UBC Multidisciplinary Undergraduate Research Conference 2011

The Multidisciplinary Undergraduate Research Conference celebrates the contributions of undergraduate scholarly inquiry and research at UBC. All members of the UBC community are welcome to attend this annual celebration of undergraduate scholarly work.

Welcome

10th Annual UBC Multidisciplinary Undergraduate Research Conference

Universities, particularly great universities such as UBC, are the homes of great ideas. It is here that we create ideas, here that they get refined through open discussion, and here that they have impact through education and application. This role for universities is a vital one, and is unique to universities. Ideas are the currency of research, through research they are born, tested, and applied. Research is thus central to a great university's purpose, and key to a great university's future. One of the strengths of university research is that it is open and unfettered; the knowledge we create is made freely available to everyone. The undergraduate researchers at this conference are not only creating the new ideas so vital to our future, they are also sharing these ideas with the broader community. Thus, they are full participants in the mission of our great university, and all of us are here to celebrate their achievements.

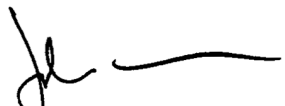
Since our first conference in 2002, we have had hundreds of students present their research spanning the spectrum of disciplines here at UBC. Once again this year, exciting results from all the frontiers of knowledge are being presented.

To the undergraduate researchers from our diverse Faculties and Schools; this conference is a celebration of your hard work and deliberate efforts. At this event, presentations of original research will illustrate the power of your ideas. You are the embodiment of the new university academic plan, Place and Promise, on your way to becoming exceptional global citizens, by conducting outstanding research to serve the people of British Columbia, Canada, and the world.

To the supporting faculty; with your invaluable dedication to undergraduate research mentorship, you are creating the forefront undergraduate education we are striving for at UBC, one that integrates frontier research into our undergraduate programs, and includes our undergraduate students into our exciting research enterprise.

UBC thanks all of you for helping fulfill Place and Promise, and wishes you continued success in your research efforts. At this 10th Annual UBC MURC, let us all join together as a vibrant community of thinkers, believers, and achievers. Thank you to the conference coordination team, volunteers, faculty moderators, keynote speakers and alumni panelists, graduate student adjudicators, and other members of the UBC community for their outstanding efforts at creating this celebration of our students' achievements.

Yours sincerely,



John Hepburn FRSC
Vice President, Research
& International

Brian Sullivan
Vice President, Students

Anna Kindler
Vice Provost and Associate Vice
President, Academic

Schedule of the Day

Saturday, March 19, 2011 - Irving K. Barber Learning Centre

Registration Main Foyer	10:00 - 10:30
Opening Session VIctoria Learning Theatre	10:30 - 11:00
Oral Presentation Session 1 Various classrooms	11:10 - 12:20
Poster Presentation Session & Lunch Main Foyer & Golden Jubilee Room	12:20 - 1:40
Oral Presentation Session 2 Various classrooms	1:50 - 3:00
Closing Session VIctoria Learning Theatre	3:10 - 4:00

Opening & Closing Sessions

Opening Keynote: Aneil Jaswal

Aneil Jaswal, the recipient of this year's Rhodes Scholarship for British Columbia, is a fourth-year student with a passion to improve healthcare for those who can least afford it. He is currently enrolled in the Land and Food Systems' Global Resource Systems program, which offers interdisciplinary study with research and international placements. Aneil now plans to pursue dual masters degrees in global health science and global governance and diplomacy at Oxford University.

Aneil conducted research on health systems with the World Health Organization in Geneva. Jaswal has conducted research on health systems with the World Health Organization in Geneva. As well, he worked with UBC researcher Richard Lester to investigate the use of cell phones in HIV treatment in Kenya. The findings show how simple messages of a text saying "how are you?" helped patients with the treatment process. *(Courtesy UBC Public Affairs)*

Closing Session: Alumni Panel on Research

Veronique Lecault, Moderator: Veronique is a Coordinator with the Let's Talk Science program at UBC. The program strives to improve science, technology, engineering and mathematics literacy through the outreach efforts of members of the research community at UBC.

Shona Ellis, BSc'85, MSc'93: Shona is currently a teacher in Botany at UBC. She has been teaching in the Botany Department for over 12 years, instructing courses from first-year introductory biology to fourth-year plant anatomy. Shona has also been involved with the UBC Life Science Research Tri-Mentoring Program, where faculty and graduate students mentor senior students in their research, and the senior students mentor junior students.

Mischa Harris, BHK'09: Mischa Harris is an MSc candidate in the Faculty of Experimental Medicine at UBC. He is currently researching injury prevention techniques for the youth athlete population, with a particular focus on pelvic stabilization in jumping athletes. Mischa has been working with BC's and Canada's top volleyball & beach volleyball players for 4 years, after finishing his career with UBC and Team Canada Beach Volleyball. *(Courtesy SportMed BC)*

Pamela Toor, BA'10: Pamela obtained her BA in Honours Sociology and International Relations, with a focus on migration and the socio-economic development of immigrant communities. As part of her degree, Pamela conducted original research and subsequently wrote her graduating thesis on the relationship between social and cultural capital and the high university participation rates of south Asian youth. Pamela currently works as a Program Assistant in the UBC Faculty of Law. *(Courtesy UBC Faculty of Law)*

Oral Presentation Session 1

Me, Myself and My Research (Workshop) — IKBLC 261

Mario Cruz

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Our Social World: Communication, Structure & Impact — IKBLC 155

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- Arviat: an Intimate Re-examination of Colonial Relations — April Dutheil
- Triangulated Media Analysis: Complicating the 'Downtown Eastside' Imaginative Geography — Hollie McKeil & George Rahi Imogen Thompson
- Hyphen-space: Authorship, Memory and Biomeditation in Digital Poetery — Katie Fedosenko
- Beyond Boundary Maintenance: Inclusive Social Groups and the I-Thou Relationship — Andew Herman
- Pathways to college drinking: Gender differences in the association between parental bonds and hazardous alcohol use — Audra Roemer

Hormones & Reproductive Strategies in Plants — IKBLC 156

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- Effects of phytohormones, auxin, cytokinin, abscisic acid, brassinosteriod on spore germiantion, protonema elongation and morphology in moss Leptobryum pyriforme — Liang Siyu
- Effect of Plant Hormones on Auxin Spatial Distribution in Arabidopsis thaliana — Divjot Kumar
- The Effects of Hormonal Regulation on the Longevity of Fresh-Cut Chystanthemums — Olivia Shi
- Development of species-specific microsatellite markers for Townsendia hookeri using next generation sequencing — Kate McGrath
- Diversity of native and exotic plant species in the endangered Antelope Brush ecosystem: do shrubs help exotics? — Katelyn Short

Barn Tales: Issues in Commercial Animal Farming — IKBLC 157

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- Benefits of Choice Feeding in Commercial Layer Production — Alice Feng
- The Behavioural Effects of Hair Dye on Dairy Cattle — Juliet Orazietti
- Methods to reduce stress in emus during transportation from farms to slaughter plants — Bettie Yim
- Using dairy cow behaviour as an indicator of udder comfort during dry-off — Rebecca Wright

Me, Myself and My Research (Workshop)
Mario Cruz

This workshop focuses on narrowing down your interests and finding your "sweet spot" where your chances of enjoying your research experience and learning from it are maximized. This talk provides a set of techniques that allow students from any faculty or discipline to align their strengths and passions with their careers to provide a more guided approach to having meaningful research experiences. Students will learn some insider tips on the best way of finding potential supervisors on and off campus.

Our Social World: Communcation, Structure & Impact — IKBLC 155

Arviat: an Intimate Re-examination of Colonial Relations
April Dutheil (Faculty Sponsor: Dr. Frank Tester)

The gap between Inuit youth, their parents and Elders has created many personal and social problems faced by youth, including young Inuit suicide. Dr. Frank Tester's two year project acknowledges these problems by using a case study approach to examine the period during which Inuit relocated from land-based camps to the settlement of Arviat, Nunavut. This project involves qualitative research and participatory action to train five Inuit youth from Arviat as researchers in the discovery of Inuit history. Through acquiring new insights into this historical period, the purpose of this project is to bring Elders and youth together and build Inuit youth empowerment and self-esteem. To equip youth with the skills and knowledge required to do historical research, youth have participated in research workshops and have started to interview Inuit Elders and Qablunaat (non-Inuit); examine archival photographs and texts; and film and blog about their experiences to construct a multifaceted understanding of Inuit social history. The Inuit youth and UBC researchers will use these findings to create a documentary film, educational resources for the Nunavut Department of Education and publish academic reports. The preliminary results of this study indicate that knowledge of Inuit history is correlated to Inuit mental health and should be explored as an alternative to Nunavut's current educational curriculum. Arviat has the highest birth rate in Canada and 75% of the population is under 25 years old, making youth focused research a practical way to explore Inuit history and address Inuit youth mental health.

Triangulated Media Analysis: Complicating the 'Downtown Eastside' Imaginative Geography
Hollie McKeil, George Rahi & Imogen Thompson (Faculty Sponsor: Dr. Jamie Peck)

Media sources, particularly in the form of newsprint both reflect and produce dominant ideologies within public discourse. Social theorist Doreen Massey asserts, "spatiality is always in the process of being made," while representations of space, in textual or other forms, produce malleable and subjective imaginative geographies (1993, 234p.). Jennifer England further contents, "because space does not form a neutral stage in which social practices perform, but actively constructs them," our mutually constitutive interactions with space are therefore articulated, instructed and regulated by mainstream producers of knowledge (2004, p.298). It has been argued that no other neighbourhood in Canada has been as spectacularized within mainstream media as the "Downtown Eastside" of Vancouver (Dobson, 2004; Sommers & Blomley, 2002). Therefore, this project in progress intends to deconstruct dominant imaginative geographies of this notorious neighbourhood, perpetuated by four multi-scalar newspaper

sources; the Vancouver Sun, the Province, the National Post and the Globe and Mail. A twenty-year trend analysis (1990-2010) of the discursive categorizations and representation will reveal the constructions of the space over time. A corresponding content analysis will codify overt practices of representation, within directly relevant articles (2005 and 2010), which will be further complimented with an in-depth qualitative content analysis of key articles. Moreover, the employment of this triangulated research methodology will enable the extraction of both concrete thematic patterns and representational practices as well as rich subjective knowledge(s) in order to reveal not only what knowledge produced, by whom, for whom, but also, the material and symbolic effects of these imaginative geographies.

Hyphen-space: Authorship, Memory and Biomediation in Digital Poetry

Katie Fedosenko (Faculty Sponsor: Dr. Larissa Lai)

According to Charles Bernstein, “poetry in a digital age [...] can invent the present in language never before heard" (516)[2]. By investigating the digital poetry of JR Carpenter and Nick Montfort as individual authors and in collaboration, I argue that in the digital age, poetry goes beyond hearing to stimulate other senses, and extends beyond the body. In the digital poetry of Carpenter and Montfort, authorship is obscured, cultural memory is morphed, and humanism is challenged. Texts are digitized, “becoming more image than letter” (Bernstein 512); becoming denoting the shift from the print era to the digital age. The intermediation of these technologies, between programming code and poetry, as described by Loss Pequeno Glazier (2007)[3], and between art and literature, are processes I explore in Carpenter and Montfort, which demonstrate new meaning(s) of authorship.Digital poetry is necessarily mediated by machines. As Maria Clara Paixao de Souza writes, “artificial logic programming is needed to mediate digital texts” (237)[4]. As cultural memory runs parallel to computer memory, a new ephemerality emerges, which is present in Carpenter and Montfort.Finally, as digital poetry is mediated via computer technology, which results in biomediation, the simultaneous extension and amputation of the human experience, the digital poetry of Carpenter and Montfort can be understood as “dehumanizing.”[5] As this project investigates poetry in digital spaces, I presented my findings online by creating a website which features critical, theoretical and creative writing. Digital poetry not only challenges how literature is defined and discussed but also how we define memory and humanism.

