La Roche Ltd. (Canada)	$4,923	Multicenter, international, doubleblind, two-arm, randomized, placebo controlled phase II trial of pirfenidone in patients with unclassifiable progressive fibrosing ILD	Clinical Trial	HLI
Sandford, Andrew J.	British Columbia Lung Association	$25,000	Epigenetic markers in the prediction of long-term adverse complications in patients with sleep apnea	Grant	HLI
Sandford, Andrew J.	Innovation, Science and Economic Development Canada	$3,750	Molecular signatures and predictive biomarkers for phenotyping allergic rhinitis responses	Grant	HLI

Sandford, Andrew J.	PROOF Centre of Excellence	$7,500	Molecular signatures and predictive biomarkers for phenotyping allergic rhinitis responses	Grant	HLI
Sandford, Andrew J.	Province of British Columbia	$3,750	Molecular signatures and predictive biomarkers for phenotyping allergic rhinitis responses	Grant	HLI
Seow, Chun	Canadian Institutes of Health Research (CIHR)	$132,345	Mechanisms underlying the bronchodilatory effect of deep inspiration in health and asthma: from airway smooth muscle to the whole lung	Grant	HLI
Seow, Chun	Natural Sciences and Engineering Research Council of Canada (NSERC)	$48,000	Molecular mechanisms for length adaptation in smooth muscle cells	Grant	HLI
Sin, Don	Canada Research Chairs	$200,000	Chronic Obstructive Pulmonary Disease	Salary Award	HLI
Sin, Don	St. Paul's Foundation	$300,000	De Lazzari Family Chair, Centre for Heart Lung Innovation	Salary Award	HLI
Sin, Don	University of British Columbia	$200,000	Airway Centre	Grant	HLI
Sin, Don	Canada Foundation for Innovation	$133,090	TORCH (Towards omics and imaging to revolutionize COPD and asthma health) in Canada	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$382,344	Using multi-omics to discover novel biomarkers and therapeutic targets fo chronic obstructive pulmonary disease	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$41,666	The role of genes and sex in determining therapeutic responses in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$1,000	Cholinergic receptor nicotinic alpha 5 expression in the airways of patients with chronic obstructive pulmonary disease	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$1,000	Hypogammaglobulinemia as a predictor of hospitalization in COPD: a meta-analysis	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$1,000	Anti-inflammatory effects of long-acting beta agonists on bronchial epithelium	Grant	HLI
Sin, Don	Canadian Institutes of Health Research (CIHR)	$55,000	SARS-CoV-2 rapid research: Fast track isothermal viral diagnosis	Agreement	HLI
Sin, Don	CSA Medical Inc	$26,058	A Prospective Safety and Feasibility Study of the Rejuvenair System Metered Cryospray Therapy for Chronic Bronchitis Patients	Clinical Trial	HLI
Sin, Don	Francis Family Foundation	$71,447	integrative genomics to identify novel therapeutic targets and biomarkers for COPD	Grant	HLI
Sin, Don	IKOMED Technologies Inc.	$30,000	Radiofrequency treatment for emphysema in mouse model	Grant	HLI

