



# Brock Science Mentorship Symposium February 1, 2020

*Thank you to the many teachers, mentors, and students who dedicate countless hours to this program. Also, thank you to Recruitment & Liaison Services, Brock University Students' Union, Parking Services, A-Z Learning Services, the James A. Gibson Library, and the Faculty of Math and Science for their generous support of the Mentorship Program without whom this Symposium would not be possible!*

Building a cheap homemade O<sub>2</sub>/CO<sub>2</sub> incubator for growing human cells*Philip Samokhin - Sir Winston Churchill Secondary School*

Research conducted under the supervision of Dr. Jeff Stuart, Department of Biological Sciences.

A CO<sub>2</sub> incubator is a very important piece of lab equipment for researchers studying mammalian cells in cultures. The incubator maintains physiological CO<sub>2</sub> levels that optimize cell viability and growth. However, CO<sub>2</sub> incubators are very expensive and represent a significant obstacle for laboratories interested in doing cell biology research, especially in developing nations. In addition, virtually no laboratories are currently regulating O<sub>2</sub> at physiological levels, despite the fact that not doing so has major consequences for cell biology. Given these two limitations in cell biology research, my goal here was to design and build an incubator capable of regulating temperature, O<sub>2</sub>, and CO<sub>2</sub> at normal physiological levels. To do this, materials were individually sourced, including an egg incubator, O<sub>2</sub> and CO<sub>2</sub> sensors, and solenoids for regulating gas flow into the incubator. Working with Mike De Lange in the electronics shop at Brock University, I helped to design and build a circuit board capable of processing data and controlling the solenoid valves. This research is ongoing as the performance of the incubator is currently being tested. Initial results indicated that there were undesired temperature fluctuations throughout the incubator, so two computer fans were purchased to assist with air circulation. Testing of O<sub>2</sub> and CO<sub>2</sub> performance is undergoing and results are expected by the end of January. If the incubator passes testing, we will have succeeded in building an incubator capable of regulating O<sub>2</sub> and CO<sub>2</sub> for ~\$500, which is more than 20-times less than a commercial version would cost. The intent is to publish this project and post all materials on GitHub so that researchers around the world can build their own ultra low-cost incubators for cell biology. Hopefully, this will inspire everyone to find creative alternatives to expensive equipment.

## Exploring the Diversity of Wild Bee Species in the Niagara Region

*Ava Naphin - Denis Morris Catholic High School*

Research conducted under the supervision of Dr. Miriam Richards, Department of Biological Sciences.

Bees play a vital role in the basic functioning of all global ecosystems. There are over 20 000 species of bees in the world, and each pollinates a unique range of plants with the purpose of stimulating growth. In the Niagara region, there are estimated to be 165 bee species, almost all of which are unknown to the average citizen; therefore, it is crucial to promote knowledge of bee diversity to grow populations. To examine phenological differences, microscopy techniques were used to catalogue 28 garden-common bee species from twelve genera. Additional research was also conducted on the specific social, behavioral, and phylogenetic characteristics of each genus and respective family. These attributes were observed and noted for the creation of an online identification guide and made accessible to the general public. The photographic results of the study are designed to guide the residents of Niagara in cultivating plants that will attract and grow local bee populations in order to develop natural biodiversity in the region.

## Ecofriendly Transformation of Waste Biomass to Biofuels

*Pranav Parakh - A.N. Myer Secondary School*

Research conducted under the supervision of Dr. Janusz Kozinski, Office of the President.

