CBR SUMMER STUDENTSHIP BOOKLET 2022

A COLLECTION OF SUMMER STUDENT EXPERIENCES

CBR
THE CENTRE FOR BLOOD RESEARCH
UBC

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Welcome to CBR Research Day 2022.

Celebrating the end of the CBR Summer Studentship Program 2022.

We warmly welcome you to the 2022 CBR Research Day! This event is held each year to celebrate the conclusion of the Centre for Blood Research (CBR) Summer Studentship Program and showcases the high quality research performed by talented undergraduate and medical students over the summer months.

This year marks the CBR's 12th annual Summer Studentship Program. Although the COVID-19 pandemic presented many challenges and changes on how we delivered the program for the last two years, we are grateful and happy that we successfully brought back meaningful and exciting opportunities through in-person activities this summer!

In the past few months, the summer students have enhanced their scientific and professional skills through their research projects, networking sessions, and participation in various career development workshops. Event highlights include the Lunch & Learn with Health & Wellbeing resources, time management workshop, Career Ask Me Anything (AMA) Café, Career Exploration Panel, Writing and Presentation skills sessions, weekly seminars, Canadian Blood Services' netCAD Blood4Research facility tour, and CBR socials. We hope these events, combined with hands-on research, have provided a well-rounded summer experience.

We want to congratulate this year's summer student cohort for all that they have accomplished! To the students: we hope you had an enjoyable and enriching experience as part of the CBR Summer Studentship Program. We can't wait to see where your journey takes you next and we look forward to seeing everything you achieve! Good luck and stay in touch!

All the best,

Dr. Parvin Bolourani
CBR Education Program Manager

Dr. Dana Devine
CBR Director

CBR RESEARCH DAY PROGRAM

NEXT-GENERATION RNA VACCINES AND THERAPIES

KEYNOTE SPEAKER: DR. ANNA BLAKNEY

ASSISTANT PROFESSOR, SBME, MICHAEL SMITH LABORATORIES

mRNA vaccines have revolutionized the world of vaccines, including the time required to develop and produce a vaccine against a novel pathogen. While this has established that mRNA is useful as a vaccine against a viral glycoprotein, where do we go from here?

Our laboratory is interested in developing next-generation RNA vaccines and therapies. We utilize a type of RNA called self-amplifying RNA, which is derived from an alphaviral genome, and encodes a replicase enzyme in addition to the gene of interest, which enables amplification of the RNA upon delivery into a cell. This amplification property enables use of a much lower dose of RNA compared to messenger RNA, usually ~100 times less.

In order to get the RNA into cells, we need a nanoparticle formulation. LNP are the most clinically progressed formulation technology for both saRNA and mRNA, with the recent approval of the Pfizer/BioNTech and Moderna COVID-19 vaccines. Here, we performed a head-to-head comparison of saRNA formulated in LNP and pABOL, a bioreducible polymer that was previously shown to be an efficient delivery vehicle for saRNA vaccines and characterized the protein expression and vaccine immunogenicity of both platforms.

AUGUST 16, 2022

12 PM - 7 PM

UBC LIFE SCIENCES CENTRE, WEST ATRIUM & LSC 3

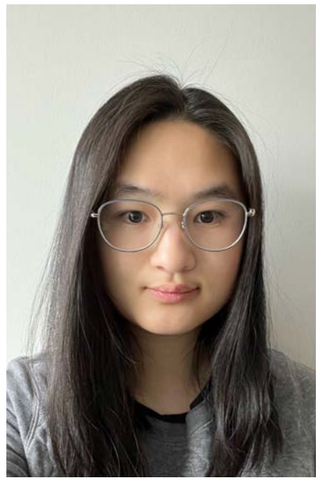
12:00 PM - 1:00 PM	**RECEPTION & POSTER PRESENTATIONS** POSTERS FROM SUMMER STUDENTS, EVENT REGISTRATION, & LUNCH	LSC WEST ATRIUM
1:00 PM - 1:10 PM	**DIRECTOR'S REMARKS** DR. DANA DEVINE	LSC 3
1:10 PM - 2:15 PM	**STUDENT ORAL TALKS** ORAL TALKS FROM SUMMER STUDENTS	LSC 3
2:15 PM - 2:30PM	**NEIL MACKENZIE MENTORSHIP EXCELLENCE AWARD** ANNOUNCEMENT OF AWARD WINNER & NOMINEES	LSC 3
2:30 PM - 3:00 PM	**KEYNOTE TALK** DR. ANNA BLAKNEY	LSC 3
3:00PM - 5:30PM	**POSTER PRESENTATIONS** POSTERS FROM SUMMER STUDENTS, OPEN BAR, & POSTER JUDGING	LSC WEST ATRIUM
5:30PM - 7:00PM	**AWARDS & SOCIAL** DINNER & ANNOUNCEMENT OF STUDENT AWARDS	LSC WEST ATRIUM

