Mountain Lion Research Day

University of Colorado Colorado Springs

Office of Research

Berger Hall, UCCS Campus

Friday, December 13, 2019

8:30 - 11:30 A.M.

Award Presentations will begin at 11:00 A.M.

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Welcome

At UCCS we know that students are more successful when they participate in research, scholarship, and creative works. Research is a high impact practice that prepares students for the workforce, to pursue an advanced education, and to engage as informed citizens. Armed with what it means to analyze, create, innovate, and discover, UCCS students are able to draw from their deep well of knowledge to adapt to the latest advancement, bend in the face of obstacles, and thrive under whatever chaos comes their way. Indeed, it is the faculty-student-research relationship that fills up that deep well with profound student learning. Faculty expertise is the foundation of our university.

During the past decade, UCCS has experienced tremendous growth in enrollment, course offerings, and campus facilities. It is thus no surprise, that in 2019, UCCS was classified as a "High Research Activity" university by the Carnegie Foundation. UCCS takes pride in being the only higher education institution in Southern Colorado that explicitly includes "research" as part of its mission. Our thriving UCCS research community is dedicated to continued discovery, innovation, and creativity.

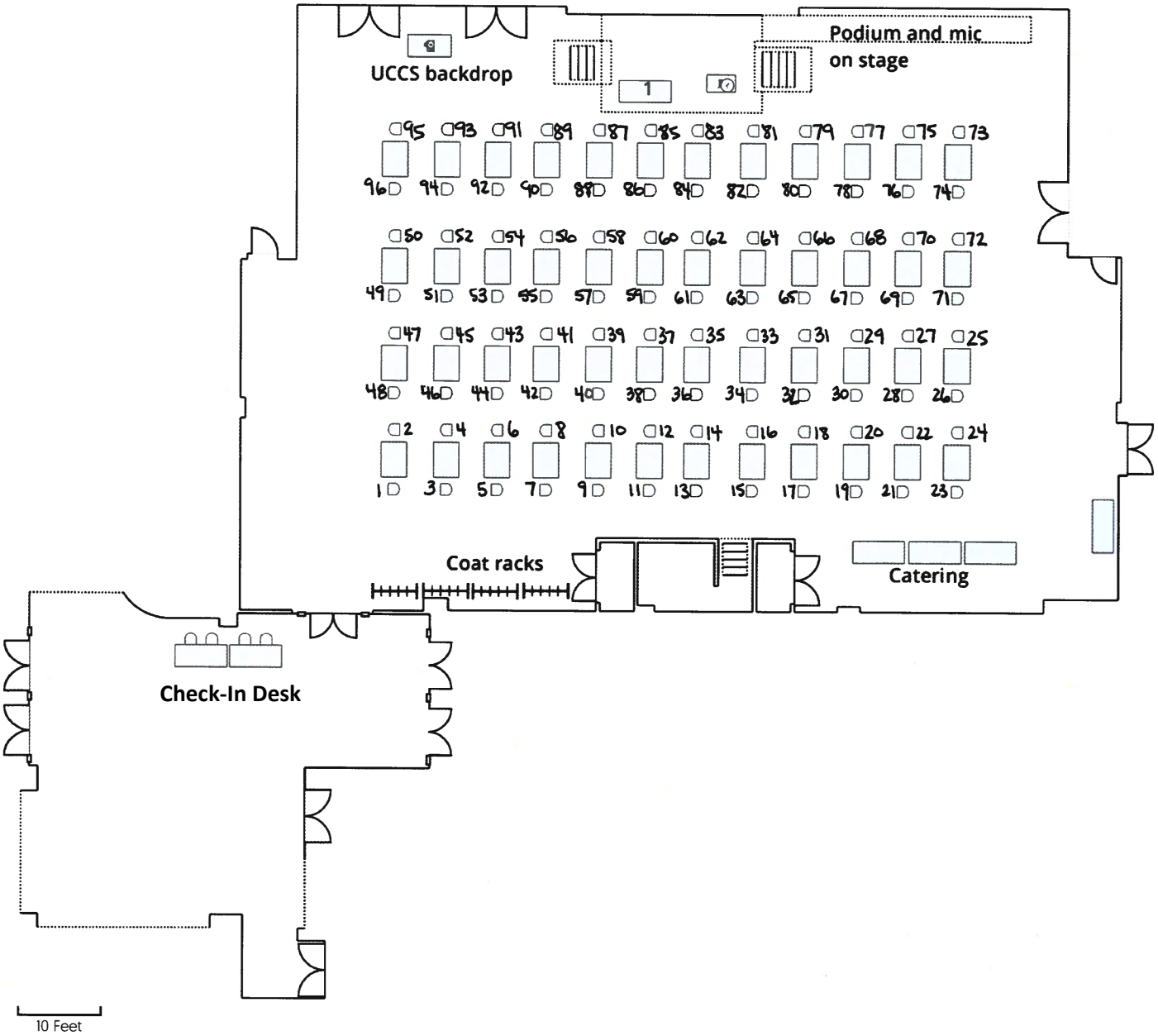
Thank you for joining us today at the 11th annual Mountain Lion Research Day. Today is not just about the research, it's also about sharing the same passions and connecting with each other as we strive to enrich our culture with knowledge and understanding. You are a valued member of our UCCS Research Community.

Jessi L. Smith, Ph.D.

Associate Vice Chancellor for Research

Follow the UCCS Office of Research on Instagram @OOR_UCCS or visit our website for events, workshops, and opportunities at uccs.edu/research

BERGER HALL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BIOFRONTIERS

Presenters:	River Gassen	Undergraduate Student	BioFrontiers Center	BioFrontiers

Authors: River Gassen, Kathrin Spendier

Title: Optical Imaging of Magnetic Particle Oscillation in High Viscosity Fluids

Abstract: The purpose of this experiment is to study the oscillation of nanoparticles in fluids of different viscosities. The investigations have practical applications to the medical field, specifically drug delivery through high viscosity fluids like mucus. Magnetic barium hexaferrite (BaFe12O19) and iron oxide (Fe3O4) particles were suspended in distilled water or various glycerol concentrations. The mixtures had a concentration of 2.50mg/ml for the BaFe12O19 and 1.00mg/ml for Fe3O4. Magnetic particles were exposed to oscillating or rotating magnetic fields and imaged with an optical microscope. Time-varying magnetic fields ranging from 10Hz to 180Hz are created by pairs of home-made wire coils that insert into the microscope. Magnetic field amplitudes can be varied from 0-12 mT. The resulting measured frequency of the particle oscillation equaled the drive frequency when the drive frequency was less than half the frame rate. For high viscosity fluids, higher magnetic field strength was necessary for particle motion. Further investigation will need to be done to determine how the viscosity, particle size, and drive frequency impact the movement of the particles, going from oscillating at the driving frequency to no particle motion.

Presenters:	Viktoriia Savchuk	Graduate Student	BioFrontiers Center	BioFrontiers

Authors: Viktoriia Savchuk, Anatoliy Pinchuk, Nicholas Jenkins

Title: Particle-substrate interactions in the laser deposition process

Abstract: Laser direct write of metal structures is a powerful method of micro and nanofabrication that has multiple potential applications in manufacturing of RF tags, biosensors, wearable electronics, LED etc. Understanding the physics underlying the laser induced deposition process is of paramount importance for further advancing this method of microfabrication. We introduce a novel approach of combining traditional DLVO theory with the laser-induced dipole-image dipole forces and show that the laser induced dipole interaction can reduce the repulsion potential barrier for a particle near a substrate and create favorable conditions for the deposition of metal nanoparticles onto the substrate.

BIOLOGY

Presenters:	Michelle Anthony	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Michelle Anthony, Alexander Mitchell, Kyle Kosinski

Title: Snowmelt Timing Effects on Insect Community Diversity and Composition

Abstract: Snowmelt depends on the release of heat and the temperature of the earth's atmosphere. Snowmelt can be water or ice and is an important part of the annual water cycle. Snowmelt is happening earlier and earlier each year. Timing of loss of snow cover can affect insect phenology and abundance. Insects use the environmental conditions such as temperature as clocks for when life cycle events should take place.

We sampled insects using sweep netting from 20 populations along a gradient of snowmelt timing in 2018 and 2019. The insects were identified by insect order using a dissecting microscope. Regardless of snowmelt date, most of the insects collected belonged to the order Hemiptera (True Bugs).

The sweep netting populations that have been analyzed and compared show a very similar diversity and composition though the overall population of insects have declined. This indicates that there may be no snowmelt timing effects on insect community diversity and composition.

Presenter:	Cody Bridgewater	Graduate Student	College of Letters, Arts & Sciences	Biology

Authors: Cody Bridgewater

Title: Removal of the Rad26ATRIP HEAT domain results in constitutive activation of Rad3ATR in fission yeast

Abstract: Schizosaccharomyces pombe is used to model eukaryotic cell cycle regulation. Of the genes in S. pombe approximately 70% share homology with human genes, making this organism an excellent model to study pathways that regulate cell cycle transitions. One such pathway is the S-phase checkpoint pathway. Central to this pathway is the ATR/ATRIP complex, which transduces the presence of damaged DNA and stalled replication forks to downstream effectors that delay entry into mitosis. ATR (ataxia telangiectasia and Rad3-related protein) is a PI3-related kinase that requires ATRIP (ATR Interacting Protein) for kinase activity. The complex is a tetramer, containing an ATR dimer and an ATRIP dimer. Structural studies suggest that a series of alpha helices called HEAT repeats present in the C-terminal part of ATRIP binds ATR dimers and is therefore important for tetramer formation. The function of the tetramer for S-phase checkpoint regulation, however, is not currently known. Here, we tested the function of the Rad3ATR/Rad26ATRIP checkpoint tetramer of S. pombe. To disrupt the Rad3ATR/Rad26ATRIP tetramer, the CRISPR/Cas9 gene editing tool was used to remove over 95% of the Rad26ATRIP HEAT domain. We report that this resulted in constitutive activation of the Rad3ATR kinase because the cells delayed mitosis in the absence of DNA damage. Our data suggest the tetramer is somehow autoinhibitory to Rad3ATR activity.

Presenter:	Jeffrey Callan	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Jeffrey Callan, Jeremy Bono

Title: Investigating the functional significance of two Drosophila arizonae genes and their role in fertility

Abstract: Sexual reproduction can be quite complex; especially in organisms who fertilize internally. For fertilization to transpire successfully, an array of exceedingly intricate molecular interactions must first take place between the male ejaculate and female reproductive tract. These interactions are essential for proper sperm migration, storage, and maintenance — among many other processes. The male ejaculate is comprised of a heterogeneous composite consisting of sperm, proteins, and other macromolecules. It is known that sperm and proteins play a vital role in influencing fertility; however, other components, within the male ejaculate, may also play a role in fertility. Therefore, our research investigates the functional significance of RNA, found within the male ejaculate, and its role in fertility. Previous studies have identified several candidate genes, within the Drosophila mojavensis/D. arizonae study system, that suggest involvement in mediating reproductive outcomes. In this study, we look to investigate two candidate genes — gi11629 and gi19546 — and whether they play a functional role in fertility.

Presenter:	Annaliese Calzadilla	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Annaliese Calzadilla, David Doran, Anh Nguyen, Christine Biermann, Hans Wagner

Title: Analysis of Perfluorinated Compound Presence and Impact on Tree Growth in the Fountain Creek Watershed

Abstract: Perfluorinated compounds (PFCs) are a category of chemicals that are common ingredients in a variety of substances used by consumers, such as waterproof fabrics and fast food wrappers. PFCs are persistent compounds that bioaccumulate within environments and are connected with negative impacts on human health. A concern regarding PFCs in the Colorado Springs and Pueblo region rose after approximately 150,000 gallons of water containing PFC fire suppressant foam were introduced to the Fountain Creek watershed in October 2016. The ecological impacts of this spill on the watershed are unknown. We are investigating the presence and impacts of PFCs in leaf samples obtained from three different tree species at two test sites. These locations were selected based on the previous investigation of PFC levels in the water, soil, and stream sediment. Fountain Creek was the primary site where the acute contamination occurred, and Monument Creek flows into Fountain Creek and represents chronic background levels of PFCs. The sample population consists of three trees for each species at two sites totaling 18 trees. A sample of leaves collected from each tree will be chemically analyzed to quantify the PFCs. Other leaves are being analyzed for traits such as leaf length, leaf shape, leaf area, leaf density, and petiole dimensions. Wood cores were extracted from a set of cottonwood trees to obtain tree ring data to analyze tree growth. These cores will be used to quantify annual growth before and after the spill year at both sites.

Presenter:	Nathan Dee	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Nathan Dee, Jeremy Bono

Title: The Role of a Drosophila arizonae Male Reproductive Gene in Fertility

Abstract: Speciation of two closely related populations results from an accumulation of reproductive isolating barriers that prevents gene flow. Postmating-prezygotic (PMPZ) isolation is a subset of these isolating barriers that drives speciation through incompatible genetic and molecular interactions between male ejaculate and the female reproductive tract. In order to understand how these interactions effect fertility previous studies have investigated sperm and male accessory proteins (Acps), however; recent findings have identified RNA transcripts transferred to females during copulation. We are in the process of investigating candidate gene GI20219 which has been shown to be transferred as RNA during copulation in Drosophila arizonae. The first step is to determine whether the gene is involved in fertility within the species. We will be conducting a mating experiment within D. arizonae by crossing females with either a wildtype or knockout male and comparing the number of larvae to hatch on 3 different days following copulation. The CRISPR/Cas9 system was used to generate knockouts and fragment analysis is being used to identify mutations.