Beyond Boundary Maintenance: Inclusive Social Groups and the I-Thou Relationship

Andrew Herman (Faculty Sponsor: Dr. Sophia Woodman)

Researchers have theorized that in order for a social group or movement to maintain solidarity, some kind of boundary-work is needed to contrast the collective identity of the movement and of its members from that of the greater society (Poletta & Jasper, 2001; Fominaya, 2010; Yukich, 2010). Central to collective identity is the ability to distinguish the self from the 'other,' in order to be recognized by those people outside of the group. But what happens when a group is concerned with eliminating the boundaries that keep people apart? Many social groups and movements are torn between asserting a clear identity and deconstructing it. Do groups that emphasize inclusivity require boundaries?

Pathways to college drinking: Gender differences in the association between parental bonds and hazardous alcohol use

Audra Roemer (Faculty Sponsor: Dr. Zachary Walsh)

College students are at increased risk for problematic substance use, and identifying factors that increase risk of hazardous alcohol use among college students is a research priority. In the present study, we examined the cross-gender consistency of the association between parental bonds and alcohol consumption among 65 (45 female, 20 male) undergraduate university students. We further examined the extent to which these relationships were mediated by self-esteem and impulsivity. The influence of parental bonds on drinking behavior differed across gender, $F(1, 61) = 5.49$, $p < .05$, such that the quality of parental bonds was associated with binge drinking among males, $F(1, 18) = 4.52$, $p < .05$, but not among females, $F(1, 43) = .48$, $p = .49$. Specifically, positive bonds with both parents were associated with more frequent binge drinking among male students. Supplementary analyses indicated that the observed effects were not attributable to self-esteem or impulsiveness. These findings highlight the importance of considering gender differences when examining risk for hazardous drinking among college students, and suggest that parental relationships may be particularly important for understanding problematic alcohol consumption among male students.

Hormones & Reproductive Strategies in Plants — IKBLC 156

Effects of phytohormones, auxin, cytokinin, abscisic acid, and brassinosteriod on spore germiantion, protonema elongation and morphology in moss Leptobryum pyriforme

Liang Siyu (Faculty Sponsor: Dr. Santokh Singh)

Phytohormones play an essential role in plants, governing growth and regulating physiological responses. The influence of phytohormones on vascular plants has been studied extensively and has been widely applied in agriculture to increase yield. On the other hand, despite an extensive biodiversity of mosses, research on hormonal regulation of growth and development of bryophytes is limited to only a few species, e.g. Funaria hygrometrica and Physcomitrella patens. The moss Leptobryum pyriforme was chosen for this study because it is ubiquitous in British Columbia, and yet its response to phytohormones has not been studied. In order to understand the exact role of phytohormones on moss L. pyriforme, this study examined the effect of various phytohormones [cytokinin (CK), auxin (naphthaleneacetic acid or NAA), brassinosteroid (epibrassinolide or epiBL) and abscisic acid (ABA)] on spore germination, protonema elongation and protonema morphology. The mature spores of L. pyriforme were cultured under aseptic conditions in Petri dishes containing minimal medium. The count of germinated spores, their protonema length, and their branching patterns and/or bud formation were compared with the control. It was found that only CK induced formation of buds while NAA and epiBL promoted spore germination. ABA was observed to function as an inhibitor for germination, growth, and bud formation. In addition, it was observed that the concentration of phytohormone plays a critical role in determining the response of L. Pyriforme. High doses of phytohormones were observed to reduce growth when applied to this moss. The results of this investigation indicate that the various phytohormones have specific roles in the growth and development of L. pyriforme. Based on these results, future experimentation on how the development and growth of moss responding to the endogenous interaction of phytohormones is suggested.

Effect of Plant Hormones on Auxin Spatial Distribution in Arabidopsis thaliana

Divjot Kumar (Faculty Sponsor: Dr. Santokh Singh)

Plant hormones are signaling molecules that control plant development via their spatiotemporal concentration gradients. Understanding how different plant hormones regulate plant growth and development by interacting with each other is an important aspect of plant biology. Auxin, an important plant hormone, is synthesized in the shoot apex and is transported through the plant by auxin-transport proteins. It affects lateral organ development, cell elongation, and can also interact with other plant hormones to influence cell division and shoot elongation. In our study, we aimed to understand the effect of auxin transport inhibitors, such as tri-iodobenzoic acid (TIBA), on the spatial expression pattern of auxin in 6 day old DR5::GUS transformed Arabidopsis thaliana plants. Secondly, we wanted to understand the influence of other hormones such as brassinosteroids and gibberellin on auxin distribution in these plants. The DR5::GUS construct used in this study, contains an auxin-response element that is sensitive to increasing endogenous auxin concentrations and allows us to visualize auxin distribution within the plant. It was found that endogenous auxin was concentrated at root tips, cotyledons, lateral root primordia, apical meristem, and the leaf margins. TIBA resulted in complete inhibition of auxin expression and ultimately lead to plant death. Brassinosteriods amplified endogenous auxin expression in the roots and leaf vascular tissues. Lastly, increasing gibberellin concentrations reduced auxin expression at the root tip. Information gained from this study could lead to a better understanding of the mechanisms by which different hormones interact to influence plant growth, development and productivity.

The Effects of Hormonal Regulation on the Longevity of Fresh-Cut Chrysanthemums

Olivia Shi (Faculty Sponsor: Dr. Santokh Singh)

Fresh-cut flowers of a variety of plant species generally become fully senesced within two weeks if placed in water. The role of plant hormones in retarding senescence and enhancing the shelf-life of cut flowers of chrysanthemums has not yet been thoroughly researched. The purpose of this study is to examine the hormone-induced delay in chrysanthemum petal senescence and to use hormones to prolong the shelf-life of these fresh-cut flowers, which would ultimately benefit the consumer and flower industry. Fresh-cut chrysanthemums were treated with various concentrations of plant hormones such as auxin, gibberellin, cytokinins, and abscisic acid. The hormone-treated flowers were then closely monitored for signs of senescence including wilting of petals. Samples of the hormone-treated flowers were taken during different senescence periods for protein analysis, especially ATP synthase by Western Blot. ATP synthase is a membrane-bound enzyme of plant cells and it gets degraded as the plant ages. In addition, the effects of pH, nutrients, and senescence-inhibitors such as silver ions were also tested. The results have shown that a synthetic cytokinin, thidiazuron (TDZ) at a concentration of 10^-5M is the most effective hormone treatment to retard senescence because ATP synthase was most prominent in these petals. Silver ion, an inhibitor of ethylene, was found to be moderately effective in delaying senescence. Furthermore, the optimum pH for fresh-cut chrysanthemums was found to be between 7 and 8. Current research is focused on investigating the best combination of hormones and nutrients to increase the longevity of these flowers.

Development of species-specific microsatellite markers for Townsendia hookeri using next generation sequencing

Kate McGrath (Faculty Sponsor: Dr. Jeannette Whitton)

Ranging from the far reaches of Alaska, to the plains of Colorado, Townsendia hookeri (Asteraceae) is the most widely distributed member in a genus of Rocky Mountain plants otherwise replete with endemic taxa and edaphic specialists. The diminutive, but charismatic T. hookeri includes both sexually reproducing diploids (with two sets of chromosomes) and geographically distinct polyploid (with more than two sets of chromosomes) asexuals. Interestingly, T. hookeri exhibits a phenomenon wherein polyploids are found at higher latitudes, and harsher climates than their diploid progenitors. The presence of diploids, and polyploids in both northern and southern populations brings to question the origins of asexuality in this taxon, and fine scale genetic data would greatly improve this understanding by providing a clear description of heterogeneity within the group. To that end we use next generation sequencing and bioinformatic toolsets to develop species-specific genetic markers (microsatellites) for T.hookeri. This approach is fast replacing traditional Sanger sequencing as it provides large numbers of long sequences without the formation of a genomic library; making it an ideal technique for our purposes. Genomic DNA from T.hookeri was extracted and high-throughput sequencing performed yielding over 240,000 reads which were then aligned and screened to identify microsatellite repeats. The elimination of recombinant genetic steps in addition to the saved time and cost versus traditional marker development make this approach not only feasible but also preferable. As the lack of available fine scale genetic markers is a strong impediment to the investigation of polploidy and degree of asexuality in T.hookeri, this project will provide a means of assessing each population at the genetic level.

Diversity of native and exotic plant species in the endangered Antelope Brush ecosystem: do shrubs help exotics?

Katelyn Short (Faculty Sponsor: Dr. Jason Pither)

This project examines the effects of understory and exposed habitats on the species richness of plants growing in the South Okanagan Shrub-Steppe environment, with a focus on the differences in richness between native and exotic species. The aim of the project was to determine if the understory habitats provided by antelope bitterbrush, Purshia tridentata, were preferential to exotic species and thus aiding their spread into already threatened areas. The results showed that understory habitats slightly favoured exotic species, though the effect may have been minimized due to the unusually high spring rainfall during the year of the study.

Benefits of Choice Feeding in Commercial Layer Production

Alice Yu Ting Feng (Faculty Sponsor: Dr. Darin Bennett)

With rising cereal grain prices and public pressure for improved animal welfare, alternative feed sources and feeding regimes need to be developed for commercial poultry production. Choice feeding presents itself as a viable alternative to commercial diets. The aim here is to assess the viability of choice feeding in terms of animal welfare, economic and food quality benefits. In choice-feeding, birds are offered a choice between three feedstuffs: an energy source, a protein source and in the case of laying hens, a calcium source whereas in commercial production, a single complete diet is offered. Research in choice feeding regimes in layers was reviewed. The greater dietary flexibility offered by choice feeding regimes allows hens to meet individual peak energy, protein and calcium demands during egg formulation more efficiently than hens on conventional diets. This leads to a production of equal or better quality eggs at the same rate as conventional layers with reduced feed inputs. As whole cereals are often offered as the energy source, costs such as grinding and mixing of the feed can be avoided. Moreover, local grains can be utilized thus saving transportation costs of imported feedstuffs. A choice-feeding regime can also potentially improve animal welfare by allowing for more natural foraging behavior and promoting digestive tract functionality. In summary, choice-feeding offers benefits in terms of egg quality, farm economics and animal welfare and should thus be considered by the poultry industry as a viable feeding practice.

The Behavioural Effects of Hair Dye on Dairy Cattle

Juliet Orazietti (Faculty Sponsor: Dr. Gosia Zobel)

Despite the widespread use of hair dyes to mark dairy cattle in behavioural research, there has been no work to determine the effects of such marking on cow behaviour. In humans, hair dye can cause changes in behaviour such as scratching. Changes in animal behaviour due to marking may affect the results of observations after marking. Therefore, research is proposed to determine the extent to which cow behaviour may be altered by marking. Four multiparous cows will be randomly assigned to four treatments in a Latin square model. The treatments are: 1) marking with black dye, 2) marking with blonde dye, 3) mock marking (cows restrained and handled identically to dye groups but with a neutral liquid), and 4) control (cows restrained but not handled). Every four days each cow will receive a different treatment, rotating until each cow has received each treatment once. This procedure will be repeated twice. Cows will be videoed from behind and from above to observe the number of tail swishes and skin twitches that occur for 15 minutes before and 30 minutes after the treatment is completed. Based on behaviours exhibited by cows due to skin irritation it is predicted that cows in the dye treatments will exhibit more incidents of tail swishing and skin twitching than those in the mock and control groups. Due to the impact these and associated behaviours may have on subsequent behavioural observations, the effect of marking dairy cattle with hair dye must be further studied.

