Saturday, April 6, 2019

ORAL PRESENTATIONS

Indicates Presenting Author

PAIRING VISUAL ESTIMATES AND ACTUAL COUNTS TO IMPROVE ESTIMATION OF WILD BERRY PRODUCTION. *Aidan Duffield*, Hellgate High School, Missoula* ***(2018 Winner: Junior Academy, Scientific Research Paper Competition)***

COMPARING THE HABITAT CONNECTIVITY OF FISHER (PEKANIA PENNANTI) AND AMERICAN MARTEN (MARTES AMERICANA) IN THE NORTHERN ROCKY MOUNTAINS, USA. Rex Koenig*, *Hellgate High School, Missoula* ***(2018 Winner: Junior Academy, Scientific Research Paper Competition)***

FAILURE TO DETECT ANTI-VIRAL ACTIVITY BY PROKARYOTIC ARGONAUTE PROTEINS. *Paul B.G. van Erp *, Microbiology and Immunology, Montana State University, Bozeman* ***(2018 Graduate Grant Awardee)***

Argonaute (Ago) proteins are present in all three domains of life and are involved in nucleic acid guided silencing and interference pathways. The well-studied Eukaryotic Argonautes (eAgo) form the catalytic core of the RNA interference (RNAi) pathway that is involved in gene silencing, transposon silencing and antiviral defense. Limited research on Prokaryotic Argonautes (pAgo) suggests these proteins are involved in defense against foreign genetic elements such as plasmids. pAgos have been hypothesized to defend against bacteriophage, however no direct evidence has been found so far. Here, we report the failure to detect antiviral defense mediated by pAgos against various Escherichia coli bacteriophages. We overexpressed 8 phylogenetically diverse prokaryotic Argonaute proteins in Escherichia coli BL21 (DE3) and challenged them with 7 bacteriophages spanning the Myo-, Sipho-, and Podoviridae families. No antiviral activity was detected that could be attributed towards the pAgo proteins. However, up to 100,000-fold reduction in viral infectivity was observed for 2 phages that correlated with plasmid-based protein expression. The mechanism through which this antiviral activity is mediated is unknown and subject for future study.

LIGAND-CONTROLLED CHEMODIVERGENT SUZUKI CROSS COUPLING USING PALLADIUM-N-HETEROCYCLIC CARBENE CATALYSTS. Emily Reeves*, Chemistry & Biochemistry, Montana State University, Bozeman. ***(2018 Graduate Grant Awardee)***

The successful synthesis of complicated organic molecules such as pharmaceuticals, agrochemicals, and organic materials requires an extensive toolbox of synthetic strategies for constructing carbon-carbon bonds. Problems can arise, however, when a molecule contains multiple functional groups that are reactive toward the same transformations. For example, both aryl halides and aryl triflates can undergo palladium-catalyzed Suzuki cross-coupling in the presence of arylboronic acids. Control of selectivity between these two electrophilic sites using

different Pd-phosphine catalysts has been described previously, but the scope of such methodology is severely limited. In this presentation, we describe the discovery of an orthogonal pair of Pd-N-heterocyclic carbene (Pd-NHC) catalysts for chemodivergent cross-coupling of aryl chlorides and aryl triflates with phenylboronic acids and demonstrate the synthetic utility of these catalysts with diverse boronic acids and substrates. The mild conditions used in these reactions allows for high functional group tolerance with respect to both substrates and boronic acids. We additionally present experimental and computational evidence that the origin of selectivity using Pd-NHC catalysts is dissimilar to the mechanism of selectivity control using Pd-phosphine catalysts.