Presenter:	David Doran	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: David Doran, Anh Nguyen, Tim Artlip, Philipp Welser, Amy Klocko

Title: CRISPR-mediated gene editing of two AGAMOUS-like genes in domestic apple

Abstract: The AGAMOUS (AG) gene is a C-function, homeotic, floral organ identity gene. The AG gene is responsible for the formation of stamens and carpels and the prevention of indeterminate growth of the meristem. Previously, the process of RNA interface (RNAi) was used to simultaneously reduce fertility and suppress two AG-like genes in apple trees (Malus domestica) to produce trees with “double flowers”. Compared to RNAi, CRISPR-Cas9 is a more efficient and precise process that alters genotypes to give loss of function mutations. CRISPR-Cas9 is a method that uses a nuclease, Cas-9, to cut target DNA sequences determined by a guide RNA with complementary bases; The damaged portion of the DNA sequence is repaired which can introduce mutation(s). Malus domestica is known to contain two AG genes but their degree of functional overlap has yet to be determined. The CRISPR method will be used to determine the effects that altering regions of the AG genes will have on floral form and development. Four CRISPR constructs designed to target various portions of the AG genes were used to produce 44 transgenic sequences for each of the two apple cultivars of interest. The transgenic lines obtained have been sequenced and will be analyzed to determine changes that have occurred to the original target sequences. Future work will include analysis of vegetative growth and floral form.

Presenter:	Allie Hall	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Allie Hall

Title: RNA Chaperone ProQ, and antisense mediated RNase III interactions, tag-team the regulation of the DNA Protection Protein DPS.

Abstract: What is the function and molecular mechanism of the antisense RNA, asdps, in Escherichia coli?

Throughout all kingdoms of life, regulatory RNAs have been shown to be important in the modulation of gene expression. High-throughput sequencing techniques have uncovered a class of RNAs that are transcribed opposite to protein-coding RNAs, termed antisense RNAs (asRNAs). Initially these asRNA were deemed non-functional and transcriptional noise despite their wide spread occurrence within the genome. We hypothesize that antisense RNAs regulate their cognate gene expression through an RNA double-strand dependent mechanism. We identified an endoribonuclease III dependent antisense RNA, termed asdps, opposite to the dps mRNA. asdps was found complexed in a double-stranded RNA form, with the dps mRNA. Moreover, we found that dps mRNA is bound by the RNA chaperone ProQ. We demonstrate that Dps protein levels are regulated by the asdps, RNase III and ProQ. Currently we are elucidating the molecular mechanism of asdps regulation of the dps mRNA that is mediated through RNase III cleavage and ProQ binding. This mechanism will allow insight into asRNAs gene regulation in E. coli, serving as

Presenter:	Kyle Kosinski	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Kyle Kosinski, Maria Mullins, Jim Den Uly, Emily Mooney

Title: Stability of Ant and Insect Diversity Along An Elevational Gradient

Abstract: Insect populations are in the midst of global decline. One key factor that may affect abundance in Colorado is snowpack. We sampled insects and ants from 20 different sites ranging in elevation in 2017 and 2018, years with varying snowpack. Specimens were classified by Order and species using a microscope and dichotomous keys. We performed statistical analysis using R package 'vegan' on richness, evenness and abundance. We found light and elevation to be critical factors affecting insects and ants, but these patterns between the two years had strong effects on family and species abundance and diversity.

Presenter:	Amelia McKenzie	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Amelia McKenzie, Wendy Haggren

Title: Colorful Sea Anemone Proteins Expressed in Bacteria

Abstract: Some species of sea anemones, relatives of jellyfish, exhibit an array of beautiful colors due to proteins expressed from genes encoded in their genomes. Our laboratory has taken advantage of recent work in which the DNA sequences of several sea anemone chromoprotein genes have been modified to be more recognizable to bacteria. The selected genes were cloned into two bacterial expression vectors, pGEX-5X1, containing the peptide tag GST, and our modified version in which the DNA for GST was deleted. We show that we can induce a bright magenta-pink color in a standard strain of E. coli using pGEX-5X1, while we see a pale pink color in cells carrying the modified vector.

Presenter:	Kacie Quigley	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Kacie Quigley, Mauricio Soriano, Abbey Swift, Emily Mooney

Title: Riparian Insect Diversity Along a Gradient of PFC Contamination

Abstract: Despite risks to human health, polyfluorinated chemicals (PFCs) are used in many industries and consumer products (1). In Colorado Springs, their use in firefighting foams has resulted in contamination within the Fountain Creek Watershed. We sought to examine the effects of PFCs on plant and arthropod communities in the Watershed riparian systems. We sampled arthropods from woody and herbaceous vegetation at 18 sites within the Fountain Creek Watershed. We identified individuals to insect order using a dissecting scope and we calculated diversity indices of arthropod samples using the vegan package in R. Insects in the order Diptera were most abundant across sites. We found that both the order diversity and evenness of the riparian communities showed a decline as the sampling gradient neared PFC contamination. This indicates that PFC contamination has a negative effect on insect biodiversity.

Presenter:	Brandon Titus	Graduate Student	College of Letters, Arts & Sciences	Biology

Authors: Brandon Titus, Brandon Goldstein

Title: The RNA-binding protein Caper functions in development of motor neurons in Drosophila melanogaster

Abstract: Motor neurons are the neurons responsible for sending signals to the muscles, prompting contraction. When motor neuron development or maintenance is disrupted, debilitating motor neuron diseases including spinal muscular atrophy (SMA), amyotrophic lateral sclerosis (ALS), and Parkinson's disease can result. Recently, RNA-binding proteins (RBPs) have been implicated in proper neuron development. RBPs are critical for post-transcriptional gene regulation. When the function of RBPs is disrupted, this can lead to dysregulated expression, which can disrupt cellular function. Recent research in the Killian lab has demonstrated that the RBP and alternative splicing factor Caper is a promising candidate gene for the development and maintenance of motor neurons in Drosophila melanogaster. Our data suggest that loss of Caper function results in aberrant morphology of larval neuromuscular junctions (NMJs), the synaptic link between motor neurons and muscle tissue. Our results show that Caper functions presynaptically, both in the neuron and glia, to develop proper neuron morphology including the number of synaptic boutons, axon branch length and branch number. However, Caper functions to a lesser extent postsynaptically, in the muscle, where it regulates axon branch length of a specific subset of motoneurons. Our research supports the hypothesis that Caper is necessary for proper development of motoneurons in Drosophila. Aberrant motor neuron morphology could result in aberrant locomotive behavior. Thus we are examining whether caper deficient larvae show locomotor defects. As Caper is an ortholog to the human RBP RBM39, further research into the function of Caper in the development and maintenance of motor neurons could provide insight into the development of treatments for motor neuron disease.

Presenter:	Erika Tixtha	Graduate Student	College of Letters, Arts & Sciences	Biology

Authors: Erika Tixtha, Eugenia Olesnicky Killian

Title: The RNA Binding Protein Caper Regulates Germline Development and Fecundity

Abstract: A foundational principle of evolution is that individuals capable of reproducing primarily within a population will be the most reproductively fit, and their genes will persist in subsequent generations. Fertility is therefore central to the survivability of all species, and mutations that decrease it often prevent their own proliferation. We have found that mutations in the gene caper, which encodes an RNA-binding protein that is involved in splicing, are associated with neurological defects in Drosophila melanogaster, and that fertility may be compromised in caper deficient animals. Interestingly, RNA binding proteins are often utilized in the development of both germline and neuronal cells, suggesting that common RNA regulatory mechanisms may be utilized by these very different cell types. Thus, experiments are being undertaken to examine egg production and viability, as well as germline development in caper mutant animals. Our results have shown that caper mutant females lay fewer eggs, which have reduced viability when compared to those of control females. We have additionally begun subsequent studies to compare the ovaries of caper mutants and control females to determine whether they differ in the number or structure of their ovarioles. Future work will focus on determining the molecular basis of these phenotypes and their similarities to caper mutant neural phenotypes. These studies will afford a greater understanding of the function of caper as a whole, and will help shed light on the common RNA regulatory mechanisms utilized by two distinct cell types.

Presenter:	Yvonne Weissbarth	Undergraduate Student	College of Letters, Arts & Sciences	Biology

Authors: Yvonne Weissbarth

Title: FMRP is required for transport and translation of RNA in developmental myelination by oligodendrocytes

Abstract: Fragile X is the leading heritable cause of Autism Spectrum Disorder, with patients exhibiting both neurological and myelin deficits. These deficits ultimately result in intellectual and developmental disabilities. Fragile X is caused by a mutation in FMR1 that results in the loss of expression in RNA binding protein, FMRP (Fragile X mental retardation protein). Although historically Fragile X has been studied as a neurodegenerative disease, myelin deficiencies implicate Oligodendrocytes in facilitating this diseased state. Myelination by oligodendrocytes in the central nervous system (CNS) is essential for the insulation of axon and modulating the speed of action potentials. Because myelin is critical for neuronal activity, plasticity and proper cognition; any abnormalities in the normal development of myelin may lead to disruptions in learning and memory characteristic of Fragile X Syndrome.

FMRP is one molecular mechanism for regulating sheath growth. However, it is unclear exactly how FMRP promotes growth. By examining in vivo mechanisms of FMRP in the central nervous system of zebrafish; I will further illustrate how FMRP facilitates myelin growth by transporting and locally translating RNAs within myelin sheaths. The current data indicates FMRP selectively regulates mRNA transcript abundance and expression of specific proteins critical for proper myelination.

CHEMISTY & BIOCHEMISTRY

Presenter:	Justin Bendesky	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Justin Bendesky, Allen Schoffstall

Title: Chemoselective Reduction of Diesters

Abstract: The chemoselective reduction of diesters is relatively untouched branch of synthetic organic chemistry. These reactions were the main goal of a project stemming from the preparation of triazole esters and the selective reduction of a single ester. Preparation of monoesters from diesters classically requires more extensive chemical preparation. Some esters will be more susceptible to reduction when adjacent to some electron withdrawing groups. Here, a novel approach to the selective reduction of reduction of 2-nitrodimethylterephthalate and dimethyl 2-(acetylamino)terephthalate afforded methyl 4-hydroxymethyl-3-nitrobenzoate and 2-acetylamino-4-hydroxymethyl-benzoic acid methyl ester respectively with the use sodium borohydride was achieved as predicted by our electronic considerations.

Presenter:	Ben Foronda	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Ben Foronda, Kevin Tvrdy

Title: Computational Modeling of Fate and Transport of Perfluorinated Compounds Contamination with Generic Environmental Model

Abstract: Perfluorinated compounds (PFCs) were part of contamination in the 1970s due to the usage of fire foam within the city of Colorado Springs. With some known negative health effects and observed higher concentrations above EPA recommendations in Colorado Springs, it was necessary that observation for concentrations and keeping awareness for the continual spread was to occur. This study focuses on modeling chemical contamination for the estimation and trend observation for the spread of PFCs in the area. A common method for observation of chemical contamination called fate and transport within the program Generic Environmental Model (GEM) was used to simulate chemicals within the environment. The method included the usage of compartmental based modeling. Prior analytical data collected from samples were used in this study for a baseline in the simulation and allowed the comparison and greater accuracy of results. Now, current results indicate the possibility of estimation for original contamination concentration and determination of future contamination sites.

Presenter:	Madison Fox	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Madison Fox, Dr. James Kovacs

Title: Enzymatic Bioremediation of Perfluorinated Compounds

Abstract: High levels of toxic contamination of perfluorinated compounds, PFC's, found in the Southern Colorado Springs Metro Area have been measured in drinking water and degraded in organisms found in chemical spill areas. They have been known to cause significant health effects in exposed populations. Methods such as filtration and carbon sorption are ineffective and expensive, so alternative methods are needed to remove them. A method of bioremediation was proposed to deflourinate PFC's using enzymes genetically designed to degrade these per-halogenated compounds. A polymerase chain reaction was used to amplify a strand of template DNA with attB specific primers, followed by a BP Recombination reaction into an antibiotic-resistant entry clone. The transformation of competent E. coli cells resulted in some colony growth, in which they should contain an antibiotic-resistant plasmid. These have then been tested using colony PCR to confirm the target gene. An LR reaction was performed to express the enzyme.

Presenter:	Whitney Herring	Graduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Whitney Herring

Title: Establishing the HIV Reservoir: the Role of Complement

Abstract: Current HIV therapeutics target all stages of HIV's life cycle, except the establishment of an infectious reservoir. This has yet to be targeted as how this reservoir is established has not been elucidated. Previous research indicates that the reservoir may be established using components from the complement system. We believe this establishment involves interaction between complement receptor 2 (CR2) and HIV's envelope glycoprotein, specifically gp120. Understanding this interaction and what other proteins are involved is crucial in discovering how and why HIV establishes its reservoir.

Presenter:	Max Hexom	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Max Hexom

Title: Novel Synthesis of Ditriazoles

Abstract: Both 1H-1,2,3-ditriazole and heterocycle-substituted perfluoropyridine moieties are known to be active against varying cancer-related cell growth processes. Specific pathways of interest include p-38 α (MAP-K 14) inhibition and B-16 melanoma cell inhibition. Synthesis of two novel ditriazoles combines these moieties in an attempt to discover biologically active compounds. These syntheses were completed utilizing SNAr, SN2, and the CuAAC "click" reaction to generate the 1H-1,2,3 triazole. Purification of the aforementioned molecules was completed with 1H-NMR structural confirmation, pending HRMS results and cytotoxicity data against colon cancer cells. Future work into the derivatization of current molecules and new syntheses are on going in search of molecules that inhibit cancer growth.

Presenter:	Gavin Hoffman	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Gavin Hoffman, Allen Schoffstall

Title: Synthesis of functionalized quinoxalines as p38α inhibitor precursors

Abstract: Experiments were conducted to prepare two functionalized quinoxalines as p38α inhibitor precursors based on a previously developed method. Two novel compounds, 2-phenyl-3-({[1-(2,3,5,6-tetrafluoropyridin-4-yl)-1H-1,2,3- triazol-4-yl]methoxy} methyl)-6,7-dimethylquinoxaline and 2-phenyl-3-({[1-(2,3,5,6-tetrafluoropyridin-4- yl)-1H-1,2,3-triazol-4-yl]methoxy}methyl)-6-chloroquinoxaline were synthesized. The syntheses involved a series of bromination, condensation, propargylation, and Sharpless "click" reactions. Product yields and characterization methods will be presented.

Presenter:	Zexin Li	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Zexin Li, Jacob Miratsky, Ronald Ruminski

Title: Electrochemistry, absorption spectroscopy and NMR spectra of new symmetric di-(trichloro platinum); bis-dipyridophenazine ruthenium (and osmium) complexes.

