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

ANNUAL REPORT 2024

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

Innovative health research to solve today's greatest challenges.

Established in 1977 by Drs. James Hogg and Peter Paré, the Centre for Heart Lung Innovation (HLI) is a University of British Columbia Senate-approved research centre located within St. Paul's Hospital in downtown Vancouver. The Centre is currently led by the HLI Executive Team: Dr. Don Sin (Director), Dr. Jordan Guenette (Associate Director), and Claire Smits (Operations Director).

As we reflect on our work and our place in this community, we acknowledge with respect and gratitude that St. Paul's Hospital stands on the unceded, ancestral, and traditional territories of the **xʷməθkʷəy̓əm** (Musqueam), **Sḵwx̱wú7mesh** (Squamish), and **səlilwətaɬ** (Tsleil-Waututh) Nations. These lands have been cared for and stewarded by these Nations since time immemorial, and their deep connections to the land, water, and all living things continue to this day.

Unless otherwise stated, all monetary amounts in this report are in Canadian dollars.

Report Content and Editing: Katherine Adolphs, Evan Phillips, Tiffany Chang
Report Design and Photography: Tiffany Chang

On the cover: (L to R) Dr. Yasir Mohamud shares a light moment with trainee Wendy Hwang in the Luo laboratory.

2024 BY THE NUMBERS

$15.9M*
Total Funding

- **$10.2M** External Grants
- **$2.6M** Contracts
- **$2.0M** Clinical Trials
- **$1.1M** Salary Awards

357
Publications

78
Principal & Affiliated Investigators

50K+
sq. ft. of Research Space

34
Research Associates & Postdoctoral Fellows

9
Visiting Scientists

9
Core Facilities

Cellular Imaging & Biophysics
Histology
Molecular Phenotyping
Tissue Culture
Pre-clinical Services
Digital Slide Scanning & Imaging
Magnetic Resonance Imaging
Bruce McManus Cardiovascular Biobank (BMCB)
James Hogg Lung Biobank (JHLB)

77
Staff Members

54 *support, operations, and administrative staff*
23 *research assistants*

92
Students & Trainees

56 *graduate students*
36 *undergraduate students*

**Funding numbers cover April 2024 to March 2025 and are rounded to the nearest $100,000.*
*Total amount held at HLI: **$8.4M***
See Appendix A for details.

TABLE OF CONTENTS

Letter from the Director

In 2022, we set out on an ambitious 5-year plan to enable "***exceptional care through exceptional science***" and specifically to "***improve the heart and lung health of the people of British Columbia, Canada and throughout the world***".

Here are some examples of HLI research in the past year that have addressed this goal.

PULMONARY LONG COVID

Long COVID is a condition that affects approximately 5% of patients who, after recovery from their acute COVID, continue to experience significant daily symptoms for 3 or more months post-COVID[1]. One subset of long COVID patients are those with a predominance of respiratory symptoms such as persistent cough, sputum production or shortness of breath with exertion; this condition is now called pulmonary long COVID (PLC)[2]. By engaging patients with PLC as partners and using state-of-the-art technology including hyperpolarized xenon magnetic resonance imaging (^{129}Xe MRI)[3] and single cell RNA sequencing of airway samples (from the HLI biobank)[4], HLI investigators showed that the predominant disease signature was found in the "small" airways of PLC patients. This signature was characterized by impairment of xenon (as a surrogate for oxygen) transfer across the gas exchange units of the lung and infiltration of immune cells called neutrophils, which release toxic chemicals into the airways[3,4]. Importantly, inhaled corticosteroids, which are common asthma medications, could be used to treat this condition[2]. This research was only possible because of the generous support of our donors at St. Paul's Foundation, funding from CIHR (Canadian Institutes of Health Research) and CFI (Canada Foundation for Innovation), engagement of our patient partners and most importantly, the unique collaborative ecosystem at St. Paul's Hospital that enables translational (human-to-lab) research in pulmonary and cardiovascular sciences.

AIR POLLUTION AND FIBROTIC LUNG DISEASE

Fibrotic lung diseases are progressive disorders that lead to premature morbidity and mortality. Most of these conditions are "idiopathic" with no known cause. HLI investigators showed that air pollution is a significant contributor to the progression of these disorders, leading to poor patient outcomes[5]. These data highlight the importance of clean air especially for our most vulnerable patients. "Healthy air" is indeed the key to having a "Healthy life".

ELIMINATING TOXIC DRUGS IN CYSTIC FIBROSIS

There are some drugs we give that are therapeutically ineffective and may be toxic to our patients. Many clinicians use systemic corticosteroids, which are fraught with significant adverse effects, to treat patients during acute exacerbations of cystic fibrosis (CF), on the assumption that the benefits of these drugs outweigh their side effects. HLI investigators, along with colleagues across Canada, performed a randomized controlled trial in CF patients and definitively showed that the use of these medications did not significantly improve lung function or reduce the future risk of exacerbations[6]. Now, CF patients everywhere in the world will be spared these very toxic drugs during acute exacerbations.

BETTER CARE TO PREVENT CORONARY ARTERY DISEASE (CAD)

Despite large improvements in the care and management of acute coronary syndromes, coronary artery disease (CAD) remains one of the leading causes of death in British Columbia (BC) and throughout Canada. The most effective public health method of reducing CAD is through prevention by treating important risk factors such as hyperlipidemia before patients actually develop clinically significant myocardial events. This is particularly true among young people. Using population-based data in BC, HLI investigators showed that less than 15% of young patients who eventually develop clinically significant CAD received lipid-lowering therapy prior to their cardiac events, even though nearly everyone had a health care encounter prior to the cardiac event and were eligible to receive these drugs based on clinical indications[7]. This research has increased awareness of CAD among young people and most importantly, highlighted the importance of early detection and intervention to prevent devastating cardiac events in vulnerable individuals.

These are few of many examples where research led by HLI investigators is impacting patient care and addressing the global challenges of heart, lung and blood vessel conditions in BC and elsewhere.

Letter from the Director Cont'd

MY SINCERE GRATITUDE

I'd like to extend my special thanks to Providence Research (PR), the UBC Faculty of Medicine (FoM), and Providence Health Care (PHC). In particular Dr. Darryl Knight, PR President and VP of Research at PHC, and Dr. Rob McMaster, Executive VP of Research, UBC FoM, have been relentless in their support of the HLI over the past many years and enabled the Centre to be a national powerhouse in heart and lung disease research. I also offer my sincere gratitude to St. Paul's Foundation and the many donors and patient partners who have been instrumental in our research enterprise through engagement and financial support and to PHC for creating a unique ecosystem for bed-to-bench research in heart and lung sciences and leadership's unwavering support to improve patients' daily lives through exceptional science.

I'd like to thank our incredible staff at the HLI, who have enabled the success of our labs, trainees and programs. These include (but not limited to) our outstanding staff in: operations, finance, human resources, biobanking, grants support, GEM, molecular and cellular phenotyping, clinical research, imaging, maintenance and facilities, education/safety, microscopy, administration, computation and information technology and many more. You are the wings that make HLI soar! A special shout-out goes to the HLI Trainee Association (TAHLI), which has been incredible in enhancing the educational experience at HLI and making HLI a special place for all trainees.

PLANS FOR 2025 AND BEYOND

Over the past year, HLI has welcomed two new Principal Investigators (PIs) to the Centre, who will build upon the excellence of HLI and address critical gaps in research. Dr. Yuan Yao (UBC Engineering and Cardiology) is an expert bioengineer in microfabrication and 3D bioprinting of cardiac tissues, and Dr. Rachel Eddy (UBC Radiology and Pediatrics) is an expert imaging engineer, who will develop and apply novel pulmonary imaging and data science tools to address important clinical issues in CF, COPD and other pulmonary disorders.

In 2025, we will welcome two other PIs. Dr. Stephen Wright (UBC Physical Therapy) is an expert cardiovascular (CV) exercise physiologist. He uses novel tools in integrative cardiopulmonary physiology to understand exercise tolerance and breathlessness in patients with heart failure and other cardiopulmonary diseases. Dr. Scott Lear (SFU Pfizer/Heart and Stroke Foundation Chair in Cardiovascular Prevention) is a world-renowned researcher in CV prevention. His laboratory will be integrated with those of Drs. Wright and Koelwyn (SFU Canada Research Chair in Public Health Omics) to create a first-of-its-kind lab, the HLI CV Exercise Physiology Lab. These PIs will revolutionize our understanding of breathlessness in CV patients and implement novel strategies to prevent the devastating impact of heart and blood vessel diseases in our community.

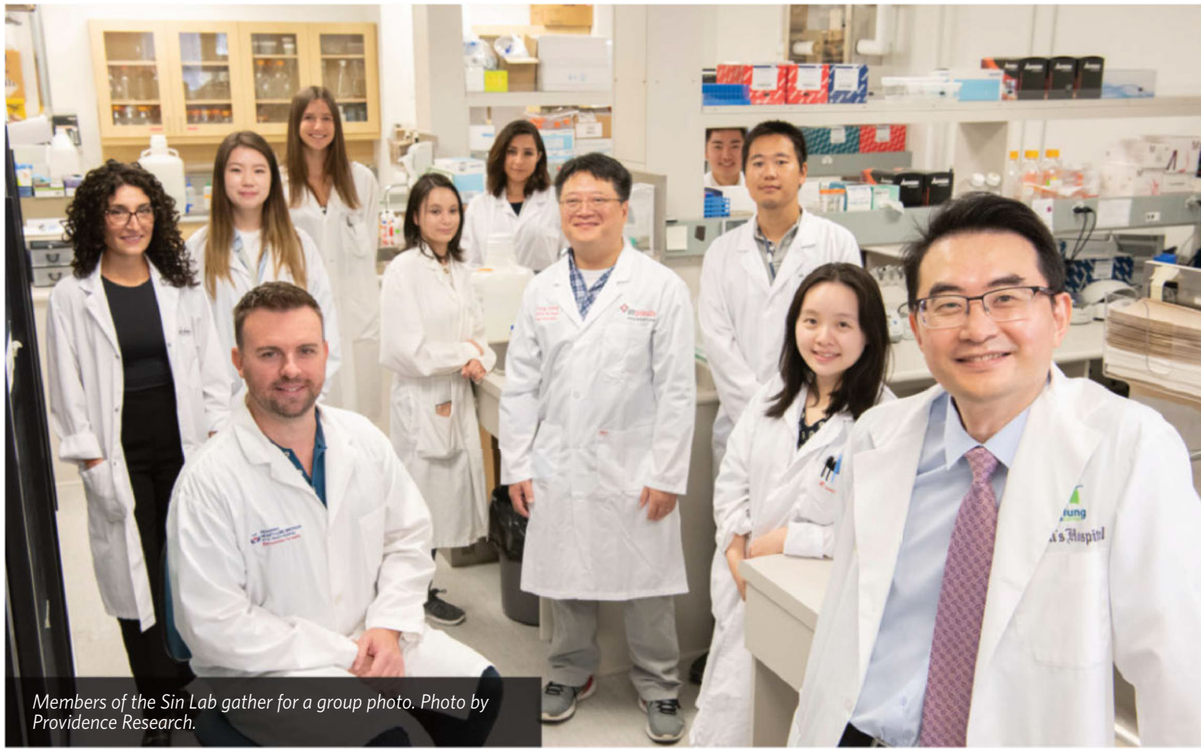
We will continue our work with PR and PHC to design the new lab spaces at the Clinical Support and Research Centre (CSRC), which will be a state-of-the-art new building (370,000 square feet) on Station Street, directly adjacent and connected to the new St. Paul's Hospital. It will be the new home of HLI for the next 100 years!

Ted Roosevelt, the 26th President of the United States, once famously stated that "patients don't care how much you know until they know how much you care". It is this compassion that fuels our research. Indeed, HLI stands at the intersection between curiosity (for science) and compassion (for our patients). With this ethos, HLI is at the forefront of new innovations in the prevention and treatment of patients with heart and lung disease. 2025 is the Year of the Snake, which symbolizes "transformation, renewal and spiritual growth". I wish all of our family members at HLI a transformational 2025.