IDENTIFICATION OF CELLULOLYTIC HOT SPRING ORGANISMS THROUGH BIOORTHOGONAL LABELING. *Nicholas J. Reichart *, Chemistry and Biochemistry, Montana State University, Bozeman* ***(2018 Graduate Grant Awardee)***

Bioprocessing of cellulose from plant waste into ethanol has been a focus of the renewable energy field for several decades. The recent developments of genome sequencing technologies have reinvigorated the topic. Identification of genes and the potential to degrade cellulose has been the major outcome thus far. High-throughput techniques to link taxonomy and in situ function of the organisms responsible for these processes have, however, been lacking. Bioorthogonal non-canonical amino acid tagging is a nondestructive method to fluorescently label active, protein-synthesizing cells that can later be separated from a community using fluorescent activated cell sorting (BONCAT-FACS).
Biomass collected from a Yellowstone National Park hot spring was incubated with four cellulose substrates to identify organisms that were preferentially active in the presence, but not the absence of cellulose substrates. A short timeframe (2 weeks) bioorthogonal labeling incubation and a longer enrichment (6 weeks) incubation were compared for differences in community composition to highlight the competition of an incubation that is typically missed with enrichment schemes. Over 14 days of incubation the community began to shift to a simplified population comprised of Aquificae, Deinococcus-Thermus, or Chloroflexi. However, at early time points, the active community was comprised by a multitude of uncultured and cultured organisms including Fervidibacteria, Aigarchaeota, or Thermotogae which were eventually outcompeted by dominating organisms in the later time points. BONCAT-FACS outlines a novel approach of using single-cell bioorthogonal labeling to profile a microbial community's activity regarding biotechnology industry interest.

ECOSYSTEM ENGINEERING BY NET-SPINNING CADDISFLIES (HYDROPSYCHIDAE) IN ROCKY MOUNTAIN STREAMS. *Benjamin Tumolo*, Ecology, Montana State University, Bozeman* ***(2018 Graduate Grant Awardee)***

Ecosystem engineering is a ubiquitous process by which organisms modify physical habitat characteristics and influence patterns of biological organization. Often, modification of physical environments by ecosystem engineers can facilitate other organisms by creating habitats for species that would otherwise be absent. Despite the potentially wide reaching consequences of facilitation through ecosystem engineering, many facets remain poorly understood in stream ecosystems. Here we present a synthesis of ecosystem engineering by hydropsychid caddisflies

and describe how they affect stream macroinvertebrate communities. Hydropsychid caddisflies are a globally distributed group of net-spinning insects that live in stream gravel beds and have high abundances across western Montana. Hydropsychid caddisflies act as ecosystem engineers because their silk structures alter sediment transport conditions and local flow patterns of streambeds. Using lab experiments and field surveys, we show that ecosystem engineering by caddisflies changes physical templates of streambeds and influences other members of the macroinvertebrate community. We found that caddisfly nets increase the shear stress required to initiate gravel movement for gravels up to 70 mm. Additionally, we found that caddisfly silk structures substantially alter local flow at the streambed surface by reducing velocity by 70%. Furthermore, we have found that the presence of net-spinning caddisflies markedly increases local abundances and biomass of other stream macroinvertebrates across environmental gradients. Taken together, these findings indicate that caddisflies impart substantial physical changes to streambed habitats that have ecologically significant consequences for stream macroinvertebrate communities. Our findings indicate that caddisflies influence ecological processes from physical habitats to biological community structure and could act as important controls of Rocky Mountain stream ecosystems.

