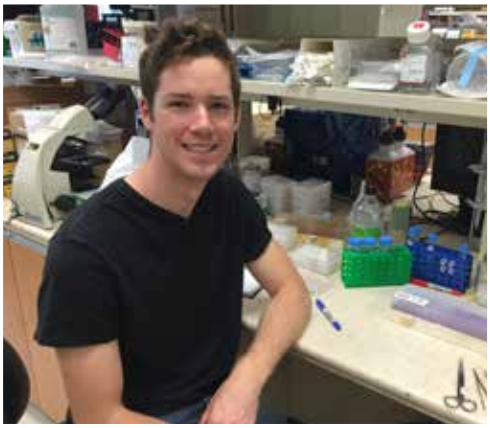
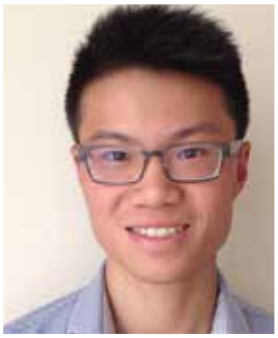
women & children's health research institute







2015 Summer Studentship Program

We thank...

The Women and Children's Health Research Institute (WCHRI) is a partnership between the University of Alberta and Alberta Health Services and is generously supported by the Stollery Children's Hospital Foundation and the Royal Alexandra Hospital Foundation. In addition to this, the Faculty of Medicine & Dentistry provides operating and in-kind support.

The University of Alberta and the Faculty of Medicine & Dentistry

The University of Alberta strives to create and support an environment of research excellence across the university to fuel knowledge advancement, discovery and innovation; all of which provide significant contributions to society provincially, nationally and globally. It is through the continued support of the University of Alberta's Faculty of Medicine & Dentistry (FoMD), that WCHRI can house many of its core groups and its administrative staff. FoMD also provides partial funding for WCHRI's operating expenses, without which WCHRI would not be able to manage its many grants programs and research support initiatives.

Alberta Health Services

Alberta Health Services is a strong and active supporter of WCHRI. Their guidance has been invaluable in ensuring that women and children's health and AHS standards in the delivery of clinical care, wellness and prevention remain a focus of WCHRI's mandate.

The Stollery Children's Hospital Foundation

The Stollery Children's Hospital Foundation (SCHF) is dedicated to raising funds in support of the pursuit of excellence in children's health care. As part of this goal, the Stollery Children's Hospital Foundation supports evidence-based pediatric research by funding research programs and initiatives through WCHRI. The SCHF is proud of its contribution towards growing a new generation of researchers through the summer studentship program.

The Royal Alexandra Hospital Foundation

The Royal Alexandra Hospital Foundation (RAHF) inspires community support in its aim to make the Lois Hole Hospital for Women into the best women's hospital in Canada. The research funded by RAHF through WCHRI ensures patients and their families receive the best, most up-to-date care that is available and contributes towards a healthier future for women in Alberta and across Canada.

...for making this program possible!

Message from the director

The WCHRI Summer Studentship Program provides academically gifted students with a competitive opportunity to participate in women and/or children's health research during the summer months. This often marks a student's first experience in research and can serve as a jumping off point to a research career.

In the following pages, we invite you to learn about the WCHRI summer students funded in the 2015 competition. We are delighted that many of our successful summer students this year were also the recipients of external awards, allowing us to leverage our resources. We are proud of our commitment to these new researchers and look forward to seeing the products of their work.

We would like to thank the Stollery Children's Hospital Foundation and the Royal Alexandra Hospital Foundation for their support of this grant program. Their ongoing financial commitment to the program makes this invaluable research opportunity possible for students.

In addition, this year we are grateful to have had support for an additional six summer students through the new Maternal, Newborn, Child and Youth Strategic Clinical Network (SCN). The Strategic Clinical Networks were created by Alberta Health Services to bring together researchers, physicians, patients and managers to improve the quality of health-care delivery and health outcomes for every Albertan. The Maternal, Newborn, Child and Youth SCN was officially launched in March 2015 and we are delighted to be working with them.

Sincerely,

Dr. Sandra Davidge
Director
Women & Children's Health Research Institute

Our Summer Studentship Program

The WCHRI Summer Studentship program assists students working on specific projects under the supervision of WCHRI researchers. Projects span disciplines, research pillars and methodologies, and provide program awardees with outstanding learning opportunities under the guidance of leading experts. WCHRI first offered the summer studentship grant program in the summer of 2009. In 2015, the program funded 24 students. Now in its seventh year, the program truly does exemplify the breadth of areas of investigation that advance research in women and children's health.

2015 Successful Awardees

Summer Studentship Program

Student	Supervisor	Project Title	Faculty-Department
Danesh, Ghazal	Wine, Eytan	Enhanced elimination of enteric pathogens by macrophages through NLRP3 activation	FoMD Pediatrics
Domun, Suraj Sharma	Uludag, Hasan	siRNA therapy of leukemias	Engineering Chemical & Materials Engineering
Donaldson, Kaley	Ross, Sue	Menopause in women with inflammatory bowel diseases: An investigation of symptoms and mediators	FoMD Obstetrics & Gynecology
Duan, Sudi (Annie)	Pagliardini, Silvia	Investigation of the role of REM-active pontine structures in the control of the expiratory rhythmic activity	FoMD Physiology
Floora, Hardeep	Elahi, Shokrollah	Investigating the development and accumulation of CD71+ cells during pregnancy in the fetus and the mother	FoMD Dentistry
Fung, Ryan	Eisenstat, David D.	DLX2 homeobox regulation of enteric nervous system development and role in Hirschsprung Disease	FoMD Medical Genetics
*Gyenes, Dora	Hornberger, Lisa K.	Exploring the relationship between altered cerebral blood flow in utero & neurodevelopmental outcomes in children with Hypoplastic Left Heart Syndrome	FoMD Pediatrics
*Hernandez, Juan	Rosychuk, Rhonda J.	Identifying geographic clusters of frequent pediatric presenters to Alberta emergency departments for self-harm	FoMD Pediatrics
*Joffe, Rachel	Garcia Guerra, Gonzalo	The reliability of invasive and non-invasive blood pressure measurements in unstable critically ill children	FoMD Pediatrics
Katzell, Alexis	Funk, Gregory D.	Is ICAN the ion channel via which astrocyte-derived ATP excites inspiratory rhythm generating networks during hypoxia?	FoMD Physiology
Lamarche, Brendon	West, Lori J.	Assessment of neonatal tolerance to blood group A antigen in a novel mouse model of ABO-incompatible transplantation	FoMD Pediatrics
Light, Isabel	Rasmussen, Carmen R.	Screening for FASD: the neurobehavioral screening tool and neuropsychological functioning	FoMD Pediatrics

