

Mentorship Symposium

February 9, 2019

Time	GSB 305	GSB 306	GSB 307
9:30-9:40	Welcome in GSB 306		
9:45 - 10:05	Nicholas Carbonara <i>Denis Morris Catholic Secondary School</i>	Trinity Kewley-Fare <i>Westlane Secondary School</i>	Antoinette Coco <i>Holy Cross Catholic Secondary School</i>
10:10 -10:30	Giya Joseph <i>Denis Morris Catholic Secondary School</i>	Cynthia Wan <i>Sir Winston Churchill Secondary School</i>	Katrina van der Zalm <i>Holy Cross Catholic Secondary School</i>
10:35-10:55	Ryan Ghosh <i>Eden Secondary School</i>	Athena Liu <i>Sir Winston Churchill Secondary School</i>	Daniela Patitucci <i>Holy Cross Catholic Secondary School</i>
11:00-11:20	Curtis Ehlert <i>Governor Simcoe Secondary School</i>	Ishan Herath <i>Sir Winston Churchill Secondary School</i>	Sephira Scappaticci <i>St. Paul Catholic High School</i>
11:25-11:45	Georgia Schellenberg <i>Governor Simcoe Secondary School</i>	Ahmed Alagil <i>Sir Winston Churchill Secondary School</i>	Emily Harper <i>St. Paul Catholic High School</i>
11:45-12:15	Lunch		
12:15-12:35	Jamie Wertz <i>DSBN Academy</i>	Spencer Ireland & Yi Qiu <i>Sir Winston Churchill Secondary School & AN Myer Secondary School</i>	Isabella Daneyko <i>Greater Fort Erie Secondary School</i>
12:40-1:00	Ally Lawson <i>DSBN Academy</i>	Zoe Gagnon <i>Lakeshore Catholic High School</i>	Christine Tolentino <i>St. Michael Catholic High School</i>
1:00	Closing Remarks in GSB 306		

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!

The Prevalence of Microplastics in Drinking Water in the Niagara Region

Nicholas Carbonara - Dennis Morris Catholic Secondary School

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

Water is an integral component of life. Water is required for the operation and survival of the human body, to conduct photosynthesis, and to sustain the biodiversity of marine and aquatic systems. The United Nations considers access to clean drinking water a human right. Unfortunately, the quality of water resources across the globe are affected by a multitude of stressors. Across the globe, including here in the Niagara Region, most water resources are now polluted with both primary and secondary microplastics. Primary microplastics are plastics that are fabricated in miniscule sizes to be included in a range of products from personal care to industrial use and these can often find their way into water sources. Secondary microplastics are larger pieces of plastic that enter aquatic environments and then break apart into smaller pieces of plastic. Microplastics are pieces of plastic material with a diameter of less than 5 mm. Microplastics are difficult for water treatment plants to remove from the water system because of their small size. To understand the prevalence of microplastics in the Niagara Region, three one-litre water samples were gathered weekly from five test locations across the region. Test locations include a residential well on Ridge Road in Fort Erie, a residence in Port Dalhousie, and a secondary school in southern St. Catharines. Water samples were also collected from a residence in southern St. Catharines that included tap water and water from a Brita water system to filter drinking water. To determine the extent of microplastic occurrence in the drinking water of each of these locations, the water was processed through a series of sieves (500µm, 250µm, 125µm and 63µm) and suspected pieces of plastic or microfibers were retained and then viewed under a microscope to count all the plastic particles present in the sample. After all particles were collected from the sample, the particles were analyzed and compared to a key to determine if the particle was a microplastic. The samples collected from the residential well on Ridge Road in Fort Erie consistently had the highest amount of particles present followed by the samples collected from the secondary school. Both residential samples in St. Catharines contained fewer particles. The water processed through the Brita Water filter system contained the fewest number of particles.

