

2016

Irving K. Barber School of Arts and Sciences

11th Annual Undergraduate Research Conference

EME Building - Mezzanine (main floor)

Wednesday, April 27th, 2016

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Personality Differences in Manipulation: Face-to-Face versus Computer-Mediated Communication

Student: Lauryn VANDER MOLEN

Supervisor: Michael Woodworth

Research has examined how more nefarious personality traits such as psychopathy are related to deception in face-to-face and computer-mediated contexts. However, less is known about the relationship between deception and universal personality traits such as the Big Five (i.e. openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism), altruism, and self-esteem, and how communication mediums influence the ability to successfully deceive. In this study, a mock job hiring paradigm was implemented with dyads (N = 204) of psychology and management undergraduate students. One participant was given the opportunity to engage in deceitful behaviour to increase their odds of winning a \$500 raffle while subsequently lowering the other participants' chances of winning. Participants then completed measures for the Big Five, altruism, and self-esteem. We investigated if extraverts would have increased success face-to-face, as well as if altruism and self-esteem would moderate the relationship between success and the Big Five. Results indicated that conscientiousness, agreeableness, and self-esteem significantly contributed to successful deception, and provided support to the hypothesis that extraversion was related to successful face-to-face deception. Analysis also revealed that altruism and self-esteem moderated the relationship between the Big Five and successful deception. The current research project aims to contribute to knowledge surrounding personality, communication medium, and deception, and underscores the importance of considering more general personality characteristics when conducting research involving deception.

Cultural Adaptations to Augment Health and Mental Health Services: A Systematic Review

Student: Megan STAGER

Supervisor: Susan Wells

Objective: Individuals from diverse cultural, ethnic, and racial groups are subject to inequities in their outcomes and experiences with health and mental health services. Though many attempts in recent years have been made to mitigate these discrepancies through provision of culturally adapted services to diverse populations, it is yet unknown whether cultural adaptations to extant services provide any additive benefits to the client above the efficacy of the service alone. **Methods:** Reviewers searched MEDLINE, PsycINFO, EMBASE, CINAHL, and grey literature sources for English-language studies that took place between January 1955 and January 2015. Cultural adaptations to any aspect of service delivery were considered. Outcomes of interest were changes in the medical, self-report, or behavioural outcomes of service recipients and changes in the behaviour of service providers. **Results:** Thirty-one studies were identified that met inclusion criteria. The most common adaptation made to services was the inclusion of cultural content in the materials or services delivered and this occurred primarily with regard to preventive services. The majority of research concerned the outcomes and experiences of African Americans. Seventeen of 31 studies reported one or more significant effects in favour of the culturally adapted group, however, findings were largely mixed. Reviewers did not find consistent evidence to support the implementation of any specific cultural adaptations, either generally, or with a particular cultural group. **Conclusions:** This review aggregated and evaluated the most rigorous experimental research available. Implications for policy, practice, and research are discussed, with emphasis on individualized care, cost considerations, and client satisfaction. **KEYWORDS:** Cultural safety, cultural appropriateness, cultural competence, health, mental health, racial disparities, ethnicity

Three's Company: Exploring Group Versus Individual Performance in Lie Detection

Student: Tianna DILLEY

Supervisor: Stephen Porter

Research demonstrates that individual observers detect lies at chance-level (e.g., Bond & DePaulo, 2006). As such, research has suggested ways to improve human lie-detection skills. For example, indirectly assessing a liar via his or her personal traits may result in more accurate outcomes (Hart, Fillmore, Griffith, 2009; Ulatowska, 2013; Vrij, Edward, & Bull, 2001). Further, a recent study indicated that small groups of observers may be more accurate than individuals at detecting lies (Klein & Epley, 2015). As such, the current study examined group lie detection ability when using indirect and direct methods of deception detection. Individuals (n = 50) versus "teams" of three (n = 50 groups) observers were asked to assess the honesty of six targets (three lying, three truthful) from a library of high-stakes "public pleaders" (ten Brinke & Porter, 2012). Through discussion, groups either decided whether the target was being honest or reached a consensus on the deception-associated traits of the speaker (e.g., likeableness). Accuracy will be compared between groups and individuals. The results of the study will highlight the role of group dialogue in detecting honest and deceptive high-stakes liars via multiple strategies. Findings have implications for group work within the criminal justice system, such as credibility assessments (e.g., parole board hearings) and jury deliberations, guiding future research and practice in the field of investigative psychology.

Examining Impulsivity in Relation to Cognitive Bias Modification and Eating Disorders

Student: Nicole LEGG

Supervisor: Maya Libben

Etiological models of eating disorders (EDs) propose that biased cognitions underlie the manifestation and maintenance of pathological symptoms (e.g., Misener & Libben, submitted). Recently, the role of cognitive distortions regarding body weight (where ED sufferers view themselves as heavier than they are) has been highlighted as a crucial area of investigation (Antro, 2014). Although numerous studies report a link between weight distortion and EDs (see Shafran et al., 1999 for a review), these correlational studies preclude conclusions as to the causal status of distortions in the manifestation of ED traits. Furthermore, it has been identified that levels of impulsivity are related to eating disorders. Specifically, it has been found that individuals who display bingeing and purging symptoms tend to show higher levels of impulsivity ratings while the findings regarding restriction symptoms are inconclusive. Moreover, impulsivity may moderate the role between body dissatisfaction and eating disorders. Implications of these findings indicate that bulimia and anorexia may lie on separate ends of a spectrum regarding impulsivity, and as such, ratings of impulsivity may differentiate between types and symptoms of ED's. Evidence on the causal status of impulsivity in perpetuating body dissatisfaction or moderating the role of dissatisfaction on eating disorders remains unclear. Using Cognitive Bias Modification (CBM) allows for the examination of the causal effects that impulsivity and body perception distortions may have on the manifestation of ED traits. This talk will discuss the methods of experimental study using CBM and measures of impulsivity, the results, and the implications that this knowledge provides for the early identification of risk factors and treatments of ED's.

Examining the Link Between Antibiotic Use, Dietary Fats, and *E. faecalis* Biofilm Formation

Student: Blake BIRNIE

Supervisor: Deanna Gibson/Sanjoy Ghosh

Infective endocarditis is a serious infection caused by microorganisms colonizing both the heart valves and surrounding tissues (the endocardium). Infective endocarditis has a fatality rate of 40% within 5 years of diagnosis. This is alarming because the incidences of infective endocarditis are on the rise. In the USA alone, there was a 54% increase in infective endocarditis cases between 1998 and 2009. As the prevalence continues to increase, it is crucial to gain a better understanding of the pathology of this disease. Our lab has previously found that mice fed diets high in n-6 polyunsaturated fatty acids (n-6 PUFA) and treated with antibiotics unexpectedly suffered cardiac dysfunction due to infective endocarditis. It was later found that *Enterococcus faecalis* caused the infective endocarditis in these mice through the formation of biofilms in the endocardium. *E. faecalis* is a bacterium that is naturally found in our gut and is often antibiotic resistant. We hypothesize that there may be a link between n-6 PUFA consumption, antibiotic use, and *E. faecalis* biofilm formation. This presentation will highlight the in vitro methods that were used to examine *E. faecalis* biofilm formation and discuss the results that were found.

PUFAs and depression: How much do we really know?

Student: Alexandra CLOHERTY

Supervisor: Sanjoy Ghosh

Major Depressive Disorder (MDD) is a severe illness characterized by diverse symptoms, and in 2015 was estimated by the World Health Organization to be the leading global cause of disability. In an attempt to support better health outcomes, dietary saturated fats have been substituted with unsaturated fats, and high amounts of n-6 polyunsaturated fatty acids (PUFAs) have been introduced in Canadian diets. However, researchers have observed a temporal correlation between MDD prevalence and dietary shifts to higher n-6:n-3 PUFA ratios. Both PUFAs are thought to have an effect on mental health by modifying lipid rafts, which can impact neurotransmitter release and neuroinflammation via alteration in cell signalling. The two PUFA families interact, as n-6 PUFAs compete with n-3 PUFAs for esterification into phospholipids of neuronal cell membranes. Although there is an abundance of diverse literature on this diet-depression relationship in both humans and other animals, there is sufficient inconsistency within the literature to warrant re-analysis of the issue. This systematic literature review aims to clearly delineate the effect of PUFA supplementation on patients' MDD symptoms. The databases PUBMED, CENTRAL, MEDLINE, and PSYCinfo were searched for relevant articles using a preset search criteria to identify randomized controlled trials that used a treatment of PUFA supplementation and assessed MDD symptoms using a variety of scales. Peer-reviewed papers identified through these databases were screened for inclusion; duplicate studies and articles drawing data from the same study were removed or pooled. Bias assessments of each of the 11 included studies were performed as per standard Cochrane recommendations. Data and bias assessments were extracted into characteristic tables and entered into the Comprehensive Meta-Analysis Software for analysis. Preliminary data suggests that n-3 PUFA supplementation has a small but positive effect on mental health outcomes. Therefore, the increasing levels of n-6 PUFAs in Western diets may have detrimental mental health outcomes due to competition with n-3 PUFAs.

Impact of maternal diet on breast milk and the infant microbiome

Student: Deanna PASQUALE

Supervisor: Deanna Gibson

Over the past few decades our diets have become more “westernized,” and in many countries this change in diet seems to coincide with an increased prevalence of chronic inflammatory diseases. Immune regulation and disease susceptibility are largely regulated

by the gut microbiota which is established during the first two years of life. Multiple factors influence this initial colonization including early infant diet. For the first 1-6 months, most infants rely on breast milk as their sole source of nutrients. In addition, breast milk also contains many components imperative to the development of the infant gut and early infant immune system. Lipids and bacteria are among these components of breast milk and have been shown to be impacted by the mothers' diet. To understand the impact of maternal diet in exclusively breastfed infants, we conducted a clinical study to determine how maternal diet affected the development of the infant gut bacterial diversity. We compared mothers who exclusively consumed milk to those who exclusively consumed almond beverage. To determine if replacement of cow's milk with almond beverage changed the bacterial diversity in the breastfed infants, we analyzed the stool samples from 16, 5 month old infants. Using DNA extraction and qPCR techniques we found that there was a depletion in the relative abundance of bacteria from the phyla Firmicutes in the almond beverage group. To determine if this change in infant gut microbes was due to an altered microbiome from the breast milk we examined the mother's breast milk microbiome. We found the almond beverage group had a significant increase in the abundance of Lactobacillus bacteria when compared to the cow's milk group. This corresponded to an altered lipid composition in the breast milk. These results show that maternal diet changes the breast milk lipid composition and microbiome, which translates to an effect on infant gut health. The observed changes in the bacterial diversity of the infant microbiome and the mothers breast milk suggests, that the current changes in dietary trends may play a significant role in the development of immune regulation and disease susceptibility in infants.