Methods to reduce stress in emus during transportation from farms to slaughter plants

Bettie Yim (Faculty Sponsor: Dr. Darin Bennett)

Feed withdrawal is a common practice for many farm animals before they are transported to slaughter plants. Feed is typically withdrawn 24 hours before loading to ensure that animals do not excrete in the truck. However, feed withdrawal has a negative impact on animal welfare and meat quality post-slaughter. Research results on cattle has shown that feeding a nutritional supplement containing free amino acids, glucose, and electrolytes, is effective in reducing stress and carcass loss and downgrades. However, this supplement has not been tested using non-traditional species, such as emus. Emus are known to be particularly sensitive to stress and to novel situations; therefore, the purpose of the proposed research is to test the effectiveness of a nutritional supplement at reducing stress and maintaining body weight during feed-restricted transportation. 24 emus on 3 trucks will be used in the study and these birds will be transported from Saskatoon, Saskatchewan to Lacombe, Alberta for slaughter. Emus will be feed restricted for 24 hours before transport. Half of the emus in each truck will receive feed supplement, and half will not. Measurements will be taken before and after transportation, and will include coricosterone (a stress hormone) and body weight. The hypothesis is that emus fed the supplement will have a reduced weight loss and lower corticosterone levels after transportation compared to the control birds. Feeding a nutritional supplement during transportation may both improve emu welfare and carcass quality at slaughter.

Using dairy cow behaviour as an indicator of udder comfort during dry-off

Rebecca Wright (Faculty Sponsor: Dr. Gosia Zobel)

In North America dairy cows typically are milked for 305 days, at which point milking is ceased (dry-off) and there is a 40-60 d period where the cow is not milked (dry period). A proposed welfare concern arising from dry-off is udder discomfort caused by intramammary pressure, distention and inflammation. The objective of the proposed study is to investigate the effects of two dry-off treatments on the comfort of cows during dry-off and the early dry period. Comfort will be measured using vocalizations and lying behaviour. Cows will be assigned to pairs matched for age and milk production. One of each pair will be assigned to one of two treatments: abrupt (on day 0) or gradual cessation of milking (by intermittent milking ending on day 5, or when milk production is < 11 kg). Behaviour will be measured from 2 days before dry-off until the last day of the gradual treatment (day 5). In the first two days after abrupt cessation of milking intramammary pressure is expected to be high. Therefore, the predicted results are: 1) an increase in vocalizations in the abruptly treated cows on days 1 and 2, and 2) an increase in lying bouts and decrease in total lying time in the abrupt group (due to discomfort caused by external pressure on the udder) compared to the gradual group. These results would indicate that gradual cessation of milking at dry-off reduces discomfort in the udder during the early dry period.

Mismatches in Knowledge of an Exploited Ecological System

Caitlin Millar (Faculty Sponsor: Dr. Edward Gregr)

Resource managers lack perfect knowledge of resource systems. Despite advances in our understanding of such things as gear mortality, economic pressures, and extinction, there are significant mismatches between the incomplete knowledge applied to resource management practices and the actual dynamics of the system, and our understanding of the consequences of such mismatches remains poor. This project identifies the ecological and economic consequences of mismatches in knowledge of an exploited ecological system. This is achieved by comparing inconsistencies found between the respective outputs of the model used by resource managers "" the assumed model "" and an idealized model of the resource dynamics "" the real model. The models employ the Gordon-Schaefer bioeconomic model and the assumed model optimizes net revenues using Optimal Control Theory. The dynamical system has been developed using the agent based modeling environment, Netlogo, and is run using the System Dynamics Modeler, which is a program within Netlogo that examines the behavior of populations of agents. We develop a better understanding of the net revenue and biomass response times and the effects of structural uncertainty on the system. In doing so, we are closer to mitigating the harmful effects of inefficient harvesting on the resource and the economy.

Increasing Access to Essential Medicines: The Role of Universities

Michelle Lee & Jenny Shin (Faculty Sponsor: Dr. Kishor Wasan)

Worldwide, 2 billion people lack access to existing essential medicines. As a result, over 10 million people die every year from treatable illnesses (WHO). Publicly-funded research at universities plays a crucial role in developing essential pharmaceuticals. In the US, 15 of the 21 most important drugs introduced between 1965 and 1992 were developed using science derived from federally-funded research. There is therefore enormous potential for research conducted at universities to improve global health. UBC's University-Industry Liaison Office, in collaboration with Universities Allied for Essential Medicines, has adopted a set of principles for global access to UBC technologies, in accordance with the Trek 2010 Vision of conducting research to serve the people of BC, Canada, and the world. These principles aim to provide underprivileged populations affordable access to products of research carried out at UBC. Our presentation will highlight the student movement built around ensuring that the fruits of university biomedical research reach all patients in need.

Efficacy of new environmentally friendly, sustainable weed control methods using the UBC campus as a living laboratory

Amritpal Singh Sidhu & Takin Kheirandish (Faculty Sponsor: Dr. Santokh Singh)

In pursuit of sustainability in agriculture and urban landscaping, there is now a greater push to develop and test new environmentally friendly agricultural practices. Using the UBC campus as a living laboratory in collaboration with the UBC Social, Ecological, Economic Development Studies (SEEDS) program and the UBC Building operations department, this study examines the efficacy of environmentally friendly, natural organic acid-based herbicides i.e. Topgunâ„¢ (Fatty Acid) and Ecoclearâ„¢ (acetic acid) for control of Canada thistle (Cirsium arvense), Morning glory (Calystegia sepia), and Horsetail (Equisetum arvense).These weed species were investigated on 8 different sites at UBC, where the subjects were treated with various combinations (C100%, C50%), and mixtures (M100%, M50%) of Topgun and Ecoclear .At the physiological level, an almost complete inhibition of the photosynthesis and transpiration rates was observed within few hours of the application. Between Topgunâ„¢ and Ecoclearâ„¢ solutions, Topgunâ„¢ worked the best on every site, as it induced rapid and more drastic changes in the plants. The results of this study indicated that the combination and the mixture of the Topgunâ„¢ and Ecoclearâ„¢ were the most effective treatments in rapidly killing these weeds and inhibiting their re-growth. These results are also supported by the intensity of the bands produced in the Coomassie gels for all of species. In particular, Morning glory and Horsetail were completely eradicated after two cycles of treatment. Further studies on the use of lower concentrations of these natural herbicides, either singly or in combinations or mixtures on weeds is in progress at UBC.

The Effect of Environmental Changes on Photosynthesis and Transpiration Rates of Evergreen and Deciduous Trees During the Summer, Autumn, and Winter Periods

Manmeet Singh Kaile (Faculty Sponsor: Dr. Santokh Singh)

By analyzing the seasonal changes in the photosynthesis (CO2 uptake and fixation) and transpiration (water loss) rates of evergreen and deciduous trees, we can determine which trees should be promoted for future plantation projects, to develop a greener and more sustainable future. Trees exhibiting higher photosynthesis rates under various environmental conditions and growing seasons could reduce the rapidly increasing concentration of CO2 in our atmosphere, and global warming. Evergreen and deciduous trees differ in their leaf senescence patterns through seasonal variations. The photosynthesis and transpiration rates of two evergreen species: (Western Red Cedar, Lawson Cypress) and two deciduous species: (Red Maple, Red Oak), growing on UBC's Sustainability Street, were monitored during a span of 9 months (July 2010 - February 2011) using the LI-COR LI-6200 Portable Photosynthesis System. Results so far show higher photosynthetic and transpiration rates amongst the evergreen species during the fall/winter period, when compared to the deciduous species, as deciduous leaves undergo a senescence process due to environmental changes. Furthermore, specific protein gel analysis data through SDS-PAGE profiling and Western Blotting also showed higher levels of key photosynthesis proteins, light harvesting complex of photosystem II (LHCIIB), and the ribulose-1,5 bisphosphate carboxylase/oxygenase (RUBISCO) in evergreen species when compared to deciduous ones during the fall/winter. Photosynthesis and transpiration data will be discussed in relation to environmental parameters such as light intensity, temperature, and the amount of precipitation. The findings of this study will contribute to our knowledge about the role of these trees in CO2 absorption and sustainable development.

Lavender Protects Against Infectious Colitis

Jessica Baker (Faculty Sponsor: Dr. Deanna Gibson)

Colitis is a type of inflammatory bowel disease (IBD) and refers to inflammation of the colon. It is a chronic, relapsing, immunologically mediated disorder in the gastrointestinal tract that results in bloody diarrhea and ulceration. Canada has the highest prevalence and incidence of IBD in the world. Currently there is neither a cure nor prevention with limited therapeutic options. Lavender essential oil extract has an extensive therapeutic history and has been shown to possess antimicrobial and anti-inflammatory properties. The goal of this study was to examine a unique cultivar of lavender, Lavandula x intermedia cv Okanagan Lavender, for anti-inflammatory effects in a mouse model of colitis induced with an intestinal pathogen, Citrobacter rodentium. We found that lavender essential oil was protective against infectious colitis. Orally gavaged lavender resulted in a significant reduction in cecal tissue damage corresponding with significantly reduced cytokine expression and immune cell infiltration during colitis compared to colonic mice alone. We found the lavender had direct cytotoxicity to Citrobacter rodentium revealing that antimicrobial properties were important for the loss of inflammatory responses. Our results reveal that Okanagan Lavender is a potential therapeutic against acute colitis through antimicrobial and/or anti-inflammatory effects.

Potential mouse model to study obesity and diabetes: PWD/PhJ mouse show resistance to diet-induced obesity and unique insulin secretion pattern

Amy Hung (Faculty Sponsor: Dr. Susanne Clee)

Genetically-distinct inbred PWD/PhJ (PWD) mouse is a new strain developed from wild-caught mice. These wild-derived inbred strains are different from the commonly inbred mouse like C57BL/6J (B6) mice as they offer greater genetic variability. Their genome has been extensively analyzed in genome-wide association studies. However, their potential as models of obesity and diabetes susceptibility has not been assessed. Obesity and diabetes-related traits were examined in female PWD and B6 mice fed on high fat diet and the traits were compared with male mouse strains that were previously characterized in our lab. PWD mice, fed on chow or high fat diet, remained slim and maintained similar body weights, while B6 on high fat diet developed obesity by the end of 19 weeks. Starting with greater body percent fat, PWD mice on both diets only experienced slight increase in body fat, while B6 mice on high fat diet reached as high as 51% body fat. Interestingly, PWD mice on chow released minimal insulin in intraperitoneal glucose tolerance tests, whereas as those on high fat diet had a large increase in the second phase glucose-stimulated insulin secretion in vivo, suggesting loss of insulin sensitivity and the onset of insulin resistance. The females exhibited different insulin and glucose responses from the males, highlighting the presence of gender-specific traits. Thus PWD is an obesity resistant strain with unique insulin secretion phenotype and it is an interesting model that can offer insight into new genes involved in the development of obesity and diabetes.