Allelopathic effects of Smooth Pigweed (*Amaranthus hybridus*) on the growth of Alfalfa (*Medicago sativa*) and Red Clover (*Trifolium pretense*)

Trinity Kewley-Fare - Westlane Secondary School

Research conducted under the supervision of Ms. Heather VanVolkenburg, Department of Biological Sciences.

An agroecosystem is an ecosystem created within or in the presence of developed farmland. Farmers use common cover crop plants to prevent soil erosion and maintain soil quality. Allelopathy is a common interaction between plants and their environment, which can produce positive and negative effects. Plant growth is usually hindered in the presence of a plant excreting allelochemicals into the immediate environment. Smooth Pigweed (*Amaranthus hybridus*) is a common weed present in agroecosystems. Smooth Pigweed has been found to leech allelochemicals into the surrounding soil. The purpose of this study was to observe the effects of Smooth Pigweed tissue on two common cover crop plants: Alfalfa (*Medicago sativa*) and Red Clover (*Trifolium pretense*). A total of thirty specimens were examined: 15 Red Clover and 15 Alfalfa. Three study groups were created for the Alfalfa and Red Clover specimens. The study groups consisted of a control group with soil uncontaminated by Smooth Pigweed, a second group containing 0.25 grams of Smooth Pigweed, and a third group containing 0.50 grams of Smooth Pigweed. Observations occurred over a 30-day growth period. Plant height, leaf count, dry and wet weights of plant roots, dry and wet weights of plant shoots, and plant mortality were used to measure the effects of Smooth Pigweed on the specimens. The Smooth Pigweed tissue in the specimen's growth medium affected specimen growth. Specimens in the control group for Alfalfa and Red Clover thrived for the 30-day observation period. Specimens with 0.25g and 0.50g concentrations of Smooth Pigweed tissue showed sensitivity to the presence of Smooth Pigweed. The research findings suggest Alfalfa and Red Clover may not be effective options for cover crop plants in environments where Smooth Pigweed is present. The findings suggest cover crop plants need to be carefully selected in the presence of Smooth Pigweed.

Linguistic Differences Between Truthful and Deceptive Statements Made by Maltreated and Non Maltreated Children

Antoinette Coco - Holy Cross Catholic Secondary School

Research conducted under the supervision of Dr. Angela Evans, Department of Psychology.

Recent methods for detecting children's deceptive statements have begun to examine linguistic differences between truthful and deceptive statements. Children's dishonest statements contain more of certain word types than honest statements. For example, children's dishonest reports contain more self-references and tentative terms compared to honest reports. Additionally, maltreatment is an important factor to consider given that it is related to delayed verbal development and may lead to children using less complex language. In the current study, 9 to 12 year old children (50% maltreated) played one of two games with an experimenter. The children were randomly assigned to one of two conditions where half the children played a forbidden game that crashed the computer, and the other half played a game where nothing bad happened. The children were then interviewed about the game they played. The present study compared the reports of children who lied about crashing the computer to reports of children who experienced no transgression. Reports were analyzed using linguistics software programs to examine two types of differences between truthful and deceptive statements: (1) the types of words the children use and (2) the complexity of their sentences. Findings indicated that word type did not significantly differ based on honesty or maltreatment status. However, there were significant differences in the complexity of children's truthful and deceptive statements. Specifically, children who told the truth had more complex sentence structure and used more words per sentence than children who lied. There was no significant differences between maltreated and non-maltreated children when comparing the complexity of their statements. Overall these findings suggest that children's honest reports of an event contain more complex language than dishonest reports.