RESEARCH DAY PRESENTERS & ABSTRACTS

Name	Principal Investigator	Project Title
Christina Pan	Dr. Chris Overall	Investigating MALT1 Substrate Specificity with Different CARD-BCL10-MALT1 Complexes
Emma Kang	Dr. Dana Devine	Using Lipid Nanoparticles to Deliver Nucleic Acids into Human Platelets for Extracellular Vesicle Repackaging and Functional Enhancement
Jasmin Malhi	Dr. Ed Pryzdial	The Procoagulant Coronavirus Surface
Kate Halverson-Kolkind	Dr. Jayachandran Kizhakkedathu	Immunomodulating Polymer Conjugates for Targeting and Treating Glycocalyx Dysfunction
Luis G. Alde	Dr. Karen Cheung, Dr. W. Russ Algar	The Covalent Functionalization of Si Photonic Biosensors
Marcus Shew	Dr. Dana Devine	Fatty Whole Blood Donation and Red Blood Cell Quality
Melody Weng	Dr. Andrew Shih	Evaluating the Effects of Calcium Flashers on Increasing Calcium Administration Rates and Improving Markers of Blood Coagulation
Nathan Louie	Dr. Leonard Foster	Identifying Ribosomal Protein and Biogenesis Factors Involved in Virus Translation
Nicholas C. Tang, Akshay Khale	Dr. Karen Cheung	Inkjet Printer Design to Activate Silicon Photonic Biosensors for Simultaneous Low-Cost Patient Diagnostics
Paniz Ghavimi	Dr. Edward Conway	Development of Anti-Inflammatory Coatings for Biomedical Devices
Quan Nguyen	Dr. Hugh Kim	The Role of Microtubules in Platelet Function
Ralph Uy	Dr. Dana Devine	The Effects of Pen Ink and Surface Disinfectants on Red Blood Cells Stored in Plasticized Polyvinylchloride Transfusion Bags
Sofia Levy	Dr. Hélène Côté	Bridging the Lifespan Gap: Why Do Women Living with HIV Age Faster?
So Jung Kim	Dr. Karen Cheung	Bubbleshooting: Troubleshooting Bubble Formation Issues in Microfluidic Biosensors
Tien Do	Dr. Robert E.W. Hancock	Synergistic Effects of Antibiofilm Peptides and Conventional Antibiotics on *Pseudomonas aeruginosa* and Methicillin-resistant *Staphylococcus aureus* Biofilms
Waris Bhatia	Dr. Jayachandran Kizhakkedathu	Development of Universal/Stealth Red Blood Cells by Novel Enzymatic Cell Surface Engineering
Yifei Liu	Dr. Karen Cheung	Improving the Robustness of Peak-Tracking Data Analysis Using Cosine Similarity

Poster Presentation & Oral Talk

INVESTIGATING MALT1 SUBSTRATE SPECIFICITY WITH DIFFERENT CARD-BCL10-MALT1 COMPLEXES



Christina Pan

Supervisor(s)/Collaborator(s): Peter Bell, Chris Overall

Mucosa-associated lymphoid tissue lymphoma translocation protein 1 (MALT1) is a protease that regulates immune responses. It is also a drug target for treatment of lymphomas and autoimmune disorders. MALT1 activity is highly regulated, requiring interaction with B cell lymphoma/leukaemia 10 (BCL10) and one of four coiled-coil linked Caspase Recruitment Domain containing proteins (CARD), to form a "CBM" complex. MALT1 and BCL10 are widely expressed; however, the expression of CARD9, CARD10, CARD11, and CARD14 is cell type-specific, making CBM composition cell type-specific. It is currently unknown if the CARD protein affects MALT1 substrate specificity. This project aims to determine if CBM composition affects MALT1 substrate specificity, and identify model cell lines to assay CBM activity. To identify CBM-specific cleavage, plasmids encoding the CBM components for the four complexes were co-transfected with known MALT1 substrates in HEK293 cells. The proteins were subsequently analysed by Western blot. Preliminary results from 14 substrates suggest MALT1 substrate specificity is largely unaffected by CBM composition. These results informed the development of a bioinformatics workflow to identify cell lines in which endogenous cleavage of substrates by the CBM can be detected. Our workflow also draws on protein and mRNA expression data from sources such as the Human Protein Atlas to identify potential cell lines. Having a more targeted approach to identifying useful cell lines would allow for greater efficiency in discovering and validating MALT1 substrates, and improve the understanding of MALT1 activity and its effects on other pathways.

Poster Presentation

USING LIPID NANOPARTICLES TO DELIVER NUCLEIC ACIDS INTO HUMAN PLATELETS FOR EXTRACELLULAR VESICLE REPACKAGING AND FUNCTIONAL ENHANCEMENT

Emma Kang

Supervisor(s)/Collaborator(s): Colton Strong, Jerry Leung, Dana Devine

Platelets are integral for managing bleeding and hemostatic dysfunction. When activated, platelets release extracellular vesicles (pEVs) that participate in hemostasis and may play an important role in many other physiological settings. Thus, loading therapeutic cargo into platelets and pEVs represents a potential strategy to enhance the coagulability of donor platelets or utilize them as a natural delivery system as a new cell therapy. In this study, we developed a technology to load platelet-derived extracellular vesicles with molecular cargo using lipid nanoparticles optimized for delivering nucleic acids into platelets. Preliminary data demonstrates that platelets can be loaded with a fluorescently labelled siRNA that is subsequently repackaged within platelet-derived extracellular vesicles upon stimulation with agonists. Additionally, we further optimized a flow cytometry detection method for extracellular vesicles, and established a rotational thromboelastometry (ROTEM) based assay to detect exogenous aprotinin, an antifibrinolytic agent that will be loaded into platelets in future studies.

Poster Presentation & Oral Talk

THE PROCOAGULANT CORONAVIRUS SURFACE

Jasmin Malhi

Supervisor(s)/Collaborator(s): Michael Sutherland, Ed Pryzdial

Everyone knows about virus infection, but did you know that most, if not all, viruses affect your blood clotting system, often with severe outcomes? A prime example would be the virus responsible for the current COVID-19 pandemic, SARS-CoV-2. SARS-CoV-2 has caused over 6 million deaths, largely due to abnormal clotting. This is true for many other viruses too. My project uses the close coronavirus cousin of SARS-CoV-2, HCoV-229E, to explain how COVID-19 and many other viral infections induce clotting. Our lab's idea is based on a virus structure called the envelope, a host-cell membrane-derived coat found on many types of viruses. To broaden the spectrum of viruses, our lab has shown the ability to activate clotting on the virus surface. My work indicates in preliminary form that a protein called tissue factor (TF) found on the HCoV-229E envelope can accelerate clot-forming pathways, as demonstrated on other viruses in our lab. To extend this finding to coronaviruses, we first added various clotting enzymes interacting with TF alongside HCoV-229E to evaluate whether enzymes enhance infection. Then, we tested the ability of HCoV-229E to activate the clotting enzyme called factor X through interactions with TF to identify TF activity on the virus envelope. The preliminary data trends suggest that adding clotting enzymes have the potential to enhance infection and that HCoV-229E can activate Factor X, so TF should be present on the viral envelope. We can further examine whether infection with HCoV-229E can simultaneously enhance infection with SARS-CoV-2 through TF-related mechanisms.

