



2018 Annual Meeting Montana Academy of Sciences

Student Union, Montana Tech, April 6th & 7th

Abstracts for Oral Presentations

(titles by time of presentation)

9:00-9:15 am

HYALURONIC ACID CONJUGATED WITH ANTIOXIDANTS FOR TREATMENT OF CMV-INDUCED HEARING LOSS (ORAL)

Zoe Peach-Riley *, Hellgate High School, Missoula, MT

Cytomegalovirus (CMV) is the leading nongenetic cause of sensorineural hearing loss (SNHL) in children in the United States. Current antiviral treatments exist, however with only modest short-term improvements and uncertain long-term outcome as well as reports of complications. Because CMV causes SNHL through inflammation and oxidation of the inner ear, an anti-inflammatory compound such as hyaluronic acid (HA) can be modified and combined with an antioxidant compound like D-methionine as a potential treatment. Preliminary results indicate successful synthesis of the compound CMHA+D-methionine as well as demonstrated cytocompatibility. Upcoming procedures will include testing the combined anti-inflammatory and antioxidant effects of the novel compound CMHA+D-methionine and investigating its potential to act as an effective treatment for CMV SNHL.

Key words: cytomegalovirus, hearing loss, hyaluronic acid, inflammation, methionine

9:15-9:30 am

REQUIREMENTS FOR AGGRESSION: ALTERING EAAT1 EXPRESSION TO MANIPULATE GLUTAMATE UPTAKE IN DROSOPHILA MELANOGASTER (ORAL)

Lucy Sirrs *, Hellgate High School, Missoula, MT

Aggression is a behavior required for survival and reproduction. Research has identified several neurons and neurotransmitters (signaling molecules) that are important for promoting aggression, but the neurotransmitter glutamate has only recently been identified, and its role is not fully understood. This research examines how manipulation of glutamate expression via altered expression of its transporter, EAAT1, alters aggression in the *Drosophila* model organism. Glutamate function was reduced by increasing expression of the glutamate transporter, EAAT1 (Excitatory Amino Acid Transporter 1). EAAT1 recycles extracellular glutamate to regulate neuronal communication. By increasing the amount of EAAT1, more glutamate is recycled, reducing its ability to signal to the downstream neuron. EAAT1 expression was increased via controlled transgenic expression. Conversely, glutamate function was increased by reducing expression of EAAT1 via RNA interference. Using genetic tools and antibody labeling, it was verified that EAAT1 is widely expressed in glial cells throughout the brain. A reduction in glutamate produced male flies that were less aggressive compared to controls, similar to previous research that manipulated glutamate expression only in octopamine neurons. Specifically, experimental flies took longer to start fighting, lunged less, and produced fewer wing threats and wing extensions. Flies with increased glutamate levels were also less aggressive, though this may be due to limited function at the neuron or the neuromuscular junction, where a motor neuron and a muscle fiber meet. These results demonstrate glutamate function is required for sex-specific behavior and provide a foundation to determine the role of glutamate in aggression circuitry in any system.

Key words: aggression behavior, glutamate, glutamate transporter expression

9:30-9:45 am

CHARACTERIZING EXCITED STATE DIFFUSION IN PCDTBT USING TRANSIENT ABSORPTION MICROSCOPY (ORAL)

Eric S. Massaro *, Chemistry and Biochemistry, Montana State University, Bozeman
Andrew H. Hill, Montana Materials Science Program, Montana State University, Bozeman
Casey L. Kennedy, Chemistry and Biochemistry, Montana State University, Bozeman
Saranyan S. Rangunath, Montana Materials Science Program, Montana State University, Bozeman
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Organic semiconducting polymers (OSPs) are an attractive alternative to traditional inorganic semiconductors for use in photovoltaic devices and other optoelectronic applications because they are cost effective and solution processable. Here we describe our efforts towards understanding excited state transport in micron-scale domains of the OSP, poly[N-9''-hepta-decanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3'-benzothiadiazole)] (PCDTBT) utilizing transient absorption microscopy (TAM). Using TAM, we directly image excited state diffusion across micron scale domains of PCDTBT thin films, reducing the effects of morphological heterogeneity in these complex polymeric systems. To further understand exciton diffusion and dissociation dynamics we have begun the development of two individual experiments. This presentation will discuss the theoretical evaluation of both experiments as well as preliminary experimental development. The first experiment has been investigated by Monte Carlo simulation of exciton dissociation at microfabricated donor-acceptor interfaces. The second experiment relies on the fabrication of polymer devices so that carrier diffusion can be characterized under the influence of an electric field. Investigation and implementation of these experiments was made possible by support from the Montana Academy of Sciences and will provide a more thorough understanding of the excited state transport dynamics in micron scale regions of PCDTBT.