The importance of alternative fuel sources is escalating as our environment, ecosystems, natural resources, and climate are being compromised by the excessive consumption of fossil fuels. As the population and energy demands continue to increase, biofuels produced from lignocellulosic biomass and organic wastes provide a potential alternative towards a low-carbon economy. In this study, the candidacy of pressed grapes obtained from local wineries in the Niagara region was determined to produce biofuels. The pressed grapes were analyzed and compared with other lignocellulosic biomass samples using Fourier Transform Infrared (FTIR) spectroscopy, thermogravimetric (TGA) analysis, and Carbon-Hydrogen-Nitrogen-Sulfur (CHNS) analysis for determining their organic chemistry, energy density (thermal stability) and elemental composition, respectively. The pressed grapes were found to have a lower calorific value when compared to other lignocellulosic feedstocks like canola meal and pinecone because of their high moisture and oxygen content. It was also found that the pressed grapes had an uncharacteristically higher concentration of sulfur when compared to canola meal and pinecone. This is because sulfur is used in the wine-making process to prevent oxidation and bacteria growth. Lignocellulosic biomass (including pressed grape) is composed primarily of cellulose, hemicellulose, and lignin, which are all high-energy structural components. To convert lignocellulosic biomass to biofuels, thermochemical (pyrolysis, torrefaction, gasification, liquefaction), hydrothermal (supercritical and subcritical water gasification and hydrothermal liquefaction), and biological (fermentation and anaerobic digestion) conversion pathways are used. These conversion technologies produce primary biofuels products like bio-oils, biochar, syngas, biohydrogen, biomethane, bio-ethanol, and bio-butanol that can be used to replace hydrocarbon-based fuels. It was concluded that a hydrothermal conversion technology would be effective for the pressed grapes because of their high moisture content. The study concluded that biomass-based fuels could provide an alternative to fossil fuels and have the potential to create a more sustainable and brighter future.

*The Paradoxical Wonders of Cold Induced Vasodilation**Grant Booth - Saint Paul Catholic High School*

Research conducted under the supervision of Dr. Stephen Cheung, Department of Kinesiology.

Cold-induced vasodilation (CIVD) is a topic which is studied extensively, yet the scientific community is still unable to come to a sound conclusion as to why it occurs. It is thought that the CIVD response may be due to a number of factors, including the Hunting Response and Sympathetic Withdrawal, both of which are due to the need for homeostasis within the body. CIVD is triggered by a dramatic drop in skin temperature, and only takes place in hairless skin, such as the hands, toes, ears and face. Participants put their hand in a tank of 7 °C - 9 °C water, and are then monitored using thermocouples and laser-Doppler probes. Through this data collection method, the effect of cold exposure on the skin blood flow and ultimately CIVD can be monitored. A secondary double blind test is performed before the primary test of CIVD on the body, the participant is given either nitrate-rich beetroot juice or a nitrate-free placebo. This allows the effect of exogenous nitrate, and subsequently nitric oxide, on the CIVD response to be monitored and tested. Currently testing is still in the data collection phase, however, it will be interesting to see what conclusions the results lead to.

Examining the Effects of Octopamine as a Neurotransmitter and Co-transmitter in the *Drosophila* Nervous System*Kiran Hazra - Eden High School*

Research conducted under the supervision of Dr. Joffre Mercier, Department of Biological Sciences.

Chemicals called neurotransmitters play a fundamental role in the nervous systems of nearly all animals. Released from the axon of a neuron, they act as signalling molecules and will bind to receptors on other neurons, or on muscle cells. This process is called neurotransmission, and is the primary way that signals are passed from neurons to target cells. In many cases, another chemical called a co-transmitter is released along with the neurotransmitter (primary transmitter) in order to modify the neurotransmitter's effects. My research involves octopamine, which is believed to act as a co-transmitter in a wide variety of species that modifies the effects of glutamate, a neurotransmitter responsible for depolarizing muscle cells and causing them to contract. This research examines whether high concentrations octopamine can induce contractions on its own, as previously believed. By measuring the intensity of the contraction when octopamine is introduced to *Drosophila* larva body wall muscles in a saline bath, it was found that octopamine on its own did not induce contractions at concentrations of  $1.0 \times 10^{-4}$  mol/L. This seems to indicate that octopamine does not serve to induce muscle contractions, as concentrations greater than  $1.0 \times 10^{-4}$  mol/L are not physiological. Research on the effects of octopamine as a co-transmitter is in progress, with results pending further data.

## The Use of Rosemary Extract to Prevent Free Fatty Acid-Induced Muscle Cell Insulin Resistance

*Maggie Wan - Sir Winston Churchill Secondary School*

Research conducted under the supervision of Dr. Litsa Tsiani, Department of Health Sciences.