Summer Studentship Program

Student	Supervisor	Project Title	Faculty-Department
Maarouf, Nayef	Simmonds, Andrew	Modeling peroxisome disorders in Drosophila melanogaster	FoMD Cell Biology
Mah, Darryl J.	Dyck, Jason R.B.	Metformin protects against doxorubicin-induced cardiomyopathy	FoMD Pediatrics
Paton, Amanda	Kingston, Dawn E.	Development and evaluation of an online, interactive education program for perinatal mental health screening and care	Nursing
*Rea, Winnona	Aziz, Khalid	Developing and implementing a sentinel event reporting system for quality improvement in neonatal intensive care	FoMD Pediatrics
Roczkowsky, Andrej	Schulz, Richard	Intracellular targets of matrix metalloproteinase-2 in doxorubicin-treated cardiomyocytes	FoMD Pharmacology
Rowe, Stewart	Davidge, Sandra	LOX-1 mediated endothelial dysfunction in preeclampsia	FoMD Obstetrics & Gynecology
Rumley, Alina	Cordat, Emmanuelle	Role of claudin-4 and kidney anion exchanger 1 in electrolyte homeostasis in children	FoMD Physiology
*Schlegelmilch, Michael	Vohra, Sunita	Pediatric Integrative Medicine (PIM) trial	FoMD Pediatrics
Wakefield, Paige	Steinback, Craig D.	The influence of sympathetic nervous system activity on vascular function during pregnancy	Physical Education & Recreation
Wollin, Michael	Persad, Sujata	Structural and molecular changes of the esophageal wall of children with Eosinophilic Esophagitis	FoMD Pediatrics
Student redacted	Mason, Andrew	Metagenomic analysis of placental tissues to evaluate the influence of microbiome and human endogenous retrovirus expres	FoMD Gastroenterology
*Zhang, Amy	Scott, Shannon D.	Evaluating approaches to parent engagement in KT and child health research	Nursing

Supported by funding from the Maternal, Newborn, Child and Youth Strategic Clinical Network

Awardees

Ghazal Danesh

Supervisor: Dr. Eytan Wine
Project Title: Enhanced elimination of intestinal pathogens by macrophages through NLRP3 activation
Motivation: "I am interested in studying mammalian cells and bacteria and learning research techniques that are used to probe their interactions."
Career Aspirations: "This summer studentship has introduced me to gastroenterology, a specialization that I am considering after completing medical school."

"Inflammatory bowel diseases (IBDs) are lifetime debilitating intestinal disorders that affect up to 0.5 per cent of the Canadian pediatric population. The cause of IBD in adults and children is unknown, but links to environmental conditions, genetic variants, and microbial factors have been determined. A mutation in the gene for the nod-like receptor protein complex 3 (NLRP3) is associated with an increased susceptibility to Crohn's disease, a type of IBD. This protein is part of a family of protein complexes called inflammasomes. Inflammasomes recognize many different danger signals from pathogens to promote the secretion of proinflammatory cytokines, such as interleukin-1β (IL-1β), to fight infection. Inflammasome dysfunction has been linked to other inflammatory disorders such as rheumatoid arthritis, asthma, gout and type 2 diabetes. These disorders are associated with the overproduction of IL-1β, which contributes to chronic inflammation. Genetic variants linked to increased susceptibility to Crohn's disease, however, elicit a decrease in the expression of NLRP3, leading to the reduced production of IL-1β. Previous work in the Wine lab has shown that mice lacking the NLRP3 protein are more susceptible to infection with an intestinal pathogen and that the addition of IL-1β reverses this effect. Using this mouse model, we hypothesize that inflammasome activation is required for macrophages, a type of immune cell, to uptake and eliminate bacteria, in both mice and humans. To study this, both human and mouse macrophages will be infected with pathogenic and nonpathogenic bacteria, while exposed to known inflammasome activators and inhibitors, and their bacterial elimination will be quantified."

Suraj Sharma Domun

Supervisor: Dr. Hasan Uludag
Project Title: Cancer therapy by siRNA
Motivation: "As a chemical biomedical engineering coop student, I chose to undertake my clinical placement by joining Dr. Uludag's team. In helping them work towards their goals, I am gaining clinical experience. It was an opportunity for me to apply all the lab techniques engineers learn in academic courses."
Career Aspirations: "The four months I spent in the Uludag lab marked the beginning of my biomedical engineering career. This opportunity offered me the freedom to use my own imagination and ideas to design and setup my own experiment. This built my confidence that I can do research and proved my worth as a biomedical engineer."

"The research being done in the Uludag lab is very oriented towards treatment of cancer. The probable solution (siRNA treatment) being studied by the lab is of interest globally and is likely the future treatment for cancer. The lab is working to deliver siRNA to cancer cells. siRNA was discovered as a solution to suppress cancer cells, among other diseases. However, the major problem is delivery of the drug and its uptake by cancer cells. Being an engineering student, I studied the delivery part. I worked with a polymer called polyethylenimine (PEI) and its cholesterol and linoleic acid derivatives. Polymers bind to the siRNA molecules, carry and protect them. The siRNA binding efficiency of these polymers and their stability in serum were investigated using various biomedical techniques such as SYBR assays and electrophoresis.

I also studied the size and zeta potential of those complexes in collaboration with another student. I measured how easily these polymers can release the siRNA by dissociation away from the siRNA. This is an important part of the delivery mechanism. I also interacted with other research being done in the lab which looks at how to successfully transfect the cancer cells with the siRNA and learned about biological aspects of siRNA therapy.

Financial support is important for students to enter into the world of research. I am very thankful to WCHRI for considering my project worthy of investment, and I am grateful to the Uludag lab for providing me the platform for my clinical placement."

Elsa Kaley Donaldson

Supervisor: Dr. Sue Ross and Dr. Beate Sydora

Project Title: Menopause symptoms in women with inflammatory bowel diseases: A questionnaire survey

Motivation: "This project was very interesting because of its foundation in women's health and my desire to learn more about obstetrics and gynecology. I was also curious about how a chronic illness could affect women differently than men and how menopause and menstrual cycles could be affected by inflammation."