Key words: organic semiconducting polymers, transient absorption microscopy

9:45-10:00am

EXPLORATION OF THE EFFECT OF PLATELET YIELD ON 5-7 DAY STORAGE (ORAL)

Aja Anderson*, Biology, University of Providence, Great Falls, MT

Platelets are a blood component essential for normal blood clotting. Donated platelets are critical for the survival of many patients, but the currently accepted shelf life of platelets is only 5 days. Thus, maintaining an adequate supply of lifesaving platelets is an ongoing concern. Platelet supply could be increased if data supported an increased shelf life. Previous studies revealed that increasing numbers of platelets in the storage bag (platelet yield) is negatively correlated to shelf life. This study explores the effect of platelet yield on the longevity of the units and examines donor differences with respect to their platelet storage profiles. We studied 12 donor units, split into 36 experimental bags, loaded at four yield levels. Our goal was to ascertain the maximum platelet yield that maintained a bag pH above 6.2 at day 7. A platelet bag is considered “failed” when the pH drops below 6.2. We found that higher platelet yields correlated with decreasing bag pH, while donor differences were related to the magnitude of the bag failure. No bags loaded at nominal yields (the most commonly used yield) failed by day 7. Of note, none of the 18 bags loaded at high-nominal yields (a less common current practice) failed at day 5, but 3 failed before day 7. These results confirm previous studies and support manufacturer determined yield limits and shelf life. Yields at and above manufacturer limits were associated with high failure rates, and are not recommended.

Key words: blood components, platelet storage, , platelet activation, , platelet yield

10:00-10:15am

ANALYSIS OF ANTIMICROBIAL PEPTIDE EFFICACY AGAINST CHYTRIDIOMYCOSIS FROM SKIN SECRETIONS OF COLUMBIA SPOTTED FROGS (*LITHOBATES LUTEIVENTRIS*) (ORAL)

Emma Esposito *, Biology, Carroll College, Helena

Amphibian populations have been declining in size in recent years. A major contributing factor to this decline is the fungal disease chytridiomycosis. Chytridiomycosis occurs when the zoospores of the fungus *Batrachochytrium dendrobatidis* (Bd) imbed into amphibian skin and disrupt the homeostatic functions the skin provides, leading to death in most amphibians. Amphibian skin can produce antimicrobial peptides (AMPs) that inhibit Bd infection. The goal of this experiment was to determine whether or not the amount and type of AMPs a frog produces affects its ability to defend against chytridiomycosis. Columbia spotted frogs were chosen as a model organism because they vary in susceptibility to the disease, yet their populations have not been drastically affected by the fungus. AMP samples were collected from ten Columbia spotted frogs at four different locations in western Montana (40 samples total). The AMP concentration for each sample was determined using a micro BCS assay. The minimal inhibitory concentrations (MICs) were determined using 96 well plate growth inhibition assays. In the assay a set of ten AMP dilutions from each frog (ranging from 100-1000 µg/mL) were used. The Bd was grown in each dilution and growth was measured after four days as change in absorbance measured at 492 nm. Infection load of frogs was determined using Quantitative PCR analysis. From the data collected, there was no statistically significant correlation between the MIC observed and infection load.