In recent years, a condition known as insulin resistance, caused by impaired insulin action, has increased in prevalence worldwide. Insulin resistance can lead to type two diabetes mellitus (T2DM), resulting in impaired glucose and lipid homeostasis. Obesity and elevated serum free fatty acid levels, such as palmitate, have been linked to the development of insulin resistance. Historically, insulin resistance and T2DM are treated with pharmaceuticals, such as Metformin, however, many have serious side effects and can lead to long term adverse complications. In the search for alternatives and to better understand the intrinsic insulin signaling pathways involved, there has been an increased interest in using plant-based compounds/polyphenols. These polyphenols have attracted attention due to their anticancer, antioxidant, anti-inflammatory, and antidiabetic properties. The purpose of this study is to determine the effects of rosemary extract polyphenolic compounds (carnosic (CA) and rosmarinic acid (RA)) on free fatty acid-induced insulin resistant muscle cells. L6 rat muscle cells treated with palmitate will be used as a model of insulin resistance and treated with CA or RA. Analysis of the samples involved the use of a variety of biological techniques such as western blotting, cell culturing, and protein quantification. The data suggests that rosemary extract increased insulin-stimulated glucose uptake. The effects of palmitate are counteracted by rosemary extract treatment with increased insulin-stimulated insulin signaling and reduced kinase protein levels. Further studies should be performed on the efficiency of polyphenols and to elucidate the effects of polyphenol combination treatments. Overall, rosemary extract has great potential to treat insulin resistance and type two diabetes mellitus.

## Effects of Social Instability Stress on Reward Preference in Long-Evans Rats

*Arianna Paolone - Denis Morris Catholic High School*

Research conducted under the supervision of Dr. Cheryl McCormick, Department of Psychology.

Stressors cause the release of glucocorticoid hormones from the adrenal gland, which can then have effects on the brain. Adolescence is a time-period where sensitivity to stressors can be especially profound, and may affect the ongoing development of the dopaminergic mesocorticolimbic system, and thereby may alter the organism's reward preferences. The purpose of this study was to examine how stress affects reward preference in adolescence versus adulthood in Long-Evans rats. Both males and females of each age underwent Social Instability Stress (SS: 16 days of 1 hour daily isolation followed by pairing with a novel cage partner) or left as non-stress controls (CTL) and subsequently provided with a choice between varying concentrations of sucrose (0, 2, 5, and 10%) or a novel stimulus rat, both of which are rewarding to rats. Tests were carried out across days and counter-balanced. The time spent drinking versus investigating the novel rat was scored. The hypothesis was that SS would shift the rat's preference away from the novel rat according to each concentration of sucrose (social discounting). It was found that SS in adolescence in rats of both sexes they drank less sucrose overall compared to CTL rats, whereas SS in adults had no effect. Further, SS and CTL rats at either age did not differ in how much sucrose they drank when alone. Thus, the social context influenced the value of the reward in SS adolescent rats only and highlight the how the reward system of adolescents is malleable by stressors.

## From Sensory Processing to Target Detection

*Mayah Cousens - A.N. Myer Secondary School*

Research conducted under the supervision of Dr. Ayda Tekok-Kilic, Department of Child and Youth Studies.

Sensory processing is the way that an individual processes and responds to sensory stimuli. Dunn's model (1997) is comprised of 4 quadrants, concerning two variables; neurological thresholds (high vs low) and behaviour strategies (passive vs active). How we process sensory information may change how we conceptualize and behave in our environment. To understand how self-reported sensory processing differences affect perception and cognition, we will be taking an event related potential (ERP) approach. ERPs are the averaged electrophysiological response to a specific event, such as sensory stimulation, measured using an electroencephalogram (EEG). In this study, an early appearing component, the P1, is related to visual perception in the occipital brain areas, whereas, the later P2 component, is related to early attentional processing in frontal brain areas. The AX CPT task, a sustained attention task, was used to test target detection (Go conditions) and response inhibition (NoGo conditions) in each of the participants. Additionally, sex differences were examined. In women, higher scores in sensory avoiding (low threshold/active strategy) was related to a larger P1 amplitude. In women, high scores in sensory sensitivity (low threshold/passive strategy) and low registration (high threshold/passive strategy) were related to smaller P2 amplitude. There was no relationship between sensory processing patterns and ERPs in males. The implications of this research can allow for a better understanding of how sensory processing affects early and mid level cognitive processing and sex differences that may exist.

*Examination of Remnants of Faults in Valles Marineris, Mars**Mackenzie Smith - Saint Michael Catholic High School*

Research conducted under the supervision of Dr. Frank Fueten, Department of Earth Sciences.