Characterization of a recombinant proteinacious pectin methylesterase inhibitor (LuPMEI45) from flax, and comparative analysis of PME activity assays

Student: Daniel KING

Supervisor: Michael Deyholos

Pectins are complex polysaccharides that form part of the glue that binds plant cells to each other. During biosynthesis, the majority of the galacturonic acids in pectin are methylesterfied. Throughout development, pectins are demethylated by endogenous pectin methylesterases (PMEs), which change the properties of the pectins. For example, demethylated pectins can be more rigid by the formation of complexes between Ca²⁺ ions and the carboxylates of demethylated pectin. Canada is the world's leading producer of flax (*Linum usitatissimum*). All of Canada's flax is grown for its seed (i.e. linseed). Flax has extremely strong phloem fibers that grow in the outer layers of the stem. These fibers are a nuisance to linseed farmers, but in some countries, the fibers are harvested to make linen. Utilization of fibers requires retting, a process in which microbes are allowed to colonize the stems and partially digest the pectins that hold the fibers in place. Canada's climate is too cold and dry for retting, but it has been proposed that fiber extraction could occur instead by preventing the pectin demethylation that normally occurs during fiber development. PME activity is regulated in part by PME inhibitors (PMEIs); small (~150 aa) proteins. The flax genome encodes 105 putative PMEs and 95 putative PMEIs. LuPMEI45 is one of the flax PMEIs that is expressed during fiber development. This 17.4kDa protein was previously cloned and expressed recombinantly in *E. coli*, but has not been fully characterized. As a first step towards characterizing LuPMEI45, and to facilitate future identification of flax mutants with altered methylation patterns, I evaluated PME assays based on cost, time demand, sensitivity and reproducibility of results. Two published PME activity assays were evaluated, as well as one novel assay. First, in the ruthenium red gel diffusion assay, PME was applied to a well within a pectin-rich gel, which was then incubated and finally stained with a ruthenium red solution. Ruthenium red complexes with demethylated pectin and the area of PME activity is revealed after staining. This assay was discontinued due to a high cost in time and materials, and the potential for error in diffusion area measurement. Second, a novel PME activity assay was designed to measure the change absorbance over time in a pectin-ruthenium red solution caused by PME. As the enzyme generated free carboxylate positions within the pectin, the ruthenium red would be removed from solution and, in theory, show a decrease in absorbance over time. This assay was discontinued because of low sensitivity due to the background change in absorbance of the solution. The third assay measured the change in absorbance of a pectin-bromothymol blue solution. A decrease in absorbance is caused by a decrease in pH from the galacturonic acid (GalA) produced by demethylation. This assay was the best of all assays tested, because it was relatively fast, had high reproducibility, low cost, and highest sensitivity (minimum $7.78 \times 10^{-3} \mu\text{mol GalA}/\text{min} \pm 4.56 \times 10^{-6}$). The kinetic parameters of the inhibitor including the K_M , k_{cat} , v_{max} in the presence of the inhibitor; the K_I , the temperature and pH tolerance; and the theoretical isoelectric point were determined. Moving forward, the selected assay could be applied to future PME mutant screening. However, attempts should be made to increase the change in absorbance, perhaps by greater quantities of enzyme, substrate and bromothymol blue; and running the assay under buffered conditions as it was largely unbuffered and significant effort was applied to maintaining assay solution pH.

Modeling snowshoe hare population cycles

Student: Luke CREVIER

Supervisor: Karen Hodges

The snowshoe hare population cycle is a well-known phenomenon in the northern boreal forest. Snowshoe hare populations go through regular cycles of high and low numbers. Although these cycles have been known and studied since at least the early 20th century, there is no firm consensus on their cause. The field is further complicated by the fact that some populations of snowshoe hares, mostly in the southern part of the species' range, do not follow the same boom and bust pattern. Many factors, including predation, lack of food, and disease, have been studied to determine the cause of the snowshoe hare cycle. One possible cause could be that certain vital rates of the hares, like survival or reproduction, vary through time. To investigate the effect of dynamic vital rates on the population dynamics of snowshoe hares, we developed a mathematical model to simulate snowshoe hare populations over time.

Ungulates as Ecosystem Engineers: The Role of Grazing in Structuring the Plant and Soil Microbial Communities

Student: Nicola SHIPMAN

Supervisor: Miranda Hart

With continued population expansion and degradation/urban development of arable land, the need for improved agricultural productivity and range-land for livestock is crucial. Understanding ecological community function of grassland habitats is essential in order to conceive of and implement effective management strategies. In grassland areas, continuous grazing from large mammals can result in sustained stress that drastically alters the composition of the ecosystem. Not only is the plant community affected by grazing, but sustained disturbance from grazing also alters the composition of the soil microbial community. The effects of grazing on the symbiotic soil microbiota influence their effects on the plant community. It is unknown whether soil microbes in grazed soils improve the plant growth or ability to tolerate grazing, or if they place an added burden on already stressed plants. In order to evaluate possible differences in plant benefit from soil microbiota between grazed and ungrazed soils, a study was initiated in which soil samples were collected from paired grazed/ungrazed grassland sites in the Okanagan and subsequently used to grow two species of native plants (*Achillea millefolium* and *Poa pratensis*). To assess whether differences in plant growth would be visible only in the presence of grazing, a clipping treatment was applied to half the plants. Plants were grown for each unique combination of treatments: two plants species, grazed vs. ungrazed, clipped vs. unclipped, across five sites for a total of 400 plants. Plant benefit was measured as the ratio of aboveground to belowground biomass. Percent colonization of the roots was quantified as a measure of infectivity of the soil fungal community. Preliminary results suggest site and host identity are more important than grazing history for determining the degree host benefit from soils. The results from this study will contribute to a larger study encompassing biodiversity of plant and soil microbial communities and succession in microbial fungal communities.

Selection of new potential microbial antagonists from an organic orchard in the Okanagan to control postharvest fungal diseases on Spartan and Gala apple cultivars

Student: Melissa LARRABEE

Supervisor: Louise Nelson

Postharvest disease of pome fruit causes considerable economic losses that can represent more than 25% of production, making it a serious issue faced by the B.C. tree fruit industry. Synthetic fungicides have been the main way to control these pathogens because of their ease-of-use and effectiveness. However, pathogen resistance to these products and increasing health concerns have led to the search for alternative control methods, such as the application of a biocontrol agent, also called an antagonist. Research indicates that the best place to find an antagonist is where disease can be expected, but does not occur, and that the selection of an

antagonist may be enhanced by selecting samples from organic orchards where bacterial populations have not been exposed to synthetic pesticides. This study implemented a research program in which 200 microorganisms were isolated from soil, leaf and fruit of apple and pear in an organic orchard in the Okanagan and tested for their potential as antagonists against the three major postharvest pathogens in the Okanagan, *Penicillium expansum*, *Botrytis cinerea*, and *Mucor piriformis*, on Spartan and Gala apples. The objectives were to identify isolates that showed the greatest in vitro fungal inhibition against all three pathogens and then to determine their in vivo efficacy on apples in cold storage and their possible modes of action. Out of the 200 isolates tested, 8 showed potential biocontrol activity in vitro against all three fungal pathogens. The top two isolates, AST14 (*Serratia proteamaculans*) and ASA15 (*Pseudomonas putida*), selected on the basis of (1) in vitro effectiveness and (2) their identification, were chosen for use as in vivo biocontrol agents on Spartan and Gala apples in cold storage (4°C) for 15 weeks. The isolates originated from the soil beneath apple trees. They were not effective against *P. expansum* on Gala or Spartan apples. Both isolates exhibited control of *M. piriformis* equivalent to that of the commercial biocontrol Biosave and the fungicide Scholar on Gala. Only AST14, along with the commercial controls, was effective against *B. cinerea* on Spartan. Scanning electron micrographs of the fungi incubated with each isolate showed intense deterioration of the fungal cell walls. Metabolite screening showed that AST14 and ASA15 produced protease, but not chitinase, cellulase, or siderophores. Further characterization is required to determine if these antagonists, which are naturally adapted to environmental conditions of the Okanagan region, have commercial potential for control of postharvest disease in the Okanagan.

Effect of commercial and novel biocontrol agents on suppression of postharvest disease in Ambrosia and McIntosh apples by four *Penicillium expansum* strains.

Student: Someshwar LATCHMAN

Supervisor: Louise Nelson

Loss of apples due to postharvest fungal disease is of great economic consequence to the fruit industry in British Columbia and around the world. *Penicillium expansum* is the predominant cause of postharvest fungal losses in apples. While fungicides are traditionally used to inhibit fungal pathogens, many of these pathogens have developed resistance to fungicides. Increasing fungal pathogen resistance to fungicides, negative public opinion about the use of fungicides, and greater governmental restrictions on fungicide use have led to research on alternatives to fungicides. *Pseudomonas fluorescens* 4-6, a Canadian soil isolate, has the potential to act as a biological control agent and suppress postharvest fungal pathogen *P. expansum*. In this study, *P. fluorescens* 4-6, Bio-Save, a commercial biocontrol agent, and Scholar, a commercial fungicide, were tested for their ability to inhibit the growth of four locally isolated *P. expansum* strains (1790, p8, p17, p22) in vivo and in vitro. *P. expansum* p17 and p22 are resistant to thiabendazole, the active ingredient in the commercial fungicide Mertect, whereas *P. expansum* 1790 and p8 are non-resistant strains. The ability of each control agent to reduce the growth of each fungal strain was tested in vivo on McIntosh and Ambrosia apples kept in cold storage (4°C) for 15 weeks. All three treatments significantly inhibited fungal growth of all four *P. expansum* strains, except for *P. expansum* p22 on McIntosh apples. Apples treated with Scholar showed the greatest inhibition with almost no fungal growth, followed by isolate 4-6. The infection severity was greater on Ambrosia apples at 15 weeks compared to McIntosh apples for *P. expansum* p8, p17 and p22. In in vitro inhibition assays isolate 4-6 at 9 log CFU/mL significantly reduced fungal growth of all four *P. expansum* strains compared to 6 log CFU/mL. When isolate 4-6 cell-free supernatant (CFS) was supplemented into the medium it significantly inhibited the growth of *P. expansum* 1790 and p8. The *P. expansum* strains were inoculated into McIntosh and Ambrosia Filter Sterilized Apple Broth (FSAB) to investigate the effect of pre-set pH (5 and 7), and temperature (4°C and room temperature) on fungal growth and ability to change the pH, which could relate to the ability of these acidophilic fungi to establish during storage. The *P. expansum* strains grew and changed the pH similarly in both McIntosh and Ambrosia FSAB. Growth was slower at 4°C than at room temperature and a negative relationship was observed between the final pH and mycelium growth. Isolate 4-6 demonstrated broad spectrum antagonistic activity against all four *P. expansum* strains comparable to commercial biological and chemical control agents.