Abstract: Two mixed-metal complexes $[(Cl)_3Pt(dpop')Ru(dpop')Pt(Cl)_3]$ and $[(Cl)_3Pt(dpop')Os(dpop')Pt(Cl)_3]$ (dpop'=dipyrido (2,3-a: 3',2'-j) phenazine) were synthesized and studied. Electronic absorption spectra were recorded in dimethylformamide and showed Ru(II) (dπ) → dpop' (π*) ^{1}MLCT energy at 573nm and multiple Os(II) (dπ) → dpop' (π*) MLCT between 500-650 nm. Cyclic voltammetry data for $[(Cl)_3Pt(dpop')Ru(dpop')Pt(Cl)_3]$ showed a shift to less negative reduction of the bridging $dpop'^{0/-1}$ by 0.12 V compared with the previously prepared bi-metallic complexes. ^{1}H, ^{13}C, and 2D NMR spectra were used to assign resonances. Results confirmed both symmetric coordination and downfield shifts of dpop' protons due to the deshielding effect of $(Cl)_3Pt$-.

Presenter:	Rachel Lindstrom	Graduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Rachel Lindstrom, Dr. Wendy Haggren

Title: Bacterial Survival upon Exposure to Different Antibiotics

Abstract: Bacteria employ several strategies that enable them to survive the presence of antibiotics in their environment. These include biofilm formation, recruitment of membrane pumps, and resistance through genetic mutations. Additionally, a phenomenon called bacterial persistence, in which bacterial cells appear to be metabolically dormant, may explain the failure of antibiotics to eradicate bacteria during in a chronic infection. Unlike resistance, persistent cells are not genetically different from those which are not persistent. Our experimental results suggest that for E. coli, entrance into a persistent state may hinge on both the type of antibiotic and production of the microbial signaling molecule indole.

Presenter:	Andrew Outlaw	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Andrew Outlaw

Title: Derivatization of Novel P38-α Inhibitors via SNAr and Reductive Amination Reactions

Abstract: Several new potential P38-α inhibitors containing a 2,4-disubstituted 3,5,6-trifluoropyridine core have been synthesized via stepwise substitutions onto the central pyridine core. Key reactions in these syntheses include 1H-1,2,3-triazole formation via Sharpless copper(I)-catalyzed alkyne-azide cycloaddition (CuAAC) at C-4, followed by substitution using various amine nucleophiles at C-2 and C-6 of the pyridine ring. Derivatization via SNAr and reductive amination reactions afforded products based on a propargyl moiety designed to introduce new functional groups β to the triazole ring. Investigations were also performed to study the conditions necessary for nucleophilic substitution by heterocyclic amines at both C-2 and C-6 of the pyridine ring. All compounds were characterized using spectroscopic methods.

Presenter:	Sara Rodriguez	Graduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Sara Rodriguez, Yulia Shtanko

Title: Effect of Large Genome Rearrangements on Genomic Organization in Neurospora crassa

Abstract: The eukaryotic genome has a three-dimensional organization that facilitate the formation of dynamic long and short range contacts that may play a role in gene control. However, genome organization can be altered following incorrect repair of a double stranded DNA break where a large region of DNA, up to thousands of base pairs in length, is translocated into a novel site on a different chromosome. These rearrangements hypothetically disrupt the native inter- and intra-chromosomal interactions and form novel DNA contacts. This re-organization may impact DNA elements that regulate gene expression and cell function which can influence new phenotypes or diseased states. Translocations can occur in human cancers through the dysregulation of genes that result aberrant growth. However, it is challenging to investigate the role of translocations in cancer cells where these rearrangements are known to be heterogenous. To explore the impacts of translocations on genomic organization and gene expression, we have used the filamentous fungus Neurospora crassa, which is analogous human genomic organization and expression mechanisms, but is more simple such that single rearrangements can be isolated. In N. crassa, translocations are explored using chromosome conformation capture with high throughput sequencing (Hi-C) to investigate changes to global organization and novel gene interactions. Here, we present the preliminary genome topology data of translocation strains and their impact on genomic organization and whether changes to gene contacts occur at translocation fusion points.

Presenter:	Yulia Shtanko	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Yulia Shtanko, Sara Rodriguez, Andrew Klocko

Title: Influence of Translocations on Genomic Organization and Gene Expression in Neurospora crassa

Abstract: Translocations are large-scale genome rearrangements caused by incorrect repair of a double strand break, whereby a segment of DNA is moved from one chromosome to another; translocations, can compromise genome function and lead to cancer.1-5 While it is known that if a breakpoint occurs in a gene, it can result in unregulated proteins, yet little is known for how translocations impact long-range contacts. In fact, gene regulation often requires an exact genome organization to facilitate long-range contacts between core promoters and enhancers within the spatial confines of the nucleus; these elements may normally be separated by thousands of base pairs of DNA, and translocations would physically segregate these elements on different chromosomes.3 It is difficult to study the impact of translocations on genome organization in human cancer cells, rendering the need for a more simplistic system. Here, we use single, pure translocation strains of Neurospora crassa to study the link between genome organization and gene expression. Genomic organization is analyzed through Hi-C (chromosome conformation capture coupled with high throughput sequencing) which identifies long-range contacts providing organizational information.6-9. We performed Hi-C experiments on seven N. crassa strains, two of which will be outlined in this report, and examined for how translocations disrupt long-range contacts and if gene expression is altered.

Presenter:	Bailee Troutman	Graduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Bailee Troutman

Title: Alternatives to GFP: Color from Sea Anemones

Abstract: Sea anemones and jellyfish express proteins that give them stunningly beautiful coloring and fluorescence underwater. One of the most well known of these is green fluorescent protein (GFP) from jellyfish has been used in research laboratories as a marker for gene expression since studies on this protein were conducted in the 1960s and 1970s. Our laboratory is exploring the use of two proteins, asPink and aeBlue, visible in ordinary daylight without the use of UV light, as alternatives to GFP. The ultimate goal is to study regulation of gene expression in the bacterial species Magnetospirillum magneticum, paving the way for expression and production of peptides and proteins that have biomedical applications.

Presenter:	Brianna Vigil	Undergraduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Brianna Vigil

Title: Characterizing a Novel Engineered Therapeutic Agent to Reverse Lupus Symptoms

Abstract: Systemic Lupus Erythematosus (SLE) is a chronic inflammatory autoimmune disease that effects approximately 1 out of every 1000 individuals in the United States. Auto-antibodies are produced when improper destruction of apoptotic cells results in B-cell activation and differentiation. Since the auto-antibodies are secreted by mature B-cells, the complement system has long been a target of interest in treating SLE. Along with our collaborators, we have identified antibodies that have been shown to reverse the symptoms of SLE in a mouse model of lupus. In order to use this antibody as a potential therapeutic or imaging agent we have engineered a single chain variable fragment (scFv). After expressing the scFv in mammalian cells, subsequent purification resulted in high yields of pure protein. Binding affinities were measured and represent a valid approach to replace the much larger antibody.

Presenter:	Ashley Ward	Graduate Student	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: Ashley Ward, Andrew Klocko

Title: Assessing changes in the genomic organization of Neurospora crassa upon altering epigenetic marks

Abstract: Compaction of eukaryotic genomic DNA is critical for its function: DNA is wrapped around histone octamers, forming chromatin, which is further compacted into interacting “loops” of like chromatin to physically separate active and silent DNA into nuclear “compartments”. Covalent modifications of the histones and DNA of chromatin demarcate the transcriptional state of each chromatin type. These epigenetic marks are essential during development and can lead to cancer if incorrectly regulated. It is currently unknown if different levels of epigenetic modifications within chromatin impact the organization of chromatin in the nucleus. To assess how epigenetic marks impact organization, we performed high-throughput chromosome conformation capture sequencing (Hi-C) experiments on epigenetic mutants of the filamentous fungus Neurospora crassa. We began with Hi-C of a Neurospora strain lacking the chromodomain protein-2 (Δcdp-2): a member of a histone deacetylase complex important in removing active marks; this strain has increased histone acetylation, and size dependent DNA methylation changes in silent regions: larger regions gain DNA methylation while smaller regions lose DNA methylation. These altered epigenetic marks resulted in decreased intra- and inter-centromeric interactions. To examine if these changes in genomic interactions are primarily due to altered histone acetylation or DNA methylation marks, we analyzed a double mutant strain lacking CDP-2 and DIM2 (Δdim2): a DNA methyltransferase responsible for catalyzing DNA methylation. Presented are analyzes of genomic interactions in single and double mutant strains of Neurospora, which will expand our understanding of how epigenetic marks influence DNA organization.

Presenter:	David Weiss	Faculty	College of Letters, Arts & Sciences	Chemistry & Biochemistry

Authors: David Weiss, Robert Wrobel Patrick McGuire

Title: Can Students Learn Chemistry without Midterm Exams?

Abstract: Do we need a formal lecture in order for students to learn upper division analytical chemistry? How do we know they have learned the material without midterm exams? Changing our course to active learning, we wanted to know if students could learn chemistry and retain that knowledge without a traditional lecture course, and if they could demonstrate this using the national American Chemical Society exam. We also were interested to see if students liked an active learning approach more and felt more engaged in an active learning course compared with traditional lecture. The professor's lecture was shortened with the expectation that students would prepare for lecture, and much of the lecture time was spent working on inquiry sets based upon the course material (like in-class homework based on the textbook and the current literature in the area), as well as learning the literature in the area. Students wrote a short literature review and a research proposal on analytical chemistry and learned how to give a presentation on this work. They also gave short lectures on the course material themselves to the other students. Can they learn this material and increase their engagement without formal lecture and exams?

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

Authors: Michael Wheeler, James Kovacs

Title: Towards Understanding the EBV gp350 – Complement Receptor 2 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 CR2 and gp350 protein and are currently in the process of analyzing the binding kinetics between them via biolayer interferometry analysis. Crystallography will be used to analyze the protein-protein interactions of CR2 and gp350 to create a 3D structure of the protein binding complex.

COMPUTER SCIENCE

Presenter:	Oluwatobi Akanbi	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Oluwatobi Akanbi, Amer Aljaedi, Xiaobo Zhou			
Title:	PLS: Proactive Load Shifting for Distributed SDN Controllers			
Abstract:	Balancing the workload among distributed SDN controllers plays a critical role for both the network performance and the control plane scalability. Therefore, various load balancing techniques were proposed for SDN to efficiently utilize the control plane's resources. However, such techniques suffer increased latency and packet loss resulting from load migration and intensive communication among the SDN controllers. The existing solutions adopt load migration based on CPU utilization, which are susceptible to inconsistent load spikes. In this paper, we formally define the problem and present an alternate approach called PLS that constitutes the cornerstone for addressing this problem. We then show through experimental results that our approach provides accurate responses to load migration event triggers.			

Presenter:	Ahmed Bensaoud	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Ahmed Bensaoud, Jugal Kalita			
Title:	Classifying Malware Images with Convolutional Neural Network Models			
Abstract:	In this paper, we use several convolutional neural network (CNN) models for static malware classification. In particular, we use six deep learning models, three of which are VGG16, ResNet50, and Inception V3, past winners of the ImageNet Large-Scale Visual Recognition Challenge (ILSVRC). The other three models are CNN-SVM, GRU-SVM, and MLP-SVM, which enhance neural models with Support Vector Machines (SVM) for malware classification. In our experiment, we detect using the Malimg dataset. This dataset has malware images that were converted from Portable Executablemalware binaries, and it is divided into 25 malware families. Comparisons show that the InceptionV3 model achieves a test accuracy of 99.24%, which is better than the accuracy of 98.52% that was achieved by the current state of the art called M-CNN model.			

Presenter:	Matthew Briggs	Undergraduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Matthew Briggs			
Title:	Accessible Art			
Abstract:	Accessible Art is a graphics program built in Unity3D leveraging Maya, Mudbox, and Materialize to represent traditional ceramic artwork. The purpose of this program is to realistically present classical and traditional pottery to an audience who does not have access to a museum. The goal of the program is to inform and educate audiences about the history, make-up, and significance of a piece in hopes to instill an appreciation for traditional art. Furthermore, the program's goal is to aid in the preservation of tangible history in a virtual form. Traditional pottery is physical history, beautifully preserved. Currently, the program only represents pottery that is fully intact; however, further research will allow for fragmented pieces to be re-formed. This will allow for the restoration of pottery lost to time.			

Presenter:	Brandon Collins	Graduate Student	College of Engineering & Applied Science	Computer Science

Authors: Brandon Collins

Title: Exploiting an Adversary's Intentions in Graphical Coordination Games

Abstract: How does information regarding an adversary's intentions affect optimal system design? This paper addresses this question in the context of graphical coordination games where an adversary can indirectly influence the behavior of agents by modifying their payoffs. We study a situation in which a system operator must select a graph topology in anticipation of the action of an unknown adversary. The designer can limit her worst-case losses by playing a security strategy, effectively planning for an adversary which intends maximum harm.

However, fine-grained information regarding the adversary's intention may help the system operator to fine-tune the defenses and obtain better system performance. In the context of a simple model of adversarial behavior, this paper asks how much a system operator stands to gain by fine-tuning a defense for known adversarial intent. We find that if the adversary is weak, a security strategy is approximately optimal for any adversary type; however, for moderately-strong adversaries, security strategies are far from optimal.

Presenter:	Adam Duby	Graduate Student	College of Engineering & Applied Science	Computer Science

Authors: Adam Duby, Ahmed Bensaoud, Yanyan Zhuang

Title: Lightweight Dynamic Features for Malware Program Classification

Abstract: Combating malicious software, or malware, is an evolving endeavor in the cyber battlefield. Malware variants are released at an alarming rate, and security researchers are charged with maintaining pace to analyze, detect, and mitigate the proliferation of malware. In the first quarter of 2019 alone, McAfee Labs observed over 65 million new malware samples introduced into the wild. Manually analyzing each sample does not scale for threat researchers. Compiler variations, code obfuscation, and other variations in the development tool chain create a fertile landscape for malware diversity. Individual malware samples are rarely an entirely new malware family, since malware authors commonly reuse tactics, techniques, and procedures by re-purposing existing code. Automated similarity techniques afford analysts the time to focus on new and unknown malware tactics.