Valles Marineris is the largest canyon system in the solar system, measuring 4000 kilometres in length and up to 11 kilometres in depth. The chasm itself is believed to be formed through various faulting and collapsing of rock over time. The exposed walls of the chasm provide substantial information on the geological features of Mars. In particular, the presence of planar surfaces along the walls of East Candor may suggest how the Valles Marineris canyon was formed. In order to measure the planar regions across East Candor, CTX images were used. Satellite images, elevation models and Digital Terrain Models were combined with the computer system, Global Mapper, to create measurable images. The computer program Orion was used to measure strike and dip measurements of particular spurs across the walls of the chasm. The measurements of each particular spur were combined with others along the hypothesized planar surfaces, based on maximum deviation and other factors. The data showed that some regions were particularly planar, with a low maximum deviation over a long trace length. The results also showed that the complexity of each planar surface varies between each segment of the chasm walls. These measurements provide substantial insight on the orientation of spurs, as well as the location of planar regions across the East Candor region of Valles Marineris.

*The Effects of Dual Vector Resistance Bands on Shoulder Muscle Activity During Rehabilitation Exercises**Sydney Thompson - Eden High School*

Research conducted under the supervision of Dr. Michael Homes, Department of Kinesiology.

The glenohumeral joint is one of the most flexible and inherently unstable joints in the human body, with up to 25% of our population suffering from some type of shoulder injury at one point throughout their lifetime. A common method of shoulder rehabilitation uses elastic resistance bands as they are inexpensive, versatile, adaptable and are an effective way to incorporate external resistance into rehab programs. However, little research has been done on the effects of exercises that use additional lines of elastic loading at more proximal joints to create additional forces in different directions. This study used electromyography and motion capture to examine the effects of these dual vector exercises on muscle activation in comparison to traditional ones for 16 different muscles surrounding the shoulder. Sixteen male participants were tested. Muscle activation was measured using surface electromyography, and motion capture markers placed on bony landmarks tracked body segment motion. Using a TheraBand stretched to a normalized tension, subjects were asked to perform eight exercises consisting of abduction, flexion, internal and external rotation, in either a single vector (one band held in the hand) or a dual vector (one band in the hand, another wrapped around the elbow). Two sets of three repetitions were completed in a randomized order, at a pace of 60 beats per minute, with one minute in between each exercise. The EMG has not yet been processed; therefore, the results of the study are still pending.

## Posture's Effects on Body Image

*Charlotte Chan - Sir Winston Churchill Secondary School*

Research conducted under the supervision of Dr. Kimberley Gammage, Department of Kinesiology.

Body image is a multifaceted construct reflecting how people think and feel about their bodies and can be positive or negative. Appearance-based aspects of the body (e.g., weight, muscularity) are often the most influential aspects on body image, although social factors (friends, family, media), fitness, health, and functioning can also play a role. While some aspects of body image have been shown to impact our posture, whether posture can in turn impact body image has not been investigated. Previous studies suggest performing expansive, open, large space-occupying postures produce a heightened feeling of empowerment and pride, whereas contractive, closed, space-minimizing postures have been shown to lead to low power perceptions and increased feelings of shame. This study examined the effects of expansive and contractive postures mood and state body image in university women. One-hundred seven women 17-29 years of age performed three either expansive or contractive postures for one minute each. Participants filled out measures of state body image and mood just prior to and following the poses. Independent samples t-tests showed there were no differences in any state body image/mood variables between the two conditions after completing the poses. However, paired samples t-tests showed significant increases in body appreciation, body satisfaction, and functional appreciation in participants assigned to the contractive condition. Those in the expansive condition reported significantly lower self-objectification and higher body satisfaction after completing the poses. Next, analysis of the effects of these postures on hormones (cortisol, testosterone) will be examined.

## Vineyard Monitoring

*Branson Vernon - Thorold Secondary School*

Research conducted under the supervision of Mr. Tom MacDonald, Manager - Technical Services.

This project's main purpose is to construct micro-controllers that monitor various environmental conditions that grapes grow in within a vineyard over time. These conditions include temperature, humidity, ambient light levels and soil resistivity, which could be useful in finding the environmental conditions that cause a grape bud to enter acclimation (maximum hardiness) and deacclimation periods. The monitoring micro-controllers will be used to collect data every minute over the course of a week until their internal non-volatile memory is almost exhausted. Afterwards, a wireless handheld micro-controller is used to retrieve this information from the monitoring micro-controllers via Bluetooth, which is then brought back to a laboratory setting for further analysis. To produce these micro-controllers, we must do a variety of actions including designing the circuit board's layout digitally, coding its functionality using an embedded C program, constructing the board physically with surface-mount and through-hole soldering methods, and designing a waterproof plastic housing for the board with three dimensional printing technology.