Examining Layered Rock Formations on West Candor, Mars

Giya Joseph - Denis Morris Catholic Secondary School

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

Candor Chasma is one of the largest canyons in the Valles Marineris canyon system on Mars. Within West Candor, interior layered deposits (ILDs) can be commonly found. These layered sediments on the Martian surface are important to analyze because they can provide key information about the geological history of the region. In order to measure layering within West Candor Chasma, HiRISE (High Resolution Imaging Science Experiment, resolution 1 m/pixel) and CTX (Context Camera, resolution 5 m/pixel) imaging were used. The computer program "Global Mapper" was used to view the various images taken from Mars. A geological map was created using different DTMs (Digital Terrain Models) making the ILDs clearly identifiable. Strike and dip measurements (which quantify the 3D orientation of the layers) were taken along the layered terrains of West Candor using the computer program "Orion." These measurements gave more insight into the orientation of the geological features found on West Candor. The graphic design software, "CoreDRAW" was used to create a basemap of West Candor Chasma. The basemap showed that no layered terrain was evident in certain regions of West Candor, or that no measurements could be taken on the layered deposits. However some other regions of the Chasma contained layered material where numerous strike and dip measurements were taken. The strike and dip measurements generally ran parallel to the walls of the Chasma and one study has shown that this is most likely attributed to landsliding within these layered deposits. The results show that the origin of the ILDs and the geological history of the region are fairly complex.

Pain, Agitation and Delirium Management in a Community Intensive Care Unit

Cynthia Wan - Sir Winston Churchill Secondary School

Research conducted under the supervision of Dr. Madelyn Law, Department of Health Sciences.

Pain, agitation and delirium (PAD) are prevalent conditions for patients in the intensive care unit (ICU). Delirium is closely linked with adverse outcomes including prolonged hospital stays, increased health care costs, increased mortality and long-term cognitive impairment. This project aims to evaluate the impact of a multifaceted and multidisciplinary intervention on PAD management in ICU patients by involving nurses, physicians and family members. Baseline data demonstrated that there are a number of PAD management practices that a local ICU can improve. Prior to the implementation of the intervention, data was collected for all ICU patients who had been admitted for more than 24 hours. I worked together with members of the Critical Care Research Team to collect patient data through nurses' flow sheets, medication orders and interdisciplinary records over the course of 30 days. The data included demographic and clinical information, process of care data and medication information. Assessment results from the numeric rating scale for pain, the Richmond Agitation-Sedation Scale (RASS) and the Confusion Assessment Method for the ICU (CAM-ICU) were also recorded. This same data will be reviewed post interventions to determine the effectiveness of these changes. These findings will be instrumental in guiding our scientific understanding of interventions that improve care for ICU patients which can be translated to enhancements in patient care in other community-based ICUs.

Posture and Body Image

Katrina van der Zalm - Holy Cross Catholic Secondary School

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

The posture and positioning of the body is believed to have an impact on psychological and physiological responses. Research has shown that expansive poses (for example, taking up lots of space) can increase feelings of power and pride; they may also lead to decreases in cortisol (which is released in times of stress) and increases in testosterone (which is associated with feelings of dominance), but these findings have been mixed. The purpose of this experiment is to examine the effect of expansive (vs. contractive) postures on body image, mood and hormonal responses in men and women. Male and female participants are randomized into either an expansive or a contractive pose condition. They engage in three variations of either the expansive or contractive pose for one minute each. Expansive poses involve opening up the chest and holding the arms and legs away from the body taking up a large amount of space. Contractive postures (which are linked to feelings of shame) involve wrapping the arms around your body to hide it and holding the head down with shoulders collapsed. Saliva samples are collected 5 times throughout the session and will be analyzed to examine fluctuations of two hormones, cortisol and testosterone. Participants will also complete questionnaires assessing positive and negative body image and mood multiple times throughout the session. We are expecting to see that those who engage in expansive poses will experience an increase in their testosterone levels and a decrease in cortisol levels as well as improved body image and mood.

The Exact, Rotational Solutions to the 3-Dimensional Euler Equations

Ryan Ghosh - Eden Secondary School

Research conducted under the supervision of Dr. Stephen Anco, Department of Mathematics and Statistics.

In this project, we employ an analytical approach to solving for the exact, rotational solutions to the 3-Dimensional Euler Equations for compressible fluids, where $\text{div} \vec{u} \neq 0$.

