# Mountain Lion Research Day

University of Colorado Colorado Springs
Office of Research

Friday, November 30, 2018

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Featured Luncheon Speakers
12:00-1:00pm ~ Berger Hall

# "Journey of a Faculty Scholar"

Dr. Chris Bell
Department of Communication
Video Presentation

Dr. Kathrin Spendier
Department of Physics

Introductions by Jessi L. Smith, PhD
Associate Vice Chancellor for Research

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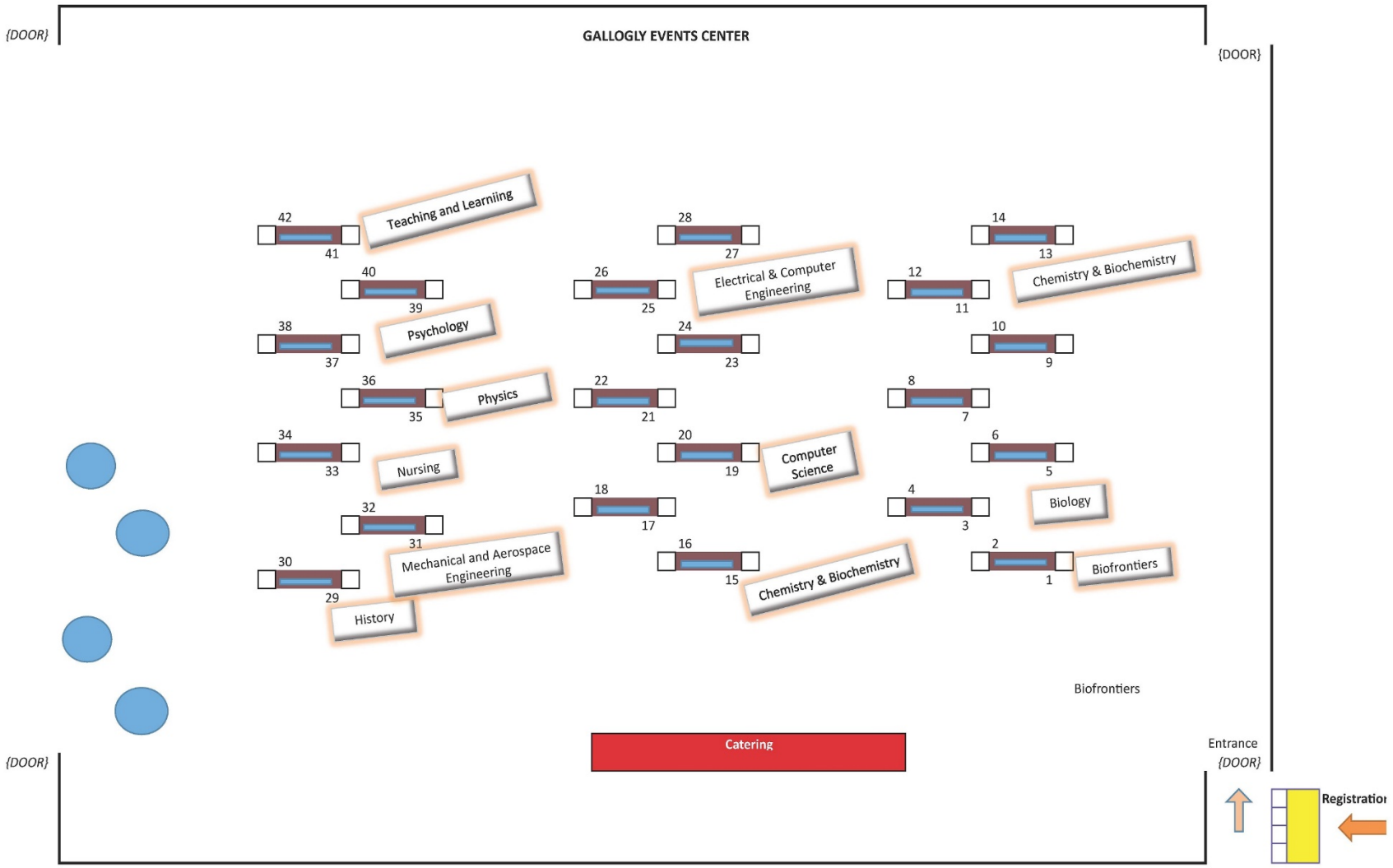
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## BIOFRONTIERS

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| Presenters: | Danielle Morin<br>Dr. Kathryn Spendier | Undergraduate Student<br>Faculty | BioFrontiers Center | BioFrontiers |

Authors: Danielle Morin, Kathrin Spendier, Guy Hagen

Title: Effects of Static Magnetic Fields on RBL-2H3 Cell Degranulation

Abstract: Mast cells are found in various mammalian tissues and release histamine (degranluate) as part of an organism's immunological response to allergen exposure. Histamine is an organic compound which, when released, provokes an array of physiologic responses in mammals, including vasodilation, increased vascular permeability, tissue edema, ecchymosis, and an itching sensation. RBL-2H3 cells, a cancerous cell line derived from rats, degranulate similarly to mammalian mast cells and are frequently used to model degranulation. This study sought to investigate the effects of static magnetic fields (SMFs) on RBL-2H3 degranulation, searching for a non-invasive and non-pharmaceutical mediator of histamine release. Degranulation in RBL-2H3 cells was provoked by an established immunological assay involving IgE antibody and the artificial allergen, DNP-BSA. After overnight IgE priming, degranulation was triggered by exposure to DNP-BSA. RBL-2H3 cells were exposed to SMFs of various strengths and for various durations prior to, and during, degranulation. Our data suggests that RBL-2H3 cell degranulation is affected by both SMF strength and duration of exposure. Specifically, degranulation in RBL-2H3 cells appears to decrease when the cells have been exposed to a magnetic field less than 100mT prior to immune challenge. Based on our data, SMF exposure may provide a therapeutic option for allergic individuals.

## BIOLOGY

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| Presenters: | Garrett Groener<br>Taylor Van-Gundy | Staff & Undergraduate Student<br>Staff | College of Letters, Arts & Sciences | Biology |

Authors: Garrett Groener, Taylor Van Gundy, Cornelius Schneider, Jorg Vogel, Meghan Lybecker

Title: Identification of RNA chaperones in the Lyme disease spirochete

Abstract: Lyme disease is the most prevalent tick-borne disease in the United States of America, with over 300,000 cases reported annually. The spirochete Borrelia burgdorferi is the causative agent of Lyme disease and cycles between a tick-vector and a vertebrate host. Gene expression is highly regulated in the disparate environments of the tick and host and is necessary for transmission to humans. Post-transcriptional gene regulation is known to play an important role in the virulence of many pathogens. However, little is known about posttranscriptional gene regulation in B. burgdorferi. RNA chaperones facilitate RNA-dependent post-transcriptional gene regulation and generally stabilize or destabilize mRNAs. In B. burgdorferi there are few known RNA chaperones including Hfq, Bpur and CsrA. Hfq is a highly conserved RNA chaperone that was first discovered in Escherichia coli. B. burgdorferi has a unique Hfq protein that is necessary for host infection. Recently, we identified over a thousand sRNAs in B. burgdorferi. Surprisingly, less than a third of these sRNAs were dependent on Hfq, suggesting that there are other RNA chaperones in B. burgdorferi. Gradient-sequencing (Grad-Seq) identified a number of putative RNA chaperones in B. burgdorferi. Several of these proteins are currently being examined for RNA chaperone activity.