ASSESSING THE EFFECTS OF COMPETITION AND SEASONALITY ON STRESS, IMMUNITY, AND NUMBER OF SCARS IN DEERMICE

Andreas Eleftheriou, Wildlife Biology, University of Montana, Missoula*

Abiotic and biotic stressors can affect the physiology and behavior of wildlife. In particular, baseline stress, immunity and contact rates could vary with season and competition with dominant species. Sin Nombre virus (SNV) is carried by deermice (Peromyscus maniculatus), and in western Montana grasslands, deermice coexist with voles. Since voles are dominant over deermice, they could increase SNV prevalence via effects on stress, immunity and contacts. Our objectives were twofold 1) to examine seasonal changes in baseline stress, immunity, and contact rates in deermice and 2) to investigate whether voles could increase SNV prevalence by either stress-induced immunosuppression, alterations in contact rates, or both. We trapped small mammals over a year at four grids where we recorded species and weighed, marked, and sampled deermice. We also evaluated deermice for scar numbers (proxy for contact rates), demography, ectoparasites, and body condition scores (BCSs). Blood was evaluated for total white blood cell (WBC) counts, differentials, and SNV antibodies, and feces for fecal cortisol/corticosterone metabolites (FCMs) to measure stress. Using linear and generalized mixed effect regression trees, we found that BCSs of nonreproductive deermice and FCM levels were highest in fall and lowest in spring/summer, but neutrophil:lymphocyte (N:L) ratios and scar numbers showed the opposite pattern. Monocyte counts were highest in spring but WBC counts were lowest in summer at only two grids. We did not find clear vole effects on deermouse stress, immunity, or contact rate measures. Due to low SNV prevalence, we could not evaluate effects of voles on infection. More scars and higher N:L ratios but lower BCSs and WBC counts over spring/summer may provide an ideal time for SNV transmission. Competition with voles may not influence susceptibility to SNV infection although low vole densities may have masked potential effects. Our findings may be applicable to other directly-transmitted wildlife diseases.

EVALUATING THE ACCURACY OF BLOODSTAIN PATTERN ANALYSIS USING HEMODYNAMIC PROPERTIES. *Paul Yount *, Forensic Science, University of Providence, Great Falls*

This comparative survey explores the relationships between the discipline of bloodstain pattern analysis (BPA) and hemodynamic blood properties, such as viscosity and hematocrit. In BPA, forensic scientists study the phase change of blood when in contact with air, but little forensic literature connects blood biomechanics, such as hematocrit levels to BPA. Red blood cell count, or hematocrit, in females (37-48% of blood volume) is slightly lower than males (45-52% of blood volume) from menstrual red cell loss, etc. Strong evidence suggests that erythrocytes influence blood viscosity because of their high concentration (4-6 x 10^6 RBC/mm3 or 40-45% of blood volume in healthy individuals). When whole blood is altered by a disorder/disease or alcohol intake, hematocrit levels can be affected as well. With this knowledge, there is reason to believe that blood viscosity changes with individualistic hematocrit levels. Therefore, it is hypothesized that traditional BPA angle of impact tests can produce inaccurate results. Intravenous blood samples were drawn from 9 volunteers (all women, including 8 with blood disorders/alterations and 1 healthy control) at the University of Providence into collection tubes containing ethylenediaminetetraacetic acid as an anticoagulant. Each sample was tested for viscosity using a Canon-Fenske viscometer and for hematocrit levels using an LW Scientific ZipCombo centrifuge. Finally, each sample was used to make several blood stains at varying degrees of impact (10°, 30°, 60°, and 90°). A MANOVA was used to compare viscosity, hematocrit, and angle of impact variables against each other within the 8 participants. This survey connects hemodynamic properties to angle of impact tests in BPA by significantly showing how bloodstains can be inaccurately misinterpreted. By examining blood viscosity among several individuals, this research assesses the accuracy of BPA by comparing experimental and expected bloodstain angles and creating individualistic standards for future forensic methods. ","blood, forensic science, hematocrit, impact angle, viscosity.

GENERATION OF A HIGH THROUGHPUT SCREENING SYSTEM FOR SMALL MOLECULES THAT CAN RESCUE AXONOPATHY. *Cody Walters*, Biological and Physical Sciences, MSU-Billings, Billings*

