THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

ANNUAL REPORT

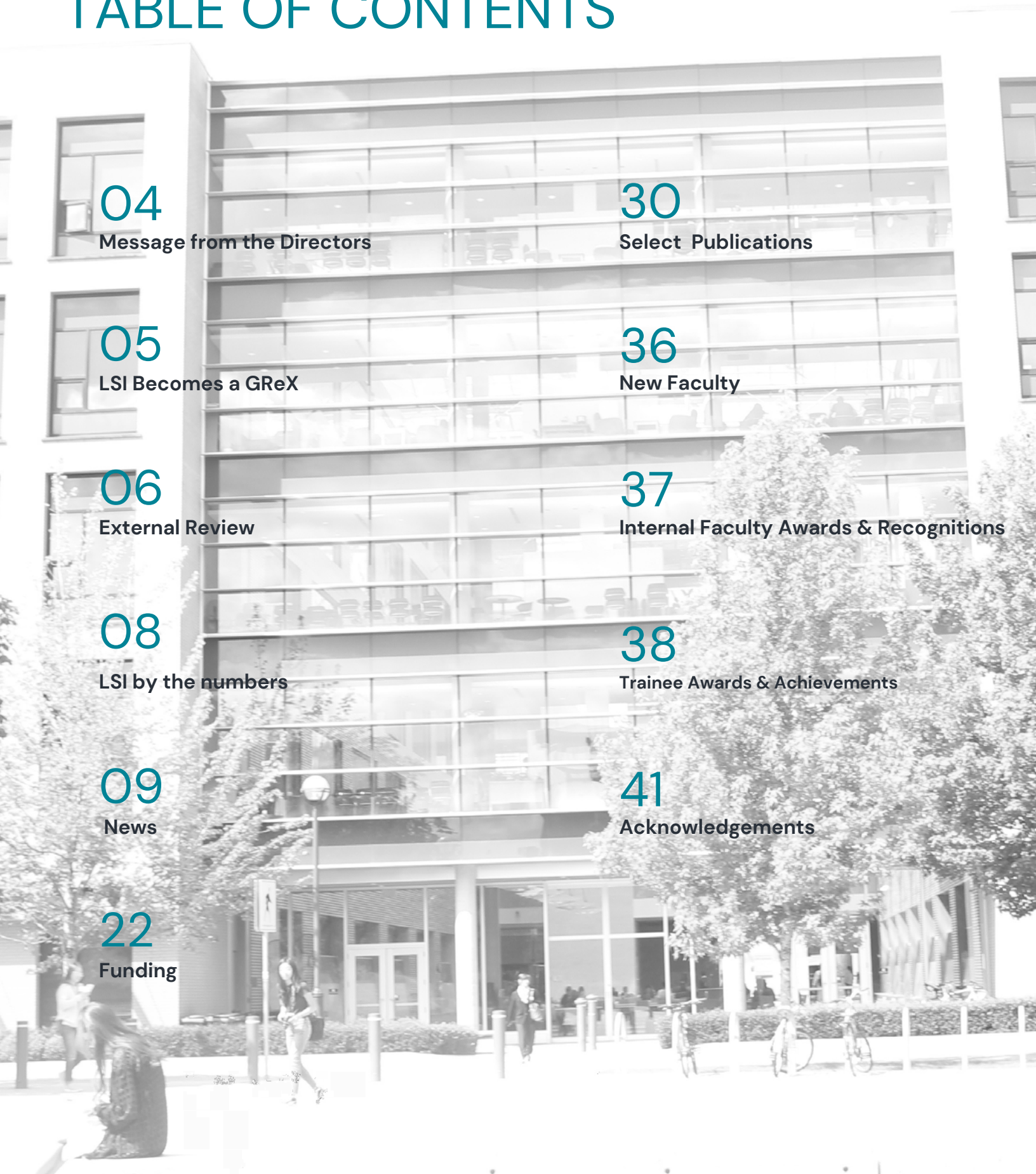
2022-2023

LSI.UBC.CA

LAND ACKNOWLEDGEMENT

We acknowledge that the land, on which we have the privilege to gather, teach and pursue our science is the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) People.

TABLE OF CONTENTS



MESSAGE FROM THE DIRECTORS

As Directors, we would like to start by thanking everyone in the LSI for your brilliant ideas, your hard work, and your trust in our shared vision.

The past year was very productive for the LSI – after a year of self-evaluation, re-organizing, and a lot of hard work, we can report significant achievements that lay a foundation for the next several years.

We are pleased to report the launch of the Biological Resilience Initiative (BRI) in June 2022, as part of the LSI's new designation as a Global Research Excellence Institute (GREx) at UBC (described in more detail on p. 5). With new support for shared technology-driven resources and expertise, we anticipate improved efficiencies and greater collaboration, as we harness our collective expertise to tackle some of the grandest challenges facing our planet, through the unique lens of biological resilience.

We are also pleased to report very positive feedback from an external review of the LSI conducted in January, 2023 (p. 6). Recognizing the diverse research strengths, significant recent investments in shared infrastructure and expertise, and our success in funding the BRI, the review committee concluded the LSI provides an excellent environment for interdisciplinary life sciences research, with access to well-run core facilities and opportunities to collaborate across a broad spectrum of research areas. These results are a clear endorsement of our strategic vision, as well as a testament to everyone's commitment to work together to make the LSI what it is today.

After three years of a global pandemic, the personal and professional challenges for LSI trainees and researchers continue to be significant. Yet, despite these challenges, the LSI has continued to make amazing breakthroughs – designing new strategies to combat SARS-CoV-2 variants and antimicrobial resistance, revealing fundamental mechanisms governing muscle health, developing cutting-edge tools to study the brain, and engineering novel surface coatings to keep medical devices free of bacteria.

To support all of this valuable work, we now focus on achieving goals to further increase our local, national, and international profile. To increase fundraising and team grant success, we are working with our Research Focus Teams to obtain additional funds through new collaborations, private sector partnerships, and philanthropic sources. We have put in motion plans to expand the Research Facilitation Office to provide additional support for team grants, and generate communications materials to present the outstanding work performed by these teams to potential funding partners. We are also planning to refresh the LSI website to increase our visibility and improve communication with other units and with the general public, again to increase our profile and fundraising success. As always, we welcome feedback from LSI members about their research facilitation needs, and will do our best to accommodate these.

The LSI is more than just a building. It is a community. We are committed to continue growing the sense of community and our profile. We are here to facilitate your research. Please enjoy this report on the past year of the LSI's journey.

THE LSI BECOMES A GLOBAL RESEARCH EXCELLENCE INSTITUTE

In June, 2022 the LSI officially became a UBC Global Research Excellence Institute (GREx), announcing the launch of the Biological Resilience Initiative (BRI).

THE LIFE SCIENCES INSTITUTE
BIOLOGICAL RESILIENCE INITIATIVE

The BRI will be the first initiative in Canada to study life science questions through the lens of innate resilience. Through 4 billion years of evolution, all living organisms, from single-celled microorganisms to humans, have developed mechanisms of resilience to protect them from both internal and external threats. By deploying our collective expertise across the molecular, genetic, cellular, organism, and ecosystem scales, we will leverage the mechanisms underlying this resilience to find new solutions to the grand challenges facing human health and the health of our planet.

Our challenges include, but are not limited to:

- The race against antimicrobial resistance
- Cancer as a failure of biological resilience across scales – from molecules and cells to the whole organism
- Cellular plasticity in immune resilience
- Metabolic stability and resilience in healthy aging
- Harnessing microbial resilience for sustainability

Our five-year goals are centered on three major areas: **Collaboration, Talent, and Engagement.**

Collaboration: GREx funding will support the enhancement of several LSI core facilities, including recruitment of additional expert staff. We anticipate building new collaborative research teams around these shared technologies and expertise, supporting interdisciplinary teams to lead high-risk, high-reward projects addressing Grand Challenges. By democratizing access to transformative, enabling technologies, we will create a culture, where scientists are only limited by their imagination.

Talent: We will be better positioned to attract, nurture and educate the next generation of scientists, proposing new international training programs for postdoctoral fellows and undergraduate summer students, as well as key support for existing graduate programs. In all of our recruitments, we are committed to upholding respect, equity, diversity, and inclusivity as a guiding principle. As of January, 2023, we initiated the process of recruiting six new principal investigators, as part of a multi-career-stage, diversity cluster hire.

Engagement: As part of our new strategic plan, and to increase the visibility of our work, LSI researchers are now part of 20 disease- and challenge-based Research Focus Teams. They will work with Development teams in UBC Faculties of Medicine and Science to engage in meaningful ways with fundraising campaigns, and partner with charities and other philanthropic organizations to communicate our work to the public. We will improve our collaborations with industry, for example, through industry-partnered training initiatives that will grow the Canadian pipeline of life sciences and biomanufacturing talent. Finally, we will increase our connections with patient and public groups, ensuring that our research best serves the needs of the diverse communities, in which we live and work.

We are confident that as a new GREx, we will be better able to promote collaborative, interdisciplinary research excellence, supported by shared technology-driven resources. This achievement would not have been possible without input, advice, and support from everyone in the LSI, and, especially, leadership from our Director, Josef Penninger, and Deputy Director, Jim Johnson, as well as Richa Anand, former Director of Research Development, who was instrumental in helping put together the awarded proposal. We are also grateful to UBC leadership and members of UBC Senate, for supporting this vision.

A REVIEW OF THE LSI IN 2023

In January, the LSI underwent an external review. The last review in 2013 included recommendations for the LSI to move beyond a research space with excellent individual labs and small groups, and recruit a new visionary Director to lead the institute, creating a shared identity and facilitating new synergistic collaborations that would help realize the LSI's true potential as a leader in biomedical research. In 2018, UBC recruited Josef Penninger as a Canada 150 Research Chair in Functional Genetics and the LSI's new Director, who had a vision to bring together diverse researchers under a common, unifying theme of biological resilience.

Under Josef's leadership, the LSI significantly invested in expanding core facility infrastructure and expertise, established the Research Development Office to support grants and communications, and, in 2022, Josef, together with Deputy Director Jim Johnson, successfully re-branded the LSI under the banner of the Biological Resilience Initiative. In consultations with the LSI community, they also identified a strong appetite for change in how the institute represents itself, leading to work spearheaded by Jim to reorganize LSI researchers into 20 new public-facing Research Focus Teams centered around diseases or challenges that would help the LSI better connect with the public and funders, and increase opportunities for interdisciplinary collaborations.