Poster Presentation & Oral Talk

IMMUNOMODULATING POLYMER CONJUGATES FOR TARGETING AND TREATING GLYCOCALYX DYSFUNCTION

Kate Halverson-Kolkind

Supervisor(s)/Collaborator(s): Anna Herrmann, Jayachandran Kizhakkedathu

The endothelium consists of a single layer of cells lining all blood vessels, lymphatics, and organs. Endothelial cells are coated in a delicate layer of sugar-protein polymers, collectively known as the glycocalyx, which provides a protective interface between tissue and flowing blood. Despite its key role in maintaining normal vascular physiology, the glycocalyx is fragile and its structure is vulnerable to inflammation, high blood pressure, and trauma. Under these conditions, the glycocalyx has been shown to degrade and shed into the vascular lumen, leaving behind an exposed endothelium. Such damage increases endothelial permeability, oxidative stress, and enhances the migration of proinflammatory cells. Currently, glycocalyx dysfunction is recognized as a contributing factor in many inflammatory and immune-mediated diseases such as diabetes, cancer, stroke, autoimmune disorders, sepsis, and transplant rejection. With their prevalence anticipated to increase, glycocalyx dysfunction and treatment have become compelling areas of research. In our study we aim to apply cell surface engineering techniques to rapidly rebuild the depleted glycocalyx and restore normal vascular physiology in patients with inflammatory and immune-mediated diseases. This will be achieved by systemic administration of highly biocompatible polymer conjugates which present multiple ligands that allow simultaneous integration of therapeutic and targeting abilities. By integrating multiple ligands on the cell surface, we aim to mimic the natural glycocalyx and restore its function. If successful, this could both prevent and treat immune mediated diseases, relieve the healthcare system, and improve many lives.

Poster Presentation

THE COVALENT FUNCTIONALIZATION OF SI PHOTONIC BIOSENSORS

Luis G. Alde

Supervisor(s)/Collaborator(s): Samantha M. Grist, Lauren S. Puumala, W. Russ Algar, Karen C. Cheung

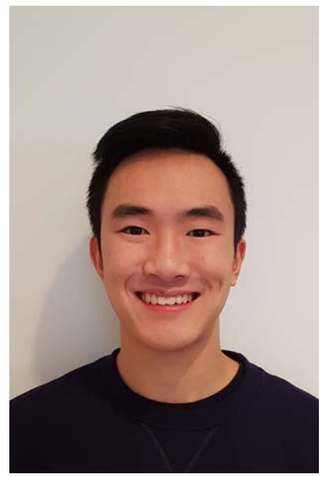
With the recent advances in semiconductor manufacturing and micro-scale electronics, label-free optical biosensors have shown great promise as low-cost, portable, and effective point-of-care diagnostic devices. In this context, we are developing a silicon photonic sensor that will be a widely applicable, data-rich, economic, and scalable bio-analysis platform.

Presently, physisorption is used to bind biomolecules (e.g. proteins and antibodies) to the silicon resonator surface for selective detection of target analytes. This approach presents a challenge in reproducibility and stability due to the randomness of adsorption and the possibility of desorption before or during sensing. Covalent immobilization of biomolecules addresses these challenges, but there is no consensus within the scientific community on the optimum reaction chemistry and protocol for immobilization.

Here we present initial results on a silane-based covalent strategy for immobilizing biomolecules on silicon photonic sensors. Different protocols for modification of the silicon surface with 3-aminopropyltrimethoxysilane (APTMS)–an inexpensive and versatile silane– were tested and characterized using ellipsometry, AFM, contact angle measurements, and fluorescence measurements in an effort to find an optimum method. The APTMS-modified silicon surfaces were then reacted with three different cross-linkers for subsequent coupling to amine groups on biomolecules. We anticipate that the optimized covalent strategy will allow for the immobilization of a wide scope of biomolecules. It should also enable a more robust and reproducible sensor, which is critical for future clinical applications.

Poster Presentation & Oral Talk

FATTY WHOLE BLOOD DONATION AND RED BLOOD CELL QUALITY



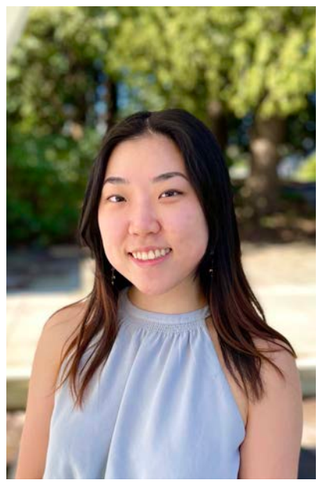
Marcus Shew

Supervisor(s)/Collaborator(s): Narges Hadjesfandiari, Dana Devine

With the amount of life-saving blood donations in Canada dropping to a decade low, it is critical that donations are maximized in quality for optimal patient care. Recent research has shown that red blood cells introduced to fatty blood plasma cause increased rupturing of red blood cells in a test-tube setting. Thus, this project investigates whether short-term levels of fat consumption in diet also increase rupturing of red blood cells. The quality of blood donations from 10 donors, three hours after eating a fatty meal, 20 grams of fat or more, and a lean meal, 3 grams of fat or less, on two separate days are compared. Donations are analyzed for deformability, the red cells' ability to withstand shear stress; osmotic fragility, the red cells' resistance to rupturing at different salt water concentrations; hemolysis, the amount of red blood cell rupturing; and morphology, the quality of cells by shape using microscopy. Additionally, blood samples are measured for concentration of triglycerides, the main components of fat, to ensure fat levels differ. The results indicate there are no statistically significant differences in red blood cell quality immediately following fatty versus lean meals; however, after 48 hours, fatty donations have statistically significant higher levels of hemolysis and poorer morphology scores. Further investigation could evaluate possible changes to the metabolic pathways of red blood cells. Additional research could also include a larger sample size and investigate if the differences in these metrics translate to clinically relevant differences in quality of blood donations.