Study of kainate receptors in astrocytes via confocal imaging and electrophysiology

Student: Melissa HINDERLE

Supervisor: Fred Menard

Neurodegenerative diseases are incurable and debilitating conditions that result in the progressive breakdown and eventual death of nerve cells. In most neurodegenerative diseases, synapse elimination is a process that has gone awry; therefore cells, such as astrocytes, that are involved in processes that maintain a healthy synapse are thought to be crucial to preventing neurodegenerative diseases. Astrocytes are known to support synapse connections and provide nutrients to neurons. Recent discoveries show that astrocytes possess a type of receptor called an ionotropic glutamate receptor (iGluR), which controls calcium flow and is thought to play a role in how astrocytes communicate with each other and modulate synaptic activity. However, knowledge of the receptor's correlation to neurodegenerative diseases is limited due to the lack of precise methods to investigate these receptors in live cells. In order to study iGluRs our lab invented a fluorescent molecular probe based on kainic acid as a means to image iGluR activity using super-resolution microscopy on live cells. The ultimate goal of my research is to gain insights into the role iGluR6 plays in astrocytes and how this affects neuronal connections using imaging techniques. The gene for GluR6 receptors was successfully integrated into a pcDNA3 backbone. Human embryonic kidney (HEK) cells were successfully transfected with said plasmid and observed with confocal microscopy. Confirmation of functional expression of the GluR6 protein is achieved using SDS-PAGE, Western Blot and immunocytochemistry techniques.

Computational analysis using hydrophathy indices for in silico homology modeling of the Dengue Virus NS2B protein.

Student: Ryan HODGSON

Supervisor: Al Vaisius

The Dengue virus (DENV) is a member of the flavivirus family, which also contains other virulent pathogens such as the West-Nile and Yellow Fever viruses. While DENV is not as widely mentioned as its family members, it is the most prevalent mosquito-borne viral disease, and currently there are no vaccinations or antivirals that have been approved for use. DENV has four serotypes, and while infection with one serotype may not be fatal, it can facilitate infection by the other serotypes, which can lead to severe life threatening diseases such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). The genome of DENV is a single-strand of RNA, which encodes the three structural proteins (the capsid, envelope, and membrane), and eight non-structural proteins (NS1, NS2A, NS2B, NS3, NS4A, 2K peptide, NS4B, and NS5). Of the eight non-structural proteins, NS3 and NS2B make up the viral protease and helicase, which are vitally important to the cleavage of the polyprotein into its eleven functional components. While the NS3 protein contains the protease on the N-terminus, the NS2B is absolutely necessary for proper functioning and catalytic activity to occur. The NS2B protein helps to stabilize the NS3 protein complex, and forms part of the active site pocket helping to facilitate catalysis. Due to the important role of the NS3/NS2B complex, it is a prime target for therapeutic research and is already the focus of many antivirals currently being developed. In this study 120 unique strains from the America's (30 for each of the four serotypes) were selected and studied in silico from the NCBI database. The NS2B sequence was determined for each and then, using the Kyte and Doolittle hydrophathy scale and a sliding scale of nine, the hydrophathy for each individual amino acid in the NS2B protein was determined. Using the generated hydrophathy profiles and statistical analysis, unique strains were found for each serotype (with four unique, five unique, four unique and one unique strain for serotype one, two, three, and four respectively). Each unique strain was modeled using Swiss PDB, then checked for authenticity using MolProbity. After doing so the different unique strains were compared and any structural differences in the NS2B protein that was incorporated into the NS3 complex, that made up the active site pockets, and hydrophobic areas that hold the complex on the membrane were recorded. These changes are important as any structural difference reflect the high variability in the Dengue Virus and made lead to better modeling.

Computational Analysis of Architecture and Comparative Homology Modelling of the Dengue Virus Envelope Protein

Student: Amanda ENEVOLDSON

Supervisor: Al Vaisius

Dengue Virus (DENV) is an extremely infectious mosquito-borne flavivirus characterized by four serotypes. While DENV can cause a wide range of symptoms, infection by more than one serotype may put an individual at risk of life threatening diseases known as dengue hemorrhagic fever and dengue shock syndrome. This year, the world health organization estimates that 390 million dengue infections will occur, and there is still no effective vaccine. Current therapeutic strategies may struggle to produce effective vaccines due to the high variability in sequence across DENV substrains. DENV consists of three structural proteins; the capsid, the membrane, and the envelope. The envelope protein is made up of 90 head to tail homodimer subunits, and due to its involvement with fusion to the host membrane, it is a major component in determining virulence. Residues within the ectodomain of the envelope protein may be involved with stabilizing conformational changes of the stem/anchor region for fusion of the membrane with that of the host. In this study, 120 substrain DENV ectodomains (30 substrains per serotype) were computationally analyzed using the relative hydropathy scale of Kyte and Doolittle to gain insight onto the changes in architecture of the ectodomain with sequence variability. A family profile for each serotype was calculated based on the 30 substrains, and Structure Divergence Scores and Protein Divergence Scores were calculated for each serotype in order to find structural outliers. A total of 10 outliers were found for DENV1, 12 outliers were found for DENV2, 12 outliers were found for DENV3, and 11 outliers were found for DENV4. Hydropathy indices were successfully used to elucidate changes in architecture across the DENV ectodomain via in silico comparative homology modelling. Regions of increased sequence variability may point to areas of increased virulence. Family profiles were found to vary greatly from some of the current X-ray crystallography structures, indicating a potentially significant problem for those trying to biochemically synthesize therapeutic agents directed to the ectodomain.

Comparative Analysis of Structural Hydropathy amongst Substrains of Dengue Virus in the Americas to Elucidate Hydropathy Blocks in the Capsid Protein common to Apo B100

Student: Sara DUNBAR

Supervisor: Al Vaisius

The World Health Organization estimates that there are 2.35 million Dengue virus (DENV) infections in the Americas every year. A member of the Flaviviridae family, DENV a mosquito transmitted disease is becoming one of the most rapidly spreading viruses. Typically only found in tropical climates this virus has become increasingly mobile due in part to increasing global trade, relaxed efforts in mosquito population control, and climate change. Cases have been reported in North America. DENV virions contain a single strand RNA genome packaged by capsid proteins and enveloped by a host derived lipid bilayer. The RNA genome encodes a single polyprotein that produces three structural proteins; capsid (C), membrane (M), and envelope (E) and seven non-structural proteins. The capsid protein has a high content of amino acids lysine and arginine which resemble the arginine/lysine (R/K) clusters found near the N-termini of Apo B100 that have been suggested as a nucleic acid binding domains and nuclear localization signal sequences. A possible entry method of Flaviviruses is by the low-density lipoprotein (LDL) B/E receptor which contains an arginine/lysine cluster LRKLRK with the critical residues being the lysines. If either lysine is replaced with arginine as RXXX or KXXX binding affinity is maintained but if both are altered binding is dramatically reduced. When the DENV capsid protein and Apo B100 R/K clusters are compared three similar R/K-X-X-R/K motifs are found in the Apo B100 N-termini and all serotypes of DENV capsid contain the motif. The focus of this project was to use computational techniques to compare capsid protein architecture as evident in hydropathy blocks for 120 substrains of DENV specific to the Americas. The goal was to identify common variable regions between DENV capsid protein and Apo B100 protein of human LDL particles. Hydropathy is better conserved than protein sequence during evolution and is an important physiochemical property for amino acids. Protein hydropathy graphing is a method used to link protein sequences to architectural structure, where hydropathy scales assign a value to each amino acid relative to its hydrophilicity and hydrophobicity. The study used hydropathy values for a sliding scale of nine amino acids to determine the average hydropathy scalar value for every residue along the capsid protein. A modified version of the Structure Divergence Score (SDS) was used to quantify the variability between hydropathy profiles in the DENV substrains while a Profile Difference Score (PDS) measured the variance between the family profile and an individual substrain. This presentation will outline the structure predictions, architectural variance within the capsid protein and the potential intermolecular bonding interactions.

The Influence of Social Attachment and Social Networking Site Usage on Happiness, Self-Esteem, and Loneliness

Student: Christy GRENON

Supervisor: Mark Holder

This study will investigate the influence of individuals' adult attachment style on happiness, self-esteem, and loneliness while considering the frequency, duration and type (e.g., Facebook, Twitter, Instagram, and Snapchat) of social networking site (SNS) usage. SNS usage is a daily part of most people's lives despite that research shows that increased SNS usage is linked to a decrease in well-being. Attachment styles have also been linked to well-being. Research and theory categorize attachment styles as either secure or insecure, and people who have insecure attachment styles report lower levels of happiness, lower self-esteem, and greater loneliness, than those who have secure styles. Research has not determined how attachment style and SNS usage together influence well-being. The current study will explore these relationships by assessing SNS usage, attachment style, happiness, self-esteem, and loneliness in University of British Columbia undergraduates. Results will be known this year. Thus, we now present the theory behind the research and the methods, as well as our hypotheses. The findings of this study will contribute to our knowledge of well-being and potentially lead to new positive psychology interventions.