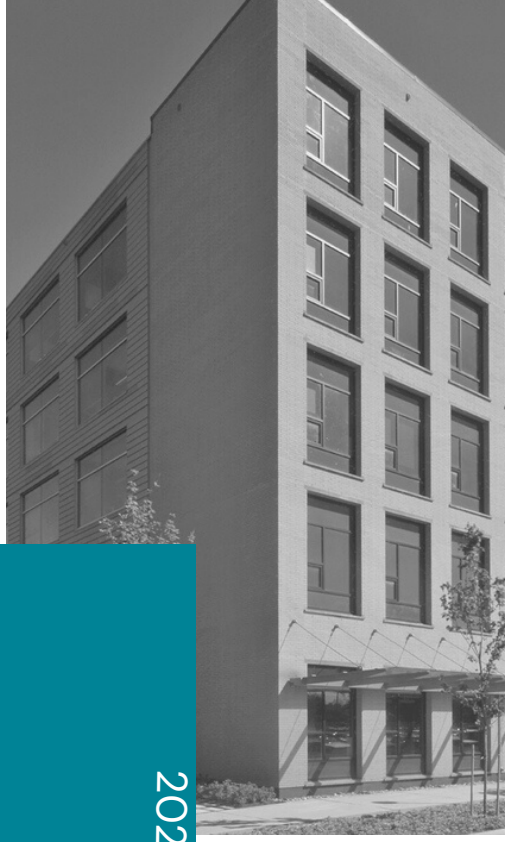
Fast forward to 2023: this year's external review committee consisted of **Dr. Brenda Andrews**, PhD, CC, FRSC, Canada Research Chair in Systems Genetics & Cell Biology, The Donnelly Centre for Cellular and Biomolecular Research, Univ. of Toronto; **Dr. Jim Woodgett**, Senior Scientist, Lunenfeld-Tanenbaum Research Institute, Toronto; and **Professor Mary Collins**, Director of Blizard Institute, Queen Mary University of London.

The review was based on a self-study report, summarizing the strengths, challenges and opportunities of the unit since 2018, and describing grant funding, awards, publications, and other bibliometric analyses, as well as discussions over three days of interviews with LSI leadership, faculty, administrative staff, core facility members, trainees, and the Deans of the Faculties of Science and Medicine and other relevant University administrators.

The review committee had overall very positive things to say about the LSI's successes in the last 5 years: "By any objective measure (e.g., joint publications and grants; co-supervision of students; joint inventions), the LSI has succeeded in establishing a productive interdisciplinary environment that has catalyzed new collaborations and research projects across a broad spectrum of life sciences research." The review committee recognized the power of shared technology and expertise, and noted that "the recent investment in core facilities has been very successful with broad consensus of the cores being well run, appreciated, and of leading-edge quality." They concluded that "with recruitment of a new director, the launch of a new strategic plan and the funding of the Biological Resilience Initiative, the LSI is now in an excellent position to advance its own mission to support interdisciplinary life sciences research, while supporting and elevating the academic and research missions of participating departments and faculties."

The committee also submitted a list of recommendations to help the LSI achieve its goals over the next five years, including support for fundraising efforts and development of industry partnerships, increase in overall budget, and increased visibility of the LSI within the university.

A very big thank you to Jim Johnson, Richa Anand, and Aryannah Rollinson for helping the LSI prepare for the review, the Faculty of Medicine for organizing the review, and the three members of the review panel. The review was an excellent opportunity to get feedback, both from the external committee, as well as from LSI members, which will ensure continued improvements in the near future, and the success of the institute for many years to come.



2022–2023

GRANTS
38.1M

PUBLICATIONS
232

PRINCIPAL INVESTIGATORS
82

Over the last decade, LSI researchers have published more than 3,000 research articles on 1,100 topics and have been cited approximately 130,624 times.

In the last 10 years, LSI researchers have attracted $410M in grants from federal, provincial, charitable and industrial sources, including $243M from the Canadian tri-agencies.

Since the launch of the LSI, our researchers have collectively drawn $31M from the Canada Foundation for Innovation (CFI) and have pooled their resources to develop technology-driven, core facilities, which serve all of UBC and enable leading-edge discoveries. Under new leadership since 2019, these facilities have expanded and continue to grow.

NEWS & AWARDS

2023 KILLAM PRIZE AND OTHER AWARDS FOR **DR. P. CULLIS'S** CONTRIBUTION TO LNP TECHNOLOGY

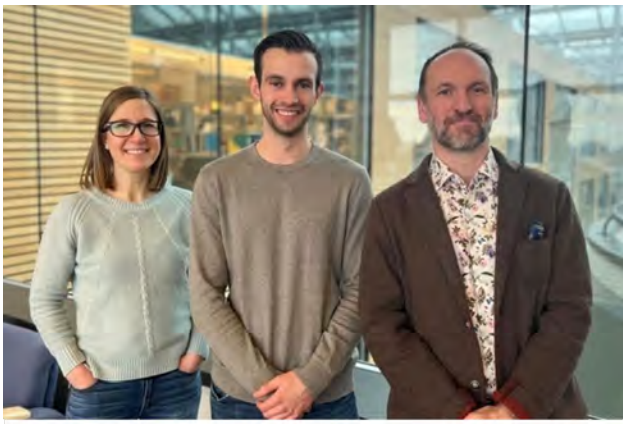
Dr. Pieter Cullis, Dept. of Biochemistry and Molecular Biology, Faculty of Medicine, LSI's COVID-19 Research Focus Team, was one of two UBC faculty awarded a *2023 Killam Prize*, administered by the National Research Council of Canada. He is recognized for vital advances in the development of nanomedicines that employed lipid nanoparticle (LNP) technology and enabled highly effective COVID-19 mRNA vaccines. Also, **Dr. Cullis** contributed to five approved drugs, co-founded 11 biotech companies, published over 350 scientific articles and is an inventor on over 100 patents.

In the past year, **Dr. Cullis's** pioneering work has also been recognized by highly prestigious awards, such as 2022 *Canada Gairdner Award* and *Governor General's Innovation Award* (nominated by CIHR). The latter is a team award that **Dr. Cullis** shared with Drs. Hope and Madden - a team that was formed in the early 1980's in the UBC laboratory of **Dr. Cullis** and that first invented a device to make lipid nanoparticles. Their 40-year-long collaboration resulted in the formation of several Canadian biotechnology companies, with Acuitas Therapeutics, which has agreements with partners like Pfizer/BioNTech, being one of them.

International recognitions of LNP technology include 2022 *Lipid Science Prize* (Lund, Sweden) and 2022 *Tang Prize in Biopharmaceutical Science*. Both awards were shared with collaborator Dr. Kariko (BioNTech), with the latter also being shared with collaborator Dr. Weissman (Penn Institute for RNA Innovation, USA). Both collaborators contributed to anti-inflammatory RNA modification techniques. "To be recognized in this way brings enormous international attention to the high quality of Canadian science", said **Dr. Cullis**. "If we hadn't spent decades trying to understand the physical properties of lipids in biological membranes, we wouldn't have had the tools or insight to play a role in the development of the COVID-19 mRNA vaccines."

Locally, **Dr. Cullis** received *Life Sciences BC 2022 Global Impact Award* for his scientific entrepreneurialism, advancement of successful health innovations and contributions to BC's life sciences ecosystem. Finally, **Dr. Cullis** was featured in Science Magazine in a story on next-generation mRNA vaccines. "This is a system that clearly has legs," says **Dr. Cullis**, but "we still need to increase the efficiency of LNPs—that's for sure."

DR. E. RIDEOUT DEMONSTRATES SEX DIFFERENCES IN INSULIN PRODUCING BETA-CELLS AND RECEIVES *2022 END DIABETES RESEARCH AWARD*



Drs. Rideout (left) and Johnson (right), with first author George Brownrigg (centre).

Dr. Elizabeth Rideout, Dept. of Cellular and Physiological Sciences, LSI's Diabetes Research Focus Team, received support for a project focused on understanding why women are protected from type 2 diabetes more so than men from Diabetes Canada, as part of their recently announced $9M commitment to diabetes research in Canada. Her initial studies in collaboration with **Dr. James Johnson**, also a member of the Diabetes Research Focus Team, showed that in humans and mice male and female beta cells are different – beta cells in women survive stress better than beta cells in men, and are better at making insulin in stressful conditions. (featured in Science in Vancouver, February 2023).

Using the investment funds, **Dr. Rideout** will determine whether better stress management may be the reason women are better protected from type 2 diabetes. She will identify the pathways and cellular strategies women's beta cells use during times of stress to maintain the body's insulin levels, which, in turn, will provide for the development of better treatments to relieve beta cell stress, improve insulin production, and better manage diabetes in both women and men.

BREAST CANCER SURVIVAL PROMOTED BY OSTEOPOROSIS DRUG

Research by **Dr. Josef Penninger,** LSI Director (2018-2023) and professor of Medical Genetics, laid the foundation for a treatment that may potentially improve outcomes for certain types of breast cancer patients and reduce concomitant bone damage. The antibody, called Denosumab, originally developed using **Dr. Penninger's** groundbreaking research on RANKL system and approved by FDA to be used for the treatment of postmenopausal osteoporosis, was recently shown in a long-term Phase 3 clinical trial to reduce the rate of breast cancer metastasis in bone and to advance survival of hormone receptor-positive early breast cancer women receiving aromatase inhibitor treatment.

"More than two decades ago we started the experimental groundwork that revealed Denosumab's potential as a treatment for breast cancer patients," says **Dr. Penninger.** "These results are incredibly exciting and will help improve the lives of millions of patients. I am very proud of all the people in my lab over the years, who did that work and helped pave the way for this achievement." **Dr. Penninger** is now part of a large international prevention trial (BRCA-P) evaluating Denosumab for the reduction in the risk of any breast cancer in young women, who carry BRCA1 mutations. Please read full story on the Faculty of Medicine website.

DR. N. STRYNADKA APPOINTED TO UBC'S HIGHEST FACULTY HONOUR: *UNIVERSITY KILLAM PROFESSOR*

Dr. Natalie Strynadka, Dept. of Biochemistry and Molecular Biology, LSI's Antibiotic Resistance Research Focus Team, was awarded with UBC's highest honour conferred on a faculty member, which recognizes exceptional teachers and researchers, who are leaders in their fields, and who have received international recognition for their talents and achievements.

Dr. Strynadka's research addresses the critical global health problem of bacterial resistance to antibiotics. Her research is focused on understanding, at an atomic level, how antibiotic resistance mechanisms work in bacteria, and on characterizing and designing novel treatments and ways to inhibit disease-causing bacteria.

Dr. Strynadka is a visionary leader in the atomic analysis of membrane protein assemblies that underlie infection, and one of the first in her field to use cryogenic electron microscopy for this work. "I am very honoured to receive this recognition from UBC," **Dr. Strynadka** said. "The award reflects directly the amazing trainees and research scientists of our laboratory, whose multifaceted abilities, energy and curiosity for science have fueled our anti-infective research over the past two decades."