Key words: *Batrachochytrium dendrobatidis*, minimal inhibition concentration

10:15-10:30am

INVESTIGATING THE ROLE OF DNC-2 AND DLI-1 ON AMPA RECEPTOR MEDIATED BEHAVIORS IN C. ELEGANS (ORAL)

Natalie Oberding *, Biology, Carroll College, Helena
Stefanie Otto-Hitt, Biology, Carroll College, Helena

γ -amino-3-hydroxy-5methylisoxazole-4-proprionic acid (AMPA) receptors (AMPARs) are protein complexes involved in excitatory neurotransmission. AMPARs are tetrameric structures consisting of the pairings of GluA1, GluA2, GluA3, and GluA4 subunits. Dctn2 and Dync1li1 were found to interact with GluA2 in an immunoprecipitation screen that was performed on postnatal day 14 rat brains. DNC-2 and DLI-1 were identified as the *C. elegans* homologs of Dctn2 and Dync1li1, respectively, and are components of motor proteins that transport cargo throughout the cell. The goal of this project was to determine whether knocking down DNC-2 and DLI-1 by RNAi affects AMPA Receptor-mediated behaviors, including mechanosensation and chemosensation, in *C. elegans*.

Key words: AMPA receptors, *C. elegans*, excitatory neurotransmission, DNC-2, DLI-1

10:45-11:00am

SINGLE PARENTS DESCRIBE BALANCING ROLES: PARENT AND STUDENT(ORAL)

Rayvn Scott *, Highlands College A. S., Montana Tech, Butte

The purpose of this qualitative study was to explore lived experiences described by single-parent students while balancing their roles: parent and student. A qualitative design included a hermeneutic approach with interpretation that consisted of a transcript coding process. Approximately 30 hours were spent reading through transcripts, while highlighting words which identified themes. Seven themes evolved: structure, stress, not enough time, guilt, isolation, self-care, perfectionism. For example, structure, isolation, and not enough time were themes reflected as Meg stated, "I know what a priority is and what isn't. Friends are not a priority. It's like this constant balancing act. Everything is going a million miles a minute, so fast - the teaching, homework, learning, my kids, the days, studying." On-campus single-parent students' academic support and family-friendly social activities were limited; inequities in social justice were evidenced. Following themes of structure, stress, and isolation, a homework-support group on campus was offered twice a week. There was scarce involvement by single-parent students. After the last six interviews, a different approach was used for support by following the themes of guilt and isolation. On campus, family-friendly social activities were offered and participation was successful. By offering family-friendly social activities on campus, single-parents received improved support while balancing their responsibilities of parent and student.

Key words: single-parents, students, structure, stress, guilt

11:00-11:15am

MINERALOGY OF A URANIUM-COPPER BRECCIA PIPE (ORAL)

Zane White *, Geological Engineering, Montana Tech, Butte
Robert Hofer *, Geological Engineering, Montana Tech, Butte

In northern Arizona, uranium-rich breccia pipes are common, however, these deposits are rarely found to contain 36% copper. Energy Fuels sent fifteen drill-core samples from their Canyon mine to Montana Tech. These samples contain varying amounts of copper and uranium from different areas of the deposit. The samples were cut, trimmed, placed into epoxy, and polished. A total of 36 polished "plugs" were made. The plugs were scanned using an X-Ray Fluorescence (XRF) device to determine rough estimates of element composition. Each plug was then carefully observed under a reflected-light microscope. The mineralogy and estimated amounts of minerals were noted. Plugs that were seen to have interesting features, high amounts of unusual elements, or unknown minerals were placed in a scanning electron microscope (SEM). The SEM uses electron dispersive spectroscopy (EDS) to obtain a chemical analysis of a specific point on the plugs which aids in mineral identification. Some specimens were also examined by Raman spectroscopy and X-ray diffraction (XRD). The most abundant mineral found in our samples was tennantite ($\text{Cu}_6[\text{Cu}_4(\text{Fe},\text{Zn})_2]\text{As}_4\text{S}_{13}$) followed by chalcopyrite (CuFeS_2). We also found the minerals uraninite (UO_2), pyrite (FeS_2), bornite (Cu_5FeS_4), galena (PbS), sphalerite (ZnS), chalcocite (Cu_2S), covellite (CuS), and rammelsbergite (NiAs_2). These minerals were deposited by hydrothermal fluids into a quartz grain matrix, in which they act as a cement holding the grains together. The discovery of rammelsbergite, a nickel mineral, was an unexpected find. The results of this project will be sent to Energy Fuels where they will use the data to help in milling and metallurgy. This mineralogy study may also help the mine understand potential sources of metal contamination for future mining wastes. One of our recommendations to Energy Fuels will be to assay their ore for recoverable nickel in addition to the other metals (Cu, U, Pb).