Career Aspirations: "I am beginning my second year of medical school and my experience with research this summer will be an invaluable tool in allowing me to better help my patients, no matter which field I choose to pursue, and it has prepared me to take on future research projects throughout my career. "

"Hormonal changes during menopause lead to a variety of physical and psychological symptoms including hot flashes, incontinence, sleep disturbances, depression, and mood swings. Symptoms can be influenced by medical treatment, diet and lifestyle options. Women with chronic illnesses, such as Inflammatory Bowel Diseases (IBD), may experience menopause symptoms in a different way than women without IBD, partly due to surgical and medical interferences. It is not known whether and how IBD and its treatment affects menopause; neither is it clear how hormonal changes during menopause effect the clinical presentation of IBD. The objective of this project was to study the interaction between menopause symptoms and clinical presentation of IBD. Women age 30 - 65 with IBD are recruited from the Zeidler IBD clinic and are surveyed regarding their experience and feelings of menopause symptoms and symptoms commonly associated with intestinal inflammation using validated questionnaires. Blood samples are collected from willing participants and levels of menopause-related hormones and inflammatory cytokines will be assessed and correlated with menopause stage and IBD activity. Knowledge gained from this study will support women with IBD in health choices when coping with hormonal changes and symptoms during menopause.

Recruiting patients in a clinic this summer gave me the opportunity to appreciate how differently individuals with a similar illness perceive their illness and symptoms. Being able to interact with each of the patients gave me insight into what women find most difficult about IBD and their ideas on what is unique to their experience with menopause. The patients' willingness to share personal information with me was extremely gratifying and allowed me to understand how much trust is given to health practitioners, researchers and the scientific community. This project challenged me to learn about topics I had no previous knowledge of and to take on tasks independently. It also gave me the chance to collaborate with both researchers and clinicians and offers me my first opportunity to present my research findings at local research days and conferences."

Annie (Sudi) Duan

Supervisor: Dr. Silvia Pagliardini

Project Title: Investigation of the role of REM-active pontine structures in the control of active expiration

Motivation: "This project will allow me to further my understanding of basic research and provide experience in conducting my own research project."

Career Aspirations: "I am looking into the possibility of graduate school within the field of neurophysiology."

"Breathing in mammals is most fragile during sleep, in particular during rapid eye movement (REM) sleep. Premature and full-term infants often present sleep-related breathing disorders (SBD) due to the immaturity of the respiratory system and the neuronal networks that control rhythmic respiratory muscle recruitment, resulting in irregular respiration during sleep. Breathing is usually interrupted by pauses (apneas) often associated with drop in oxygenation and potential life threatening events. The ability to maintain regular breathing or recover from these respiratory disturbances is fundamental for survival. Results from our laboratory suggest that recruitment of expiratory abdominal muscles during REM sleep is associated with improved ventilation and more regular breathing.

My project aimed to identify and characterize structures that influence the generation of expiratory activity in order to improve ventilation control in sleep disordered breathing.

I wish to investigate the respiratory network in mammals to further our understanding of sleep disordered breathing, which affects millions of lives, especially in premature babies. This research will contribute to our current knowledge of the issues surrounding sleep disordered breathing and may one day provide therapeutic treatments."

Hardeep Floora

Supervisor: Dr. Shokrollah Elahi
Project Title: Mapping the accumulation of CD71+ and T-Regulatory cells in BalbC mice pups
Motivation: "I am completing my degree in post-diploma medical laboratory science and have always been highly interested in the research laboratory."
Career Aspirations: "I am contemplating further education, PhD or master's, after my degree and wanted to get an experience of research and data analysis to determine if it was the right path for me."

"CD71 is a transferrin receptor highly present on immature red blood cells, also known as erythrocyte precursors, when the cells are also positive for another receptor, Ter119. CD71 is also present on any cells that are actively proliferating. These cells and receptors are highly elevated in fetal mice, newborn mice and pregnant mice and may play an immuno-suppressive role. The aim of the project was to determine if there was a correlation between the increase in CD71+/Ter119 cells in mice pups and the accumulation of T-regulatory cells. The cells increasing in parallel could propose that there is cross talk between the cells and that CD71+/Ter119 elevated in pregnant mice and newborns could help activate and proliferate T-regulatory cells, helping maintain pregnancy and establishment of the neonatal microbiome in the gut post-delivery.

My program (of study) required a research course in my last year. This experience not only provided insight into the research world, but it also helped me to complete my course requirements for graduation from my program. As a medical laboratory technologist, research experience is highly valuable as these skills are also applicable in the clinical laboratory. This experience may potentially help me in successfully getting a job."

Ryan Fung

Supervisor: Dr. David Eisenstat

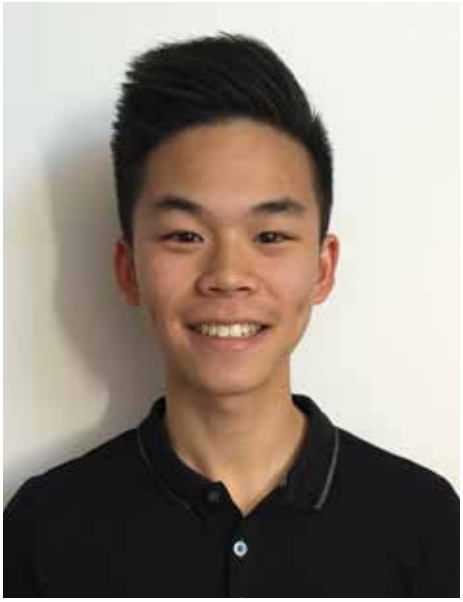
Project Title: DLX2 homeobox regulation of enteric nervous system development and role in Hirschsprung Disease

Motivation: "My primary motivation to participate in this research is to gain valuable experience in a biomedical research lab that will help me in my future endeavours and the fact that the project has the potential to offer a new insight into Hirschsprung's Disease that has such dire consequences for children is an added bonus."

Career Aspirations: "My career aspiration is to become a physician with a background in research. This opportunity has allowed me to see the research side of medicine so that in the future, I will be able to translate my research experience to become a more well-rounded physician."

"Hirschsprung's Disease is a congenital disease that affects one in 5000 live births with a male to female predominance of 4:1. This disease greatly affects a child's ability to move digested food along the gastrointestinal tract (GIT) and can cause bowel obstruction due to a lack of proper innervation of the enteric nervous system (i.e. the nerve supply to the bowels doesn't properly develop).

My research project examined the effect that the transcription factor DLX2 of the homeobox family has on the proper development of the enteric nervous system through the direct regulation of expression of the Ret proto-oncogene. DLX2 is primarily involved with the proper development of craniofacial structures, the forebrain, and the retina. On the other hand, Ret encodes a receptor tyrosine kinase that acts as a cell surface receptor and aids in the proliferation and differentiation of cells. Hirschsprung's Disease often results from a Ret loss of function or mutation that causes the intestinal tract to be partially lacking or devoid of innervation. No group has previously studied what transcription factor(s) regulate Ret gene expression.



