



CANADIAN SPRING CONFERENCE FOR BEHAVIOUR AND BRAIN - FERNIE, BC.

Thursday, February 22th, 2018

6:00pm Social Night – Informal buffet with wine, beer, and soft drinks

Friday, February 23th, 2018

4:00pm Introductory Comments

4:10pm Seizures & Stress (Dr. Matthew Hill)

5:22pm **Break**

5:30pm Keynote Speaker: Dr. Tim Bussey – “Strategies for cognitive translation from animals to humans: knock-outs, neurogenesis, neurodegenerative and neuropsychiatric disease”

6:30pm **Dinner**

7:30pm Sensitization (Dr. Cam Teskey)

7:51pm Brain Trauma (Dr. Richelle Mychasiuk)

8:21pm **Break**

8:30pm Animal Models & Methods I (Dr. John Howland)

9:08pm Development & Plasticity (Dr. Richelle Mychasiuk)

Saturday, February 24th, 2018

4:00pm Grasping & Cognition (Dr. Jenni Karl)

4:42pm Animal Models & Methods II (Dr. Peter Hurd)

5:03pm **Break**

5:10pm Keynote Speaker: Dr. Lisa Saksida – “How is memory organized? Memory Systems versus the Representational-Hierarchical View”

6:10pm **Dinner**

7:10pm Learning & Memory (Dr. Majid Mohajerani)

7:55pm	Drugs & Behaviour (Dr. Tammy Ivanco)
8:23pm	Break
8:30pm	Cerebellum & Cerebral Cortex (Dr. Douglas Wylie)
9:11pm	Circuits & Pathways (Dr. Douglas Wylie)
9:45pm	Wrap-up, Awards, and Social

SCIENTIFIC PROGRAM AND ABSTRACTS – FRIDAY, FEBRUARY 23TH, 2018

Seizures & Stress (Moderator Dr. Matthew Hill – 4:10 to 5:22pm)

Haris Malik (GS), Marshal D Wolff, G Campbell Teskey, Richelle Mychasiuk. A novel model of post-traumatic epilepsy and the characterization of post-traumatic hippocampal oxygenation.

Department of Psychology, Faculty of Science, University of Calgary

Traumatic brain injuries (TBIs) can lead to an increased risk of developing comorbidities such as epilepsy. Efforts to study this trauma-induced epileptic process have been hampered by the lack of ethologically relevant models. Presently, we've demonstrated a novel method of eliciting seizures by delivering a TBI using a lateral impact device that closely mimics the biomechanics commonly observed in human TBI. Moreover, we've characterized corresponding changes to hippocampal oxygenation in response to trauma and post-traumatic seizure for the first time. This oxygenation response may serve as a predictor/mechanism of epileptogenesis, and may therefore provide a therapeutic target/biomarker for post-traumatic epilepsy.

Roberto Colangeli (PHD), Maria Morena, Jordan S. Farrell, Matthew N. Hill, G. Campbell Teskey. Amygdalar physiological alterations parallel interictal emotional impairment associated with seizures.

Department of Cell Biology and Anatomy, Faculty of Medicine, University of Calgary

Temporal lobe epilepsy is often associated with interictal memory deficits and negative emotional disturbances. The underlying mechanism of seizure-induced emotional impairment is unclear. We investigated whether amygdala kindling caused permanent behavioural alterations in memory and emotionality. We then correlated the seizure-induced behavioural changes with electrophysiological alterations within the amygdala. Preliminary data show alterations of the emotional behaviour and fear memory in kindled rats, which are associated with dysregulation of the GABAergic transmission and plasticity, and increased basal neuronal excitability within the amygdala. These data suggest that repetitive seizures cause long-lasting changes in amygdala physiology, which is paralleled with emotional disturbances.

Wolff MD (GS), Farrell JS, Colangeli R, Morena M, Teskey GC. Attenuation of postictal hypoxia prevents postictal behavioural dysfunction.

Department of Neuroscience, Faculty of Medicine, University of Calgary

Following the cessation of brief seizures, a long-lasting severe hypoxic event occurs in the brain regions involved in the seizure. The temporal period of "postictal hypoxia" coincides with postictal behavioural and cognitive deficits typically seen in individuals with epilepsy. Thus we hypothesized that local postictal hypoxia in the brain, and not the seizures themselves are responsible for behavioural dysfunction following seizures. We tested this hypothesis in both the amygdala with cued fear conditioning and in the hippocampus with the novel object/context-mismatch task.

Antis G. George (GS), Alexandra K. Wall, Jordan S. Farrell, Corin Kuang, G. Campbell Teskey. Postictal hypoperfusion/hypoxia as a mechanism of SUDEP and pharmacological intervention.

Department of Neuroscience, Faculty of Medicine, University of Calgary

Sudden Unexpected Death in Epilepsy (SUDEP) occurs when someone with epilepsy, who is otherwise healthy dies suddenly with no known cause. Our lab recently discovered a COX-2 mediated period of severe hypoxia during and following a seizure in the brain regions involved in the seizure which can cause cellular and behavioral dysfunction. We hypothesize that SUDEP occurs when seizure activity propagates to brainstem breathing centers causing severe local hypoxia leading to dysfunction of breathing and death. Further, that inhibition of COX-2 activity could rescue this severe hypoxia. Acutely using an intrahippocampal model of TLE and chronically using the Kv1.1 model of SUDEP, treatment with ibuprofen a COX-2 inhibitor significantly extended life beyond that of controls.

S. Alisha Epps (PHD), Ashley Allemeier. The Effect of Caloric Restriction in a Rodent Model of Depression and Epilepsy Comorbidity.

Department of Psychology, Faculty of Science, Whitworth University

Alterations in diet such as the ketogenic diet and caloric restriction have shown beneficial effects for patients with epilepsy under certain circumstances. However, patients with epilepsy are also at increased risk for comorbid depression, and the effects of these diets on depression are often less clearly characterized. Here, we assess the effect of acute and chronic caloric restriction in a rodent model of comorbid depression and epilepsy, the Swim Low rat.

Preliminary data suggest a positive effect of chronic caloric restriction. If caloric restriction is indeed both anticonvulsant and antidepressant, it may provide a safe and effective non-pharmacological therapeutic intervention.