Key words: tennantite, rammelsbergite, nickel, hydrothermal, deposit

11:15-11:30am

ECOLOGICAL EVALUATION OF RECLAMATION SUCCESS OF MINE SITES OF THE SAPPHIRE MOUNTAINS (ORAL)

Jeremy Aal *, Biology, Montana Tech, Butte

Sapphires and gems have been mined from the Sapphire range of southwest Montana for more than 150-years. Across this region and elsewhere, an unknown count of pits and tunnels and tailing piles lay abandoned while the local ecology reclaims the disturbed earth. A historical practice of reclamation for decommissioned mines was to bulldoze the site flat, removing physical hazards from the landscape. This process mixes the soil strata and alters the composition of the topsoil. Soil compaction is also a consequence of this process. Altered composition and significant increases in soil compaction often cause native plant species to struggle or fail to thrive in an area, causing opportunistic weedy species to proliferate. Our research investigated the species richness and coverage of three sites: a disturbed mine without reclamation, a mine site with bulldoze reclamation, and a third site in the vicinity which was not mined. Our multivariate analyses confirmed that species composition was different among the three sites. The natural site had higher plant cover, however, it was not significantly different from the other two sites due to the higher coverage of exotic weeds in the reclaimed sites. A greenhouse-controlled species competition supported this as soil from the reclaimed site was significantly better for knapweed test plants. Soils from the natural sites proved to be significantly better for native bluebunch wheatgrass growth. These results show that reclamation success does depend on initial site preparation, on the presence of exotic plant species that can be further spread by inappropriate site management. Also reclamation sites need to be managed if exotic invasion could be a potential.

Key words: knapweed, tunnels, compaction, exotic, wheatgrass

11:30-11:45am

IN VITRO SYNTHESIS OF APATITE COATINGS ON TITANIUM ALLOY SP-700 TO IMPROVE BIOCOMPATIBILITY (ORAL)

Ben Suslavich *, Metallurgical & Materials Engineering, Montana Tech, Butte

Titanium and its alloys are commonly used in the biomedical industry for their superior strength, corrosion resistance, machineability, fatigue resistance, elastic moduli, and biocompatibility; however, endosseous implants struggle with osteointegration due to poor adhesion between the implant and the receiver's bone. It is known that by synthesizing a bone-like apatite surface coating, integration of the implant with surrounding bone is not only quicker, promoting shorter recovery times, but also reduces interface stress concentrators creating a more robust implant. This study focused on synthesizing an apatite coating via the sodium titanate method on the titanium alloy SP-700 which is a contender to be used as an implant material having a similar elastic modulus to bone. The synthesized coatings, which formed after treatment in simulated body fluid solution were characterized for topography and elemental composition using SEM/EDS analyses. The results of this study show that it is possible to synthesis thin apatite layers on the surface of SP-700 with a topography conducive to improving bone growth onto the surface of the implant.

Key words: implants, endosseous, titanate, coatings, synthetic

11:45am-12:00pm

CLONING gRNAs TO ENABLE CRISPR-MEDIATED HUMAN GENE KNOCKOUTS (ORAL)

Teal Taylor *, Organismal Biology, Montana Tech, Butte

The human genome encodes over 80 members of the tripartite motif (TRIM) protein family. Many of the TRIM proteins are upregulated in cells responding to interferon-beta (IFN β). Interestingly, screens have shown that approximately half of the TRIM proteins act on interferon signal transduction pathways in positive and negative feedback loops. Cell lines are being created that can be used as tools for identifying the step of IFN signaling acted upon by TRIM proteins. To create tools for this goal, we have cloned guide RNAs targeting IFNB, IFNAR1, IRF3, and IRF7 genes into the pSpCas9(BB)-2A-EGFP vector using recombination techniques. Success of cloning was confirmed by restriction digests and DNA sequencing. Human cells (293T) were successfully transfected and are currently being cultured to attain monoclonal EGFP⁺ lines. Screening for loss of gene expression in clonal lines will be assessed by immunoblotting as well as tested functionally using luciferase reporter assays.