The Effect of a Microbiota Transfer Containing Segmented Filamentous Bacteria on Gene Expression Levels of Jackson and Taconic Mice

Andrea Brown (Faculty Sponsor: Dr. Benjamin Willing)

The human gastrointestinal tract harbours an immense quantity of bacteria. Under normal circumstances these bacteria are highly beneficial to the host, playing an important role in regulating host immune function. Segmented filamentous bacteria (SFB) is one species of gut bacteria that is particularly adept at inducing an immune response in the mouse. SFB induce the differentiation of CD4+ T helper cells into Th17 cells, although the molecular basis of this differentiation is unknown. The purpose of this study was to examine the effects of SFB on the host, when introduced to a host that was not previously colonized by SFB. This was achieved by transferring the total microbiota from mice that were colonized by SFB into the same strain of mice that lacked SFB. Prior to microbial transfer, the microbiota was depleted by a high dose streptomycin treatment to promote colonization. The expression of numerous genes involved in innate immune defense were then examined. Gene expression analysis by quantitative real-time PCR showed that in most cases, genes involved in inflammation were more highly expressed in mice colonized by SFB than in mice lacking SFB. In addition, of the SFB-colonized mice, gene expression levels were highest among those that had been recently colonized with SFB, as opposed to the donors. This indicates that following SFB colonization, inflammation levels will likely decrease over time, to a final level greater than that of mice lacking SFB altogether. These results confirm the importance of SFB in stimulating genes involved in inflammation.

Synthesis of Heterocyclic compounds

Zafar Qureshi (Faculty Sponsor: Dr. Marco Ciufolini)

Tuberculosis kills around 2 million people a year. This is in part due to its resistance to conventional antibiotics. One of the ways TB evades our antibiotics is efflux pumps. These pumps capture the antibiotics and push them out into the medium. Our research will focus on counteracting these pumps with a small heterocyclic compound called Bromperidol. This compound has shown signs of inhibiting the efflux pumps but as of now its biological activity is low and there have been some issues of safety with the use of Bromperidol. By making minor changes to the drug we hope to increase the biological activity and also eliminate its side effects. This can save a great deal of time and money as developing new antibiotics is extremely difficult and time consuming.&CR;&LF;In addition to the analogs of Bromperidol I have also been working on the total synthesis of a retinoic acid receptor inverse agonist named AGN 194310. Retinoic acid receptors are essential in regulating cell growth. Binding of this compound produces the opposite cellular reaction compared to the naturally occurring ligands. By controlling the compounds that bind these receptors we can have some control over cellular proliferation and differentiation. With the use of this inverse agonist we might to be able to control some aspects of tissue regeneration and/or tumor suppression.

Systems-Wide Analysis Identifies Features of Proteins Susceptible to Misfold in Cell

Alex Ng (Faculty Sponsor: Dr. Thibault Mayor)

Aggregation of misfolded proteins is a hallmark of many neurodegenerative diseases. Amyloids and prions have been identified in these insoluble deposits and are characterized by cross-beta sheet structures, hydrophobic stretches, and glutamine-rich regions. Although these properties explain why some proteins are prone to aggregate, they represent only a subset of the proteins that aggregate; characteristics that make other proteins susceptible to misfold remain poorly understood. In this study, I used a systems biology approach to identify misfolding-prone proteins and compare their characteristics to those that are less susceptible. Given the plethora of genome-scale data from the model yeast organism S. cerevisiae, I adopted this approach to analyze which proteins are targeted for proteolysis after heat-shock induced misfolding in yeast cells. Quantitative mass spectrometry identified 240 misfolding-prone proteins and a reference set of 772 unaffected proteins. To identify distinguishing features between these two groups, I developed a platform using computational biology to automate and integrate previous genome-scale studies. Partitioning the proteome into two classes described their propensity to misfold: highly structured and intrinsically disordered proteins. For structured proteins, misfolding propensity was independent of the complexity of the structure; instead, thermodynamic instability was a major determinant. In contrast, disordered proteins lack well-defined structures, and I found that bias in amino acid composition, newly evolved proteins and increased interaction motifs correlated with their susceptibility to misfold. Many trends are also applicable to protein that aggregate in human neuroblastoma cells, suggesting they may explain the pathogenesis of these aggregation diseases.

Poster Presentation Session

Boosting a Sense of Meaning Increases Prosocial Behavior

Alice Zhang (Faculty Sponsor: Dr. Lara Aknin)

The Meaning Maintenance Model (MMM) proposes that people have a need to perceive the world through mental representations of expected relations, which give them a sense of meaning (Heine, Proulx & Vohs, 2006). Recent studies have shown that when people"'s sense of meaning is threatened by events which violate their expectations, individuals can act in punitive ways to restore their meaning framework. The present study was designed to investigate whether the MMM could be reversed""that is, we investigated whether boosting people"'s sense of meaning would encourage pro-social behaviour. In one field study conducted at the University of British Columbia, we randomly assigned participants to either a control or meaning boosting condition. In the control condition, participants were simply given questionnaires assessing their demographics and mood. In the meaning boosting condition, participants watched a video illustrating the importance of social connections before completing the same questionnaires. Participants were then told the study was over but it would be helpful if they could complete a set of algebra questions for a new student in the lab. The number of algebra questions completed was our measure of pro-social behaviours. Result supported our hypothesis and showed that participants in the meaning boosting condition engaged in more pro-social behaviour (i.e. answered more algebra questions). These findings suggest that charities may be able to collect larger donations by boosting people's sense of meaning before soliciting donations. This finding also implies that society can promote pro-social behaviours by establishing norms and policies which encourage interconnection and sense of meaning.

Negotiating Linguistic Loyalties within a Multicultural Context: Immigrant Parents' Attitudes Towards Children's Heritage Language Acquisition and Ethnic Identity Formation

Amanda Cheong (Faculty Sponsors: Dr. Jennifer Chun & Dr. Alexia Bloch)

Conducted in the multicultural context of Vancouver, this study explores immigrant parents"' attitudes towards their children"'s heritage or dominant language acquisition, as well as perceived effects of language upon their children"'s ethnic identities. Data was gathered in spring 2010 from ethnographic fieldwork and ten semi-structured interviews with immigrant mothers at Gordon Neighbourhood House, a community-based organization in Vancouver"'s West End. Adapting and expanding upon J.W. Berry"'s acculturation attitudes framework, three stances were found to be held regarding heritage language use, acculturation, and ethnic identity formation. Mothers who adopted an assimilationist approach observed an erosion of their children"'s fluency in their heritage language, due to lack of language use enforcement at home and exposure to English within society. Other respondents held an integrationist or bicultural stance, and made conscious efforts to uphold heritage language and cultural values, as well as participate in Canadian life. A third group demonstrated a pragmatic approach, seeing proficiency in a second language as a practical skill that would help children become cosmopolitan citizens in the classroom and workplace. Common across these viewpoints, however, was the idea that language acts as an avenue through which children can develop community ties""to either the language"'s corresponding ethnic group, Anglo-Canadian society, or a combination of both. This study argues that, rather than having a direct effect on identity, language acts as a mechanism through which parents tie children to their ethnic and/or Canadian culture. Thus, language-mediated membership to these networks may be a more salient shaper of identity than language alone.

Being Shady Changes The Way People Look At You

Amara Sarwal (Faculty Sponsor: Dr. Alan Kingstone)

Previous work has shown that the eyes of people are preferentially selected when individuals look at natural scenes (Birmingham, Bischof, Kingstone, 2008). However, in real life, eyes are often covered with eyeglasses or sunglasses. In the current study, we asked whether this preference for eyes holds when the eyes are partly or fully blocked by glasses. We tracked the eyes of participants while they viewed complex, real world social scenes containing people wearing eyeglasses, sunglasses or no eye coverings. The no eye covering results corroborated previous work, showing that people preferentially look at the eyes of other people, and that this was particularly true in scenes with high social content (more than one person). As for the eyeglasses and sunglasses data, people preferentially selected the eye regions of those wearing eyeglasses over those wearing sunglasses. We also show that when unable to see the eyes, people select the mouth region over and above the mouth regions of people whose eyes are visible. These results suggest that selection of the eye region in complex social scenes depends on the information content available and that when this content cannot be accessed, people compensate by looking at other regions of the face. Results are discussed in the context of current theories of social attention, whereby the eyes are particularly salient for human attentional and emotional signalling.

Communication with a Haptic Creature

Andrea Michelle Slade (Faculty Sponsor: Dr. Elizabeth Croft)

Many children suffer from anxiety or stress disorders. TAMER is a haptic creature that calms anxious or stressed children. This research is involving communication with TAMER through touch. TAMER is a robotic device that mimics a small lap animal. It is composed of a breathing mechanism, purring mechanism, a warming element, as well as pressure sensors for communication through touch. The emotional state of TAMER is determined by recognizing gestures from the child. For example, light stroking could reflect in a happy or pleased emotional state. TAMER may help calm children with anxiety or stress disorders by recognizing signs of stress and adapting its emotional state to sooth a child. The creature may wiggle or change breathing rate to communicate with the child. This creature may be helpful to psychologists when trying to asses a child"'s state of anxiety.

Charting the Territory: Symptoms in Children with Life-Threatening Conditions

Anqi Sun (Faculty Sponsor: Dr. Hal Siden)

Children with non-treatable, progressive conditions are an understudied population. While diagnoses are varied and numerous, clinical presentation is similar in symptoms limiting quality of life. Without cure or life-prolonging treatment, symptom management is emphasized. Charting the Territory follows these children and provides some of the first-ever detailed descriptions of the clinical symptom trajectory of non-treatable progressive conditions. Parents completed a clinical symptoms checklist for the first 75 children enrolled. Health records were also reviewed for clinician reports of symptoms. Descriptive and Pearson-r correlation statistics were used in analyses to correlate parental reports with clinician-recorded symptoms. We also describe results from a unique online survey, which allows parents to track their child"'s symptoms monthly for a subset of 44 affected children. The first 75 children where both parent and clinician reports are available include 35 girls, 40 boys with an average age of 7.51 years (SD=5.275). Their conditions were primarily Severely Neurologically Impaired (n=20, 26.67%), Metabolic Conditions (n= 12, 16.00%) and Chromosomal Disorders (n=10, 13.33 %). Clinicians typically reported symptoms less often, e.g., clinicians

reported pain in only 41% of children whose parents reported the symptom. The frequency, severity, and distress of each symptom reported by parents were highly correlated over time. The average number of symptoms was 3.5/child of 7 reportable by parents. In comparison to parent reports, symptoms such as pain are significantly under-reported by clinicians in health records. Further study is important to determine why these discrepancies occur and our longitudinal design may reveal more results over time.

Yoga and other complementary and alternative therapies for quality of life in perinatal women

Arjun Nanda (Faculty Sponsor: Dr. Shaila Misri)

Perinatal depression affects a mother"'s mood, relationships, and overall mental stability. While remission is used as a gauge to determine treatment efficacy, measurement of quality of life is important in order to understand maternal functioning and her overall sense of wellbeing. Treatments of mental disorders are complex and often require multiple approaches to restore functionality. In addition to standard pharmacotherapy and psychotherapy, complementary and alternative therapy (CAM), including yoga, is often recommended by clinicians. The purpose of this study is to examine the current literature on the effect of CAM therapies, specifically yoga, on depressed perinatal populations and potential improvement in their quality of life. Six online databases were searched using a combination of words specific to CAM therapies, perinatal depression, and functionality yielding 20 relevant articles. No articles specifically integrated the topics of yoga, quality of life, and depression in the perinatal population. Sixteen articles showed reductions in anxiety and depression symptoms, cortisol levels, stress, and an increase in quality of life after yoga therapy. The remaining 4 reviewed papers outlined other CAM treatments (omega-3 fatty acids, S-adenosyl-methionine (SAMe), bright light therapy, and exercise) that were shown to have positive effects alongside conventional treatment in perinatal populations for depression and impaired quality of life. While several studies have suggested that yoga and other forms of CAM are efficacious as a supplement to conventional therapy for depression, more research is required in the applicability to treatment of perinatal populations as clinically yoga is found to be effective when implemented.