T.J Phillips (GS), R.C. Gom, G.C Teskey. Four Commonly Consumed Drugs: Caffeine, Nicotine, Ethanol and THC in relation to Postictal Hypoxia.

Department of Cell Biology and Anatomy, Faculty of Medicine, University of Calgary

Recently our lab discovered a local hypoxic event that occurs after seizures, an event we call postictal hypoxia (PIH). PIH has been postulated to contribute to various brain abnormalities in people with seizure disorders. Interestingly, while pharmacological interventions have been found, PIH is yet to be treated in a clinical setting. This study uses a kindled rat model to examine the acute effects of four commonly consumed drugs in relation to PIH: caffeine, nicotine, ethanol and tetrahydrocannabinol. As persons with epilepsy may have one or more of these drugs on-board during a seizure, it is important to investigate their relation to the onset and recovery of PIH.

Shultz SR (PHD), Casillas-Espinosa PM, Lee J, Brady R, Braine EL, Sun, M, Jones NC, O'Brien TJ. Disease modifying effects of sodium selenate in a rat model of chronic temporal lobe epilepsy.

Department of Neuroscience & Medicine, Faculty of Medicine, Monash University

There is currently no disease modifying treatment that can prevent the development of temporal lobe epilepsy (TLE), or mitigates its severity once established. We have shown in animal models that treatment with sodium selenate, which up regulates the tau phosphatase PP2A, after an epileptogenic brain insult reduces the severity of the epilepsy and behavioural comorbidities. However, most epilepsy patients that present at the clinic already have established epilepsy. Therefore, this study evaluated if sodium selenate would be able to modify the severity of epilepsy, behavioural comorbidities and neuroimaging changes in chronically epileptic rats.

Robert Aukema (GS), Andrei Nastase, Matthew Hill. Investigating basolateral amygdala projection populations involved in the acute stress response.

Department of Cell Biology and Anatomy, Faculty of Medicine, University of Calgary

The basolateral amygdala (BLA) is an important brain region activated by psychological stress, acting to integrate sensory information with higher-order cognitive input. In turn, the BLA projects to many downstream regions capable of modulating various physiological and behavioral responses. However, it is unclear which projection populations are recruited during stress exposure. Using a combination of retrograde tracing and c-fos mapping, we have identified that discrete projection populations targeting the prelimbic cortex, hippocampus, and striatum are activated during acute restraint in the rat. This provides a framework to investigate the role of each individual projection population during stress exposure.

Gavin Petrie (GS), Georgia Balsevich, Tamas Fuzesi, David Rosenegger, Robert Aukema, Jaideep Bains, Matthew Hill. Tonic endocannabinoid signalling gates stress-like stereotypic behaviors.

Departments of Cell Biology and Anatomy, Faculty of Medicine, University of Calgary

Endocannabinoid (eCB) signalling is known to gate many aspects of the stress response, including its ability to negatively regulate the hypothalamic-pituitary-adrenal (HPA) axis. Studies have shown that under both resting conditions, and in response to stress, disruption of eCB signalling can increase drive on the HPA axis. Our initial findings indicate that administration of the CB1 receptor antagonist AM251 (3mg/kg) to non-stressed mice parallels key aspects of the stress response, such as increasing circulating corticosterone and a significant increase in self-directed behaviors. This is consistent with previous studies indicating that tonic eCB signaling gates activation of the stress response and that a disruption of eCB signaling produces a stress-like state.

Break (5:22 to 5:30pm)

KEYNOTE SPEAKER – Dr. Tim Bussey (5:30 to 6:30pm)

Strategies for cognitive translation from animals to humans: knock-outs, neurogenesis, neurodegenerative and neuropsychiatric disease

Western Research Chair, Molecular Medicine Research Group, Robarts Research Institute & Department of Physiology and Pharmacology, Schulich School of Medicine & Dentistry, Western University, London, ON, Canada. The Brain and Mind Institute, Western University, London, ON, Canada.

Department of Psychology and MRC & Wellcome Trust Behavioural and Clinical Neuroscience Institute, University of Cambridge, United Kingdom

The use of animal models is an indispensable tool for the study of normal cognition, and for understanding and discovering treatments for disorders of attention, memory, and other aspects of cognition, such as those observed in neuropsychiatric and neurodegenerative disease. A major goal in the use of the animal models of cognition is *translation*, the ability successfully to transfer our behavioural results in animals to studies in humans (and back again). However, the currently most widely used animal behavioural tests are very dissimilar to those used with human subjects, and criticism has been levied at animal research for using methodology that does not translate. The touchscreen method, in which mice and rats interact with an ipad-like touchscreen, provides the ability to test rodents on tasks in many cases identical, in all important respects, to the computerised tests increasingly used in humans. Furthermore some of the touchscreen tests developed in rodents are now being used successfully in human research. By taking such an approach we have a better chance of achieving successful translation from rodent to human in the study of normal cognition, and in discovering treatments for disorders of cognition. In my talk I will illustrate this approach by describing experiments in neurodegenerative and neuropsychiatric disease in mice, rats and humans. I'll also describe our plans for touchscreencognition.org, an outward-facing, open-access resource for touchscreen users (now about 200 labs) around the world, including facilitating the combination of touchscreens with e.g., optogenetics and miniscopes, searchable databases, and on-site training.

Dinner (6:30 to 7:30pm)

**Sensitization
(Moderator Dr. Cam Teskey – 7:30 to 7:51pm)**

Cassandra Klune (UG), Catherine Thomas, Alicia Zumbusch, Jeffrey Kates, Una Mrdja, Vedran Lovic. Opioid Sensitization Leads to Rapid Incentive Sensitization.

Department of Neuroscience, Faculty of Science, University of Calgary

Stimuli (cues) paired with potentially addictive drugs can become imbued with incentive (motivational) value allowing them to instigate and intensify drug seeking, consumption, and relapse. How opioid sensitization exposure affects the attribution of incentive value to opioid-cues remains unknown. Cue value (operant responses made for cue presentation) was assessed in rats pretreated for 10 days with either remifentanil or saline. A single session of pairing remifentanil with a light/tone cue was sufficient to increase cue value and this effect was greater in remifentanil-pretreated rats. These findings are important in understanding how drug- cues can gain pathological control over behaviour.