Poster Presentation & Oral Talk

EVALUATING THE EFFECTS OF CALCIUM FLASHERS ON INCREASING CALCIUM ADMINISTRATION RATES AND IMPROVING MARKERS OF BLOOD COAGULATION



Melody Weng

Supervisor(s)/Collaborator(s): Mina Salehi, Xiu Qing Wang, Kanwal Deoh, Sakara Hutspardol, Jian Mi, Phillip Dawe, Andrew Shih

Calcium in human blood catalyzes the late stages of rapid and effective blood clot formation, also known as coagulation. In injured trauma patients with large amounts of blood loss, appropriate coagulation is important to cease further bleeding in a process called hemostasis. To balance out the effects of severe blood loss, these patients receive massive blood transfusions. However, blood components are stored in a citrate-based anticoagulant, which prevents blood clot formation during storage by binding calcium, an element required for coagulation. Thus, upon transfusion, citrate toxicity leads to hypocalcemia (a lack of calcium) which can negatively affect blood coagulation. Following transfusions in most trauma centers, hypocalcemia is treated once detected, however, a more proactive rather than reactive approach is being tested with a "calcium flasher" system using reminders in packs of blood. This new system implemented at Vancouver General Hospital in November 2019 reminds physicians to administer calcium whenever blood is given, with the aim that patients receive more calcium and improve hemostasis. Our quality improvement project therefore investigates the efficacy of these flashers and may guide us to implement improvements in calcium administration to improve trauma patient care. In this project, we examined trauma patient charts from before and after the introduction of calcium flashers, recording laboratory values including calcium levels and coagulation testing, patient characteristics, and outcomes. After descriptive and statistical analysis of our data, we hope to gain insight into the current efficacy of calcium flashers, guiding us towards future interventions if we find hypocalcemia treatment is lacking.

Poster Presentation & Oral Talk

IDENTIFYING RIBOSOMAL PROTEIN AND BIOGENESIS FACTORS INVOLVED IN VIRUS TRANSLATION

Nathan Louie

Supervisor(s)/Collaborator(s): Brenna Hay, Leonard Foster

Ribosome biogenesis has long been identified as a cellular process through which new ribosomes, consisting of ribosomal RNA and protein, are generated. Although each ribosome shares the common function of translating mRNA into protein, the landscape of ribosome composition is incredibly diverse and its impact on cell function and response regulation has yet to be fully characterized. In this current project we aim to better understand the impact of ribosome composition and ribosome biogenesis on modulating cell responses to virus infection in the context of virus translation. We identify RPL28, a component of the 60S large ribosomal subunit, and BOP1, a ribosome biogenesis factor involved with rRNA processing and maturation, as potential regulatory elements of virus translation. RPL28 and BOP1 knockdown experiments reveal reduced Coxsackievirus B3 viral titers when compared to control groups, suggesting that these ribosomal factors may normally facilitate proper viral protein production. Future experiments will be focused on stimulating cells with interferon to assess how the translational modulation of virus propagation may operate in tandem with cell innate immune responses. Work will also be done to investigate the role that RPL28 and BOP1 have on Sendai virus infection, an infection model that induces a strong interferon response.

Poster Presentation

INKJET PRINTER DESIGN TO ACTIVATE SILICON PHOTONIC BIOSENSORS FOR SIMULTANEOUS LOW-COST PATIENT DIAGNOSTICS

Nicholas C. Tang & Akshay Khale

Supervisor(s)/Collaborator(s): Lauren S. Puumala, Samantha M. Grist, Lukas Chrostowski, Sudip Shekhar, Karen C. Cheung

Currently, medical conditions can be diagnosed with biological indicators (biomarkers), but this process requires lab equipment, and most are inaccurate and slow. For faster point-of-care biomarker recognition, low-cost label-free biological sensors using silicon photonic technology are promising. Since silicon photonic biosensors have small sizes, tens of multiplexed sensors can be integrated onto the same chip for multiple markers or to detect various conditions. Biomarker detection uses "functionalization", or attaching biomolecules like antibodies to the surface of the sensor, to achieve specific measurements. To detect multiple biomarkers on the same chip, adjacent tiny (~0.1 mm) sensors need to be functionalized with different chemistries. One functionalization method involves inkjet printing, offering accurate droplet propulsion onto adjacent detection sites on the same chip through a nozzle suspended above; it can also facilitate parallel printing with different solutions, similar to CMYK printheads in office inkjet printing. However, not only are commercial solutions expensive, but existing devices also have low resolution or can potentially damage the chip surface from direct contact pin-spotting. In this work, we present a printer design optimized for biosensor functionalization that dispenses four separate "inks" through four nozzles to rapidly functionalize multiplexed sensors on silicon photonic chips. Each aspect of the printer design and its selection criteria and process will be explained, ranging from the electronic hardware for enabling quick functionalization to the environmental control. We believe that our system will support the development of compact, low-cost, multiplexed silicon photonic sensors for more accurate diagnostics.