Existing similarity techniques use either static or dynamic features. Static features scrape surface level information from the program. Static features capture what the malware looks like, while dynamic features try to capture what the malware performs. Dynamic techniques use more semantically meaningful information, such as function call graphs. Static features are especially vulnerable to malware diversity, and dynamic features are computationally expensive to examine. Our research examines lightweight dynamic features of a malware process to cluster malware into families. Our lightweight features overcome the shortfalls of static features, while reducing the complexity of full dynamic analysis. We scrape the malware process for our features, and feed these feature vectors into machine learning algorithms to determine the intrinsic grouping among the unlabeled malware family.

Presenter:	Samuel Layton	Undergraduate Student	College of Engineering & Applied Science	Computer Science

Authors: Samuel Layton

Title: Fractal Synesthesia

Abstract: Fractal Synesthesia is a program built in Unity3D which combines fractal generation techniques and algorithmic musical analysis to visualize the organic development of a song. When users launch the application, a tree grows as a song of their choice plays, dynamically changing the former's color and structure to reflect momentary and developmental characteristics of the music. To generate the fractal tree, the program uses a combination of L-systems and recursive Unity coroutines, allowing it to grow in real time with the song. Concurrently, the program analyzes the music by performing a fast Fourier transform on the audio wave, mapping 1024 samples to 8 frequency bands representing the amplitude of distinct musical voices ranging from low bass to high soprano. The tree adjusts the HSV-color values of its currently growing branches using a set of heuristics that track momentary changes in pitch, harmony, and "fullness." As branches grow, the tree also samples values from a second set of heuristics. These track broader characteristics such as melodic range and the strength of the harmony; those that represent the current movement rather than moment of the song. The tree then averages the samples of each heuristic taken during the current generation, using those values to adjust structural aspects of the next branch generation. Such aspects include randomness in branches' angle and height and the number of branches grown, resulting in a tree that is both unique to and representative of the song's development and character.

Presenter:	Justin Leo	Undergraduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Justin Leo, Jugal Kalita			
Title:	Moving Towards Open Set Incremental Learning: Readily Discovering New Authors			
Abstract:	The classification of textual data often yields important information. Most classifiers work in a closed world setting where the classifier is trained on a known corpus, and then it is tested on unseen examples that belong to one of the classes seen during training. Despite the usefulness of this design, often there is a need to classify unseen examples that do not belong to any of the classes on which the classifier was trained. This paper describes the open set scenario where unseen examples from previously unseen classes are handled while testing. This further examines a process of enhanced open set classification with a deep neural network that discovers new classes by clustering the examples identified as belonging to unknown classes, followed by a process of retraining the classifier with newly recognized classes. Through this process the model moves to an incremental learning model where it continuously finds and learns from novel classes of data that have been identified automatically. This paper also develops a new metric that measures multiple attributes of clustering open set data. Multiple experiments across two author attribution data sets demonstrate the creation an incremental model that produces excellent results.			

Presenter:	Chunchun Li	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Chunchun Li, Akshay Dhamija, Steve Cruz, Terrance Boult, Manuel Günther			
Title:	PACT: Parameter-free Autonomous Clustering Technique			
Abstract:	For unsupervised machine learning, clustering is the most well-known issue and a part of several computer vision tasks. In most problems, the number of clusters in the data is unknown and must be estimated. Unfortunately, to cluster data with available techniques, the number of clusters -- or another similarly difficult choice -- needs to be provided, which requires knowledge of the problem or a tedious parameter search. To this end, we present the first Parameter-free Autonomous Clustering Technique (PACT), where no primary parameter needs to be specified, and no selection among different potential cluster partitions is required. Instead, a data-driven decision of when to stop merging clusters is incorporated into our bottom-up clustering technique. We show that PACT provides superior performance on multiple machine vision-related clustering tasks with very different characteristics. When using deep features, PACT outperforms all prior clustering techniques even when they select parameters based on the ground truth. We also show that PACT can be used for unsupervised deep learning techniques as a plug-in replacement for other clustering algorithms, without the need for parameter optimization/selection. When used in deep/deeper clustering, PACT improves the state of the art performance.			

Presenter:	James Peng	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	James Peng			
Title:	Tracing Provenance to Discover APT in Machine Learning Pipelines			
Abstract:	Cyberattacks globally cost more than natural disasters: It is estimated that detected and traceable cybercrimes cost UC$6 trillions annually by 2021. The number is already big, but the major portions of attacks are undetected and untraceable, or so-called persistent threats. To defeat Advanced Persistent Threats (APT), organisations should understand as much as possible about their network traffic and events in a persistent manner. However, there is an inadequacy in the current research community in keeping system information during machine learning pipeline, especially after optimizations. A lot of adversarial machine learning methods such as poisoning take advantage of this, so heuristic-based intrusion detection systems (IDS) can be fooled by APT hackers. Our research focuses on coarse and fine provenance in machine learning as post-optimization integrity functions to circumstantiate system information, unlike IDS of signature, protocol and anomaly-based analysis. Also our detection enhancing solution accords with principles of least privilege as we keep system information, making long-time persistent tracing feasible.			

Presenter:	Arijet Sarker	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Arijet Sarker, SangHyun Byun, Wenjun Fan, Maria Psarakis, Sang-Yoon Chang			
Title:	A Privacy Preserving Voting Credential Management System			
Abstract:	Electronic voting requires voting privacy to protect the voter anonymity. We present a novel design framework for credential management called Voting Credential Management System (VCMS) which preserves voting privacy against attackers who do not only monitor the voting transactions/communications but are also capable of compromising a single authority involved in the credential management and generation. VCMS achieves such properties by building on the well-established cryptographic primitives and by separating the voting token (the VCMS output credential used for the voting) and the intermediate key token (which is used within VCMS and bridges the registration/certificate with the voting token). VCMS is specifically applicable to electronic voting and is simpler than other sophisticated credential management systems achieving comparable security properties.			

Presenter:	Jonathan Schwan	Undergraduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Jonathan Schwan, Akshay Dhamija			
Title:	I-MOVE: Independent Moving Objects for Velocity Estimation			
Abstract:	We introduce I-MOVE, the first publicly available RGB-D/stereo dataset for estimating velocities of independently moving objects. Velocity estimation given RGB-D data is an unsolved problem. The I-MOVE dataset provides an opportunity for generalizable velocity estimation models to be created and have their performance be accurately and fairly measured. The dataset features various outdoor and indoor scenes of single and multiple moving objects. Compared to other datasets, I-MOVE is unique because the RGB-D data and speed for each object is supplied for a variety of different settings/environments, objects, and motions. The dataset includes training and test sequences captured from four different depth camera views and three 4K-stereo setups. The data are also time-synchronized with three Doppler radars to provide the magnitude of velocity ground truth. The I-MOVE dataset includes complex scenes from moving pedestrians via walking and biking to multiple rolling objects, all captured with the seven cameras, providing over 500 Depth/Stereo videos.			

Presenter:	Taniza Sultana	Graduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Taniza Sultana, Kristen Walcott			
Title:	Notification Delay in Wearable Devices			
Abstract:	Wearable devices such as smartwatches and fitness trackers can communicate with smartphones, laptops, and IoT devices, and they are growing in popularity. From these devices, the wearer or other connected devices can receive email or text notifications, health information, and much more. The timing of receiving such notifications can be critical, and the delay to receive notifications varies between devices. This research focuses on call notification delays in smartwatches and cellphones to examine factors that cause delay of notifications. We test several sets of Android phones and their connected smartwatches and examine differences between devices, network setup, memory usage, and other factors. Our results show that notification push delays are more common in older versions of Android phones. We also examined separating factors in network architectures, system and software designs between the devices with the delay behavior in call notifications pushes. As a result, we are able to identify and present influencing vectors that affect notification timings.			

Presenter:	Shaoqi Wang	Undergraduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Shaoqi Wang, Aidi Pi, Xiaobo Zhou			
Title:	Scalable Distributed DL Training: Batching Communication and Computation			
Abstract:	Scalability of distributed deep learning (DL) training with parameter server architecture is often communication constrained in large clusters. There are recent efforts that use a layer by layer strategy to overlap gradient communication with backward computation so as to reduce the impact of communication constraint on the scalability. However, the approaches cannot be effectively applied to the overlap between parameter communication and forward computation. In this paper, we propose and design iBatch, a novel communication approach that batches parameter communication and forward computation to overlap them with each other. We formulate the batching decision as an optimization problem and solve it based on greedy algorithm to derive communication and computation batches. We implement iBatch in the open-source DL framework BigDL and perform evaluations with various DL workloads. Experimental results show that iBatch improves the scalability of a cluster of 72 nodes by up to 73% over the default PS and 41% over the layer by layer strategy.			

Presenters:	Lily Zephyr	Undergraduate Student	College of Engineering & Applied Science	Computer Science
Authors:	Lily Zephyr, Oluwatosin Oluwadare			
Title:	TADMaster			
Abstract:	In order to get a comprehensive view of the 3D structure of the human genome, a biochemical strategy known as High-throughput Chromosome Conformation Capture (the Hi-C technique) was developed to map interactions in genomes. In 2012, regions known as Topologically Associated Domains (TADs) were discovered in Hi-C data. TADs are sections of DNA that are folded together more closely than other sections. TADs have been observed in eukaryotic cells, and studies have shown that they perform a biologically significant function in the cell. For instance, analysis of TADs has been shown to provide early warning signs of many diseases, including breast and prostate cancers. However, TAD analysis is a complex process, and while many tools exist to perform this analysis, each has a narrow scope and limited statistical significance. To provide statistically significant analysis with real-world application, our goal is to develop TADMaster, an innovative one-stop-shop for complete TAD analysis. TADMaster accepts interaction matrices from Hi-C experiments and preprocesses the data using one of several accepted data normalization methods. At least 15 known TAD detection algorithms will then be run on the data, and their results will be juxtaposed into a single heatmap of the chromosome. Substantial analysis of the results will be compiled in an intuitive format, including analysis between different algorithms and normalization methods, as well as biological significance in human subjects. TADMaster will be accessible online at https://biomlearn.uccs.edu/TADMaster/ and the source code is available at https://github.com/lilyzephyr/TADMaster.			

Presenter:	Zanyar Zohourianshahzadi	Graduate Student	College of Engineering & Applied Science	Computer Science
uthors:	Zanyar Zohourianshahzadi, Jugal Kalita			
Title:	Neural Twins Talk			
Abstract:	We introduce a novel twin cascaded attention model that outperforms a state of the art image captioning model with single channel of attention that ensures the visual grounding of the words in the generated caption. We report the results of our experiments in standard, novel and robust image captioning tasks on COCO and Flickr30k, COCO and COCO datasets respectively. The results are reported under standard image captioning metrics to show the improvements achieved by our model over the previous image captioning model. The results gathered from our experiments suggest that cascaded twin attention models improve previous attention models that employ a single channel of attention in a variety of different tasks.			

CRIMINAL JUSTICE

Presenter:	Leslee Bechtel	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Leslee Bechtel

Title: Department of Homeland Security (DHS) Systematic Review of the Department of Homeland Security (DHS) Blue Campaign: Combating Human Trafficking.

Abstract: Identifying and prosecuting human trafficking, to the greatest extent in the criminal justice system, is paramount to the United States Department of Homeland Security (DHS). Taking a victim-centered approach to combating human trafficking, DHS Blue Campaign is a National public awareness campaign which trains and educates the first responder community, citizens, private sector organizations, and other governmental agencies to recognize indicators of human trafficking. This systematic review of the effectiveness of the Blue Campaign examines the reported, empirical evidence of increases in federal law enforcement identifications, arrests and prosecution in human trafficking. The data collected for this systematic review was gathered from two primary sources: The Department of Justice, Federal Bureau of Investigation (FBI) National Incident-Based Reporting System (NIBRS), and the 2018 Federal Human Trafficking Report. Findings indicate the Blue Campaign has positively affected the increased number of human trafficking arrests and convictions nation-wide. A more current perspective looks at combating human trafficking as a combination of the public awareness training, DHS partnerships with state governments, local governments, private sector partners, and law enforcement enhanced programs. DHS should continue to grow their Blue Campaign and propel the United States to the forefront of combating human trafficking.

Presenter:	Ella Chilcote	Undergraduate Student	School of Public Affairs	Criminal Justice

Authors: Ella Chilcote, Gia Barboza

Title: ICWA: The Forced Home Removal of Indigenous Children

Abstract: The Indian Child Welfare Act (ICWA) was proposed and enacted into federal policy "...to protect the best interest of Indian Children and to promote the stability and security of Indian tribes and families by the establishment of minimum Federal standards for the removal of Indian children and placement of such children in homes which will reflect the unique values of Indian culture... "(25 U.S. C. 1902). Although the federal government claims to have federal regulations and jurisdiction regarding these cases, tribal leaders and courts have exclusive jurisdiction over all cases associated with the ICWA. Several studies have researched the higher rates of forced home removal amongst minority children within predominately Latino and African American communities across the United States. However, few have focused on the short- and long-term outcomes associated with the ICWA and the impact it has on indigenous children. QGIS mapping will be used to demonstrate the at-risk population, in order to determine the extent at which these minority children.

Presenter:	Jeff Deickman	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Jeff Deickman

Title: Collegiate Sexual Assault Resistance Program

Abstract: In the last few decades, there has been an increasing attention given for combating collegiate sexual assault. Present study systematically reviews the current existing research on the Sexual Assault Resistance Program. Findings from this review showed that a Sexual Assault Resistance Program for first-year students shows paths to reduce sexual assault as well as educate students in other areas associated with sexual assaults. This review also discovered that while policymakers and university administrators call for legislative and institutional change, the use of evidence-based prevention programs that have been studied, developed, and implemented on a small scale would best continue to improve this focused area of concern. Bystander training is among those that have shown results by reframing the sexual assault, by making everyone aware, and by pushing the community and social networks to adjust social norms. Reviewed research indicates that from partner associated acts of victimization to sexual coercion, changing the way we both see and deal with any sexual interaction should be relearned and taught both according to the law and how society sees it.

Presenter:	Zaida Dominguez	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Zaida Dominguez

Title: The Study of Crime Prevention Through Environmental Design: A Systematic Review

Abstract: In the wake of urbanization, architectures, police officers, city planners, and community members are finding new innovative ways to make the environment a safe place for everyone. For many researchers, Crime Prevention Through Environmental Design (CPTED) has been a resourceful program that uses multiple components to alter the physical environment to reduce crime and fear of crime. This current paper attempts to examine the Defensible Space theory to establish the foundation of CPTED principles and the utilization around the world, whether in the United States and internationally. Furthering, this paper reviews scholarly literature reviews to compare and contrast the CPTED principle's effectiveness at reducing crime and/or fear of crime in two different countries, such as the United States and Asia. Overall, the findings will suggest that CPTED can be a useful resource when multiple components of CPTED are used to alter the physical environment.