Sin, Don	Innovation, Science and Economic Development Canada	$30,000	Platform development to assay immune cell chemotaxis in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Sin, Don	Innovation, Science and Economic Development Canada	$15,000	Radiofrequency treatment for emphysema in mouse model	Grant	HLI
Sin, Don	Mereo BioPharma 4 Limited	$8,837	A phase 2, proof-of-concept, multicentre, double-blind, randomized, dose-ascending, sequential group, placebo-controlled study to evaluate the mechanistic effect, safety, and tolerability of 12 weeks twice daily oral administration of alvel	Clinical Trial	HLI
Sin, Don	Michael Smith Foundation for Health Research	$54,900	Biomarker tests to diagnose and prognose acute exacerbations of chronic obstructive pulmonary disease	Grant	HLI
Sin, Don	Providence Health Care	$25,000	Platform development to assay immune cell chemotaxis in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Sin, Don	Province of British Columbia	$10,000	Platform development to assay immune cell chemotaxis in chronic obstructive pulmonary disease (COPD)	Grant	HLI
Sin, Don	Province of British Columbia	$15,000	Radiofrequency treatment for emphysema in mouse model	Grant	HLI
Sin, Don	St. Paul's Foundation	580,482	TORCH (Towards omics and imaging to revolutionize COPD and asthma health) in Canada	Grant	HLI
Sin, Don	British Columbia Lung Association	$25,000	Effects of inhaled corticosteroids on airway bacterial microbiome and host responses in patients with COPD	Grant	HLI
Tan-Hogg, Wan C.	GlaxoSmithKline (Canada) Inc.	$85,493	Characteristics and Stability of Blood Eosinophils in a Population-based COPD Sample	Clinical Trial	HLI
Tebbutt, Scott	British Columbia Lung Association	$25,000	Identification of diagnostic biomarkers to differentiate subtypes of interstitial lung disease	Grant	HLI
Tebbutt, Scott	Canadian Institutes of Health Research (CIHR)	$35,000	Identification of blood-based biomarkers to distinguish subtypes of interstitial lung disease	Grant	HLI
Tebbutt, Scott	Canadian Institutes of Health Research (CIHR)	$1,000	Identification of blood-based biomarkers to distinguish subtypes of interstitial lung disease	Grant	HLI
Tebbutt, Scott	Michael Smith Foundation for Health Research	$24,208	HEARTBIT: A novel multi-marker blood test for management of acute cardiac allograft rejection	Grant	HLI

Tebbutt, Scott	National Institutes of Health	$200,719	Systems biology to identify biomarkers of neonatal vaccine immunogenicity: Project 1 - Innovative OMIC integration to predict immunogenicity	Agreement	HLI
Tebbutt, Scott	National Institutes of Health	$15,015	Systems biology to identify biomarkers of neonatal vaccine immunogenicity: DMC	Agreement	HLI
Tebbutt, Scott	National Institutes of Health	$19,116	Dengue Human Immunology Project Consortium (DHIPC)	Agreement	
Tebbutt, Scott	Natural Sciences and Engineering Research Council of Canada (NSERC)	$34,000	When human and fungal worlds collide - a systems biology approach to understanding the dynamic interactions between human bronchial epithelial cells and conidiospores of Aspergillus fumigatus	Grant	HLI
Tebbutt, Scott	UBC Faculty of Medicine	$100,000	Career Development Initiative: Preparing the Next Generation of Heart and Lung Health Researchers for Careers Beyond Academia	Grant	HLI
Thamboo, Andrew	Michael Smith Foundation for Health Research	$90,000	Understanding a potentially common upper airway disorder: empty nose syndrome	Salary Award	HLI
van Eeden, Stephan	Canadian Institutes of Health Research (CIHR)/GlaxoSmithKline (Canada) Inc.	$120,000	Research professorship in COPD	Salary Award	HLI
Van Eeden, Stephanus F.	American Air Liquide, Inc.	$10,367	The Use of Electronic Wearable Devices to Improve Outcomes in COPD	Clinical Trial	HLI
Walley, Keith	Canadian Institutes of Health Research (CIHR)	$279,865	Translational research to improve sepsis outcomes	Grant	HLI
Walley, Keith	Michael Smith Foundation for Health Research	$24,208	Improving sepsis outcomes with anti-PCSK9 monoclonal antibody therapy	Grant	HLI
Yang, Decheng	Natural Sciences and Engineering Research Council of Canada (NSERC)	$34,000	Mechanisms of selective host gene translation regulation in picornavirus infection	Grant	HLI