Familial Dysautonomia (FD) is a neurological disease with both developmental and degenerative aspects including axonopathy of peripheral nerves. FD results from a point mutation in the ELP1 gene, causing reduced levels of the corresponding protein that functions in assembling a highly conserved, six-subunit complex known as Elongator. Elongator catalyzes the chemical modification of transfer RNAs needed for the translation of codon-biased transcripts that preferentially use AA- or AG-ending codons. Like FD, axonopathies are a common feature of many other neurological diseases including amyotrophic lateral sclerosis (ALS), and Alzheimer's. Despite their prevalence in neurodegenerative diseases, the discovery of therapeutics for treating axonopathies has been impeded by the difficult and costly nature of culturing primary neurons. Therefore, an experimental model that can withstand the manipulation required for a high throughput small molecule screen is essential for drug discovery. Candida albicans shows a pronounced polarized growth phenotype that is distinct among other yeasts. To determine whether this phenotype is dependent on Elongator, as is polarized growth in neurons, we made a C. albicans Elp1 knockout. Importantly, this knockout exhibits a severely compromised growth habit. Our long-term goal is to use this knockout to develop a high throughput screen for small molecules that can rescue normal polarized growth. Molecules that rescue in our yeast model

system, will then be tested in vitro for the ability to rescue axon elongation in Elp1 deficient neurons.

A LOGISTIC REGRESSION IMPLEMENTATION OF THE "ABCD" METHOD FOR IDENTIFYING MALIGNANT MELANOMA. *Havilah Neujahr*, Biology & Mathematics, University of Providence, Great Falls*

This project investigated a way to more accurately assess the probability that a skin mole is malignant or benign using the ABCD classification system used in healthcare. To determine the probability that a mole was malignant or benign, numerical values were calculated for each classification. The numerical value for A (asymmetry) was calculated by drawing an estimated half-way point through the image and then filling in each half with simple geometric shapes whose areas could be easily calculated in Microsoft Word. Once the area of each half was found, the absolute value of the difference between the area of the two halves was the numerical value assigned to A. For B (border irregularity), the perimeter and area of each mole was put into the formula $B=(P)2/(4\pi T)$, where T stands for area. C (color) was estimated on a scale of 1-5, where 1 was light, uniform color distribution and 5 was uneven, splotchy, and dark color distribution. For D (diameter), the archive used (ISIC Archive) to obtain the images had the diameter included in the metadata of each image. In total, 45 training images were used, and 5 different test images were used to cross-validate the results obtained. Both a quadratic logistic regression model and linear logistic regression model were used to see how accurate both models were in predicting the probability that a mole was malignant or benign. The results produced showed that the quadratic model was more accurate than the linear; however, both models had a high rate of accurate predictions. The quadratic model accurately predicted 44 out of 45 of the training data sets and 5 out of 5 of the test data sets. The linear model accurately predicted 41 out of 45 of the training data sets and 4 out of 5 of the test data sets.

LIGAND K-EDGE STUDY OF M(PDTC)L COMPLEXES. *Alexander Fryett*, Biological and Physical Sciences, MSU-Billings, Billings*

Carbon tetrachloride is a known carcinogen that can cause cancer related illnesses when it is dechlorinated by Cytochrome P450, located in the human liver. Environmental reduction of carbon tetrachloride can produce lesser chlorinated intermediates, such as the trichloromethyl radical, which is harmful to living organisms. [Cu(PDTC)L]- has shown to be able to dechlorinate carbon tetrachloride so that it will produce CO2 and chloride, which are environmentally safe compared to lesser chlorinated intermediates. The mechanism between [Cu(PDTC)L]- and carbon tetrachloride is poorly understood. This study links the dechlorination reactivity of a series of [M(PDTC)L]- complexes (L = Cl-, CN-, and PPh3 and M = Cu and Ni) to the individual electronic structures of each complex by using sulfur k-edge. We find that reactivity of a given [Cu(PDTC)L]- species is linked to the lability of L in a given solvent rather than to the relative covalency of the M-S bond in each species. ","carbon tetrachloride, covalency, dechlorination, pyridine-2,6-bis(thiocarboxylate)

ELECTRICAL PROPERTIES OF CARBON NANOFLUIDS. *Isaac Gilfeather *, Mechanical Engineering, Montana Tech, Butte*