A more thorough comprehension of these solutions will yield to a profound understanding to dynamic fluid systems such as blood flow throughout the body or oil flowing down a pipe. To begin, an investigation on a previous article (Yuen. M., 2011) on the topic was conducted. Their rotational solutions were not truly symmetrical because they had based their solutions on a hidden vector. To simplify the problem, an examination of the 2-Dimensional case was conducted, where the only types of rotational solutions are radial and angular. A substitution with a linear combination for the form of these solutions into the classic fluid flow equations was employed where \vec{u} represents velocity, ρ represents density, and P represents pressure.

$$\rho_t + \nabla \cdot (\rho \vec{u}) = 0$$

$$\rho [\vec{u}_t + (\vec{u} \cdot \nabla) \vec{u}] + \nabla P(\rho) = 0$$

This substitution yielded three equations describing pressure, density, and velocity of inviscid fluid flow. In addition, a nonlinear oscillator differential equation, which has many variations of solutions depending on certain cases, was found. Two of the cases for the nonlinear oscillator equation were analyzed where $\beta' \equiv 0$ and $\beta' \neq 0$.

$$t = \pm \int \frac{dT}{\sqrt{2E - a_1^2 T^{-2} - \frac{a_0}{\beta} T^{-2\beta}}}$$

These cases resulted in two solutions of physical significance with $\rho > 0$ and decaying \vec{u} . Further study into the separate cases of the nonlinear oscillator differential equation is needed to fully comprehend the nature of these compressible inviscid fluids.

10:35 - 10:55

Mobile Technology and Triangular Health

Athena Liu - Sir Winston Churchill Secondary School

Research conducted under the supervision of Dr. Brent Faught, Department of Health Sciences.

Triangular health comprises of three domains, including physical, mental and social. It is especially important to recognize and enhance these domains among teenagers as a means of increasing their overall health. As cell phone use is predominant among teenagers, an app was designed with the intent to educate and facilitate teenagers triangular health. The features included health suggestions, articles and videos that educated teens about how to take care of themselves, inspirational quotes to motivate and a to-do list function that helped students keep track of their tasks on hand. Also, there was a meditation guide to relieve stress and a memory journal to record their memories, with a help page providing information on places where they can get help. The app was launched in a local high school for a period up to 45 days. Students were asked to fill out a survey assessing their pre- and post-health status and utilization of the app at the beginning and conclusion of the app launch. A total of 56 students completed the pre assessment and 53 of these students made use of the app functions. App use surveillance indicated one student used the app at least 90% of the days. Furthermore, at least one student used the app each day for nearly three weeks. However, the number of clicks still increased to as high as 828 over the course of the app's life cycle. Student did use the app, but lost interest over time. The level of student satisfaction was enhanced with their health increasing following app use. Most profound improvement were found in social health, followed by physical and mental health.

Inhibiting the Collection of Condensation on Display Cases Using Hydrophilic and Hydrophobic Silanes

Daniela Patitucci - Holy Cross Catholic Secondary School

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

Display case companies are faced with the task of creating a product that refrigerates products in a desirable manner. The contrast of the warm air and the chilled display case causes condensation to form on the viewing glass. Manufacturers have tried to prevent condensation mechanically, by using fans to blow warm air on the inside surface of the glass. However, this method is costly due to electric inefficiency. A chemical coating applied periodically on the inside of the glass could be a cost-efficient alternative. Silane coatings will bond to the surface of the glass and alter the way condensation interacts with the surface. Hydrophilic silanes, when bonded to the surface of glass will attract water, which will cause the condensation to spread across the glass in a thin, transparent layer. Hydrophobic silanes will resist the collection of water on its applied surface and form distinct droplets that will roll off the surface and funnel down to a drain, which will also result in a transparent, condensation-free display case. Varieties of hydrophilic and hydrophobic silanes are being tested in humid conditions to find which silanes in what amounts will effectively prevent condensation from obscuring the view of products in the environment of a chilled display case.