DR. L. FOSTER RECEIVED THE *TONY PAWSON PROTEOMICS AWARD*

"The Canadian National Proteomics Network (CNPN) named **Dr. Leonard Foster**, Dept. of Biochemistry and Molecular Biology, Michael Smith Laboratories, LSI's COVID-19 Research Focus Team, its 2022 recipient of the *Tony Pawson Proteomics Award*. Presented at the CNPN annual meeting, held in Montreal in May, 2022, the award recognized **Dr. Foster's** lifetime contributions to the development of proteomics technologies. Among the most significant ones is the technique for characterization of protein interactions and protein complexes on a system-wide scale, with a particular focus on co-migration and measurements of large-scale temporal changes in protein interaction networks: a cutting-edge proteomics method first described by **Dr. Foster** and colleagues in 2012. Published in Cell in 2021 ("An atlas of protein-protein interactions across mouse tissues."), this study opened up new avenues to uncover regulatory mechanisms that shape interactome responses to normal and abnormal stimuli in mammalian systems.

Earlier this year, Dr. Foster (born and raised in BC) received *Distinguished Service Award* from Youth Science Canada in recognition of long and dedicated service to Regional Science Fairs (now STEM) in BC, as well as Canada-wide Science Fairs. Dr. Foster was one of seven people recognized by the organization.

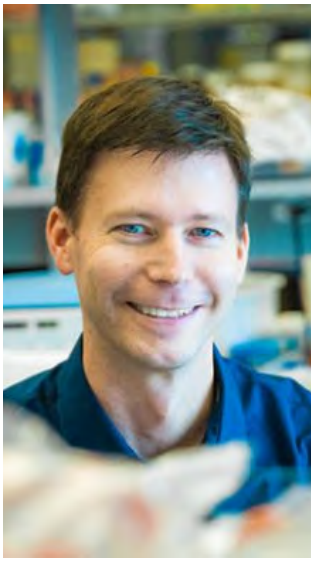
DR. N. STRYNADKA AND **DR. L. FOSTER** RECEIVE $11.1 MILLION TO ADVANCE mRNA VACCINE TECHNOLOGIES.

The **Honourable Harjit S. Sajjan**, Minister for International Development and Minister responsible for the Pacific Economic Development Agency of Canada (PacifiCan), announced the funding to enhance the delivery and efficacy of mRNA vaccines.

"PacifiCan is committed to supporting British Columbia's life sciences sector and these projects at the University of British Columbia reflect that commitment. Establishing a home-grown pipeline for mRNA vaccine research will not only save lives, but create jobs for British Columbians and position Canada as a global leader in biotechnology innovation," said **Minister Sajjan.**

The two project teams will work in tandem, meeting regularly and coordinating research to maximize the value and effectiveness of both projects. **Dr. Foster's** main objective is to improve the delivery of mRNA vaccines, whereas **Dr. Strynadka** will advance antiviral therapy for COVID-19 variants, with a particular focus on Delta variant. Please read the full story on the Faculty of Medicine website.

DR. T. KIEFFER RECEIVED FUNDING THROUGH THE JDRF–CIHR PARTNERSHIP FOR THE DESIGN OF STEM CELLS FOR DIABETES THERAPY



Juvenile Diabetes Research Foundation (JDRF) Canada, Canadian Institutes of Health Research (CIHR) and Diabetes Canada are joining forces to move diabetes research towards cures through support of two innovative projects focused on cutting-edge research on beta cells and islet replacement therapy.

One of the two multidisciplinary teams is led by **Dr. Tim Kieffer,** Dept. of Cellular and Physiological Sciences, LSI's Diabetes Research Focus Team, who aims to significantly improve the manufacturing of islet cells to achieve more robust insulin delivery, with a focus on mass-producing stem cell-derived islet cells: "We are very excited by the potential for stem cell-derived islets to provide a source of regulated insulin in patients living with diabetes and are extremely grateful for this funding support by JDRF, CIHR, and Diabetes Canada to enable our efforts to accelerate the development of this approach."

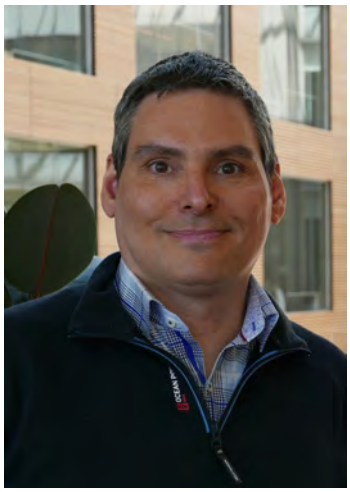
"Using the technology that was developed in collaboration with partner ViaCyte, **Dr. Kieffer,** together with Dr. David M. Thompson, a clinical assistant professor in endocrinology at Vancouver Coastal Health and the principal investigator for the study in Vancouver, implanted patients with wafer-thin devices equipped with millions of lab-grown stem cells that are 'coached' into making insulin, the hormone that controls a person's blood sugar.

About the size of a quarter, the 3D-printed medical implant contains stem cells 'coached' into producing insulin.

Six months after implantation, the stem cells had not only survived, but successfully matured into insulin-producing beta cells. "Seeing the results from the first clinical trials, we knew right away that it has the potential to eliminate the need for insulin injections altogether — and transform the management of Type-1 diabetes once and for all," **Dr. Kieffer** explains.

The paper describing this work (*Implanted pluripotent stem-cell-derived pancreatic endoderm cells secrete glucose-responsive C-peptide in patients with type 1 diabetes*) was selected for "Best Of Cell Stem Cell" 2021 Edition and appeared alongside publications showcasing advanced technologies and delivering foundational insights into hematopoiesis, aging and cancer.

BC SEA SPONGE AS COVID-19 THERAPEUTIC



Featured on CBC news, the discovery led by **Dr. François Jean,** Dept. of Microbiology and Immunology, and a member of the LSI's COVID-19 Research Focus Team, identified three natural compounds that block COVID-19 replication in human cells. UBC researchers in collaboration with multidisciplinary international teams screened more than 350 naturally occurring and structurally diverse compounds, in search for a drug blueprint to treat COVID-19 variants. By bathing human lung cells in solutions made from these compounds and then infecting the cells with SARS-CoV-2, the researchers found three compounds, miniscule concentrations of which reduced infection by 50%. "The advantage of these compounds is that they are targeting the cells, rather than the virus, preventing the virus from replicating and helping the cells to recover," said co-first author **Dr. Jimena Pérez-Vargas**, a staff scientist in **Dr. Jean's** laboratory.

The three most potent compounds come from Canadian seas: alotaketal C from a sea sponge collected in Howe Sound, B.C., bafilomycin D from a marine bacteria collected in Barkley Sound, B.C., and holyrine A from marine bacteria collected in Newfoundland waters. They appear to be safe for human cells and effective against both Omicron and Delta variants. "Our research is also paving the way for large-scale testing of natural product medicines that can block infection associated with other respiratory viruses that are of great concern in Canada and around the world, such as influenza A and RSV," said **Dr. Jean.** Please see the full story on UBC news here.

DR. Y. AV-GAY DISCOVERS BROAD CORONAVIRUS ANTIVIRALS

As featured on Global News, a recent article in *Molecular Biomedicine* by UBC Life Sciences researchers highlighted the discovery of a compound that could potentially halt infection from a range of coronaviruses. "Beyond COVID-19, there are many different types of coronaviruses that can cause serious and sometimes fatal disease, and even more are likely to emerge in the future," says **Dr. Yossef Av-Gay**, an infectious disease professor at the Faculty of Medicine, a member of the LSI's Tuberculosis Research Focus Team and the study's senior author.

"We're working toward treatments that can be broadly effective against all types of coronaviruses, so that we can respond to not only current health challenges, but also future pandemic threats. Identifying this compound and the pathway, by which it works to stop viruses, is an important step in that direction."

The compound's broad efficacy relies on it targeting human cellular processes that the virus uses to replicate, instead of targeting the virus itself. The compound is part of a broader family of experimental drugs, known as GSK3 inhibitors, that have been studied since the late 1990s for their potential as treatments for a number of diseases, including diabetes, Alzheimer's and cancer.

The research was conducted at UBC FINDER, a level-3 biocontainment facility, where researchers are working with highly infectious pathogens with an aim to develop future treatments. Please see full story on UBC news.

LSI/CBR RECEIVES AWARDS FOR IMPACT ON ADVANCING ORGAN TRANSPLANTATION RESEARCH

Left to right: Daniel Luo, Dr. Erika Siren and Dr. J. Kizhakkedathu

Researchers from **Dr. Jayachandran Kizhakkedathu's** Lab, Dept. of Pathology and Laboratory Medicine, Centre for Blood Research, (CBR) and LSI's Blood Research Focus Team, were recently honoured with two awards: 1) *the Logan Boulet Humanitarian Award 2021* and 2) *the Organ Transplant Innovation and Research Team Award 2021* (presented to the CBR and accepted by **Dr. Kizhakkedathu**).

The researchers discovered a special polymer to coat blood vessels in organs to be transplanted. In a paper published in *Nature Biomedical Engineering*, they showed that the coating substantially diminished rejection of transplants when tested in mice by collaborators at Simon Fraser University and Northwestern University. "We're hopeful that this breakthrough will one day improve quality of life for transplant patients and improve the lifespan of transplanted organs," said **Dr. Kizhakkedathu**.

Award representative Rodney Staff presented both honours, on behalf of the Angels Legacy Project from the Dawne Switenky Memorial Foundation. A Saskatchewan-based foundation that supports respectful organ donations was named after Dawne Switenky, who died while on the waiting list for a lung

transplant. A donor herself, Dawne's eyes were donated after her passing, and her husband – Terry Switenky, a close friend of Rodney Staff – set up the Foundation in her memory. The foundation, in turn, supported the creation of the Logan Boulet Humanitarian Award, named after young defenseman on the Humboldt Broncos hockey team, who passed away following the 2018 Humboldt Bus Tragedy in Saskatchewan. His organs were donated so that 6 others could live on – a story that inspired *an estimated 150,000* others to become organ donors in the following weeks, in what was called the "Logan Boulet Effect" across Canada.

"It was eye-opening to be recognized by an organization like this," said **Dr. Kizhakkedathu**, the Principal Investigator of the lab. "Publishing a paper on our study was great, but it's really the community recognition that reinforces the importance of transplantation research, for people and society." Please see full story on CBR website.

CIFAR RESEARCHER, **DR. C. TROPINI** IS APPOINTED *ALAN BERNSTEIN FELLOW*

Canadian Institute for Advanced Research (CIFAR) has named its member of Humans and the Microbiome program **Dr. Carolina Tropini** inaugural *Alan Bernstein Fellow* in honour of CIFAR's President Emeritus, who led the creation of the Azrieli Global Scholars program.

With this appointment, CIFAR celebrates Bernstein's decade of leadership and his long-standing commitment to fostering the next generation of early career researchers. "Carolina exemplifies innovative, bold thinking and the next generation of brilliant scientists", explained Dr. Bernstein.

"I was incredibly honoured and touched by the news that I was appointed the inaugural Alan Bernstein Fellow," said **Dr. Tropini,** Dept. of Microbiology and Immunology, the School of Biomedical Engineering, Crohn's and LSI's Colitis Research Focus Team. "I will work hard to live up to the high standards Alan has set," she added. "I hope to continue his legacy."