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| Presenters: | Sarah E. Hetz<br>Michael R. Norton | Undergraduate Student<br>Undergraduate Student | College of Letters, Arts & Sciences | Biology |

Authors: Sarah E. Hetz, Michael R. Norton, Philip M. Batterson, Sachi Rohilla, Dr. Keston G. Lindsay, Dr. Andrew W. Subudhi, Dr. Robert A. Jacobs

Title: Skeletal muscle oxygenation: Revolutionary, non-invasive measures improving our understanding and predictive accuracy regarding endurance performance

Abstract: Exercise physiology canon has long described one's capacity for endurance performance as a product of three variables: maximal aerobic capacity (VO2max), an aerobic / non-aerobic metabolic threshold, and the economy of a given movement. More recently, novel evidence suggests that the capacity for skeletal muscle to utilize oxygen is the single best predictor of endurance performance. Near-infrared spectroscopy (NIRS) is an emerging, cost-effective, technology that allows for the validated measure of skeletal muscle oxygenation, accounting for the balance between oxygen delivery and utilization in skeletal muscle. Accordingly, NIRS shows promise as a non-invasive means of assessing skeletal muscle oxygenation across real-world settings. Purpose: We compared the predictive strength of traditional, widely-accepted physiological variables against measures of skeletal muscle oxygenation in relation to endurance performance. Methods: Fourteen cyclists fitted with NIRS devices performed two subsequent exercise tests to determine aerobic capacities in addition to measures describing individual metabolic thresholds and mechanical efficiencies, followed by a 25km time-trial (TT) to determine endurance performance. Results: Backwards stepwise regression analyses identified the strongest traditional and skeletal muscle-specific variables when describing endurance performance. Skeletal muscle variables exceeded the traditional measures in describing endurance performance ($p < 0.001$, Adj $R2 = 0.751$vs $p = 0.013$, Adj $R2 = 0.535$ respectively). Conclusion: These results demonstrate that measures reflecting the balance of skeletal muscle oxygen delivery and utilization during exercise are superior to long-held classic physiologic measures when predicting 25 km time trial cycling performance.

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| Presenter: | Meera Khatri | Undergraduate Student | College of Letters, Arts & Sciences | Biology |

Authors: Meera Khatri, Colin Anderson, Abhilasha Jain, Crystal Kuzyk, Stefanos Aivazidis

Title: Statin-mediated potentiation of chemotherapeutic toxicity

Abstract: The primary indication for statins is in the reduction and management of hyperlipidemia. However, other evidence shows that statins may have the ability to increase the toxicity of chemotherapeutics within cancer cells by producing antiproliferative, antiangiogenic, and antimetastatic effects on those cells. With the goal of demonstrating that statin therapy can decrease the effective dosage of cytotoxic chemotherapeutic agents, like doxorubicin, we hypothesized that treatment of neuroblastoma cells with the lipophilic statin simvastatin in conjunction with doxorubicin will enhance toxicity and decrease the effective dosage of this tumor killing agent. Utilizing SK-n-AS neuroblastoma cells and employing real-time cell imaging and fluorescent probes, we assessed cell proliferation, necrosis and caspase activation. After determining the toxicity of simvastatin after a 48h exposure, we utilized 10uM as the intervention concentration. Additionally, we found that doxorubicin caused significant cell death at a dose of 2.5uM. Furthermore, when cells were co-treated with both simvastatin and doxorubicin, a significant decrease, from 2.5 to 1uM, in the toxic dose of doxorubicin was observed, indicating that simvastatin was successful in potentiating the toxic effect of doxorubicin. In conclusion, statin treatment was able to potentiate the toxic effect of a known cytotoxic chemotherapeutic agent and this potentiation ability will be tested on other known cytotoxic anticancer drugs with hopes that this treatment paradigm may decrease negative side effects of chemotherapy and enhance quality of life and survival in cancer patients.

| Presenter: | Santana Navarrette | Undergraduate Student | College of Letters, Arts & Sciences | Biology |
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Authors: Santana Navarrette, Jeremy Bono

Title: Investigating the Functionality of Candidate Gene During Reproduction

Abstract: Although research investigating male contributions to reproduction has historically focused on sperm's role during fertilization, more recent studies demonstrate that other male molecules (e.g. ejaculate proteins) play an important role in fertilization success in organisms ranging from insects to humans. Studies have shown that fruit flies transfer hundreds of proteins to females during mating and that some of these proteins have important functional effects. In this study, we focus on one fruit fly protein in particular that has been recently discovered to be transferred to the female reproductive tract during mating: GI11629. Using CRISPR, we functionally disabled the gene that synthesizes this protein, and we conducted a mating experiment to compare the reproductive success of females mated to males both with and without the GI11629 protein. We hypothesized that if GI11629 does play a functional role during reproduction, then females mated to males lacking this protein would show lower levels of reproductive success than females who mate to males that produce the protein. Our data on egg-laying numbers suggest that a strong relationship exists between the presence of the protein and the egg-laying habits of females on a day-by-day basis. Females who were exposed to the GI11629 protein exhibited markedly increased fecundity the day after mating. Given that our data shows that GI11629 influences fecundity, the next step in our research involves investigating whether GI11629 effects overall fertilization rates as well (e.g. how many eggs lead to a viable offspring).

| Presenter: | Andrea Poliakon | Undergraduate Student | College of Letters, Arts & Sciences | Biology |
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Authors: Andrea Poliakon

Title: The RNA-binding Protein Caper Regulates Grooming Behavior in Drosophila Melanogaster

Abstract: Caper is an RNA-binding protein (RBP) that helps regulate alternative splicing, which is critical to gene expression, and has emerged as a critical regulatory mechanism in neuronal development and consequently behavior. Mutations in RBPs can contribute to neurological diseases, including Autism Spectrum Disorder (ASD) and neurodegenerative disorders. Drosophila melanogaster is an excellent model for assessing the genetic regulation of various behaviors. One stereotypical behavior that is often studied to assess neurological function in flies is grooming. Due to previous experimental data collected in the Killian lab, we hypothesized that caper might regulate grooming in adult flies. Due to this, the grooming behavior of caper mutant animals were quantified, as compared to controls. Subjects were observed for three-minute intervals to measure the total time spent grooming and number of grooming sessions. The caper mutants groomed less than controls in total duration and number of sessions under baseline conditions with no stress induction. There was a greater difference in males than females, and all genotypes groomed more frequently with age. To test stress-induced grooming in Drosophila, flies were heat stressed for 30 minutes before trials began. To determine if caper function is specifically required in the nervous system, caper was specifically inactivated in the nervous system using a technique called RNA interference (RNAi). Preliminary data shows that neural-specific caper RNAi recapitulates the phenotype of the caper mutant. Our results confirm that caper regulates grooming behavior.

| Presenter: | Katrina Richardson | Graduate Student | College of Letters, Arts & Sciences | Biology |
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Authors: Katrina Richardson, Casey Dolen, Meghan Lybecker