## Engineering an Optogenetic Variant of Gal-4

*Ayyah Elayan - A.N. Myer Secondary School*

Research conducted under the supervision of Dr. Aleksander Necakov, Department of Biological Sciences.

Embryogenesis is a crucial process in any organism's life. It is driven by different patterns of gene expression. There are many signalling pathways involved in this process. It is important to understand the underlying mechanisms of this process and the contribution of different signalling pathways to this process. *Drosophila melanogaster* is a commonly used model organism in genetic studies. The aim of this study is to develop a tool that allows researchers to manipulate gene expression in *Drosophila melanogaster*. The Gal4/UAS system is a common tool that is used by fly geneticists to manipulate gene expression. This study aims to develop an optogenetic variant of GAL4 to provide spatiotemporal control of the system. The GAL4 protein will be tagged with optogenetic tags, that allow its cleavage and transportation to the nucleus, where it can facilitate UAS gene expression in the light. In the dark, GAL4 will be tethered to the membrane, where it will not be able to affect gene expression. This system has successfully been used to control other transcription, such as Notch. It is anticipated that this tool will be a valuable tool to fly geneticists as it is a widely used system and the spatiotemporal control will allow researchers to have more control over the timing and spatial expression of the genes of interest.

*Children's Saving Behaviour**Maria Conversano - Holy Cross Catholic Secondary School*

Research conducted under the supervision of Dr. Caitlin Mahy, Department of Psychology.

The ability to save money, space, and time is an important developmental achievement during childhood. The current study measures and investigates children saving behaviour in different domains and how it increases in early childhood. The main goal of this study aims to determine if different measures of saving are related to one another (money, space, and time) and if these types of saving increase with age. Twenty-one children between the ages of 3 and 6 were given a series of behavioural tasks including: a savings board game, a marble run activity, a sticker game, a saving space task, and a saving time activity. Preliminary results indicate that: (1) saving money is related to the ability to save time, (2) the ability to save money and time is positively related to children's age, and (3) age is not related to the ability to save space or time. This study suggests that various types of saving behaviours are connected to one another in early childhood, and this behaviour develops as a child grows. This research contributes to our knowledge of the development of children's saving behaviour and how various measures of saving are or are not related.

GSB 308

*Synthesis of NacNacAl and its Coupling Chemistry**Sam Nolan - St. Francis Catholic High School*

Research conducted under the supervision of Dr. Georgii Nikonov, Department of Chemistry.

Catalysis is a process wherein a compound - catalyst is used to accelerate the rate of a chemical transformation. Advantages of catalysis manifest in the boost to economic growth, that relies on derivatives of chemical industry such as gasoline, plastics, drugs, etc. Organometallic complexes based on transition metals proved to be the most efficient for such purposes, as they possess multiple oxidation states which are utilized for substrate coordination and product release from the catalyst. On the other hand, the price, scarcity and toxicity of d-block elements deters scientific society from its prolonged use. The current research explores the possibilities of exploitation of group 13 metals as catalysts. The limited number of oxidation states accessible for those elements necessitate meticulous ligand design so that the resulting system mimics reactivity of transition metals. This project encompasses the chemistry of organoaluminum complexes where the oxidation state of +1 is achieved for the metal by binding it with  $\beta$ -diketiminato ligand. Subvalent aluminum state enables oxidative addition reactions that are milestones to the catalysis. Synthetic routine from organic ligand to the reactive Al(I) species will be discussed in detail, and the reactivity patterns of the compound in question will be exemplified by coupling reactions involving benzophenone as an auxiliary moiety for the binding molecules with double and triple bonds.

GSB 310

## The Impact Of Forest Management Strategies On Cell Structure And Carbon Sequestration In Trees

*Jane Bellefleur - Governor Simcoe Secondary School*

Research conducted under the supervision of Dr. Michael Pisaric, Department of Geography.