To date, experiments done as a part of the research project, such as a chromatin immunoprecipitation (ChIP), has shown that DLX2 interacts with the promoter region of Ret in embryonic and adult intestinal cells while a electrophoretic mobility shift assay has shown that DLX2 and Ret are bound together as protein: DNA complexes in vitro. The DLX1/DLX2 double knockout mouse has fewer ganglion cells in the distal bowel consistent with a Hirschsprung Disease-like state.

My supervisor, Dr. Eisenstat, a pediatrician and WCHRI member, suggested that I apply for the Summer Studentship Program as I was in his lab last summer as a high school student and expressed interest in continuing the project this summer. I am extremely grateful for the opportunity that WCHRI and the Eisenstat lab gave me this summer to foster my research and interpersonal skills."

Dora Gyenes

Supervisor: Dr. Lisa Hornberger and Dr. Joseph Atallah

Project Title: Exploring the relationship between altered cerebral blood flow in utero and neurodevelopmental outcomes in children with Hypoplastic Left Heart Syndrome (HLHS), and evolution of the Fetal Atrioventricular (AV) interval from 6-40 weeks of gestation

Motivation: "I was motivated to take part in this research because of my fascination with fetal and pediatric cardiology. I had been exposed to cardiology and echocardiography previously, and I wanted to learn more. Over the course of this research, I learned about not only fetal echo, but also about a variety of fetal and neonatal cardiac pathologies, pediatric echo, cardiac surgery, ND assessments and much more."

Career Aspirations: "This research was something I was innately drawn to, and has subsequently reinforced my interest in pediatrics and cardiology and inspired me to want to learn more about the human heart and its abnormalities."

"I investigated how blood flow patterns in the middle cerebral artery (MCA) in the brain of unborn babies with underdeveloped left hearts correlated with neurodevelopmental (ND) outcomes at two years. Affected babies have little or no forward flow from their left hearts, largely relying on reversed flow through the aortic arch to provide blood to the brain. The brain tries to compensate for this lack of normal blood flow and oxygen by dilating its blood vessels, which increases the blood flow getting to the brain. This phenomenon called "brain-sparing" can be detected using the pulsatility index (PI) of the MCA Doppler profile, a measure that looks at how forcefully the blood is being pumped to the brain. Brain sparing is seen as a decrease in MCA PI and this has been previously demonstrated in many fetuses with HLHS. We hypothesized that the lower the MCA-PI before birth, the worse ND (cognitive, language, motor) outcomes would be as we suspected this would be found in those with the most abnormal circulation and thus a need to "brain spare." I measured MCI-PI and other parameters in a total of 49 fetuses with HLHS and found that a lower MCA PI before birth was associated with better cognitive outcomes at two years (p=-0.327). The results suggested fetal brain sparing may in fact be a protective response in HLHS, thus our original hypothesis was incorrect. We also found altered umbilical artery flow (high PI) suggesting abnormal placental function and usually associated with low oxygen levels, to correlate with worse cognitive outcomes.

I also looked at the changes that occur in the AV interval with gestation. The AV interval, also known as the "mechanical PR" is measured from simultaneously assessed left ventricular inflow and outflow Doppler blood flow patterns which can be examined by fetal echocardiography as the time between onset of atrial to onset of ventricular contraction. Other hemodynamic factors influence the mechanical PR interval measured before birth, but it is the only tool available to screen fetuses at risk for developing AV or heart block. I examined heart rate and the A-wave and AV interval duration and will shortly analyze these data with a statistician to report the changes in the interval and the factors that influence it.

We were thrilled to have had this research funded through this program, and I am grateful to have been given such an amazing learning opportunity."

Juan Fernando Hernandez

Supervisor: Dr. Rhonda J. Rosychuk

Project Title: Identifying geographic clusters of frequent pediatric presenters to Alberta emergency departments for self-harm

Motivation: "I wanted to apply my training as a statistician on a large data set, gain practical experience related to programing and data manipulation, and learn new statistical methods for data analysis in biostatistics."

Career Aspirations: "I plan to go to graduate school and keep learning new techniques in statistics. I am especially interested in classification problems and machine learning. This research position allowed me to work with a real data set and it pushed to think critically about my results, which are valuable experiences that not every undergraduate student has."

"My research project focused on disease surveillance for self-harm to identify trends over geography and time for emergency mental health care use during 2002 to 2011. Using Alberta administrative data on children and youth (age 10 to 17 years), we described important features associated with emergency department (ED) visits for self-harm including type of injury and severity. Using statistical cluster detection methods, we identified geographic areas and time periods with higher emergency health service usage than expected. We focused our attention on "frequent users" who are children and youth with at least one self-harm ED presentation and at least one additional mental health ED presentations (for self-harm or other mental health conditions) within a 12-month period of time.

The results of our work can have provincial impact by targeting areas of the province where mental health services need to be strengthened. Addressing the mental health care provided in the ED is an important step, since it is often the first place of contact between youth, their families and the mental health system."

Rachel Joffe

Supervisor: Dr. Jon Duff and Dr. Gonzalo Garcia Guerra

Project Title: The reliability of invasive and non-invasive blood pressure measurements in unstable critically ill children

Motivation: "My primary motivation to participate in this research was to gain experience in a healthcare setting and in patient interaction, and to learn about the research process to assist me in making an informed career decision."

Career Aspirations: "My career aspiration is to be a doctor, so this experience taught me a great deal about the health-care environment and gave me valuable exposure to clinical research."

"This project was a prospective observational study examining the accuracy of both invasive arterial line and non-invasive manual cuff blood pressure measurements. The dynamic performance of the arterial line was analyzed to determine how often invasive blood pressure measurements are over- or under-damped (as opposed to optimally damped), and therefore under or overestimating blood pressure, respectively. Additionally, non-invasive and invasive measurements were compared to establish how well they correlate, and potential pre-specified predictors of the correlation were recorded.

During data collection, after receiving signed informed consent as required by the Health Research Ethics Board, basic demographic information was collected to determine if health, personal, or care factors predict inaccuracies. The arterial lines were flushed and the resulting waveforms were analyzed to calculate the damping of the system. Finally, invasive and non-invasive blood pressures were recorded simultaneously. All of this was done with critically ill children in the PICU. We were attempting to replicate similar studies done in adults to see if the incidence of damping is comparable in unstable children. Furthermore, we hope that this research will improve diagnosis and treatment by informing clinicians about the accuracy and possible errors of blood pressure measurements. Accurate blood pressure is an important vital sign for directing management of critically ill children."