Title: A novel antisense RNA regulates the expression of the stress response protein Dps in Escherchia coli

Abstract: RNAs have emerged as major regulators of gene expression in both bacteria and eukaryotes. High-throughput sequencing techniques have uncovered a new type of RNA termed pervasive transcripts. Pervasive transcripts occur genome-wide and do not adhere to canonical gene boundaries. Despite the wide-spread occurrence of pervasive transcription, little is known about their function and initially they were considered to be noise. Bacterial genomes are compact, composed of 90% protein-coding DNA. Therefore, most pervasive transcripts are antisense (as) to protein-coding genes. We identified functional asRNAs base-paired to their cognate mRNA in double-stranded RNAs. We identified a dsRNA-dependent antisense RNA opposite the dps mRNA. The dps gene encodes a non-specific DNA binding protein that is important in the cells defense during stressful conditions. Our goal is to understand the molecular mechanism of the as-dps RNA and its regulation of dps expression in E. coli. By elucidating the function of as-dps we hope to gain more knowledge on how antisense RNAs are regulating gene expression in E. coli, which can serve as a model for asRNA gene regulation in other organisms.

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| Presenter: | Meg Super | Undergraduate Student | College of Letters, Arts & Sciences | Biology |

Authors: Meg Super, Brandon Titus

Title: Caper regulates the development of neuromuscular junction and is required for survival during various life stages

Abstract: Disruption of development and maintenance of the nervous system, can lead to a myriad of devastating neurological diseases, such as amyotrophic lateral sclerosis (ALS), Parkinson's disease, and other neurodegenerative disorders. These disorders have been linked to mutations in genes encoding RNA-binding proteins (RBPs). Work in the Killian lab has shown that the RBP and splicing factor Caper regulates development and maintenance of the nervous system in Drosophila melanogaster. Thus, disruption of Caper can have negative developmental, morphological, and behavioral consequences. One proposed morphological consequence occurs in the development of neuromuscular junction (NMJ) in a tissue-specific manner. Based on perturbing caper function in various tissues, including muscle and neuronal tissue, aberrant NMJ morphology is observed between wild-type (WT) and Caper mutant animals, and with animals in which neural-specific caper function is inactivated. Given that development of neuromuscular junctions is important for proper signaling of muscular contractions, it is hypothesized that aberrant Caper function would result in abnormal locomotive behavior in larvae. Another consequence observed involving Caper dysfunction is reduced survivability. Differences in survivability were observed between WT and Caper mutants across multiple life stages of Drosophila. The results of this work provide a clearer understanding of the role Caper plays in neurodevelopment. Although it has yet to be studied in the context of neural function, caper is conserved in humans and across all metazoan. Thus, knowledge gained from our study provides important information for designing therapeutics for neurological diseases and understanding their etiliogy.

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| Presenter: | Ethan Wright | Graduate Student | College of Letters, Arts & Sciences | Biology |

Authors: Ethan Wright, Eugenia Olesnicky Killian

Title: How does the RNA Binding Protein Caper influence behavior and lifespan in Drosophila

Abstract: Neuronal morphology is critical for correct wiring and function of the nervous system. Dysmorphic neurons are directly correlated with many neurodegenerative diseases, including ALS, yet the genetic basis for many of these heritable diseases is not understood. Recently, RNA regulatory mechanisms have increasingly been implicated in myriad neurological disorders. RNA binding proteins (RBPs) mediate RNA regulatory mechanisms, such as splicing. Caper, an RBP and splicing factor, is a candidate gene for studying these processes. Using the Gal4-UAS and RNA interference (RNAi) technologies, we knocked down the levels of caper in a cell type specific manner to understand its role in different tissues. Our research shows that Caper plays an important role in the Drosophila nervous system, and its dysfunction results in significantly reduced lifespan. Our data also show that Caper dysfunction results in increased severity of behavioral phenotypes with age, implicating Caper in the maintenance of neural function during aging. Moreover, while Caper is expressed in muscle, its function in muscle is dispensable for adult locomotor behavior and lifespan. Importantly, Caper is conserved in humans and is active in the nervous system. Nonetheless, nothing is known about the function of Caper within human neurons. Thus, the results of this research have far reaching implications, as they implicate Caper as a novel and fundamental player in neuronal maintenance and function.

# CHEMISTRY & BIOCHEMISTRY

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| Presenter: | Justin Bendesky | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Justin Bendesky | | | |
| Title: | Selective Reduction and Triazole Formation of Dimethyl-2,5-pyridinedicarboxylate | | | |
| Abstract: | Triazole synthesis via Cu-catalyzed azide-alkyne cycloaddition, commonly referred to as a type of "Click Chemistry", has become the preferred method for 1,4-disubstituted 1H-1,2,3-triazole formation, due to its high-yielding and regiospecific outcomes. 2,5-Dimethyl pyridinedicarboxylate was selectively reduced at C-2 by reduction with sodium borohydride, followed by tosylation and azidation to prepare for a click reaction. Terminal alkynes including 1-ethynyl-3-fluorobenzene were used for triazole formation. Products were characterized by spectroscopic methods. | | | |

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| Presenter: | Christopher Clements | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Christopher Clements | | | |
| Title: | Towards the Synthesis of Functionalized Niotrquinoxalines | | | |
| Abstract: | In the continued search for novel drug compounds, the quinoxaline has been pursued due its biological activity, having shown promise as an anticancer, antiviral, antibacterial, and inflammatory and anti-fungal compound. Various synthetic routes have been explored to optimize reaction efficiency to create low yields of various compounds. After traditional methods were used with less than ideal results, nontraditional synthetic methods were attempted. Optimization of these methods is underway to improve efficiency and yields, including the use of various reagents following traditional synthetic routes. Once optimized, these methods will be applied to other synthetic routes and to further functionalize quinoxaline compounds for future applications. | | | |

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| Presenter: | Hannah Maben | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Hannah Maben, Andrew McGrath | | | |
| Title: | The Synthesis of Two Novel p-38α Inhibitors and the Stereoselective Reduction of Pyrazine | | | |
| Abstract: | The synthesis of two novel, potential p-38α inhibitors, bis-1,3-(4,6-difluoro-4-{4-[quinoxalin-2-ylmethoxy]methyl}-1H-1,2,3-triazol-1-yl]pyridin-2-yl) 5-methyl-6-phenylpiperazine-2,3-dicarbonitrile (I) and 2,6-di(5,6-Dimethyl-6,7-dihydro-5H-[1,2,5]oxadiazolo[3,4-b]pyrazin-4-yl)-3,5-difluoro-4-(4-phenyl-[1,2,3]triazol-1-yl)-pyridine (II) were conducted. The syntheses involve several SNAr reactions, a Sharpless “click” reaction, and a mild reduction via sodium borohydride. Upon the synthesis of II, the stereoselective reduction of pyrazines was investigated as well, which afforded dihydropyrazines. | | | |