Climate change is a global concern that many believe is impacting the Earth. Climate change is partly driven by the concentration of greenhouse gases, such as carbon dioxide, in the atmosphere. The biosphere, especially vegetation such as trees, takes up carbon dioxide from the atmosphere. Forest management strategies attempt to maximize carbon sequestration. This study aims to determine if forest management strategies such as variable retention harvesting impacts growth and carbon intake of trees in a red pine plantation near Turkey Point, Ontario. Trees from two red pine plots were compared. At one of the plots, no trees were removed, retaining 100% of its forest biomass. The second plot had 67% of its trees removed, retaining 33% of its pre-harvest forest biomass. Using two trees per site, samples were prepared for microscopic analysis. To begin, thin sections of each tree core were prepared using a microtome and then stained with safranin and astrablue stain. Afterwards, the samples were dehydrated with various concentrations of ethanol. The samples' cell wall thickness, size of lumen area, number of resin ducts and number of cells was measured for each tree during the five years before and after the harvesting activities. These were analysed to determine the differences in cell structure and growth. Results will determine if forest management strategies such as variable retention harvesting can increase tree growth and carbon sequestration. Increased cell growth would demonstrate that harvested plots remove more carbon dioxide out of the atmosphere and could potentially contribute to the reduction of greenhouse gas concentrations.

## Towards an Efficient, Chemoenzymatic Synthesis of Unsymmetrical Lipid Species Containing Siloxane Units

*Kevin Stefanchuk - Thorold Secondary School*

Research conducted under the supervision of Dr. Paul Zelisko, Department of Chemistry.

The purpose of this project is to optimize the synthesis precursors (Lyso-PC) to unsymmetrical lipid species containing siloxane units. Siloxane-containing lipids have been shown to have unique properties when compared to traditional lipid molecules and they have a tendency to spontaneously self-assemble into single-bilayer vesicles; traditional biologically relevant lipids typically form multi-layer vesicles, making them ideal candidates for the delivery of biologically active compounds. In order to fully explore the physical and surface properties of these molecules, an optimized synthetic strategy is required. A chemoenzymatic approach employing four different immobilized enzymes was used to couple aliphatic carboxylic acids with glycerophosphocholine (GPC). The products of these experiments (Lyso-PCs) are the precursors to unsymmetrical siloxane-containing lipids. Experimental evidence indicated that every enzyme system yielded the Lyso-PC, however, depending on the enzyme used different isomers of the Lyso-PC were obtained. This presentation will examine the synthesis of the Lyso-PCs using different immobilized enzymes, the product distributions obtained from each reaction and the implication(s) for the synthesis of siloxane-containing lipids will be discussed.

*Exploring the Measures of Preservation for Protein Storage in Solution**Morgan Robinson - Greater Fort Erie Secondary School*

Research conducted under the supervision of Dr. Jeffrey Atkinson, Department of Chemistry.

The tocopherol transfer protein is responsible for the transportation of vitamin E in humans. The protein's ability to function after being frozen was tested through freezing the protein in three different concentrations; 3.8uM, 14uM, and 32uM in buffer alone, and with the addition of either a 60% sucrose buffer or an 80% glycerol buffer. Storage success was measured through the protein's ability to bind to a fluorescent vitamin E. The human tocopherol transfer protein was produced through a heterologous protein expression and it's functionality was assessed using a fluorescence binding assay before being frozen for short (under 25 days) and long (over 30 days) periods at -80 °C. Protein concentration was measured using a Bradford assay before it's binding ability was tested. This study focused on providing further information about protein storage in solution so that aggregation does not occur, a common issue that becomes more prevalent overtime and ultimately renders the protein unusable. It was later thawed and then reassessed using a Bradford protein assay, followed by another binding assay. Higher concentrations of the protein proved to be beneficial for storage in solution as a higher percentage of the protein treated and untreated remained in solution. The addition of sucrose and glycerol had little impact on the protein's binding ability and ultimately was unable to prevent aggregation.



## Recognition of Cardiac-Related Prodromal Fatigue: A Multilayered Experience

*Brooke Bernier - Stamford Collegiate Secondary School*

Research conducted under the supervision of Dr. Sheila O'Keefe-McCarthy, Department of Nursing.

**Background:** Unprovoked fatigue experienced early in the development of coronary artery disease (CAD) is not recognized as a serious symptom by patients or health care providers. Prodromal fatigue [PF] is the most prevalent early warning sign of CAD more so than angina. However, there is little description of PF within current literature. **Purpose:** The purpose of this study was to describe how PF has been experienced in individuals and to understand what is involved in the process of its recognition.