Alexis Katzell

Supervisor: Dr. Greg Funk
Project Title: Mechanisms underlying the ATP-mediated excitation of breathing
Motivation: "I was motivated by an interest in understanding and gaining hands-on experience with the scientific method and the process through which advances in biomedical science and medicine arise."
Career Aspirations: "I intend to apply to medical school when I complete my BSc and the summer research experience was very important in helping me evaluate whether I want to focus on medicine or continue in research as a clinician scientist."

"My summer research project explored how the brain controls breathing responses to periods of low oxygen, or hypoxia, during early development. The activity of the network in the brain that generates breathing is controlled via homeostatic reflexes that maintain blood oxygen (O2) and carbon dioxide (CO2) at constant levels.

During hypoxia, an initial increase in ventilation is followed by a secondary depression that varies in magnitude with age. The depression is relatively small in adults such that breathing remains elevated throughout exposure to hypoxia. However, in premature infants, the depression is much greater and breathing actually falls below baseline. Due to immature breathing networks, premature infants experience frequent periods when breathing stops (apnea of prematurity), which causes hypoxia. Thus, a life threatening positive feedback loop can develop in which apnea leads to hypoxia, a further depression of breathing and greater hypoxia. For this reason, many premature infants are given a respiratory stimulant to minimize these apneas. The stimulant of choice is caffeine. It is very effective, but ~20 per cent of infants do not respond or have negative responses to caffeine, highlighting the need for alternate treatments. Recent work has demonstrated that during hypoxia ATP is released in the region of the brain that generates rhythm (the preBötzinger Complex) and that this ATP binds to a specific receptor, the P2Y1 receptor, to increase breathing and reduce the magnitude of the secondary respiratory depression.

The objective of my research project was to identify the ion channels upon which the P2Y1 receptors act in the preBötC to stimulate breathing. The hope is that understanding the signaling systems through which P2Y1 receptors stimulate breathing will identify novel therapeutic targets that might be manipulated to counteract the depressant actions of hypoxia on breathing during perinatal development.

I first became involved in research in the summer following my first year of university. This support from WCHRI allowed me to expand my research experience and better evaluate my career objectives."

Brendon Lamarche

Supervisor: Dr. Lori J West

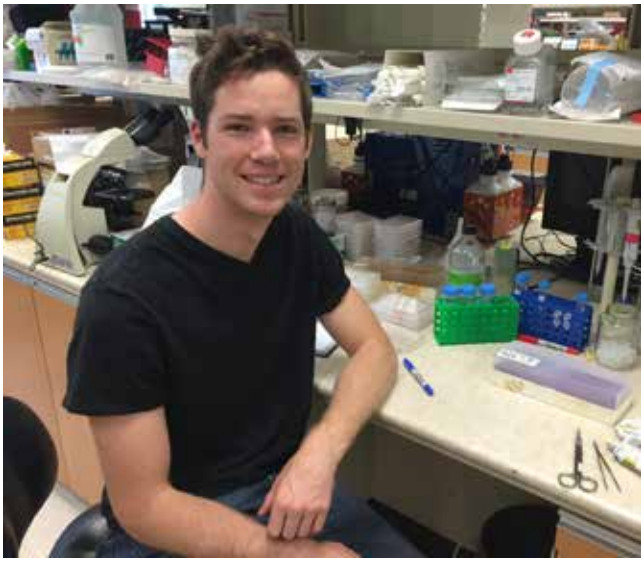
Project Title: Assessment of neonatal tolerance to blood group A-antigen in a novel model of ABO-mismatched transplantation

Motivation: "My goal is to become a cardiovascular surgeon and undertake research to help decrease the mortality rate of cardiovascular heart transplant recipients and increase their quality of life."

Career Aspirations: "My summer project is a perfect fit to my career goals which include undertaking cardiovascular and transplant-related research."

"The goal of my project was to help understand how infants become tolerant to foreign ABO blood group antigens following ABO-mismatched heart transplantation. Infants have the highest waiting list mortality rates for heart transplantation. Dr. West introduced crossing the ABO blood group barrier in infants to reduce the wait-list time of infants needing a heart transplant. The immaturity of the infant immune system results in excellent long-term outcomes following ABO-mismatched heart transplantation. For my project, we measured donor ABO-specific antibodies and assessed rejection of ABO-mismatched hearts following neonatal exposure to the ABO-mismatched antigen.

My project was supported by WCHRI and Alberta Innovates Health Solutions (AIHS) summer studentships."



Isabel Joanna Light

Supervisor: Dr. Carmen Rasmussen

Project Title: Screening for Fetal Alcohol Spectrum Disorder (FASD): The Neurobehavioral Screening Tool and neuropsychological correlates

Motivation: "I became interested in improving outcomes and better supporting kids with FASD while working in a community setting. This project allowed me to integrate my passion for psychology, statistics and psychometrics with the hopes of being able to promote early diagnosis and improved outcomes for children with FASD."

Career Aspirations: "This summer research complemented my education and career goals in several ways. First, I am completing my honors thesis in Dr. Rasmussen's lab on adverse childhood experiences in children with FASD. Having the chance to spend a whole summer learning even more about children with FASD and developing my research skills contributed hugely to my understanding of FASD and motivated me further to excel in my honours program. Secondly, having the chance to work on screening tools and learning about the importance of screening has sparked my interest in pursuing graduate studies in public health. In doing so, I hope to further research prevention, screening and intervention for children with FASD, and the impact of adverse childhood experiences on mental and physical health across the lifespan."

"The goal of this project was to further research the Neurobehavioral Screening Tool (NST), a 10-item behavioural questionnaire designed to screen for the neurobehavioral phenotype of Fetal Alcohol Spectrum Disorder (FASD). Previous research has demonstrated that the NST has excellent specificity and good sensitivity. However, all studies have used a retrospective design. This study was the first to administer the NST prior to an FASD assessment, the context in which the NST was designed. Furthermore, we examined whether the scores on the NST, a subjective parent report of problem behaviors, are related to objective measures of neuropsychological functioning. Doing so will not only provide convergent validity of the NST, but could also help us understand what cognitive deficits are related to problem behaviors in children with FASD, which would be an important finding for intervention programs."

Nayef Maarouf

Supervisor: Dr. Andrew Simmonds and Dr. Richard Rachubinski
Project Title: Modeling peroxisome disorders in Drosophila melanogaster
Motivation: "I have wanted to be part of a research project for a long time and I was very excited to have been given this opportunity. My motivation to participate in research stems from a general scientific curiosity (and how things work)."
Career Aspirations: "During this coming school year I will be heading to Toronto to continue my education in the Faculty of Dentistry at the University of Toronto. Whether it is during the summers or taking courses that allow me to do research, I always hope to be part of projects such as this one. There is always so much to learn and each question in science generally leads to (even) more questions."