Key words: TRIM proteins, 293T, interferon, cell lines, cloning

1:00-1:15pm

COMPARISON & ANALYSIS OF LOCAL ENVIRONMENTAL METAGENOMICS AND DIVERSITY SEQUENCING DATA SETS (ORAL)

Lucas Stout *, Software Engineering, Montana Tech, Butte

Metagenomics is the rapidly advancing field that studies genetic material extracted directly from environmental samples. Recent advances in computational and sequencing methodologies now give an array of options to biologists who seek to analyze their samples; however, these new technologies are often run independently with little comparison of the results obtained between methods on the same sample. Prior to this study, field work by local biology instructors in conjunction with the labs of Drs. Marisa Pedulla and Alysia Cox made use of two such techniques to analyze the DNA of a locally-obtained soil sample. One technique, “shotgun,” or metagenomic sequencing, sequenced all of the DNA molecules in the sample; the second technique, “diversity” sequencing, only sequenced the molecules amplified from a single gene, the 16S ribosomal subunit rRNA gene, of the prokaryotic DNA in the sample. Because the 16S gene is highly recognizable and species-specific, the latter method also provided a count of the occurrences of each prokaryotic species. Due to this feature, the use of the 16S diversity sequencing approach is commonly utilized for studies aiming to understand prokaryotic species representation in samples. When metagenomics DNA sequences are known, represented species and their number of occurrences in a sample may also be derived computationally by comparison to procured databases of known sequences of organisms. This exploratory study compared the commercially obtained results of bacteria proportions in our sample by the diversity method, along with two experimental computational methods using these sequences compared to the public databases. Our hypothesis was that metagenomics data would provide the most accurate portrayal of bacteria in the sample at the phylum taxon. Results found significant disparities in results between each method, with implications in microbiome studies of the environment and human gut.

Key words: bioinformatics, Blast+, MRDNA, NCBI, 16S amplicon

1:15-1:30pm

DETECTION OF COLORADO TICK FEVER VIRUS IN DERMACENTOR ANDERSONI (ORAL)

Zach Hart *, Cell Molecular Biology, Montana Tech, Butte

Colorado tick fever virus is a double stranded RNA (dsRNA) virus transmitted by Rocky mountain wood ticks (*Dermacentor andersoni*), which can be found at high elevations in a number of western states including Montana. Although Colorado tick fever often presents as flu-like symptoms that are usually not life threatening, twenty percent of those infected are hospitalized. Little is known about the evolution of CTFV. The reference strain, Florio, has been sequenced, but this particular strain was isolated in Colorado in 1943. We hypothesize that isolates collected in Montana would have novel mutations because of the geographic distance and time between them and the reference strain. Ninety-seven ticks were collected in a previous SURF project this summer, mostly from Maud S. Canyon. RNA was extracted from crushed ticks and reverse transcribed. PCR successfully amplified CTFV cDNA from a positive control, but none have been detected in the tick samples to date. In contrast, using primers for a tick actin gene, PCR resulted in an amplicon of the expected size. This would suggest that the nucleic acids were collected from the tick. While no positive results for CTFV in the ticks have been obtained, there is reason to believe that the protocols developed are working. Our results are inconsistent with other studies that have found the virus in 21% of ticks sampled in Wyoming.