Presenter:	Garrett Gebhart	Undergraduate Student	School of Public Affairs	Criminal Justice

Authors: Garrett Gebhart

Title: Veteran Suicide: Is It a Epidemic In El Paso County?

Abstract: There is an average of 22 veteran suicides per day in America. With that in mind, El Paso county, Colorado has a higher amount of veteran suicide per capita than the United States. In my research I will answer why veterans are taking their lives and what we can do to mitigate losing some many of our children to an epidemic. Data comes from the Colorado Department of Public Health. Findings revealed that substance use was a factor in 1 in 3 suicides. Most suicides occurred at home, but other locations were also noted. Implications for suicide prevention in the veteran population are discussed.

Presenter:	Alondra Gonzalez	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Alondra Gonzalez

Title: Management of Offenders with an Identified Sex Offense: A Meta-Analysis

Abstract: Recidivism rates can be a key indicator of treatment quality within the Colorado Department of Corrections. Recidivism rates can become increasingly more important when dealing with sexual assaults. By appropriately assessing and treating sexual offenders while they are involved with the Colorado Department of Corrections can have a significant impact on future sexual reoffending. Recently, the Colorado Department of Corrections has replicated Washington State's sex offender treatment program and has implemented policy changes that will impact the management of sexual offenders within our communities. This research provides a review of Washington State's current sex offender treatment program. The findings in this study will provide us with a better understanding of Washington State sex offender treatment program and its impact on high-risk sexual offenders. In addition to this, we will examine if Washington States sex offender treatment program had a significant reduction in sex offender recidivism rates. Lastly, this study will examine if similar results can be expected within the Colorado Department of Corrections.

Presenter:	Jay Jaramillo	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Jay Jaramillo

Title: Fighting Graffiti with Murals: Municipalities Commissioning Murals to Combat Vandalism

Abstract: The study, "Fighting Graffiti with Murals: Municipalities Commissioning Mural to Combat Vandalism", will compare the amount of graffiti cases in relation to the size of two municipalities that neighbor each other, who have and have not implemented mural programs and the data reflecting the population density in each municipality; they are the Cities of Northglenn & Thornton located in the Denver Metropolitan Area in the state of Colorado. The City of Northglenn is a small (7.5 square miles in area), semi-urban, northern suburb of Denver along the Interstate-25 corridor which is surrounded by the much larger (27 square miles in area), more rural City of Thornton. (U.S. Census Bureau, 2016)

Presenter:	Scott McCormick	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Scott McCormick

Title: Scared Straight Programs - The Effects on Juvenile Recidivism

Abstract: The present study systematically reviewed existing literature and found Scared Straight programs had a negligible effect on juvenile recidivism. Scared Straight programs gained popularity in the criminal justice community after the 1978 movie Scared Straight and the follow up television show Beyond Scared Straight. These prevention programs were created in an effort to reduce juvenile recidivism and to ultimately prevent a juvenile from committing their first crime. Inmates who ran many of these programs would instill fear into the juveniles in the hopes they would not commit crimes that would land them in prison. The movie and follow-up TV program portrayed these efforts as successful, leading to their popularity. However, none of the criminal justice efforts were based on evidence. After conducting a systematic review on various states' Scared Straight programs, the research shows these types of programs resulted in very little reduction in juvenile crime. Some studies conducted indicate Scared Straight programs actually increase recidivism. The question to explore further is whether or not Scared Straight programs should be used in the criminal justice system? It is difficult to justify spending taxpayer money to support these types of programs until more evidence can be found to support their use.

Presenter:	Layne Pachl	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Layne Pachl

Title: Crisis Intervention Team Officer Dispatched, Arrived, and Disposition: A study of calls to service in Seattle

Abstract: The Crisis Intervention Team (CIT) is a 40-hour training instructing law enforcement on how to handle individuals with mental illness. One of the objectives of this model is to reduce arrest by either de-escalating the situation and providing the individual with resources or referring the individual to a mental health service. Most research literature provides an indication that a CIT trained officer arriving on scene reduces an arrest. The present study utilized the Seattle Open DataBase portal to assess 60,839 calls for service from 2015 to October 2019. Multinomial logistic regression models were estimated and revealed that the dispatching of a CIT officer indeed reduced the likelihood of the arrest while increasing the likelihood of mental health service referrals. However, in contrast to the existing literature, the present study found that an actual arrival of a CIT officer to the scene increased the likelihood of the arrest. Implications are discussed.

Presenter:	Layne Pachl	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Layne Pachl, Gia Barboza

Title: Spatiotemporal patterns and county-level associations of drug overdose fatalities in Michigan: A Bayesian Hierarchical Approach

Abstract: Few studies have examined county-level structural and social vulnerability and their associations with drug-related fatalities across space and time. This paper examines variations in the spatio-temporal patterns of drug overdose deaths in the state of Michigan, USA and the relationship between the relative risk of drug overdose and county-level structural and social characteristics. The drug overdose data used in the study was reported to the Michigan Department of Public Health between 1999â€“2016, drug distribution data were obtained from the Drug Enforcement Administration (DEA) and structural and socioeconomic conditions were derived from the Centers for Disease Control Social Vulnerability Index. Several different Bayesian hierarchical space time models were fit to the data. The final model included random effects, spatial autocorrelation, a first order random walk, a spatio-temporal interaction term, and covariates. Results indicate that spatio-temporal autocorrelation in drug overdose deaths increased over the study period, and identified social (i.e., education, unemployment) and structural vulnerability (e.g., multi-unit dwellings, severely overcrowded housing, average number of pain pills distributed per person) as significant contributing factors. The implications of identifying spatio-temporal patterns of drug overdose deaths and county-level associations in order to develop a comprehensive approach to overdose prevention and intervention are discussed in context.

Presenter:	Nichole Patton	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Nichole Patton

Title: The Study of Crisis Intervention Training for Law Enforcement - A Systematic Review

Abstract: The present paper systematically reviews the ongoing literature regarding the current law enforcement practice of Crisis Intervention Training (CIT) as it pertains to decreasing the arrest rate of those persons suffering from mental illness or substance abuse. It will further examine whether the CIT training decreases the use of force incidents as reported by existing literature. Finally, the current paper will also examine whether law enforcement personnel certified in CIT find the program to be beneficial and worthwhile in performing their duties as evidenced by a change in attitude, stigma or behavior towards those suffering from mental illness or substance abuse. The findings from this systematic review will be used to make recommendations for future improvements to the CIT program utilized by the local law enforcement of Colorado Springs.

Presenter:	Kelly Waterhouse	Graduate Student	School of Public Affairs	Criminal Justice

Authors: Kelly Waterhouse

Title: The Impacts of Medical and Recreational Marijuana Legalization in Colorado

Abstract: In 2009, Colorado was one of the first states to legalize the use of medicinal marijuana with the implementation of Amendment 20. Additionally, Colorado was one of only two states to legalize the recreational use of marijuana, for individuals 21 and over, by the passing and implementation of Amendment 64 in 2012. Even with the legislations that were implemented and assessed in attempts of regulate the use, possession, and consumption of marijuana, there still remains a controversial focus on the legalization of recreational marijuana. The purpose of this paper is to determine whether the implementations of Amendments 20 and 64 have impacted and increased the driving while under the influence crime rates in Colorado. In addition, this paper will also attempt to assess these impacts of marijuana legalization on the risk perceptions of youth and overall public health.

Presenters:	Jasmine Williams	Undergraduate Student	School of Public Affairs	Criminal Justice

Authors: Jasmine Williams, Gia Barboza

Title: Implicit Bias: The Effect on Jury Decisions

Abstract: In Batson v. Kentucky, 476, U.S. 79 (1986), the Supreme Court held that peremptory challenges may not be used to exclude jurors on the basis of their race. However, evidence suggests that the racial composition of juries continues to be problematic. The study presented seeks to expand on previous research about implicit attitudes and its impact on decision-making to explore how bias effects sentencing outcomes. To do so, the Implicit Attitudes Test (https://www.projectimplicit.net/index.html) (IAT) was used. The IAT evaluates associations between concepts, like race or gender, and both negative and positive evaluations, like "good" or "bad".

In the present study, a version of the IAT and three jury scenario questions were given to mock jurors correlating their conviction decision with bias level. The expectation was, regardless of race, a person's implicit bias will predict their decision to either convict or acquit a defendant as well as their opinion of sentence severity post conviction. To perform the analysis, a version of the IAT written in the Python programming language was reprogrammed to run, the Guilty /Not Guilty IAT developed by Levinson, Cai and Young (2009), within the PsychoPy3 framework. Three jury scenario questions were developed with five multiple choice sentencing options to choose from. Following completion of the IAT and jury scenario questions, a comparison was conducted to explore whether sentencing decisions have any correlation to the implicit bias a person holds about racial minorities. Implications for measuring implicit attitudes towards defendants are discussed in context.

ELECTRICAL & COMPUTER ENGINEERING

Presenter:	Dubari Borah	Graduate Student	College of Engineering & Applied Science	Electrical & Computer Engineering

Authors: Dubari Borah, T.S. Kalkur

Title: Differential Multiband Reconfigurable Filters for RF Front-end Applications

Abstract: Manufacturers of modern electronic appliances are continuously striving for lowering power supply voltage in portable devices to save power consumption. However, it results in poor noise immunity of the system. Therefore, differential signaling is getting much attention for research and development these days. Differential signaling transmits the information using two complementary signals and the noise associated with both signals gets cancelled out as the receiver detects the difference between them. So far, differential architecture has been applied to many electrical circuits such as amplifier, antenna, mixer etc. Being the principal frequency selective device in RF front end applications, filters with different characteristics such as wideband, narrowband, tunable, high selectivity, dual band etc. have been also implemented in differential topology. Most of these works incorporate either single-band bandpass response with/without tunability or multiband structures only limited to dual band response without tunability. Also, negligible amount of research has been done in the field of differential band stop filter. Our project investigates two new topologies of differential filters-one with bandpass response and the other with band stop response. The advantages of these new topologies include 1) realization of arbitrary number of frequency bands 2) flexibility of all the bands to tune independently or simultaneously 3) the bands maintain constant absolute bandwidth (ABW) for the entire tuning range and 4) easy implementation with lumped elements to reduce the filter size.

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

Authors: Tanghid Rashid, Heather Song

Title: A Wideband High Efficiency Compact Switchmode RF Power Amplifier

Abstract: In modern wireless communication systems, RF power amplifiers (PAs) play a vital role specifically in system transceiver block. Due to the demand for ever-increasing bandwidth along with high output power and efficiency, efforts to improve the PA performance in discrete subsystem will continue for foreseeable future. From an application perspective, future cellular communications systems e.g. 5G would require high data rate which means increased signal bandwidth (100MHz below 6GHz, 400MHz above 6GHz). High-efficiency PAs are usually achieved with switch-mode topologies, such as Class D, Class-E, and inverse Class-F. But those PAs are commonly narrowband ones since the optimum impedances to achieve maximum efficiency and maximum power would require narrowband matching networks. Thus, realizing high power and efficient PAs design along with wide bandwidth has become a challenging task and critical area of research. In this proposed work, we will demonstrate a comprehensive approach for the design and implementation of a wideband high-efficiency Class-E power amplifier at fo= 2.65 GHz using CREE 25 W GaN HEMT transistor model. Novel circuit topology of input and output matching networks will be used to achieve wideband and high-efficiency performance.

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

Authors: Chiranth Siddappa, Mark Wickert

Title: CAF Implementation on FPGA Using Python Tools

Abstract: The purpose of this project is to provide a real time geolocation solution by generating code for the complex ambiguity function (CAF) in a hardware description language (HDL) and the implementation on FPGA hardware. The CAF has many practical applications, the more traditional being radar or sonar type systems. By using scientific Python tools, this project provides a solution for testing signals and the ability to customize modules to target multiple devices. The processing for this implementation will be done on a PYNQ board designed by Xilinx. The PYNQ board provides a Zynq chip which has both an ARM CPU and FPGA fabric. All required mathematical operations for the CAF are returned to the user through Python classes which produce synthesizable code in the Verilog HDL. The Python classes use Jinja templates integrated into the Verilog code to allow for configuration changes that a user will need to change for investigation and simulation, development, and test. Helper methods are included in the package to help simulation of the HDL such as quantization, complex data reading and writing, and methods to verify the data using quantized values.

GEOGRAPHY & ENVIRONMENTAL STUDIES

Presenter:	Ashley Joyal	Graduate Student	College of Letters, Arts & Sciences	Geography & Environmental Studies

Authors: Ashley Joyal, Emily Skop

Title: A Study of Local Media Portrayal of Undocumented Latino Immigration in U.S. Immigrant Gateways

Abstract: Immigration, both legal and undocumented, has been prevalent throughout the history of the United States. With increasing numbers of undocumented immigrants from Central America arriving in nontraditional destinations in the United States, some research has begun to articulate these new geographies. Using predetermined gateways, I have chosen to examine newspaper coverage of Latino undocumented immigrants in six cities that have either maintained a high foreign-born population or have newly emerged as a gateway for the foreign-born population arriving in the United States. The objective of this research is to identify trends in local media in the selected gateways from the last two decades. I will observe the language used to discuss these populations and explore whether the diversity of these Latino immigrants is reflected in the news. For this study, the newspaper coverage was pulled from ProQuest using a key word search of "illegal immigration" and "undocumented immigration" in the headlines of the articles. The results of this analysis will show how the media in six US cites narrate undocumented immigration in the United States.