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| Presenter: | Kevin Stewart | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Kevin Stewart, Allen Schoffstall | | | |
| Title: | Further development of triazole-based fluoropolymers and triazole-based monomers | | | |
| Abstract: | Three novel triazole-based dicarboxylic acids were prepared from corresponding diazides using two different synthetic routes of the copper (I) azide-alkyne cycloaddition, or CuAAC. These compounds will be used in the future in polyamide polymerizations for possible industrial applications. Moreover, two new polytriazole fluoropolymers were prepared using the CuAAC, after the synthesis of a partially fluorinated aromatic dialkyne and a partially fluorinated aromatic diazide was successfully achieved. This polymers show promising thermostability, but preliminary thermogravimetric analysis analysis indicates that polymerization conditions must be optimized as it is likely the polymers are of low molecular weight. Additionally, one of the crude polymers do show promising solvent processibility. | | | |

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| Presenter: | Marissa Trujillo | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Marissa Trujillo | | | |

Title: Substitution of fluorinated 1H-1,2,3-triazolopyridines by secondary amines

Abstract: Fluorinated pyridines are highly tailorable molecules, being particularly susceptible to SNAr reactions. The effect of a triazole substituent on the pyridines and the specific characteristics influencing nucleophilic substitution are described. Piperidine was used as a nucleophile in order to synthesize a potential p38Î± inhibitor. Fluorinated pyridines readily undergo nucleophilic substitution at the 4-position, but there is less known regarding reaction conditions for further substitution. It is shown that not only does nucleophilic aromatic substitution take place readily when the pyridine ring contains a triazole, but the substitution is selective and can therefore be applied more specifically to create novel compounds.

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| Presenters: | Ashley Ward | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| | Sara Rodriguez | Undergraduate Student | | |
| Authors: | Ashley Ward, Sara Rodriguez, Andrew Reckard | | | |

Title: Characterization of the higher order organization of the heterochromatin machinery genes in the nucleus of Neurospora crassa

Abstract: Eukaryotic genomes are specifically compacted and organized within the nucleus, and current research has suggested that this non-stochastic organization may be essential for proper gene regulation. DNA is compacted through the formation of precise loops, which may control intra-chromosomal transcription by bringing distal promoter / enhancer elements in close contact; loop placement may also control long-range inter-chromosomal contacts for proper gene expression. Presently, the dynamics and control of DNA looping, as well as the genetic factors necessary to establish loops, are not well understood. To mechanistically explore the establishment and regulation of intra-chromosomal loops and inter-chromosomal contacts, we utilized the genetically-tractable organism Neurospora crassa. The chromatin of Neurospora has similar properties to that of humans, yet the smaller genome of Neurospora is amenable to the high-throughput chromosome conformation capture sequencing (Hi-C) studies examining short- and long-range chromatin contacts. We have devised a bioinformatics protocol that allows us to examine the specific interactions of any euchromatic locus by mining published Hi-C datasets. We have started to employ this method to examine the genic interactions within the nucleus, which will be confirmed with traditional chromosome conformation capture (3C) methods. Here we present our initial characterization of the organization of several genic loci in the nucleus of Neurospora crassa, which may elucidate mechanisms of transcriptional regulation critical for proper gene expression.

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| Presenters: | David Weiss | Faculty | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| | Pat McGuire | Faculty | College of Education | Teaching & Learning |
| Authors: | David Weiss, Patrick McGuire, Wendy Clouse, Raphael Sandoval | | | |

Title: Clickers aren't enough: Results of a decade-long study investigating instructional strategies in chemistry

Abstract: Studies on the effectiveness of clickers in undergraduate chemistry courses are mixed, and there is disagreement of how to effectively leverage clickers to improve student learning performance. To fill a gap in the research we analyzed three different teaching strategies (two involving clickers) in a General Chemistry I course over a 13-year time period. Student performance outcomes (e.g., midterm exam scores, final exam grades, final course grades, and course drop rates) were analyzed from 1551 undergraduate chemistry students from three groups: 1) students who learned through traditional lecture without clickers; 2) students who used clickers in unstructured learning environments (unassigned groups) within a traditional lecture; and 3) students who used clickers in a structured, collaborative small group format (assigned groups) to solve problems during lecture. ANOVA indicated a statistically significant difference between group 1 (lecture without clickers) and group 3 (clickers in conjunction with collaborative small assigned groups) on all student performance outcomes studied. We also observed a reduction in the percentage of students withdrawing from the course when comparing the traditional lecture group to the groups exposed to clickers.

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| Presenter: | Michael Wheeler | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |

Authors: Michael Wheeler

Title: Towards Understanding the Complement Receptor 2 and Epstein Barr Virus Glycoprotein 350 Molecular Interaction

Abstract: Complement Receptor 2 (CR2) is the obligate human host receptor for the Epstein Barr Virus (EBV). The viral surface glycoprotein 350 (gp350) is known to interact with CR2 on human immune cells, resulting in viral infection. EBV infection results in either, an asymptomatic response as a result of infant infection, or a symptomatic response clinically known as infectious mono resulting from infection later in life. Regardless of when the initial infection occurs, the virus will remain latent in the body until the immune system becomes compromised. This latency has been suggested to be related to many different cancers and diseases. Currently there are no therapies or vaccines against the Epstein Barr Virus. The results we present are the first steps in understanding the molecular interactions required for the infection of immune cells by the Epstein Barr Virus. We have cloned and expressed the two proteins involved in the interaction are working towards collecting data to understand the interaction.

# COMPUTER SCIENCE

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| Presenter: | Ahmed Al Guqhaiman | Graduate Student | College of Engineering & Applied Science | Computer Science |

Authors: Ahmed Al Guqhaiman, Edward Chow

Title: Design Considerations of Underwater MAC Protocols

Abstract: Underwater Wireless Sensor Networks (UWSNs) can be used in environmental monitoring, disaster prevention, oil spill detection, and other applications. Monitoring these environments can avoid man-made and natural disasters, such as the oil spill in the Gulf of Mexico. The primary issue is how to meet applications requirements and allow multiple nodes to transmit and receive data without collisions. With limited capabilities in the UWSNs, designing an efficient underwater communication protocol is very challenging. UWSNs have limited bandwidth, power, memory, high propagation delay, high Bit Error Rate (BER), and unreliable communication compared to wired and Wi-Fi networks. The speed of sound is five order of magnitude slower than the radio wave, which poses a significant challenge to meet real-time applications. An efficient Media Access Control (MAC) protocol must balance between bandwidth and network lifetime as different applications have different requirements. The underwater network architecture plays a key role in designing a suitable MAC protocol. Therefore, increasing or decreasing date rate, total distance, network size, and data size have a different impact on the network performance. There are several ways can resolve these issues, including using multiple transmission channels instead of single channel, multiple communication mediums (e.g., acoustic and optical), and software-based mechanisms instead of hardware-based. All these techniques can benefit UWSNs regarding throughput, delay, Packet Delivery Ratio (PDR), code reuse, and many other aspects.