"Peroxisome Biogenesis Disorders are caused by a compromised assembly of the peroxisome often resulting in severe symptoms in metabolism in early child development. Our project investigated Pex3 and Pex19, proteins known to be involved in peroxisome biogenesis, expression through studying the promoters themselves. During the summer we created vectors that contain the Pex3 and Pex19 promoters and studied the effect of different treatments of fatty acids and hydrogen peroxide in cells that contain these vectors.

Through this project I gained a lot of knowledge about how the cell works and more specifically how the peroxisome organelle functions in the cell. I applied for this summer studentship specifically because of a combination of the new cell biology techniques that I was taught, as well as being able to use my background in biochemistry for actual research. I was able to learn a lot of new procedures while being able to utilize and apply what I learned from class.

I would like to thank the Women and Children's Health Research Institute for providing me with the funding to be able to participate in a great research project and learn much more than I could have imagined."

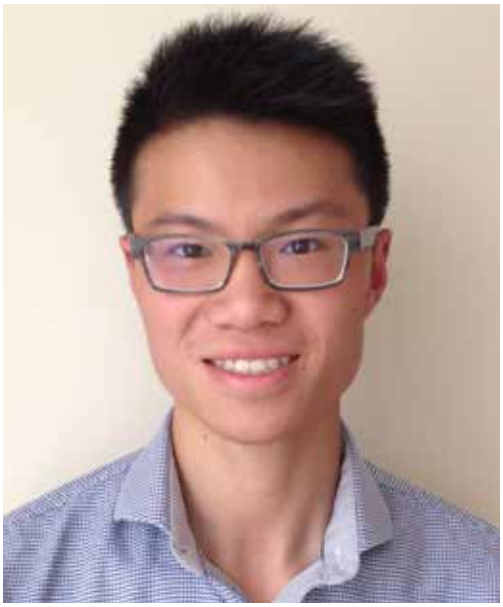
Darryl Mah

Supervisor: Dr. Jason Dyck

Project Title: Metformin protects against doxorubicin-induced cardiomyopathy

Motivation: "I was particularly interested in cardiovascular physiology and energy metabolism, which led me to contact Dr. Jason Dyck, who is one of the leading experts in both of these fields. In addition to learning a variety of molecular and cardiovascular techniques, this opportunity allowed me to branch out into oncology. This unexpected opportunity exposed me to basic research on the two major causes of mortality in the Western world. The experience has broadened my understanding of research in the health sciences and has provided me with a strong appreciation for research and scientific discovery."

Career Aspirations: "My hopes are to use the skills that I have learned this summer to continue to do research in the pharmacology field as a clinical scientist. In addition to the laboratory skills I have gained, I now have a much more thorough understanding of the research process, including experimental design, troubleshooting and the communication of results. These skills will not only strengthen my own research program, but will also help me in my clinical practice by providing me with an in-depth understanding of how basic science improves the lives of patients."



"Over the past 40 years, advancements in diagnosis and treatment of cancers have increased survival rates of children diagnosed with cancer by 23 per cent. Despite increased survival, children are more susceptible to developing several late occurring toxic side effects from anti-cancer treatments, such as doxorubicin. Although doxorubicin is effective at treating several childhood cancers, young patients who receive even low doses often go on to develop heart disease later in life. Initially damage to the heart caused by doxorubicin goes unrecognized but it can eventually develop into heart disease as the children get older. The exact reasons for delayed damage to the heart caused by doxorubicin and the best approach to prevent it in childhood cancer survivors are not fully understood. Since there is no relevant experimental model, there is a lack of understanding of how damage to the heart by doxorubicin occurs in children and why children develop several late occurring adverse health effects following their anti-cancer treatment. This research proposal aimed to develop a clinically relevant experimental model of doxorubicin-induced heart injury in children, investigate the mechanisms responsible for this delayed cardiac injury and identify a potential therapy to prevent or treat this cardiac injury."

Amanda (Mandi) Paton

Supervisor: Dr. Dawn Kingston

Project Title: Development and evaluation of an online, interactive education program for perinatal mental health screening and care

Motivation: "I was motived to participate in this research because it combines my interests in both obstetrics and mental health."

Career Aspirations: "I will be going into my final year of undergraduate nursing this fall and hope to be working as an RN with perinatal women and/or newborns after graduation. Long-term, I would like to return to school and become a nurse practitioner. This work has given me the unique opportunity to influence practice before becoming an independent clinician, as well as knowledge that I will be able to integrate into my daily practice."

"This project involved the development of an education program for health-care providers that is focused on screening and assessment for perinatal mental health disorders. The goals of this research are to (1) understand the areas of perinatal mental health where education is needed, and (2) create a comprehensive online education program to address those needs. To meet these goals, I will (1) conduct data analysis on a needs assessment survey to identify areas of educational needs for health-care providers, (2) conduct a comprehensive literature search on best practice in perinatal mental health screening and assessment, and (3) write an education module in collaboration with Dr. Kingston and partners in Alberta Health Services (AHS) /Alberta Perinatal Services that address health-care providers' needs and conform to best practice."

Winnona Rea

Supervisor: Dr. Khalid Aziz

Project Title: Developing and implementing a sentinel event reporting system for quality improvement in neonatal intensive care

Motivation: "My primary motivation to participate in this research project was essentially the aspect of being able to apply the research knowledge and skills that I have learned towards helping others."

Career Aspirations: "In the future, I would love to continue this research path as there are still many questions that I would love to find the answers to. I aspire to obtain a master's degree in rehabilitation medicine and to continue clinical research in order to help improve the quality of health care and to help a broader range of individuals."

"Every year, out of the 1400 babies admitted to the neonatal intensive care unit (NICU) at the Royal Alexandra Hospital (RAH), approximately 120 babies are extremely preterm and born at less than 29 weeks of gestational age. Over half of these extremely preterm babies develop serious complications such as brain injury or a threat to vision (retinopathy of prematurity or ROP). These serious complications lead to either death or injury. Approximately 30 per cent of these babies have brain lesions on ultrasound and 20 per cent develop ROP. Some of these serious complications and their precursors, known "sentinel events", are preventable. In our study, the PARiHS framework was used as a foundation for our quality improvement intervention. The PARiHS framework focuses on three domains: evidence, context and facilitation. In practice, these domains equate to: data, teamwork and implementation. Using these quality improvement domains, our research goals were to collect data, review findings as a team and implement change with the long-term goal of reducing sentinel events.