Dr. Tropini studies the human microbiome — a field with tremendous possibilities for medical discovery and impact. Researchers, such as **Dr. Tropini**, are working to better understand the vibrant microscopic world located within the human gut, and the potential it holds for precision medicine.

JOINT LSI–MICROBIOLOGY & IMMUNOLOGY BAKE SALE

The LSI community generously supported the Oct 28 2022 bake sale advocating for the protection of women's rights and civil rights in Iran. "We had an amazing turnout and we raised $2,765.20," said **Dr. Carolina Tropini,** who took the lead in organizing the event, which sold out four hours ahead of schedule.

Proceeds were donated to the following non-profit organizations: Malala Fund $800, Equality Now $800, Iran Human Rights Documentation Center $1000, https://www.ps752justice.com/ $200.

DR. C. OVERALL RECEIVED THE 2022 *HELMUT HOLZER AWARD*

Dr. Christopher M. Overall, Dept. of Oral Biological and Medical Sciences, LSI's COVID-19 Research Focus Team, was awarded the *Helmut Holzer Award*, an honour recognizing remarkable impact on the progress of the proteolysis field. The Award, sponsored by The International Union of Biochemistry and Molecular Biology, was presented at the opening plenary lecture of the September 2022 Federation of European Biochemical Societies conference "Proteolysis at the Interface between Health and Disease," in Bled, Slovenia. Dr. Overall's lecture was entitled. "Pathobiology of COVID-19 Deciphered by TAILS Analysis of SARS CoV-2 3CLpro Substrates." Please see the full story on the Faculty of Dentistry website.

DR. L. OSBORNE WINS *CIHR–INMD–CAG PRIZE* AND IS FEATURED BY THE CANADIAN SOCIETY FOR IMMUNOLOGY

Dr. Lisa Osborne, Dept. of Microbiology and Immunology, LSI's Multiple Sclerosis Research Focus Team, was awarded CIHR Institute for Nutrition, Metabolism and Diabetes (INMD) and Canadian Association of Gastroenterology (CAG) Early Career Researcher Partnership Prize, recognizing outstanding contributions to gastroenterology through basic and/or clinical research, by candidates within ten years of their first academic appointment.

Last year, **Dr. Osborne** was highlighted by the Canadian Society for Immunology (CSI) for her groundbreaking work on the multibiome, and her dedication to mentorship. **Dr. Osborne** is the second LSI researcher to be profiled by CSI during Women's History Month. Last year, the organization posted a tribute to the LSI Immunology Professor **Dr. Pauline Johnson**.

"Thanks for this recognition," **Dr. Osborne** responded in a retweet of the CSI's post. "Such a great community to be part of, and full of so many inspiring scientists. Mentors ahead of me made this a welcoming community, and I'm blown away by the quality of work the trainees are doing now."

DR. A. ALCAZAR RECEIVED THE *EMERGING LEADER AWARD* FROM THE METABOLOMICS ASSOCIATION OF NORTH AMERICA

The Emerging Leader Award in Metabolomics Service Cores recognizes contributions in metabolomics and promotes the leadership skills of a primary service core researcher/scientist. Metabolomics Association of North America (MANA) will contribute up to $1000 in attendance cost toward a leadership course/workshop of the winner's choice within 18 months of the award date.

Dr. Armando Alcazar (right), LSI's Proteomics Core Manager, received this award from Dr. Tom Metz, president of the MANA 2022 conference, hosted by the University of Alberta and The Metabolomics Innovation Centre in Edmonton, Canada.

DR. R. KAPPELHOFF CHAMPIONED LAB SUSTAINABILITY WITH GLOVE AND MASK RECYCLING PROJECT

Dr. Reinhild Kappelhoff, Lab Manager in Dr. Overall's Lab, UBC Sustainability Coordinator, member of the Green Labs Program and the Life Sciences Centre Sustainability Leadership Team, applied and received funding from the Workplace Sustainability Fund for a pilot project for combined mask and glove recycling. From March to May 2022, 17.25 kilograms of material was collected to be recycled. After a one-week trial, the recycling project was rolled out to all four research floors of the LSI.

Dr. Kappelhoff is not the only one working to 'green' the gloves on campus. Staff members at the UBC Djavad Mowafaghian Center for Brain Health, Center for Disease Modelling and the Modified Barrier Facility have also launched recycling initiatives, inspired by a doctoral student, Melody Salehzadeh during COVID-19 pandemic. Since the custodial staff were not able to enter her lab due to restrictions, she noticed just how much plastic waste her work created. "I knew it was possible to recycle the gloves, it was just a matter of someone putting in the effort," Salehzadeh says. Her project to combat plastic waste has collected 48,700 gloves, diverting 146.1 kilograms of waste from landfills in 2022.

GLYCONET FUNDING SUPPORTED UBC STARTUP **ABOZYMES** IN BECOMING A WORLD LEADER IN BLOOD TYPE ANTIGEN CONVERSION

GlycoNet, one of the world's leaders in glycomics, the study of carbohydrates in all living organisms, awarded substantial seed funding to **ABOzymes Biomedical Inc**., a GlycoNet startup company, to further develop its ground-breaking proprietary technology platform that enables blood transfusions and life-saving organ transplants, regardless of patients' blood type.

Built upon the discoveries by GlycoNet investigators, Drs. Stephen Withers (Chemistry), **Jayachandran Kizhakkedathu** (LSI/CBR), and Peter Rahfeld (Chemistry), ABOzymes' platform converts blood group antigens to group O, which is the universal donor type. This platform has the potential to increase donor organ matching opportunities and the supply of universal donor blood, addressing critical shortages of universal organs and blood in Canada and around the world.

DR. D. DEVINE ELECTED AS INCOMING PRESIDENT OF BIOMEDICAL EXCELLENCE FOR SAFER TRANSFUSION

Dr. Dana Devine came to the post as the director of the UBC Centre for Blood Research, professor in the Dept. of Pathology and Laboratory Medicine, member of the LSI's Blood Research Focus Team, and the Chief Scientist at Canadian Blood Services.

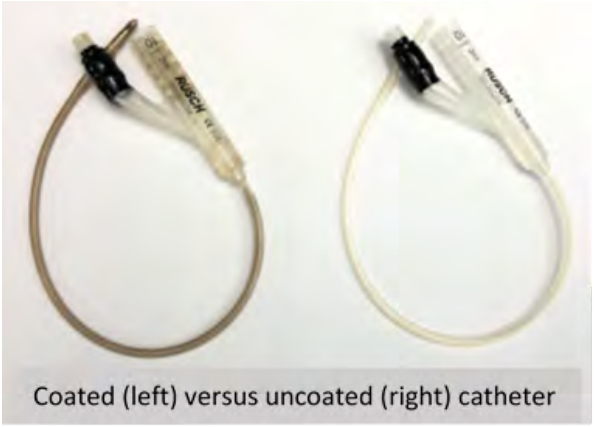
Dr. Devine also chairs several significant medical advisory committees, including one for the American Red Cross (the largest US blood operator, as well as the medical board for the transfusion product company, Macopharma based in Lille, France. She sits on the board of directors of STRM.Bio, a Boston-based gene therapy start-up company, and is a member of the research advisory boards of the Australian Red Cross Lifeblood, Vitalant (a US-based blood operator), and the Bloodworks Northwest (formerly known as the Puget Sound Blood Centre).

LAUNCH OF THE IMMUNOTHERAPEUTICS RESEARCH EXCELLENCE CLUSTER

Concerned by the translational lag between lab bench discovery and the production of drugs to treat patients, as well as the increasing evidence that immune and inflammatory cell behaviour and function contribute to all human disease and normal tissue repair, **Drs. Kelly McNagny** and **Pauline Johnson** have set out to shorten the way. On March 9, 2022, UBC's Research and Innovation Office announced 40 research excellence clusters. Among the emerging teams was the new Immunotherapeutics Cluster, known as ImmunoT or ITC. Co-led by **Dr. McNagny,** Dept. of Medical Genetics and School of Biomedical Engineering, and **Dr. Pauline Johnson**, Dept. of Microbiology and Immunology, and a member of LSI's Lung Health and Cancer Research Focus Teams, cluster's primary goal is to shorten the translational lag between lab bench discovery and the production of drugs to treat patients. ITC intends to build a scientific and clinical community focused on developing the next generation of immunotherapeutics to promote health, and prevent and treat disease. "Immunology and the distinction of self and non-self is at the heart of keeping us safe from infection and cancer," concludes LSI Director Dr. Josef Penninger, a member of the ITC. "The new immunotherapeutic network will enhance the visibility of immunology at UBC and has the promise to develop radical new therapeutic solutions for many diseases."

As a research-to-practice continuum, the cluster plans to link basic researchers with clinical disease specialists, industry partners, health-care economists and policy experts. The cluster already has over 100 members, including graduate students, early career investigators, and clinicians. With UBC seed funding for the first year, ITC will move to expand membership – all interested parties are welcome – and lay the groundwork for operationalizing its commitments to equity, diversity and inclusion, with a translational focus. Training, and trainees are seen as a top priority. The ITC proposal outlines a cross-disciplinary, inclusive trainee community with direct ties to experts in immunology and immunoengineering.

UBC EXPLOITS ANTIBACTERIAL POWER OF SILVER TO KEEP IMPLANTED MEDICAL DEVICES BACTERIA-FREE


Coated (left) versus uncoated (right) catheter

As featured by CTV news, the team led by **Dr. Jayachandran Kizhakkedathu** (LSI) and Dr. Dirk Lange (Vancouver Coastal Health Research Institute), has developed a silver-based coating for catheters, stents and feeding tubes. Many researchers have tried to use silver as a way to keep implanted devices free of bacteria for years. However, silver toxicity and difficulty adhering to surfaces, as well as lack of durability, have prevented its use in blocking infection.

The researchers combined silver nitrate, dopamine and two hydrophilic polymers into a compound that releases silver in controlled quantities - enough to kill bacteria, but not harm human cells. It also keeps the implanted devices clean for longer than has been achieved by other coatings.

"This is a highly effective coating that won't harm human tissues and could potentially eliminate implant-associated infections. It could be very cost-effective and could also be applicable to many different products," said **Dr. J. Kizhakkedathu**, co-senior author of the study published in *ACS Central Science*.

The researchers performed a 30-day trial, during which they placed silver-coated medical device in an environment with a high concentration of diverse and resilient bacteria known to cause infections. Their device came out clean and bacteria-free, and performed the same way in a seven-day test with live rats. According to the team, this coating could be applied to almost any medical device without pre-treatment, such as catheters (central venous, urethral and peritoneal), feeding tubes, vascular grafts, ureteral stents or orthopedic implants. It is currently in the "proof of concept" stage and it might take five to ten years to complete clinical evaluation. Please see full story on Faculty of Medicine website.