Pictured: Nicholas C. Tang

Poster Presentation & Oral Talk

DEVELOPMENT OF ANTI-INFLAMMATORY COATINGS FOR BIOMEDICAL DEVICES

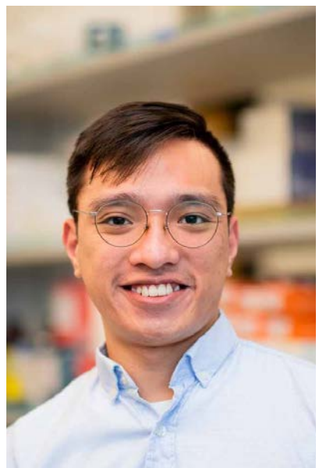
Paniz Ghavimi

Supervisor(s)/Collaborator(s): Edward Conway

The use of vascular grafts and artificial valves is rapidly increasing, meeting the needs, particularly of an aging population. The presence of any implanted biomaterial that's exposed to blood, triggers a host response. This response seeks to eliminate the foreign material from the body through activation of innate immunity, inflammation, and coagulation. The result isn't only damage to the device and loss of its function, but possibly widespread harm to the host. My goal is to reduce the adverse response of the host towards the implanted biomaterial. The objective of my project is to reduce inflammation triggered by the device by coating its surface with a protective layer. Thrombomodulin (TM) is a naturally occurring anti-inflammatory, anticoagulant protein, that consists of 5 functional domains. I'm focusing on the lectin-like domain of TM (TM-LLD), which has anti-inflammatory and anti-complement properties. To immobilize the TM-LLD onto the biomaterial surface, I first subcloned into the cDNA expression vector, encoding the TM-LLD (His-TM-LLD). Following transfection of the vector into Chinese Hamster Ovary cells, I purified the recombinant TM-LLD by affinity chromatography. Functional assays confirmed that the recombinant TM-LLD reduced complement activation via the classical and lectin pathways. Further, studies will validate whether the TM-LLD also interferes with leukocyte adhesion. I will then upscale production of the TM-LLD to conjugate it onto a biomaterial surface, where its biocompatibility will be assessed. Overall, I'm hopeful TM-LLD will prove to be a useful biomaterial coating component to minimize the inflammation and coagulation that commonly occurs with blood-exposed devices.

Poster Presentation & Oral Talk

THE ROLE OF MICROTUBULES IN PLATELET FUNCTION



Quan Nguyen

Supervisor(s)/Collaborator(s): Hugh Kim

Platelets are small blood cells that are responsible for blood clotting. Platelets circulate in our bloodstream in their “resting” form and become “activated” in response to cuts and/or chemical signals such as thrombin. When activated, platelets quickly transform from a round shape into a spiky, spread-out shape. This shape change is controlled by the cytoskeleton, which forms the backbone of the platelet structure. There are 2 distinct networks of the cytoskeleton: the actin cytoskeleton, made up of a protein called actin, and the microtubule cytoskeleton, made of a protein called tubulin. Activated platelets also release molecules, namely adenosine triphosphate (ATP) and P-selectin, during a process called secretion. The actin cytoskeleton has a critical role in platelet secretion, however the role of the microtubule cytoskeleton in this process is not defined. I treated platelets with the drug colchicine which disrupts microtubules. I then measured, in colchicine-treated platelets (and controls), the amount of ATP and P-selectin released after activation with thrombin. I found that colchicine did not have a significant effect on platelet secretion, suggesting that the microtubule cytoskeleton is not essential for this aspect of platelet function.

Poster Presentation & Oral Talk

THE EFFECTS OF PEN INK AND SURFACE DISINFECTANTS ON RED BLOOD CELLS STORED IN PLASTICIZED POLYVINYLCHLORIDE TRANSFUSION BAGS

Ralph Uy

Supervisor(s)/Collaborator(s): Katherine Serrano, Narges Hadjesfandiari, Andrew Shih, Dana Devine

Canada has faced constraints to blood supply notably, in part, due to the COVID-19 pandemic. In addition, though blood is altruistically provided by donors, each unit of red blood cells (RBCs) produced is a significant cost to the health care system. Therefore it is imperative that we minimize the amount of blood wastage occurring. At many hospitals, including Vancouver General Hospital (VGH), blood bags with pen markings and those that are exposed in an infectious environment are often discarded due to unclear effects on RBC quality and safety. In this study, we investigate the feasibility of pen markings and surface decontaminants diffusing through blood bags and whether or not either of these blood bag modifications/treatments negatively affect the quality of red blood cells. Blood bags were sampled at two time points: 24 hours after applying the treatment and day 42 of collection. Data from the first time points indicate no differences in red blood cell count, morphology, deformability, potassium content, and hemolysis for both the pen marking and decontaminant replicates. Preliminary data from day 42 seem to follow a similar trend. Our data show that pen ink and surface decontaminants have no effect on the quality of red blood cells 24 hours after application. We anticipate this data will clarify both Health Canada standards and hospital policy to further safeguard RBC supply.

Poster Presentation & Oral Talk

BRIDGING THE LIFESPAN GAP: WHY DO WOMEN LIVING WITH HIV AGE FASTER?

Sofia Levy

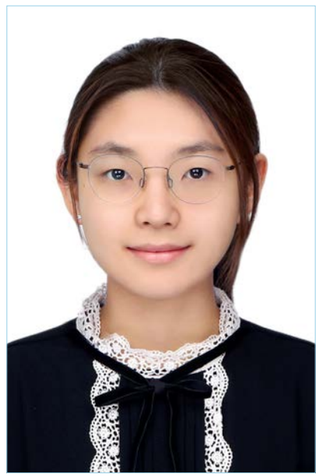
Supervisor(s)/Collaborator(s): Tetiana Povshedna, Hélène Côté

The improvement in HIV treatment has increased life expectancy and quality of life for people living with HIV. Despite this, studies have shown that women living with HIV have a shorter lifespan and a higher risk of developing additional illnesses than men living with HIV and HIV-negative women, which suggests faster aging. This discrepancy highlights the need for women-centered research that will identify biological and social factors that affect healthy aging in women living with HIV.