The Remorse Code: An Examination of the Linguistic Patterns of Remorse in Offenders

Student: Brianna VERIGIN

Supervisor: Stephen Porter/Brian O'Connor

Within the judicial system, the perceived authenticity of individuals' emotional displays (e.g., remorse) informs subsequent decision-making (MacLin, Downs, MacLin, & Caspers, 2009). Despite the powerful role that remorse plays within legal and investigative settings, there has been scarce psychological research on the manifestation of the affective state of remorse. The current sample was comprised of a random subset ($n \geq 100$) selected from a database of federally incarcerated offenders who participated in a semi-structured clinical interview (Psychopathy Checklist – Revised [PCL-R]; Hare, 1991, 2003). The selected sample of individuals included male offenders with psychopathy scores ranging along the clinical continuum. Empirical evidence suggests that there is value in attending to verbal cues to gather information regarding the foundations of cognitive and emotional processes involved in emotional deception (DePaulo et al., 2003). Accordingly, linguistic analysis was used to examine the nature of remorse displays as a function of psychopathy. It was predicted that displays by psychopathic offenders during discussions of experienced remorse would have specific verbal aspects (e.g., slowed speech rate, increased speech hesitations/inconsistencies, and fewer self- and other-references) representative of insincere remorse. The present study aims to advance our understanding of the expression of sincere versus insincere remorse in offenders, which will have significant implications for legal decision-makers when assessing the veracity of offenders' emotional displays of remorse.

Mixed Method Analysis of Ayahuasca Experience Reports

Student: Avery SAPOZNIKOW

Supervisor: Zach Walsh

Ayahuasca, a traditional medicine of Amazonian culture in Peru, is an entheogenic brew consisting of N,N-dimethyltryptamine (DMT) and monoamine oxidase inhibitors (MAOIs). It has long been associated with hallucinations and visionary experiences, as well as the reduction of symptoms of a variety of psychopathologies. Use in North America is less ordinary in comparison to ritual use in Peru and surrounding areas, however use has been increasing in recent years. North American use has diverse manifestations, ranging

from ceremonies that mirror traditional use in setting and constituent of the admixture, to the use of pharmacological admixtures taken in non-ceremonial settings. Anecdotal reports from users of their perceptual experiences and feelings, during and after the ingestion of Ayahuasca, may shed light on the influences of these diverse contexts. Experience reports (n=200) were collected from Erowid.org, a website which facilitates the publication of user experience reports for most psychoactive substances, and edited for analysis through Linguistic Inquiry and Word Count (LIWC), a textual analysis software. The output gives psychologically meaningful information about the content of the text entered in terms of temporal, emotional, and cognitive aspects. Further, a detailed output covering the syntactic aspects of language, such as proportions of nouns, pronouns, adverbs, negativity, etc. is presented. The experience reports were compared in terms of traditional ritual use and non-traditional home use using the output from LIWC and data from the initial collection and editing of the reports. Additionally, reports of the use of *Psilocybe cubensis* mushrooms (n=50) and 3,4-methylenedioxymethamphetamine (MDMA) (n=50) were analyzed as perceptual/psychedelic and methodological controls, respectively. The results may provide useful information on the general effects of the use of Ayahuasca, the role of setting in experiences, and if the components of the admixture that make up the brew provide different experiences and effects.

Hallucinogen and Violence Towards Self and Others

Student: Michelle THIESSEN

Supervisor: Zach Walsh

Prior research has broadly identified substance use as a risk for negative psychosocial outcomes (Boles & Miotto, 2003). However, recent evidence suggests that among a representative sample of adults in the USA, hallucinogen use was associated with reduced global psychological distress (Hendricks et al., 2015; Krebs & Johansen, 2013), and among high-risk individuals with prior criminal records, outcomes were improved when compared to hallucinogen naïve individuals (Hendricks et al., 2014; Walsh et al., 2016). The association between hallucinogen use, intimate partner violence (IPV) and non-suicidal self-injury (NSSI) has not been thoroughly examined, and the few extant findings are equivocal. Furthermore, the psychological mechanisms underlying the potential protective effects of hallucinogen use for behavioral disorders remains poorly understood. Recent neuroimaging data suggest that the therapeutic effects of hallucinogens may relate in part to their ability to modulate neural circuits that are implicated in mood and affective disorders (Vollenweider & Kometer, 2010; Carhart-Harris et al., 2012). This has led us to theorize that increased levels of emotional regulation and distress tolerance may be the mechanisms underlying a decrease in violence among hallucinogen users. The current investigation evaluated the relationship between NSSI, IPV, and hallucinogen use among a community sample of 1061 adult respondents to an online survey. We hypothesize that a lifetime history of hallucinogen use will be associated with reduced likelihood of IPV and NSSI and that the relationship will be partially mediated by emotional regulation and distress tolerance. Results from the current study will increase our understanding of the relationship between hallucinogen use and violence. Findings such as these could have important policy implications as the continued stigmatization and criminalization of these substances may be more costly to society than their use.

Session 2B – EME 1153

Improving Introductory Computer Science Courses Through Learning Analytics

Student: Shannon FARVOLDEN

Supervisor: Bowen Hui

As the use of technology in society continues to rise, the demand for undergraduate students in these fields rise as well. How can we improve our introductory computer science courses to ensure students get a positive experience with computer science? Analyzing data recorded from a learning management system can tell us a lot about how students learn, understand what topics students struggle with, and what actions should students take to succeed in a historically challenging course. Making this data available to instructors in real time would provide valuable feedback with how students are doing in the course and allow instructors to make adjustments as needed. In addition, if students are able to visualize their own progress and have an understanding of what actions

have contributed to success in the course in the past, this would provide a guide for actions they can take to reach their personal goals. In order to retrieve this data, a custom learning management system has been developed and piloted by the first year Introductory Computer Programming course (COSC 111). This system includes features such as a discussion forum, quizzes, slides, lab/assignment submissions, and administration functionality. A custom learning management system allows us to collect data based on use of the system, perform data analysis to predict trends, and display findings back to both students and instructors on a personalized dashboard.

Simulating the Urban Spread of the Mountain Pine Beetle

Student: McCall MILLIGAN

Supervisor: Rebecca Tyson

The mountain pine beetle epidemic in British Columbia inspired a lot of models in an attempt to control and anticipate future problems. Other studies have focused on non-urban areas, leaving the movement of the mountain pine beetle in an urban environment to speculation. One of the largest impacts of these attacks on urban areas is the death of tree stands, which lessens the health and wellness of the residents. We will use the model in an attempt to explain the data collected in a field study on urban mountain pine beetle movement. Simulations were run for beetle movement on a theoretical landscape with features mimicking those of the field study's landscape. By modelling the urban movement of the Mountain Pine Beetle, we hope to find information that may help limit or stop the spread of the beetle in order to preserve urban pine stands.

The Effects of Multiplicity in Meta-analysis and its Biased Outcomes

Student: Broghan ERLAND

Supervisor: Jason Loepky/Deanna Gibson

The field of meta-analysis has gained popularity but some of the errors in meta-analysis have not become widespread knowledge. Multiple outcomes within a study analyzed in a meta-analysis are a source of multiplicity and can bias the results. Many of the studies in a meta-analysis contain multiple dependent outcomes that cannot be approached using the same methods as single independent study outcomes. The Cochrane Collaboration, considered the gold standard of meta-analysis, proposes the selection of a single primary outcome for each study to be used to avoid multiplicity at the study level. The aim is to highlight multiplicity and the current issues associated with resolving multiple outcomes with emphasis placed on the Cochrane Collaboration's approach. Data was acquired from a previous meta-analysis on the effects of n-3 polyunsaturated fatty acid supplementation on infant health. Using Comprehensive Meta-analysis Software, separate meta-analysis was run with selectively biased single outcomes for each study to render results favouring both directions of the outcome. Then in RStudio, a randomization of all possible outcomes for each study was then run and plotted to show the range of possible p-values that can be obtained. We found that by selecting single outcomes study results can become significant for both the control and experimental. The range obtained from a randomization of meta-analysis run 10,000 times was found to give some results of p-values varying between (0, 1) in both the fixed and random effects models. This research has found that multiple outcomes within a study can bias a meta-analysis and directly affect its outcome.

A 2nd Moment Iterative Deconvolution Technique

Student: Nolan FRYMIRE

Supervisor: Murray Neuman

Most traditional deconvolution methods are Fourier based and noniterative. In other words, they exploit the convolution theorem which states that the convolution of two images is simply the point wise product of the Fourier transforms of the two constituent images. Even after the advent of the Blackman-Tukey algorithm Fourier based deconvolution methods can still be computationally

expensive. When one considers large amounts of data, such as a video with frame rates on the order of 100 frames per second, one can see an obvious need for even faster deconvolution methods. In this work, a less computation-intensive method is proposed. A local power series expansion of the object function leads to an expression for its difference from the image function as a series of terms proportional to the moments of the point spread function. Then, iterative estimation and removal of the lowest-order error terms allows recovery of the object, effectively deconvolving the image. In this paper, the moment based method is tested on one-dimensional data arrays with varying ratios of widths of object and point spread functions. This method has also been extended to two-dimensional arrays, thus allowing its use in the field of image-processing.

Session 2C – EME 1202

Influence of basin bedrock geology on debris-flow magnitude: A case study from British Columbia and Alberta, Canada

Student: Alicia RENYARD

Supervisor: Fes de Scally

Debris flows in steep mountain channels are a destructive mass movement process, posing a serious hazard to human activity and infrastructure on the depositional fans built by debris flows. The associated level of risk can in part be evaluated by examining the magnitude of past events as evident from the deposits of debris-flows on the fans. The amount of weathered material (sediment) in a debris-flow basin is an important controlling factor on debris-flow magnitude, and the availability of such sediment should be related to the strength of the basin's bedrock. However, little research has been done on the relationship between bedrock type and debris-flow magnitude. In this study a database of 60 documented debris-flow events in British Columbia and Alberta, Canada was created, containing information on debris-flow magnitude (i.e. volume) and basin bedrock type. The basin bedrock type was categorized into six classes on the basis of significant differences in rock strength: extrusive igneous (volcanic), intrusive igneous (plutonic), weak and strong sedimentary, and weak and strong metamorphic. Box-and-whisker plots were then created to compare the basin bedrock classes against total debris-flow volume, debris-flow volume normalized by basin area, and the various morphometric variables. The plots show that, as expected, median debris-flow volumes associated with weak volcanic rocks are much greater than those associated with strong plutonic rocks. A similar difference in median debris-flow volume is noted for weak and strong sedimentary rocks although this difference is minor compared to the variability within each bedrock class. However, strong metamorphic rock is found to be associated with on average greater debris-flow volumes than weak metamorphic rock. This is an unexpected result because basins underlain by weak metamorphic rocks may be expected to generate greater amounts of sediment for debris flows. The minor difference in median debris-flow volumes between weak and strong sedimentary rocks, and the unexpected result between weak and strong metamorphic rocks may reflect the very small sample sizes for these rock classes. This highlights the need for better documentation of debris-flow events in all geological domains of the Canadian Cordillera for research purposes. The result for metamorphic rocks might also reflect the fact that in basins underlain by weak metamorphic rocks, an abundance of sediment increases the frequency of debris flows, which decreases the volume of debris-flows because less sediment is available to be transported in individual events. Therefore, while basin bedrock type undoubtedly plays some role in controlling debris-flow magnitude, this is probably complicated by an inverse relationship between event frequency and magnitude and by other factors such as the fact that not all the sediment in a basin is available for transport by debris-flows.