Una Mrdja (UG), Catherine Thomas, Cassandra Klune, Alicia Zumbusch, Briana Renda, Vedran Lovic. Cocaine Sensitization Retroactively Potentiates Incentive Drug Cue Value.

Department of Psychology, Faculty of Arts, University of Calgary

Repeated exposure to potentially addictive drugs produces long-lasting changes to the brain and behaviour resulting in sensitization. Drug-related stimuli (cues; e.g., syringes) gain Pavlovian predictive value and can also gain motivational value that is potentiated by drug pre-exposure. Does drug exposure retroactively intensify motivational drug-cue value? We examined whether post-treatment with cocaine potentiated the motivational value of a light-tone cue, previously attributed in a single Pavlovian session. Motivational cue-value was potentiated by cocaine post-treatment, suggesting that motivational drug-cue memories remain liable to sensitization effects after encoding. This has considerable implications for understanding and treatment of drug addiction.

Catherine Thomas (GS), Alicia Zumbusch, Cassandra Klune, Una Mrdja, Ioana Petriman, Vedran Lovic. Opioid Sensitization Potentiates Cue-Evoked Dopamine.

Department of Psychology, Faculty of Arts, University of Calgary

All drugs of abuse potentiate dopamine (DA) neurotransmission at the nucleus accumbens (NAcc), a key node in the attribution of motivational value to drugs and drug-related stimuli (cues). Repeated drug exposure produces enduring changes that intensify the physiological and behavioural effects of further drug exposure (sensitization). How repeated drug exposure influences the motivational value attributed to drugs and drug-cues remains unknown. Sensitization effects on NAcc DA response to remifentanil (μ -opioid agonist) and a remifentanil paired cue (light-tone) was examined. Cue-evoked but not drug-evoked DA neurotransmission was elevated in remifentanil-sensitized rats, suggesting a putative mechanism for motivational cue-value attribution.

Brain Trauma
(Moderator Dr. Richelle Mychasiuk – 7:51 to 8:19pm)

Reid Collins (UG), Jason Tabor, Richelle Mychasiuk. Effects of steroid use on post-concussive symptomology in adolescent rats.

Department of Psychology, Faculty of Arts, University of Calgary

Repetitive mild traumatic brain injury (RmTBI) and anabolic androgenic steroids (AAS) and their impacts on the developing brain have been strongly documented. Despite this rich level of knowledge, the interaction between AAS and RmTBI is not well established. We strive to investigate the interaction of AAS and RmTBI on developing adolescents. Adolescent rats were subject to steroid or placebo treatment, RmTBI or sham injuries. All animals were examined using seven behavioural tests to examine this interaction, accompanied by qPCR gene expression analysis.

Weerawardhena H (GS), Yamakawa GR, Mychasiuk R. Circadian and pathophysiological outcomes associated with repetitive mild traumatic brain injury in rats exposed to monosodium glutamate.

Department of Psychology, Faculty of Arts, University of Calgary

Sleeping problems are a common complaint following concussion. This could indicate disruption in the circadian clock located in the hypothalamus. Neonatal exposure to MSG has been shown to be neurotoxic to the hypothalamus. We sought to determine the effects of neonatal MSG on the expression of behavior, circadian rhythms, and epigenetic changes following repetitive mild TBI (RmTBI). Male and female rats were exposed to saline or MSG and subjected to sham or RmTBI. Post-concussive syndrome was assessed using a behavioural test battery, while locomotor activity and body temperature were monitored throughout. Changes in mRNA expression were also examined.

Sabrina Salberg (UG), Richelle Mychasiuk. The Effects of Sleep Deprivation Following Mild Traumatic Brain Injury in Adolescent Rats.

Department of Psychology, Faculty of Arts, University of Calgary

An old wives tale and strongly held dogma maintains that one should be kept awake after a mild traumatic brain injury (mTBI) to prevent a coma. This however conflicts with the known benefits of sleep; repair and restoration. We therefore sought to examine the effects of sleep deprivation (SD) in the posttraumatic sleep period on post concussion syndrome (PCS). Adolescent rats were administered repetitive mTBIs or sham injuries and were then assigned to 5hrs of SD or left undisturbed. All animals were then tested using 7 behavioural tasks validated to examine PCS, followed by qPCR gene expression analysis.

Jennaya Christensen (GS), Glenn Yamakawa, David Wright, Sandy Shultz. MR imaging of glymphatic clearance following repetitive mild TBI in adolescent female rats.

Department of Neuroscience & Medicine, Faculty of Science, Monash University

Traumatic Brain Injury (TBI) is one of the most common, pediatric health issues. Possible causes of the post-concussive symptomology (PCS) associated with repetitive mild TBI (RmTBI) may include neuroanatomical modifications or deficient removal of injury-induced waste. The glymphatic system is responsible for the clearance of waste from the CNS and is more active during sleep. Since sleep disturbances are regularly reported following a TBI, impaired glymphatic function may explain the development of post-concussive syndrome. We induced RmTBIs in adolescent female rats before MR imaging for glymphatic function. A behavioural test battery was also utilized to assess symptomology consistent with PCS.

Break (8:19 to 8:30pm)

**Animal Models & Methods I
(Moderator Dr. John Howland – 8:30 to 9:08pm)**

Surjeet Singh (GS), Edgar Bermudez Contreras, Mojtaba Nazari, Robert J. Sutherland, Majid Mohajerani. Low-Cost Open-Source Solution for Rodent Home-Cage Behaviour Monitoring.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

In the current research on measuring complex behaviours/phenotyping in rodents, most of the experimental design requires animal-experimenter interaction in which the animal is removed from its home-cage environment and placed in an unfamiliar apparatus. This may influence behaviour, general well-being, and metabolism of the animal, effecting the phenotypic outcome even if the data collection method is automated. We have developed a low-cost open-source solution for home-cage behavioural data acquisition that will allow investigators to study the effects of experimental manipulations on behavioural changes in an animal without compromising its welfare, as well as removing experimenter bias.