DOCOSANEDIOIC ACID: An Investigation into the Engineering of C22

Curtis Ehlert - Governor Simcoe Secondary School

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

Throughout the cell, lipids must be directed to where they are needed in order to fulfill their responsibilities of storing energy, of signaling, and of structure. By definition, however, lipids have very poor solubility in water and thus must be transferred from site to site via various transfer proteins. One such example is a phosphatidylinositol transfer protein (PITP), which has been suggested to be an important factor in cell signaling, among other things. The most studied phosphatidylinositol transfer protein is the enzyme Sec14, which plays an important factor in homeostasis as well as in cell signaling. 29 genes code for a protein with Sec14 domain, proteins which may lead to problems, and even disease, if the proteins suffer mutation. Although the behaviours of Sec14 have been thoroughly studied in vitro, in test tubes and scientific apparatus, they are poorly understood in vivo, meaning in appropriate organic environments. Thus, in order to be studied as such, cellular environments and molecular compounds found within must be replicated. To study behaviours such as how Sec14 enzymes behave towards substrates that are to be phosphorylated, test substrates of varying lengths must be used to test extraction ability. One test substrate which is to be used, and one which is the focus of this research, is docosanedioic acid (C22), a long chain carbon diacid with a chain length of 22 carbons. Docosanedioic acid is engineered through a long process involving the acylation of enamines and cyclic ketones, and which follows a long chemical road map which begins with the compound 1-morpholinocyclohexene and where three important compounds are built along the way: 2,2'-sebacoyldicyclohexanone (C22H28O4), disodium 7,16-diketodocosanedioate (C22H30Na2O6), and of course, docosanedioic acid (C22H42O4).

Investigating the process of creating friable, stationary cell callus from the medicinal plant *Catharanthus roseus*

Ishan Herath - Sir Winston Churchill Secondary School

Research conducted under the supervision of Dr. Vincenzo De Luca, Department of Biological Sciences.

Catharanthus roseus also known as the “Madagascar Periwinkle” is one of the most sought out plants in the field of pharmacology due to its many medicinal properties (Edge et al. 2018; Qu et al. 2017). Vincristine and vinblastine are two vinca alkaloids in particular which draw attention due to their anti-cancer properties. These two alkaloids are major components in chemotherapeutic treatments against various cancers, including lung cancer, leukemia, Hodgkin’s disease and breast cancer (Aslam et al. 2010). One strategy to investigate alkaloid biosynthesis within the plant is producing friable cell callus in a sterile in vitro environment. Calli are masses of undifferentiated cells that naturally grow in response to plant wounding and can be induced in a lab setting in response to specific hormones. The advantages of creating callus are: they present a simpler biological system, they may grow faster than whole plants, they allow easier manipulation of the growth environment, they can allow for the regeneration of whole plants, they allow for the analysis of the biochemical pathways, and they allow for the formation of cell suspension culture which can be used as a bioreactor for large-scale production of metabolites. This project focused on finding the optimal medium and growth environment to produce friable *Catharanthus* callus. Through this investigation, the following were found to be successful: carrot media containing 30g/L of sucrose and 1 mg/L of the auxin 2,4 -D (2,4-Dichlorophenoxyacetic acid), a light environment, and a temperature of 25 °C.

11:00 - 11:20

The Relationship between Mild Traumatic Brain Injury and Depression

Sephira Scappaticci - St. Paul Catholic High School

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

Traumatic brain injury (TBI) is considered to be a serious issue due to the lack of public awareness. Brain injuries do lie on a spectrum, ranging from mild (eg. concussion) to severe (eg. loss of consciousness). Following a brain injury regardless of severity, people exhibit a dampened autonomic arousal which can be quantified with electrodermal activity (EDA), furthermore, individuals also experience changes with respect to their cognition and emotion. This is due to damage to the ventral-medial prefrontal cortex, located in the frontal lobe. It is common for individuals to experience depressive symptoms after sustaining a brain injury. However, these depressive symptoms are different from persons who have not sustained a brain injury that also suffer from depression. In this study, the contrast between affective depression and somatic depression is focused on. Affective symptoms include dampened mood, sadness, and feelings of worthlessness. Somatic depression includes lethargy, changes in appetite, and difficulties with sleep. This research will mainly focus on the relationship between mild traumatic brain injury and how it increases the risk of depression in the future.