Tectonic Implications of the Petrogenesis of the Ulleri-Melung-Salleri Orthogneiss

Student: Hannah CAVALLIN

Supervisor: Kyle Larson

A series of mylonitic orthogneiss bodies crop out along most of the >2000 km length of the Himalayan orogen. They have been variably interpreted to be the product of continental collision-related anatexis, arc plutonism, or extrusive volcanism. Previous studies, however, have been based on limited geochemical analysis, poorly constrained geochronologic ages, and low spatial

resolution sampling, making interpretation of these rocks difficult. This study uses detailed petrography, and new major and trace element geochemistry data from a suite of specimens collected in east-central Nepal to interpret the petrogenesis of the orthogneiss protolith. The combined results from this work are consistent with rocks originating as an A-type/within-plate pluton associated with an extensional tectonic environment. Published and unpublished geochronologic constraints on these same rocks show that the protolith is Paleoproterozoic age. This is consistent with evidence of rifting recorded in both the Indian craton and around the globe at this same time.

An Assessment of Sockeye Salmon Habitat Potential in Lower Vernon Creek, British Columbia

Student: Alexander MACDUFF

Supervisor: Bernard Bauer

Anadromous salmon were extirpated from most of the Okanagan Basin over 50 years ago due to aggressive river channelization projects and subsequent installation of flow-control structures that precluded fish passage. As part of the Okanagan River Restoration Initiative (ORRI), however, there are efforts underway to reintroduce salmon into Okanagan Lake and its tributaries. Lower Vernon Creek, despite having experienced large scale habitat degradation and flow modification, would likely serve as a prime spawning stream and also facilitate further fish passage into Kalamalka Lake. The principal objective of the research was to provide an up-to-date assessment of the habitat value of Lower Vernon Creek in the context of inevitable reintroduction of sockeye into the upper parts of the Okanagan Basin. A study was designed with four distinct components: (1) repeat stream walks to provide a qualitative-expert assessment of reach viability; (2) substrate sampling and analysis to assess spawning gravel capacity for redd building; (3) water quality monitoring to identify possible constraints on habitat preferences by fish; and (4) hydraulic modelling to simulate the range of conditions likely encountered through a typical hydrological year. The results indicate that only two of five sub-reaches in the section between Kalamalka Lake and Okanagan Lake are suitable for salmon. Bed siltation and bottom armoring were major issues in the other reaches. The hydraulic modelling for high, average and low flow conditions suggests that less than half of the study sites would have hydraulic conditions required by spawning sockeye (assessed using the Froude number, flow depth, and flow velocity), during hydrological conditions encountered in a typical year. However, the study results also suggest that the stream may be more productive than has previously been assessed, and it may only require modest restoration efforts to greatly enhance the overall capacity of the stream to support anadromous salmon.

Session 2D – EME 1101

A study of the correlation between cannabinoid content and trichome clarity and color within *C. sativa*, *C. indica* and *C. sativa* var *Hemp*

Student: Justin PEARSON

Supervisor: Paul Shipley

Cannabis is an annual, dioecious flowering herb that is native to the Central Asian and Indian subcontinent. Presently, there are 3 well-documented species of Cannabis including *C. sativa*, *C. indica* and *C. ruderalis*. Cannabis has applications both medicinally and recreationally, most commonly through the ingestion of edibles or by smoking the dried flower. Cannabis is prescribed medicinally as an analgesic medicine as well as an appetite stimulant for many cancer and MS patients. One of the major terpenophenolic compounds found within Cannabis is the psychoactive component Δ^9 -tetrahydrocannabinol (Δ^9 -THC). Over the last 10 years, Δ^9 -THC and other secondary metabolites have received much attention, resulting in substantial metabolomic profiling of many hybridized subspecies of Cannabis. Terpenophenolic precursors naturally develop and mature within glandular trichomes, which are mainly localized to the flowers of the plant. Throughout the plant's development, these trichomes change in both color and clarity, starting clear and transitioning to amber as the plant matures. Clear trichomes are believed to indicate low levels of active secondary metabolites and high concentrations of terpenophenolic acids whereas amber trichomes can indicate high levels of all active

secondary metabolites. There is a clear need to correlate genotype, phenotype, and chemical constitution of the oils extracted from these trichomes. The goal of this research study was to determine the relationship between trichome clarity and coloration and the resulting cannabinoid profiles found in two *C. indica* dominant, two *C. sativa* dominant and two *C. sativa* var. hemp subspecies. Cannabis oil was isolated from floral material using the Rick Simpson protocol and chemical constituents quantified by a commercial laboratory using HPLC. Data from this analysis were analyzed using uni- and multivariate statistical methods. We expect to determine whether trichome clarity/coloration can be relied upon as an effective indicator of chemical composition, and to what degree different Cannabis hybrids produce different amounts of these compounds at these stages of development.

A Structural Analysis of the Integrin $\alpha\beta 5$

Student: Ayaz DAMJI

Supervisor: Fred Menard

Integrins are a large family of integral membrane proteins that mediate cell-cell and cell-extracellular matrix (ECM) adhesive interactions. In the brain, the integrin $\alpha\beta 5$ is expressed only in astrocytes and has been shown to play a major role in mediating astrocyte-ECM adhesion. Astrocytes are an essential component of neural synapses; however, their role in synapse elimination has not been resolved. To study integrins in living cells, the Menard Lab is developing a novel chemical imaging probe. The design of such a probe first requires the structural details of the protein's binding site. The aim of this study is to analyze the structure of the integrin protein $\alpha\beta 5$. Since no $\alpha\beta 5$ crystal structure currently exists, the computer program PyMOL was used to analyze a high resolution crystal structure of an alternate isoform, $\alpha 11\beta 3$. Next, a homology map was created using the aforementioned crystal structure as a reference. Critical structural features of $\alpha\beta 5$ were deduced to gain a better understanding of astrocyte-ECM adhesive interactions. Finally, an in depth literature review was prepared to correlate the structure and function of $\alpha\beta 5$. These findings will guide the design of a chemical probe to elucidate the molecular mechanism responsible for synapse elimination. Identification of the molecular factors involved in synapse elimination is expected to lead to novel therapeutic targets for neurodegenerative diseases.

Developing Pyrazole Derivatives to Reduce Neuroinflammation

Student: Jordan MCKENZIE

Supervisor: Andis Klegeris/Ed Neeland

Alzheimer's disease (AD), the most common form of dementia in people over the age of 65, is a neurological disorder associated with neuronal death and cognitive deficits. Inflammatory mechanisms contributing to AD pathogenesis result from an upregulated glial cell response to pathological hallmarks of AD including: insoluble beta-amyloid ($A\beta$) deposits, neurofibrillary tangles and necrotic neuronal cells. This study explores the derivatization of novel dipyrazole ethandiamide analogues in an effort to develop new pharmacological agents that may be useful in slowing down the progression of AD. Compounds with the dipyrazole ethandiamide structure have been shown previously to have neuroprotective effects by inhibiting activation of microglia. Microglia are the resident immune cells of the brain and have been found to phagocytize and degrade deposited $A\beta$, which is generally beneficial for maintenance of homeostatic conditions in the brain. However, in some circumstances, the activation of microglia may lead to a neurocytopathic microglial state characterized by an enhanced release of inflammatory cytokines and chemokines, reactive oxygen and nitrogen species and other inflammatory mediators which become neurotoxic at pathological concentrations. The objective of this study was to determine how changing the amine substituents during synthesis of the pyrazole compounds alters the beneficial biological properties towards the viability of the target cell types. A total of eight unique nucleophiles with a wide spectrum of molecular structures were chosen to develop the novel pyrazole derivatives. The variance in molecular substituents extending from the core pyrazole structure allows for the interpretation of the structure-activity relationship when biological activity is assessed. Initial screening eliminated two derivatives due to interference with the methods used in the biological assay, while the remaining six derivatives continued to be biologically assessed. Determining which pyrazole derivatives are capable of reducing toxic microglial secretions will focus further research towards developing compounds with substituents known to have neuroprotective properties; with more iterations of this process it is likely that a clinically effective compound will be discovered to combat neuroinflammation in AD.

Investigating the metabolite-mediated effects of acetaminophen on microglial inflammation

Student: Wyatt SLATTERY

Supervisor: Andis Klegeris

Alzheimer's disease (AD) is a neurodegenerative disorder which is characterized by gradual cognitive decline and the development of extracellular deposits of beta-amyloid (A β). Previous research has shown that inflammatory processes facilitated by microglia, the resident immune cells of the brain, are central to the pathogenesis of AD. Nonsteroidal anti-inflammatory drugs (NSAIDs) have been identified to reduce the relative risk of AD development when administered over the course of two or more years. While not a member of the NSAID class, acetaminophen is a readily available drug that has similar clinical indications to NSAIDs and is implicated in the management of inflammatory symptoms such as pain and fever. However, it has been demonstrated that regular consumption of acetaminophen for a period of two or more years increases the relative risk of developing AD. It has been suggested that acetaminophen has several unique mechanisms of action which are primarily mediated by its metabolites, and that the contribution of acetaminophen to the pathogenesis of AD is due to its metabolism into the toxic compound, N-acetyl-p-benzoquinone imine. It has further been proposed that the analgesic and antipyretic effects of acetaminophen are mediated, at least in part, by its metabolism to the anti-inflammatory compound, N-arachidonoylaminophenol. Although several molecular mechanisms have been identified by which N-arachidonoylaminophenol reduces inflammation, its mechanism of action in reducing cellular production of the pro-inflammatory mediator nitric oxide remains elusive. Investigation of the metabolite-mediated effects of acetaminophen on microglial inflammation will offer insights to the efficacy of acetaminophen metabolites in managing AD pathogenesis and potentially identify novel molecular targets for modulating microglial inflammation.