Charting the Territory: Descriptive Results and Accuracy of PEDI Scales

Brigid Wong (Faculty Sponsor: Dr. Hal Siden)

Charting the Territory is a longitudinal study with research assistants (RA) in 6 Canadian cities. Eligible study participants are children with rare, progressive diseases. Children with these conditions experience a wide range of physical and mental declines. RAs use the Pediatric Evaluation of Disability Inventory (PEDI) to assess functional abilities in these children over time. The PEDI sub-scales measure how much the child can do and how much help they need. Scores on Self-Care, Mobility, and Social Function are assessed once a year. Each RA was trained by an occupational therapist prior to administering the PEDI. Scores on a sample case were also calculated to assess administration accuracy. We describe results for 81 families, with 86 children for the PEDI at baseline. Average age is 7.17 years (SD= 5.258): 51.2% girls, 48.8% boys. The majority of the children are young: 0-3 (n= 31, 36%), 4-7 (n=19, 22.2%). Their primary diagnoses are undiagnosed Severe Neurological Impairment or "SNI" (n= 21, 24%), Chromosomal Anomalies (n= 14, 16%), and Other Metabolic Disorders (n= 12, 14%). A decrease in mean functional skills of at least 15% was noticed for all three sub-scales when comparing the scores at baseline and after one year. Children with undiagnosed SNI had the highest level of impairment. Preliminary results show a decrease in children"'s functional abilities over the first year. Children with undiagnosed SNI present early on with higher degrees of impairment. Training given by an occupational therapist is sufficient for RAs to obtain high accuracy when administering the PEDI.

Beneficial Mutations and their Fitness Effects

Dara Lo (Faculty Sponsor: Dr. Aleeza Gerstein)

Genetic research has historically focused on the study of neutral and deleterious mutations. Understanding beneficial mutations has the largest implications on the study of adaptation by natural selection, yet beneficial mutations have proven more difficult to isolate. Because of this, much is still to be done to quantify the effects of adaptive mutations. In this study, single beneficial mutations were acquired in haploid Saccharomyces cerevisiae by exposing the cells to the antifungal drug nystatin. The level of nystatin was chosen such that wild type individuals were unable to grow quickly, and so novel mutants were isolated by the sudden appearance of individuals capable of growing in the selective environment. Here we describe the characterization of 35 such novel mutations. We first determine the tolerance limits conferred by each mutation by growing the cells in an incremental concentration of nystatin. We find that some mutants tolerated only a minimal increase beyond the level that they were selected in, whereas others survived at concentrations of an order of magnitude greater than the original environment. We then ask whether tolerance to nystatin is transferable to other environments. Particularly, we test whether mutants that have achieved the largest tolerance to nystatin show a larger trade-off in other stressful environments. This work provides some of the first empirical data on the variance of fitness effects of single beneficial mutations across multiple environments in a eukaryote.

Mineralogy of supergene carbonate-hosted nonsulphide Zn-Pb mineralization in southern and central British Columbia

Halley Keevil (Faculty Sponsors: Dr. Gregory Dipple & Dr. Suzanne Paradis)

Carbonate-hosted nonsulphide base metal (CHNSBM) deposits form in supergene environments when base metal sulphides are oxidized and chemical weathering causes the metals to be leached out and deposited as metal-bearing gossans. The metals can be deposited by “direct replacement” as nonsulphide minerals directly above the sulphide ore, or can travel away from the underlying sulphides with percolating water and be deposited as “wall-rock replacement deposits”. Direct replacement deposits are known as “red ores” and are usually rich in iron oxides and contain economic concentrations of zinc and lead. Wall-rock replacement deposits, known as “white ores”, typically contain higher concentrations of zinc but lesser amounts of lead. Both forms of mineralization have been recognized as valid targets in B.C., but detailed mineralogy and chemistry of representative deposits is needed to better establish exploration models. Petrography, X-ray diffraction and scanning electron microscopy analyses were completed on select nonsulphide deposits, i.e., Redbird, Lomond, and Oxide in the Salmo district of the Kootenay terrane, and Cariboo Zinc in the Quesnel Lake district of the Cariboo terrane. All of the deposits studied fit the direct replacement style of nonsulphide mineralization with the exception of the Oxide property, which shows traits of wallrock replacement style mineralization. Though different, both deposits fit the general supergene model of nonsulphide mineralization and further characterization can assist in creating an exploration model for similar deposits in BC and the rest of the Cordillera.

Dietary Supplementation with Phytosterol and Ascorbic Acid Reduces Mass Accumulation in High Fat-fed Mice

Ian Wong (Faculty Sponsor: Dr. Kishor Wasan)

Previous studies have found that mice fed a high fat diet and a supplement comprised of a plant extract linked to ascorbic acid resulted in reduced mass accumulation. However, to date, no mechanism has been identified. This study investigated the potential mechanisms by examining the effect of phytosterol and ascorbic acid supplementation in high fat-fed mice. Results from this study could assist in the development of weight-loss medications. Animals were fed a high-fat diet supplemented with phytosterol and ascorbic acid, both alone and in combination, and their mass, food and water intakes were recorded weekly. Resting metabolic rate (RMR), maximal oxygen consumption (VO2 max), food transit time, fecal output were measured and plasma and fecal lipids, cholesterol, triglycerides and non-esterified fatty acids were assessed. Mice fed a high-fat diet supplemented with both phytosterol and ascorbic acid showed a significant reduction in mass accumulation which was not attributed to differences in food intake, water intake, RMR, VO2 max or metabolic scope. However, animals fed a diet supplemented with phytosterol, alone, and phytosterol with ascorbic acid exhibited an increased passage rate and decreased fecal output. Significant reductions in mass accumulation associated with dietary supplementation of phytosterol and ascorbic acid to a high fat diet have not been found to be due to changes in metabolism, but rather, it is suggested to be due to changes in gut morphology. The elucidated effect of phytosterol and ascorbic acid supplementation provides insight into a novel mechanism of action to apply towards anti-obesity medication development.

Design, Construction, and Characterization of an Interference-Filter-Stabilized External-Cavity Diode Laser

Jon-Paul Sun (Faculty Sponsor: Dr. Kirk Madison)

Atomic physicists are turning to diode lasers as a relatively cheap and effective alternative to conventional coherent light sources for their research. However, the frequency instability and large spectral linewidth characteristics of free-running diode lasers makes such devices unsuitable for atomic cooling. We describe an economical, robust, and versatile diode laser system, stabilized by optical feedback regulated by the use of an interference filter in an external cavity. The output characteristics of this system were determined through a delayed self-heterodyne interferometer. Our system provides single-mode operation with a linewidth of less than 10 kHz""orders of magnitude better than commercially available systems.

Efficient Implementation and Performance Analysis of a Database Repair Algorithm

Jonathan Leung (Faculty Sponsor: Dr. Lake Lakshmanan)

Integrity constraints in databases, such as functional dependencies, serve to ensure consistency between entries in a database. For large databases, enforcing all possible functional dependencies during updates is not a scalable task. Hence, due to user errors or lack of accurate data, the databases may become inconsistent. One approach to the problem of inconsistency is to repair the database by directly modifying its entries. My work involves implementing such an algorithm (Kolahi and Lakshmanan, 2009) for finding and correcting functional dependency violations in a database. The goal of this implementation is to investigate how well the algorithm scales to large data sets under various conditions. I have tested the algorithm on relatively small datasets of 100-500 database rows. Currently, I am working on optimizing my implementation and running it on different data sets. I plan to run extensive experiments that will provide useful insights on the performance and efficiency of the repair algorithm.

Variable Friction in Touchscreen Interactions

Louise Oram (Faculty Sponsor: Dr. Karon MacLean)

Touchscreens are increasingly prevalent, but lack the tactile feedback afforded by keyboards and other mechanical devices. Augmenting touch interactions through the use of friction on the touch surface may create a more enjoyable and potentially faster or more accurate interaction. The device used for our experiments is a small touchscreen that allows for programmed changes in friction, i.e. variable friction. Our first experiment showed that for a simple target acquisition task variable friction increased performance. The changes in friction allow for faster approach times towards the target. A second study showed that for exemplar applications the variable friction version was generally preferred to the normal touchscreen. Additional exploratory studies were performed to examine the perceptual capabilities that are at stake when designing applications with variable friction. Current work is investigating scrolling interactions, particularly in applications where users may not be able to pay close attention to visual feedback. Variable friction may be particularly useful in multitasking settings (such as mobile applications) since information communicated non-visually will reduce the strain on the visual cognitive load.

A novel interaction between the medium subunit of the AP-1R complex, Apm2, and Ima1 is required for the transport of the yeast SNARE, Snc1

Nandini Raghuram (Faculty Sponsor: Dr. Elizabeth Conibear)

Vesicular transport is an essential cellular process that is important for the movement of cargo molecules. It regulates the presence of receptors at the cell surface, transport along axons and organelle biogenesis1. Multimeric adaptor protein (AP) complexes mediate the incorporation of cargo into coated vesicles. The yeast AP complex, AP-1, facilitates transport between the Golgi and endosomes. An alternate form of this complex, AP-1R, shares the same subunits as AP-1 except for the medium subunit Apm1, which is replaced by Apm2. The function of Apm2 is still unclear. A recent genome-wide study used to identify genes regulating the recycling of the yeast SNARE Snc1 (a homolog of the mammalian SNARE VAMP/Synaptobrevin) identified a potential role for AP-1R and an additional uncharacterized ORF, IMA12. We found that Apm2 interacts with Ima1 and promotes the transport of Snc1. Through yeast two-hybrid studies, the domains through which Ima1 and Apm2 interact have been narrowed down providing a model to visualize the way these proteins come together into a complex. Concurrent with the yeast studies, we are conducting experiments in mammalian cells to investigate the role of the Ima1 homolog TMCO4. Further work on the medium subunits of AP-1 and AP-1R will provide insight into how alternating subunits determines cargo specificity. In addition, because Ima1 is highly conserved between yeast and humans, its characterization in yeast may offer insight into its function in vesicular transport pathways of higher eukaryotes and our understanding of disorders that may arise due to dysfunction of these pathways.