Yours sincerely,

Don D. Sin, MD
Director and the de Lazzari Family Chair, HLI
Tier 1 Canada Research Chair in COPD
Professor of Medicine, UBC

1. Guinto E, Gerayeli FV, Eddy RL, Lee H, Milne S, Sin DD. Post-COVID-19 dyspnoea and pulmonary imaging: a systematic review and meta-analysis. *Eur Respir Rev* 2023; **32**(169).
2. Gerayeli FV, Eddy RL, Sin DD. A proposed approach to pulmonary long COVID: a viewpoint. *Eur Respir J* 2024; **64**(3).
3. Eddy RL, Mummy D, Zhang S, et al. Cluster analysis to identify long COVID phenotypes using (129)Xe magnetic resonance imaging: a multicentre evaluation. *Eur Respir J* 2024; **63**(3).
4. Gerayeli FV, Park HY, Milne S, et al. Single-cell sequencing reveals cellular landscape alterations in the airway mucosa of patients with pulmonary long COVID. *Eur Respir J* 2024; **64**(5).
5. Goobie GC, Saha PK, Carlsten C, et al. Ambient Ultrafine Particulate Matter and Clinical Outcomes in Fibrotic Interstitial Lung Disease. *Am J Respir Crit Care Med* 2024; **209**(9): 1082-90.
6. Waters V, Shaw M, Perrem L, et al. A randomised trial of oral prednisone for cystic fibrosis pulmonary exacerbation treatment. *Eur Respir J* 2024; **63**(6).
7. Vikulova DN, Lee MK, Humphries KH, et al. Preventive Lipid-Lowering Therapy and Interactions With Health Care in Patients Who Develop Premature Coronary Artery Disease. *JACC Adv* 2025; **4**(1): 101316.



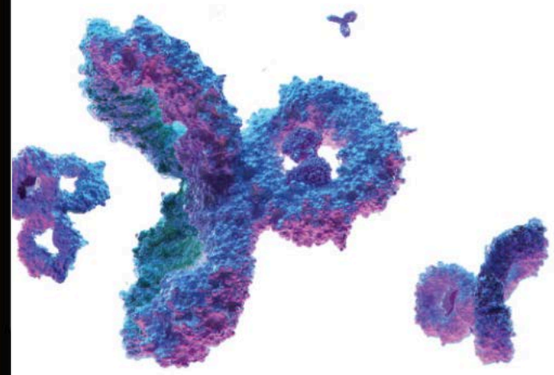
Members of the Sin Lab gather for a group photo. Photo by Providence Research.

RESEARCH SPOTLIGHTS

Driving Discovery. Advancing Health.

Our team of researchers at the Centre brings together diverse expertise, leading collaborative studies across Canada and beyond. Through curiosity-driven and patient-centred science, we generate the knowledge needed to transform care and improve lives.

Atherosclerotic coronary artery stained with 40 antibodies and imaged using PhenoCycler on 5-micron FFPE tissue sections. Photo by Maria Elishaev (Wang Lab).



How Early Antibiotics Prime Babies for Allergies

Antibiotics given to newborns can disrupt gut bacteria, setting off a chain reaction that makes children more likely to develop lifelong respiratory allergies and asthma.

Babies often receive antibiotics shortly after birth to combat infections. The depletion of intestinal microbes that results can lead to lifelong respiratory allergies and asthma.

The HLI's Dr. Kelly McNagny led a team of researchers that identified the specific cascade of events that is responsible for allergic susceptibility.

Normally, our immune system protects us from harmful invaders including bacteria, viruses and parasites. However, when the immune system reacts too strongly to harmless substances, including pollen, dust or pet dander, an allergic reaction occurs. Severe reactions are a leading cause for emergency visits for kids.

Immune development occurs very early in life, with microbes in the gut playing an important role. When infants receive antibiotics, butyrate-producing bacteria can be diminished. Previous work in Dr. McNagny's lab showed that babies with fewer of these bacteria become particularly susceptible to allergies. Now, using a mouse model, the group demonstrated how this works.

Butyrate is decreased in the mouse gut, as occurs following antibiotic use when butyrate-producing bacteria are diminished. As a result, mice develop twice as many ILC2 immune cells. ILC2 cells produce molecules that encourage white blood cells to produce certain antibodies that coat cells in a misguided defence mechanism against foreign invaders.

As a result, the immune system is primed to attack at the slightest provocation — as occurs during an allergic reaction. Butyrate can be given to prevent this cascade of events, but this only works during a narrow window after birth. If this window is missed, lifelong respiratory allergies and asthma result.

This new research opens new opportunities for halting the cascade, even after the butyrate supplementation window has closed.

Understanding the cells and mechanisms behind hypersensitive immune systems could enable more effective, long-terms solutions to address the root of allergic reactions — and pave the way for a future where allergies may be avoided altogether.

This work was published in the Journal of Allergy and Clinical Immunology.

> Our research finally shows how the gut bacteria and antibiotics shape a newborn's immune system to make them more prone to allergies.

Dr. Kelly McNagny, PhD

Principal Investigator, HLI and Professor, Dept. of Medical Genetics, UBC

Dr. Don Sin, MD, MPH

Director and the de Lazzari Family Chair at HLI, Tier 1 CRC in COPD, and Professor of Medicine, UBC

Heart Risks Increase After COPD Flare-Ups

A large-scale study from HLI reveals that COPD flare-ups — also known as exacerbations — significantly increase the risk of heart problems for up to a year, underscoring the need for closer monitoring and coordinated, team-based care.

Chronic obstructive pulmonary disease (COPD), a lung condition causing breathing difficulties, affects over 300 million people globally. People with COPD can experience sudden worsening of symptoms called exacerbations or flare-ups. When a person's breathing gets worse due to a flare-up of COPD, this event dramatically increases their risk of heart problems.

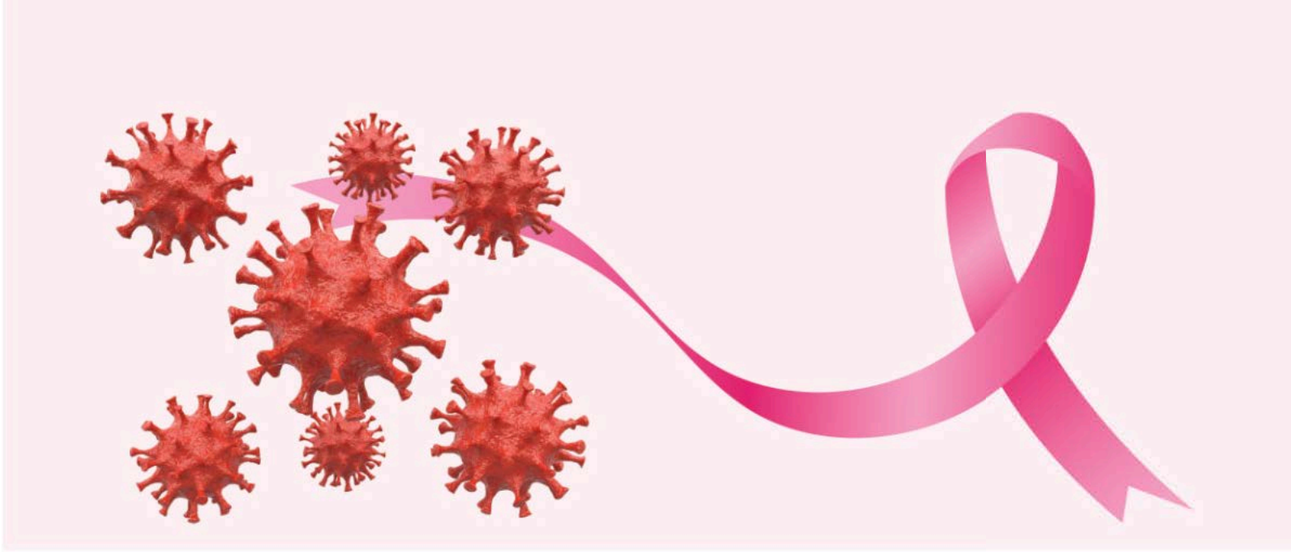
Prior research has shown that low oxygen levels during flare-ups strain the heart, and that inflammation occurring in COPD is linked to damage of arteries. To better understand the association between the time following an exacerbation and risk of hospitalization for an adverse cardiovascular event, HLI Director and PI Dr. Sin and colleagues analyzed the data of 143,000 patients with COPD in the weeks following one or more exacerbations.

Patients had a very high risk of being hospitalized for an adverse cardiovascular event. The risk of experiencing heart failure, heart attack, irregular heart rhythm, or stroke increased by 16 times compared to periods without flare-ups. The risk of experiencing heart failure alone rose 72 times in the first week. These risks stayed elevated for up to a year, especially after severe flare-ups requiring hospitalization. Nearly half of the patients studied had at least one flare-up during the study and almost a quarter died. Many of these deaths were related to adverse cardiovascular events.

This study reinforces the critical link between lung and heart health. Managing COPD effectively (e.g., using inhalers consistently, avoiding smoking, and getting flu vaccines) could prevent exacerbations and protect the heart. Patients should monitor for heart-related symptoms (like chest pain or swelling in the legs) after flare-ups, and doctors should consider heart screenings during these high-risk periods.

This research urges a shift in how we approach care, with healthcare professionals working together to prevent exacerbations and mitigate the heightened risk of cardiovascular events in patients with COPD.

This study was published in Heart.



Reprogramming Viruses to Fight Breast Cancer

HLI researchers have developed a novel virus-based therapy that attacks breast cancer cells with precision — combining virotherapy, chemotherapy, and immunotherapy into one potent, targeted treatment.

Oncolytic virotherapy — which uses naturally occurring or genetically engineered viruses to infect and destroy tumour cells—represents a promising strategy for cancer therapy. In this approach, normal tissues are spared while tumour cells are eliminated through direct lysis or via anti-tumour immune responses triggered by the viral infection.

Coxsackievirus B3 (CVB3) has shown strong oncolytic potential against triple-negative breast cancer and several types of lung cancer. However, its clinical application has been limited due to the risk of severe systemic side effects, such as myocarditis and pancreatitis.

To address this, Dr. Honglin Luo and her team previously engineered a modified variant of the virus, miR-CVB3, which incorporates a tumour-specific microRNA to enhance tumour targeting and reduce off-target effects. Despite these improvements, systemic delivery remains a challenge due to pre-existing neutralizing antibodies and immune clearance mechanisms.

To overcome these hurdles, the Luo lab developed a strategy to encapsulate miR-CVB3 in bioengineered exosomes — membrane-bound extracellular vesicles that protect the virus and improve delivery. These exosomes were further modified with tumour-targeting molecules and loaded with doxorubicin, a chemotherapeutic agent, to boost efficacy.

Results showed that engineered oncolytic viruses could reshape immune-related protein profiles towards a more immunostimulatory state and enhance activation of immune cells. Their analyses confirmed selective targeting of breast cancer cells, induction of cancer cell death, and robust immune cell infiltration within the tumour microenvironment—while sparing healthy organs.

This innovative approach holds promise for broad cancer applications and presents a versatile strategy for advancing cancer immunotherapy.

The study was published in ACS Nano.

Dr. Honglin Luo MD, PhD

Principal Investigator, HLI and Professor, Dept. of Pathology and Laboratory Medicine, UBC

KNOWLEDGE TRANSLATION

Turning Discovery into Impact.

At HLI, knowledge translation is woven into every stage of the research process — from study design to implementation — to ensure our findings inform real-world care, policy, and practice.

Transplant Stories

Showcasing Science in the Community

In November 2024, the **Bruce McManus Cardiovascular Biobank (BMCB)** at the HLI was featured in Transplant Stories, a four-part documentary series aired on the Knowledge Network. The series follows the personal life-and-near-death journeys of transplant patients across British Columbia and highlights the dedicated work of the medical professionals who support and perform transplants.

Produced in partnership with Providence Health Care, BC Transplant, and others, the series was directed by local filmmaker Sheona McDonald and produced by Omnifilm Entertainment in Vancouver.