Appendix B: Publictions by HLI PIs in 2019

1. Adibi A, **Sin D,** Sadatsafavi M. Lowering the P Value Threshold. JAMA. 2019;321(15):1532-3.
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3. Agustí A, **Hogg JC**. Update on the Pathogenesis of Chronic Obstructive Pulmonary Disease. N Engl J Med. 2019;381(13):1248-56.
4. Al'Aref SJ, Maliakal G, Singh G, van Rosendael AR, Ma X, Xu Z, Alawamlh OAH, Lee B, Pandey M, Achenbach S, Al-Mallah MH, Andreini D, Bax JJ, Berman DS, Budoff MJ, Cademartiri F, Callister TQ, Chang H-J, Chinnaiyan K, Chow BJW, Cury RC, DeLago A, Feuchtner G, Hadamitzky M, Hausleiter J, Kaufmann PA, Kim Y-J, **Leipsic JA**, Maffei E, Marques H, Gonçalves PdA, Pontone G, Raff GL, Rubinshtein R, Villines TC, Gransar H, Lu Y, Jones EC, Peña JM, Lin FY, Min JK, Shaw LJ. Machine learning of clinical variables and coronary artery calcium scoring for the prediction of obstructive coronary artery disease on coronary computed tomography angiography: analysis from the CONFIRM registry. Eur Heart J. 2019:ehz565.
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6. Allen RJ, Guillen-Guio B, Oldham JM, Ma S-F, Dressen A, Paynton ML, Kraven LM, **Obeidat M**, Li X, Ng M, Braybrooke R, Molina-Molina M, Hobbs BD, Putman RK, Sakornsakolpat P, Booth HL, Fahy WA, Hart SP, Hill MR, Hirani N, Hubbard RB, McAnulty RJ, Millar AB, Navaratnam V, Oballa E, Parfrey H, Saini G, Whyte MKB, Zhang Y, Kaminski N, Adegunsoye A, Strek ME, Neighbors M, Sheng XR, Gudmundsson G, Gudnason V, Hatabu H, Lederer DJ, Manichaikul A, Newell JD, Jr., O'Connor GT, Ortega VE, Xu H, Fingerlin TE, Bossé Y, Hao K, Joubert P, Nickle DC, **Sin DD**, Timens W, Furniss D, Morris AP, Zondervan K, Hall IP, Sayers I, Tobin MD, Maher TM, Cho MH, Hunninghake GM, Schwartz DA, Yaspan BL, Molyneaux PL, Flores C, Noth I, Jenkins RG, Wain LV. Genome-Wide Association Study of Susceptibility to Idiopathic Pulmonary Fibrosis. Am J Respir Crit Care Med. 2019:10.1164/rccm.201905-1017OC.
7. Almagro P, Martínez-Camblor P, Miravitlles M, Rodríguez-Carballeira M, Navarro A, Lamprecht B, Ramirez-Garcia Luna AS, Kaiser B, Alfageme I, Casanova C, Esteban C, Soler-Cataluña JJ, de-Torres JP, Celli BR, Marin JM, Ter Riet G, Sobradillo P, Lange P, Garcia-Aymerich J, Anto JM, Turner AM, Han MK, Langhammer A, Sternberg A, Leivseth L, Bakke P, Johannessen A, Oga T, Cosío B, Ancochea J, Echazarreta A, Roche N, Burgel P-R, **Sin DD**, Puhan MA, Soriano JB, 3CIA Collaboration. External Validation and Recalculation of the CODEX Index in COPD Patients. A 3CIAplus Cohort Study. COPD. 2019;16(1):8-17.
8. Alotaibi NM, Chen V, Hollander Z, **Leipsic JA**, Hague CJ, Murphy DT, **DeMarco ML**, FitzGerald JM, **McManus BM**, **Ng RT**, **Sin DD**. Phenotyping and outcomes of hospitalized COPD patients using rapid molecular diagnostics on sputum samples. Int J Chron Obstruct Pulmon Dis. 2019;14:311-9.
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Appendix C: 2019 HLI Friday Seminar Series