Key words: RT-PCR, Rocky mountain wood tick, Montana, dsRNA

1:30-1:45pm

INTEGRATION OF A FLUXGATE MAGNETOMETER AND GPS SYSTEM INTO AN UNMANNED AIRCRAFT SYSTEM (ORAL)

Sierra Luoma *, Geophysical Engineering, Montana Tech, Butte

Magnetic method has been widely used for exploration of magnetic minerals or rocks and the detection of artificial objects such as unexploded ordinances (UXOs). However, a ground-based magnetic survey is time-consuming. Aeromagnetic surveys will be faster and more efficient. In this project, we integrated a fluxgate magnetometer and GPS units with an unmanned aerial vehicle (UAV), i.e., Matrice 600 Pro, to measure magnetic anomalies for aero-geophysical exploration. To achieve this objective, we used an Arduino microprocessor to control a triaxial fluxgate magnetometer (FGM-301/310) and two GPS units (ANT-GPS-SH-SMA). Arduino IDE codes were written for simultaneous data collection from the magnetometer and the two GPS antennas and for storing the data to a microSD card. These components will be attached to the DJI Matrice 600 Pro UAV. The whole system will be tested using a UXO sample. We will fly the UAS with the magnetometer over a sample UXO. With the two GPS antennas, the location and orientation of the magnetometer is obtained so that the three components of the magnetic field can be calculated. The data collected will be processed to create a georeferenced map of magnetic fields and will be interpreted. The accuracy of the fluxgate magnetometer and UAV system will be evaluated.

Key words: Magnetic, Drone, Magnetic Fields, Arduino, UXO

1:45-2:00pm

GROUNDWATER/SURFACE WATER INTERACTIONS ON THE CLARK FORK RIVER (ORAL)

Eva Hover *, Geological Engineering, Montana Tech, Butte

Grant-Kohr's Ranch is a National Historic Site located near Deer Lodge, MT. The ranch stretches along a two mile reach of the Clark Fork River, which has been contaminated by mine tailings. Plans for remediation are in progress, and information regarding where groundwater enters and leaves the river is important in this remediation process. A handheld temperature (T) and specific conductivity (SC) probe was used to look for spatial anomalies of these parameters that may indicate where groundwater enters the river. To do this, fifteen cross sections consisting of several T and SC readings were collected perpendicular to flow, and several readings were collected along the river banks (no cross sections) between each cross section. Significant spikes in specific conductivity values are consistent with groundwater entering the river. Zones of low high water temperatures in the winter is consistent with areas where groundwater warmer than the surface water is infiltrating the river. This idea holds true in warmer months as well, as areas where low temperatures are logged may show where cooler groundwater is infiltrating the warmer surface water. Radon-222 (^{222}Rn) was collected along both the right and left banks at all fifteen monitoring locations to verify groundwater inputs inferred from T and SC measurements. ^{222}Rn de-gasses quickly when a river flows from a gaining to a losing reach, so this is an ideal validation. Local lithology suggests a sandy gravelly aquifer that would interact with surface water. Both ^{222}Rn combined with T and SC suggest intermittent zones of groundwater inflow along the river banks, often only occurring along one side of the river at a time.

Key words: Grant-Kohr's, groundwater, temperatures, radon-222, inflow

2:00-2:15pm

PROSOCIAL BEHAVIOR AND EMPATHY: ANALYSIS OF EMOTIONAL RESPONSES DURING THE USE OF TED TALK VIDEOS IN THE CLASSROOM (ORAL)

Robert Shelton *, Highlands College A. S., Montana Tech, Butte

Empathy may increase when observing prosocial behavior of others. The purpose of the study was to evaluate students' emotional responses when observing prosocial behavior demonstrated in a Tedx Talk video through the lens of cognitive empathy and affective empathy. Tedx Talk videos are often shown in college classrooms to enhance learning outcomes. Student participants (N=157) completed the Interpersonal Reactivity Index pre/post assessment to examine if differences of empathy were measurable from before watching the video and after. Paired Samples t test Analyses were run to explore if there were differences between groups over time. Independent Samples t tests were used to understand differences between groups: age, gender and parental status. Results suggested statistically significant changes in empathy both over time and between groups.