Presenter:	Tyler Wendtland	Undergraduate Student	College of Letters, Arts & Sciences	Geography & Environmental Studies

Authors: Tyler Wendtland, Katharina Zito

Title: Impacts of Drought on Tree Growth at the Lower Montane Forest Ecotone in Colorado Springs

Abstract: As the climate changes, Colorado's forests are experiencing increased drought stress, associated with changes in precipitation, temperature, and the timing of snowmelt. Drought-induced pinyon pine (Pinus edulis) mortality has been widely documented throughout Colorado, Utah, New Mexico, and Arizona, and in the Colorado Front Range, pinyon pines are progressively more vulnerable to insect infestation as a result of drought and decreased moisture availability. In this study, we collected and analyzed 20 pinyon pine core samples from the Austin Bluffs area of Colorado Springs, a transitional ecosystem between the drier foothills scrubland life zone and more mesic montane conifer forests. After measuring and dating each annual growth ring on each core sample, we performed correlation analysis to assess the relationship between pinyon pine growth and climatic conditions associated with drought (monthly precipitation, Palmer Drought Severity Index (PDSI), maximum temperature, and average temperature). Our research indicates that the growth of pinyon pines in the Austin Bluffs ecosystem is strongly limited by summer moisture conditions. Since 2000, drought has resulted in severe growth suppressions in pinyon pines in 2002, 2008, 2011, and 2013. Future research will compare pinyon pine growth with growth of co-occurring species such as ponderosa pine, Douglas fir, and Rocky Mountain juniper in response to drought and other climate variabilities.

HEALTH SCIENCES

Presenters:	Karisa Dreyer	Undergraduate Student	Helen and Arthur E. Johnson Beth-El	Health Sciences

Authors: Karisa Dreyer, Joseph Lee

Title: School Wellness Environments: Perceptions Versus Reality

Abstract: Background: Recent legislation requires schools to self-evaluate and report information about their school wellness policies and environments. However, it is not clear whether school personnel can accurately evaluate factors related to school wellness. Therefore, the purpose of this study was to explore the accuracy of school-reported information about school wellness environments and policies. Methods: A school wellness leader at ten Midwestern elementary schools completed a 35-item survey about their school wellness environment. The survey included questions concerning nine areas of the school wellness settings focused on physical activity, nutrition, and overall school wellness policies. After completing the survey, a full-day direct observation protocol was conducted by a trained researcher to objectively code the corresponding elements captured in the survey. Cohen's Kappa and Prevalence-Adjusted Bias-Adjusted Kappa were used to assess the degree of agreement between school reporters and direct observation. Results: The mean percent agreement between reporters and direct observation was 77.1%. There was variation in the percent agreement within each of the nine categories ranging from 67.3% (School Food Environment) to 92.0% (School Wellness Policies). Results of the Kappa statistics demonstrated that 65.7% of the survey items demonstrated fair or better agreement. The physical activity items had higher prevalence of fair to strong agreement, 79.2% compared to nutrition items 36.4%. Conclusions: Results provided preliminary support for the utility of school wellness leaders to self-report information about school wellness environments. Efforts to facilitate independent reporting on wellness environments by school leaders will contribute to broader applications for school wellness programming.

Presenters:	Darena Herschler	Undergraduate Student	Helen and Arthur E. Johnson Beth-El	Health Sciences

Authors: Darena Herschler, Joseph Lee

Title: Assessing Changes in Youth Biking Competencies and Habits through NPO Bike Camp Programming: Phase 1

Abstract: Background: Kids on Bikes (KOB) is a non-profit organizations (NPO) whose purpose is to influence and empower all kids to lead healthy, active, and happy lives through bicycling. It is often difficult for NPOs to conduct evaluations of their programs due to limited staff, time, and evaluation-specific expertise. The purpose of this project was to establish a collaborative community-based project between the University of Colorado Colorado Springs (UCCS) and KOB to evaluate the impact and effectiveness of KOB youth bike camp programming. Methods: During summer 2019, 58 youth participated in three KOB programs. Bike camps ranged in duration from 1 to 3 weeks. Youth completed a survey pre and post camp to evaluate biking knowledge, general self-efficacy, lifestyle behavior characteristics, and bike ownership characteristics. Descriptive statistics were used to plot sample demographics, youth behaviors, and biking habits and ownership data. Paired samples t-test were used to evaluate changes in biking knowledge, self-efficacy, and behaviors from pre-to-post camp. Results: The findings showed that 76% of youth participating in KOB camps did not have a bike of their own. Paired samples t-test revealed that youth biking knowledge and self-efficacy did not change from pre-to-post camp (both $p>.05$). Conclusions: The results of this study provided useful information about the impact KOB has on youth participating in camps; however, the study also revealed the need to significantly revise the KOB survey to better align the survey questions with current program objectives/curriculum. These results demonstrate the utility of establishing university-community collaborations to support and enhance health-related programming being conducted through NPOs within communities.

Presenter:	Morgan Lavender	Graduate Student	Helen and Arthur E. Johnson Beth-El	Health Sciences

Authors: Morgan Lavender, Joseph Lee, Kelly R. Laurson

Title: Associations Between Bedroom Television and Child Versus Parent-Reports of Youth Screen Time and Sleep Duration

Abstract: Child self-report and parent proxy-report are frequently used for assessing youth sleep duration (SLP) and screen time (ST) behaviors; however, discrepancies in the reporting of youth SLP and ST between children and parents are not well understood.

Purpose: The purpose of this study was to examine if family ST rules and child bedroom televisions (BTV) were associated with discrepancies between child and parent-reports of children's SLP and ST behaviors.

Methods: Children aged 8-11 years self-reported SLP and ST behaviors and if they had a BTV. Parents reportedinformation about their child's SLP and ST behaviors and family ST rules. Paired-samples t-tests evaluated differences in SLP and ST reporting between children and parents. Pearson correlation statistic was used to examine the association between child and parent-reporting of SLP and ST behaviors. Linear regression models evaluate if BTV and family ST rules were predictive of discrepancies in child-parent reporting of youth SLP and ST behaviors.

Results: Paired-samples t-tests showed that parents reported 17.4 more minutes/day of SLP (t (685)= -7.07, p=.01) and 29.4 fewer minutes/day of ST (t (441) =4.77, p=.03) compared to child-reports. Correlation analyses revealed weak-to-moderate associations between child and parent-reports for SLP (r=.36) and ST (r=.38). Regression analyses identified child BTV as a significant predictor of discrepancies in child-parent reporting for SLP (β=.-10, t(678)=-2.54, p-=.01) and ST (β=.-11, t(434)=-2.18, p=.03).

Conclusions: Child BTV contributes to discrepancies between child-parent reporting of youth SLP and ST behaviors. Future work evaluating youth SLP and ST behaviors should capture information about child BTVs.

HISTORY

Presenter:	Heather Bergh	Graduate Student	College of Letters, Arts & Sciences	History

Authors: Heather Bergh

Title: 'A Whole City of Whores:' Prostitution in the Civil War

Abstract: Classified as the “True Woman” during the Victorian Era, women sought to contribute to their country in any way they could as the War Between the States raged on. As their men left towns and cities, womenfolk followed. They packed up their household goods and made camp with soldiers, acting in unofficial capacities. Unsurprisingly, the Union and Confederate armies saw a rise in bawdy houses filled with insatiable nymphs. During the Civil War, women sought to gain economic autonomy while using their bodies to rebel against gender normatives during a time of unparalleled social change. Indeed, it is important to distinguish the immense sexual transformation that took place as women rebuked the purity, piety, submissiveness and domesticity expected of them. In turn they became fallen women, painted women, wife-like whores looking for liberation from the suffocating Victorian ruleset of hegemonic womanhood. During this time, Nashville and Memphis ventured to codify prostitution by issuing licenses and regulating disease while Richmond struggled with their population of “fair ones”. In the end, these “disgraceful” ladies challenged contemporary convictions of womanhood and femininity by exercising their autonomy by acquiring their own wealth and utilizing their bodies in ways unbecoming.

Presenter:	Bridgett Harris	Undergraduate Student	College of Letters, Arts & Sciences	History

Authors: Bridgett Harris, Joseph Lee, Kelly R. Laurson

Title: American Apartheid

Abstract: “American Apartheid” explores the topic of institutionalized racism in the United States. A key challenge in conveying the severity of the systemic racism that still exists in the country today lies in the confusion created by its veneer of equality. Critics who argue that institutionalized racism is a myth point to legislation such as the Civil Rights Act and the Fair Housing Act as evidence that true equality has been achieved and any subsequent disparities are the fault of the individual, not the system. However, people of color in the United States report a much different experience with regard to equality, one in which the Civil Rights Act not only did not fully accomplish its intended purpose, it became a convenient mask to constantly silence them in their continuing battle to achieve true equality. “American Apartheid” creates a new entrance into the conversation on racism in the United States by comparing one of the most aggressively codified, widely recognized systems of institutionalized racism in history— South African apartheid — to the covert (and often not so covert) systems that fostered a climate of violence, poverty and unrest in Los Angeles, California in the late 1980s and early 1990s. By comparing the conditions of a purportedly free society against the conditions of blatantly legislated oppression and racism, this paper further illuminates the inherent racial bias that exists in the United States.

LEADERSHIP, RESEARCH, & FOUNDATIONS

Presenter:	Kathryn Starkey	Graduate Student	College of Education	Leadership, Research, & Foundations

Authors: Kathryn Starkey, Sarah Cooksey, Sylvia Mendez, Valerie Martin Conley

Title: Mentorship and Community Building: How Latinx Postdoctoral Scholars Develop and Maintain Their STEM Identity

Abstract: Broadening participation for underrepresented minorities in STEM fields is of paramount importance to the scientific and educational communities. As such, this research sought to investigate STEM identity of Latinx postdoctoral scholars and its impact on their employment choices. Recruited from the National Postdoctoral Association listserv, 10 Latinx STEM postdoctoral scholars participated in semi-structured interviews about their STEM identity and journey to career acquisition. The theoretical framework of this study involved the use of Carlone and Johnson's (2007) science identity development model which includes competence, performance, and recognition in the context of race, ethnicity, and gender. Inductive and deductive coding techniques yielded 3 themes. Interview participants find themselves at various stages of establishing their STEM identity as they pursue a STEM career. Some believe they belong in STEM, while others question that concept, ameliorating the challenges to their identity as they either emulate or avoid characteristics they saw in their mentors and attempt to find a sense of community. All of these components of the scientific method of the STEM identity journey culminated in the end goal for participants conducting research that will benefit their community as a means to bolster their STEM identity. This study contributes to the current research on Latinx STEM identity, confirming the need for scholars to have productive and supportive mentoring relationships to facilitate their success in STEM. This study illuminates the value of postdoctoral scholars being exposed to more inclusive working environments in order to foster their confidence, independence, and success in STEM related careers.

Presenter:	Patty Witkowsky	Faculty	College of Education	Leadership, Research, & Foundations

Authors: Patty Witkowsky, Nicole Ferguson, Mona Shaker

Title: Lost in Translation: Perspectives and Skills Developed by Student Affairs Professionals Abroad

Abstract: Emerging from a worldwide study of 29 U.S.-trained student affairs professionals with higher education work experience abroad, the purpose of this study was to explore the perspectives and skills developed through working abroad with the intent of demonstrating, to hiring authorities in U.S. student affairs divisions, the value of professional experience abroad in student affairs. Particularly because of the challenges of expatriates returning to the U.S. for employment, the findings of this study provide useful advocacy for this group of professionals to demonstrate their unique perspectives and critical skills developed abroad that can contribute to higher education internationalization, support of international students in the U.S., and address intercultural issues in higher education.

MARKETING, STRATEGY, & INTERNATIONAL BUSINESS

Presenter:	James Van Scotter	Faculty	College of Business	Marketing, Strategy, & International Business

Authors: James Van Scotter, Skyler Colwell, Adelita Aguirre, Matthew Hayashida

Title: Thin-slice video perceptions of personality and leadership: A study of inter-rater reliability in a sample of Colorado Springs entrepreneurs

Abstract: Using a video-based behavioral assessment technique, raters separately observed 6-minute public YouTube videos of 150 entrepreneurs. Following a standard format, entrepreneurs each gave a pitch discussing their business and "entrepreneurial journey." These presentations took place at weekly meetings of 1 Million Cups, a startup support community with an active local chapter in Colorado Springs. To examine reliability, ratings were compared across four different raters, ratings were compared across multiple different traits, and ratings were compared over time. A subset of entrepreneurs were observed on more than one occasion, and some were rated after an additional 20 minute Q&A period.

MECHANICAL & AEROSPACE ENGINEERING

Presenter:	Bashir Alnajar	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Bashir Alnajar, Michael L. Calvisi

Title: Numerical modeling of the dynamics of bubbles and droplets with the Level Set Method

Abstract: The Level Set Method (LSM) is an efficient method used to simulate multiphase flows in which fluids of different phases (e.g., bubbles and droplets) are separated by a complex, evolving interface. In the present work, the flow field is discretized by a single -field, finite difference formulation of incompressible, immiscible Navier-Stokes equations on a stationary grid, and the liquid-gas interface is implicitly represented by the zero level set of a smooth function. The convections terms in the Navier-Stokes and level set equations are discretized using a second-order (ENO) scheme and a fifth-order (WENO) scheme, respectively. The model incorporates the influence of surface tension at the interface and is stable even for large density and viscosity ratios, on the order of 1:1000. Illustrative simulation examples are provided of rising bubbles and deforming droplets for parameter ranges of practical interest.

Presenter:	Fathia Arifi	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Fathia Arifi, Michael L. Calvisi

Title: Optimal control of the nonspherical oscillation of encapsulated microbubbles for biomedicine

Abstract: Encapsulated microbubbles (EMBs) consist of a gas core surrounded by a stabilizing shell (e.g., lipid, polymer, or protein) and were originally developed for ultrasound imaging. More recently, EMBs are being developed as vehicles for drug and gene delivery. After injection into the circulatory system, the EMBs are excited by an ultrasound transducer at a location of interest. In ultrasound imaging, the EMBs reflect the incident acoustic waves and help to improve the contrast of the resulting images. The ultrasound can also be used to incite EMB rupture and promote drug and gene delivery at targeted sites (e.g., tumors) within the circulatory system. In certain cases, the EMBs deform nonspherically, which can enhance the acoustic reflections and also facilitate rupture. Therefore, the ability to control nonspherical oscillations, or shape modes, can improve the efficacy of diagnosis and treatment mediated by EMBs. This work uses optimal control theory to determine the ultrasound input that maximizes a desired nonspherical EMB response (e.g., reflection or rupture), while minimizing the total acoustic input in order to enhance patient safety and reduce unwanted side effects. The optimal control problem is applied to an EMB model for small nonspherical oscillations and is solved numerically through pseudospectral collocation methods using commercial optimization software. Single frequency and broadband acoustic forcing schemes are explored and compared.