11:25 - 11:45

The Impact of Social Pressures on Body Image and Adolescents' Attitudes Towards Doping

Georgia Schellenberg - Governor Simcoe Secondary School

Research conducted under the supervision of Dr. Philip Sullivan, Department of Kinesiology.

There are many research projects on The act of attempting to inform those of adolescent steroid use, as well as discourage it. The number of adolescents who use steroids due to dissatisfaction with their body is too large to be ignored. It is evident now that more research needs to be conducted in order to conclude who or what is causing body insecurities, and why these factors are leading adolescents to choose steroids. In this paper, we take a deeper look at how the sociocultural factors such as parents' and peers' influence on body perception can affect leading them to choose steroids to alter their appearance. This research was done by means of distributing surveys to high school student athletes asking questions about their attitudes towards steroids, and also questions about how these sociocultural factors make them feel about their bodies.

Sentiment Analysis of Scraped Amazon Reviews

Ahmed Alagil - *Sir Winston Churchill Secondary School*

Research conducted under the supervision of Professor Jon Radue, Department of Computer Science.

Analyzing and anticipating consumers behaviour has always been a promising area of study with the potential to increase profits. Data from customer reviews help sellers gain insights into markets as the understanding of their customers' opinions grant businesses invaluable knowledge of the industry and the ability to proactively improve sale strategy. Sentiment analysis uses complex statistical algorithms coupled with software engineering principles to computationally determine whether a piece of writing is positive, negative, neutral, or mixed in a powerful yet efficient manner (Escalona 2018). The use of Natural Language Processing allows for the detection of sentiment and key phrases (Saini 2018). The program's ability to detect sentiment is done using deep learning algorithms that use scoring mechanisms and attributes during the evaluation of text. The objective of this study is to help sellers understand where they can improve their products and predict how well their new products would do. The program consists of data found in product listings, including product descriptions and consumer reviews, from Amazon. Sentiment analysis of texts could be practical in E-commerce. By analyzing the polarity of the text, sellers can effectively inspect the strengths and weaknesses of their products and their predicted sales rank.

The Effects of Cerebellar Transcranial Magnetic Stimulation on Balance Recovery

Emily Harper - *St. Paul Catholic High School*

Research conducted under the supervision of Dr. Craig Tokuno, Department of Kinesiology.

Continuous theta burst stimulation (cTBS) is a non-invasive method of brain stimulation that temporarily reduces neural excitability or function. This method of brain stimulation has previously been used to establish the role of the cerebellum during static standing but to date, no studies have examined whether the cerebellum is important for dynamic balance tasks. Therefore, the purpose of this study was to investigate whether applying cTBS over the cerebellum affects an individual's ability to respond to an unexpected loss of balance. Twenty healthy young adults were randomly divided into either the control (no cTBS) or cTBS group. Both groups initially experienced 20 platform perturbations of randomly varying amplitudes between 20-40 cm. In response to each platform movement, the participant's objective was to recover their balance as quickly as possible without taking a step. This was followed by participants in the cTBS group receiving cTBS (600 magnetic stimuli for 40 seconds) over the cerebellum. Finally, both groups experienced another 30 platform perturbations, which were presented in a serial order from smallest to largest. For each platform perturbation trial, the participant's ability to recover balance was quantified using electromyography (EMG) to record muscle activity. The results revealed no differences in the EMG onset latency and amplitude of the right soleus, gastrocnemius and tibialis anterior muscles between the two groups. This suggests that applying cTBS did not inhibit the cerebellum strong enough to cause a functional change in balance recovery. Future studies should consider applying a stronger intensity of cTBS over a larger portion of the cerebellum to elicit a stronger cerebellar depression. This may better simulate the balance recovery impairments typically observed in people with cerebellar damage.