A RETIREMENT SYMPOSIUM AND CELEBRATION HONOURING THE CAREER OF **PROFESSOR D. MOERMAN**

The symposium held on May 20, 2022 celebrated the retirement and scientific career of **Professor Donald Moerman** from the Dept. of Zoology, LSI and features prominent scientists, who interacted with Don personally and scientifically. Speakers included members of the Royal Society of London, Lasker Award winners (Dr. G. Ruvkun), Gairdner Award winners (Dr. Fire, Dr. Ruvkun and Dr. Waterston) and Nobel Prize winners Dr. Chalfie (chemistry) and Dr. Fire (physiology/medicine).

Topics spanned early embryonic development, brain development, touch and thermal sensation, RNAi and microRNA regulation of gene expression, and genomic approaches to outstanding issues in contemporary biology.

Although December 31, 2019 marked the official retirement of **Dr. Donald Moerman,** he continued running his research lab as an Emeritus Professor until 2021. **Dr. Moerman** has been an important member of the department and a vital member of the department's Cell Biology subgroup. **Dr. Moerman's** highly successful research program took advantage of the genetic power of the model organism, *Caenorhabditis elegans*. His contributions to our understanding of muscle development, and the use of genetic and genomic tools, set a paradigm for how a simple model organism, the worm, with powerful genetic approaches, can reveal startling insights into genomic organization, gene regulation, and the structure and function of a number of proteins. **Dr. Moerman's** work was based on the key developments and use of tools and approaches that allow for the dissection of fundamental mechanisms of the biological processes that the organism undergoes.

VACCINE INFORMATION FAIR IN THE LSI

UBC Vaccine Information Fair was hosted at the LSI, as a public outreach in June 2022, to share vaccine information and enhance vaccine confidence amongst the public, while also providing opportunities for trainees to develop their science communication and leadership skills by getting involved in event planning and facilitation. Members of the local neighbourhoods and their families were invited to attend talks and Q&A with experts in the field, watch a screening of the film "Give it your best shot", and participate in hands-on activities.

Keynote talks were given by invited guest speakers, such as Dr. Alyson Kelvin (Vaccine and Infectious Disease Organization), who provided an overview of her research on developing universal vaccines targeting all coronaviruses, and Dr. Katherine Wu (*The Atlantic* magazine), who discussed how complex research is communicated effectively to the public. Drs. Kelvin and Wu were also joined by Dr. Manish Sadarangani (head of the Vaccine Evaluation Center at BC Children's Hospital), and Dr. Yanet Valdez (COVID-19 Resources Canada), as part of an expert panel for a Q&A session about vaccines. Student volunteers delivered 2-minute talks about the life cycle of vaccines and helped carry out many of the activities, including a "Race to Immunity" game.

The Fair was organized by Dr. Rachel Fernandez (Dept. of Microbiology and Immunology, and Associate Vice-President, Research and Innovation at UBC) and her team, including faculty mentors Dr. Maria Tokuyama and Dr. Dave Oliver, who helped students develop their 2-minute talks (Microbiology and Immunology), Dr. Dave Ng and Dr. Anna Blakney (Michael Smith Laboratories), Dr. Hana Mitchell (co-lead

on the MSFHR-funded project to create "Give it your best shot"), Jillian Turner (event coordinator), Kelli Kadokawa (University Neighbourhoods Association liaison), Darlene Birkenhead (Microbiology and Immunology liaison), Morgan Alford ("Let's Talk Science" liaison), Mihai Cirstea (keynote moderator), and many wonderful student volunteers from the LSI, Michael Smith Laboratories, and BC Children's Hospital, who helped make this event a success!

THE MICHAEL GOLD EARLY CAREER INVESTIGATORS WEBINAR SERIES

The **Michael Gold** Webinar Series have been established by the Canadian Society for Immunology (CSI) to honor a current or past CSI member, who has made lasting contributions to the mentoring of early career investigators and postdoctoral scholars transitioning into independent research positions. **Dr. Gold** is a professor, former Head of the Dept. of Microbiology and Immunology LSI and the 2013 recipient of the Cinader Award (presented to an immunologist, who is an exceptional researcher working in Canada, a full member of CSI and who has an additional activity in which they excel). He is known for his many contributions to the scientific community, including his roles in mentoring trainees of all levels to the top. **Dr. Gold** also started the First-Gen Student Mentoring Program in Microbiology and Immunology to support students, who are the first in their family to attend a four-year college/university with the goal of obtaining a bachelor's degree (established in 2020).

OUTSTANDING LSI CO-OP SUPERVISORS OF 2022

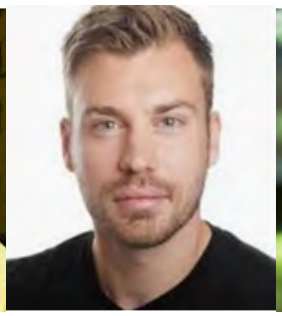
The *Co-op Employer Recognition Awards* ceremony, established in 2017, is held annually to celebrate exceptional employers, who have supported the Science Co-op Program and its students through work-integrated learning opportunities.

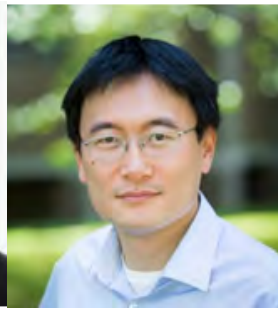
Candidates in this category are nominated by the co-op students. Congratulations to (left to right) **Dr. Janel Kopp** (assistant professor at the Dept. of Cellular and Physiological Sciences), **Dr. Filip Van Petegem** (professor at the Dept. of Biochemistry and Molecular Biology), **Dr. Howard Haoning Cen** (postdoctoral fellow in Jim Johnson's lab, Dept. of Cellular and Physiological Sciences) for being the recipients of *Co-Op Employer Recognitions Awards* of 2022.

EXAMPLES OF LSI'S GRANT FUNDING ACHIEVEMENTS IN 2022/23

IN APRIL

LSI researchers were awarded funding from the New Frontiers in Research Fund (NFRF), which supports interdisciplinary, high-risk and high-reward projects. Investigators funded through the NFRF Exploration stream include **Dr. Mark Cembrowski** (Cellular and Physiological Sciences), for a project titled "The cell-type-specific basis of epilepsy and treatment in the living human brain", and **Dr. Hongshen Ma** (Mechanical Engineering; co-applicant **Dr. Pauline Johnson**, Microbiology and Immunology), for "Immune profiling using single cell cytokine secretome and transcriptome analysis".





Dr. Leonard Foster (Biochemistry and Molecular Biology) was awarded funding from Genome BC and the Investment Agriculture Foundation of BC, as part of the Genomic Innovation for Regenerative Agriculture, Food, and Fisheries Program, for a project entitled "Identifying climatic determinants of pollinator health". The project is a collaboration with Dr. Lan Tran from Agriculture and Agri-Food Canada, and proposes to improve the health of honey bees, by providing knowledge to help BC beekeepers, crop growers, and policy makers mitigate against the effects of climate change.

Two LSI-led projects were among ten funded by Cystic Fibrosis Canada, aimed at addressing priorities and improving the health outcomes of people impacted by cystic fibrosis (CF):

Dr. Cara Haney (Microbiology and Immunology, now at U of Pittsburgh) received the *Marsha Morton Early Career Investigator Award*. Her work focuses on how Pseudomonas senses its environment to establish chronic infection. Pseudomonas is a major cause of lung infections in people with CF.

Dr. Yossef Av-Gay (Microbiology and Immunology) will continue his work identifying novel agents against *Mycobacterium abscessus. M. abscessus* is a type of nontuberculous bacteria that live in soil, swamps and water sources, and was identified in the lungs of people with CF in the 1990s. **Dr. Av-Gay's** research aims to improve airway detection and find new treatments.

Also in May, **Dr. Sheila Teves** (Biochemistry and Molecular Biology) received an *Early Career Researcher Jump-Start Award* from Canada's Stem Cell Network, for a project entitled "Transcription regulation of hiPSC-derived cardiomyocytes during maturation and hypertrophic cardiomyopathy", conducted in collaboration with D. Glen Tibbits at Simon Fraser University.

Dr. Carolina Tropini (Microbiology and Immunology, School of Biomedical Engineering), along with Dr. Annie Ciernia (Biochemistry and Molecular Biology, Djavad Mowafaghian Centre for Brain Health) received a *Precision Health Catalyst Grant* from UBC Faculty of Medicine for a project entitled "Metabolite control of Microbiome-Microglia Communication in Pediatric Inflammatory Bowel Disease (IBD)".

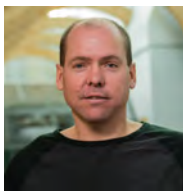
Dr. Jessica Rosin (Asst. Professor, Oral Biological and Medical Sciences) received a *Brain Star Award* for her postdoctoral work providing new insights on the sensitivity of embryonic neuroimmune cells to maternal stress during pregnancy ("Microglia in the embryonic brain sense maternal stress and influence brain development").

IN JUNE

SEVEN LSI RESEARCHERS WERE AWARDED
NSERC DISCOVERY GRANTS

Dr. David Fedida
(Anesthesiology, Pharmacology & Therapeutics)
"Structures of ion channel complexes"

Dr. Rachel Fernandez
(Microbiology & Immunology)
"Biogenesis and modification of the Bordetella cell envelope"



Dr. Leonard Foster
(Biochemistry & Molecular Biology)
"Measuring and understanding health stressors in honey bees"

Dr. Pauline Johnson
(Microbiology & Immunology)
"Molecular analysis of hyaluronan and CD44"

Dr. Michael Murphy
(Microbiology & Immunology)
"Bacterial ion acquisition",

Dr. Ivan Robert Nabi
(Cellular & Physiological Sciences)
"tauSTED: Flourescent Lifetime Upgrade for Stimulated Emission Depletion Super-Resolution Microscope",

Dr. Jessica Rosin
(Oral Biological & Medical Sciences)
"Characterizing the role CSF1R-expressing cells play in craniofacial development",

IN JULY

*LSI RESEARCHERS WERE AWARDED MORE THAN $8M IN **CIHR SPRING PROJECT GRANTS***

Dr. Mark Cembrowski (Cellular and Physiological Sciences)
"A specialized neural circuit representing novelty on behavioural timescales"

Dr. Pieter Cullis (Biochemistry and Molecular Biology)
"Development of LNP/mRNA systems for direct transfection and generation of functional Chimeric Antigen Receptor (CAR) T-cells *in-vivo* for treatment of blood and other cancer cell types"

Dr. Ethan Greenblatt (Biochemistry and Molecular Biology)
"Determining the role of FMRP complexes in autism-relevant gene expression"

Dr. François Jean (Microbiology and Immunology)
"Pre-clinical development of broad-spectrum antiviral strategies against human respiratory viruses of pandemic concern"

Dr. Hongshen Ma (Mechanical Engineering)
"Behaviour-based cell separation to interrogate host cell heterogeneity in CAR-T cell therapies"

Dr. Robert Nabi (Cellular and Physiological Sciences)
"Role of MERCs and Mitophagy in Cancer Progression"

Dr. Elizabeth Rideout (Cellular and Physiological Sciences)
"Understanding sex differences in the neuronal control of whole-body fat storage and breakdown"

Dr. Maria Tokuyama (Microbiology and Immunology)
"Mechanisms of endogenous retrovirus-mediated antiviral immunity against genital herpes simplex virus 2 infection and disease".