Presenter:	Sean Coughenour	Undergraduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Sean Coughenour, Hui Wan

Title: Modes of droplet breakup in confined shearing flow

Abstract: The deformation of an isolated droplet confined in a fluid channel was analyzed using Gerris, a computational fluid dynamics solver using the Volume of Fluids method. The deformation behavior was analyzed for both simple shear flow and oscillatory shear flow. Within each case, the effects of various Reynolds numbers, Weber numbers, viscosity ratios, density ratios, degrees of confinement, and oscillation frequencies were studied. The resulting deformation was categorized by whether the droplet experienced breakup or not. In the cases of droplet breakup, it was further categorized into one of three modes: midpoint pinching, edge breakup, and homogeneous breakup. Current results were obtained using two-dimensional simulations. Three-dimensional simulations will be conducted in future study.

Presenters:	Joseph Day	Undergraduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Joseph Day

Title: Nonlinear Acoustic Damping: Single Baffle Combustor

Abstract: Combustion instabilities are the feedback coupling of combustion and acoustic modes in a combustion chamber. They have affected virtually all liquid rocket engine development programs. Left unchecked, these instabilities increase heat transfer to the point of failure. Including a baffle blade structure inside of a combustion chamber reduces the instabilities by increasing the acoustic damping. The baffle bladeâ€™s damping mechanism is, however, not fully understood. To elucidate the damping mechanism, a chamber has been designed to simulate the acoustic environment of a liquid rocket engine with an asymmetric baffle blade. This design has gone through several conceptual and detailed design reviews and is in the process of being machined in the UCCS Machine Shop. Once machined, data acquisition will be completed with dynamic pressure sensors on loan from PCB Piezotronics and a particle image velocimetry (PIV) laser system from the USAFA.

Presenter:	Emilie Henning	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Emilie Henning, Ryan Reger, Daniella Patton, Karl Jepsen, Todd Bredbenner

Title: Deep learning-based segmentation of vertebral image data outperforms other automated methods

Abstract: Manually segmenting image data to separate bone from background is labor intensive; however, automated methods have generally not performed well. Recently, U-Net, a deep learning-based method has been used to automatically segment medical image data with encouraging results. The objective of this study was to evaluate the performance of several automated methods for segmenting microcomputed tomography (microCT) images of vertebral bodies.

Six evenly spaced slices from microCT data of 28 human L1 vertebral bodies were manually segmented to create ground truth bone masks. Several unsupervised global and local thresholding methods were used to segment the selected microCT data. U-Net, a fully convolutional neural network was trained and tested on the same image data using a nested four-fold cross-validation approach. Segmentation performance was evaluated using five different similarity metrics. Kruskal-Wallis rank sum tests with Nemenyi's all-pairs comparison tests were used to test for metric differences between all methods. A nonparametric analysis of multivariate data with Wilks' lambda test was used to consider all similarity metrics to evaluate the relative performance of each method.

For each metric, the U-Net method significantly outperformed all other methods, except in a few cases where U-Net performance matched that of other methods. Additionally, U-Net outperformed other methods when taking all metrics into account.

The significant gains in segmenting image data using the U-Net method outweighed the initial, but limited, time required to train the network. Evaluation of the performance of U-Net networks within and across other microCT image sets is ongoing.

Presenter:	Lindsey Nast	Undergraduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Lindsey Nast, Michael L. Calvisi

Title: Diagnosing Intracranial Saccular Aneurysms through Acoustic Emissions

Abstract: Intracranial aneurysms, lesions in the walls of cranial arteries, develop in up to 6% of the population. Many aneurysms are asymptomatic until rupture, producing a subarachnoid hemorrhage with a high mortality rate. Intracranial aneurysms are difficult to detect prior to rupture, and current diagnostic methods are invasive or have some risk associated with them. Further, while it is difficult to predict if an aneurysm will rupture, all available treatments for unruptured aneurysms are highly invasive and carry risks to the patient. Despite the volume of research done in the last 40 years, the mechanics behind the potential formation, expansion, and rupture of aneurysms are not fully understood.

This research seeks to relate the acoustic emissions of intracranial aneurysms to their structure and blood flow. A simplified model for the hemodynamics of a saccular aneurysm will be constructed and analyzed using ANSYS Fluent. Then, the internal blood flow will be analyzed for strong, distinct acoustic components, with the intent to find correlation with aneurysm geometry and with rupture rate. Further, it will be investigated if these sounds can be detected from outside the body. The end goal of this research is to further the development of a noninvasive methodology for detecting and diagnosing intracranial aneurysms.

Presenters:	Kristen Parker	Undergraduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Kristen Parker, Jurgen Seidel

Title: Computational Investigation into Structural and Aerodynamic Characteristics of Ram-Air Parachutes

Abstract: In order to improve JPADS landing accuracy, the structure of a ram-air parachute is simulated in ABAQUS. FEM analysis of fabric structures presents a challenge that has been overcome with specific boundary conditions and careful use of solver settings. FEM analysis has been utilized to determine the effects of different boundary conditions and to achieve a geometry similar to that of an actual parachute in free flight. In addition, CFD simulations have been run with the FEM generated geometries and nominal parachute geometries using Chem and Kestrel fluid solvers. The results are encouraging and indicate that with further research, using this process to determine the flight shape of ram-air canopies could be advantageous in the design of parachutes.

Presenter:	Ryan Reger	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Ryan Reger, Emilie Henning, Todd Bredbenner

Title: Comparison and optimization of U-Net based segmentation implemented through different platforms

Abstract: Manually segmenting medical image data is a labor-intensive process. However, recent developments in deep learning have been used to decrease the amount of labor necessary. The purpose of this work is to evaluate and optimize the performance of a U-Net fully convolutional neural network for automatically segmenting a large number of microcomputed tomography (microCT) data sets. Six evenly-spaced slices from microCT data of 28 human L1 vertebral bodies were manually segmented to create ground truth bone masks. Slices from 21 randomly-selected vertebrae were used to train U-Net networks and slices from the remaining vertebrae were used as a test set to evaluate segmentation performance. U-Net networks were trained in Python via Keras, MATLAB via the Deep Learning Toolbox (The Mathworks Inc, Natick, MA), and Dragonfly image processing software (Object Research Systems, Montreal, QC, CA). Batch size, patch size, the number of training epochs, and validation frequency were varied in order to improve segmentation performance, as measured using the average Dice coefficient for the set of test slices. An optimization procedure was implemented to vary training parameters in MATLAB to maximize the minimum Dice coefficient for the test set with a time-based penalty to ensure that the system would not converge to training parameters requiring excessive time or computing power. The effect of applying a median filter with variable radius to the imaging data was also investigated.

The Dragonfly implementation of the U-Net network is outperforming current iterations of the Python and MATLAB implementations, but work to improve the latter approaches is ongoing.

Presenter:	Jared Strutton	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Jared Strutton, Jena McCollum, Scott Lacono

Title: Mechanical Performance of 3D Printed Curable Particulate Composites with Glycerin

Abstract: Extrusion-based 3D printing can be adapted to a variety of materials including paste composites. A hydroxyl-terminated polybutadiene (HTPB) binder embedded with metal particulates (i.e. aluminum) can be extruded to increase the performance of traditional composite production methods. At high particulate loadings (i.e. 70% and greater) the paste slurry displays high viscosity behavior. Most market printers are unable to produce a consistent flow at high pressures. A custom extruding system was created to control and regulate the intense pressure to allow for consistent print quality. Additionally, the mechanical properties, as well as the flow viscosity, can be altered by varying the concentrations of initiation and surfactants. Glycerin is a small molecule that can be added to regulate these properties and consequently control the mechanical performance of the cured composite.

Presenters:	Lluis Umbert	Graduate Student	College of Engineering & Applied Science	Mechanical & Aerospace Engineering

Authors: Lluis Umbert, Steve Tragesser

Title: Repeatable tethered aerobraking maneuver

Abstract: This work considers the attitude control of a tethered satellite that uses aerobraking to decrease the orbital energy. The tether has the advantage over conventional aerobraking of keeping the temperature sensitive portion of the satellite outside the appreciable atmosphere and also provides additional control authority. For many applications, multiple-orbit may be necessary to obtain the desired deltaV. In order for the mission to be repeatable, the net torque exerted on the system over one orbit has to be zero. Defining the libration angle as the angle between the local vertical and the tether, this condition can be achieved by repeating the libration angle and its time derivative at a given point in the orbit.

The solution for a repeatable maneuver is found by separating the problem into an endo-atmospheric part followed by an exo-atmospheric one. The former is dominated by atmospheric drag, while the latter motion is governed by gravity gradient torque. Assuming the optimal theory previously developed in the literature for the endoatmospheric portion of the orbit, the attitude of the system has to be symmetric during the flythrough, achieving a zero in both libration angle and its derivative at periapsis. This part of the orbit governs the deltaV achieved and provides a change in angular momentum, deltaH. For the exo-atmospheric section, a control law for the tether length is implemented in order to achieve an equal and opposite deltaH while also satisfying conditions on the tether angle and rate. The control law is based on an analytic solution of linearized, inhomogeneous equations of motion. The control law is validated via numerical simulation of the nonlinear equations of motion.

NURSING

Presenters:	Kelli Baptist	Undergraduate Student	Helen and Arthur E. Johnson Beth-El	Nursing

Authors: Kelli Baptist, Kelcey Vogel, Janel Vogt

Title: Relationship among physical functioning, pain, and energy/fatigue in women with heart disease

Abstract: As future nurses, our goal for patient care is to improve physical functioning in order to optimize patient outcomes. Pain and energy/fatigue have been shown to negatively impact physical functioning in individuals with varying disease processes. In order to explore the relationship between pain and energy/fatigue and their effects on physical functioning in women with heart disease (HD), we conducted a cross-sectional, observational study of 27 women with HD (average age of 74.48 years) recruited from the community. All testing was done in-home during the middle of the day, in a well-hydrated condition. Consistent with the U.S. Behavioral Risk Factor Surveillance System, heart disease was defined as “heart disease,” “coronary heart disease,” “heart attack,” “myocardial infarction,” “angina,” or “other heart problems,” in response to the question, “Has a doctor, nurse, or other health professional EVER told you that you had any of the following?” Preliminary analysis reveals that there was a significant relationship between physical functioning and severity and frequency of pain (r = 0.492, p < 0.01). Similarly, there was also a significant relationship between physical functioning and increased energy/decreased fatigue (r = 0.695, p < 0.01). This correlation confirms that nursing interventions that prioritize physical functioning may contribute to improved patient outcomes, including higher energy levels, less fatigue, and decreased pain.

Presenters:	Mythreyi Ramesh	Undergraduate Student	Helen and Arthur E. Johnson Beth-El	Nursing

Authors: Mythreyi Ramesh, Kathy Prue-Owens, Keston Lindsay

Title: Interprofessional Approach: Cardiovascular Risk Perception Survey

Abstract: Cardiovascular disease is a leading cause of death for men and women in the United States. While many studies have been conducted about the risk factors regarding the disease, not many have been done regarding an individual’s risk perception. This study aimed to find the views of cardiovascular disease risk perception in those participating in a Personal Trainer Program, using the Cardiovascular Risk Perception Survey (CRPS). Participants were asked to rate their perception on a scale of none, very small, small, big and very big regarding risk factor associated with cardiovascular disease: high blood pressure, high cholesterol, overweight, physical inactivity, smoking, diabetes, age/gender, ethnicity, family history, and stress. The results from the questionnaire showed that the perception of risk factors is evident within this population. These results indicated that interprofessional collaboration can result in increased knowledge of cardiovascular disease and positive health outcomes.

PHYSICS

Presenter:	Yaroslav Balytskyi	Graduate Student	College of Letters, Arts & Sciences	Physics

Authors: Yaroslav Balytskyi, Kelly McNear, Adham Atyabi, Kyle Culhane, Tristan Paul

Title: Deep Residual Learning for Raman Spectra Identification

Abstract: Bacterial infections are a leading cause of death worldwide, taking more than 6.7 million lives each year. According to the Centers for Disease Control and Prevention, over 30% of the patients are treated unnecessarily while waiting for diagnostic results. Typical diagnostic delays can take up to 48 hours during which the patient is often given broad-spectrum antibiotics. Not only is this expensive “taking 8.7% of the annual US healthcare budget” but it is also detrimental to the immune system. Surface-enhanced Raman scattering (SERS) in combination with Deep Learning (DL) can drastically reduce the time needed to correctly identify a given pathogen to hours reduce the need for treatment with broad-spectrum antibiotics. In our work, we developed an ensemble of Deep Convolutional Neural Networks(CNNs) in combination with Recurrent Neural Network (RNN) which can identify a weak and noisy SERS spectrum with >96% accuracy in a matter of minutes. An ensemble of different CNNs is needed for two reasons. First, they are sensitive to different hierarchical features such as the overall shape of the spectrum and the shapes of the particular peaks. Second, the application of CNNs with different strides makes the ensemble flexible to different kinds of noise which is a priori unknown.

This combination, together with the RNN which is sensitive to the relative positions of the peaks in the spectra, makes the ensemble quite stable to the noise in the signal and can thus reliably identify the SERS spectra.

Presenter:	Paul Couture	Graduate Student	College of Letters, Arts & Sciences	Physics

Authors: Paul Couture, Robert Camley, Karen Livesey, Zbigniew Celinski

Title: Ferromagnetic Resonance Studies of the MnZn Ferrites/Polymer Composite Materials

Abstract: We characterize MnZn ferrite particles embedded in a polymer for use in low frequency EMF emissions shielding. The ferrites particles are approximately 1.2 Âμm in diameter and embedded in PVC resin in various concentrations: 10% - 70% by weight. The composite undergoes an extrusion process which creates a 0.6 mm thick slab and orders some of the particles along the extrusion direction. This creates an easy axis along the extrusion direction with an associated anisotropy. We characterized the ferromagnetic resonance absorption peaks with broad-band FMR, 1-30 GHz, and cavity based FMR systems. Comparing the results to the expected FMR peaks for measurements along the easy and hard axes, and normal to the slab, using the Landau-Lifshitz-Gilbert equation provides some interesting irregularities. Samples with high ferrite concentrations, Kittel's equation for thin film resonance can be used to describe the FMR frequency vs. field dependence. For low ferrite concentrations the resonance conditions have to be modified to account for an effective thickness beyond the normal filling factor correction associated with presence of a matrix. These results indicate the effective demagnetizing factors, determined by the spatial extend of the RF fields, can describe the observed FMR absorption.