In the second episode, heart transplant recipient Angela Neufeld visits the BMCB to view her own explanted heart, which had failed due to a condition called cardiac amyloidosis. The visit gave Angela the opportunity to see how her donated tissue is contributing to cardiovascular research, while offering a moment of closure as she viewed the organ that had once sustained her life. Dr. Gurpreet Singhera, operational manager of the biobank, also appears in the episode, explaining the biobank's role in advancing cardiovascular health research.

Through storytelling and media partnerships, the HLI continues to share the impact of its work, fostering public awareness and supporting ongoing efforts in medical research.

(L to R) Dr. Gurpreet Singhera, Dr. Anson Cheung, Coco Ng and Tiffany Chang. Photo by Tiffany Chang.

Angela Neufeld with her mother before heading into her heart transplant surgery. Photo by Transplant Stories, Knowledge Network Corporation

The documentary is available to watch for free across Canada at: www.knowledge.ca/transplant-stories.

Premature heart disease often goes undetected in Canadians under 55. SAVE BC is changing that with genetic screening and public outreach to catch risk early and save lives.

SAVE BC Targets Hidden Heart Risk in Young Adults

Premature cardiovascular disease (CVD) is common, and yet underdiagnosed, making it a significant health concern in Canada. Early detection and prevention is critical for those with a family history of heart disease, particularly in men under 50 and women under 55. This is the goal of the **Study to Avoid cardioVascular Events in BC (SAVE BC)**, led by HLI PI Dr. Liam Brunham and HLI Associate Member Dr. Simon Pimstone.

SAVE BC offers comprehensive screening, including advanced blood tests and genetic analysis to assess individual risk factors for CVD. This program enables healthcare providers to personalize prevention and treatment strategies. Importantly, because many heart conditions are hereditary, first-degree relatives are also invited to be tested.

The impact of the program is exemplified by participants like Matt McArthur who suffered a heart attack at 41 despite being otherwise healthy. His enrollment in SAVE BC not only provided him with crucial insights into his health but also prompted his family members to undergo testing, potentially averting future cardiac events.

SAVE BC hosted two highly successful events in Kelowna this past year, a public forum and a clinician forum. These forums raised awareness and allowed SAVE BC researchers to share new knowledge and findings from their work.

The public forum at the Okanagan Regional Library saw an impressive turnout with 123 people attending online and 68 in person. Dr. Brunham and Dr. Frank Halperin shared recent experiences and discussed the importance of early detection in combating heart disease.

Matt McArthur, a patient featured in Global BC's video, speaks with a doctor. Photo by Global BC.

Post-forum feedback was overwhelmingly positive, with 80% of attendees extremely satisfied and 73% finding the event extremely useful. The survey also highlighted that 61% of attendees were concerned about their health or that of loved ones, and only 5% reported no family history of cardiovascular disease. Notably, only 16% of respondents were participants in SAVE BC, emphasizing the event's community impact.

SAVE BC forum staff check in attendees at the Vancouver Convention Centre. Photo by Iulia Iatan.

SAVE BC
Study to Avoid cardioVascular Events in British Columbia

(L to R) Drs. Iulia Iatan (presenter), Michael Khoury (presenter), Luba Cermakova (FH, Lp(a) Research Coordinator), Rose Brooks (volunteer), Liam Brunham (presenter). Photo by Nicol Vaizman.

The clinician forum was equally well-received, attracting 94 clinicians, including 38 online attendees and 56 in-person. The in-person event had such high demand that a waiting list was necessary, highlighting the strong interest from the healthcare community. These accomplishments underscore our commitment to broadening our reach and engaging both patients and medical professionals in meaningful ways.

Later that year, in October, a broader patient education forum was held at the Vancouver Convention Centre coinciding with the national Canadian Cardiovascular Congress (CCC). Drs. Liam Brunham and Iulia Iatan, a former HLI trainee and now clinical assistant professor, led the organizers from UBC and HLI.

The event, titled "Genetic Lipid Disorders and Premature Atherosclerotic Cardiovascular Disease: Raising Awareness to Save Lives," focused on familial hypercholesterolemia (FH) and elevated lipoprotein(a) [Lp(a)], two of the most common inherited lipid disorders affecting Canadians.

Participants heard from clinician-scientists, an Indigenous researcher, and individuals with lived experience. Patient speakers shared powerful testimonials, including a man with elevated Lp(a) and premature heart disease, a female student living with homozygous FH, and a mother with FH whose young children were also diagnosed. Health care providers discussed strategies for prevention, early diagnosis and management, including in specific populations such as Indigenous communities and children.

The forum emphasized the importance of screening, early identification, and personalized care, and empowered patients to become advocates for their health. The key takeaway was clear: improving awareness, education, and engagement is essential to reducing the burden of premature cardiovascular disease across diverse populations in Canada.

Read more by visiting the SAVE BC website.

Dr. Liam Brunham presents on the importance of Lp(a) measurement at the CCC Patient Forum. Photo by Iulia Iatan.

Food for Thought

COPD flare-ups, also known as exacerbations, significantly increase the risk of heart problems for up to a year, underscoring the need for closer monitoring and coordinated, team-based care.

Chronic airway diseases, including chronic obstructive pulmonary disease (COPD) and asthma, affect over 500 million individuals globally and are associated with substantial morbidity and mortality. These diseases are characterized by persistent inflammation and oxidative stress, with imbalance of reactive oxygen species (ROS) and antioxidants contributing to airway damage.

It is well known that environmental factors, such as cigarette smoke and air pollution, exacerbate symptoms. In a recent review, Dr. Sin and colleagues present evidence for the significant influence of dietary patterns on disease state.

Diets high in saturated fats and processed foods (such as the Western diet), are linked to inflammation and poor respiratory outcomes. Diets rich in fruits, vegetables and fish (such as the Mediterranean diet), exhibit anti-inflammatory properties that may help mitigate respiratory symptoms and improve lung function.

Dietary choice also influences body weight and BMI (body mass index). BMI has a parabolic relationship with lung function, and can contribute to airway disease severity, with both under- and overweight patients suffering poor outcomes.

Interestingly, although high BMI worsens asthma severity, in COPD, obesity can be protective, which may be attributed to higher muscle mass and energy reserve in these patients, which are critical for respiratory function.

The authors conclude translational and clinical studies are necessary to better understand the mechanisms underlying nutrient interaction and lung structure-function.

In the meantime, Dr. Sin and colleagues suggest combatting obstructive airway disease by following a healthy Mediterranean-style diet rich in antioxidants, fiber, protein and poly-unsaturated fatty acids, with limited intake of cured meats, saturated fats and refined carbohydrates.

This review was published in Curr Opin Pulm Med.

Dr. Don Sin, MD, MPH

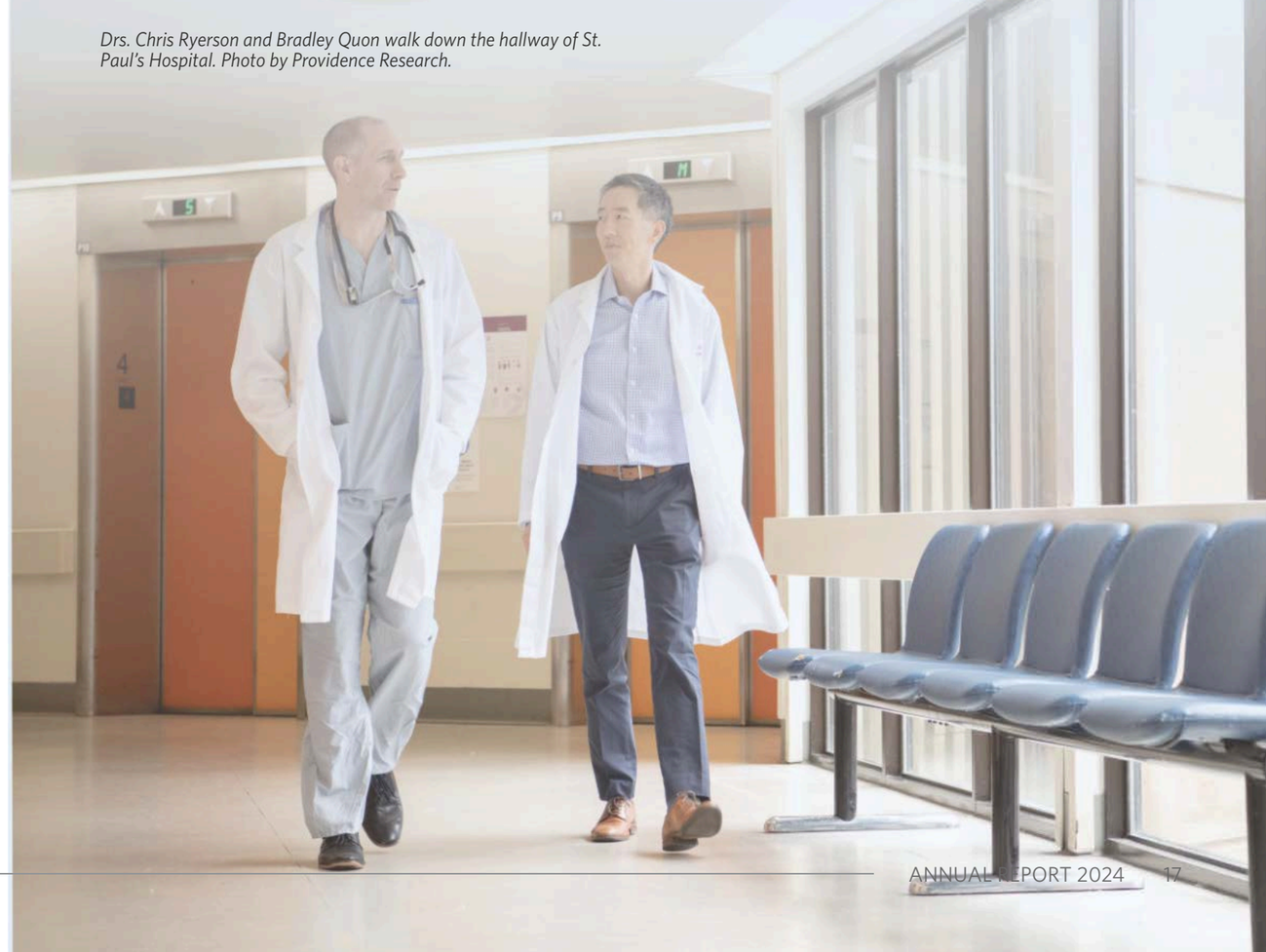
Director and the de Lazzari Family Chair at HLI, Tier 1 CRC in COPD, and Professor of Medicine, UBC

RESEARCHERS

A community of innovators.
A commitment to better health.

Whether through basic science using molecular and cellular research, or through clinical approaches to discovery, HLI researchers work in a dynamic, multidisciplinary environment to advance understanding and improve care in heart, lung, critical illness, and more.

Drs. Chris Ryerson and Bradley Quon walk down the hallway of St. Paul's Hospital. Photo by Providence Research.