Dr. Filip Van Petegem (Biochemistry and Molecular Biology), two projects:
"Structural and functional investigation of Junctophilins in health and disease",
"Regulatory mechanisms of voltage-gated calcium channels"

ALSO IN JULY

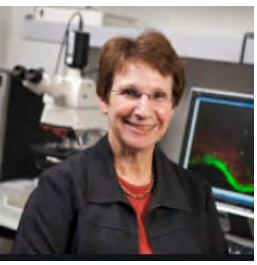
Dr. Lisa Osborne (Microbiology and Immunology) received funding from Scialog (science + dialog): Microbiome, Neurobiology and Disease, which supports research by stimulating interdisciplinary conversation and community building. Out of 45 early-career faculty that were invited to participate in the 2022 Scialog as Fellows, only 13 researchers came away with funding for their high impact ideas – with **Dr. Osborne** playing a role on two of the final seven US-Canadian teams:

Understanding the Protective Effect of Helminth Immunotherapy Through the Lens of the Gut-Brain Axis" together with Ukpong Eyo, Neuroscience, University of Virginia

"The Intersection of Age, Microbiome and the Zeal for Continuous Learning by Cells of the Neuro-Immune Network" together with Linnea Freeman, Biology, Furman University and Gianna Hammer, Immunology, University of Utah

A project led by **Dr. Francois Jean** (Microbiology and Immunology), "Therapeutic approaches and emerging therapies for SARS-CoV-2 VOCs: Mono or Combination Therapy, Mechanisms, and Antiviral Resistance", was awarded funding from the Coronavirus Variants Rapid Response Network (CoVaRR-Net). The project is a collaboration between Dr. Jean, lead of Pillar 10: Antiviral Strategies and Antiviral Therapeutics in CoVaRR-Net, and a team of researchers, including CoVaRR-Net Pillar 10 Deputy **Dr. Natalie Strynadka** (Biochemistry and Molecular Biology) and six other researchers from across Canada, together with Dr. Mel Krajden at the BCCDC. This work will provide critical information on the potential for SARS-CoV-2 Omicron variants to resist current antiviral treatments and how combination of antiviral therapies can be used as alternatives to monotherapy to improve treatment.

IN AUGUST



Dr. Joanne Weinberg (Cellular and Physiological Sciences), as part of a project team with Dr. Claire Coles at Emory University, was awarded funding from the NIH (National Institute on Alcohol Abuse and Alcoholism) for a project entitled, "A Multisite Study of Prenatal Alcohol Exposure: Effects of Inflammation and Endocrine Dysfunction in Adulthood".

IN SEPTEMBER

Dr. Maria Tokuyama (Microbiology and Immunology) was named a *Michael Smith Health Research (MSHRBC) BC Scholar*, for her proposal, "Immunomodulatory effects of endogenous retroviruses in infection and inflammation". The MSHRBC Scholar Program supports early-career health researchers, who are building leading-edge health research programs, training the next generation of scientists and expanding their potential to make significant contributions to their field.

Dr. Eric Jan (Biochemistry and Molecular Biology) and NanoVation Therapeutics (NTx) received an award from Innovate BC's Ignite program for a project that aims to advance RNA vaccines by improving mRNA stability and production ("Enabling Canadian RNA medicines").

Dr. Pauline Johnson (Microbiology and Immunology) was awarded a grant from the Cancer Research Society for her project, "Regulation and function of CD44 in tumour metastasis to the lung".

IN OCTOBER

Dr. Mark Cembrowski (Cellular and Physiological Sciences) received funding from the Scottish Rite Charitable Foundation, for a project titled "Understanding and therapeutically leveraging a rare neocortical neuron type in an ASD mouse model". The Foundation annually provides grants in support of biomedical research into Puzzles of the Mind, such as dyslexia and autism, as well as for neurodegenerative diseases, such as Alzheimer's.

IN NOVEMBER

Canada Research Chairs / Chaires de recherche du Canada

Three LSI researchers were named Canada Research Chairs. The prestigious Canada Research Chairs Program enables Canadian universities to achieve the highest levels of research excellence and become world-class research centres. Chairholders improve our depth of knowledge and quality of life, strengthen Canada's international competitiveness, and help train the next generation of HQP. The new chairs are:

Dr. Jayachandran Kizhakkedathu (Pathology and Laboratory Medicine)
Tier 1 Canada Research Chair in Immunomodulation Materials and Immunotherapy

Dr. Jessica Rosin (Oral Biological and Medical Sciences)
Tier 2 Canada Research Chair in Immune Regulation of Developmental Programs

Dr. Sheila Teves (Biochemistry and Molecular Biology)
Tier 2 Canada Research Chair in Transcriptional Memory and Plasticity in Stem Cells

IN DECEMBER

Jason Rogalski, **Andy Johnson**, and **Dr. Guang Gao**, Managers of the proteomics, flow, and imaging core facilities, respectively, secured funding from the UBC Research Facilities Support Grants for critical repairs, maintenance, and instrument upgrades.

IN FEBRUARY

EIGHT LSI RESEARCHERS WERE AWARDED
FALL 2022 CIHR PROJECT GRANTS

Dr. Carolyn Brown (Medical Genetics)
"Role of XIST in human X-chromosome inactivation and health"

Dr. Pieter Cullis (Biochemistry and Molecular Biology)
"Newly Optimized LNP Systems for Genetic drugs and Gene therapy in Neurological diseases"

Dr. Lisa Osborne (Microbiology and Immunology)
"Propagation of diet-derived immunoregulatory signals across tissues"

Dr. Jayachandran Kizhakkedathu (Pathology and Laboratory Medicine)
"Localized immuno-cloaking organ engineering approach to prevent transplant rejection without immunosuppressants"

Dr. Calvin Roskelley (Cellular and Physiological Sciences; Principal Applicant; Nominated Principal Applicant: Dr. McNagny) - Breast Cancer Priority Announcement: "Podocalyxin's role in tumor invasion, metastasis, and immune evasion"

Dr. James Johnson (Cellular and Physiological Sciences) - Bridge Grant
"Beta-cell Na+ channels as therapeutic targets"

Dr. Chris Overall (Oral Biological and Medical Sciences) - Bridge Grant
"Deciphering inflammation pathways in gum disease"

Dr. Christopher Loewen (Cellular and Physiological Sciences) - Bridge Grant
"Systematic characterization of membrane contact sites in budding yeast'

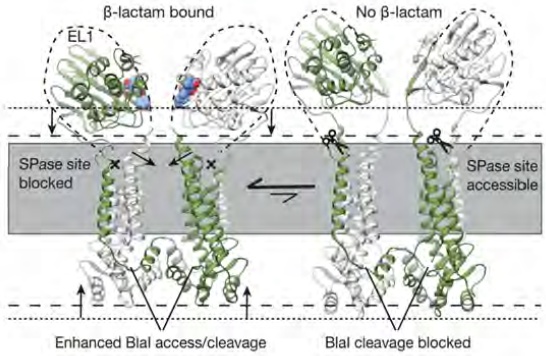
SELECT PUBLICATIONS

See a complete list of our publications in the **Pub Corner** on the LSI website.

Structural basis of broad-spectrum β-lactam resistance in *Staphylococcus aureus*

CBR
THE CENTRE FOR BLOOD RESEARCH

Broad spectrum β-lactam antibiotic resistance in *Staphylococcus aureus* is a global health problem, and largely controlled by BlaR1, a two-component signaling receptor in the bacterial membrane. Using cryo-electron microscopy, this paper provides the first structural model of BlaR1, and crucial insights into dimer formation, signal transduction, and protease activity, facilitating the development of new therapeutics to treat drug-resistant infections.



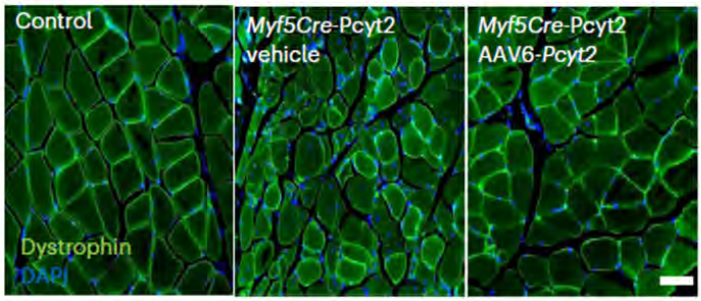
Alexander JAN and Worrall LJ *et al.*
Nature Jan 4, 2022

Strynadka Lab
Antibiotic Resistance Research Focus Team

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

PCYT2-regulated lipid biosynthesis is critical to muscle health and aging

Muscle degeneration is the most prevalent cause of frailty in aging. This paper shows that PCYT2, a key enzyme in the biosynthesis of membrane lipids called phosphatidylethanolamines, plays a fundamental and conserved role in vertebrate muscle health and muscle wasting, linking PCYT2 and PCYT2-synthesized lipids to severe muscle dystrophy and aging, and providing novel avenues for therapeutic intervention.



Cikes *et al.* ***Nature Metabolism*** MAR 20, 2023

Penninger Lab
Aging Research Focus Team

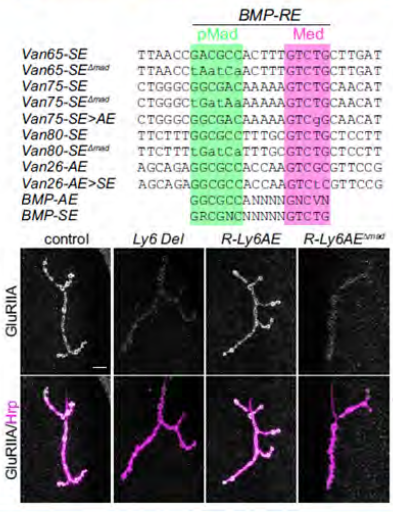
THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

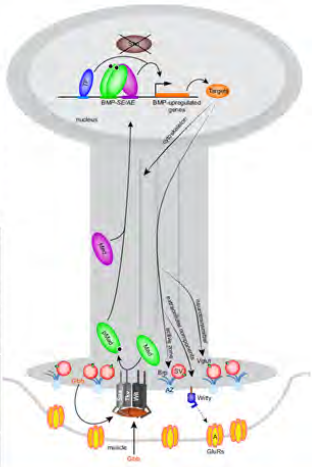
Dichotomous *cis*-regulatory motifs mediate the maturation of the neuromuscular junction by retrograde BMP signaling

Brief Abstract

Communication between motor neurons and muscle fibers at the neuromuscular junction is essential for coordinated movement. These authors uncovered key molecular mechanisms downstream of Bone Morphogenetic Protein (BMP) signaling regulating maturation of this synapse.