The process of aging is associated with the accumulation of aging-related diseases and higher exposure to viral infections, some of which are lifelong and cause additional burdens on the immune system. This project aims to investigate the possible link between the number of common lifelong viral infections and risk of negative health outcomes, including predicted risk of all-cause mortality and of developing heart, kidney, and liver disease. We will determine the presence of 5 viral infections (varicella zoster (chicken pox/shingles), herpes simplex 1&2 (cold/genital sores) & hepatitis C/B) from blood samples and estimate risk of negative health outcomes based on common laboratory tests in the subset of women living with and without HIV participating in the British Columbia CARMA-CHIWOS Collaboration (BCC3) study. BCC3 is a cohort study that is currently enrolling women across BC and explores biological, clinical, and social factors that affect aging in the context of HIV. This project contributes to the body of knowledge that will ultimately help close the health gap and improve quality of life for women living with HIV.

Poster Presentation

BUBBLESHOOTING: TROUBLESHOOTING BUBBLE FORMATION ISSUES IN MICROFLUIDIC BIOSENSORS



So Jung Kim

Supervisor(s)/Collaborator(s): Yas Oloumi, Samantha M. Grist, Karen C. Cheung

Microfluidic integration can play a crucial role for achieving high sensor accuracy with minimal sample volume as the small-scale channels allow the precise delivery of fluids to the detection zone. Nevertheless, there are challenges with one being the most common yet impactful, often leading to sensor malfunctioning: bubbles. While bubbles arise due to various reasons, they are principally due to supersaturated gas in moving fluids nucleating on the non-wetted crevices of microfluidic channels. These small bubble nuclei enlarge and cause problems, such as flow rate fluctuations and obstructions. Researchers are overcoming this issue by implementing hydrophilic coatings for more complete channel wetting or bubble traps to remove bubbles before they reach the microfluidic device.

In our silicon photonic biosensors, we found that the continual passage of bubbles can disturb the sensor performance as they correlated with abnormal sensor outputs. To identify the source of bubble formation, we conducted four sets of “bubbleshooting” experiments with two different microfluidic devices: a single-layer gasket with two channels differing in surface roughness and a dual-layer one-channel gasket with more crevices due to a via-channel misalignment. Through these experiments, we determined the importance of channel pre-wetting with low surface energy liquids and reducing channel roughness and channel-via layer misalignments. Furthermore, we validated the effectiveness of bubble traps in preventing bubbles from the fluid source being introduced into the channels. The insights from the bubbleshooting experiments can also help us design next-generation microfluidics with improved fluid control for integration with biosensors and other applications.

Poster Presentation & Oral Talk

SYNERGISTIC EFFECTS OF ANTIBIOFILM PEPTIDES AND CONVENTIONAL ANTIBIOTICS ON *PSEUDOMONAS AERUGINOSA* AND METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* BIOFILMS

Tien Do

Supervisor(s)/Collaborator(s): Evan F. Haney, Robert E.W. Hancock

Biofilm, an altered growth state of bacterial cells, is developed when a cluster of bacterial cells adheres to a surface and forms a surrounding extracellular matrix layer. As this layer provides protection against antibiotic, biofilm-associated infections, found in skin infections or in chronic wounds, become the cause of substantial health problems due to the resistance of biofilm cells to current antibiotic treatments. Amidst the need for new treatments for these infections, studies have shown that a synthetic antibiofilm peptide, called DJK-5, not only prevents biofilms from forming but also destroys existing biofilm cells. Beyond the direct activity of the peptide, synergy with conventional antibiotics has also been reported in the literature against planktonic bacterial cells. However, it is unclear whether these relationships exist between antibiofilm peptides and antibiotic molecules against cells growing within a biofilm. Therefore, we examined synergistic relationships occurred between DJK-5-derived peptides and conventional antibiotics on biofilms formed by the Gram-negative *Pseudomonas aeruginosa* and the Gram-positive Methicillin-resistant *Staphylococcus aureus*. Indeed, we found that peptides, when combined with antibiotics show antibiofilm effects against the two strains while decreasing the working concentration of each compound alone. Specifically, the antibiotic class Aminoglycosides and a topical antimicrobial display synergy with antibiofilm peptides. These promising results suggest that peptides and antibiotics can be used together to treat biofilm-associated infection without increasing the chance of resistance.

Poster Presentation & Oral Talk

DEVELOPMENT OF UNIVERSAL/ STEALTH RED BLOOD CELLS BY NOVEL ENZYMATIC CELL SURFACE ENGINEERING

Waris Bhatia

Supervisor(s)/Collaborator(s): Haisle Moon, Stephen Withers (Withers Group), Jayachandran Kizhakkedathu

Matching red blood cells (RBCs) for blood groups is essential in transfusion therapy. Unintentional mismatch of RBC blood groups and shortage of RBCs with rare blood groups are important challenges faced by clinicians performing blood transfusions. We aim to address this unmet clinical need in blood transfusions by developing universal/stealth RBCs that would not be rejected or removed by immune cells. The success of this approach relies on avoiding immune detection such that no innate immune response is mounted towards the modified RBCs. Here we aim to enzymatically modify minor antigens, such as the highly immunogenic Rhesus (Rh) D antigen, on the surface of RBCs by building a protective layer of a molecule called polysialic acid. This would shield the minor antigens, such as Rh D antigen, from recognition by the host's immune system. In our findings, we observed a significant decrease in immune recognition of our modified RBCs compared to unmodified RBCs. The current results also show similar functionality as unmodified RBCs. We anticipate that building a layer of polysialic acid would modulate the host immune response and prevent detection of the Rh D antigen. Such an approach could help prevent adverse reactions due to unintentional mismatch of blood groups as well as help increase supply of RBC units. For future studies, we intend on developing a combinational method using recently identified novel enzymes from human gut bacteria to cleave the blood group A and B antigens to create truly universal RBCs.