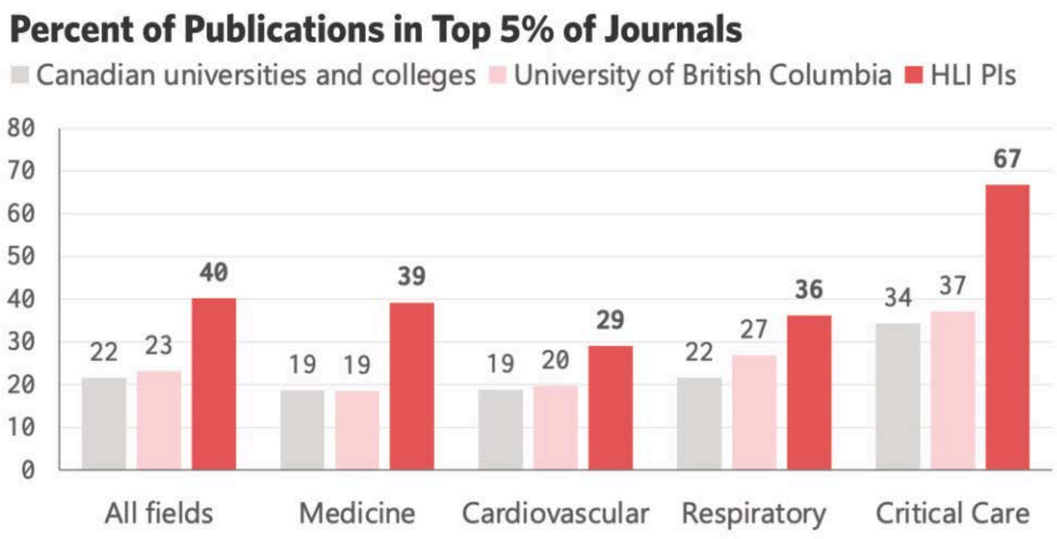
RESEARCH SNAPSHOT

Global reach and citation strength of HLI research

1,270
Citations (as of April 24, 2025)

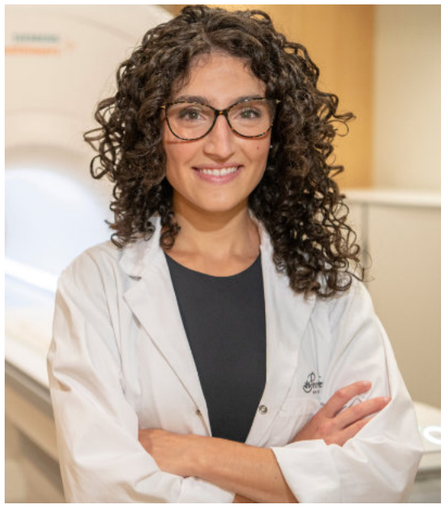
357
Research publications

2.31×
Higher-than-average global citation impact (FWCI)



Publication and citation data were obtained from SciVal. Field-Weighted Citation Impact (FWCI) compares the actual number of citations received to the expected number for publications of the same type, year and discipline. A value of 1.00 is average; 2.31 means HLI publications were cited over twice as often as the global average for similar work. Citation data current as of April 24, 2025.
See Appendix B for a full list of publications.

New Principal Investigators



Dr. Rachel Eddy

rachel.eddy@hli.ubc.ca

Assistant Professor | Department of Radiology, UBC Department of Pediatrics, UBC & BC Children's Hospital

Dr. Rachel Eddy is an imaging scientist with expertise in quantitative CT and MRI of the lungs. She is an Assistant Professor in the Departments of Radiology and Pediatrics at UBC and James Hogg Young Investigator in Pulmonary Imaging at HLI. Dr. Eddy is a biomedical engineer by undergraduate training and completed her PhD in Medical Biophysics at Western University. She completed a postdoctoral fellowship at UBC, HLI, and BC Children's Hospital, during which she launched the pulmonary MRI research program using hyperpolarized ^{129}Xe gas at HLI. Dr. Eddy serves as the Director of the MRI Core at HLI.

Dr. Eddy's research program is focused on developing and applying novel pulmonary imaging and data science tools to provide an in-depth understanding of chronic lung disease and novel inhalational lung exposures.

Dr. Yuan Yao

yuan.yao@hli.ubc.ca

Assistant Professor | Department of Mechanical Engineering, UBC | Department of Medicine, UBC

Dr. Yuan Yao is an Assistant Professor in the Department of Mechanical Engineering and Division of Cardiology, Department of Medicine at UBC. She received her PhD in chemical engineering at the University of Waterloo in 2021, and then completed her postdoctoral training at the University of Toronto.

Dr. Yao is interested in bioengineering approaches to regenerate vascular and cardiac tissues. Her research primarily focuses on developing engineered tissue constructs that incorporate vascular networks to mimic natural tissue environments. Additionally, her work involves the design of dynamic hydrogels that respond to physiological cues for cardiac tissue repair and regeneration.

Principal Investigators

CARDIOVASCULAR

Dr. Liam Brunham
liam.brunham@ubc.ca

Dr. Brunham's research focuses on understanding how genetic variation contributes to abnormalities in lipid levels and risk for cardiovascular disease as well as response to medications.

Dr. Mike Allard
mike.allard@pathology.ubc.ca

Dr. Allard's program focuses on adaptation of the heart to physiological states, such as endurance exercise and pathological processes, like hypertension, that result in cardiac hypertrophy.

Dr. David Granville
david.granville@hli.ubc.ca

Dr. Granville researches vascular injury, inflammation and remodeling in the context of atherosclerosis, transplant vasculopathy, and ischemia and reperfusion injury.

Dr. Gordon Francis
gordon.francis@hli.ubc.ca

Dr. Francis's research involves understanding the mechanisms of cholesterol accumulation in atherosclerosis and how to remove it to prevent coronary heart disease and stroke.

Dr. Zachary Laksman
zlaksman@mail.ubc.ca

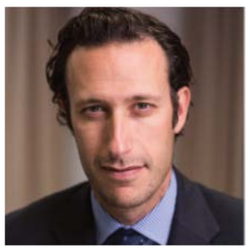
Dr. Laksman's research focuses on the genetic basis of heart muscle diseases, heart rhythm disorders and causes of sudden cardiac death.

Dr. Andrew Krahn
akrahn@mail.ubc.ca

Dr. Krahn investigates the genetic causes of arrhythmia, sudden cardiac arrest, syncope, and the use of implantable arrhythmia devices.

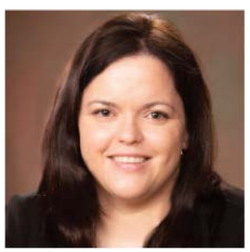
Dr. Honglin Luo
honglin.luo@hli.ubc.ca

The focus of Dr. Luo's research program is to define the molecular and pathogenetic determinants of virus-host interactions in enterovirus-induced cardiac and brain diseases.



Dr. Jonathon Leipsic
jleipsic@providencehealth.bc.ca

Dr. Leipsic's program is at the forefront of advanced imaging for structural heart disease, researching acute myocardial infarction, sudden cardiac death, and COPD.



Dr. Stephanie Sellers
stephanie.sellers@hli.ubc.ca

Dr. Sellers' research focuses on valvular heart disease and bioprosthetic heart valve degeneration as well as the development of new imaging techniques for cardiovascular disease.

Dr. Bruce McManus
bruce.mcmanus@hli.ubc.ca

Dr. McManus studies heart allograft rejection — its mechanisms, detection and monitoring — as well as enteroviral damage to the myocardium as a pathway to heart failure.

PULMONARY

Dr. Decheng Yang
decheng.yang@hli.ubc.ca

Dr. Yang's research programs focus on the molecular biology and pathogenesis of coxsackievirus B3 (CVB3)-induced myocarditis.

Dr. Ying Wang
ying.wang@hli.ubc.ca

Dr. Wang's research is focused on studying cell-cell and cell-microenvironment interactions to determine why diseased cells accumulate in atherosclerotic lesions and methods of their removal.

Dr. Scott Tebbutt
scott.tebbutt@hli.ubc.ca

Dr. Tebbutt's research program is focused on the molecular and cellular understanding of inflammatory disorders of the lung, allergic rhinitis, heart failure, and neonatal vaccinology.

Dr. Amrit Singh
amrit.singh@hli.ubc.ca

Dr. Singh's research focuses on the identification of biomarkers for heart and lung disease such as asthma and heart failure using high throughput biological ("omics") datasets.

Dr. Pascal Bernatchez
pascal.bernatchez@hli.ubc.ca

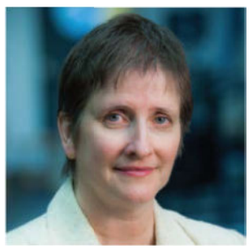
Dr. Bernatchez's research focuses on the dynamic interplay between blood vessel homeostasis and chronic diseases such as hypertension and atherosclerosis.

Dr. Graeme Koelwyn
graeme.koelwyn@hli.ubc.ca

The Koelwyn lab applies a translational, 'omics-based' approach to understand how heart, lung, and/or oncologic diseases communicate through immune-specific mechanisms.

Dr. Chris Carlsten
carlsten@mail.ubc.ca

Dr. Carlsten's clinical and research interests centre on occupational airways disease, including the effects of inhaled exposures on asthma induction and exacerbation.



Dr. Pat Camp
pat.camp@hli.ubc.ca

Dr. Camp's research focuses on improving health outcomes of people with chronic lung disease, with a particular focus on Indigenous lung health.

Dr. Del Dorscheid
del.dorscheid@hli.ubc.ca

Dr. Dorscheid leads an active research group investigating the role of the airway epithelium in the genesis of inflammatory airways diseases.

Dr. Denise Daley
denise.daley@hli.ubc.ca

Dr. Daley studies how inherited genetic variants and environmental exposures interact to modify the risk for developing diseases.

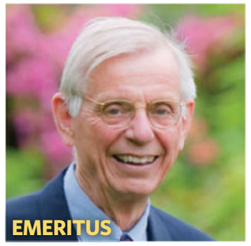
Principal Investigators Cont'd

Dr. Jordan Guenette
jordan.guenette@hli.ubc.ca

Dr. Guenette's research program aims to better understand the physiological factors that limit exercise tolerance across the spectrum of health and chronic respiratory disease.

Dr. Chun Seow
chun.seow@hli.ubc.ca

Dr. Seow's research focus is on the mechanical function, ultrastructure and biochemistry of airway and vascular smooth muscle in health and disease.



Dr. James Hogg
jim.hogg@hli.ubc.ca

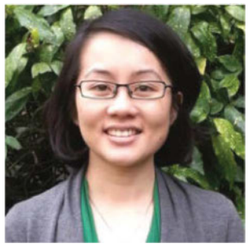
Dr. Hogg maintains an active research program focused on the inflammatory process in the lung, with particular reference to the structure and function of the lungs in COPD.

Dr. Ilker Hacihaliloglu
ilker.hacihaliloglu@ubc.ca

Dr. Hacihaliloglu develops AI learning methods for processing medical image data on neurosurgery, liver disease, orthopedic surgery, lung disease, and interventional radiology.

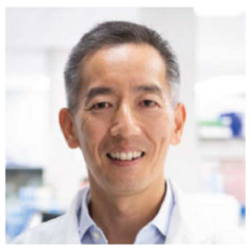
Dr. Paul Man
paul.man@hli.ubc.ca

Dr. Man's research expertise is in clinical trials and translational research, particularly in COPD, and AIDS/HIV.



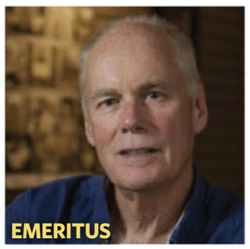
Dr. Janice Leung
janice.leung@hli.ubc.ca

Dr. Leung is studying the clinical outcomes, manifestations, and underlying mechanisms of HIV-associated chronic obstructive pulmonary disease.



Dr. Bradley Quon
bradley.quon@hli.ubc.ca

Dr. Quon's research is dedicated to developing tools to diagnose and monitor conditions that complicate the lives of individuals living with cystic fibrosis.



Dr. Peter Paré
peter.pare@hli.ubc.ca

Dr. Paré's research expertise is in the pathophysiology and genetics of asthma and COPD, having studied the genetic control of gene expression in the lung and blood of COPD patients.

Dr. Andrew Sandford
andrew.sandford@hli.ubc.ca

The focus of Dr. Sandford's research is the genetic basis of obstructive lung disease. He identifies genetic risk factors for the development of asthma, peanut allergy, and COPD.

Dr. Chris Ryerson
chris.ryerson@hli.ubc.ca

Dr. Ryerson's research focuses on the diagnosis, management, and prognostication of pulmonary fibrosis.

Dr. Wan-Cheng Tan
wan.tan@hli.ubc.ca

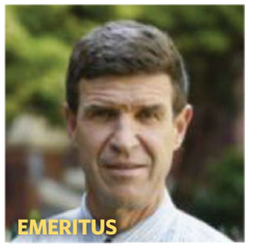
Dr. Tan's research interests include the prevalence, mortality and risk factors of hospitalization in COPD and the implementation of asthma guidelines.

Dr. Don Sin
don.sin@hli.ubc.ca

Dr. Sin's research is geared towards biomarker discovery in COPD and related conditions such as lung cancer, ischemic heart disease and stroke.