Sara E. Dawes (UG), Alisha S. Epps. The Comorbidity of Anxiety and Depression Demonstrated in SwHi and SwLo Rats

Department of Psychology, Faculty of Science, Whitworth University

Previous research supports SwLo rats to be meaningful models of depression-related behavior, while SwHi rats are a useful model of depression-resistance. This study sought to measure the comorbidity of depression and anxiety through three different measures. Significant differences were found between SwLo and SwHi rats in the Porsolt Swim Test and in the total number of entries into all areas of the Open Field Test. Results did not reveal significant differences between SwLo and SwHi rats in the Elevated Plus Maze. These results suggest SwLo rats may be demonstrating ADHD-like comorbidities rather than anxiety-like comorbidities as originally hypothesized.

Candace J Burke (GS), Madison Mauro, Anthony Phillips, Sergio Pellis, David Euston. Combining behavioural and vocal analyses in assessing depression in a rodent model.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

The Wistar-Kyoto (WKY) rat was developed as a control for the spontaneous hypertensive rat but has also been used as a genetic animal model of depression due to its hyper-responsiveness to stress. To determine differences between WKY and normal Wistar (WI) rats, we examined the ultrasonic vocalizations and behaviour of these animals during anticipation of social reward. We found marked differences in behaviour and vocalizations in both juveniles and adults, with both movement and vocalization been depressed in WKY. This provides an exciting baseline for the potential to remediate these differences with various pharmaceutical interventions.

Rachel Ward-Flanagan (GS), Alto Lo, Marissa Sobey, Clayton T. Dickson. Knock-out models: Sleep-like EEG dynamics under anaesthesia.

Department of Neuroscience and Mental Health Institute, Faculty of Medicine and Dentistry, University of Alberta

Sleep is a vital neurobiological process, but delineating the underlying mechanisms has been slow to progress as the most common model for sleep has been sleep itself. Naturally, anaesthesia, which has direct behavioural parallels to natural sleep, such as reversible loss of consciousness, decreased sensory awareness and reduced behavioural responsiveness, presents a potential alternative model for natural sleep. Our aim is to characterize the agent-specific

anaesthetic promotion of specific electrophysiological components of sleep to identify how anaesthesia may co-opt endogenous sleep pathways. Currently, our data suggests that the most viable anaesthetic model for the complete spectrum of natural sleep is urethane.

Samsoon Inayat (PHD), Surjeet Singh, Qandeel, Ian Whishaw, Majid Mohajerani. Let's pull a few strings with Matlab.

Department of Neuroscience, Faculty of Arts and Science, University of Lethbridge

String pulling is a bimanual task in which food deprived animals pull strings to obtain food rewards. This task requires little training and allows assessment of fine motor functions by quantifying topographical/kinematic parameters for forehand movements and body postures. Currently, manual analysis of videos is used to make these assessments, which limits data collection. We have developed a Matlab® based software with a graphical user interface to assist researchers in analyzing video data. After the user defines epochs of behavioral events, the software automatically tags animal's forehands, ears, body centroid, and string, calculates and plots behavioral parameters.

Development & Plasticity
(Moderator Dr. Richelle Mychasiuk – 9:08 to 9:43pm)

Rejimol Perika (UG), Jong Rho. Investigating the therapeutic effects of agmatine on autism-like behaviours in a BTBR T+tf/J mouse model.

Department: Developmental Neurosciences, Faculty of Medicine, University of Calgary

Autism Spectrum Disorder is a collection of neurological disorders exhibiting these main characteristics: impaired social interaction and communication, and repetitive behavior/interests. The Ketogenic Diet has been proven to alleviate such autism-like behaviours. The regulation of physiological agmatine levels in the central nervous system is one of the proposed ways that the diet works. My study aimed to test the effect of exogenous agmatine on autism-like behaviours in a mouse model through both acute and chronic administration. Preliminary results showed that acute agmatine treatment significantly improved vocal communication in the mouse model.

Lauren Seabrook (GS), Lindsay Naef, Corey Baimel, Madelyn Ellis, Stephanie Borgland. Diet-induced obesity impairs outcome devaluation and alters excitability of the OFC.

Department of physiology and pharmacology, Faculty of Medicine, University of Calgary

To make an appropriate decision one must evaluate the value of the outcome based on current information. This goal directed behavior, updating the action based on the value of the outcome is mediated via the orbital frontal cortex (OFC). The OFC has previously been shown to be important in outcome guided behaviours and is essential for selecting goals based on expected reward outcomes. Little is understood on how this neural circuit is impeded in diet-induced obesity. We tested the hypothesis that obese mice have impaired ability to devalue rewards and this may be due to alterations in the OFC.

Ryaan EL-Andari (UG), Barbara Tschirren, Felipe Cunha, Andrew Iwaniuk. Does selection for increased maternal investment in offspring affect the cerebellum?

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

The brain has a finite size partially based on the amount of resources an individual or species has to invest in it. So what happens when an individual has more or less resources to invest in their brain? We examined the brains of two strains of quail that were bred for differing amounts of maternal investment into reproduction: one high and one low.

Cerebellar size, volumes of the layers of the cerebellar cortex, foliation, Purkinje cell size and number were quantified to test if this form of artificial selection affected the cerebellum.

Ben Brinkman (GS), Ayanda Ngwenya, Krista Fjordbotten, Olivia Stephen, Bryan Kolb, Andrew Iwaniuk. Quantifying neuronal morphology in a seasonally reproducing rodent, Richardson's ground squirrel (*Urocitellus richardsonii*).

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Brain anatomy is not static throughout the lifetime of an individual, both sex and season can alter brain region sizes and neuron morphology. To date, there have been no quantitative assessments of neuronal size or shape co-varying with sex and season in any wild mammal species. Testing for these effects on neuron size and shape in wild rodents is essential for understanding the mechanisms underlying seasonal plasticity in the mammalian brain. I report our findings on neuronal morphology in the Richardson's Ground Squirrel (*Urocitellus richardsonii*), a mammal that experiences changes in the hippocampus across sex and season.