Poster Presentation

IMPROVING THE ROBUSTNESS OF PEAK-TRACKING DATA ANALYSIS USING COSINE SIMILARITY

Yifei Liu

Supervisor(s)/Collaborator(s): Mohammad Al-Qadasi, Samantha M. Grist, Avineet Randhawa, Yas Oloumi, Elly Kim, Sudip Shekhar, Karen C. Cheung

Label-free biosensors using silicon photonics technology show great promise to improve diagnostic testing at the point of care due to their low cost and quantitative, data-rich output. These devices typically produce a set of evenly spaced resonance peaks when measured by an input laser sweep, and the resonance peaks shift in the presence of a biomolecule of interest. Accessing the data-rich readout of these sensors thus involves tracking these wavelength shifts. However, noisy or missing peaks are quite commonly found in practice and complicate peak tracking. Furthermore, large peak shifts may also mislead the trace and often accumulate, thus exceeding the detection range. This project utilizes the shape information of absorption peaks, and quantitatively determines the peak shape similarity, with a differentiative method to handle these common peak tracking problems. A GUI data analysis software based on this method was developed and deployed in the biosensor lab. It was proved to process three times faster than the previous version with an easy-to-use graphic interface. These performance and usability improvements will free researchers from manually processing challenging datasets, saving time and yielding more reliable data from biosensing experiments.

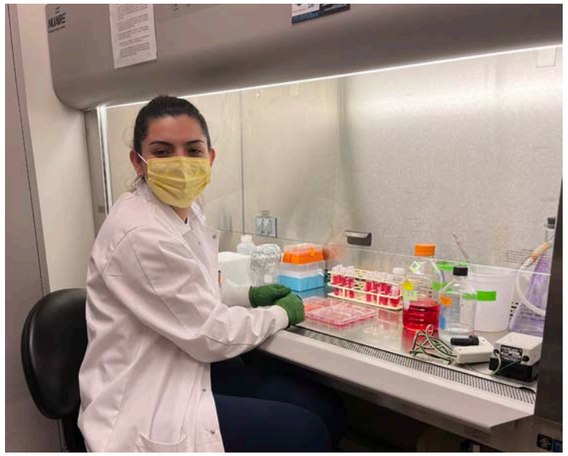
2022 PROGRAM HIGHLIGHTS

The CBR recognizes the value of developing skills and experiences not only in the lab, but also outside of it. The Summer Studentship Program aims to provide opportunities for students to socialize, network, explore career different paths, and practice essential skills like public speaking and communication.

Below are memories of just a few of the events that were held throughout the Program, from skills workshops to socials, as well as student snapshots!

Several of the workshops, professional development events and socials held were:

- Welcome Orientation
- Time and Project Management
- Critical Evaluation of Research Studies
- Health and Wellbeing Workshop
- Career Ask Me Anything (AMA) Café
- CBR Summer Social
- Building your Career
- Career Exploration Panel
- Effective Presentation Skills
- CBR Research Day

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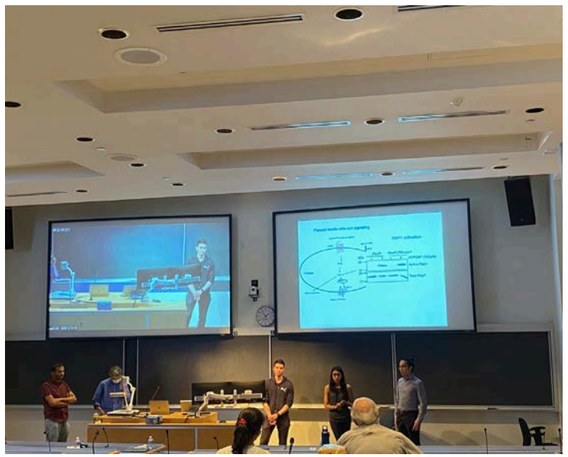
CAREER DAY 2022
CONVERSATIONS WITH PROFESSIONALS IN DIVERSE CAREER PATHWAYS
SMALL GROUP THEMATIC MENTORING WITH PANELISTS
BUILD A PROFESSIONAL NETWORK AND OPTIMIZE YOUR LINKEDIN PROFILE WITH A PANELIST
SCIENCE COMMUNICATION: MESSAGE IN A BOTTLE
CBR




SUPERHERO


CBR


Summer Internship
CBR

PROGRAM IMPACT & PAST STUDENT PERSPECTIVES

12 **summer students**
supported with CBR funding in 2022

12 years
of program growth, research excellence, & mentorship

40+ principal investigators & research teams
participating over the years

200+
students supported
since 2011

"My experience with this program, coupled with the amazing mentorship of my supervisors, has furthered my passion for clinical research."

"I worked with Dr. Andrew Shih, Dr. Krisztina Vasarhelyi, and Dr. Maya Gislason on a case study that followed the implementation of the CONCOR-1 trial in British Columbia. This clinical trial examined the safety and efficacy of administering convalescent plasma to treat COVID-19 patients as compared to standard of care.

I truly appreciated how this program supported me in ways beyond Research Day by hosting professional development workshops, organizing social events, and having Seminar Series on current CBR research. Despite the virtual format due to the COVID-19 pandemic, I loved the sense of community that this program fostered and the care that was demonstrated through the check-in sessions. My experience with this program, coupled with the amazing mentorship of my supervisors, has furthered my passion for clinical research."