Dr. Tillie Hackett
tillie.hackett@hli.ubc.ca

Dr. Hackett's research program focuses on the disruption of normal repair processes within the epithelial-mesenchymal trophic unit of the lung.



Dr. Stephan van Eeden
stephan.vaneeden@hli.ubc.ca

Dr. van Eeden's research program focuses on the mechanisms of lung inflammation caused by infection and inhalation exposures, particularly cigarette smoking and air.

Dr. John Boyd
john.boyd@hli.ubc.ca

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.

Dr. Andrew Thamboo
researchdirector@stpaulssinuscentre.com

Dr. Thamboo's research interests span the areas of unified airway hypothesis, upper airway physiology, office-based rhinology, personalized medicine, and outcomes research.

Dr. Keith Walley
keith.walley@hli.ubc.ca

Dr. Walley translates basic discoveries into clinical practice in the ICU, investigating organ failure during sepsis and the impact of genotype on outcomes in systemic inflammatory disease.

Dr. James Russell
jim.russell@hli.ubc.ca

Dr. Russell does research on randomized controlled trials in patients with septic shock and COVID-19, their biomarkers, and the interaction between diabetes and sepsis/septic shock.

Dr. Mari DeMarco
mari.demarco@ubc.ca

Dr. DeMarco's research group specializes in the discovery, design and implementation of protein-based diagnostics for neurodegenerative disorders and beyond.

Dr. Kelly McNagny
kelly@brc.ubc.ca

Dr. McNagny's research program is focused on hematopoietic stem cell biology and its implications in chronic allergy, asthma, and other inflammatory diseases.

(L to R) Dr. Jim Russell and his lab members gather for a photo. Photo by Providence Research.

HLI Associate Members

University of British Columbia (UBC)
Dr. Jamil Bashir | Surgery
Dr. Samuel Lichtenstein | Surgery
Dr. Peter Skaarsgard | Surgery
Dr. Jian Ye | Surgery
Dr. Philipp Blanke | Radiology
Dr. Emily Brigham | Medicine
Dr. John Mancini | Medicine
Dr. Sammy Chen | Medicine
Dr. Andrew Ignaszewski | Medicine
Dr. Ed Conway | Medicine
Dr. James Dunne | Medicine
Dr. Pearce Wilcox | Medicine
Dr. David Wood | Medicine
Dr. Robert Schellenberg | Medicine
Dr. Simon Pimstone | Medicine
Dr. Alan Rabinowitz | Cardiology
Dr. Jonathan Rayment | Pediatrics
Dr. Colin Collins | Urologic Sciences
Dr. Iulia Iatan | Healthy Heart Program
Dr. Ismail Laher | Anesthesiology
Dr. Chi Lai | Pathology
Dr. Steven White | Pathology
Dr. Ed Moore | Physiology
Dr. Emmanuel Osei | Biology (UBCO)
Dr. Fabio Rossi | Biomedical Engineering
Dr. Karen Cheung | Biomedical Engineering
Dr. Mohsen Sadatsafavi | Pharmaceutical Sci.
Dr. Raymond Ng | Computer Science
Dr. Bill Sheel | Kinesiology
Dr. Stacey Skoretz | Audiology

Simon Fraser University (SFU)
Dr. Scott Lear | Health Sciences

University of Northern British Columbia (UNBC)
Dr. Kevin Keen | Mathematics

University of Victoria (UVic)
Dr. Xuekui Zheng | Mathematics

External Associates — National
Dr. Jeremy Hirota | McMaster University
Dr. Michael Seidman | UHN
Dr. Yannick Molgat-Seon | Univ. Winnipeg
Dr. Miranda Kirby | Toronto Metropolitan Univ.

External Associates — International
Dr. Stephen Milne | Univ. Sydney, Medicine and Health
Dr. Fernando Sergio Leitao Filho | Federal Univ. of São Paulo

External Associates — Industry
Dr. Harvey Coxson | Boehringer Ingelheim
Dr. Raouf Dridi | Quantum Computing
Dr. Ma'en Obeidat | Novartis

Research Grants and Contracts

HLI Principal Investigators (PIs) are listed as Nominated Principal Applicants on the grants awarded in 2024 below.

CIHR TEAM GRANTS IN LUNG HEALTH

Dr. Chris Carlsten
Lungs on fire: Wildfire smoke, incident diseases, susceptible populations, and community values in Canada

Dr. Janice Leung
The Canadian lung outcomes in users of vaping devices (CLOUD) Study

CIHR PROJECT GRANT

Dr. Tillie Hackett
Integration of multi-resolution imaging to improve the diagnosis and treatment of fibrotic interstitial lung disease

Dr. Janice Leung
Accelerated lung aging in people living with human immunodeficiency virus

Dr. Zachary Laksman
Personalized drug safety and targeted therapies for individuals with truncating titin variants

Dr. Gordon Francis
Arterial smooth muscle cell lysosomal acid lipase as a novel target for atherosclerosis treatment and prevention

Dr. Kelly McNagny
Neonatal ILCs sculpt long-term adult immune response

HEART AND STROKE FOUNDATION

Dr. Ying Wang
Characterizing the inflammatory pathways targeted by colchicine to better repurpose drugs for coronary artery disease

CANADIAN CARDIOVASCULAR SOCIETY

Dr. Amrit Singh
A multimodal approach to risk stratification in hypertrophic cardiomyopathy

NSERC DISCOVERY GRANT

Dr. Graeme Koelwyn
Monocyte adaptations to chronic exercise stress

Dr. Ying Wang
Cell-cell and cell-microenvironment interactions maintain tissue homeostasis of the cardiovascular system

CANADIAN CONSORTIUM ON NEURODEGENERATION IN AGING (CCNA)

Dr. Mari DeMarco
CCNA: Application for Phase III CCNA Operations Centre

NATIONAL INSTITUTES OF HEALTH

Dr. Pat Camp (Subaward; UBC PI)
TB PuRe: Pulmonary rehabilitation to reduce post-tuberculosis morbidity

Dr. Stephanie Sellers (Subaward; UBC PI)
Patient-specific blood cell reactivity and flow dynamic profiles in transcatheter aortic valve replacement

CANCER RESEARCH SOCIETY

Dr. Kelly McNagny
Targeting podocalyxin for the treatment of adverse-risk acute myeloid leukemia

LONG COVID WEB

Dr. Jim Russell
Neuro-inflammation and corticosteroid treatment in Long COVID

BOEHRINGER INGELHEIM

Dr. Chris Ryerson
Personalized approaches to prognostication and management of fibrotic interstitial lung disease

CANADIAN AGENCY FOR DRUGS AND TECHNOLOGY IN HEALTH (CADTH)

Dr. Chris Ryerson
The Canadian Registry for Pulmonary Fibrosis (CARE-PF): Setting patient-informed priorities and processes that reach all Canadians with pulmonary fibrosis

MSHR BC REACH AWARD

Dr. Liam Brunham
Genetic Lipid Disorders and Premature Atherosclerotic Cardiovascular Disease: Raising Awareness to Save Lives

GENETIC AORTIC DISORDERS ASSOCIATION

Dr. Pascal Bernatchez
Targeting the beta-arrestin2 pathway to improve Marfan patient care

MITACS ACCELERATE

Dr. Ilker Hacihaliloglu
AI-Integrated Multi-Anatomy Ultrasound: A New Frontier in Venous Thromboembolism (VTE) Management

NSERC ALLIANCE – MITACS ACCELERATE

Dr. Amrit Singh
Novel bioinformatics approaches for multiomics data

Research Grants Cont'd

BC LUNG FOUNDATION

Dr. Bradley Quon
The real-world impact of elexacaftor-tezacaftor/ivacaftor on prescribing patterns, clinical outcomes, and health care utilization for people with cystic fibrosis living in British Columbia

Dr. Andrew Sandford
Identifying Functional Genetic Variants Associated with Susceptibility to COPD

Dr. Gillian Goobie
Characterizing the role of environmentally-susceptible epigenetic targets in idiopathic pulmonary fibrosis

UBC GREEN LABS PROGRAM

Drs. Ying Wang and Gurpreet Singhera
Toward Greener Preservation: Vacuum-Based Long Term Heart Tissue Storage as an Alternative to Formaldehyde

Awards

National and international awards for excellence in mentorship, leadership and innovation.

Dr. Tillie Hackett
Michelle Harkness Mentorship Award (AllerGen) — *Mentoring Excellence, Investigator*

Dr. Jim Hogg
2024 American Thoracic Society — *Solbert Permutt Trailblazer Award*

Dr. Chris Ryerson
2024 American Thoracic Society — *Mentoring Award in Clinical Problems*

(L to R) Dr. Bruce McManus, Dr. James Hogg, Dr. Keith Walley, Dr. Peter Paré. Photo by Providence Research.

TRAINEE ASSOCIATION, EDUCATION AND EDI

Learning Together. Leading Tomorrow.

The Trainee Association at HLI (TAHLI) connects learners across disciplines and career stages through mentorship, professional development, and peer-led initiatives.

Dr. Ying Wang points to the PhenoCycler device while discussing its features with members of her lab. Photo by Tiffany Chang.

Trainee Association at HLI (TAHLI)

Established in 2018, the mission of the HLI Trainee Association (TAHLI) is to enhance the academic experience of HLI trainees by promoting a training environment enriched with collaboration, education, professional growth, and career success.

In 2024, under the leadership of **Firoozeh Gerayeli** and **Sunaina Chopra**, TAHLI worked closely with trainees, principal investigators, and staff to foster community and professional development through a range of events. The TAHLI committees organized many events, including the following:

- Summer student icebreaker, fall welcome event
- Third annual donation drive for local shelters
- HLI Research Day
- Holiday ornament painting event in December
- Weekly "HLI Insider" newsletter to share opportunities and updates

TAHLI extends appreciation to the HLI Executive Team, principal investigators and donors for their ongoing support.

In 2025, Sunaina Chopra and Eric Xiang will serve as TAHLI Co-Chairs. Trainees interested in joining or sharing ideas can contact **trainees@hli.ubc.ca**.

TAHLI Committees

PROFESSIONAL DEVELOPMENT COMMITTEE

Co-chaired by Firoozeh Gerayeli and Eric Xiang, the Professional Development Committee hosted a career talk focused on the medical science liaison (MSL) pathway. The team also organized Lunch and Learn sessions with HLI guest speakers, with special thanks to Drs. Ying Wang and Honglin Luo for inviting their visiting lecturers to engage with trainees.

MENTORSHIP COMMITTEE

Led by co-chairs Raveen Badyal and Brandon Kohlen, the Mentorship Committee organized several community-building activities, including an ice skating event, regular coffee walks, and an end-of-mentorship gathering to celebrate participants' experiences.

OMICS AND BIOINFORMATICS COMMITTEE

Formerly the Biostatistics Committee, the Omics and Bioinformatics Committee, co-chaired by Jasleen Kaur and Josie Tuong, expanded its focus to reflect broader interests in computational research. In 2024, the committee represented HLI at UBC's Bioinnovation Conference and hosted a R workshops series in support of the Hackathon.

SCHOLARSHIP COMMITTEE

Chaired by Eric Xiang and Razieh Sadat Banijamali, the Scholarship Committee held internal and CIHR award workshops to support trainees in securing travel and research funding. The team extends special thanks to the HLI Grants Team and St. Paul's Foundation for their support.

Group of trainees at an i-EXIT escape room event organized by TAHLI.

2024 HLI Research Day

HLI's annual Research Day showcased the collaborative spirit at the Centre and a shared commitment to advancing heart, lung and critical care science. Trainees presented their latest findings through oral talks, poster sessions and a new format: the Knowledge Translation Video Competition.

The 2024 HLI Research Day, held Aug. 16 at UBC Robson Square, brought together 85 trainees, 35 faculty and staff, and many other invited guests for a full day of science, storytelling and community.

This annual day showcased the Centre's collaborative spirit and shared commitment to advancing heart, lung and critical care science. Trainees presented their latest findings across 12 oral talks, 34 posters and a new format: the Knowledge Translation (KT) Video Competition.