L. WILLIAMS (GS), A. NGWENYA, R. STRYJEK, K. MODLINSKA, W. PISULA, S. M. PELLIS, A. N. IWANIUK. Using the isotropic fractionator technique to assess the effects of domestication on neuron and non-neuronal cell numbers in the rat (*Rattus norvegicus*) brain.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

The laboratory rat, the domestic version of the Norway rat, is an important model organism in scientific research. Like other domesticates, lab rats have smaller brains than wild rats. Little is known, however, about the underlying changes in cellular composition responsible for such intraspecific variation in brain morphology. Here, we used the isotropic fractionator technique to test for differences in brain composition of female wild Norway rats and two widely used laboratory strains: Long-Evans and Sprague-Dawley. We conclude that brain composition differs between lab rats and wild rats, but that the effects of domestication varies across strains and brain regions.

Jason Tabor, Yannick Griep. Broken Promises Break The Bank: The Neurological Correlates of Corporate Time-Theft

Department of Psychology, Faculty of Arts, University of Calgary

Broken promises from employers has been shown to decrease performance on future tasks or result in corporate time-theft, both incurring massive costs in lost productivity. Using a rodent model, we sought to examine the neurological correlates of this behaviour to help explain why an employee might conduct themselves this way. Rats were trained in a behavioural task to receive a reward upon successful completion. The animals' performance of the task and aggression levels were then measured after the reward was no longer provided. Physiological stress levels were examined, followed by qPCR gene expression analysis of select brain regions.

SCIENTIFIC PROGRAM AND ABSTRACTS – SATURDAY, FEBRUARY 24TH, 2018

Grasping & Cognition

(Moderator Dr. Jenni Karl – 4:00 to 4:42pm)

Jessica R. Kuntz (GS), Jenni M. Karl, Jon B. Doan, Ian Q. Wishaw. What the heck are they looking at? Visual guidance takes a backseat in pantomime reaching.

Department of Neuroscience, Faculty of Arts and Science, University of Lethbridge

The action-perception theory proposes that real reaching, reaching out to grasp a target, is online (unconscious) and mediated via the dorsal stream whereas pantomime reaching, reaching out to grasp a remembered target, is offline (conscious) and mediated via the ventral stream. Our research shows real reaching utilizes visual anchoring; visually attending the target from initiation to final grasp. Visual attention; however, has not been studied in pantomime reaching. Here we studied the kinematic and attentional differences in a real and pantomime reach and found that vision is uncoupled for pantomime reaching, supporting the action-perception theory.

Marisa E. Bertoli (UG), Jenni M. Karl, Chris Wilson, Alex M. Wilson. Contact with an underlying surface may enable the development of precise visually-guided reach and grasp movements in human infants.

Department of Psychology, Faculty of Arts, Thompson River University

During development reach and grasp movements originate under haptic control but eventually come under visual guidance. It is unclear how the transition from haptically- to visually-guided reaching and grasping occurs. Sighted adults, unsighted adults, and 12-month-old infants reached for Cheerios located on a flat table or a tall narrow pedestal. When infants were able to contact the tabletop they were more likely to use an appropriate grasping digit to contact the Cheerio. This suggests that physical contact with an underlying surface may be an important factor that enables the transition from haptically- to visually-guided reaching and grasping.

Nicole van Rootselaar (GS), Marisa Lelekach, Fangfang Li, Claudia Gonzalez. Don't trip on your ski trip, because if you fall, you can't ski until fall: How nouns, verbs, and manual action affect speech.

Department of Kinesiology, Faculty of Arts and Science, University of Lethbridge

Previous research demonstrates that the meaning of words (semantics) produced when grasping can alter hand kinematics. Similarly grasping can change speech production. It is unknown if semantics can interact with hand actions to alter speech production. Participants pronounced verb/noun homophones in a control condition, as well as when looking at the block, reaching towards the block or grasping the block. Acoustic analysis revealed that several components of vowel production (formants) were altered; specifically, verbs pronounced while grasping were influenced more than nouns. Results are discussed in relation to the theory of embodied cognition.

Lara Coelho (GS), Kayla Hauck, Jennifer Copeland, Robbin Gibb, Claudia Gonzalez. Jive to stay alive: The effect of physical activity on executive function and memory in older adults.

Department of Kinesiology, Faculty of Arts & Science, University of Lethbridge

You hear it all the time, everywhere (more if you are in a Kinesiology department): "Exercise is good for your body and for your brain". To investigate this, we recruited seniors (65+) and split them into two groups based on their physical activity level (low/high). All participants completed a variety of executive function (EF) tasks (paper-based and hands-on) and a memory test. The more physically active seniors were, the better their EF and memory. These results indicate that physical activity is indeed good for your brain, as it helps preserve EF and memory in older adults.

Frank Robertson (GS), Clarissa Beke, Robbin Gibb, Claudia Gonzalez. What is Executive Function?

Department of Neuroscience, Faculty of Arts and Science, University of Lethbridge

Executive functions (EF) are behaviours that fall into the categories of cognitive flexibility, working memory, and behavioural inhibition. Interest in EF has exploded in the last decade, as researchers, clinicians and educators have sought ways to measure and improve these abilities. Questionnaires, and hands-on tasks have been developed to evaluate different factors of EF. Despite the clinical significance of these measures, their relationships to one another are unclear. My results show weak relationships between self-reported elements of EF, and the hands-on tests designed to measure them. Understanding of what these factors measure is crucial to a rigorous definition of EF.

Nikola Klassen (UG), Dr. Jenni Karl. Peri-hand space: A positive feedback loop for the early development of visually-guided reach and grasp movements?

Department of psychology, Faculty of Arts, Thompson River University

How do infant reach and grasp movements, which originate under somatosensory control, come under visual guidance during development? Based on recent work from our lab, and others, we propose a new model for how somatosensory feedback signals, associated with initially crude reaching movements, might refine neural activity in early extrastriate areas of the dorsal visual stream and thus, promote the development of skilled visually-guided reach and grasp movements.

**Animal Models & Methods II
(Moderator Dr. Peter Hurd – 4:42 to 5:03pm)**

Marissa Sobey (UG), Colin Casault, Elizabeth Clement, Clayton T Dickson. Nothing to sneeze at: Antihistamine influences on sleep-like states under urethane anesthesia.