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| Presenter: | Akshay Raj Dhamija | Graduate Student | College of Engineering & Applied Science | Computer Science |

Authors: Akshay Raj Dhamija, Dr. Manuel Gunther, Dr. Terrance Boult

Title: Reducing Network Agnostophobia

Abstract: Agnostophobia, the fear of the unknown, can be experienced by deep learning engineers while applying their networks to real-world applications. Unfortunately, network behavior is not well defined for inputs far from a networks training set. In an uncontrolled environment, networks face many instances that are not of interest to them and have to be rejected in order to avoid a false positive. This problem has previously been tackled by researchers by either a) thresholding softmax, which by construction cannot return "none of the known" classes, or b) using an additional background or garbage class. In this paper, we show that both of these approaches help, but are generally insufficient when previously unseen classes are encountered. We also introduce a new evaluation metric that focuses on comparing the performance of multiple approaches in scenarios where such unseen classes or unknowns are encountered. Our major contributions are simple yet effective Entropic Open-Set and Objectosphere losses that train networks using negative samples from some classes. These novel losses are designed to maximize entropy for unknown inputs while increasing separation in deep feature space by modifying magnitudes of known and unknown samples. Experiments on networks trained to classify classes from MNIST and CIFAR-10 show that our novel loss functions are significantly better at dealing with unknown inputs from datasets such as Devanagari, NotMNIST, CIFAR-100 and SVHN.

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| Presenter: | Arijet Sarker | Graduate Student | College of Engineering & Applied Science | Computer Science |

Authors: Arjet Sarker, Simeon Wuthier, Sang-Yoon Chang

Title: Anti-Withholding Reward System to Secure Bitcoin Mining Pools

Abstract: Miners are rewarded for processing transactions and generating new blocks in decentralized cryptocurrency systems such as Bitcoin. To reduce the variance of mining, the miners join mining pools to earn a more stable reward income, and the reward earned by a mining pool is shared among the participating miners according to their contributions to the pool. However, the miner-based attacks such as Block Withholding (BWH) and Fork After Withholding (FAW) yields unfair reward advantage to the attacker while pretending to contribute to the victim pool. This paper introduces Anti-Withholding Reward System (AWRS) to prevent FAW and BWH attacks. Implemented only at the pool manager (reducing the implementation/adoption overhead and supporting backward-compatibility), AWRS deprives the incentives for FAW and BWH and reduces the rational attacker to follow the protocol (honest mining) by providing greater reward portion for block submissions. According to our analyses focusing on defending against FAW attack (more advanced than BWH), AWRS completely disincentives FAW attack and makes the optimal attacker behavior to become honest mining regardless of the attacker's computational power capability or its infilltration strategy.

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| Presenter: | Zanyar Zohourianshahzadi | Graduate Student | College of Engineering & Applied Science | Computer Science |

Authors: Zanyar Zohourianshahzadi

Title: Deep Neural Consciousness

Abstract: A deep neural network system that is designed to play the role of the mind of the robot. This learning model collaborates events with different context in order to build a knowledge representation that could be used by the model in order to solve complicated tasks better than any other AI agent or learning model. This mkdel includes Deep Reinforcement Learning as well as neural machine translation and neural object recogtiontion.

# ELECTRICAL & COMPUTER ENGINEERING

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| Presenter: | Keith Alan Davidson | Graduate Student | College of Engineering & Applied Science | Electrical & Computer Engineering |

Authors: Keith Alan Davidson, Dr. Gregory L. Plett, Dr. M. Scott Trimboli

Title: VAMPIRE: Virtual Automated Mechanism for Pursuing Investigations in Redox Electrochemistry

Abstract: The Virtual Automated Mechanism for Pursuing Investigations in Redox Electrochemistry (VAMPIRE) suite is a student-designed and built modular real-time embedded hardware simulator which replicates up to 12 series-connected lithium ion battery cells per module. Simulated cell voltages are used by a Battery Management System (BMS) framework to evaluate prototype algorithms: VAMPIRE produces no power enabling safe operation by remote students and supports BMS application experimentation by simulating a realistic automotive design environment with faulted battery pack operation, heterogeneous cell states, noisy environments, current demand curtailment and multiple drive cycle simulations through serial UART, RS-232 & CAN bus communication and control.

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| Presenter: | Julian Medina | Undergraduate Student | College of Engineering & Applied Science | Computer Science |

Authors: Julian Medina, Jugal Kalita

Title: Comparison of Attention Mechanisms for Natural Language Processing

Abstract: Latest innovations in natural language processing have proposed the strict use of attention mechanisms. Although the sheer variety and volume of work on attention mechanisms have been immense, there has not been an excellent analytical evaluation of all proposed attention mechanisms. To the authors' knowledge, this paper presents the first in-depth analysis, evaluation, and summarization of attention mechanisms used in the previous and current state of the art. This paper provides a springboard for future research to compare.

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| Presenter: | Tanghid Rashid | Graduate Student | College of Engineering & Applied Science | Electrical & Computer Engineering |

Authors: Tanghid Rashid, Dr. Heather Song

Title: Analysis of Biological Effects of Cell Phone Radiation on Human Body Using Specific Absorption Rate (SAR) and Thermoregulatory Response

Abstract: Health and science have reached a point of intersection which has never existed before. In the past several years, a great deal of attention has been paid the health implications of electromagnetic (EM) waves. With the recent rapid increase in the use of cellular phones and long periods of usage of these devices near the human body, public concern regarding potential health hazards due to absorption of EM energy has been growing. One of the dominant effects caused by microwave absorption is a temperature increase. To address these issues, this paper evaluates the average Specific Absorption Rate (SAR) in different human tissues by varying source to antenna distance and radiated power using the ANSYS 3D human body model. For SAR simulations, a planar inverted-F antenna that covers all commercial cellular band was reproduced in High-Frequency Structure Simulator (HFSS). The Pennes Bioheat transfer equation was solved analytically to calculate the long-time exposure effect and temperature rise within these tissues. The results show that regardless of the frequency, if the antenna radiated power is low (less than 125 mW), temperature increase within the human tissues is low; however if the antenna operates at high radiated power (1 W), temperature tends to increase eight and half times compared to that of the low radiated power. The temperature increase in low radiated power was approximately 0.35Â°C. The proposed research provides an understanding of the thermal analysis using the Pennes Bioheat transfer equation, and simulations using the ANSYS 3D human body model.

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| Presenters: | Justin Shaffer<br>Heather Song | Undergraduate Student<br>Faculty | College of Engineering & Applied Science | Electrical & Computer Engineering |

Authors: Justin Shaffer, Dr. Heather Song

Title: Compact Attachable Fractal Antenna for Medical, Military, and Communications Applications

Abstract: Countless electrical applications depend on a reliable antenna to function smoothly. Wireless medical systems, military operations, UAS (unmanned aircraft systems), along with other possible areas would benefit directly from those exhibiting the characteristics of compactness, having low profile, being able to send and receive signals in any direction, and being (re-)attachable to the medium on which they operate. For instance, a system affixed wholly or in part to the arm of an individual could aid in monitoring vital signs of athletes or the elderly, or help locate individuals like wandering children or military personnel. In UAS, different types of antennas could be attached to the hull or wing of an aircraft, serving various purposes. This project aims to accomplish all this using a single universal antenna. To allow a larger spectrum of application, one whose resonance centers around the 2.45 GHz mark in the unlicensed ISM band is preferable. To cover as much atmosphere as possible, a microstrip patch antenna on a substrate such as FR-4 is ideal for this low frequency, generating an omnidirectional pattern. To fit the low profile and compactness requirement, fractal designs are being investigated, which increase the electrical length of the component, making it exhibit the same performance as an antenna of greater size. Lastly, the attachability of the antenna will be achieved making use of hook-and-loop, or "Velcro" material. Prototypes and results are forthcoming.