Vuilleumier *et al.*
Nucleic Acids Research
Aug 27, 2022





Allan Lab

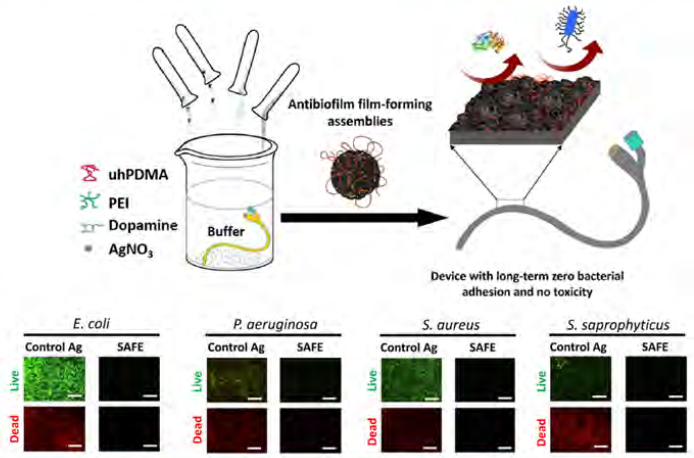
THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Durable Surface from Film-Forming Silver Assemblies for Long-Term Zero Bacterial Adhesion without Toxicity

CBR
THE CENTRE FOR BLOOD RESEARCH

Brief Abstract

These authors developed new silver-based film-forming antibacterial engineered (SAFE) assemblies for coating indwelling medical devices. The SAFE coating prevents bacterial adhesion long-term without evidence for cellular toxicity, and is anticipated to have widespread application in preventing implant/medical device-associated infections.



Yazdani-Ahmadabadi H *et al*.
ACS Central Science May 25, 2022

Kizhakkedathu Lab
(collaboration with Lange Lab at VGH)

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Gut commensal *Enterocloster* species host inoviruses that are secreted *in vitro* and *in vivo*

Inoviruses are under-characterized bacteriophages previously implicated in bacterial pathogenesis. This paper reports the detection, validation, and characterization of novel inoviruses in *Enterocloster* members of the gut microbiome, pointing to unappreciated roles for inoviruses in human commensal bacteria.

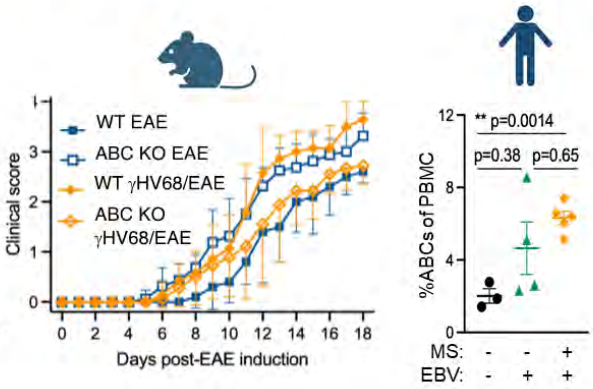
Burckhardt JC*, Chong DHY*, Pett N, & Tropini C
Microbiome | MAR 30, 2023
*contributed equally

Tropini Lab

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Gammaherpesvirus infection drives age-associated B cells toward pathogenicity in EAE and MS

We have previously shown that latent gammaherpesvirus 68 (γHV68) infection exacerbates experimental autoimmune encephalomyelitis (EAE), the mouse model of multiple sclerosis (MS). Here, we show that age-associated B cells (ABCs) are expanded and modulated following γHV68 infection and EAE induction, and that ABCs are required for EAE exacerbation. Further, ABC populations are expanded and altered in people with relapsing MS.



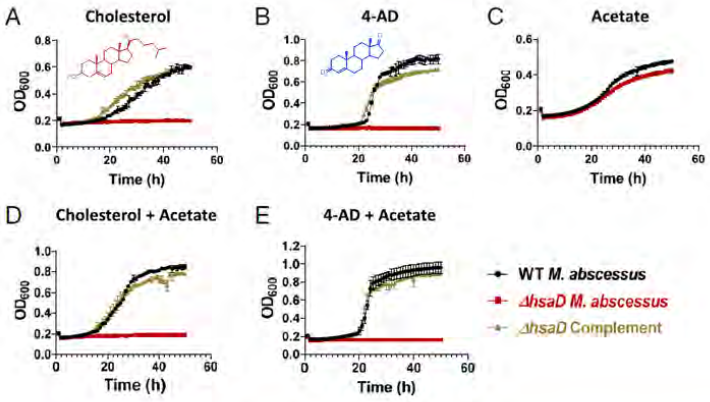
Mouat *et al*.
Science Advances
Nov 25, 2022

Osborne and Horwitz Labs
Multiple Sclerosis Research Focus Team

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

The unusual convergence of steroid catabolic pathways in *Mycobacterium abscessus*

This study provides insight into steroid catabolism in *Mycobacterium abscessus*, a nontuberculous mycobacterium that causes pernicious lung infections. The authors identified unique features in *M. abscessus* catabolism of cholesterol and 4-androstenedione (4-AD), and show these pathways are essential for growth in human macrophages.



Crowe AM, Krekhno JMC *et al.*
Proc Natl Acad Sci USA
Oct 4, 2022

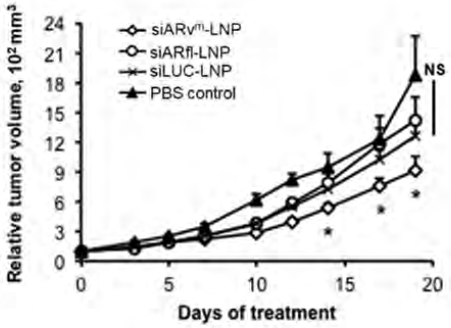
Eltis Lab

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Lipid nanoparticles to silence androgen receptor variants for prostate cancer therapy

Brief Abstract

Overactivation of androgen receptor (AR) is a central driver of prostate cancer. Despite robust responses to androgen deprivation therapy (ADT) in early-stage disease, many patients progress to an advanced, incurable stage, possibly due to AR splice variants that are insensitive to ADT. This is the first report to demonstrate therapeutic effects of lipid nanoparticle (LNP)-siRNA targeting of AR splice variants in prostate cancer.



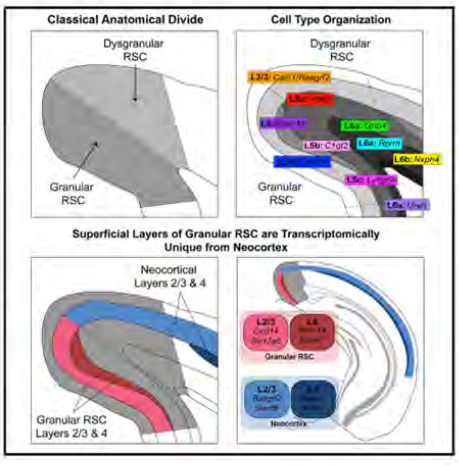
Quick J *et al*.
J Control Release, JULY 7 2022

Cullis Lab

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Sharp cell-type-identity changes differentiate the retrosplenial cortex from the neocortex

The laminae of the neocortex are fundamental processing layers of the brain, and believed to be relatively homologous across short spatial scales. This paper shows the retrosplenial cortex (RSC) is an exception to the rule: the authors identify sharp cell-type-identity changes across RSC subregions, and distinct transcriptomic profiles in several laminae relative to corresponding neocortical layers, indicating a specialized cell-type organization distinct from the neocortex.



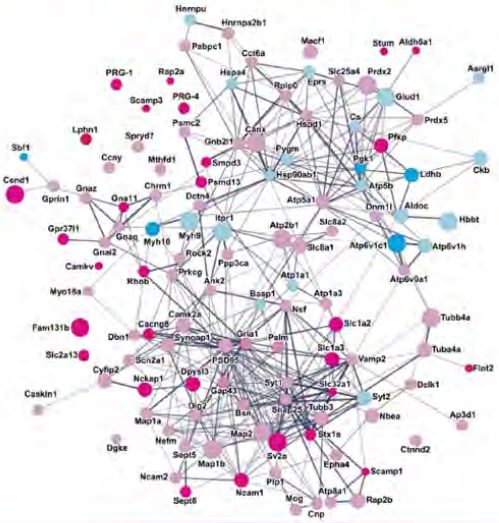
Sullivan KE *et al*.
Cell Reports MAR 6, 2023

Cembrowski Lab
Alzheimer's/Autism Research Focus Teams

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Synaptic activity-dependent changes in the hippocampal palmitoylome

Dynamic protein S-palmitoylation is critical for neuronal function, development, and synaptic plasticity. This paper identified a network of proteins that are palmitoylated in the fear-conditioned mouse hippocampus, and proposes a key role for the differential palmitoylation of synaptic proteins in learning and memory.



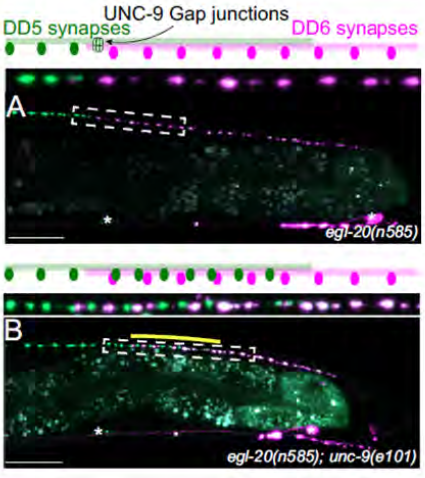
Nasseri GG and Matin N *et al.*
Sci Signal DEC 6, 2022

Bamji* & Foster Labs
*Alzheimer's, Autism Research Focus Teams

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

Channel-independent function of UNC-9/Innexin in spatial arrangement of GABAergic synapses in *C. elegans*

This paper describes a novel role for the gap junction protein, UNC-9/Innexin, in controlling synapse patterning in *Caenorhabditis elegans* motor neurons. While gap junctions are crucial for the proper functioning of the nervous system as channels, the authors show a channel-independent role for UNC-9, and propose it serves as a positional cue to define presynaptic domains.



Hendi A *et al.*
eLife NOV 15, 2022

Mizumoto Lab

THE UNIVERSITY OF BRITISH COLUMBIA
Life Sciences Institute

NEW FACULTY

LSI WELCOMES NEW FACULTY: ***DR. GOVIND KAIGALA*** *(SCHOOL OF BIOMEDICAL ENGINEERING) AND* ***DR. KEVIN WEI*** *(ZOOLOGY)!*

Dr. Govind Kaigala is an Associate Professor recruited to UBC from IBM Research, where he was a Scientist for 11 years, and principal investigator for 9 years. Dr. Kaigala is an Electrical Engineer by training, and his lab, the Laboratory of Microtechnologies for Quantitative Biomedicine @ UBC, is focused on developing enabling technologies for spatiotemporal analysis, applicable to cancer research and personalized medicine. In addition to being a member of the LSI, Dr. Kaigala is part of the SBME, Vancouver Prostate Center, and the BC Cancer Research Institute.