This research gave me an opportunity to potentially help reduce the number of sentinel events at the NICU and to save lives of preterm babies. Most importantly, it also gave me a chance to be a part of and to work with a team of health-care professionals to improve the quality of care that every patient deserves. I would love to travel and learn about new clinical interventions, as well as to share the knowledge that I have acquired throughout this experience and hopefully other research opportunities in the future.

Ultimately, this research project exposed me to many different research methodologies and has given me an optimistic view towards health-care careers and research. I was honoured and blessed to be a part of such a wonderful learning environment, surrounded by respected, knowledgeable and inspiring individuals."

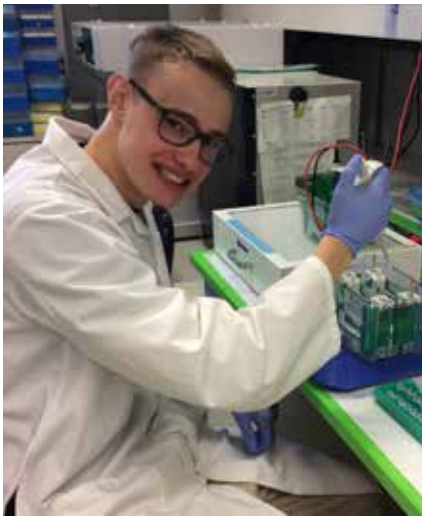
Andrej Roczkowsky

Supervisor: Dr. Richard Schulz

Project Title: The role of intracellular matrix metalloproteinase-2 in doxorubicin-induced cardiotoxicity

Motivation: "I am entering my final year of the BSc specialization in pharmacology program and I wanted to gain some hands-on experience in research. Cardiovascular pharmacology has always been an interest of mine to pursue and I wanted to contribute to the field from a basic and clinical science perspective."

Career Aspirations: "This summer was my first hands-on experience working in a research lab. I have learned many fundamental techniques and improved my critical thinking skills as a scientist. Working alongside world leaders in our research has made me realize the impact of our work on medicine and has inspired me to pursue a career in research."



"Doxorubicin is a commonly prescribed anti-cancer drug used to treat many cancers in women and children. Although doxorubicin is highly effective in treating cancer, many develop heart failure within months or years after completing treatment. Consequently, there is great interest in understanding how doxorubicin affects the heart. To date, doxorubicin is known to stimulate oxidative stress and activate an enzyme called matrix metalloproteinase-2 (MMP-2) in the heart. MMP-2 cuts several important proteins in heart muscle cells that regulate the heart's ability to pump blood. We hypothesize that doxorubicin causes heart injury by activating MMP-2 in heart muscle cells. To test this, we treated heart muscle cells with doxorubicin and drugs which block MMP-2 activity. From this knowledge, we can determine whether drugs that block MMP-2 activity can prevent doxorubicin-associated heart failure. My research will help develop new drugs that prevent heart failure and improve the therapeutic outcome in patients taking doxorubicin. This would eliminate one serious, long-term complication in anti-cancer therapy."

Stewart Rowe

Supervisor: Dr. Sandra Davidge
Project Title: LOX-1 mediated endothelial dysfunction in preeclampsia
Motivation: "Primarily I became interested in research after my first year at the University of Alberta. Motivation for research came from professors, mentors and students further into their undergraduate programs who recommended research as a rewarding and interesting summer job that has relevance to the material being learned throughout an undergraduate degree."
Career Aspirations: "As I am leaning towards a career in medicine, this research experience has been invaluable as I have acquired useful scientific skills."

"Preeclampsia (PE) is a common pregnancy disorder that affects between 2-8 per cent of pregnant women and is diagnosed by the development of high blood pressure and kidney damage after 20 weeks of gestation. It often leads to early delivery of the fetus and can be life-threatening to the mothers. Even though the disorder remains poorly understood, it has been suggested that the placenta develops abnormally and sheds certain factors that circulate through the body. There is considerable evidence to suggest that these factors may then cause reduced blood vessel function and contribute to the condition. Our lab recently made the exciting discovery of a new pathway involving a specific cellular receptor, called LOX-1, on the surface of the blood vessels of women with PE. Many molecules that can bind to this receptor have been described, but interesting new candidates are the syncytiotrophoblast-derived microparticles (STBMs). STBMs are one of the many factors released from the placenta into the mother's bloodstream during pregnancy and their numbers are higher in PE. It is our belief that these STBMs could activate LOX-1 on the cells lining the inside of vessels called endothelial cells. My project aimed to study the possible activation of LOX-1 by STBMs through the treatment and analysis of isolated endothelial cells. The results of the STBMs stimulations were quantified using fluorescent staining and molecular techniques to determine the presence of damaging molecules and proteins related to LOX-1 activation. So far, we found that STBMs were able to activate the endothelial cells, and that this may in part be via LOX-1, but there also seem to be other pathways activated. This research will increase our understanding of the development of PE in order to develop new therapeutic strategies in the future."

Alina Carly Rumley

Supervisor: Dr. Emmanuelle Cordat
Project Title: The role of kidney chloride/ bicarbonate exchangers and the body's acid-base balance
Motivation: "I worked as a laboratory technician in this kidney physiology lab for 1.5 years before starting medical school. After learning renal clinical tests and renal physiology in my first year (of medical school), I wanted to go back to this lab to apply and expand my knowledge."
Career Aspirations: "I am not yet certain what kind of doctor I want to be, but I know that I would be eager to conduct clinical research as a part of my future medical career."

"The kidney has an important role in maintaining blood volume, electrolyte, and acid-base balance. The kidneys filter blood and remove metabolic waste products from the body via urine. Specifically, proteins that exchange chloride and bicarbonate in the nephron of the kidney work with other transporters to help maintain electrolyte balance of the body. Having an electrolyte imbalance can lead to many negative symptoms such as muscle stiffness or heart arrhythmias. The Cordat lab works on two chloride/ bicarbonate exchangers, SLC26A7 and SLC4A1 (kAE1). One protein, SLC26A7, has also been shown to function as a chloride channel or as a bicarbonate exchanger. My summer project aimed to clarify the role of SLC26A7 in kidney cells: as an exchanger or chloride channel, and to determine why SLC26A7 is unable to compensate for the absence of kAE1. The absence of kAE1 leads to distal renal tubular acidosis (dRTA), which is characterized by an inability to acidify the urine, urinary stone formation, bone demineralization, and possible renal failure. The project I worked on tested the expression level, localization and function of SLC26A7 in renal cells, or cells either expressing kAE1 or a dRTA mutant kAE1. These proteins are important in a person's health as they contribute towards maintaining chloride homeostasis, blood pressure and acid-base balance."