During the opening remarks, Drs. Graeme Koelwyn and Rachel Eddy reflected on exploring the blurry lines between research, career, and personal life as early-career principal investigators.

Dr. Simon Rousseau, Associate Professor in the Department of Medicine at McGill University, delivered the Peter Paré Lecture keynote. "Trainees are the foundation of academic research and I am continuously amazed and delighted to see the breadth of work carried out," he said. "The knowledge translation segment was quite astonishing; plenty of talent in spreading the outcomes of research to lay audiences."

After lunch, graduate student Sunaina Chopra held a fireside chat with Bruce McManus Lecturer **Dr. Simon Pimstone**, Clinical Assistant Professor in the Division of General Internal Medicine and Associate Member in the UBC Division of Cardiology. Well-versed in the different sectors and paths available to trainees after graduation, Dr. Pimstone offered career advice to young researchers. "Just focus on one path," he said. "Once you find success from it, it becomes a lot easier to switch after."

For the KT Video Competition, trainees created two-minute videos explaining their research to a lay audience. You can watch all five submissions here.

HLI's Director Dr. Don Sin concluded Research Day with closing remarks, who praised the calibre of trainee presentations. "I was blown away by the quality of their presentation and their studies," he said. "This was the best ever HLI Research Day and I can't wait for next year's."

This story is adapted from an article by communications co-op student Michael Wu.


(L to R) Basak Sahin, Yasir Mohamud, David Granville , Amir Bahreyni, Kevin Seo, Eric Xiang, Carly Lin, Claire Wang. Photo by Michael Wu.

(L to R) Dr. Graeme Koelwyn and Dr. Rachel Eddy speak during the opening of HLI Research Day. Photo by Michael Wu.

> "I was blown away by the quality of their presentation and their studies, the poise and maturity of the presentation and students' ability to think on their feet and field questions.
>
> **Dr. Don Sin, MD, MPH**
> *HLI Director*


Audience applauds a speaker at HLI Research Day 2024. Photo by Michael Wu.

Fostering Equity, Diversity, and Inclusion (EDI) at HLI

The HLI's EDI Committee, co-chaired by **Basak Sahin** and **Elizabeth Guinto**, is a volunteer-led initiative committed to promoting equity, diversity, and inclusion across the Centre. The committee supports the HLI community through education, resource-sharing, and policy guidance, focusing on addressing barriers faced by equity-deserving groups.

Basak Sahin
Lab Technician, Molecular Phenotyping Core Laboratory

Elizabeth Guinto
PhD Program, Experimental Medicine, UBC (Sin Lab)

DISCUSSION GROUPS & DIVERSE DIALOGUES

Every two months, the committee hosted interactive sessions that encouraged open conversations around EDI. These sessions brought the community together to watch a documentary, listen to a podcast, or host a guest speaker, where participants reflected together on real-world challenges and how to create change. Topics covered this year included:

- **EDI in Research (July 25):** Drs. Yasir Mohamud and Hernandez-Cordero, CIHR REDI award recipients, shared their experiences navigating the grants and awards process through an equity lens.
- **Invisible Disabilities (May 30):** The group viewed *Invisible*, a documentary on the experiences of six disabled women activists.
- **Compassion Fatigue (September 26):** The committee organized a session on strategies to recognize and manage emotional fatigue in care-focused workplaces.

The committee also organized **Diverse Dialogues**: small, intimate gatherings that created space for staff and trainees to connect and share lived experiences. These conversations helped strengthen a culture of inclusion within the community.

EVALUATION

The committee conducted a tailored workplace experience survey, modelled after UBC's, to gather feedback from staff and trainees on EDI committee efforts.

The committee received 29 responses. Overall the responses to 16 general statements were positive (e.g., "Getting to know people with backgrounds different from my own has been easy", and "HLI creates opportunities for everyone to understand what diversity, inclusion, and equity are"). Most individuals found HLI to be a safe place to be themselves. Many reported that time was the biggest barrier to attending events.

Going forward, the committee is offering slides, webinars and other documents online for increased accessibility.

HLI members gather to celebrate Lunar New Year with food, activities, and performances.

PARTNERSHIPS

UBC Faculty of Medicine's EDI Joint Interest Group: to enhance resources and align institutional efforts

Providence Research (PR): to work with EDI manager to expand resources and coordinate collaborative EDI events with other PR centres

UBC School of Biomedical Engineering (SBME): to coordinate site tours and trainee networking opportunities

HLI members gather for a group photo during an origami event organized by the Workplace Well-being Initiative team. Photo by Michael Wu.

Workplace Well-being Initiative

In Winter 2024, HLI joined a UBC Recreation initiative to reduce sedentary behaviour and promote well-being. As one of three units selected, the Workplace Well-being Initiative, led by **Beth Whalen**, hosted biweekly 15-minute movement breaks featuring activities such as stretching, origami, games and scavenger hunts with riddles and chocolates.

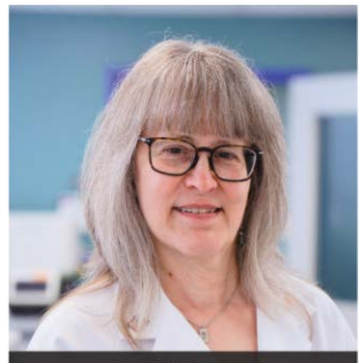
These interactive sessions helped break daily routines and fostered connection in a research environment often marked by long hours at lab benches or desks.

The team also contributed to UBC's annual Thrive campaign, a month-long initiative focused on mental health. As part of Thrive, HLI hosted two creative sessions where participants sculpted and painted their own "desk buddies." Common themes included animals, plants and mushrooms, reflecting a wide range of creativity.

To complement these hands-on activities, weekly self-reflection prompts were posted in shared spaces, including the building elevator. Questions such as "What do you like most about yourself?" and "How do you cope with stress?" encouraged personal reflection and community dialogue.

By integrating movement, creativity and reflection into HLI's workplace culture, these efforts supported emotional awareness and strengthened community across HLI.

Three "desk buddies" created by Sonali Sharma, Evan Phillips, and Katherine Adolphs (L to R) sit side by side on the windowsill.



Beth Whalen
Manager, Molecular Phenotyping Core Lab
Workplace Well-being Coordinator

Trainee Awards and Scholarships

Ana Hernandez Cordero | Leung/Sin Labs
CIHR Research Excellence, Diversity, and Independence Early Career Transition Award (inaugural)
Epigenetic and molecular regulation of aging and age-related comorbidities
CIHR Summer Program in Aging, 2024

Yasir Mohamud | Luo Lab
CIHR Research Excellence, Diversity, and Independence Early Career Transition Award (inaugural)
Elucidating the intricate interplay between mitochondria, innate immunity, and viral pathogenesis in heart failure

Razieh Banijamali | Luo Lab
Vanier Canada Graduate Scholarship
Enhancing Triple-Negative Breast Cancer Therapeutics with Oncolytic Virotherapy

Raveen Badyal | Hackett Lab
Canada Graduate Scholarship - MSc
The Effect of Transforming Growth Factor-Beta Receptor Inhibition on Skin and Lung Fibrosis in Patients with Systemic Sclerosis
UBC Faculty of Medicine Graduate Excellence Award
The Effect of TGF-β Receptor Inhibition on Fibrosis in Patients with Systemic Sclerosis

Yolanda (Chen Xi) Yang | Tebbutt/Sin Labs
CIHR Doctoral Research Award
Towards precision health in chronic obstructive pulmonary disease: A single-cell and spatial transcriptomics atlas of airways across the full spectrum of disease severity

Eric (Pinhao) Xiang | Francis Lab
CIHR Doctoral Research Award
Understanding macrophage-smooth muscle cell interactions in foam cell development in atherosclerosis

Alanna Hind | Guenette Lab
BC Lung Foundation - Respiratory Rehabilitation Fellowship
Pathological, sensory and ergogenic effects of salbutamol - implications for athletic screening and β2 agonist use in sport

Sunaina Chopra | Camp Lab
BC Lung Foundation - Respiratory Rehabilitation Fellowship
Niwh Yizt'Iyh Hilht'Iz Nets'Eelh'Iyh – "Strengthening Our Bodies": Exploring the impact of land-based activities on the health and wellbeing of BC First Nations men
UBC BPOC Graduate Excellence Award
Niwh Yizt'Iyh Hilht'Iz Nets'Eelh'Iyh – "Strengthening Our Bodies": Exploring the impact of land-based activities on the health and wellbeing of BC First Nations men

Fatemeh Aminazadeh | Hackett Lab
UBC Four-Year Doctoral Fellowship
The contribution of sex differences to small airways disease in Chronic Obstructive Pulmonary Disease
2024 American Thoracic Society Abstract Scholarship - *Structure & Function Assembly*

Hattie Luo | Laksman Lab
UBC Four-Year Doctoral Fellowship
Generation of co-culture engineered heart tissue for drug screening

Hesam Karimi | Luo Lab
UBC Four-Year Doctoral Fellowship
Lipid nanoparticle-based delivery of a genetically engineered coxsackievirus B3 as a therapeutic cancer vaccine for lung cancer therapy

Guangze Zhao | Yang Lab
Top Postgrad. Student Poster Presentation UBC FoM Dept. Pathology and Laboratory Medicine
CVB3-induced m6A modification of RNA enhances viral replication via suppression of YTHDF-mediated stress granule formation

Estefania Espin | Tebbutt Lab
Long COVID Web - Seed Funding 2024
Advancing Long-COVID Biomarker Development in Canada: Integrating Transcriptomics and Stakeholder Perspectives

Firoozeh Gerayeli | Sin Lab
UBC Faculty of Medicine Graduate Award
Canadian Thoracic Society
Basic Science Poster (2nd runner up)
Lung Health Foundation - *Travel Award*

Clarus Leung | Sin Lab
2024 American Thoracic Society
Abstract Scholarship - Structure & Function Assembly

Cassie Gilchrist | Leung Lab
Canadian Lung Association - PhD Studentship Award
Exploring the Impact of Cannabis Smoke Exposure on Lung Health with Single Cell RNA Sequencing and Microbiome Analysis

Mehdi Jafari | Quon Lab
CIHR-MSHR BC Health System Impact (HSI) Fellowship
The real-world impact of ETI on prescribing patterns, clinical outcomes, and healthcare utilization for PwCF living in British Columbia
BC Lung Foundation
The real-world impact of ETI on prescribing patterns, clinical outcomes, and healthcare utilization for PwCF living in British Columbia

Kate Huang | Laksman Lab
Stem Cell Network - Till & McCulloch Meetings Travel Award
Modelling a ventricular fibrillation-related titin variant using patient iPSC-derived cardiomyocytes

Asma Tanveer | Dorscheid/Tebbutt Labs
RespNet BC Trainee Salary Stipend
Characterizing the expression and regulation of IL-13 receptor subunits in response to injury signals in asthma

Maria Elishaev | Wang Lab
CIHR Travel Award
Using a novel multiplex imaging platform to visualize inflammation and cell death in early human atherosclerotic lesions

Elizabeth Guinto | Sin Lab
2024 AAI Trainee Poster Award
Single-cell proteomic analysis of peripheral blood mononuclear cells in patients with pulmonary long COVID

Iulia Iatan | Francis Lab
Canadian Cardiovascular Society Trainee Research Award
Familial Hypercholesterolemia in Canada: Investigating Management Patterns and Clinical Outcomes from the FH Canada Registry

Jasleen Kaur | Quon Lab
Mitacs Accelerate
Biological clustering of Pulmonary Exacerbation in Cystic Fibrosis (BioPEx-CF)

Melody Cheng | Wang/Tebbutt Labs
Mitacs Accelerate
Finding blood biomarkers to inform local inflammation in coronary artery disease

Samuel Leung | Wang/Tebbutt Labs
Mitacs Accelerate
Finding blood biomarkers to inform local inflammation in coronary artery disease

INTERNAL AWARDS

For young researchers who have demonstrated excellence in basic scientific and/or clinical research

BOB SCHELLENBERG ROOKIE OF THE YEAR
Milad Vahedi| Koelwyn Lab

CORNELIS VAN BREEMEN OUTSTANDING YOUNG INVESTIGATOR
Pinhao (Eric) Xiang | Francis Lab

JAMES C. HOGG OUTSTANDING YOUNG INVESTIGATOR
Debora Petry-Moeke | Camp Lab

For HLI trainees who will be presenting at a local, national, or international meeting, or engaging in activities that enhance trainee education beyond traditional travel awards

JAMES HOGG AWARD
Leiana Hoshyari | Dorscheid Lab
Carly Lin | Luo Lab

PETER PARÉ AWARD
Sayed Milad Vahedi | Koelwyn Lab
Najmeh Assadinia | Hackett Lab

BRUCE MCMANUS AWARD
Hattie Luo | Laksman Lab
Razieh Sadat Banijamali| Luo Lab

STUART GREENE AWARD
For an HLI employee whose outstanding service, patience, and cooperativeness as a team player have made a major impact to the success of the HLI mission.
Evan Phillips | Grants Team

ALEXANDRA KERJNER TECHNICIAN AWARD
For HLI technicians or managers who have made continued contribution with the highest level of technical skill, work ethic, enthusiasm in mentoring and team spirit.
Coco Ng | BMCB

(L to R) Evan Phillips and Coco Ng stand beside Dr. Don Sin with their awards.