Key words: cognitive, affective, interpersonal reactivity index, parental status, gender

2:30-2:45pm

METAL-MICROBE INTERACTIONS IN SILVER BOW CREEK (ORAL)

Jordan Foster *, Environmental Chemistry, Montana Tech, Butte

This project studies the relationship between microbes and both metals and metalloids in Silver Bow Creek. Biotic manganese nodule formation in Silver Bow Creek was identified through previous studies. The formation of these nodules is of interest to Silver Bow Creek restoration since heavy metals can bind to the nodules and potentially lower contaminants of concern. The goals of this study were to identify the organism(s) involved in the formation of manganese nodules and to identify how the nodules were formed using proteomic analyses. In addition, water chemistry data was used to study relationships between several elements in the creek and the potential effect these factors have on the microbial life. A combination of microbial culturing and LC-MS was used in an attempt to isolate the microbes involved with nodule formation and identify the proteins produced by the microbes. Currently, this work is attempting to isolate a microbe in the creek and analyze metagenomic data to predict the proteins used in the formation of the nodules. Once the microbe has been isolated or the proteins predicted, proteomic analyses with LC-MS can proceed. This work, in its current phase, has implications upon the interactions of microbial communities with contaminants of concern in Silver Bow Creek.

Key words: LC-MS, water chemistry, culturing, manganese, proteomics

2:45-3:00pm

CALIBRATION AND APPLICATION OF MONTANA TECH SHAKE TABLE APPARATUS (ORAL)

Brent Sordo *, Geological Engineering, Montana Tech, Butte

In the field of geotechnical engineering, a key task when designing earth structures is preparation for seismically induced loads. To directly study the impacts of these loads upon geologic structures, models or samples of the structures are tested with a seismic shake table, an apparatus that precisely accelerates back and forth according to a specific pattern. Montana Tech recently acquired a high quality, unique shake table, and this project was the first use of it. Initially, the table was installed and a booklet outlining its use and specifications created. With the table in use, the efficacy of its ability to model acceleration-induced loads was tested by subjecting a number of rock joint samples to seismic loads of varying intensity. The critical acceleration value, the value at which static friction is overcome, will then be identified and compared to other methods of frictional analysis such as tilt tests. The critical acceleration can be implemented into a calculation to find static coefficient of friction, as can a friction angle acquired from tilt tests of the same samples, allowing for direct comparison. Furthermore, samples subjected to sinusoidal wave patterns can also be compared to dynamically loaded discrete element models for further verification. This project itself is preliminary, but with this relationship proven, the application of the shake table can proliferate to more complex simulations such as liquefaction, structural fundamental frequencies, and complex earthquake time histories.

Key words: earthquake, geotechnical, modeling, seismic, simulations

3:00-3:15pm

ERGONOMIC EVALUATION OF A HIGH-PERFORMANCE GAMING INPUT DEVICE AND A COMPARISON WITH TRADITIONAL DEVICES (ORAL)

Jacob Van Dyke *, Occupational Safety and Health, Montana Tech, Butte

The goal of this study is to address the need for research on the ergonomic effects of computer gaming by providing an objective, ergonomic evaluation of a gaming input device using a simulated gaming task that compares ergonomic and performance measures with traditional computer input devices. The computer input devices included one traditional, a rollerball, and a gaming input device. Twenty participants wore sEMG sensors placed on the abductor pollicis brevis of the right hand. The subjects' maximum voluntary contraction (MVC) was recorded at the beginning of the study. Performance was measured by recording the number of correct sequences that subjects completed during their trial, while force was measured using sEMG. A Welch's one-way ANOVA (Analysis of Variance) was used to analyze statistical significance of the data; a Games-Howell Pairwise Comparison test was used for the post hoc analysis. The difference in mean force exerted by the abductor pollicis brevis for the input devices was significant ($p < 0.001$). The number of correct sequences completed by each subject, was also significant ($p < 0.001$). Two post-hoc comparisons were statistically significant for each data set. The %MVC for the gaming input device was significantly different from both the rollerball input device ($p = 0.021$) and the traditional input device ($p < 0.001$). The number of correct sequences for the traditional input device was significantly different from both the gaming input device ($p < 0.01$) and the rollerball input device ($p < 0.001$). The results of this study suggest that there is a possibility that gaming input devices increase force exertion while performing gaming tasks which may increase the risk of developing MSD's of the hand and thumb, without an apparent increase in performance within the constraints of this study. Further research is needed to determine if similar results exist during a gaming task performed by actual gamers.