Expression analysis of novel obesity-associated genes with changes in metabolic status

Piriya Yoganathan (Faculty Sponsor: Dr. Susanne Clee)

Obesity is associated with a higher risk of many weight-related diseases, such as diabetes mellitus, and hypertension. The development of obesity involves both environmental and genetic factors. Recent genome wide association studies have identified genetic variants that are implicated in the risk of obesity, many of which may affect the regulation of nearby genes. However, very little is known about most of these genes, such as where they are expressed, their function, and how they might contribute to the development of obesity. We initially analyzed the tissue distribution of expression of 20 obesity-associated genes in C57BL/6 mice using bioinformatics and then verified the distribution with real-time quantitative reverse transcription PCR. To investigate whether the obesity-associated genes are regulated by metabolic status, we then assessed expression levels of these genes between different diet conditions, such as feeding and fasting, and/or a high fat diet and a normal diet, in 4 tissue types, adipose, liver, hypothalamus and the rest of the brain. Our results suggest that many genes are differentially regulated by feeding and a high fat diet in both adipose tissue and the hypothalamus. Further, in the brain, while several genes are regulated by feeding, only 1 is regulated by a high fat diet. Also, only a few genes show differential regulation by feeding and a high fat diet in the liver. Our study provides additional support for these genes playing a role in obesity and suggests that tissue specific gene regulation may play a role in the development of obesity.

Neural circuit integration: plasticity between three behaviours (nose touch response, chemical avoidance, and tap withdrawal response) with shared circuitry in the nematode Caenorhabditis elegans

Sepehr Nassiri (Faculty Sponsor: Dr. Catharine H. Rankin)

Animals' behaviours are controlled by neural circuits. No nervous system, however, is comprised of a single circuit; they are networks of many converging and overlapping circuits. Understanding how information flows and integrates through these networks is fundamentally important to our understanding of neuroscience. To tackle this question, this study examined the neural plasticity between three behaviours (nose touch response, chemical avoidance, and tap withdrawal response) using the model organism Caenorhabditis elegans. The neural circuits of nose touch response and chemical avoidance overlap while the neural circuitry for nose touch/chemical avoidance and tap response converge on the command interneurons. Habituation, a form of non-associative learning in which repeated exposure to a stimulus leads to decreased responding, is a great measure to test the cross-plasticity in these circuits. Although C. elegans habituate to all three behaviours, it is unknown whether habituation generalizes between them. Animals were habituated to one stimulus (nose touch, chemical avoidance, or tap) and subsequently provided a single test stimulus of another type (all combinations were tested) and compared to a "˜naÃ¯ve"' group that received a single test stimulus without any previous stimuli. The worms showed no decrement in the tap response after habituation to the nose touch/chemical avoidance and vice versa, but nose touch and chemical avoidance habituation generalized with each other. This suggests the mechanisms for habituation occur upstream of where these two circuits converge, in the sensory neurons, and that overlapping circuits will likely generalize habituation, while converging circuits will discriminate.

The Clogged Sink Model: The Effects of High Fat Diet on Peripheral Î²-amyloid Metabolism and Alzheimer"'s Disease

Sharon May (Faculty Sponsor: Dr. Cheryl Wellington)

Alzheimer"'s Disease (AD) is the most common cause of senile dementia affecting 40% of persons over 85 years (Burgess, 2006). AD is a neurodegenerative disease driven by amyloid plaque build-up in the brain, much like a clogged sink that can"'t be drained. Amyloid plaques contain Î²-amyloid (AÎ²) peptides which are derived via proteolytic processing of amyloid precursor protein (APP). Development of AD is influenced by a variety of factors including: genetics, environment and diet. Consumption of a high fat diet (HFD), also known as a Western diet, is associated with increased risk of AD (Petot, 2004). HFD increases production of peripheral triglyceride rich lipoproteins (TRLs) and the TRL marker polipoprotein B (apoB). Peripheral AÎ² associates with TRLs in intestinal cells and may therefore be also elevated by HFD. Most recently, cerebral amyloid plaques have been found to colocalize with apoB, suggesting that apoB may "carry" peripheral AÎ² across the blood brain barrier and contribute to amyloid plaque formation (Takechi ,2009). Through this series of experiments, we show that HFD could elevate TRL production, increasing peripheral APP expression, causing a net increase in AÎ² production which will in turn drive AÎ² uptake into the brain, aggravating AD.

In Vitro dynamic lipolysis model: assessment of pharmacological inhibitors of intestinal absorption of cholesterol.

Susana Conteras (Faculty Sponsor: Dr. Kishor Wasan)

In Vitro dynamic lipolysis model: assessment of pharmacological inhibitors of intestinal absorption of cholesterol. Susana Contreras-Whitney1, Pavel Gershkovich2, Olena Sivak2, Jerald W Darlington3, and Kishor M. Wasan2 1Faculty of Sciences, The University of British Columbia; 2Division of Pharmaceutics and Biopharmaceutics, Faculty of Pharmaceutical Sciences, The University of British Columbia; 3AMCOL International Inc. Background A new potential candidate for treatment of hypercholesterolemia, are the non-absorbable protonated nanostructured aluminosilicate clays (NSAS). Previous research found that the administration of NSAS to both mice and rats reduced total plasma cholesterol levels without systemic adverse effects. It has been established that protonated NSAS lowers plasma cholesterol levels by inhibiting the absorption of cholesterol in the gastrointestinal tract. However; the exact mechanism is still unknown. Objectives To investigate the mechanisms of action of protonated nanosutructured aluminoslicates and currently used drugs such as cholestyramine using a dynamic In-vitro lipolysis model. Methods Parameters were set out to mimic fasted state conditions found within the gastrointestinal tract. The digestion buffer was composed of 50mM tris maleate, 150mM NaCl, 5 mM CaCl2Â·2H2O, 5mM Na taurocholate, and 1.25 mM phosphatidylcholine. The pH was maintained at 7.4 by a stat titrator. The triglyceride (peanut oil), 3H and cold cholesterol were added prior to the commencement of lipolysis, which was initiated by the incorporation of pancreatic lipase. Experimental groups included the control (water), protonated NSAS or cholestyramine at various doses. Samples were ultracentrifuged and separated into an oil, aqueous, and sediment phase. The distribution of cholesterol was determined by means of radioactivity. Results In the control groups the majority of cholesterol was found in the aqueous phase representative of readily absorbed cholesterol. The protonated NSAS group demonstrated almost complete redistribution of cholesterol from the aqueous to sediment phase at the maximal dose (262.5 mg) corresponding to an effective inhibition of cholesterol absorption. The incorporation of cholestyramine exhibited redistribution of cholesterol from the aqueous to oil phase also at the maximal dose (262.5 mg), corresponding to inhibited or delayed cholesterol absorption. In addition, incorporation of NSAS

decreased the completion time of lipolysis at the maximal dose where as addition of cholestyramine increased the total duration time at the maximal dose. Conclusions Dynamic in-vitro lipolysis model is a novel and useful tool for assessment of inhibitors of intestinal absorption of cholesterol. The results suggest that protonated NSAS inhibits the absorption of cholesterol in the intestine by redistributing cholesterol to the sediment phase and subsequent excretion with feces, in a dose dependant manner. Further research will be needed to reveal the exact nature of the interaction between NSAS and cholesterol in the gastrointestinal tract.

Optimizing Microfluidic Technology for High-content, Image-Based Assays of Mammalian Cells at the Single Cell Level

William Bowden (Faculty Sponsor: Dr. James Piret)

Microfluidic technology provides a flexible platform to conduct high-content, image-based assays of mammalian cells at the single cell level. Bulk assays can hide key individual cell responses because they provide averaged data over large populations. Our microfluidic devices consist of arrays containing 1,600 to 6,144 chambers, each having a volume of 4.1 nL. The system allows automated monitoring of in vitro responses of single suspension cells and their clonal progeny over several days of culture. These capabilities allow fundamental questions about the nature of stem cells to be addressed in ways that are not feasible with conventional techniques. This project aimed to increase the throughput and efficiency of the technology by improvements in the design features and the post-experiment data processing. Previously, cells were randomly settled into the bioreactors to obtain a stochastic distribution of cells per chamber, but this is not optimal for single cell analysis at high time resolution. For rare cell populations, it is critical that the loading procedures are optimized to obtain one cell per chamber. To remedy these issues, we designed and integrated traps into the device to capture single cells for deposition into each chamber. In addition, we developed post-experiment image processing algorithms capable of segmenting cells and tracing lineages. These improvements were tested on HSC-enriched cell populations cultured at the single cell level. Together these improvements allow for more efficient acquisition, experimentation with limited stem cell populations, and the detailed analysis of cell expansion and death under well-defined conditions.

The Role of Cohesin Associated Protein PDS5 in Silencing

Yasmin Yassin (Faculty Sponsor: Dr. Hugh Brock)

Cohesin proteins have been found to play roles in both transcriptional regulation and in cell cycle regulation. A novel complex containing the cohesin PDS5 was co-immunoprecipitated along with the Polycomb group (PcG) proteins, Polyhomeotic (Ph) and Polycomb (Pc). PcG proteins function in Hox gene repression and silencing during the development of multicellular organisms. In higher eukaryotes, the selective repression of Hox genes in certain regions allows for proper segmental identity. My research builds upon the previous work of Beck et.al (unpublished). The purpose of this study is to investigate whether this novel complex functions in cell cycle regulation or transcriptional silencing/repression. Past evidence suggested that ph may function in the DNA damage checkpoint. Using immunohistochemistry, it was found that pds5 and ph do not play a direct role in DNA damage repair. Genetic interaction studies have determined that pds5 mutants enhance the homeotic phenotype of ph mutants. Also, ChIP data has shown that pds5 binds to the PcG response elements (PREs) at sites similar to that of ph. We discuss the possible role of this complex in transcriptional regulation of genes.

Somatostatin receptor subtype-2 and opioid receptors (Î¼, Î´, Îº) modulate signaling pathways in breast cancer cells

Yu-Chen Lin (Faculty Sponsor: Dr. Ujendra Kumar)

Somatostatin is an anti-proliferative neuropeptide hormone and it has five G-protein coupled receptors (SSTR1-5). Over-expression of SSTR2 has been observed in various breast cancer cells and this suggests an innate protective mechanism of SSTR2 against uncontrolled cell growth. Opioid receptors (ORs), namely Âμ, Î´, and Îº, have also been suggested to suppress tumor cell growth upon activation. Both SSTR2 and ORs are variably expressed breast cancer cells and their analogous structures indicate potential functional interactions. Whether SSTR2 co-expresses and functionally interacts with ORs in breast cancer cells are currently unknown. We speculate that the simultaneous activation of SSTR2 and ORs may exert a synergistic effect on various downstream signaling pathways and enhance the anti-proliferative effect in human MCF7, MDA-MB231, and T47D breast cancer cell lines. Laboratory techniques such as immunofluorescence immunocytochemistry and western blot analysis were employed to determine the cell surface expression of SSTR2 and Âμ, Î´, Îº-ORs in the breast cancer cell lines. Western blot analysis was also used to investigate the changes in MAPK, cell survival and tumor suppressor pathways upon treatment with SSTR2 specific agonist in the presence or absence of Âμ-OR specific agonist, Î´-OR specific agonist, or Îº-OR specific agonist. Our results showed that SSTR2 and Âμ, Î´, Îº-ORs display differential expression in MCF7, MDA-MB231, and T47D breast cancer cell lines. Activation of SSTR2 and ORs modulate the downstream signaling pathways which suggests a possible synergistic role in inhibition of cell proliferation. These observations implicate novel therapeutic targets in the treatment of breast cancer.

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A Hunt For A Supervisor (Workshop)

Mario Cruz

This workshop focuses on becoming "relevant" to your supervisor of choice to secure a research position in the area you want to work in. The workshop will guide you through the application process and give you hints on how to overcome the most common hurdles that most students go through. From the first contact to closing the deal, this workshop will provide you with the tools necessary to turn a supervisor's "NO" into a "WOW".