**Methods:** Using qualitative descriptive analysis, the narratives of 23 men and women with CAD were analyzed for codes, categories and themes until saturation occurred. Individual interviews were digitally recorded and transcribed verbatim.

**Results:** Sample: 23 participants (women, n=9; 39.1%) participated in the study and had a mean age of  $65.8 \pm 8.1$  years. Family history of CAD (83%), dyslipidemia (83%), hypertension (70%) and diabetes (30%) were the four most reported risk factors. Qualitative data revealed the overarching theme as a lack of recognition of prodromal fatigue which is an important symptom in the development of cardiac disease. Participants used different forms of coping identified as: a) rationalization, b) denial- where active ignoring of the symptoms occurred which then, c) lead to normalization or habituation of the symptom of fatigue. Rationalization was attributed to lack of knowledge of prodromal symptoms and participants misconstrued fatigue as not related to a decline in their heart health. Participants chose denial to cope with the uncertainty that fatigue evoked, thus the process of normalization of the symptoms lead to blinding them to the realization that they were developing CAD.

**Conclusion:** It is imperative that the general public, health care providers, policy makers and individuals who suffer with cardiac disease are aware of the intricacies involved in how people recognize their early warning prodromal symptoms that lead to CAD. Specifically, pre-emptive education of prodromal fatigue to patients, families and health care providers may help stave off debilitating cardiovascular morbidity and mortality.

*Investigating Emotional Dysregulation in Individuals with MHI*

*Gabryelle Corriveau - Welland Centennial Secondary School*

Research conducted under the supervision of Dr. Dawn Good, Department of Psychology.

Individuals with Mild Head Injury (MHI) often experience emotional and social challenges even after the physical symptoms subside; as such, these consequent emotional and social challenges are often ignored or misattributed to characterological factors. Past research has shown that people with MHI exhibit lower autonomic arousal levels (compared to an age-matched cohort) which can impair their ability to detect emotional states and, thereby, diminish their reactions to social cues. This study investigated how MHI and its resulting disruption of the ventral medial prefrontal cortex (vmPFC) physiologically dampens a person's autonomic and functional responses. We focused on the effects of emotional dysregulation and affective empathy in students with MHI and its interaction with social re-integration. It was hypothesized that individuals who sustain an MHI report having more difficulties with emotional expression, empathy, and the ability to detect social cues than a nonMHI cohort. 107 students were given neuropsychological self-report questionnaires (QCAE, SRP-III) and measures of physiological arousal (e.g., heart rate, electrodermal activation [EDA]) were collected. As expected, it was found that those who reported a prior history of MHI had lower EDA than nonMHI students. Further, those with MHI produced lower scores on measures of empathy, antisocial tendencies, erratic lifestyle, and callous affect. This research confirms that individuals with MHI experience impairments that affect emotional expression and perception of social cues - functions that are valuable to an individual's well-being and social engagement. Acknowledging these impairments as concomittant with MHI should be considered as important rehabilitation goals to enhance social success.