Electrically conductive inks have wide applications in wearable electronics, sensors, and inkjet printed circuits. The goal of this project was to make quantitative measurements on the electrical properties of aqueous suspensions of carbon nanomaterials. To create the electrically conductive ink, Sodium Dodecyl Sulfate (SDS) was used to stabilize the MWNTs in solution. Coats of ink were applied to standard printer paper to measure the sheet resistance of the ink using a Signatone S-302 4-point probe. The resistivity of the ink was determined with an apparatus that I designed and built, it used a series of inter-locking vinyl tubes and solid copper rods as the electrodes. An Agilent 3458A 81/2 Digital Multimeter was used to capture a resistance measurement which was then used along with the dimensions of the vinyl tubes to calculate the resistivity of the ink. By measuring the resistivity of a 5 wt% sample of saltwater and then comparing it to the values found in a table, it was concluded that the apparatus was accurate within a reasonable margin of error.

CHICKEN TAIL VERTEBRAL FUSION SHEDS LIGHT ON A HUMAN BACKBONE DISEASE. *Kevin Surya *, Honors College, Montana State University, Bozeman*

Ankylosing spondylitis (AS) is an inflammatory disease that causes vertebral fusion, affecting approximately 0.6% of the US population. Genome-wide association studies have shown that over 90% of AS patients harbor the HLA-B27 allele, which is associated with the histocompatibility complex. Still, underlying cellular mechanisms of AS are little understood, and a trigger has not been identified. Since AS mechanisms are difficult to study in humans, we require a suitable animal model. The chicken naturally fuses four of its last tail vertebrae during post-hatching growth, forming a compound bone called the pygostyle. As part of this fusion process, cartilaginous intervertebral discs remodel to become bone, and the nuclei pulposi at the centers of the discs completely degrade. How do chicken discs mineralize and does this phenomenon follow a similar path as human AS? We have observed several analogous features between chicken and AS vertebral fusion, including tissue bands bridging fusing vertebrae and fat deposits at the base of fusing vertebrae. Also, we observe an infiltration of neutrophil-like cells, suggesting that chicken vertebral fusion, like in AS, involves the immune system. Histology stains indicate that mineralization is present, but osteoid and osteoclasts are absent; fusion does not occur by endochondral ossification. We hypothesize this phenomenon represents the unusual transchondral ossification, where chondrocytes transform into osteoblasts. Currently, we're testing for cell death using TUNEL assays. Cell deaths would suggest that chondrocytes are dying not transforming. A possible trigger scenario involves transdifferentiation of disc chondrocytes into osteoblasts. Dying notochordal cells may cause the release of Complement 3 which facilitates transchondral ossification by recruiting neutrophil cells and promotes transdifferentiation of chondrocytes to osteoblasts. Finally, this study provides insights into AS mechanisms and elevates the chicken as an animal model.

DESIGN, BUILD, AND TESTING OF RESONANT AIR COMPRESSOR. *Grace Ostermiller*, Montana Technological University, Butte*

Mechanical resonance of a system is achieved when the oscillation amplitude of a system is maximized and the resultant velocity and input force are in phase. In theory, a vacuum pump running at resonance should be more efficient when compared to an off-the-shelf air compressor. The focus of this project was to build a resonant compressor, obtain efficiency values from that compressor, and compare those values to that of an off-the-shelf compressor. An off-the-shelf air compressor was tested by pulling a vacuum of a bell jar while collecting data for every 100 mmHg of vacuum that was pulled to the vacuum pressure of 400 mmHg. The values collected were the current, voltage, power, and time it took to reach each vacuum value. In building the resonant air compressor various pieces were printed using 3D printing technology, machining various parts out of steel, and purchasing steel springs. In the design of the new compressor, the piston and valving from the off-the-shelf compressor were used. A copper wire was coiled around a 3D printed bobbin and the compressor was assembled. Alternating current was sent through the copper wire and the current, voltage, and power values were all collected during the same vacuum test as previously defined. These values were then compared to the values collected from the off-the-shelf air compressor.