12:15 - 12:35

Prot2Gene

Jamie Wertz - DSBN Academy

Research conducted under the supervision of Dr. Ping Liang, Department of Biological Sciences.

Prot2Gene is a tool developed by professor Ping Liang to map and sort DNA and protein sequences. The code runs on Ubuntu and is written for use in Perl, using BLAST databases while running the code. The purpose of the Prot2Gene code is to predict and map exons using proteins. Within the code there are function errors. The first error repeats the output strand while the second error is within the minus strand, there are two strands to DNA, when the program flips from the plus to the minus there is an area in which the strand did not flip. Conducting this project entails learning the programming code Perl, developing a deeper understanding of genetics and mapping exons, creating a flowchart in order to familiarize ourselves with the exact order of the code, matching the output commands to the outputs within the interface and finally finding and fixing the errors. To find the errors the code was run one line at a time as to determine the function of each command line. Testing the code was done by running specific genomic input files that were known to fail then using such to find the point of failure. When running correctly the program outputs a prediction of the first exon and compares the user-inputted DNA sequence and protein sequence. With the help of the Prot2Gene program researchers can further their work with a specific gene. Gene research is a widely pursued and important field and this program may help in the pursuit of many different projects.

Application of Computer Vision for Convenient Parking Systems

Spencer Ireland and Yi Qiu

Sir Winston Churchill Secondary School and AN Myer Secondary School

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

Integrated parking lot systems have progressed in complexity, with rapid changes towards the automatic organization of parking availability; however, the addition of camera vision is a new technology that is proven to be a vital tool in reducing costs of additional sensors and increasing the functionality of a parking system. Although complex neural network-based computer vision is a new development that has created new powerful image processors, the automatic digital organization of parking lots has not been fully explored. The application of optical character recognition and image processing has presented a strategy for automatically archiving parking lot systems. It is prevalent that several open source libraries, such as OpenCV, and Tesseract, will enable predominant advances in Licence plate detection and digital parking organization. The objective of this research is to integrate both systems in a model; that automatically processes a license plate image with previously archived plates and detects parking lot availability with computer vision. A demonstration of the concept including truly automated parking lot systems is established when both license plate identification and parking lot organization is processed without human interaction. The advantageous qualities gained with a fully integrated parking system will increase the quality and efficiency of public or private parking lots in the future.

12:15 - 12:35

Modelling the Enzyme Tabersonine-19-Hydroxylase: Computational Evaluation of the Binding of the Natural Substrate

Isabella Daneyko - Greater Fort Erie Secondary School

Research conducted under the supervision of Dr. Heather Gordon, Department of Chemistry.

Tabersonine-19-Hydroxylase is a protein found in the plant, *Catharanthus roseus*, also known as the Madagascar periwinkle. This protein is an enzyme that accepts tabersonine into its binding site as a part of a pathway that creates compounds with antitumor characteristics. A better understanding of this enzyme could result in the ability to create these anticancer compounds in larger quantities than the plant naturally produces. The three-dimensional structure of Tabersonine-19-Hydroxylase is undiscovered, making it difficult to understand why it accepts tabersonine as a substrate and not other molecules. My research focused on using computer modelling techniques to create three-dimensional structures of this enzyme that I could then use to run docking experiments with the natural substrate and other ligands. Our main objectives are to understand how tabersonine fits in the binding site of Tabersonine-19-Hydroxylase and which amino acids affect that.

12:40 - 1:00

Telling Story of 18th-century Nova Scotia/Acadie through French and British Maps

Ally Lawson - DSBN Academy

Research conducted under the supervision of Dr. Daniel Samson, Department of History.