Month	Day	Speaker	Host	Title of Lecture
January	18	**Kevin J. Keen**	Chris Ryerson	Comparison of MicroRNA Expression Profiles in Cases with Idiopathic Pulmonary Fibrosis, or Scleroderma (with or without Interstitial Lung Dis-ease), and Controls
	25	**Sonya Cressman**	Don Sin	Lung screening economics: resource utilization to research utilization
February	1	**Don Sin**	HLI	Precision Medicine in COPD
	8	**No Seminar - Heart & Lung Fest 2019**		
	15	**HS Jeffrey Man**	Don Sin	Long noncoding RNAs – a New Frontier in Endothelial Gene Regulation
	22	**Jennie Hui**	Denise Daley	The Busselton Health Study
March	1	**David Martino**	Denise Daley	Decoding allergic disease through the lens of epigenomics
	8	**Jacqui Brinkman**	HLI	Graduate School and Postdoc Success Planning
	15	**No Seminar - Spring Break**		
	22	**William T. Jackson**	Honglin Luo	How enteroviruses rewire cellular pathways to benefit their replication
April	5	**Pieter Cullis**	Jim Russell	Lipid Nanoparticle Systems For Enabling Gene Therapies
	12	**Luca Richeldi**	Chris Ryerson	Pulmonary fibrosis 2019: Where are we, and where are we going?
	19	**No Seminar - Good Friday**		
	26	**John V. Fahy**	Don Sin	Mucus Phenotypes of Asthma
May	3	**Jonathon Leipsic & Stephanie Sellers**	HLI	Bioprosthetic Heart Valves: Lessons for the clinic, insights from the bench
	10	**Chen Seng Ng**	Honglin Luo	Crosstalk Between Stress Granules and Innate Immunity: An association between Viral Infection and Human Disease
	17	**American Thoracic Society Conference - No Seminar**		
	31	**Michelle Tallquist**	David Granville	Fibroblast Roles in Cardiac and Pulmonary Development and Disease

June	7	**Ying Wang**	Gordon Francis	Attacking the clones: accumulation of diseased smooth muscle cells in atherosclerosis
	14	**Kerri Johannson**	Chris Ryerson	Time-Space-Fibrosis: The Impact of Environment on Interstitial Lung Disease
	21	**Jin-Ah Park**	Chun Seow	Airway epithelial cells in asthma: Secretion and Unjamming
	28	**Rachel L. Eddy**	Don Sin & Jonathon Leipsic	Pulmonary MRI of Airways Disease: Space-Time Explorations
July	5	**Zachary Laksman**	Don Sin	Next generation drug screening and arrhythmia modeling
August	**Summer Hiatus**			
September	6	**SPH Nutritionists (Healthy Heart): Kay McQueen & Simran Dukhia**	HLI	Canada's Official Food Rules" to the Current "Canada's Food Guide
	13	**Mohen Sadatsafavi & Amin Adibi**	Don Sin	The ACute COPD Exacerbation Prediction Tool (ACCEPT)
	20	**Renaud Leguillette**	Chun Seow	Horse athletes: Extreme exercise and respiratory physiology
	27	**Harikrishnan Parameswaran**	Chun Seow	Can increased stiffness of the airway extracellular matrix drive the development of airway hyperreactivity in asthma?
October	4	**Sarah Hedtrich**	Don Sin	Human-based organ models as tools for (patho-) physiological research in human epithelia
	11	**Shelley Sainsbury**	HLI	The Campaign for a new St. Paul's
	18	**Honglin Luo**	HLI	The Dual Nature of Enteroviruses: From Heart and Neurological Disease to Oncolytic Virotherapy
	25	**Aaron Barlow**	HLI	A Journey Through the Lung: From Macroscale to Nanoscale

November	1	**Carolina Tropini**	Don Sin	Defining Gut Microbiota and Host Resilience to Physical Perturbations: A Multi-Scale Approach
	8	**Wayne Mitzner**	Tillie Hackett	New Insights into Lung Anatomy
	15	**Paul O'Byrne**	Chris Ryerson	Changing Paradigms in the Management of Mild Asthma
	22	**Spencer Proctor**	Gordon Francis	The beginning & end of non-fasting remnant cholesterol? Data from the ATP cohort & a novel antibody to target ASVD
	29	**Lisa Strug**	Brad Quon	The Complex Genetic Model for Cystic Fibrosis Lung Disease
December	6	**Celia Greenwood**	Denise Daley	Modelling genetic & epigenetic associations with phenotypes: two stories where richer models lead to new results
	13	**Bruce McManus**	Don Sin	Postal Code SoL 1So – Farm Teams, Freedom, Fulfillment