Departments of Psychology, Faculty of Science, University of Alberta

Although the best model for sleep mechanisms may be sleep itself, we have shown that urethane anesthesia mimics several dynamics of sleep, including spontaneous alternations between REM- and NREM-like brain states. If similar to sleep, then these dynamics should be sensitive to drugs known to affect both sleep and the sleep cycle. First generation anti-histamines (H1 antagonists) like diphenhydramine are common over-the-counter sleep aids which promote NREM states. Systemic administration of diphenhydramine in urethane anesthetised rats also resulted in increased time spent in NREM-like states. Urethane evokes an unconscious state that appears highly similar to natural sleep.

HaoRan Chang (GS), Leonardo A. Molina, Majid Mohajerani, Bruce L. McNaughton. Tablet-based movement tracking and virtual-reality system for head-fixed mice.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Virtual reality systems offer an alternative behavioral apparatus to studies constrained by physical limitations or researches that can benefit from distorting the rules of physics. We propose a novel VR system that is capable of movement tracking and delivery of visual stimuli using a collection of touch-screen tablets and other easily accessible parts. We bench-marked the performance of our device against a standard treadmill in head-fixed mice under a two-photon calcium imaging setup. Similar behavioral performance and CA1 place fields qualities were obtained using our system as compared to the previous solution.

Brittany Hope (GS), Trevor Hamilton, Peter Hurd. Anxiolytic validation of the submerged plus maze.

Department of Neuroscience & Mental Health Institute, Faculty of Graduate Studies and Research, University of Alberta

A common test used to measure anxiety in rodents is the elevated plus maze, but there is currently no equivalent for use in fish research. We validated an adapted version, the submerged plus maze, using the benzodiazepine diazepam. After diazepam exposure, fish spent more time in and entered more open arms of the maze than after vehicle exposure, mirroring validations used for the elevated plus maze. We found that the submerged plus maze maintains construct validity for testing anxiety in fish.

Break (5:03 to 5:10pm)

KEYNOTE SPEAKER – Dr. Lisa Saksida (5:10 to 6:10pm)

How is memory organized? Memory Systems versus the Representational-Hierarchical View.

Brain and Mind Institute and Department of Psychology, Western University

The predominant paradigm in cognitive and behavioural neuroscience assumes that the brain is organized into processing modules specialised for particular psychological functions. With respect to memory, the textbook view is that different systems are specialised for processing underlying specific types of memory. For example, there is thought to be a memory system localised in the medial temporal that is specialised for declarative (explicit) memory. Structures in the ventral visual stream, on the other hand, are important for other functions such as perceptual discrimination, categorization, etc — the so-called "perceptual representation system". In my talk I will describe, and provide evidence for, an alternative framework – the Representational-Hierarchical View, which suggests that instead of labeling different areas of the brain as being important for different types of memory processing, it may be more useful to think in terms of content, i.e., the specific representations that different regions maintain, and specifically how higher-level representations disambiguate behaviourally ambiguous lower-level representations. This view can account for everything the memory system view can account for -- and much that it can't.

Dinner (6:10 to 7:10pm)

**Learning & Memory
(Moderator Dr. Majid Mohajerani – 7:10 to 7:55pm)**

Andrei S. Nastase (UG), Alessia Santori, Maria Morena, Matthew N. Hill. Sex-specific effects of endocannabinoid hydrolysis inhibition on fear memory dynamics.

Department of Cell Biology and Anatomy, Faculty of Science, University of Calgary

Fear extinction is an essential process for recovery from traumatic events. Endocannabinoids are importantly involved in modulating fear extinction and the recruitment of fear coping strategies in male rodents; however, little is understood about this regulation in females. Preclinical studies show that females prefer active fear coping strategies (darting), while males predominately exhibit passive fear responses (freezing). We examined potential sex differences of endocannabinoid modulation of fear memory extinction and fear coping responses in rats. We found that boosting endocannabinoid anandamide levels increased freezing and diminished darting in females to levels comparable to males, in early extinction learning and recall.

Gavin A. Scott (GS), Nadine K. Zabder, Andrew J. Roebuck, Quentin Greba, John G. Howland. Inactivation of the Rat Parietal Cortex Impairs Performance of a Visuospatial, but not Olfactory, Working Memory Task.

Department of Physiology, Faculty of Science, University of Saskatchewan

Working memory (WM), the ability to temporarily store information for use and manipulation, likely depends on neocortical areas including fronto-parietal circuits. However, little research has been conducted in rodents to elucidate the role of the parietal cortex (PC) in WM. We assessed the effects of inactivating the PC in the odour span task (OST; a non-spatial olfactory WM task) and the TUNL task (a visuospatial WM task) in rats. Inactivation of the PC significantly impaired accuracy in TUNL, but caused no impairment in the OST. These results may indicate a sensory modality-specific role for the PC in WM.

Qandeel (GS), Samsoun Inayat, Mojtaba Nazari, Surjeet Singh, Ian Whishaw, Majid Mohajerani. Can't Remember What You Did Yesterday: Low acetylcholine and homeostatic theory of memory storage.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Is neuromodulation of acetylcholine (ACh) during sleep required for memory consolidation? We investigated whether consolidation of hippocampus-independent motor memory depends on early sleep when ACh levels are low. We trained mice on rotarod and allowed them to sleep after injecting drug physostigmine (intraperitoneally) to increase ACh levels during early sleep. Subsequent retesting on rotarod showed that mice with increased ACh had significantly declined performance compared to controls. Electrophysiological data suggested a reduction in slow-wave activity in early sleep. Thus, the early phase of sleep may contribute to memory storage by providing a homeostatic state characterised by reduced ACh.

Behroo Mirza Agha (GS), Ian Q. Whishaw, Majid H. Mohajerani. What does it take to ski better?

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

The Cholinergic Theory posits that neurotransmitter acetylcholine (ACh) is important variously for learning, performance, and brain plasticity. It was expected, therefore, that the errors made by freely moving mice reaching for food could be reduced by ACh upregulation. Optogenetic stimulation in Nucleus Basalis activated ACh projections to the cortex as assessed by LFP recordings but did not improve the concurrent success or movements of reaching. That the upregulation of ACh does not influence motor skill may mean that ACh is not important for online motor function.

Pasha Ghazal (PHD). AMPA receptor trafficking in recent vs. remote memories.