ZIC TRANSCRIPTION FACTORS THAT INFLUENCE CONVERGENT EXTENSION.
*Jocelyn Waggoner *, Cell Biology and Neuroscience, Montana State University, Bozeman*

My research is focused on a specific time frame during embryonic development called gastrulation, in which intricate cell movements give rise to the ectoderm, mesoderm and endoderm layers of the embryo. The mesoderm layer undergoes movements called convergent extension, which allow cells to intercalate and move inside the embryo. The Zic family of zinc-finger proteins have a crucial role in gastrulation and neurulation. Based on findings from our lab (K. See and Merzdorf, in preparation) and others (Cast et al., 2012), I hypothesize that zic genes are required for convergent extension during gastrulation. Since there are 5 different, but very similar, zic genes, I will test each of these genes for a role in convergent extension during gastrulation. A knockdown method for each of the 5 zic genes in embryos of the model organism Xenopus laevis will be combined with a method called Keller Explants to allow analysis of convergent extension. In my experiments, I have ruled out zic 2 as a regulator of convergent extension. My current hypothesis is that zic3 is the most likely candidate because of its known roles in neural tube formation and other reasons I will explain below. I am also analyzing zic1,4, and 5 for convergent extension regulation.

IS TIME RESOLVED INFRARED RADIOMETRY AN ALTERNATIVE OF POSITRON ANNIHILATION LIFETIME SPECTROSCOPY FOR DEFECT DETECTION IN METALS: AN EXPERIMENTAL APPROACH AND A MODEL DEVELOPMENT. *Md Salah Uddin *, Material Science & Engineering Program, Montana Technological University, Butte*

Time resolved infrared radiometry (TRIR) and positron annihilation lifetime spectroscopy (PALS) are both defect detection methods used in different materials for more than 40 years. Interestingly, both of the methods are similar in many ways, such as non-invasive testing

procedures and follow a decay scheme. Both of the methods are successfully applied to metals, polymers, and composites materials. However, the methods are different in application mechanism and principle. TRIR is a thermography technique that measures temperature decay with time of the investigated material whereas PALS uses positronium decay with time of the tested material. In PALS, two-state trapping model is mostly used. Two state trapping model is a positronium trapping model used to describe positron diffusion inside the material. According to the trapping model, high energy positron beam is emitted from radioactive nuclei, diffused into the material, and trapped in a defect caused emissions of comparatively lower energy γ (gamma) rays. We develop a model to describe the similarity between time resolved infrared radiometry and positron annihilation lifetime spectroscopy. In the model, we describe the heat transfer and diffusion mechanism in the investigated material in time resolved infrared radiometry. The model also describes an experimental development for time resolved infrared radiometry research.

STUDENT ENGAGEMENT WHILE ESTABLISHING CLASSROOM MATHEMATICAL PRACTICES. *Emmanuel Barton Odro*, University of Montana, Missoula*

There is a significant connection between student engagement and performance achievement. Klem and Connell write, "student engagement has been found to be one of the most robust predictors of student achievement and behavior in school, a conclusion which holds regardless of whether students come from families that are relatively advantaged or disadvantaged economically or socially" (2004, p. 5). However, student engagement is complex, and currently relationships to outcomes such as mathematical understanding and learning are elusive (Fredricks, Blumenfeld, & Paris, 2004; Middleton, Jansen, & Goldin, 2017).
This study investigates student engagement while learning through use of an app that collected student engagement reported by participants during a classroom teaching experiment. This paper discusses preliminary results on students' engagement in the process of learning. Though not anticipated, we observed differences between male and female students' engagement while working in mixed-pairs worthy of investigation. In particular, we observed differences between male and female students' engagement while working in mixed-pairs surrounding important mathematical contributions from female partners. Female students described situations in which they perceived of male partners overlooking valuable contributions towards completing tasks, resulting in dips in engagement. With, regards to data collection, the app and survey effectively gathered information on student engagement, which was triangulated by students' descriptions in recall interviews.