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| Presenter: | Chiranth Siddappa | Graduate Student | College of Engineering & Applied Science | Electrical & Computer Engineering |

Authors: Chiranth Siddappa, Mark Wickert

Title: Exploring the Extended Kalman Filter for GPS Positioning Using Simulated User and Satellite Track with gps-helper

Abstract: A Python computational tool (gps-helper) for exploring the use of the extended Kalman filter (EKF) for position estimation using the Global Positioning System (GPS) pseudorange measurements. The development was motivated by the need for an example generator in a training class on Kalman filtering, with emphasis on GPS. In operation of the simulation framework both user and satellite trajectories are played through the simulation. The User trajectory is input in local east-north-up (ENU) coordinates and satellites tracks, specified by the C/A code PRN number, are propagated using the Python package SGP4 using two-line element (TLE) data available from Celestrak.

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| Presenter: | Mark Wickert | Faculty | College of Engineering & Applied Science | Electrical & Computer Engineering |

Authors: Mark Wickert

Title: Real-Time Digital Signal Processing Using pyaudio_helper and the Jupyter widgets in the Jupyter Lab

Abstract: The focus of this paper is on teaching real-time digital signal processing to electrical and computer engineers using Jupyter Lab and the code module pyaudio_helper, which is a component of the package scikitdsp-comm, with the author the lead developer. Specifically, we show how easy it is to design, prototype, and test using PC-based real-time DSP algorithms for processing analog signal inputs and returning analog signal outputs, all within Jupyter Lab. A key feature is that real-time algorithm prototyping is simplified by configuring a few attributes of a DSP_io_stream object from the pyaudio_helper module, leaving the developer to focus on the real-time DSP code contained in a callback function, using a template notebook cell. Real-time control of running code is provided by Jupyter widgets. The PC-based instrumentation aspect allows measurement of the analog input/output (I/O) to be captured, stored in text files, and then read back into the notebook to compare with the original design expectations via matplotlib plots. In a typical application slider widgets are used to change variables in the callback. One and two channel audio applications as well as algorithms for complex signal (in-phase/quadrature) waveforms, as found in software-defined radio, can also be developed. The analog I/O devices that can be interfaced are both internal and via USB external sound interfaces. The sampling rate, and hence the bandwidth of the signal that can be processed, is limited by the operating system audio subsystem capabilities, but is at least 48 KHz and often 96 kHz.

# HISTORY

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| Presenter: | Nina Ellis Frischmann | Faculty | College of Letters, Arts & Sciences | History |

Authors: Nina Ellis Frischmann, M.A., Ph.D.c.

Title: Role Playing Games, Movies, and Illustrated Comics, Oh My!: Connecting Students with the Classics Using Popular Culture

Abstract: Join Athena who will visit our panel from the Hellenistic/Roman world to introduce us to some of her favorite Classical remakes. Get students excited by connecting the Classics to modern popular culture:role playing games, movies, and illustrated comics. Ask them to debate Helen of Troy's culpability, recreate Amazonian society with Wonder Woman, and explore the eruption of Mt. Vesuvius with "The Last Days of Pompeii" comics series from Classics Illustrated -- all with a discussion of how the pedagogy supports High Impact Practices (HIPs).

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| Presenter: | Haley Hunsaker | Undergraduate Student | College of Letters, Arts & Sciences | History |

Authors: Haley Hunsaker

Title: Extra! Extra! Read all about it. Contradicting Stories Confuse Historians but One Thing Is For Certain, Floyd Dies.

Abstract: Kentucky cave explorer Floyd Collins became trapped in Sand Cave, January 30, 1925. This story of rescue gained the attention of the nation and beginning what is possibly the first media frenzy. Years after the death of Floyd Collins, songs, musicals, children's books, and other areas of popular culture tell his unique story. This project was intended to tell the story of Floyd Collins aside from his narrative in pop culture. However, with research the contradicting primary and secondary sources shifted the focus. The goal is no longer to tell the historical narrative but is more an exercise is navigating and negotiating primary sources that make up the intriguing and often contradictory narratives of Floyd Collins' life and death. This will be done by comparing newspapers accounts of events at Sand Cave across the nation over decades, as well as analyze the shift in narrative told in pop culture.

# MECHANICAL & AEROSPACE ENGINEERING

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| Presenter: | John Thompson | Undergraduate Student | College of Engineering & Applied Science | Mechanical & Aerospace Engineering |

Authors: John Thompson

Title: Development of ForceTrak, a biomechanical and video tracking application and estimations of anthropometric parameters

Abstract: UCCS Mechanical and Aerospace students have been developing a low-cost video tracking software system for use in biomechanical analysis. This research focuses on the enhancement of this software, its deployment, and use in a simplified approach for estimating individual anthropometric parameters. The tracking system utilizes smart phone camera slow motion capture of 120 or 240 frames per second to track markers placed on the human body. Kinematic parameters and ground reaction forces are estimated using numerical differentiation without the need for expensive force plates. The system then uses an inverse dynamics approach to calculate joint moments and forces for symmetrical body movements. The primary objective of this research was to address occultation and apply inverse dynamics to calculate joint forces and moments. Simple vector geometry was utilized to calculate the position of knee and hip markers during occultation to a high measure of accuracy, broadening the potential application of this software to previously untrackable human movements. Currently tables of anthropometric parameters from cadaver studies are being used to model the human test subjects. A secondary aim of this research is to utilize the video tracking software to provide a quick and easily implemented method for the estimation of individual test subject body segment masses to increase the accuracy of the biomechanical analysis of the ForceTrak software.

# NURSING

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| Presenter: | Jennifer Schwertfeger | Undergraduate Student | Helen and Arthur E. Johnson Beth-El College of Nursing & Health Sciences | Nursing |

Authors: Jennifer Schwertfeger, Jennifer Zohn

Title: Mental Health Apps Provide Supplementary Resources to College Students

Abstract: One in four college students will experience suicidal ideation during their college career. In fact, suicide is the second leading cause of death for Americans aged 15-24-yrs old. The goal of this literature review was to evaluate current mental health apps and to note any benefits they may possess. It was discovered that college students appreciate the versatility and privacy that comes from using mental health apps. However, several researchers have noted that many of the apps do not offer evidence bases practice. Therefore, it is important to view apps as a coping tool and not a way to replace a provider.