Key words: Computer gaming, input device, musculoskeletal disorders, surface electromyography, thumb pain

3:15-3:30pm

MECHANISTIC AND KINETIC INSIGHTS OF [CU(PDTC)L] (ORAL)

Matt Queen, Biological and Physical Science, Montana State University Billings, Billings
Daniel Willems, Biological and Physical Science, Montana State University Billings, Billings
Alexander Fryett *, Biological and Physical Science, Montana State University Billings, Billings

Carbon tetrachloride (CT) is a known carcinogen. It is known that when pyridine-2,6-bis(thiocarboxylic acid) (PDTC) forms square planar coordinate complexes with copper(II) the combination can dechlorinate CT stoichiometrically. In this study three different complexes, where the position four ligands are varied Cu(PDTC)L (L= Cl-, CN-, and PPh₃), were used to probe the mechanism of the dechlorination reaction. GC-MS kinetic assays were performed to assess the aqueous dechlorination kinetics while organic solvents were used in UV-Vis assays to test organic based solvents. Results on the UV-Vis show that Cu(PDTC)PPh₃ shows the most significant reaction with CT in organic solvent, followed by Cu(PDTC)CN with very limited reactivity, and finally Cu(PDTC)Cl with no reaction. Water-based kinetics were done in phosphate buffer with Cu(PDTC)Cl, Cu(PDTC)CN, and Cu(PDTC)PPh₃. Cu(PDTC)Cl showed the most significant loss in CT in air and under inert gas. In addition variable temperature kinetics assays were performed to elucidate activation energies for the reaction.

Key words: carbon tetrachloride, pyridine-2,6-bis(thiocarboxylic acid), dechlorination, kinetics

3:30-3:45pm

ELONGATOR FUNCTION IN THE ANTERIOR PITUITARY AND ITS RELEVANCE TO FAMILIAL DYSAUTONOMIA (ORAL)

Joseph Walters *, Biological and Physical Sciences, Montana State University - Billings, Billings

Joy Goffena, Biological and Physical Sciences, Montana State University - Billings, Billings

Richard Buksch, Biological and Physical Sciences, Montana State University - Billings, Billings

Lynn George, Biological and Physical Sciences, Montana State University - Billings, Billings

Familial Dysautonomia (FD) is a devastating neurodegenerative childhood disease characterized by a diminished number of autonomic neurons. FD children suffer from a multitude of autonomic symptoms including cardiovascular instability, gastrointestinal incoordination, and respiratory dysfunction. FD patients also exhibit an abnormal autonomic stress response, show poor growth velocity, and have difficulty gaining and maintaining weight. Treatment with growth hormone (GH) has been shown to increase growth velocity in FD patients. FD results from a mutation in the *IKBKAP* gene and diminished levels of the corresponding protein IKAP, a scaffolding protein that assembles a multi-subunit complex called Elongator. Elongator functions in the modification of tRNAs that mediate translation of AA- and AG-ending codons including lysine, glutamine, and glutamic acid. In the absence of Elongator, small AG biased genes are upregulated and large AA-biased genes are downregulated. IKAP is expressed throughout the autonomic nervous system and historically FD has been considered a strictly neurological disease. Here we show that IKAP is robustly expressed in the pituitary gland, indicating a strong dependence on Elongator. We hypothesize that compromised growth in FD may actually result from dysfunction of somatotrophs in the anterior pituitary, a non-neuronal cell type. To test this hypothesis, we generated a conditional knockout (CKO) mouse where *Ikbkap* is selectively ablated in anterior pituitary somatotrophs. These CKO mice exhibit decreased growth compared to control littermates. Surprisingly, quantitative immunohistochemistry indicates that GH1 levels may actually be increased in the CKO pituitary. CaBP7, a calcium binding protein that negatively regulates vesicle trafficking, is also found at elevated levels in the CKO, likely because of its strong AG-bias. In combination, these results suggest that upregulation of CaBP7 may inhibit GH1 exocytosis from pituitary cells, decreasing the amount of circulating GH1 and compromising growth in FD patients.

Key words: *cabp7*, codon bias, growth hormone, *mus musculus*