CREATING A RECIPROCATIONG AIR COMPRESSOR USING A SINGLE DEGREE OF FREEDOM SPRING MASS DAMPER RESONANT SYSTEM
Emily Maynard, Montana Technological University, Butte*

Theoretically, a reciprocating air compressor should work with a single degree of freedom spring mass damper resonant (1D-SMD) design. The following steps were used to demonstrate how the system could be applied to an air compressor. Once a mathematical model was created, the calculated results determined the parameters for the solid model using SolidWorks. The model

included a design that was based around an off-the-shelf air compressor. These parts were either 3d printed, ordered, or machined and assembled. Finally, the system was tested as an air compressor. Several design iterations were performed to improve the system. The application of this project resulted in a newly built air compressor, which suggests this is an efficient way to compress air.

DEVELOPMENT OF A UAS-BASED ELECTROMAGNETIC INDUCTION SENSOR FOR SUBSURFACE CONDUCTIVITY MAPPING. ***Andrew*** *Wilson*, Geophysical Engineering, Montana Technological University, Butte*

The Electromagnetic Induction (EMI) method is a popular and favorable geophysical technique for shallow subsurface exploration because of its high-quality, rapid data acquisition of subsurface conductivity or resistivity. However, EMI based instruments are generally ground-based. Our research aimed to investigate the practical application of an airborne EMI sensor that does not require direct contact with the ground. The objective for our project was to measure the inductive response of a conductive subsurface, and locate anomalously high subsurface zone in conductivity. To address our objective, we designed and constructed a lightweight EMI sensor for an unmanned aircraft system (UAS) based on the principles of EM induction and EM sounding. We successfully tested the instrument by measuring the secondary field response from a metal-cased Unexploded Ordinances (UXO) during its high conductivity. The innovative design and construction of our EMI sensor is original and has shown to be a practical approach for use with an UAS. The EMI sensor consists of a signal wave generator, a power amplifier, concentric transmitter and a receiver coils, and a microcontroller-based data collection and storage system. The micro-controller code for the data collection and storage system was developed in the open-source Arduino Software, Integrated Development Environment (IDE). EMI sensors operate using a transmitter coil to generate a primary magnetic field that penetrates into the subsurface and induces eddy currents in conductive subsurface Earth materials. A secondary magnetic field generated by the eddy current induced in the conductive Earth material will pass through the receiver coil, and generating an electromotive force (emf). By measuring the emf induced in the receiver, we can approximate the conductivity of Earth material.

SIN NOMBRE VIRUS PREVALENCE IN PEROMYSCUS MANICULATUS CAPTURED IN RANCH BUILDINGS IN SOUTHEASTERN MONTANA. *Kelsey Schmidt*, Biological Sciences, Montana Technological University, Butte*

Sin Nombre Virus (SNV) is a type of Hantavirus that is carried by deer mice (Peromyscus maniculatus). When SNV is transmitted to humans it causes a serious, sometimes fatal, illness known as Hantavirus Pulmonary Syndrome (HPS). Most HPS cases are linked to SNV exposure in peridomestic environments, particularly human dwellings and out-buildings such as garages, sheds, or barns. While many studies have examined SNV prevalence and transmission in natural environments, little work has been done in peridomestic environments. The objectives of my study were to determine the prevalence of SNV in deer mice found in the outbuildings of my family's ranch south of Hardin, MT. I used Sherman live traps to capture mice in around ranch buildings for 3 nights each month beginning in August 2018 and continuing until February 2019. Captured mice were ear tagged with sequentially numbered metal fingerling tags and a blood

samples were collected. Blood samples were tested for antibodies reactive with SNV recombinant nucleocapsid protein by an enzyme-linked immunosorbent assay (ELISA). During the course of my study I collected 31 blood samples from 25 different mice captured in ranch buildings. The majority of mice I captured were females (64%) and capture were highest in December. None of the mice I captured tested positive for SNV antibodies.