OPERATIONS

The Engine Behind Discovery

From biobanking to molecular phenotyping to our state-of-the-art MRI core, our operational platforms provide the critical infrastructure that powers high-impact research. These shared services ensure our investigators have the tools and support needed to accelerate innovation in heart, lung, and critical care science.

(L to R) Mathushaa Chanchayan and Beth Whalen examine a box retrieved from the ultracold freezer in the Molecular Phenotyping Core Lab. Photo by Tiffany Chang.

Preclinical Services

Preclinical Services at HLI operates a 9,000 sq. ft. facility that offers flexible space, technical services, and high-tech equipment for use with preclinical models. Equipment is maintained under a preventative maintenance program and includes certified biosafety cabinets, calibrated anesthetic equipment, and hydrogen peroxide decontamination capabilities. The Preclinical Services staff are CALAS-certified and bring expertise in microsurgery, echocardiography, cardiovascular and pulmonary models, oncology, dermatology, and diabetic models.

Under the leadership of Claire Smits, the team has spent significant time designing their future home in the CSRC, ensuring it meets the needs of HLI's current and future scientists. The team successfully stayed within budget and met all audit and mandatory inspection requirements. Projects supported this year include studies in sepsis, atherosclerosis, oncology, and emphysema.

As always, Preclinical Services and HLI follow standards set by the Canadian Council on Animal Care, operating with the support of the UBC Animal Care Committee, the UBC PAM team, and training support from UBC ACS and CALAS/ACSAL.

Tissue Culture Core

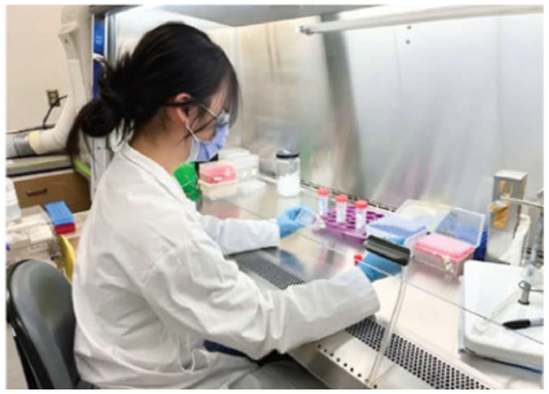
In 2024, the HLI Tissue Culture (TC) core remained a key hub for cell-based research, operating across eight specialized laboratories. It supported a range of experiments, including basic techniques and high-impact multidisciplinary collaborations with the HLI's MPLC, Imaging, and Histology cores. These efforts have directly contributed to advancing HLI's research portfolio.

Training and safety remained top priorities. TC core manager Dr. Gurpreet Singhera conducted four orientation sessions, training 24 new users with emphasis on sterile technique protocols and liquid nitrogen safety. The core also supported HLI's High School Student Week by offering hands-on cell culture experience, inspiring the next generation of scientists.

Facility enhancements in 2024 included the addition of a two-door refrigerator, a cryo-dewar to expand cryogenic storage, and new imaging equipment: an EVOS3000 microscope and Countess 3 cell counter. The core acknowledges the HLI Executive team for their ongoing support, and HLI's skilled equipment and maintenance team members, Dan Vikse and Andy Diewald, for their technical expertise.

In strategic planning, the TC core also contributed to the design of the new CSRC facility, ensuring that the lab spaces will support future cell, viral, and bacterial research. It also reached financial self-sufficiency through a user-based cost-sharing model and remains committed to supporting research, safety, and training.

Preclinical core staff. (L to R) Tyler Leversage, Lynne Carter, Eric Xu, Claire Smits, and Ray Gopaul.



High school student Catherine Xu learns to use a biosafety cabinet in the Tissue Culture Core lab. Photo by Gurpreet Singhera.

Molecular Phenotyping Core Laboratory (MPCL)

In 2024, the Molecular Phenotyping Core Laboratory (MPCL) experienced a shift in biobanking service requests, reflecting evolving research needs across the institution. Alongside routine biobanking services, the MPCL received requests from three new studies for peripheral blood mononuclear cell (PBMC) isolation — a notable expansion, as PBMC isolations had previously been performed only by special request. The MPCL also began supporting six clinical trials this year, highlighting the lab's growing role in translational and clinical research.

Under the scientific direction of Dr. Andrew Sandford and the leadership of Core Manager Beth Whalen, MPCL dedicated much of this year to planning and designing its new research laboratory in the CSRC. Starting with an empty shell, the team worked collaboratively to create a purpose-built facility that houses all MPCL equipment. The new space was designed to support current operations while allowing room for future equipment and evolving research needs, ensuring both flexibility and long-term sustainability.

This year, the MPCL faced several operational challenges. Four major instruments failed, including the Agilent Bioanalyzer and a double-door laboratory refrigerator — both deemed beyond repair. The Bioanalyzer was replaced with a refurbished unit, and a new refrigerator was purchased. The lab also incurred more than $40,000 in repair costs for the NanoString prep station and the Astrios cell sorter, highlighting the ongoing need for proactive equipment renewal planning.

A key milestone in 2024 was the MPCL securing its own UBC Biosafety Permit. Previously, core facilities operated under the permits of various Principal Investigators. Obtaining an independent permit marked a significant advancement, allowing the MPCL to streamline operations and collaborate more effectively with investigators outside the centre.

(L to R) MPCL Staff: Basak Sahin, Beth Whalen, Mathushaa Chanchayan, Gaea Buenaventura.

(L to R) Beth Whalen, Gaea Buenaventura and Mathushaa Chanchayan work under a fume hood in the MPCL.

Magnetic Resonance Imaging (MRI) Core

The Magnetic Resonance Imaging (MRI) core, directed by Dr. Rachel Eddy, continues to support eight clinical studies in the following research areas: cannabis smoking, vaping, COPD, IPF and HIV. Across these studies, over 400 participants have been enrolled and completed hyperpolarized xenon MRI to measure pulmonary ventilation, gas exchange, and/or lung microstructure. The MRI core also supports paired chest CT acquisition for advanced structure-function pulmonary phenotyping.

The HLI is one of ~25 centres worldwide with hyperpolarized xenon gas MRI capabilities, and cardiac MRI capabilities on the system are expanding. The 3T scanner is equipped with a quantitative myocardial perfusion package for cardiac MRI research applications. Research time on the MRI scanner remains available, and new studies with MRI endpoints are always welcome.

HLI PIs have prioritized use of this research time for studies dedicated to heart and lung health and disease. We also remain engaged with the New St. Paul's and CSRC discussions to ensure continuity and minimal disruption of the MRI core with the transition to the new building.

Dr. Rachel Eddy prepares a patient for a scan in the 3T MRI scanner at St. Paul's Hospital. Photo by Providence Research.

The pulmonary MRI research program at St. Paul's Hospital and UBC, launched in late 2021, has enrolled more than 400 participants for hyperpolarized ^{129}Xe functional lung MRI. Shown here are example images of smoking-related conditions. Inhaled ^{129}Xe (blue) highlights regional ventilation deficits in young people who smoke cannabis or vape (middle), and in older adults with chronic obstructive pulmonary disease, or COPD (right).

Workplace Safety Committee

The HLI Safety Committee, led by Ivan Leversage, has transitioned from a local committee to the St. Paul's Hospital Joint Occupational Health and Safety Committee (SPH JOHSC). Local terms of reference for the new committee were developed and approved to support this transition.

The SPH JOHSC currently includes representatives from the following UBC units located at St. Paul's Hospital: the Centre for Advancing Health Outcomes, the Centre for Heart Lung Innovation, and the BC Centre on Substance Use.

As part of ongoing safety initiatives, a new First Aid poster was developed (*Essential Steps for Responding to Injuries and Blood and Body Fluid Exposures*). This resource will be made available to other UBC units at St. Paul's Hospital.

In response to changes to WorkSafeBC Regulation's *Part 5: Chemical Agents and Biological Agents*, HLI worked with UBC Risk Management Services to standardize and computerize chemical inventories, improving chemical safety management and regulatory reporting.

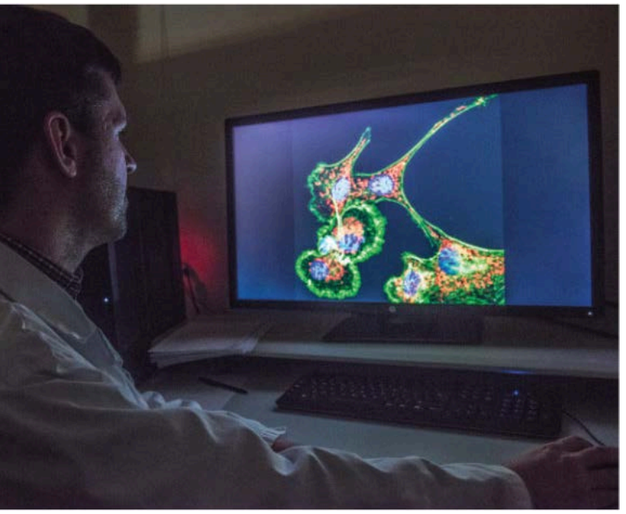
Facilities and Maintenance

Led by Dan Vikse, the Facilities and Maintenance team at HLI plays a key role in ensuring smooth operations. As noted in the Centre's 2023 annual report, the consolidation of frozen samples and laboratory equipment remains a major focus for the department. This work will continue as the team progresses toward completing the Design Phase of the new CSRC at St. Paul's Hospital.

The Planning Phase for the CSRC is nearing completion, with a few final design reviews underway to ensure the layout meets operational needs and includes all essential components.

In preparation for the transition, the team has begun identifying potential operational challenges that may arise during the hospital move and interim period before the new CSRC becomes fully operational. Measures are being explored to prevent disruptions to active research programs.

During last summer's extreme heat events, a failure in one of the main freezer room HVAC systems occurred. Temporary cooling was installed immediately, and a new HVAC system with built-in redundancy was installed in the fall. This upgrade will provide stable environmental conditions for sample storage until the transition to the new CSRC is complete.



Dr. Aaron Barlow examines a high-resolution confocal image of HeLa cells, with the nucleus in blue, mitochondria in red, and actin in green. Photo by Providence Research.

Cellular Imaging and Biophysics Core

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. Featured instruments include the Zeiss LSM 880 confocal microscope with super-resolution and multiphoton capabilities, the Nikon XTH 225-ST high-resolution microCT scanner, the Li-cor Odyssey CLx scanner and the EVOS 5000 fluorescence microscope.

NEW EQUIPMENT

In partnership with Gurpreet Singhera from the Tissue Culture core, the CIB will support the operation of two new pieces of equipment for the Centre. The core recently acquired the EVOS M3000 Imaging System. This compact bench-top microscope allows for fast, user-friendly, brightfield and phase contrast imaging up to 40x magnification, and includes real-time confluency measurements and video capture.

The CIB also acquired the iBright FL1500 imaging system. This system specializes in DNA and protein detection, chemiluminescence, and fluorescence imaging. These new instruments replace aging microscopes and the GBox systems, respectively.