# PHYSICS

| Presenter: | Jewell Anne Hartman | Graduate Student | College of Letters, Arts & Sciences | Physics |
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Authors: Jewell Anne Hartman, Hamze Mousavi, Marek Grabowski

Title: Tight-Binding Investigation of Double-Strand DNA-Like Nanowire in Green's Function Formalism

Abstract: The density of states (DOS), band structure, and electrical conductivity (EC) of different configurations of a model of double-strand poly-GC-poly-AT DNA-like nanowire are investigated within the tight-binding Hamiltonian model and Green's function formalism. Four different configurations of double-strand DNA-like nanowire were investigated: infinite, finite, cyclic, and Mobius. The change of behavior in band structure due to introducing dimerization effects of longitudinal hopping terms was studied; without dimerization, the DNA-like nanowire behaves as a conductor, with dimerization, an insulator. This change in behavior was also verified through the calculation of the DOS using Green's function formalism. Finite size effects and the effect of increasing the length of the DNA-like nanowire on EC from the Kubo formula was also studied. A direct relationship exists between EC and length of DNA-like nanowire; as the length is increased, the EC increases. This information can be helpful for both continued theoretical as well as experimental development of molecular electronics based on electronic transport of DNA.

| Presenter: | John Stroud | Undergraduate Student | College of Letters, Arts & Sciences | Physics |
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Authors: John Stroud, Janusz Hankiewicz, Karl Stupic, Tucker Walsh, Noweir Alghamdi, Tim Read

Title: Heating Metallic Implants and Development of Temperature Contrast Agents for MRI Thermometry

Abstract: As the population ages, medical implants are becoming, an ever more common method of treatment. Many patients with implants may require an MRI imaging procedure, thus it is of utmost importance to analyze the effect of imaging on metallic implants for patient safety and comfort. The primary focus of this project is to study eddy currents induced in metallic implants due to switching magnetic fields present in an MRI scanner. Such currents dissipate energy within metallic implants which can lead to an increase in temperature putting patients at risk, due to possible burns. We have found that the power dissipated by eddy currents in metallic objects within an MRI are influenced by two major factors, distance from the bore's center and the strength of switching magnetic fields. These results are of great importance in determining possible sources of danger or discomfort during an MRI procedure. In addition, we investigated the measurement of temperature during an MRI procedure using MgZnAl ferrites which, in the future, we plan to employ to determine temperature of tissue near metallic implants. This also open the way for possible therapeutic uses of heating. Such materials create inhomogeneities in the local magnetic field of an MRI scanner causing distortions which may be related directly to surrounding temperature. Such materials are important in many MRI guided operations in which a physician must be able to determine a patient's internal temperature during the procedure. Hence these endeavors are of great importance in preventing harm to patients undergoing such procedures.

| Presenter: | Alexandra Stuart | Undergraduate Student | College of Letters, Arts & Sciences | Physics |
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Authors: Alexandra Stuart

Title: The stray magnetic field above a magnetic domain wall

Abstract: Magnetic domain walls are tiny regions just a few atoms wide in a magnet that have many important technological applications. In this project, we have found expressions for the stray magnetic field in air that is created above a domain wall in a magnet. The magnet itself is only a few hundred atoms wide and roughly 10 atoms thick. The methods used to obtain these expressions include using Green's function techniques and integrating over the volume of the tiny magnet. We are currently comparing these expressions to other expressions being used in literature. We believe that our expressions use approximations that provide for a more accurate stray field prediction. Our results will impact experiments that image domain walls.

# PSYCHOLOGY

| Presenters: | Nicole Beutell | Graduate Student | College of Letters, Arts & Sciences | Psychology |
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| | Madeline Lag | Graduate Student | | |
| | Jenny Lagervall | Graduate Student | | |

Authors: Nicole Beutell, BS, Rebecca Ingram, BA, Madeline Lag, BA, Jenny Lagervall, BA, & Andrew Lac, Ph.D.

Title: Examining the Impact of Age and Mood on Perceived Worthiness of Healthcare Treatment

Abstract: Ageist beliefs, such as believing older adults are a waste of resources, are associated with negative views towards treating older patients, advocating for reducing funding for governmentally funded healthcare programs, and denying treatment to older adults. Additional research has shown that social stigma of depression is perceived as a normal part of aging and is not a health-related symptom and does not warrant treatment. The purpose of the present study is to examine the impact of age and mood on perceptions of an individual's life worth. The present study will examine the hypothesis that individuals who are older and diagnosed with depression will be perceived as less worthy of treatment. Participants will be asked to read a newspaper vignette about a woman diagnosed with Alzheimer's disease. Conditions will vary by the age of the woman and if she has depression. Approximately 200 participants will be recruited through mTurk, and data will be analyzed using a two-way ANOVA. To the best of our knowledge, previous research has not examined the social perception of life worth in older adults with depression. Therefore, this study will identify potential ageist belief toward older adults that serve as barriers to health care treatment.

| Presenter: | Emily Burmeister | Undergraduate Student | College of Letters, Arts & Sciences | Psychology |
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Authors: Emily Burmeister, Edie Greene

Title: Adversity, Empathy, and Compassion on Pain and Suffering Damages

Abstract: Difficult life experiences have been shown to inspire stronger empathy and compassion, along with a heightened propensity to help others who are in need. However, when a person has previously experienced the same type of adversity as a suffering other, their empathy, compassion, and prosocial behavior for the sufferer tend to decrease, according to recent findings. In the present study, these phenomena are tested within the framework of jury decision making regarding compensation for an injured plaintiff. Specifically, because jurors are given ambiguous directions to determine pain and suffering damage awards, the amounts were expected to be susceptible to the influences of past adversity. In other words, mock jurors who had endured more adversity in general but not the same specific type as the plaintiff were expected to award higher pain and suffering awards. But mock jurors who had gone through a similar trauma as the plaintiff were expected to award a lower pain and suffering award. The results did not support these hypotheses, as there were virtually no relationships between adverse life events, empathy, and pain and suffering damage awards. Future research should incorporate compassion as a measure, and look at variables within and related to adverse life events to better test the prior findings and link them to jury decision making.

| Presenter: | Katalin Grajzel | Graduate Student | College of Letters, Arts & Sciences | Psychology |
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Authors: Katalin Grajzel, Dr. Kelli Klebe

Title: Are UCCS Students Anxious About Statistics?

Abstract: Statistics anxiety is a growing concern among college students worldwide. It affects performance on homework assignments and exams consequently lowering grades and increasing intimidation of statistics classes and instructors (Onwuegbuzie &Wilson, 2003). To examine statistics anxiety and attitudes at UCCS we used the 51-item Statistics Anxiety Rating Scale (STARS; Cruise, Cash & Bolton, 1985). The scale measures four dimensions of statistics anxiety (Test and Class Anxiety, Interpretation Anxiety, Fear of Asking for Help and Fear of Statistics Teachers) and two dimensions of statistics attitudes (Worth of Statistics and Computational Self-Concept).
Analysis of Variance (ANOVA) and t-test statistics were used to examine differences between mean scores on anxiety and attitude dimensions of the STARS and to assess differences between UCCS student scores and scores recorded in studies conducted in the US (Baloglu & Zelhart, 2003), UK (Walsh & Ugumba-Agwunobi, 2002), South Africa (Mji & Onwuegbuzie, 2004), and China (Liu, Onwuegbuzie & Meg, 2011).
Findings for the study are presented and recommendations are given for interventions to reduce student's statistics anxiety.

| Presenter: | Rebecca Ingram | Graduate Student | College of Letters, Arts & Sciences | Psychology |
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Authors: Allison Walden, MEd, Rebecca Ingram, BA, Adrienne Bohlen, BA, Jenny Lagervall, BA, Madeline Lag, BA, & Leilani Feliciano, PhD

Title: Reducing Agitation in Long-Term Care: A Virtual Reality Intervention for Women with Dementia