Michael Schlegelmilch

Supervisor: Dr. Sunita Vohra

Project Title: Pain, nausea, vomiting and anxiety (PNVA) in pediatric inpatients and the predictive capacity of these symptom scores on parental satisfaction

Motivation: "Having the opportunity to work on a clinical trial that is investigating such a current topic (complementary and alternative medicine) is exciting, but also highly relevant to my future career."

Career Aspirations: "This opportunity aligns with my pursuit of a career in pediatric medicine, perhaps with an academic focus."

"My project looked at pediatric PNVA prevalence in three admitting departments at the Stollery Children's Hospital; oncology, general pediatric medicine and cardiology. We were interested in knowing how many patients suffer from these symptoms, and if there are any predisposing factors that influence how a patient feels while they are in hospital.

I also set out to compare PNVA, parent satisfaction and length of stay between patients in oncology, receiving usual care and those in oncology whose care is supplemented with complementary and alternative medicine interventions such as massage therapy, acupuncture and reiki.

More and more families are investigating complementary medicines and it bodes well, professionally, to 'complement' my traditional bio-medical education with research on such areas of health and healing."

Paige Wakefield

Supervisor: Dr. Craig Steinback & Dr. Margie Davenport

Project Title: The influence of sympathetic nervous system activity on vascular function during pregnancy

Motivation: "I found out about this opportunity while I was completing my practicum in the Program for Pregnancy and Postpartum Health Lab. My supervisor and I worked together to determine which project best fit my interests and we applied for several studentship grants."

Career Aspirations: "I hope to complete a master's degree and I see myself eventually working in health care applying the knowledge that I've gained through my research experience."

"Little is known about blood pressure regulation during pregnancy. We know that blood pressure normally tends to decrease during healthy pregnancy. However, in some women, blood pressure increases during pregnancy. High blood pressure during pregnancy can be detrimental to the health of the mother and fetus. The mechanisms that differentiate a normal drop in blood pressure in some women, but which cause high blood pressure in others are not well understood.

Our research looks at how the nervous system controls blood pressure during pregnancy. Elevated nervous system activity occurs in normal pregnancy, but does not cause elevated blood pressure. My project was part of a large study trying to identify the various mechanisms that differentiate a normal drop in blood pressure in some women versus the development of high blood pressure in others during pregnancy.

I studied pregnant women with normal (decreased or maintained) blood pressure. We used a mild stress (placing the hand in an ice bath) to increase the activity of the nervous system. I then looked at how the change in nervous system activity relates to blood pressure and other measures of blood vessel function. Understanding these normal mechanism(s) may lead to the identification of specific causes of high blood pressure in some pregnant women and novel preventative strategies to improve pregnancy outcomes and mitigate chronic disease risk."

Michael Wollin

Supervisor: Dr. Sujata Persad

Project Title: Structural and molecular changes of the esophageal wall of children with eosinophilic esophagitis

Motivation: "As scientists, we are always trying to make sense of the world around us, constantly asking 'Why are things the way they are?' As a researcher, one is in the forefront of addressing these questions and discovering their answers. The endeavour of finding answers to these unknowns is what got me interested in research, to take part in the chase and get some hands-on experience through the guidance of other researchers. Many professors in the Faculty of Medicine and Dentistry stress the value of undergraduate research and getting involved in a field you are passionate about. This inspired me to seek a research project that coincides with my passion for pediatrics and interest in sciences, to find meaning and applicable discoveries that will work toward the betterment of children's health."

Career Aspirations: "I would like to become a pediatrician."

"Eosinophilic esophagitis (EoE) is a disease characterized by inflammation and eosinophilic infiltrate of the esophagus of unknown etiology that appears to be increasing in prevalence in children of all ages. The symptoms of EoE in children are dysphagia (difficulty in eating), failure to thrive, poor growth and food aversion. Current treatments of EoE include dietary elimination of food allergens or treatment with corticosteroids. Dietary elimination and steroid treatments are effective in inducing partial or full remission in most patients; however both treatment regimens have their drawbacks. Many children are unable to adhere to an elimination diet for prolonged periods, while others suffer from intolerable adverse side effects from steroid treatment. Furthermore, patients experience recurrence of symptoms when steroid treatment is stopped. These factors make it problematic to maintain remission. Epithelial damage is known to contribute significantly to the pathogenesis of allergic disorders such as asthma, by inducing injury of the barrier function and changes in permeability of the mucosa. The objective of this study was to determine the integrity of the esophageal epithelia in pediatric EoE patients compared to normal esophagus. Our hope is that understanding the putative underlying mechanism of EoE will assist the design of potential therapeutic options in the future.

The summer studentship experience provided me with an excellent foothold in beginning to understand how scientific research is carried out and an appreciation for the complexity of human physiology."

Student redacted

Supervisor:
Project Title:
Motivation:

Career Aspirations:

Amy Zhang

Supervisor: Dr. Shannon Scott
Project Title: Evaluating aproaches to parent engagement in knowledge translation and child health
Motivation: "Working with children has always been an area that has interested me and my clinical experiences as a student nurse have always stressed the importance of implementing best practice. Therefore this opportunity to work with the pediatric population and examine the issue of utilizing best practice was a valuable opportunity."
Career Aspirations: "In the future I hope to work with children as a pediatric nurse, while continuing onto graduate studies and pursuing a career in research."

"Translating Emergency Knowledge for Kids (TREKK) focuses on knowledge translation in children's emergency care by bridging the gap between best practice and clinical practice implemented in health-care settings. The movement in pediatrics towards more patient and family engagement is critical to the improvement of pediatric health care, where often first and lasting impressions of health services are made for patients. The British Medical Journal proposes that health care quality can improve when patients and their families are able to actively participate in their own care. TREKK currently extends across 37 general emergency departments in Canada, including nine provinces and one territory. This Pan-Canadian initiative aims to improve health care quality through encouraging patients and their families to play a more active role in health care decision-making. However, this process is often challenging, as handouts are not always the most effective tools in portraying complex health information. Therefore it is important to provide families with innovative knowledge translation tools, created by working with children and their families. Hence parent engagement in research is crucial. To move towards greater involvement to improve care provided in pediatric emergency departments warrants the need for more evaluation and understanding of the most effective approaches of engaging parents in research."

WCHRI would like to thank all the participants, supervisors, mentors and community partners who participated in this year's program!

To find out more about the Summer Studentship program, please visit the WCHRI website at http://wchri.srv.ualberta.ca/summerStudentGrants.

www.WCHRI.org