SCIENCE EDUCATION EXPLORATION. *Terachelle Gregory *, Biological Sciences, Montana Technological University, Butte*

What inspires college-bound people to enter science-related majors? This question is critical to understanding the complex issue of getting more people to go into STEM fields in order for the USA to remain competitive and to advance our economy and society. The objectives of this study was to: explore what variables have influenced undergraduate student's decision to select a science-related major at Montana Tech; gain an understanding of students' attitudes toward K-12 education; examine the influences from K-12 teachers; and explore the level of external support to choose a science major. I hypothesized that studying these influences, along with prior research, would lead to a greater understanding of students who selected a science major as well as reveal ideas of how to support and recruit a diverse group of students for these majors. My research indicates that over half of our responders felt that their K-12 education prepared them for college and that their favorite subject influenced their chosen major. A new understanding could lead to improved techniques in science education in the Montana school systems, including high school and elementary, to engage and interest the students.","K-12 education, science, major, STEM, undergraduate

METAGENOMIC VS 16S DNA SEQUENCING FOR IDENTIFYING BACTERIAL POPULATIONS. *Luke Stout*, Software* Engineering, *Montana Technological University, Butte*

Next Generation Sequencing (NGS) technology has launched immense growth of DNA sequence databases, paving the way to better categorize the genetic diversity of the biosphere. Bioinformaticians curate and analyze this massive amount of DNA sequence data for applications that range from science and medicine to forensics and commercial ancestry services. The DNA sequences provided by NGS can be analyzed to profile bacterial communities within environmental niches. Experimental approaches for assessing these communities vary widely between labs. Our goal was to compare two common methods to test for cohesion between these approaches' results. We obtained DNA sequences from both metagenomic ("shotgun") and bacterial 16S gene sequencing for five DNA samples (two soil and three human microbiome). We developed a custom software pipeline in conjunction with the program BLAST, processed hundreds of thousands of DNA sequence reads produced by each sequencing method (metagenomic or 16S) and, for each sample, compared the two resulting bacterial profiles. For all five samples, community taxonomic profiles produced from the two methods were distinctly different. Explanations for these disparities may include sampling bias in databases or the reliability of the 16S gene as a species identifier. These results highlight the importance of establishing a common methodology to accurately infer bacterial communities from DNA sequence data.

COMPARISON OF WORDS AND PHRASES USED FOR CATEGORIES IN RISK

ASSESSMENT MATRICES. *Haley Hansen *, Occupational Safety & Health, Montana Tech, Butte*

Occupational safety has moved from a rule-based practice to a progression making use of risk assessments. A core assessment tool in risk assessment is a risk matrix consisting of two or three categories for assessing a hazard. This project addressed the words and used to define the categories of severity, likelihood and exposure frequency.

We identified from literature 16 words for each category and created a 16-page paper survey to obtain numerical ratings of all of the words. After obtaining Institutional Review Board approval, we surveyed senior engineering design courses and an OSH senior course. These courses were selected because the students are likely to be involved in risk assessments during their career. Respondents rated each word on a 100-point rating scale. An initial quality check was performed to identify respondents who made reasonable efforts and understanding to provide a genuine rating. Data from the selected booklets were used to determine the mean and standard deviation of each word. The last phase of the analysis involved Montana Tech Occupational Safety and Health faculty with professional credentials to identify recommended word sets.

We had 82 qualified survey results. The faulty meeting resulted in recommended sets of ordered words of 3, 4, 5 and 6 word-sets for severity, likelihood and exposure. For example, an exposure category we recommend a 4-word categorization of very frequent, frequent, infrequent and very infrequent with mean values of 85, 72, 23, and 15, respectively.