This study compares 18th-century British and French colonial maps by analyzing different perspectives, different ways of planning, and different ways of governing Nova Scotia/Acadie. Britain's defeat of France in the Seven Year War saw French Isle Royale (modern day Cape Breton) become British territory. How did the French and the British mapmakers represent this territory? Did they do so differently? Using the position of Max Edelson's *The New Map of Empire* to analyze maps in the Daniel Livermore Collection in Brock University's Archives and Special Collections, and supplemented by additional web-based maps from the Archives nationales de France, the US Library of Congress, and the National Archives of Canada, similarities and differences of these two empires are visible through the stories told by these maps. We tend to view maps as a simple representation of space, but they usually try to tell a story or project an idea. Researching the mapmaker, the year the map was made and the details of the map, uncover the main differences: territorial and political perspectives; and ways of planning and ways to govern territories overseas. The study focuses on five maps, all of which demonstrate the different approaches of these two Empires. This research on maps supports the position that maps tell stories and show the different approaches of the British and French in 18th-century Nova Scotia/Acadie.

Activation of a Receptor for Insulin-like Peptide Decreases Fictive Locomotion in Fruit Fly Larvae

Zoe Gagnon - Lakeshore Catholic High School

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

The human brain is a complex organ containing over 100 neuropeptides, which act as chemical transmitters between nerve cells. Peptide signaling plays a major role in human diseases, as a result of changes in peptide levels or the effects on peptide receptors. There are many similarities between peptide receptors in humans and those found in the fruit fly, *Drosophila melanogaster*. This study was conducted to examine effects of bvP phen, a chemical known to activate the receptor for insulin-like peptide in insects. Effects on larval fictive locomotion (crawling-like activity) were studied by holding down one end of the larvae, attaching the other end to a force transducer and recording movements (contractions) as changes in force. The chemical, bvP phen, is known to activate insulin receptors by inhibiting an enzyme, protein phosphotyrosine phosphatase, that normally prevents receptor activation. bvP phen was applied through a slit that was cut through the dorsal epithelium, and excess solution was removed by suction. In control trials, physiological saline without bvP phen was used. Compared to control trials, bvP phen decreased the amplitude and frequency of larval contractions, and these effects were statistically significant using a statistical test (Analysis of Variance). The decreases in amplitude and frequency might result from increased movement of sugar to energy stores, which would decrease available sugar for energy consumption. Others have reported that insulin signaling in *Drosophila* increases expression of a synaptic protein, Complexin, which decreases transmitter release onto a proboscis muscle. A similar effect on Complexin levels in neurons controlling crawling might account for the decrease in fictive locomotor movements. The results could lead to further studies on mechanisms of peptide signaling in the nervous system.

The Impact of a Sugar Tax on the General Public's Health

Christine Tolentino - St. Michael Catholic High School

Research conducted under the supervision of Dr. Fayez Elayan, Department of Accounting.

The over consumption of sugar-sweetened beverages (SSB's) is a leading factor that contributes to numerous health complications within countries, amongst the most prevalent of these being obesity. To help solve this, the implementation of a sugar tax on SSB's would theoretically be a very effective way of deterring the public away from purchasing these drinks. The sugar tax makes the public aware of the health complications that drinks with added sugar contribute to. Research performed by research facilities and leading health organizations that provided information regarding the health impact and healthcare costs of excess SSB consumption, alternatives of the sugar tax, pros and cons of the sugar tax, and its overall effectiveness. Indeed, excess SSB consumption has had an impact on the general health of citizens and costs for healthcare within various nations, but society is also able to look towards different alternatives that would play a role in helping create a healthier population. The sugar tax carries with it several pros and cons that help determine its overall effectiveness, and if society should rather look to those sugar tax alternatives. These studies suggest that the sugar tax does not serve as an effective deterrence of SSB consumption across multiple nations, as little health improvement has been reported. Thus, further studies suggesting sugar tax alternatives should be referred to.