RESEARCH HIGHLIGHTS

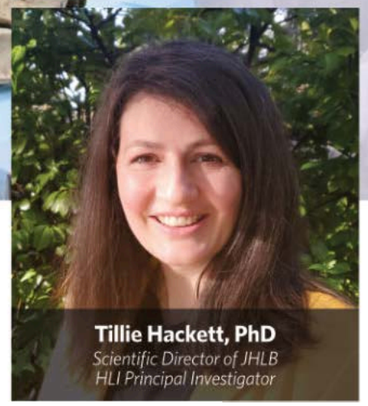
The CIB recently completed two major microCT scanning projects in collaboration with the Hackett group, with studies focused on airway remodelling in asthma and COPD patients using our unique formalin-fixed, paraffin-embedded (FFPE) imaging and frozen core imaging protocols.

In total, over 300 samples were scanned in this collaboration, amounting to over 600 hours of scan time, and we anticipate several publications will result from these data over the course of the next few years.

The CIB has continued ongoing collaborations with the Transcatheter Heart Valve (THV) group of Dr. Stephanie Sellers, where microCT was used to help evaluate a fluoroscopic technique for THV expansion and quantify leaflet calcification in extracted THVs.

Over the course of the 2024 calendar year, the CIB has trained 19 new trainees on our instruments and provided service to at least 13 different research groups throughout the Centre.

Darren Sutherland shows high school students fixed lung sections from the lung biobank. Photo by Providence Research.



Tillie Hackett, PhD
Scientific Director of JHLB
HLI Principal Investigator

James Hogg Lung Biobank

This year has been an active, productive period for the James Hogg Lung Biobank (JHLB), as the biobank continued its mission to advance respiratory research by providing investigators with high-quality, well-preserved lung samples with comprehensive clinical data to identify disease pathobiology and new therapeutic targets.

Under the scientific direction of Dr. Tillie Hackett and the management of Darren Sutherland, the JHLB met a major milestone this year: the full reorganization of its frozen lung tissue inventory. The previous storage system posed logistical challenges for retrieving and restocking individual samples. To address this, the team successfully transferred 3,500 lung tissue samples into newly barcoded cryovials. This upgrade significantly enhances the biobank's capacity to efficiently fulfill tissue requests and track sample usage.

In parallel, the JHLB team dedicated over 100 hours to the planning and design of the new CSRC located within the Jim Pattison Medical Campus. The future biobanking facilities will enable the collection of valuable clinical samples at the new St. Paul's Hospital, supporting innovative patient-led research and personalized health initiatives.

This year, the JHLB also processed seven new lung donations, contributing to ongoing studies in Chronic Obstructive Pulmonary Disease (COPD) and lung fibrosis. These generous donations underscore the critical role patients play in advancing medical science and improving health outcomes for future generations.

RESEARCH IMPACT AND COMMUNITY ENGAGEMENT

In its commitment to knowledge translation and community engagement, the JHLB continues to host students, clinicians, visiting scientists, and St. Paul's Foundation donors. These orientation sessions offer a firsthand look into the biobank's operations and the essential role it plays in respiratory research.

Over the past year, the JHLB provided lung tissue specimens and associated clinical data not only to researchers at the Centre for Heart Lung Innovation but also to international collaborators at the University of California, San Francisco, and the University of Tasmania. These efforts contributed to nine peer-reviewed research publications.

The JHLB also continues to support translational research in collaboration with the biotech company Ikomed, assisting with preclinical COPD models through tissue processing, imaging, and histological analysis.

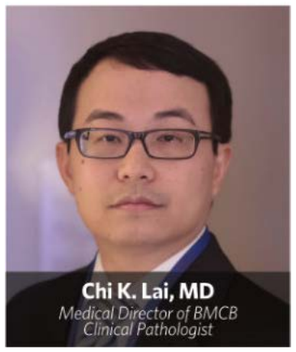
Furthermore, the team is currently working with Université Laval and the University of Groningen (Netherlands) to support one of the largest lung expression quantitative trait loci (eQTL) studies ever conducted. This international collaboration represents a major step forward in understanding the genetic regulation of lung disease.

Bruce McManus Cardiovascular Biobank

In the past year, the Bruce McManus Cardiovascular Biobank (BMCB) continued to drive progress in cardiovascular research by providing retrospective and "fit-for-purpose" prospective cardiac samples to national and international collaborators. Led by Scientific Director Dr. Ying Wang and Biobank Operations Manager Dr. Gurpreet Singhera, the BMCB remains committed to supporting knowledge translation and promoting educational initiatives.

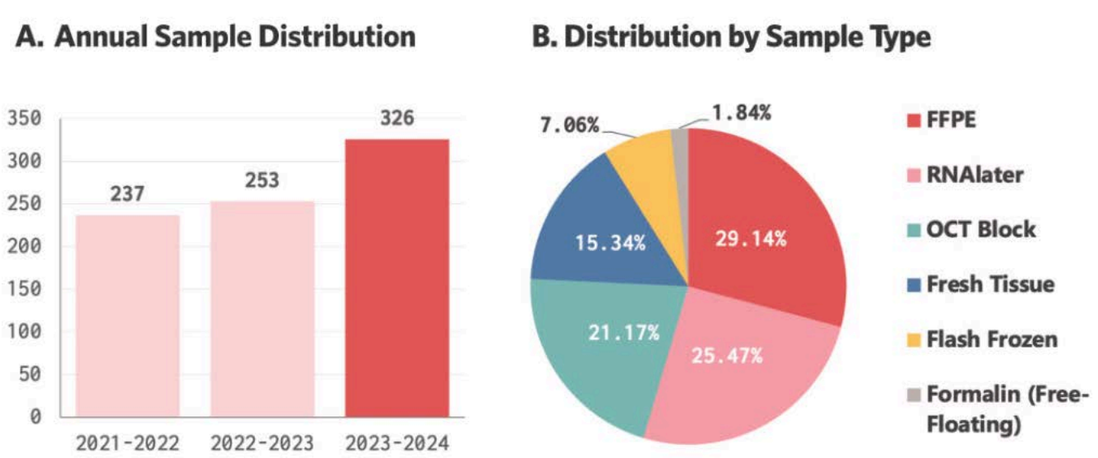
- **HQP update:** Dr. Chi Lai, Clinical Cardiovascular Pathologist at SPH, has been appointed as the Medical Director of BMCB. Having him on the team will not only expand the clinical expertise of the BMCB to support translational research, but also increase capacity for digital pathology and biomarker discovery.
- **Finance:** BMCB received a $3,680 grant from the UBC Green Labs Program to reduce formalin waste. Patient-consented donated hearts are now vacuum-sealed rather than stored in free-floating formalin. This change is expected to reduce formalin waste by 78% by adopting more environmentally sustainable storage practices.
- **REB update:** The biobank protocol was updated to enable biobanking of biopsies and blood not collected via surgical procedures, which will support research on early diagnosis of heart disease.

Ying Wang, PhD
Scientific Director of BMCB
HLI Principal Investigator



Chi K. Lai, MD
Medical Director of BMCB
Clinical Pathologist

Dr. Gurpreet Singhera speaks about biobanking and human heart specimens during the Hands-On-Hearts workshop, presented to clinical nurses from hospitals across the Lower Mainland. Photo by Tiffany Chang.



Distribution of biobank samples. (A) Total number of requested samples increased annually, reaching 326 in 2023–2024. (B) The most commonly used samples in 2024 were formalin-fixed paraffin-embedded (FFPE) tissue (29.14%) and RNAlater-preserved samples (25.47%), followed by optimal cutting temperature (OCT) compound blocks (21.17%) and fresh tissue (15.34%). This distribution highlights the demand for well-preserved tissue types, with FFPE and RNAlater samples most frequently requested by researchers for their versatility in long-term molecular analysis.

BIOBANKING ACTIVITIES AND SAMPLE UTILIZATION

For fit-for-purpose biobanking, the BMCB has modified its protocols to improve the structural and molecular integrity of samples, addressing traditional problems with fragile biospecimens and enabling future applications such as single-nuclei sequencing and in-situ 'Omics'. Working with Dr. Lai, the BMCB launched new biobanking initiatives for several early career investigators at the HLI.

In 2024, the BMCB biobanked 26 failed explanted hearts and 441 surgically-removed cardiovascular tissue specimens. The biobank extends immense gratitude to the patients who donated their tissues for their generosity and commitment to supporting research efforts.

The BMCB is growing its national and international reputation by attracting external collaborations with the University of Toronto, University of Alberta, and University of Virginia. In the past year, HLI members published seven manuscripts using samples from the BMCB.

OUTREACH ACTIVITIES

The BMCB team facilitated 15 tours this year for graduate students, heart transplant patients, and high school students.

Additionally, the team hosted a Hands-on-Hearts workshop, in partnership with St. Paul's Hospital's Heart Centre Nursing Education Day 2024. Held at UBC Robson Square on June 7, 2024 from 8 AM to 2:30 PM, the event featured presentations on immunization in cardiac care, amyloidosis, cardio-oncology, and cardiovascular genetics.

During the Hands-on-Hearts session, participants learned about the role of biobanking in cardiovascular research and examined heart specimens affected by dilated cardiomyopathy, hypertrophic cardiomyopathy, coronary artery disease, and amyloidosis.

These initiatives reflect the commitment of HLI and the BMCB to education, awareness and knowledge sharing in cardiovascular science.

(L to R) BMCB Staff: Tiffany Chang, Gurpreet Singhera, Coco Ng.

Information Technology (IT)

In 2024, the HLI Information Technology (IT) team made major progress in modernizing infrastructure across the centre. The migration to a new, streamlined architecture is nearly complete, with only a few complex systems remaining. Full completion is expected by late summer or early fall of 2025. The new system will support over 4 petabytes of storage capacity, with the ability to scale as needed.

The team successfully transitioned approximately 400 servers from a legacy IBM-designed stack (circa 2005) to a simplified, software-defined environment. By reducing the use of third-party hardware and software, the updated system has significantly lowered maintenance costs. The virtualization software stack alone now saves over $60,000 annually in licensing and support. All servers, storage, and networking are now fully software-defined.

Networking upgrades were another major focus. The team upgraded core network speeds to 100Gb and backup connections to 25Gb. The external link to BCNET is being upgraded to 10Gb with full failover redundancy. The team also began replacing aging network switches across the hospital and are establishing a redundant network connection to Hornby to strengthen overall system resilience.

ENABLING SECURE RESEARCH AND HIGH-PERFORMANCE COMPUTING

The newly deployed High-Performance Computing (HPC) cluster (see below) is now online and ready for non-GPU workloads, offering around 1,000 CPU cores. To support researchers, the team developed a custom web app that allows users to submit, edit, and rerun large batches of pipeline jobs. It automatically retrieves data, runs the analysis, stores results, and cleans up afterward. It also generates timestamped reports from the outputs, streamlining end-to-end workflows.

Focusing on security and compliance, the team continued replacing outdated Windows 7 and 10 lab computers with modern, security-compliant systems that meet both Providence Research and UBC standards. Where replacement was not feasible, machines were quarantined on secure internal networks to limit access and maintain compliance. IT staff will continue reaching out to coordinate replacements as needed.

Lastly, to support secure remote work, the team launched new platforms for statistical and graphical analysis. Designed with the new CSRC facility in mind, these systems integrate with Providence Research's infrastructure and will provide fast, secure access from anywhere in the building. High-speed remote graphics, exceeding 30 frames per second, are now possible without additional user cost, exceeding the performance of commercial solutions like *Teradici*.

TDL.js Aquarium.
A visual tool used to monitor server activity on the HPC cluster: each animated fish represents a running process or system job. Photo by Joe Comeau.

OUR PARTNERS

The HLI is grateful to our patients, donors, and funding partners:

Academic and Health Institutions
Providence Research (PR)
Providence Health Care (PHC)
Simon Fraser University (SFU)
University of British Columbia (UBC)

Government
Canada Research Chairs
Canadian Institutes of Health Research (CIHR)
Networks of Centres of Excellence (NCE)
Interior Health Authority
National Institutes of Health
National Research Council
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