Department of Biosciences, Faculty of Natural Sciences, COMSATS institute of information technology

It is now established that iteration of memory circuits takes place from hippocampus to cortical regions. The recall of recent event is largely dependent on the hippocampal networks, however, with passage of time, the cortical regions become largely involved in the recall of remote events. Molecular events, specifically, the AMPA receptor regulation underlying this iteration remains largely elusive. Therefore, in this study we used contextual fear conditioning paradigm to investigate AMPA receptor trafficking in recent vs remote memories. We observed endocytosis of GluA1 and 2 exclusively in the anterior cingulate regions in the remote memory group, one hour post retrieval session, whereas in recent group, endocytosis of AMPA receptor units was only observed in the hippocampal regions.

Andrew J. Roebuck (GS), Max C. Liu, Brittney R. Lins, Gavin A. Scott, John G. Howland. Acute stress, but not corticosterone, facilitates acquisition of paired associates learning assessed in rats using touchscreen-equipped operant conditioning chambers.

Department of Physiology, Faculty of Medicine, University of Saskatchewan

Acute stress is well known to influence many aspects of learning and memory. Using touchscreen-equipped operant conditioning chambers we found that 30 min of restraint stress facilitated the acquisition of paired associates learning (PAL) in rats while systemic administration of corticosterone (CORT) did not. This result suggests that CORT alone is insufficient to enhance stimulus-response learning in PAL and may indicate an interaction with other systems.

Drugs & Behaviour
(Moderator Dr. Tammy Ivanco – 7:55 to 8:23pm)

Katelyn Wonsiak (UG), Peter Hurd, Brittany Hope. Behavioural effects of individual radio frequency identification (RFID) tagging.

Department of Psychology, Faculty of Science, University of Alberta

Individually marking fish species for longitudinal research studies is essential when traditional means of identification (i.e., housing singly or with a different sex) is unfeasible. Radio frequency identification (RFID) tags have been easily used by researchers in smaller fish species however, long-term behavioural effects have not been widely analyzed. Tag-rejection rates were collected to assess usability. Changes in swimming behaviours were assessed using the open field task both before injection of the RFID-tag, and two months following the procedure.

Ioana Petriman (UG), Alicia Zumbusch, Dhyey Bhatt, Catherine Thomas, Briana Renda, Cassandra Klune, Adrien Takada, Jeffrey Kates, Andrew Li, Vedran Lovic. Early Life Adversity Potentiates Escalation of Opioid Self-Administration.

Department of Psychology, Faculty of Arts, University of Calgary

While the vast majority of people will sample addictive drugs (e.g., nicotine, prescription painkillers), few transition to addiction. Correlational studies suggest a link between Early Life Adversity (ELA) and addiction-related behavior (e.g. intravenous drug use). We investigated the effects of ELA on escalation of opioid self-administration. Adversity rats were exposed to mild pre-adolescent stress, while their non-adversity siblings were left undisturbed. As adults, all rats were trained to self-administer remifentanyl (short-acting μ -opioid agonist) under short and subsequently long drug access. A greater proportion of adversity rats escalated their remifentanyl self-administration. This effect was particularly evident in females that underwent adversity.

Brendan B. McAllister (GS), Richard H. Dyck. The neurogenic and behavioural effects of fluoxetine treatment on socially defeated ZnT3 knockout mice.

Department of Psychology, Faculty of Art, University of Calgary

Mice that lack ZnT3, a vesicular transporter that allows neurons to release zinc as a neuromodulator, do not show increased hippocampal neurogenesis in response to antidepressant treatment or enriched housing. Given that neurogenesis has been postulated to underlie the behavioural benefits of such treatments, we hypothesized that ZnT3 might be required for the beneficial response to the antidepressant fluoxetine. In mice stressed by social defeat, fluoxetine treatment produced marginal behavioural benefits, which - contrary to our hypothesis - did not appear to be dependent on ZnT3 status or altered neurogenesis. Neurogenesis was enhanced by stress, independently of fluoxetine treatment or genotype.

Catherine S. Laskowski (GS), Kathleen M. Ward, Danika L. Dorchak, Darren R. Christensen, David R. Euston. Long-term Dopamine Agonist Administration Induces Compulsion in Rats.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Pramipexole, a dopamine D3 agonist, is known to cause gambling addiction in humans. We aimed to replicate this effect in a rodent model. Thirty rats were implanted with either a dummy or osmotic pump which delivered pramipexole at doses of 1.0, 2.0, or 3.0 mg/kg/day after being trained to respond for reward delivered on a slot-machine-like schedule of reinforcement. Results indicated that chronic pramipexole administration increases the likelihood of relapse, motivation to work for food reward, and interferes with rats' ability to limit reward-seeking behavior. These data show that pramipexole can induce compulsive gambling behavior in rats.

Break (8:23 to 8:30pm)

**Cerebellum & Cerebral Cortex
(Moderator Dr. Douglas Wylie – 8:30 to 9:11pm)**

M. R. DANNISH (UG) , R. M. LONG, C. GUTIERREZ-IBANEZ, T. KOHL, C. E. CARR, R. K. TISDALE, I. CRACIUN, A. N. IWANIUK, D. R. WYLIE. Zebrin expression in the cerebellum of two species of crocodilians, the Nile crocodile (*Crocodylus niloticus*) and the American alligator (*Alligator mississippiensis*).

Department of Neuroscience and Mental Health Institute, Faculty of Science, University of Alberta

In the cerebellum of birds, mammals, and some lizards, Zebrin II (ZII) is found heterogeneously in alternating sagittal bands of Purkinje cells (PCs) with high (ZII+) and low (ZII-) ZII expression. Alternatively, in turtles and snakes all PCs are ZII+. This leaves open the question whether ZII stripes are a basal trait and were lost two times, or conversely, heterogeneous ZII expression convergently evolved in three separate groups. Here we examined the expression of ZII in crocodilians, the closest living relatives to birds. We found that in this group all PCs are ZII+. This suggests the independent evolution of ZII stripes in vertebrates.

Iulia Craciun (GS), Cristian Gutierrez-Ibanez, Alyssa Chan, Douglas Wylie. First description of Lugaro cells in the cerebellum of birds.