— Parvin Malhi,
2021 Summer Student alum

"I worked on a Genome-Wide Association Study (GWAS) with guidance from my remarkable supervisors, Christine Yang, Dr. Amy Lee, and Dr. Bob Hancock. The objective of my project was to perform a comprehensive study on Pseudomonas aeruginosa by first validating a GWAS software, De Bruijn Graph GWAS (DBGWAS), using ciprofloxacin resistance genes as a control so that we could then use the tool to identify novel mutations that contribute to pathogenicity. Although bioinformatics was fairly new to me, I had a lot of support from my supervisors and I have gained more confidence in computing.

Duringt the Program, I have met many great individuals who are just as passionate about research as I am. Through workshops and one-on-one support sessions, I have learned a number of skills that I know have made me a better science communicator and researcher. Thank you so much for making the Summer Studentship Program a possibility!"

— Mahta Amanian,
2020 Summer Student alum

"During the Program, I have met many great individuals who are just as passionate about research as I am.

Through workshops and one-on-one support sessions, I have learned a number of skills that I know have made me a better science communicator and researcher."

"The objective of my project was to analyze clinical and genetic parameters of patients with Juvenile Idiopathic Arthritis (JIA), in order to determine predictors of intolerance to the first line treatment of the disease, methotrexate.

I got to work closely with Dr. Martina Sundqvist of the Brown Lab at BC Children's Hospital Research Institute, who was an excellent mentor and guide in my first paid research experience. The program workshops, despite the online format, truly exhibited a care for the professional development of us summer students. CBR Research Day was an especially enjoyable time, allowing me to give a research presentation for the first time, as well as see all the interesting projects the other students had worked on this summer!"

— Rafid Haq,
2020 Summer Student alum

MENTORSHIP EXCELLENCE

Mentorship is an integral part of the CBR and the Summer Studentship Program. Each year, the CBR recognizes an individual who has demonstrated an outstanding commitment to mentorship and the development of others, through the Neil Mackenzie Mentorship Excellence Award.

Below are the 2022 award nominees, who have been recognized by others at the CBR for their dedication to mentoring. The award recipient will be announced during Research Day. Congratulations to all!

Amy Wong Strilchuk

Dr. Anna Herrmann

Colton Strong

Dr. Evan Haney

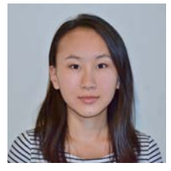
Dr. Farshad Babaeijandaghi

Haisle Moon

Dr. Hashem Etayash

Dr. Julyanne Brassard

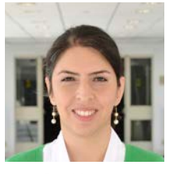
Dr. Kerryn Matthews



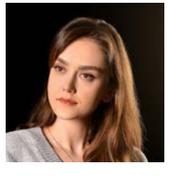
Kristen Li

Lih Jiin Juang

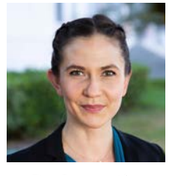
Dr. Michael Sutherland



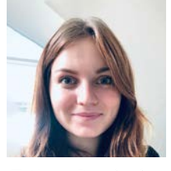
Dr. Narges Hadjesfandiari



Nasim Kajabadi



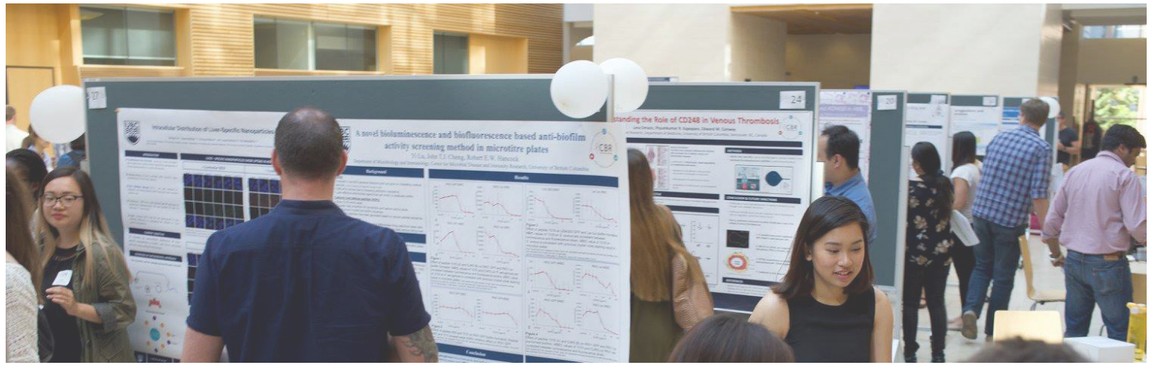
Dr. Samantha Grist



Tetiana Povshedna

About Dr. Neil Mackenzie: *Neil was a postdoctoral fellow in Dr. Brömme's lab at the CBR, who tragically passed away in a climbing accident at Joffre Peak in 2015. A dedicated and caring mentor, Neil's encouraging and motivating words and actions were sincerely appreciated by all those whom he touched – colleagues, friends, and students. In honour of his legacy, the CBR has created an award to recognize dedicated members who are making a difference.*

SPECIAL THANKS & ACKNOWLEDGEMENTS



We would like to thank our sponsors for their generous support, without whom the CBR Summer Studentship Program and Research Day would not have been possible:

Neil Mackenzie Memorial Fund

Canadian Blood Services
BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

Stago

Naiman-Vickars Endowment Fund

BAYER

GRIFOLS

We would also like to extend our heartfelt thanks to the following mentors, speakers, organizers, workshop facilitators, volunteers, collaborators and other contributors:

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Tetiana Povshedna
Dr. Tony Yang

We could not have done it without you — thank you for making this year's CBR Summer Studentship Program a success!

Organized by the UBC Centre for Blood Research (CBR)

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