Appendix D: 2019 HLI Research-in-Progress Seminar Series

Month	Day	Speaker	Title of Lecture
January	7	**Arash Tehrani**	Nitric Oxide-activating Angiotensin II Receptor Blockers in Marfan: Time to Look Beyond Blood Pressure Control?
	14	**Kimia Shahangian**	Impact of IL-4 Receptor Inhibition on Morbidity Related to H1N1 Infection in a Murine Model of Allergic Asthma
	21	**Guangze Zhao**	Coxsackievirus B3-induced reduction of intercalated disc proteins in viral pathogenesis
	28	**Mark Trinder**	High-lipoprotein and infectious disease: sepsis cohorts to population risk
February	4	**Heart & Lung FEST - No Lecture**	
	11	**Yasir Mohamud**	The Role of Autophagy in Enterovirus Pathogenesis
	18	**Family Day - No Lecture**	
	25	**Takeyuki Wada**	Radiofrequency as possible novel therapy for emphysema
March	4	**Effie Christidi**	Genetic variation in RARG influences susceptibility to doxorubicin-induced cardiotoxicity in patient-specific iPSC-derived cardiomyocytes
	11	**Tim Xue**	The Anti-Viral Role of Fused in Sarcoma (FUS) during Enterovirus Infection
	18	**Spring Quarterly Meeting - No Lecture**	
	25	**Daniel He**	Blood Biomarkers of Interstitial Lung Disease
April	1	**Anthony Tam**	Hedgehog signaling in the airway epithelium and its regulation on mucous expression in patients with COPD
	8	**Diana Vikulova**	Premature Atherosclerotic Cardiovascular Disease: Risk Assessment and Primary Prevention Eligibility
	15	**Feng Xu**	The transition from normal lung anatomy to Fibrosis in IPF
	22	**Easter Monday - No Lecture**	
	29	**Al Rohet Hossain**	NEPN Signaling Axis Proteins as Diagnostic Biomarkers for Viral Myocarditis
May	6	**Mark Trinder**	Assessing genetic risk factors for coronary artery disease: polygenic hypercholesterolemia, familial hypercholesterolemia, and elevated lipoprotein(a)
	13	**Kang Dong**	Untargeted plasma proteomics to identify novel blood biomarkers of treatment response in cystic fibrosis pulmonary exacerbations
	20	**Victoria Day and American Thoracic Society Conference - No Lecture**	
	27	**Hiroto Takiguchi**	Effect of short-term oral prednisone therapy on blood gene expression: a randomized controlled clinical trial

June	3	**Haojun (Margaret) Huang**	Genetic variation in RARG affects transcriptional response to doxorubicin-induced cardiotoxicity in human iPSC-derived cardiomyocytes
	10	**Ken Akata**	Altered M1 and M2 Macrophage Distribution and Impaired Phagocytic Activity in Chronic Obstructive Pulmonary Disease (COPD)
July - August	**Summer Hiatus**		
September	9	**Kate Huang**	Investigating atrial- and ventricular-specific effects of titin variants using patient induced pluripotent stem cell derived cardiomyocytes
	16	**Fall Quarterly Meeting - No Lecture**	
	23	**Nancy Yang**	Anti-Inflammatory Effects of Long-Acting Beta Agonists on Bronchial Epithelium
	30	**Huitao Lui**	Development of Coxsackievirus B3 as An Oncolytic Virus for Lung Cancer Treatment
October	7	**Taylor Pobran**	Detection and characterization of TDP-43 in human cells and tissues by mass spectrometry
	14	**Thanksgiving - No Lecture**	
	21	**Carleena Ortega**	Non-HDL and Non-fasting Lipid Contributions to Cholesterol Accumulation and Foam Cell Formation
	28	**Joel Chen**	Pulmonary Rehabilitation Education in Partnership with First Nation Communities - Another Kind of Personalized Medicine
November	4	**Graham Donen**	Testing the Anti-Atherosclerotic Effects of Endothelial Function: From Bench to Bedside
	11	**Remembrance Day - No Lecture**	
	18	**Denitsa Vasileva**	Using DNA Methylation Profiles to Predict Age
	25	**Steve Booth**	A Multi-resolution Analysis of Small Airways Disease Pathobiology in Chronic Obstructive Pulmonary Disease
December	2	**Guangze Zhao**	Coxsackievirus B3-induced Destruction of Cardiac Desmosome Structure Enhances Viral Pathogenesis
	9	**Winter Quarterly Meeting - No Lecture**	

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