Dr. Kevin Wei is a new Assistant Professor in Zoology, who joined the LSI in January, 2023, following a successful postdoctoral fellowship in the lab of Dr. Doris Bachtrog at the University of California, Berkeley. Dr. Wei studies “selfish” genetic elements called transposable elements, and their impact on the genome and the organism, using fruit fly models.

FACULTY RECOGNITIONS (INTERNAL)

Dr. Jayachandran Kizhakkedathu (Pathology and Laboratory Medicine) was recognized with the 2022 *Faculty of Medicine Distinguished Achievement Award* for Excellence in Basic Science Research, acknowledging outstanding basic science research and scholarly contributions in the areas of health and life sciences.

Dr. Christopher Overall (Oral Biological and Medical Sciences) received the *John McNeill Excellence in Health Research Mentorship Award*, which recognizes faculty, who exemplify a deep commitment to fostering the professional and personal development of colleagues, graduate students, and post-doctoral fellows in the early stages of their academic career. The award was established by the Faculty of Pharmaceutical Sciences in honour of Dean Emeritus John McNeill, whose leadership helped distinguish the Faculty as one of Canada's best graduate programs and research environments.

Dr. Michael Gordon (Zoology) was awarded a 2022 *Faculty of Science Excellence in Service Award*. Dr. Gordon was also the recipient of the 2021/22 *Killam Teaching Prize*, for outstanding contributions in the classroom, and for commitment to excellence in education.

Dr. Pieter Cullis (Biochemistry and Molecular Biology) received a 2022 *Achievement Award* from alumni UBC, which honours members of the UBC community for their vision and dedication through extraordinary endeavours.

Dr. Cara Haney (Microbiology and Immunology) was awarded a 2022 *Killam Faculty Research Fellowship*, supporting promising faculty members engaged in research projects of broad significance and interest to pursue full-time research and study during a recognized study leave.

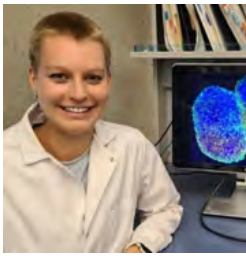
TRAINEE AWARDS & ACHIEVEMENTS

Nicole Wang, an MSc student from the Haney lab, was awarded a Governor General's Gold Medal, as the top achieving graduate student in a PhD or MSc program (one medal awarded for each) across all of UBC.

Liam Hall, a graduate student in Dr. James Johnson's lab, was one of 16 trainees across Canada selected to participate in the *Canadian Islet Research and Training Network*, funded by NSERC CREATE (https://islets.ca/create/)

Sophie Cotton received a 2022 *Ramsay Postgraduate Scholar Award*. The program, provided scholarships for 31 exceptional young Australians to pursue postgraduate studies overseas. She is pursuing a PhD in Microbiology and Immunology in Dr. Carolina Tropini's lab, focusing on how the microbiome affects the brain across the lifespan.

Andrew Sharon in Dr. Lisa Osborne's lab was awarded a 2022 *Faculty of Science Excellence in Service Award*, for his commitment to reducing barriers to higher education and research. In addition to serving as Faculty Representative for the Microbiology and Immunology Graduate Student Society, where he helped restructure expectations in the MSc program and successfully advocated for increased graduate student stipends, Andrew also served as a student leader for Science 101, a UBC Faculty of Science initiative to improve scientific literacy among people living in Vancouver's Downtown Eastside.



Annika Schulz, an MSc student in Dr. Francois Jean's lab, was awarded *3rd place in the BioImaging North America Imaging contest*, for "Brainstorm", showing a stem-cell derived dorsal forebrain organoid (provided by STEMCELL Technologies) expressing neuro-serine protease inhibitor (neuroserpin) Spn4A, an antiviral biologic discovered in the Jean lab. The image was taken using a Leica SP5 Inverted Confocal Microscope in the LSI Imaging Facility

Doctoral

Cindy Lam (Biochemistry and Molecular Biology, supervisor: I. Sadowski)
Alexander Garner (Cell and Developmental Biology, supervisors: T. Kieffer [LSI] / F. Lynn [BC Children's])
Isra Ibrahim (Craniofacial Science, supervisor: J. Richman)
Ameena Hashimi (Microbiology and Immunology, supervisor: E. Tocheva)
Julia Lu (Microbiology and Immunology, supervisor: N. Abraham)
Megan Wolf (Microbiology and Immunology, supervisor: L. Eltis)
Adrienne Kinman (Neuroscience, supervisor: M. Cembrowski)
Kaitlin Sullivan (Neuroscience, supervisor: M. Cembrowski)
Ardalan Hendi (Zoology, supervisor: K. Mizumoto)
Britany Rufenach-Barber (Biochemistry and Molecular Biology, supervisor: F. Van Petegem)

Masters

Jeffrey Lin (Cell and Developmental Biology, supervisor: J. Kopp)
Natalie Nahirney (Cell and Developmental Biology, supervisor: J. Johnson)
Anne Nathalie Ruth M Longakit (Medical Genetics, supervisor: C. Van Raamsdonk)
Charlotte Clayton (Microbiology and Immunology, supervisor: C. Tropini)
Lianne Presley (Microbiology and Immunology, supervisor: F. Jean)
Sarah Erwin, Regan Campbell (Neuroscience, supervisor: M. Cembrowski)
Andrew Thompson (Neuroscience, supervisor: S. Bamji)

Drs. Pierre-Yves Musso and **Molly Stanley**, (Gordon Lab), were recipients of 2021 *Brain Star Awards*, recognizing their prize-winning papers: "A neural circuit linking two sugar sensors regulates satiety-dependent fructose drive in Drosophila" in *Science Advances* (Musso), and "Mechanisms of lactic acid gustatory attraction in Drosophila" in *Current Biology* (Stanley).

Dr. Nadejda Tsvetkov (supervisor: L. Foster) was awarded an NSERC Postdoctoral fellowship.

Dr. Tirosh Shapira (supervisors: Y. Av-Gay, F. Jean) was awarded a Lung Health research grant from BC Lung Foundation, and named a 2022 Top Researcher.

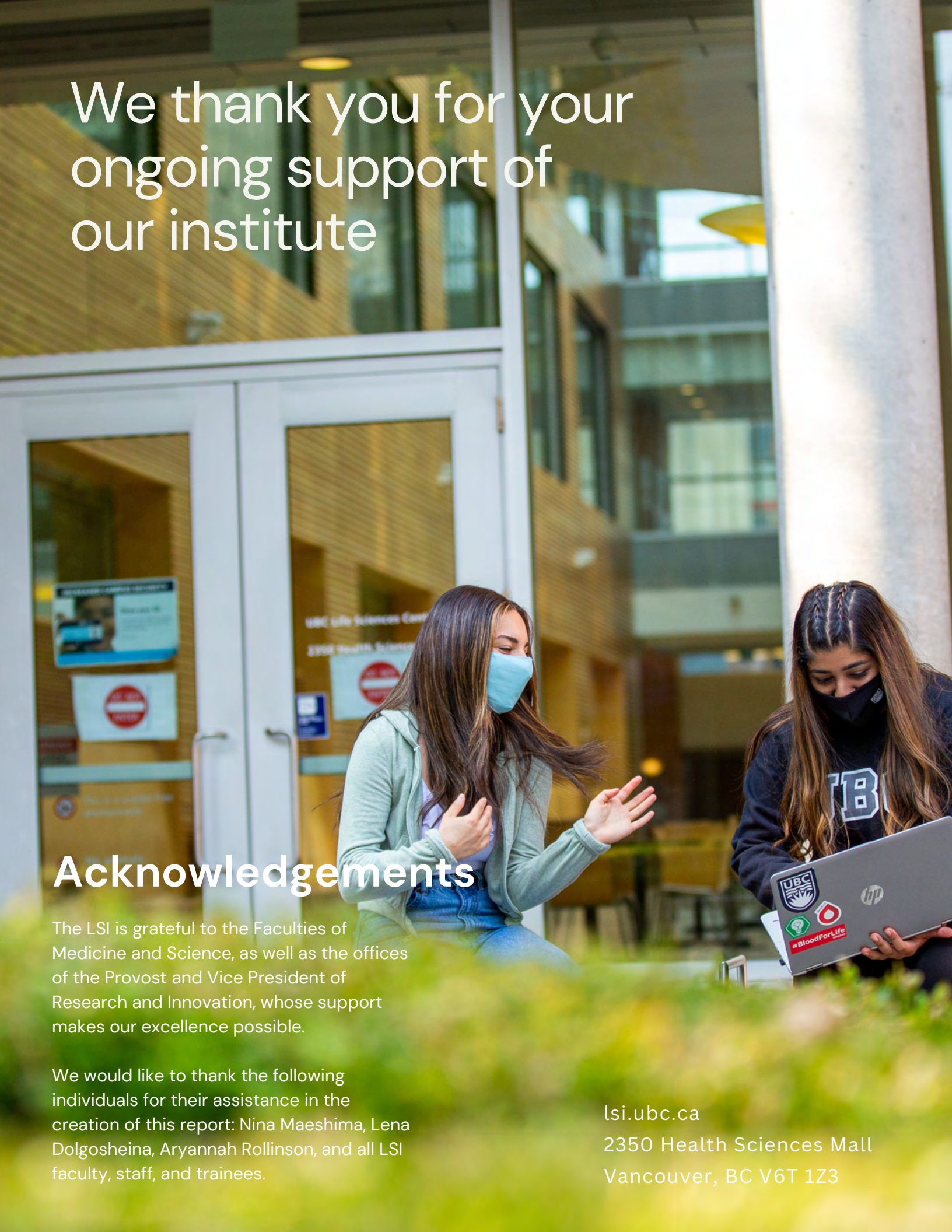
POSTDOCTORAL TRAINEE AWARDS FROM **MICHAEL SMITH HEALTH RESEARCH BC**

Dr. Jia Zhao (supervisor: T. Kieffer): "A novel stem cell model for human islet development and cytoarchitecture".

Dr. Efthymios Kyriakis (supervisor: D. Fedida): "Cryo-EM studies of activators and inhibitors of KCNQ1 and KCNQ1:KCNE1 channel complexes".

Dr. Haoning Cen (supervisor: J. Johnson): "Proteome-wide mechanisms of hyperinsulinemia and sucrose-induced, tissue-specific insulin resistance".

Dr. Marek Budzynski (supervisor: S. Teves): "Mitotic bookmarking by transcription factors as a mechanism of transcriptional memory".



We thank you for your ongoing support of our institute

Acknowledgements

The LSI is grateful to the Faculties of Medicine and Science, as well as the offices of the Provost and Vice President of Research and Innovation, whose support makes our excellence possible.

We would like to thank the following individuals for their assistance in the creation of this report: Nina Maeshima, Lena Dolgosheina, Aryannah Rollinson, and all LSI faculty, staff, and trainees.

lsi.ubc.ca
2350 Health Sciences Mall
Vancouver, BC V6T 1Z3