Footprints: The Human Impact on Animal Ecosystems — IKBLC 155

Analyzing ship noise in the critical habitat of British Columbia's Southern Resident Killer Whale population

Rebeka Rybola, Cassandra Paterson, Kristina Mosely, Danica Crystal & Shasha Wang
(Faculty Sponsor: Dr. Tara Ivanochko)

Economic development and expansion in British Columbia and Canada has led to an increase in shipping traffic along the west coast of Canada. This coast is home to the populations of Southern Resident Killer Whales (Orcinus orca) who are listed as endangered species. Current populations of killer whales are struggling to maintain their population size. These marine mammals sit at the top of B.C."'s coastal trophic levels, and have cultural significance to many British Columbians. With further development and expansion of several BC ports, shipping traffic will increase within the critical orca habitat identified. With the use of GIS, we will map the zones of influence of two sound intensities as generated by commercial shipping vessels, and identify areas within the critical habitat of the species, where the sound may interfere with the communication and hearing of the Southern Resident Killer Whale population. Further, our study will estimate whether the areas of noise risk has increased spatially over the past years. The results of our study could be used to contribute to the management plan being drafted by the B.C. Government to mitigate the negative interactions between ships and killer whales. Our goal in conducting this study is not to deter development and the accompanying increases in shipping activity, but rather to inform the decision-making process, so that planning and enforcement of shipping routes can be better-informed to protect B.C."'s killer whales.

Motion-detecting cameras as an alternative to mark-recapture methods for estimating rodent densities

Petra Villette (Faculty Sponsor: Dr. Charles Krebs)

Estimating species densities is a critical aspect of many ecological studies performed worldwide; using cameras for estimating densities has the potential to eliminate the need for direct contact with the animals being studied, reducing the impact of research on the population in question and limiting stressful and hazardous encounters between researcher and subject. Cameras as a means for density estimation have been used with some success on larger animals that feature individually-distinguishable markings, but relatively little research has been conducted to see if these methods are applicable to animals that do not feature individually-distinguishable markings, and nothing smaller than small deer have been considered. I conducted an Honours project in which I used motion-detecting game cameras commonly used among North American hunters to film deer mice (Peromyscus maniculatus), red-

backed voles (Myodes rutilus), and several vole species of the Microtus genus in the Kluane Lake region of Yukon Territory as they interacted with Longworth traps used for mark-recapture estimates of mouse and vole density, with the intention of determining if the number of one-minute videos recorded by the cameras per unit time would correlate with the density estimates of the mice and voles obtained through mark-recapture methods. Correlations between estimated densities and video capture rates for Myodes rutilus and pooled Myodes and Microtus spp. data suggest that cameras may be a possible alternative to traditional mark-recapture methods for voles, but not for Peromyscus maniculatus.

Acid-Base Regulation during Carbon Dioxide Exposure in a Primitive Vertebrate, the Lamprey (Lampetra tridentata)

Leigh Gaffney (Faculty Sponsor: Dr. Colin Brauner)

Acid-Base Regulation during Carbon Dioxide Exposure in a Primitive Vertebrate, the Lamprey (Lampetra tridentata) Presenter: Leigh Gaffney, Applied Animal Biology, UBC Faculty Sponsor: Colin Brauner, Zoology, UBC The continued burning of fossil fuels is hypothesized to elevate ocean CO2 levels (and consequently reduce ocean pH) over the next several centuries. Sequestering of excess atmospheric CO2 to deep ocean sites has been proposed as a way to reduce atmospheric CO2 tensions. This would result in potential CO2 point sources greater than any naturally occurring levels. In fish, an increase in water CO2 results in a reduction in blood pH which must be compensated for if fish are to survive. Primitive fishes, many of which inhabit deep ocean habitats, have been shown to be relatively CO2 tolerant but it is not know whether this is a general characteristic of primitive fishes. This experiment examined the effects of increased water CO2 on the blood pH of one of the most primitive extant vertebrates, the Pacific lamprey (Lampetra tridentata), which was previously unstudied. Lamprey could not tolerate CO2 tensions in excess of 3% indicating that they are fairly sensitive to CO2 relative to other fishes. Lampreys exposed to 1.5% CO2 were able to completely regulate blood pH which increased from a control value of 8.04 to 8.10 and 8.13 at 6 and 24 h, respectively. Results indicate that not all primitive fishes are CO2 tolerant and that lamprey may be negatively affected by some of the predicted ocean CO2 increases. The unique pattern of blood pH compensation in lamprey may shed exciting insight into the evolution of acid-base regulation in vertebrates.

The effects of coal mining effluent on stream ecosystems

JoAnna Rickard (Faculty Sponsor: Dr. John Richardson)

Human activities impact the environment, and all of these impacts eventually find their way into stream ecosystems. Coal is the most widely used fossil fuel in the world, and demand is not likely to decrease with a rapid increase in population and economic growth in developing countries. With no signs of a decrease in the mining of this finite resource, it is important to explore the lasting environmental effects, especially on streams. There have been relatively few studies published about the effects of coal mining on freshwater ecosystems. Of these studies, many are over 15 years old and the data is often highly variable between sites. The studies that have been done have mostly been in North America and Europe, with few in Australia, New Zealand, and South America. This variability in time, location, and data collection make it interesting to examine using meta-analysis to ascertain effect sizes. Meta-analysis was used to explore the different effects of coal mining effluent on water quality and stream invertebrates. In general, the effects of coal mining demonstrate a decrease in the total densities of stream invertebrates, and a reduction in the number of species. Most of these impacts appear to be related to increased acidity and metal concentrations in mine effluents. These results have implications for downstream water quality, ecosystem productivity, and stream biodiversity.

A New Methodology for Analyte Sensing and Identification using Optical-Disk-Drives

Samuel Schaefer (Faculty Sponsor: Dr. Kenneth Chau)

Optical disc drives are inexpensive, readily available, and use highly sophisticated optoelectronic components which can be adapted for sensing. One limitation of using compact disks (CDs) and optical disk drives for sensing of analytes placed on a CD is the fluctuations in the voltage signal from the disk drive generated while reading the data on the CD. In this study, we develop a simple, low-cost strategy for sensing and identification using CDs and optical disk drives that spectrally separates contributions to the voltage signal caused by an analyte intentionally placed onto the CD and that caused by the underlying data on the CD. Analytes are printed onto a CD surface with fixed spatial periodicity. As the laser beam in an optical disk drive scans over the section of the CD containing the analyte pattern, the intensity of the laser beam incident onto the photodiode integrated into the disk drive is modulated at a frequency dependent on the spatial periodicity of the analyte pattern and the speed of the optical disk drive motor. Fourier transformation of the voltage signal from the optical disk drive yields peaks in the frequency spectrum with amplitudes and locations that enable analyte sensing and identification, respectively. We study the influence of analyte area coverage, pattern periodicity, and CD rotational frequency on the peaks in the frequency spectrum associated with the patterned analyte. We apply this technique to discriminate differently-colored analytes, perform trigger-free detection of multiple analytes distributed on a single CD, and detect at least two different, overlapped analyte patterns on a single CD. The extension of this technique for sensing and identification of colorimetric chemical reagents is discussed. Future work will focus on adapting this technique to perform measurements at multiple wavelengths and streamlining the data collection and processing.

Photoacoustic Imaging using the Fourier Transform Image reconstruction algorithm

Iman Arbabian, Amirali Khaleghi & Amir Issaei (Faculty Sponsor: Dr. Shuo Tang)

Medical imaging techniques that are currently available are either destructive to the human body (such as MRI and X-ray), or they do not provide a good combination of image contrast and penetration depth (such as Ultrasonography or Microwave imaging). Photoacoustic imaging is a new method of biomedical imaging that is based on the Photoacoustic effect. This method employs optical waves to construct an image based on the ultrasound produced by the thermal expansion of the tissue. The Fourier Transform image reconstruction algorithm is one of many algorithms that are currently used. This particular algorithm has the benefit of providing speeds of up to 3 magnitudes higher than other techniques due to its use of FFT. The reconstruction of the simulated data for simple structures showed that the assumption of constant velocity of sound in the tissue introduces inaccuracies in the image reconstruction. Our motivation is to introduce a variable velocity of sound in the implementation of the Fourier Transform algorithm. The reconstruction algorithm should be modified to incorporate a varying velocity of sound, initially in the two-dimensional case of having two discrete sound velocities in two layers of tissue. The results of this research indicate that by considering a variable velocity of sound a more accurate image reconstruction will be preformed, and thus a higher image contrast will be acquired.

Quantitative measurement of friction on single cells in microfluidics devices and the effect of Polyethylene Glycol (PEG) coating

Laz Milovanovic (Faculty Sponsor: Dr. Hongshen Ma)

Quantitative determination of friction between single cells and engineered surfaces is important in the design of microfluidics devices and implantable devices. In particular, microfluidics devices used for cell separation, cell culture and cellular assays require significant contact between the cells and artificial surfaces. Similarly, friction between tissue cells and implantable devices like ureteral stents can cause pain, discomfort and inflammation. In both cases it is desirable to measure surface friction in order to evaluate and optimize the mechanical and material design of these devices. Currently, there are no reliable methods to quantitatively measure friction between single cells and engineered surfaces. This study demonstrates a novel technique to measure friction between single cells and surfaces including polydimethylsiloxane (PDMS) and glass. This technique is then applied to determine the ability of PEG coating to reduce friction in microfluidics devices. Friction between single cells and microfluidics devices is measured by the time required for these cells to transit through a known length of microchannel while under compression. The velocity difference between the cell and bulk liquid enables determination of friction force using a modified Stokes' flow model. Repeating this experiment for cells of various sizes travelling through the channel enables quantification of friction as a function of cell compression. The microchannels are fabricated via photolithography and replica molding prior to surface treatment. Preliminary experiments show PEGylated channels significantly reduce surface friction. This result is of significantly interest to microfluidics research and will be publishable in a peer-reviewed journal.

Lessons in Survival and Adaptations from Other Species IKBLC 157

Wildlife Rehabilitation: Survival Rates

Tiffany Wong (Faculty Sponsor: Dr. Sara Dubois)

When admitting animals to a wildlife rehabilitation centre, rehabilitators need to understand the likelihood of an animal"'s survival in order to determine the best course of action (e.g. to continue with treatment or provide a humane death). To determine the likelihood of survival, several factors need to be considered. The objective of this project was to use intake records to determine which factors predicted low survival rates. A local rehabilitation centre"'s intake records (1997 "" 2010) were examined. Numbers of young and adults, days in care, and trends associated with an animal"'s final disposition and reason for intake were recorded. Eight species that represented a majority of animals brought in to the center were examined: pigeons, gulls, mallards, robins, deer, eastern cottontails, grey squirrels, and raccoons. We found that young animals were brought in more than adults, with an exception to pigeons and gulls, comprising 51% to 88% of total animals. Orphaned young animals had release rates of â‰¥ 50%, making them more likely to be released than the adults. Total release rates for all species examined were between 25% - 70%, with deer being the lowest and mallards being the highest. Among these species, 6% to 46% of animals brought in were uninjured, indicating the need for education outreach, as the public may not know how to identify uninjured animals. These results indicate that rehabilitators should consider euthanasia sooner in the course of treatment or develop alternative treatment strategies when treating injured or sick adult animals.