Session 3A – EME 1101

Exercise Outcome Goals and Emotional Well-Being

Student: Samuel VAN GINKEL

Supervisor: Jan Cioe

Perceptions of the ideal body are changing, particularly amongst young individuals aged 24 and under. As such, the number of people exercising to increase their body's aesthetic appeal is steadily increasing. Previous research suggests that focusing on aesthetic-based goals may potentially be detrimental to well-being. However, there is some suggestion that competitive athletes training for performance goals may experience decreases in intrinsic motivation, which may also affect well-being. In this study we investigated the relationship between exercise outcome goals (performance vs. aesthetic) and emotional well-being in a university sample (N = 243). Self-motivation styles (intrinsic, extrinsic, and a-motivation) were also examined. The results of the present study support the hypothesis that aesthetic outcome goals are associated with lower levels of emotional well-being. Additionally, aesthetic outcome goals were also associated with higher levels of extrinsic and a-motivation. In contrast, performance outcome goals were associated with higher levels of emotional well-being, and frequency of exercise, and highly correlated with intrinsic motivation. Mediating relationships are discussed in a theoretical and empirical framework. The implications of the findings are discussed, as well as directions for future research.

Objectification Theory in Sports and Mental Health

Student: Joshua CHIN

Supervisor: Jan Cioe

Exercise (including participation in sports) must be broken down based on its nature (i.e., aesthetic vs. functional), as different types of exercise are said to have different effects on measures of mental health. In particular, aesthetically-based sports (e.g.,

bodybuilding, cheerleading, gymnastics) appear to support values of Objectification Theory, which emphasize evaluations of visual presentations of the body. Research has shown participation in such sports is correlated with instances of eating disorders, and low scores on measures of self-esteem. This study analyzed a sample of 304 participants who completed Rosenberg's Self-Esteem questionnaire and the Body Cathexis Scale, and reported their exercise activity in the previous month. Our main hypothesis predicted that stylistic (aesthetic) sports would decrease the positive correlation that has been frequently shown between amount of exercise and body satisfaction and self-esteem. Results were analyzed using moderated regression and analysis of variance, and are discussed in a review of objectification theory in sports.

The Experience of Schadenfreude for Painful and Benign Misfortunes

Student: Sydney RINE

Supervisor: Stephen Porter

Schadenfreude refers to the feeling of malicious pleasure or joy experienced when another individual suffers a misfortune (Heider, 1958). To date, research has focused almost entirely on the variables that promote feelings of schadenfreude, such as deservingness of the target, envy and resentment, as well as the personality factors that may affect the degree to which it is felt (Feather et al., 2001; Porter, Bhanwer, Woodworth, & Black, 2014; Smith et al., 1996). The current study examined whether the type of misfortune experienced (i.e., presence of pain, intensity) influenced the experience of schadenfreude. To do so, participants (observers) were primed to feel schadenfreude, empathy, or a neutral emotion for a target before being presented with an image of him suffering a misfortune (either low/high intensity or low/high in painfulness). Participants then filled out self-report measures related to their emotional reactions to the misfortune vignettes. Further, the experience of schadenfreude was measured objectively through smiling coding. Following this, participants completed a series of individual difference measures. Researchers examined the role of misfortune type in the experience of schadenfreude across the entire sample, as well as the ways that individual differences influenced this relationship.

Changing automatic thinking: Reducing alcohol abuse in teens and emerging adults

Student: Jennifer KEOGH

Supervisor: Marvin Krank

Dual processing theory suggests a two-system approach to decision-making. Automatic processing is our default mode of thinking, however, cognitive biases occur. What youth expect will happen if they use alcohol (outcome expectancies), and how much others are using (descriptive norms) both influence use. Alcohol outcome expectancies, for example, predict current and future drinking. Youth, who expect more positive outcomes from drinking, drink more than youth who expect fewer positive outcomes. Studies of youth suggest that many have biased views about alcohol. Many cognitive theories of substance use emphasize the importance of reasoned and planned choice, ignoring automatic and non-conscious thought. Our approach acknowledges that reasoned action is important, but further assumes that automatic and non-conscious processing leads to bias and sometimes seemingly irrational choice. Our hypothesis is that reducing biased automatic thoughts in regards alcohol will change drinking behaviour. Simple learning experiences can affect automatic processing. In this study, we will use learning exercises based on priming and exemplar generation to reduce teen biases in alcohol outcome expectancies and descriptive norms. We expect that these learning exercises will change the balance of risky and healthy cognitions, and reduce problem drinking. Further, we expect that changes in outcome expectancies and descriptive norms will mediate changes in drinking for both middle school and undergraduate students.

Towards a Quantum Dimer Model

Student: Christopher GARNER

Supervisor: John Hopkinson

In antiferromagnetic systems interactions between magnetic moments (called spins) favor anti-alignment between nearest neighbor spins. In some antiferromagnetic systems geometric frustration can inhibit the formation of magnetic order at low temperature, resulting in a highly degenerate ground state and residual entropy. It has been proposed that certain frustrated spin $\frac{1}{2}$ antiferromagnetic systems may form new phases of matter at low temperatures. Such phases include quantum spin liquids, which spontaneously break no symmetry and support exotic half-integer excitations (spinons). Interest in quantum spin liquids has grown recently with experimental hints of the realization of such a phase in a synthetically grown sample of the mineral herbertsmithite. To theoretically model the behavior of antiferromagnetic systems it can be advantageous to assume that each spin pairs-up into a singlet bond (or dimer) with another nearby spin. These models, known as quantum dimer models, offer a simplified description of spin-spin interactions by concentrating on the dynamics of the singlet bonds instead of the individual spins. Such models also have the advantage of being amenable to analytic methods due to their connections to classical dimer problems. This talk will concentrate on the statistics the classical dimer model on several mostly unstudied two-dimensional lattices while relating these results to the behavior of their associated quantum dimer models. In particular this talk will discuss the partition function, spin-site entropy, dimer-dimer correlations, and monomer-monomer correlations. Emphasis will be placed on the mathematical methods employed to determine the classical dimer results.

Cell Flow Slide Design for Raman Spectroscopy

Student: Nicholas SOMER

Supervisor: Andrew Jirasek

Raman Spectroscopy (RS) involves the measurement of molecular vibrational energy states through inelastic photon collisions. RS is a means of determining the physical and chemical composition of a substance, with applications in material science, chemistry and bio-medical physics. One application includes the detection of radiation induced changes in a cell's biochemistry. The current method of analysis is time-inefficient and therefore not feasible for clinical applications. The focus of this presentation will be on the designing and testing of micro-well slides, which, using negative dielectrophoresis (nDEP), will position cells in solution for automated RS analysis. Performance tests on the slides shall be presented, within the context of noise reduction and minimization of background scatter. Progress on the nDEP apparatus shall be presented along with a discussion of future development goals.

Next Generation Nano-Structured Metal Oxide Electrochromic Devices and their Applications in “Smart” Windows

Student: Cassidy NORTHWAY

Supervisor: Kenneth Chau

By exploiting the properties of electrochromic materials, which have varying optical properties as a function of applied voltage, we can craft windows which are more energy efficient than any traditional fenestration. Known as switchable or “smart” windows, these devices possess a “bleached” and “coloured” state in which the transmittance is respectively high and low. Switchable windows are already commercially available but there are still significant improvements which can be made in terms of transmittance, switching speeds, and colouring efficiency. Thus nanostructuring has emerged as a method to both outperform non-tailored counterparts and unlock novel and exciting behaviours such as dual band spectral selectivity. We have completed a review of nanostructured metal oxide electrochromic materials and crafted a succinct overview of the latest progress in this field. We have chosen to focus on metal oxides as they outperform other material types (eg. semiconductors and polymers). In this critical review,

we have evaluated recent material and structuring configurations in terms of feasibility for large-area manufacturing, their electrochromic properties and required deposition techniques. In this talk we will provide insight into the most promising technologies and a realistic analysis of the challenges of full-scale commercial implementation.

Artificial Spin Ice on the Sorrel Net

Student: Albert AI

Supervisor: John Hopkinson

This thesis studied the geometrically frustrated Sorrel Net, a 2D, 1/9th site depleted and 1/7th bond depleted triangular lattice first studied by Dr. John M. Hopkinson and Jarrett J. Beck. In this particular study, we looked at ferromagnetic Ising spins on each vertex of the triangles pointing either into or away from the centre of the triangle, and we looked at the physical properties of the lattice (energy per spin, heat capacity, and residual entropy) when we vary the strengths of the different couplings between the spins based on their geometry; specifically, residual entropy was of particular interest, since a nonzero residual entropy would indicate a frustrated, and thus highly disordered, lattice at low temperature, which would theoretically lead to exotic physical phenomena. The couplings were defined thusly: J_{1a} being the coupling constant between two spins pointing into each other, J_{1b} being the coupling constant between the spins that are parallel to each other, J_{1c} being the coupling constant between bonds that are almost perpendicular to each other, and J_H between the overlaying spins. We considered lattices with 4 (?) 4 unit cells using Monte Carlo simulation, and a unit cell by itself using both Monte Carlo simulation and analytical method. The cases considered were $J_{1a} = \sqrt{-1}$, $J_{1a} = J_{1b} = \sqrt{-1}$, $J_{1a} = 2J_{1b} = \sqrt{-1}$, $J_{1a} = J_{1b} = J_{1c} = \sqrt{-1}$, and $J_{1a} = 2J_{1b} = 2J_{1c} = \sqrt{-1}$. In each case, we considered the subcases where $J_H = (\text{?})+/-10$; $(\text{?})+/-5$; $(\text{?})+/-2$; $(\text{?})+/-1$; $(\text{?})+/-0.5$; 0.