Time	GSB 305	GSB 306	GSB 307	GSB 308	GSB 310
9:15 - 9:30	<b>Welcome (GSB 306) - Dr. Joffre Mercier</b>				
9:35 - 9:55	<p>Building a cheap homemade O<sub>2</sub>/CO<sub>2</sub> incubator for growing human cells</p> <p><i>Philip Samokhin - Sir Winston Churchill Secondary School</i></p> <p>Research conducted under the supervision of Dr. Jeff Stuart, Department of Biological Sciences.</p>	<p>Exploring the Diversity of Wild Bee Species in the Niagara Region</p> <p><i>Ava Naphin - Denis Morris Catholic High School</i></p> <p>Research conducted under the supervision of Dr. Miriam Richards, Department of Biological Sciences.</p>	<p>Ecofriendly Transformation of Waste Biomass to Biofuels</p> <p><i>Pranav Parakh - A.N. Myer Secondary School</i></p> <p>Research conducted under the supervision of Dr. Janusz Kozinski, Office of the President.</p>	<p><i>The Paradoxical Wanderers of Cold Induced Vasodilation</i></p> <p><i>Grant Booth - Saint Paul Catholic High School</i></p> <p>Research conducted under the supervision of Dr. Stephen Cheung, Department of Kinesiology.</p>	<p>Examining the Effects of Octopamine as a Neurotransmitter and Co-transmitter in the <i>Drosophila</i> Nervous System</p> <p><i>Kiran Hazra - Eden High School</i></p> <p>Research conducted under the supervision of Dr. Joffre Mercier, Department of Biological Sciences.</p>
10:00 - 10:20	<p>The Use of Rosemary Extract to Prevent Free Fatty Acid-Induced Muscle Cell Insulin Resistance</p> <p><i>Maggie Wan - Sir Winston Churchill Secondary School</i></p> <p>Research conducted under the supervision of Dr. Litsa Tsiani, Department of Health Sciences.</p>	<p>Effects of Social Instability Stress on Reward Preference in Long-Evans Rats</p> <p><i>Arianna Paolone - Denis Morris Catholic High School</i></p> <p>Research conducted under the supervision of Dr. Cheryl McCormick, Department of Psychology.</p>	<p>From Sensory Processing to Target Detection</p> <p><i>Mayah Cousens - A.N. Myer Secondary School</i></p> <p>Research conducted under the supervision of Dr. Ayda Tekok-Kilic, Department of Child and Youth Studies.</p>	<p><i>Examination of Remnants of Faults in Valles Marineris, Mars</i></p> <p><i>Mackenzie Smith - Saint Michael Catholic High School</i></p> <p>Research conducted under the supervision of Dr. Frank Fueten, Department of Earth Sciences.</p>	<p><i>The Effects of Dual Vector Resistance Bands on Shoulder Muscle Activity During Rehabilitation Exercises</i></p> <p><i>Sydney Thompson - Eden High School</i></p> <p>Research conducted under the supervision of Dr. Michael Homes, Department of Kinesiology.</p>
10:20 - 10:40	Refreshment Break				
10:40 - 11:00	<p>Posture's Effects on Body Image</p> <p><i>Charlotte Chan - Sir Winston Churchill Secondary School</i></p> <p>Research conducted under the supervision of Dr. Kimberley Gammage, Department of Kinesiology.</p>	<p>Vineyard Monitoring</p> <p><i>Branson Vernon - Thorold Secondary School</i></p> <p>Research conducted under the supervision of Mr. Tom MacDonald, Manager - Technical Services.</p>	<p>Engineering an Optogenetic Variant of Gal-4</p> <p><i>Ayyah Elayan - A.N. Myer Secondary School</i></p> <p>Research conducted under the supervision of Dr. Aleksander Necakov, Department of Biological Sciences.</p>	<p><i>Children's Saving Behaviour</i></p> <p><i>Maria Conversano - Holy Cross Catholic Secondary School</i></p> <p>Research conducted under the supervision of Dr. Caitlin Mahy, Department of Psychology.</p>	<p><i>Synthesis of NaCNACl and Its Coupling Chemistry</i></p> <p><i>Sam Nolan - St. Francis Catholic High School</i></p> <p>Research conducted under the supervision of Dr. Georgii Nikonov, Department of Chemistry.</p>
11:05 - 11:25	<p>The Impact Of Forest Management Strategies On Cell Structure And Carbon Sequestration In Trees</p> <p><i>Jane Bellefleur - Governor Simcoe Secondary School</i></p> <p>Research conducted under the supervision of Dr. Michael Pisarcic, Department of Geography.</p>	<p>Towards an Efficient, Chemoenzymatic Synthesis of Unsymmetrical Lipid Species Containing Siloxane Units</p> <p><i>Kevin Stefanchuk - Thorold Secondary School</i></p> <p>Research conducted under the supervision of Dr. Paul Zelisko, Department of Chemistry.</p>	<p>Recognition of Cardiac-Related Prodromal Fatigue: A Multilayered Experience</p> <p><i>Brooke Bernier - Stamford Collegiate Secondary School</i></p> <p>Research conducted under the supervision of Dr. Sheila O'Keefe-McCarthy, Department of Nursing.</p>	<p><i>Exploring the Measures of Preservation for Protein Storage in Solution</i></p> <p><i>Morgan Robinson - Greater Fort Erie Secondary School</i></p> <p>Research conducted under the supervision of Dr. Jeffrey Atkinson, Department of Chemistry.</p>	<p><i>Investigating Emotional Dysregulation in Individuals with MHI</i></p> <p><i>Gabrielle Corriveau - Weland Centennial Secondary School</i></p> <p>Research conducted under the supervision of Dr. Dawn Good, Department of Psychology.</p>
11:30	Closing Remarks (GSB 306)				