The Role of Spatial Assortment on the Ecological Maintenance of Cooperation

Erik Hanschen (Faculty Sponsor: Dr. Michael Doebeli)

Cooperation is a common behavior observed throughout the tree of life and has been immensely influential in evolutionary transitions such as the evolution of multicellularity and social behavior (Maynard Smith & SzÃ¤thmary 1995). Despite the prevalence and importance of cooperation, biologists struggle to explain the mechanisms that prevent exploitation by cheaters. This prevention is fundamental to the maintenance of cooperation. Theoretical models have demonstrated the fundamental requirement for the maintenance of cooperation is a preferential interaction (assortment) of cooperators, thus excluding cheaters from the benefits of cooperation (Fletcher & Doebeli 2009). Spatial structure is believed to be one of the possible mechanisms for assortment. Spatial structure allows for clusters of cooperators, thus segregating cooperators and cheaters. This spatial segregation may prevent cheaters from exploiting cooperators. This study uses cooperative Escherichia coli to demonstrate the role of spatial structure on the maintenance of cooperation. Competition experiments were performed in solid (structured) and liquid (unstructured) environments. However due to differences in metabolic specialization, coexistence of cooperators and cheaters is observed in the solid environment. In the liquid environment, the cooperator strain goes extinct. A cheater strain with similar metabolism to the cooperator strain will be isolated. Minimizing metabolic differences in between cooperators and cheaters will allow for cooperator/cheater differences to drive competition outcomes.

The cryptic response of Oregonia Gracilis (Graceful decorator crab) to predation and habitat changes

Maki (Nelson) Yang (Faculty Sponsors: Dr. Sarah Dudas & Dr. Michael Berger)

The study of camouflage has long been a topic of great interest in biology; however little research has been done on the cryptic response of the decorator crab O. gracilis. O. gracilis is an exemplary organism for the investigation of crypsis. It is the most spider-like and heavily decorated of all the approximately 750 spider crab species found worldwide excluding the Antarctic continent. The findings of O. gracilis and its interactions with the environment contribute to the baseline data of future Canadian west coast conservation efforts and further the understanding of the Georgia Basin Puget Sound marine ecology as well as the crab"'s evolutionary benefit in its camouflage survival strategy. This experiment investigated the cryptic response of O. gracilis under the effects of six different habitats composed of three Rhodophyta (Mazzaella spendens, Microcladia coulteri, Prionitis lanceolata), three Phaeophyceae (Egregia menziesii, Sargassum muticum, Desmarestia munda), no algae, and two predation states - the presence or absence of Cancer productus. The result of the study suggests that the effects of predation and habitat have no correlation on the decoration speed and the algae species choice of O. gracilis as well as the carapace percentage coverage of the algae species selected by the crabs. O. gracilis was observed however to prefer M. coulteri when the habitat was composed of Rhodophyta independent of predator presence. The reasons for this selection remain to be further studied.

Hormonal regulation of plant physiological and biochemical stress responses for salt, water and flooding stress

Gregory Ross (Faculty Sponsor: Dr. Santokh Singh)

This study helps to show the effects of certain external environmental stresses, such as water and salt stress, using corn (Zea mays), and flooding stress, using green bean (Phaseolus vulgaris), as models, as well as hormonal signals used by these species. Salt and water stress tolerance was monitored by analyzing physiological responses such as water evaporation through leaves (transpiration), amount of carbon dioxide fixation (photosynthesis rates) and water potential, as well as protein analysis on dehydrins, known stress induced proteins. All treatments showed drastic decreases in the above mentioned physiological responses. Addition of the phytohormone abscisic acid (ABA), a known stress signal, was shown to enhance salt and water stress tolerance, while its inhibition with fluridone decreased tolerance as well as dehydrin levels. Ethylene, another phytohormone, has been shown in the literature to be involved in flooding-induced anoxic stress signalling. Morphological changes, such as epinasty (downward turning of leaves) were observed in both ethylene and flooding treatments. Flooding was shown to be more effective than the ethylene treatments in regulating the levels of alcohol dehydrogenase (ADH), a key enzyme produced during anoxia. Triggers of ADH remain unclear but a likely candidate is a build-up of cystolic Ca2+ which is the current direction of my research. The results of this investigation indicate that different environmental stresses exhibit their unique physiological and biochemical responses in plants. This study helps to further the understanding of hormonally controlled stress induced responses which will be crucial to improving crop yields in globally changing climates.

Biomarkers of Pain

Edmund Tan (Faculty Sponsor: Dr. Hal Siden)

Although pain is universally experienced, it is often difficult to assess in non-verbal patients. We are unable to fully and effectively interpret pain expression and have limited access to patient"'s pain perception. Identifying a physiological signal or biomarker of pain would dramatically improve pain management and quality of life for certain populations such as non-verbal patients, neonates, patients with dementia, and animals. The focus of this study is to examine an endogenous analgesic substance released in painful conditions "" specifically, beta-endorphin "" to determine if detecting the presence of this substance leads to a viable method of assessing nociceptive-inflammatory pain. The study will follow children with appendicitis from their admission in the ED to post op. Two blood samples and a portion of their appendix will be collected for lab analysis. The blood samples will be used to determine protein and mRNA level quantification. In addition, beta-endorphin will be quantified using western blotting. The tissue will be used for mRNA quantification and in-situ immunohistochemistry for beta-endorphin. This project is designed to permit further analysis and measurement of pain in non-verbal patients in future studies. Establishing this new methodology should allow us to: detect Î²-END in circulating leukocytes during acute inflammation in humans, replicate in children the findings in animal models of opioid expression in inflamed tissue, replicate the technique of measuring Î²-END in plasma during acute inflammation and demonstrate a relationship between the presence of Î²-END in circulating leukocytes and elevated levels of Î²-END in plasma and tissue.

Not What, But How: Exploring Channels of Communication and Mental Health

IKBLC 260

Analysis of Infant Vocalizations and Head Movements towards Music and Language Stimuli

Suweera Desouza (Faculty Sponsor: Dr. Laurel Fais)

Previous research has shown that head movement affects the performance of participants during auditory perception tasks (Munhall et al., 2004). But these studies were conducted with adult participants. The current study investigates a similar issue with infants, namely whether infants are already beginning to make head motions that accompany speech. We tested the hypothesis that infant vocalizations are accompanied by increased magnitude of head movement. In addition, differences between infants exposed to music stimuli versus those exposed to language stimuli were examined. For the procedure, we used Anvil (Kipp, 2001), which enabled us to hand code for vocalizations in video. We also ran a Matlab script that uses Optical Flow Analysis (Barbosa et al., 2007) to compute the magnitude of pixel intensity per frame defined over Regions of Interest. This allowed us to measure the motion of the infant"'s head. The results obtained by comparing the magnitude of head motion per second during periods of vocalization to that during periods of non-vocalization, do not show a significant difference between infants exposed to music and infants exposed to language stimuli. Overall, on average, the magnitude of head motion per second during vocalization was higher than during periods of non-vocalization. These results suggest that head motion is part of co-verbal gesture even for infants. A further investigation into the timing of the onset of vocalization and increases in the magnitude of head motion just before these onsets explores the link between head motion and vocalizations in infants.

On the relationship between vocal aesthetics and speech perception

Alyssa Satterwhite (Faculty Sponsor: Dr. Molly Babel)

The voice is a rich source of information for listeners. In addition to communicating oral language, the human voice has the ability to convey a variety of information including sex, age and size, even race and emotional states. The attractiveness of a voice is potentially related to a number of such talker-specific qualities. This study reports data from four experiments exploring the interplay of meta-linguistic analyses and lower level tasks with the goal of understanding how judgments of vocal aesthetics and voice typicality affect voice and phoneme processing. In the first, speakers of west coast North American English rated the attractiveness of 60 American English voices. In the second experiment listeners were asked to rate the typicality of each voice for its sex. Ratings for attractiveness and typicality showed a strong correlation, suggesting that vocal attractiveness and voice typicality are related. In the next experiment listeners were asked to quickly classify the voices as male or female. Faster reaction times correlated with judgments of higher typicality, but not with attractiveness. Finally a group of listeners were asked to classify the vowels produced by the voices in order to assess the ease of processing speech from these speakers. Here a correlation was found with both rating tasks such that listeners were faster at vowel classification for both the more attractive voices and the more typical ones. Moreover, a correlation was found between both online tasks such that voices that listeners classified quickly by sex were also classified quickly by vowel.

Stress-Induced Cognitive Deficits

Pretty Verma (Faculty Sponsor: Dr. Anthony Phillips)

Stress is a major factor contributing to the symptoms, recurrence, and treatment outcomes in affective disorders including bipolar disorder and depression. Thus, improving our therapeutic avenues in treating affective disorders involves targeting the stress system. To this effect, a glucocorticoid receptor antagonist, RU-486, has been shown to significantly improve neurocognitive impairment and depressive symptoms in patients with bipolar disorder (Young et al., 2004; Neuropsychopharmacology 8:1538-1545). The aim of this project was to examine the mechanisms by which RU-486 leads to improvements in cognition. Rats underwent intracranial surgery to place microinjection cannulae in an area of the brain implicated in complex cognitive behaviours, called the medial prefrontal cortex. After recovery from surgery, animals were trained on our well characterized, delayed spatial win-shift task to assess working memory. Upon reaching criterion (~21 days), animals received microinjections of RU-486 or vehicle directly into the medial prefrontal cortex and were subsequently subjected to 15 minutes of acute tail pinch stress. We found that acute stress significantly impaired working memory performance and infusion of RU-486 significantly attenuated these stress-induced impairments. This research project brings new insight into mechanisms mediating stress-induced cognitive deficits, potentially leading to clinical improvements in these domains.

Examining Emotionality and Hemispheric Interaction with the DRM Paradigm

Nathan Ryckman (Faculty Sponsor: Dr. Barbara Rutherford)

This study examines the theory that rapid bilateral saccadic eye movement effects subsequent memory performance by increasing the level of interaction between the hemispheres of the brain. Emotionally valenced and neutral DRM lists (lists of 15 highly related words with one highly correlated non-presented lure word) were accompanied by a visual hemifield disruptor that allowed for either a single or both hemispheres to engage the word at encoding. Accuracy on a serially presented recognition memory test was measured. The results show that saccadic eye movements have no effect on the remembering of the word lists, though emotion and hemisphere of encoding did. Based on these findings, hemispheric interaction is likely not the underlying mechanism of the memory benefits observed in previous research examining saccadic eye movements.

Acknowledgements

Adjudicators

Amy Wei You
Alex Ardila Garcia
Alexis Lee
Amy Nicholl
Anita Prest
Billy Lam
Catalin Voiniciuc
Catherine Merchant
Charlotte Whitney
Deepa Raju menon
Ed Durgan
Gemma Dias
Jade Tong
James Montgomery
Karolynn Hsu
Laurence Madera
Leo Ng
Lina Sweiss
Margaret Ward
Matt Mayer
Mehrdad Bokharaei
Nikta Fay
Penny Yang
Rongrong Wang
Tamara Bodnar
Xu Wang

Volunteers

Aaron Greenberg
Arash Khosrovi-Eghbal
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Colleen Hughes-Games
Daanyal Hussain
Gabriel Tang
Jordan Rongavilla
Katherina Rothe
Kathy Yan Li
Lisa Zhang
Pavan Gill
Rainier Geronimo
Roini Datta
Romy Friedman
Sarah Chambers
Shayan Shakeraneh
Vivian Chui
Youlee Whang

Photography:
Phillip Jeffrey

Music: The Malcolm Aiken Jazz Quartet

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Aaron Lao
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Lauren Phelan
Margot Bell

Special thanks to:

Fisher Scientific