Department of Psychology, Faculty of Science, University of Alberta

Lugaro cells are distinct cerebellar interneurons found in the granule cell layer. They are characterized by a fusiform shape, long horizontal dendrites lying just beneath the Purkinje cell layer, and parallel fiber-like axons. Lugaro cells have previously been described in mammals and in one species of fish. Here, using immunohistochemistry, we provide the first description of Lugaro cells in an avian species based on their morphological characteristics, position in the cerebellum, and their axonal projections. Our results suggest that Lugaro cells are more wide spread among vertebrates than previously thought and may be a characteristic of the cerebellum of all vertebrates.

Felipe Cunha (GS), Janae Nahirney, Courtney Heuston, Doug Wylie, Andrew Iwaniuk. How do allometric scaling 'rules' apply to the cerebellum?

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Although the cerebellum has a relatively uniform organization across vertebrates, its' size and shape varies greatly across species. Recently, it has been suggested that there are 'scaling rules' in the evolution of vertebrate brains, but we do not know what changes in cell size or cell numbers occur in the cerebellum when it increases in volume. We

measured the volume of cerebellar layers, foliation index and number and size of Purkinje cells in galliform birds (quail and relatives). We found that all layers change uniformly and the number of Purkinje cells increases faster with cerebellum size than Purkinje cell size.

Cristian Gutierrez-Ibanez (PHD), Andrew N. Iwaniuk, Douglas R. Wylie. Parrots have evolved a primate-like telencephalic-midbrain-cerebellar circuit.

Department of Psychology, Faculty of Science, University of Alberta

Parrots have cognitive abilities and large telencephalons that rival those of primates but it is not known if there are also evolutionary changes in telencephalon-cerebellar relay nuclei. Birds have pontine nuclei but also a pretectal nucleus that connects the telencephalon with the cerebellum: the medial spiriform nucleus (SpM). We found that SpM, but not the pontine nuclei, is greatly enlarged in parrots and correlated with the relative size of the telencephalon. This suggests that the telencephalon-SpM-cerebellar pathway of birds may play an analogous role to cortico-ponto-cerebellar pathways of mammals in controlling fine motor skills and complex cognitive processes.

Wendie N. Marks (PHD), Madeline E. Parker, Nadine K. Zabder, Terrance P. Snutch, John G. Howland. T-type calcium channels in the orbitofrontal cortex mediate uni- and multisensory integration.

Department of Physiology, Faculty Medicine, University of Saskatchewan

Multisensory integration (MSI) is a cognitive process whereby uni-modal sensory features create a comprehensive multisensory representation of the environment. The regulation of MSI involves the orbitofrontal cortex, an area which shows high levels of T-type calcium channel expression. We tested the effects of blocking T-type calcium channels on the multisensory object oddity task with the T-type antagonist, Z944. Systemic Z944 treatment impaired the visual and visual-olfactory versions of the task. Infusion of Z944 produced deficits in the olfactory, visual, and visual-olfactory tasks. Elucidating MSI regulation by T-type calcium channels may help inform therapeutic development for those suffering from MSI impairments.

Circuits & Pathways
(Moderator Dr. Douglas Wylie – 9:11 to 9:45pm)

Rebecca M. Long (GS), Maximilian S. Bothe, Cristian Gutierrez-Ibanez, Tobias Kohl, Harald Luksch, Hans Straka, Douglas R. Wylie. Primary projections of the VIIIth nerve in a reptilian in vitro preparation.

Department of Psychology, Faculty of Science, University of Alberta

Detection of body motion derives from sensory transformations within the semicircular canals, which are transmitted to the brain via the VIIIth nerve. The projection pattern of individual canals has been described in various vertebrates, however, these studies generally examined only one canal at a time. We used an in vitro approach with fluorescent tracers to simultaneously examine the termination pattern of afferents from each semicircular canal in two species of snakes (*C. atrox*, *C. hortulanus*). We found that the labeling pattern from each canal was consistent with the findings from previous studies.

Michael Kyweriga (PHD), Navvab Afrashteh, Caylin Chadwick, Jianjun Sun, Artur Luczak, Majid Mohajerani.
Modulation of auditory cortex (AC) neuronal responses to pure tones by optogenetic stimulation of posterior parietal cortex (PPC) neurons.

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

The PPC is a multi-modal sensory association area showing reciprocal connections with the AC. To test whether the PPC has a modulatory role over the AC we implanted fiber optics into the PPC of transgenic mice expressing Channelrhodopsin-2 in excitatory neurons (Thy1-ChR2). Stimulation of Thy1-ChR2 PPC neurons caused significant reduction in the late responses of AC neurons to pure tones. We next trained thirsty mice, implanted with PPC fiber optics, in a tone discrimination task. Stimulation of Thy1-ChR2 PPC neurons caused strong behavioral deficits. These electrophysiological and behavioral results demonstrate a modulatory role of the PPC over the AC.

Brandon E. Hauer (GS), Silvia Pagliardini, Clayton T. Dickson. **Sleep slow waves in the cortex and hippocampus are coordinated by the nucleus reuniens thalami.**

Department of Neuroscience and Mental Health Institute, Faculty of Medicine and Dentistry, University of Alberta

Cortical sleep slow waves enhance specific forms of hippocampal-dependent memory, but the actual mechanism for this remains elusive. We are studying the role of the nucleus reuniens (RE) thalami, which mediates a direct connection between cortex and hippocampus. Consistent with an important role in coordinating the two areas, multi- and single-unit recordings in the RE showed slow-wave correlated activity. Crucially, when RE cells were chemogenetically inhibited, the synchronization between cortical and hippocampal sites decreased. The RE appears to be an integral part of the slow-wave memory circuit, acting as a mediator between cortex and hippocampus especially for slow oscillatory activity.

Ian Q Whishaw (PHD), Inayat Q. **The speed of an empty hand.**

Department of Neuroscience, Faculty of Arts & Science, University of Lethbridge

Our behaviour is encumbered by an inability to attend to two things at once, yet we have two hands and the world presents us with many problems that require simultaneous and different hand use. How do we solve these problems? We suggest that the solution was the first challenge to the evolution of terrestrial vertebrates and its solution is the basis of complex human hand action.

Wrap-up, Awards & Social
(9:45pm onwards)