Session 3C – EME 1202

The Effects of Spontaneous Whole Bunch Fermentation on the Diversity, Abundance, and Composition of *Saccharomyces cerevisiae* at a British Columbia Winery

Student: Shelby BAUMGARTNER

Supervisor: Dan Durall

Whole bunch fermentation consists of using whole bunches of grapes, including the stems and the part that attaches to the berries (pedicels) during fermentation of grape must. This method is typically used with red wine varieties, mainly Pinot noir and Syrah, but can be used with any type of variety. To date, little is known about the effects of whole bunch fermentations on yeast diversity, specifically *Saccharomyces cerevisiae*. Generally, *S. cerevisiae* strains tend to dominate the mid and late stages of fermentation, while non-*Saccharomyces* tend to dominate the early stages of fermentation. Both types of yeasts ultimately contribute to the final flavour profile of wines through their metabolites, with each type contributing to the wine bouquet and aroma differently. The objective of this study was to determine the effect of whole bunch addition on the abundance, diversity, and composition of *S. cerevisiae* strains in Pinot noir spontaneous fermentations. The treatments included a 10% addition of whole bunches and a control, where whole bunches were excluded, adding only the grapes. Fermentation of both treatments were performed in triplicate 6000L stainless steel tanks. Samples were collected at four different stages (cold-soak, early, mid, and late). Seventy-two yeast colonies from each sample were isolated and identified to the strain level using microsatellite loci. The results of this study will increase our understanding of how these yeasts contribute to whole bunch fermentations.

The effects of sulfur dioxide addition on the abundance, rate of fermentation, and composition of wine yeasts in pied de cuve or spontaneous fermentation of Chardonnay

Student: Brittany WATTERS

Supervisor: Dan Durall

Spontaneous fermentation is the production of wine without the addition of a commercial inoculum. Spontaneous fermentations allow vineyard yeasts to play a larger role during fermentation than conventionally inoculated fermentations, resulting in a more complex wine. Pied de cuve fermentation is a type of spontaneous fermentation that involves the addition of yeasts that have already begun alcoholic fermentation. There is a significant lack of knowledge surrounding pied de cuve fermentations in comparison with spontaneous fermentations, which this study aims to address. The objectives of this study were to determine: (i) yeast abundance throughout fermentation (CFU/mL), (ii) the rates of fermentation, and (iii) the yeast composition, isolated throughout spontaneous and pied de cuve fermentation at two levels of sulfur dioxide (SO₂) (0 and 40 mg/L). Chardonnay juice was treated with or without pied de cuve inoculum, and either 0 or 40 mg/L SO₂ was added to new 300L stainless steel barrels (n=3 per treatment). Samples were taken from each barrel at three fermentation stages. Twelve yeast isolates per tank were isolated and identified to the species level by sequencing the D1/D2 domain of the yeast rDNA. Total yeast abundance was significantly different between treatments. The rate of fermentation was significantly different between treatments, with the pied de cuve (0 mg/L SO₂) treatment having a lengthened lag phase and slower fermentation rate. We found that every treatment was dominated by *Saccharomyces uvarum*, which was not present in the pied de cuve inoculum, indicating that this yeast was a winery resident capable of dominating the fermentations. Understanding how different fermentation techniques affect fermentation dynamics is important to winemakers as it may influence their decision on future fermentation practices that will take place in their winery.

Cloning of a Lavandula Terpene Synthase Gene

Student: Rebecca WELLS

Supervisor: Soheil Mahmoud

Lavenders (*Lavandula*) produce essential oils composed of a variety of constituents, the combination of which can determine oil quality. Linalyl acetate, a main constituent, is a key component of the oils. It is thus of great interest to examine the biosynthesis of linalyl acetate, and identify the enzymes involved in this process. Previous work performed in the Mahmoud lab included assays which showed the production of linalyl acetate by floral protein extracts. This project aimed to identify and clone the linalyl acetate synthase which catalyzes the production of linalyl acetate in *Lavandula* floral tissues. In lieu to this hypothesis, crude proteins were extracted from *Lavandula* floral tissues and assays were performed to determine the activity. Assays were analyzed through gas chromatography-mass spectrometry (GCMS) and linalyl acetate production was again observed from the protein extracts. Seventeen candidate genes for the linalyl acetate synthase which were highly expressed in flower compared to leaf tissues were identified by digital gene expression studies (DGE) from Lavender transcriptome database. Sequences were then analyzed in the NCBI database for homology and conserved domains studies. Eight synthase candidate genes were selected and primers were designed for amplification through Polymerase Chain Reaction (PCR). Five of the eight genes showed successful amplification and will be cloned into pet41b+ vector followed by transformation into *E. coli* Rosetta cells for recombinant protein production. The recombinant proteins will be purified and linalyl acetate assays with the precursor substrate will be performed to test for synthase activity. Future efforts will be towards gene expression studies and kinetic analysis of the synthase with efforts towards determining novel ways to increase linalyl acetate biosynthesis in Lavenders. Successful cloning of this gene will provide further understanding of linalyl acetate biosynthesis by the linalyl acetate synthase which may provide the opportunity for improvements on Lavenders essential oil quality.

Application of Multi Armed Bandit on Game Development

Student: Kenny RAHARJO

Supervisor: Ramon Lawrence

We want to apply the Multi-Armed Bandit model into game development. When developing a game, we have limited knowledge of players preference, and we aim to develop a model which over time, adjusts parameters and improve the game design. We want to show that this change will result in the game being at least as good as the original, without the model implemented.

AES Cryptosystem Acceleration Using Graphics Processing Units

Student: Ethan WILLONER

Supervisor: Ramon Lawrence

As the need for processing large amounts of data grows, software developers and researchers work with new ways to accelerate how this data is processed. The Graphics Processing Unit (GPU) was originally designed for the purpose of allowing video games to render graphics more efficiently while freeing resources on the CPU. It was realized that the massively parallel properties of these devices naturally lend themselves to processing large amounts of data when provided with a way to write applications which used GPUs as general compute devices rather than dedicated graphics processors. This thesis sought to continue the work of other researchers in applying these general purpose computing capabilities of GPUs to cryptographic systems, specifically the Advanced Encryption Standard (AES) cryptosystem, which is the current standard. It was hypothesized that by offloading the operations of the cryptosystem to the GPU that large gains in performance to the whole system could be made. Specifically, it was our goal to show the benefit of utilizing the GPU for AES operations performed by an open source database such as Postgres. However, experimental results demonstrate that there are only very minor performance gains for GPU-based AES encryption for databases, and the technique is not applicable to many workloads. While previous papers have stated that GPUs are excellent devices for accelerating encryption, these papers have largely ignored how their AES implementations for the GPU compare in various workloads to hardware accelerated alternatives. Modern Intel and AMD CPUs provide developers with the AES-NI hardware accelerated instruction set for performing AES, which is utilized in libraries such as OpenSSL to provide higher performance than an implementation done in software. This paper demonstrates that when an AES implementation utilizes AES-NI, it is far more performant to utilize the CPU than it is to offload the processing to the GPU for typical workloads.

The Digital Divide and the Government: Developing a Tool for the Analysis of Government Data

Student: Emily MILLARD

Supervisor: Ramon Lawrence

The digital divide is defined as the gap between groups, demographics, or regions that have access to information communication technologies and those who do not, or who have restricted access[1]. The digital divide impacts smaller cities within British Columbia in terms of their ability to represent local infrastructure, provincial, and federal datasets spatially. As a result these municipalities are unable to use spatial data to its fullest extent in their decision-making processes. In partnership with LandInfo Technologies, this project has developed an interactive, online analysis tool that allows local government officials to make use of municipal, provincial, and federal spatial data. The goal of this tool is to enable local governments to store, maintain, and view infrastructure data allowing them to make more informed decisions, and as a result, reduce the overall cost of developing and maintaining municipal infrastructure. 1. Jan A.G.M. van Dijk, "Digital divide research, achievements and shortcomings," *Poetics* 34, no. 4-5 (2006) : 221-235

Student: Kevin EGER

Supervisor: Ramon Lawrence

Reddit is “the front page of the internet”, a slogan the company has coined and rightfully lived up to. It is a website which brings together members of all communities in a similar style as a typical forum but with much more structure and a lot more traffic. Reddit averages over 200 million unique visitors a month. With such traffic screams the demand for data analysis through a human-interpretable medium. This thesis focuses on displaying, aggregating and processing data gathered from Reddit into an easily consumable format. We will explore the implementation and results of querying the Reddit API, generating aggregate statistics, querying large data dumps of historic Reddit data with Google BigQuery and the use of unsupervised machine learning to draw powerful inferences. Not everyone has the opportunity to develop and infer the interesting data generated by Reddit, we will provide this ease of access.

Session 4A – EME 1202

Optical CT Scanning Methods for Fricke and Polymer Gel Dosimeters

Student: Andy OGILVY

Supervisor: Andrew Jirasek

Gel dosimeters are radiation sensitive chemicals that when radiated result in a change in their properties as a function of the absorbed radiation. Quantifying the response of the absorbed radiation in terms of the affected measurable property makes it possible to simulate radiation treatments and observe their result in a controlled setting. In a clinical setting, collateral damage to surrounding tissue when radiating is of great concern. Using gel dosimetry to accurately predict outcomes of radiation treatment, promises significant improvements in potentially damaging treatments, and offers opportunities to expose patients to lower doses of radiation. There are two primary types of gel dosimeter, Fricke and polymer, which react differently to radiation. Experiments were performed using a prototype fan-beam Optical CT scanner, which observed the characteristics of both Fricke and polymer gels after irradiation using scanning and artifact removal methods designed for polymer gels. During Fricke experiments two artifacts appeared that were not expected using polymer methods, requiring new scanning and artifact removal methods to be designed. The Fricke artifacts are under investigation, and a new CT scanner design is being considered to increase scanning efficiency, and remove the sources of the artifacts.

Measurement of the Polarizability Anisotropy of a Dielectric Body Through Parametric Resonance

Student: James LETVINCHUK

Supervisor: Murray Neuman

The study of dynamic systems can lead to the determination of the parameters that govern them. Specifically, the electric polarizability of a dielectric material provides information about the response of a body to an applied electromagnetic field. The directional dependence, anisotropy, of a rotor suspended in an external electric field is hard to determine analytically. However, the dynamic system composed of a body in a rotating electric field, or conversely a rotating body in a static field, is of great importance. Through the application of the Mathieu Function, which governs this dynamic system, this experiment aims to develop a quick and easy method to measure the polarizability anisotropy. The method exploits the transitions from stability to instability as predicted by the Mathieu Equation. The stable and unstable regions are characterized by the parameters of the system. This work includes the analysis of a rotor, comprised of a dielectric material, immersed in a uniform electric field. Parametric resonance produces instabilities in the orientation of the rotor, which can be easily observed. Varying the frequency and strength of the electric field can

produce such conditions for resonance. From the values of these parameters, the polarizability anisotropy of the dielectric material is extrapolated. The results of this experiment are able to be extended to other bodies of interest via simple scaling methods.