Abstract: With the rise of the Baby Boom generation, the rates of dementia (or major neurocognitive disorder) in older adults will increase dramatically. Currently, thirty-five million individuals have been diagnosed with some form of dementia, and women in particular have a higher risk of developing some type of dementia. Unfortunately, agitation behaviors often accompany dementia (particularly in later stages of the disease process), resulting in negative consequences for the individual with dementia and nursing staff in long-term care (LTC) facilities. LTC facilities will often rely on pharmacological treatments to manage the behavioral and psychological symptoms of dementia (BPSD), but these medications come with serious side-effects. Studies show that nonpharmacological interventions could be an effective alternative method of moderating BPSD. Specifically, interventions that incorporate sensory stimulation (i.e., a technique that stimulates one or more senses with the goal of reducing agitation behaviors) have had short-term success in treating BPSD. Researchers are starting to realize the potential benefits of virtual reality (VR) technology, but little research has been done that specifically looks at how VR could help reduce BPSD. Using single-case experimental design methodology, this on-going study aims to utilize VR with 3-6 older adults with dementia and agitation to reduce agitation behaviors and improve quality of life. A case example will be presented to illustrate this process.

| Presenter: | Alex Sielaff | Undergraduate Student | College of Letters, Arts & Sciences | Psychology |
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Authors: Alex Sielaff, Thomas Pyszczynski

Title: The Effect of Meditation and Mortality Salience on Defensiveness

Abstract: Research within the construct of Terror Management Theory has shown that mortality salience inductions increase defensiveness whether its in the form of prejudice or intergroup bias or worldview defense. Meditation is a practice in observation without judgment or reactivity. As such, researchers predicted a brief mindfulness meditation would reduce defensiveness following a mortality salience induction. It was also predicted that the meditation would eliminate the death-thought suppression usually found immediately after a mortality salience induction. The interaction effects of meditation and mortality salience on defensiveness and death-thought accessibility were not significant; however, a trend of the main effect of meditation on defensiveness was found.

# TEACHING & LEARNING

| Presenters: | Breanna Herron<br>Pat McGuire | Undergraduate Student<br>Faculty | College of Education | Teaching and Learning |
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Authors: Breanna Herron, Pat McGuire

Title: Booked on Math

Abstract: Story books are a widely used teaching tool in early childhood classrooms to support young children's learning. Despite the fact that story books are commonly used to develop language and literacy skills in young children, many teachers do not fully capitalize on opportunities to introduce and teach foundational math concepts through story book readings. In this research project we explored how ten purposefully selected book readings can be leveraged to teach mathematics concepts to pre-kindergarteners (children ages 3-5). This three-phase research project involved five teachers and approximately one hundred pre-kindergarten students at the UCCS Family Development Center (FDC). In phase 1, ten story books were selected from sources such as the National Association for the Education of Young Children recommended book list. Second, supplementary instructional materials were developed to be used by classroom teachers in conjunction with the book readings. Book readings and instructional resources were implemented into four pre-kindergarten classrooms (a fifth classroom served as the control group and did not receive the intervention). A pre-post analysis of student learning outcomes is currently being conducted using a nationally normed assessment, Teaching Strategies GOLD in the domains of (1) number and operations, (2) patterns and algebra, (3) geometry and spatial relations, (4) measurement, and (5) data analysis and probability. Student data will be compared between the control group and treatment groups to measure the effects of the Booked on Math intervention. Finding and implications, including opportunities for scale up efforts, will be discussed.

The Office of Research would like to thank the Bachelor of Innovation program and our BI team. Chris Breuer, Ben Dolph, Darian Hill, Braden Sherfy, and team lead Hayden Sinchak were all important contributors to this year's marketing and preparation for Mountain Lion Research Day. They helped create marketing materials, advertisements, a social media presence, and a new website design for our department. We would like to thank them for their efforts this year, and for laying a foundation for future MLRD marketing teams to build on.


Left to right: Ben Dolph, Braden Sherfy, Hayden Sinchak, Chris Breuer, Darian Hill

# Addendum

## CHEMISTRY & BIOCHEMISTRY

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| Presenter: | Andrew T. Reckard | Undergraduate Student | College of Letters, Arts & Sciences | Chemistry & Biochemistry |
| Authors: | Andrew T. Reckard*, Sara Rodriguez*, Ashley Ward*, and Andrew D. Klocko<br>*equal contribution | | | |
| Title: | Characterizing the genome organization of Neurospora crassa at high resolution | | | |

Abstract: Recent technological advances have allowed researchers to explore the organization of genomic DNA in the nucleus. Multiple studies from many labs in several model organisms have shown DNA makes non-stochastic contacts that appear to be critical for short-range DNA compaction and long-range gene regulation. Chromosomes are organized into local loops of DNA termed Topologically Associated Domains (TADs) that appear to be both structural and regulatory in nature. Long range promoter-enhancer contacts that are critical for proper gene expression have also been described. However, researchers are just "scratching the surface" in understanding the contacts that form and how these contacts change under different environmental conditions or genetic backgrounds. In a previous characterization of the chromosome conformation of the filamentous fungus Neurospora crassa, researchers found that silent (heterochromatic) regions of the genome strongly interacted to form a "heterochromatin bundle" with active (euchromatic) genomic regions looping out (Galazka*, Klocko* et al., 2016 Genome Res). However, much remains unexplored, including characterizing specific short- and long-range regulatory contacts that may be made by Neurospora genes at a high resolution. Here, we present our initial efforts to characterize the Neurospora crassa genome organization at a high resolution to more thoroughly understand short- and long-range DNA compaction. By using a more common restriction enzyme (DpnII) and obtaining greater sequencing depth, we have obtained Hi-C heatmaps with a higher resolution than the previously published data. In addition, we have applied the advances in Hi-C technology, namely in situ ligation, in these datasets, which may more accurately reflect long-range contacts in the genome.

# NOTES

# The History of

# MOUNTAIN LION RESEARCH DAY

**Mountain Lion Research Day began in 2009. At that time there were two major objectives for the Mountain Lion Research Day:**

1. **To allow UCCS faculty and students to become better acquainted with the research being conducted by faculty and students at the University with the hope of stimulating cross-campus collaborations.**
   **and**
2. **To introduce potential partners in the Pikes Peak region to the research happening at UCCS. As a "regional" university, it was beneficial for UCCS researchers to engage with entities in Colorado Springs.**

**UCCS has continued to be important to the future growth of Southern Colorado in many ways, not the least of which is by being a vibrant research university providing support for the companies who are already here or who may relocate here.**

**Mountain Lion Research Day has become a showcase of projects across the University of Colorado Colorado Springs. The idea for Mountain Lion Research Day came from Dr. Michael Larson, who at the time was the Associate Vice Chancellor for Research and Innovation. EPIIC (El Pomar Institute for Innovation and Commercialization) and the Office of Research co-sponsored the event for several years.**

**Faculty and students across the university submitted abstracts and then prepared poster presentations to document the research work being done. Those poster presentations have remained the focal point for Mountain Lion Research Day held once a year in the fall semester on the UCCS campus; it was formerly held each spring.**

**The first MLRD was held in The Lodge where around 80 participants showcased their research. Mountain Lion Research Day quickly outgrew the Lodge and then moved to what is now Berger Hall. Outgrowing that space, Mountain Lion Research Day is now held in the Gallogly Events Center. Mountain Lion Research Days have also featured a keynote speaker who has presented his/her research information during a luncheon provided to MLRD presenters and guests.**

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