An Electron Spin Resonance Study using a Toroidal Split Ring Resonator

Student: Aaron CLEMENTS

Supervisor: Jake Bobowski

Electron spin resonance (ESR) or electron paramagnetic resonance (EPR) is an experimental technique used to study paramagnetic materials containing unpaired electrons (free radicals). Electrons possess an intrinsic magnetic moment, analogous to that of a bar magnet. This magnetic moment is associated with the quantum mechanical spin angular momentum of the electron. In an external magnetic field, the component of the electron spin along the direction of the applied field can be in only one of two states – spin up (parallel to the field) or spin down (antiparallel to the field). In the absence of an external field, the energies of these two spin states are identical. In a nonzero field, electrons with their spins aligned parallel to the magnetic field are in a lower energy state than those with their spins antiparallel to the field. The energy difference between these two states is directly proportional to the strength of the external magnetic field. Transitions from the lower-energy spin-up state to the higher-energy spin-down state can be induced by irradiating the paramagnetic material, using electromagnetic radiation with energy equal to the difference in energy between the pair of spin states. Our experiment used a compact toroidal split-ring resonator (SRR) with a resonant frequency of 1 GHz. A paramagnetic sample of DPPH was contained within the bore of the resonator where there is a high concentration of microwave magnetic field lines. The entire SRR was surrounded by a hand-wound solenoid, used to immerse the sample in a uniform static magnetic field. Irradiating the sample at the resonant frequency of the SRR, we measured the rf power coupled out of the resonator as we varied the strength of the static magnetic field. We clearly observed the expected dip in the power coupled out of the resonator due to power absorption by the unpaired electrons in the paramagnetic sample. This talk will focus on the fundamentals of ESR and the toroidal SRR, the design and construction of our experimental apparatus, and a descriptive interpretation of our results.

Session 4B – EME 1151

TEFS: A Flash File System for Use on Memory Constrained Devices

Student: Wade PENSON

Supervisor: Ramon Lawrence

A file system is used to manage data on storage media. The FAT (File Allocation Table) file system was originally designed for floppy drives that were less than 500KB in size, and these drives were not capable of fast random reads and writes. FAT has been adapted to work on other types of storage devices since, and it is still widely used today. It is the standard file system used by microprocessors and embedded devices with constrained resources. Micro-controllers, like the Arduino, only officially support the FAT file system when interacting with a SD card. FAT performs well when data is read or written sequentially, but when data is read or written randomly, there is an impact on performance for large files on page based flash devices that cannot utilize caching strategies. Applications that perform random reading and writing are impacted by this architectural issue. For example, flash data structures, like a B-tree, will have poor performance since random reading is utilized to look up values. TEFS (Tiny Embedded File System) uses a simplified tree indexing structure to take advantage of the fast random reads and writes of flash storage and guarantees that the number of page reads and writes will stay constant as the file size increases when randomly reading or writing. Experimental results show that TEFS has significantly better performance than FAT on the Arduino for random I/Os, and the more efficient TEFS page interface is even slightly faster than FAT for sequential reading and writing.

Neural Networks and Image Generation

Student: Anna OFFENWANGER

Supervisor: Patricia Lasserre

Neural networks are a statistical modeling technique inspired by biological neurology. They are trained using supervised and unsupervised methods to perform data classification and recognition on a variety of applications. In particular, they are a forerunner technique for many recognition tasks, such as automatic reading of digits, text classification, and the ImageNet Large Scale Visual Recognition Challenge. There has also been a growing interest in the potential of using neural networks in generative applications, such as object generation for animation and video games. This presentation will cover the basics of neural networks and how they are trained, present examples of object generation, and discuss how effectively they can be applied to generative applications.

Quasi-Threshold Community Detection in Networks: A Greedy Approach

Student: Gordon HOLLAND

Supervisor: Yong Gao

In complex networks, groups of nodes which are more likely to be connected to each other than to those of other groups are called communities. Understanding the community organization of a network provides insight into the fundamental structure of that network and can be used to predict the behaviours or actions of the nodes. There are a variety of different ways of defining a community within a network. Some approaches use algorithmic or statistical methods to define the communities, while others use specific types of graph structures. In this work we are interested in a special type of graph structure called quasi-threshold, or trivially perfect. It has been found that this structure closely resembles the informal notion of communities in social networks, or the blood-line relationships in a family. Quasi-threshold graphs also naturally characterize the hierarchical structure present in these networks. The computational problem is then to edit a given graph to the nearest quasi-threshold graph. The resulting connected components are then treated as separate communities within the original network. This problem of optimally editing an arbitrary graph into the nearest quasi-threshold graph is NP-hard, meaning that there is no efficient way to solve this problem exactly. In this talk we will examine one particular greedy algorithmic approach to the Quasi-Threshold Editing problem (U. Brandes et al., 2015) which makes use of the local structure of the quasi-threshold graph to attempt to find the best position in the graph for each node such that the edit distance is reduced. We will also discuss the significance of quasi-threshold communities, and efficient algorithms for finding them, in the context of community detection in large scale complex networks.

An Investigation of Diffusion on Time Varying Graphs

Student: Anthony CULOS

Supervisor: Yong Gao

Traditional research into diffusion on networks has focused on static networks and how to maximize or control the spread of information. This work looks to determine the behaviour and properties of different diffusion mechanisms on dynamic networks. We focus our investigation on three different mechanisms; push-pull protocol, initial cascade, and the linear threshold model. We also extend the initial cascade model to better suit diffusion on dynamic networks. Both empirical and theoretical results are provided to describe the behaviour of diffusion on dynamic networks. We first present previous research of diffusion behaviour on static networks and then compare this with our own results on dynamic networks. Future research problems related to diffusion and dynamic graphs are also discussed.

The Transition from Rails to Trails: A Case Study of Seattle's Burke-Gilman Trail and the Kettle Valley Rail-Trail of British Columbia and Their Development to Rail-Trails from Abandoned Rail Right-of-Ways

Student: Jeremiah RYDER

Supervisor: Brigitte Le Normand

In the latter half of the 19th Century railways were built-up throughout the United States and Canada to meet the demands of industry and their respective populations. While railway expansion continued strongly through the end of the First World War by the end of the Great Depression railway service was in sharp, and irreversible, decline as trucking and air travel changed the meaning of transportation. As railway decline increased through the 1970s hundreds of railway right-of-ways covering thousands of miles were left abandoned. In the latter half of the 20th Century an explosion in interest in historical and heritage preservation brought attention to these abandoned railways. In them many people saw opportunities to reclaim precious land in urban areas for much natural, green space. Still others saw opportunities to preserve a unique piece of their local heritage. This paper examines the evolution from railway to rail-trail, using Seattle's Burke-Gilman Trail and British Columbia's Okanagan Valley's Kettle Valley Rail Trail as case studies. Where other studies of these trails have focused either on the railways from which they originated, or presented simplistic narratives of the trails' formations, this presentation focuses on how both became rail-trails.

The Northern Gateway: Pipeline, Proximity and Politics

Student: Erik KUNDU

Supervisor: Carl Hodge/Julien Picault/Jim Robinson

This paper looks at the proposed Northern Gateway Pipeline project commissioned by Enbridge Inc. that involves British Columbia and Alberta land and citizens. This project has been extremely controversial since it involves multilateral governments, interest groups, and territory. I frame the legalities associated with the actual implementation of the pipeline. I identify the way economic factors have shaped social acceptance/rejection of the proposed pipeline and I outline some of the predicted environmental ramifications of it. I finally answer the question of how partisanship and public opinions about this specific pipeline project are correlated, and how proximity to this pipeline affects public opinion about it. I answer these questions by briefly analyzing eight randomized public opinion surveys then study two of the surveys in depth, providing a more comprehensive explanation of the partisanship-proximity relationship.

Moral Panic in Great Britain: The Problematization of Strip Clubs

Student: Kathryn HELMORE

Supervisor: Carey Doberstein

The sex industry is becoming increasingly regulated and criminalized across the United Kingdom. Examples of this legislation include the 'Crime and Policing Act' of 2009 and the amendment to the 2003 Communications Act. Through this legislature, stigma surrounding those who are employed and entertained by the sex industry is formally inspired via the State. Furthermore, this legislation aforementioned is amidst a range of sex negativism encouraged by UK based feminist groups. The concern of this paper is to illustrate how this legislature, and the public conception of the sex industry, is based upon constructed assumptions. As such, this legislature is a form of what Michel Foucault terms 'Problematization'. Furthermore, this problematization is typical of a sexual moral panics. Thus, this paper will pay particular attention to strip clubs and the incorrect or fallacious illustrations of their employees, owners and patrons. Via identifying these constructions, I will demonstrate how they are indicative of moral panics and, furthermore, demonstrate how moral panics can be damaging to individuals, ideological movements and freedom of expression.

Student: James DAVISON

Supervisor: Carey Doberstein

Poverty is an endemic problem to all societies, and this is certainly true in the province of British Columbia. After the Second World War, the poverty rate in British Columbia was a staggering 27%, with more than one in four of the province's citizens were classified as poor. Through various policies and economic reforms at the provincial and national level over the next 20 years the poverty rate declined to approximately 10%. While trends were favourable for a time, the poverty rate has stagnated near the rate of 10% for over 20 years now. Poverty reduction policies in British Columbia have thus become ineffective. There are many reasons for this but the key source of the failure to further reduce poverty is found in Canadian political changes. Ideologically driven politics have reshaped the role of the government in Canada and which has resulted in a near-withdrawal from directly managing poverty issues. The continuing problem of poverty in Canada necessitates renewed action. However, the problem is structural in nature, such that the state remains a key player to reduce or eliminate poverty. Numerous proposals exist at present to address poverty that can be moulded into policy, the analysis of which will be the focus of this presentation.