Presenter:	Sara Goldman	Graduate Student	College of Letters, Arts & Sciences	Physics

Authors: Sara Goldman, Zbigniew Celinski

Title: Characterization of NiFe and silicon dioxide multilayers for on-wafer inductors operating at radio and low GHz frequencies

Abstract: The concept of magnetic layers surrounding copper core inductors is proposed for use in circuits operating at radio and low GHz frequency ranges, in order to address performance issues and quality losses normally observed in miniaturized inductors at high frequency. Coating an inductor core in a magnetic material has the potential to increase the inductance proportional to the magnetic permeability of the coating. The objective of this research is to identify and construct an appropriate magnetic coating to improve the inductance (L) and quality (Q-factor) of high frequency inductors. Permalloy (Py), an alloy of 81% nickel and 19% iron, was selected for these experiments due to its high relative permeability. Py layers are sputter deposited, from 10nm to 1µm thick, on silicon wafers for characterization. A specific issue we address is that inductor coatings have the potential to decrease the Q-factor due to eddy currents during high frequency operation. A method to reduce eddy current losses is to reduce layer thickness. Therefore, in addition to individual layers, multilayer coatings are developed: depositing 5 to 50 identical layers of Py (for totals from 150nm to 1.5µm) separated with 5nm layers of silicon dioxide. This allows for thin individual layers, while maintaining a large total thickness for maintaining µ_r. We present the characteristics of the individual and multilayer coatings to determine their suitability for high frequency inductor operations.

Presenter:	Yu Hao	Graduate Student	College of Letters, Arts & Sciences	Physics

Authors: Yu Hao, Tim Read, John Stroud, Janusz Hankiewicz, Zbigniew Celinski

Title: Nuclear relaxation time calculations with Python platform

Abstract: Nuclear Magnetic Resonance (NMR) spectrometer allows the molecular structure of a material to be analyzed by observing and measuring the interaction of nuclear spins when placed in a strong magnetic field. The approach of the measured system to thermal equilibrium is known as relaxation and T1 and T2 are relaxation times. We develop a simple, easy to use python platform for reading NMR files, extracting data from them, and fitting them to find T1 and T2 times. It will allow to improve the quality of acquired MRI images, without the use of external professional programs. Using of python also allows easy development of processing and analysis applications and allow for project tailored analysis that increase efficiency.

Presenter:	Jason Nobles	Graduate Student	College of Letters, Arts & Sciences	Physics

Authors: Jason Nobles, Kevin Smiley, Sara Goldman, John Stroud, Zbigniew Celinski

Title: Magnetic Resonance Imaging Thermography with Uniform Gd Microstructures

Abstract: Magnetic resonance imaging is an important technique in imaging living tissue and composite structures. Many medical procedures now use MRI as a critical component including MRI guided thermal ablation therapy used to treat cancer. Such procedures require real-time, spatially and thermally accurate temperature maps. We demonstrate an MRI temperature contrast agent consisting of uniform gadolinium microstructures dispersed within a media. We report on the performance of 6 micron wide, disk-shaped Gd microstructures passivated by a layer of chromium. A SQUID magnetometer was used to determine the mass magnetization of these disks. The temperature dependence of the mass magnetization was then correlated to the nuclear magnetic resonance linewidth broadening of water protons in the presence of Gd disks. We used this correlation to demonstrate the MRI image brightness of the Gd microstructures suspended in a tissue-mimicking phantom can be related to the temperature of the sample indicating these Gd disks are a good candidate for use as an MRI temperature contrast agent.

Presenters:	John Stroud	Undergraduate Student	College of Letters, Arts & Sciences	Physics

Authors: John Stroud, Karl Stupic, Tucker Walsh, Zbigniew Celinski, Janusz Hankiewicz

Title: Hidden Dangers in MRI: Investigating Heating of Metallic Objects From Switching Magnetic Gradients

Abstract: With the number of medical implants increasing every year it is inevitable that some patients with implants will at some time undergo an MRI procedure. Investigating the safety of implants during an MRI scan is vital as with current medical record keeping it can be difficult to track implants, which may put patients in possible danger. It is known in MRI oscillating magnetic fields produced by an MRI scanner have the potential to induce eddy currents in metallic implants in turn these eddy currents can heat surrounding tissue and may potentially cause damage to healthy tissue. However, much of the research evaluating the safety risks that are associated with imaging around metallic implants has focused mainly on the magnetic component of RF radiation present in the MRI scanner, and not much attention has been paid to switching gradient fields in MRI which oscillate at much lower frequencies. We investigate local heating of conductive materials within an MRI scanner producing quantitative data on the position dependence of induced EMF and heating, as well as the interaction between different gradients within the scanner. This work will assist in evaluating any dangers that may be present to patients with a metallic implants.

POLITICAL SCIENCE

Presenters:	Mary Varland	Undergraduate Student	College of Letters, Arts & Sciences	Political Science

Authors: Mary Varland

Title: Teacher Protests

Abstract: It is a known fact that the complexity of educational systems and their funding often lead to teachers being massively under-paid. The year 2018 brought on the largest wave of protests seen in this country in a generation, reports Andrew Van Dam from the Washington Post (Van Dam, 2019). This research details the background of what events lead to this massive unrest in the states that experienced educational protesting in 2018 focusing on West Virginia, Oklahoma, and Arizona. Research conducted for the purpose of this project is a natural experiment focused on the aforementioned three case studies and the outcomes of their campaigns exploring the hypothesis: The presence of protest will enact political change or the objective of teachers in achieving their desired legislation changes. The conclusion of this research can provide information for future activists on the characteristics of a successful campaign and if their energy is best spent organizing one.

PSYCHOLOGY

Presenters:	JoAnna Dieker	Graduate Student	College of Letters, Arts & Sciences	Psychology

Authors: JoAnna Dieker, Kendall Weber, Stacy Yun, Kelsey Bacharz, Sara Qualls

Title: Correlates of Family Conflict in Caregivers: Implications for Burden and Positive Aspects of Care

Abstract: A highly conflicted family environment is a stressor that can increase caregiver burden (Kwak et al., 2012). Family conflict often results from differing beliefs about the cause of the care recipient's problems, or when primary caregivers do not feel adequately supported in their role by other family members (Pearlin et al., 1990). The purpose of the present study was to examine two different kinds of conflict (family beliefs and family support) and their relations to caregiver outcomes such as burden and positive aspects of caregiving. The present sample consisted of 790 caregivers. Caregivers filled out the Caregiver Reaction Scale (O'Malley & Qualls, 2017), a multidimensional measure of the caregiving experience. Results of Pearson correlations showed significant associations among family conflict variables and caregiver contexts and outcomes. Conflict over family beliefs was significantly associated with role captivity (r = .30, p < .001) and overload (r = .32, p < .001). Conflict over family support was also significantly associated with role captivity (r = .36, p < .001) and overload (r = .40, p < .001). Conflict over family beliefs was significantly associated with personal growth (r = .17, p < .001). Conflict over family support was significantly associated with personal growth (r = .16, p < .001) and competence (r = .09, p = .01). Results highlight that while family conflict is associated with caregiver burden, it is also associated with positive aspects that caregivers derive from their experience. Findings inform assessment and intervention regarding the family environment in caregiving.

Presenter:	Katie Granier	Graduate Student	College of Letters, Arts & Sciences	Psychology

Authors: Katie Granier

Title: Age Differences on Worry Content among Younger and Older Adults

Abstract: Introduction. Worry is a ubiquitous human experience and primary symptom of anxiety that is sparsely researched among older adults. The present study examined the differences in worry content among younger (age 18-30) and older (age 65+) adults. Methods. A total of 411 participants (311 younger adults, 100 older adults; 77.1% female) completed the Worry Domains Questionnaire (WDQ) and Worry Scale online through the University of Colorado Colorado Springs extra credit system or Amazon's Mechanical Turk. Results. A series of independent samples t-tests was computed to examine age differences on each domain of worry. Results indicate that, as hypothesized, younger adults endorsed significantly greater worry than older adults about work (t=9.55, p<.05, d=0.99), finances (t=4.76, p<.05, d=0.55), aimless future (t=13.63, p<.05, d=1.47), low confidence (t=13.14, p<.05, d=1.36), and relationships (t=13.19, p<.05, d=1.31) on the WDQ. Younger adults also endorsed greater worry about social concerns (t=4.88, p<.05, d=0.54) and finances (t=4.48, p<.05, d=0.51) on the Worry Scale, but did not endorse significantly different amounts of worry about health compared to older adults. Discussion. The results of this study imply that worry varies greatly across the lifespan, with younger adults experiencing more severe worry regarding a broad range of topics. Future studies should seek to include additional age groups to better characterize changing patterns of worry across the lifespan and examine life factors that may influence worry characterization.

Presenter:	Rebecca Ingram	Graduate Student	College of Letters, Arts & Sciences	Psychology

Authors: Rebecca Ingram, Anna Robertson, Katie Granier, Rachel Schroeder, Sydney Nolan

Title: Identifying the Meaning of Dementia Grief in Caregivers: A Qualitative Study

Abstract: There are more than 16 million family caregivers who provide unpaid care for individuals diagnosed with dementia (Alzheimer's Association, 2019). Unfortunately, there are many negative aspects associated with being a caregiver which include high rates of burden, stress, and depressive symptoms (Adams & Sanders, 2004; Broxson & Feliciano, in press; Schulz, O'Brien, Bookwala, & Fleissner, 1995). One of the unique aspects of caregiving for an individual with dementia is the experience of dementia grief (or pre-death grief). Dementia grief is characterized by the experience of grieving the psychological loss of an individual while they are still living (Lindauer & Harvath, 2014). Most of the preexisting literature has looked at dementia grief from a stress-process model of caregiving (i.e., it is a symptom that manifests from the process of caregiving). There is a lack of attention in the literature on the specific meaning that caregivers give to their grief. Studying dementia grief guided by a theory in which emotions are understood outside of the context of pathology (i.e., they are considered to be adaptive and informative) could be clinically informative. The current study will use a newly developed theory, the Dementia Grief Model as a framework to understand the meaning that spousal caregivers give to their grief. Using a qualitative research design, a series of focus groups will be conducted in order to gain a more in-depth understanding of the meaning of dementia grief in spousal caregivers. Transcriptions of the audio recordings will be undertaken using Microsoft Stream and analyzed for emerging themes.

Presenters:	Jenny Lagervall	Graduate Student	College of Letters, Arts & Sciences	Psychology

Authors: Jenny Lagervall, Madeline Lag, Sophie Brickman, Rebecca Ingram, Leilani Feliciano

Title: Give a piece of your mind: A content analysis of a Facebook support group for dementia caregivers

Abstract: The online environment offers individuals a means of obtaining information, support, and social connection. Older adults are growing users of the internet. Online support groups (e.g., Facebook groups) have been found to provide health-related information and encourage mental well-being. They may be particularly advantageous for caregivers of individuals diagnosed with dementia, as it is difficult to leave loved ones with dementia alone. However, the mechanisms by which online support groups engage caregivers, and the content of support, have yet to be explored. In the current study, content from 100 posts from a private Facebook caregiver support group were evaluated for gender of post author, relationship to the person receiving care, distress, emotional tone, grief reaction, caregiver burden, and coping strategy. Results indicated that caregiver distress was associated with the presence of grief reactions, negative emotional tone, and higher caregiver burden. Utilizing venting as a coping strategy was associated with higher caregiver burden, similar to what is observed in a traditional in-person support group. Online communication for caregivers may provide an indication of caregivers' psychological well-being, as specific coping strategies and grief reactions indicated higher levels of caregiver burden and distress. Research on interventions for dementia caregivers may benefit from a focus on online social support as a means of accessing caregivers and treatment delivery.

Presenter:	Sydney Nolan	Graduate Student	College of Letters, Arts & Sciences	Psychology

Authors: Sydney Nolan, Rachel Schroeder, Frederick Coolidge

Title: Preliminary Psychometrics of a New Measure of the DSM-5 Autism Spectrum Disorder

Abstract: The purposes of the present study were to evaluate psychometrically a new measure of the DSM-5 ASD criteria and to determine whether it could differentiate among severity levels of ASD and ADHD children, as the latter can sometimes present as ASD. The 84-item, informant-as-respondent Coolidge Autistic Symptoms Survey (CASS) provides coverage for all of the ASD DSM-5 criteria for children 5 to 17 years old. In the present study, samples of convenience were recruited from our university to complete the CASS. Based on the parental reports of a child's diagnosis, children were placed into one of five groups: developing typically (DT; n = 317); Attention-Deficit/Hyperactivity Disorder (ADHD; n = 62); mild ASD (n = 23; included diagnoses of Asperger's Disorder or high-functioning autism); moderate ASD (n = 23), and severe ASD (n = 10). One-factor ANOVA revealed the overall CASS score successfully discriminated among the groups, $F(4, 430)=108.62$, $p < .0005$ with a large effect size. Tukey's post hoc tests revealed that the DT group (as expected) had the lowest mean (M = 122.39), there was no significant difference between mild ASD (M = 183.39) and ADHD children (M = 160.77), and no significant difference between the moderate ASD (M = 220.91) and severe ASD (238.30) children, although the moderate and severe ASD groups had significantly higher CASS scores than all other groups. Preliminarily, it appears that the CASS has good to excellent internal reliability, and it can distinguish among children developing typically from those with ASD.

WOMEN'S & ETHNIC STUDIES

Presenter:	Ally Moseley	Undergraduate Student	College of Letters, Arts & Sciences	Women's & Ethnics Studies

Authors: Ally Moseley, Tre Wentling

Title: Social Stress in Transgender Memoirs: An Intersectional Analysis

Abstract: Memoirs offer an opportunity to learn about life experiences from the author's perspective-privileging subjectivity and notions or real-life truths. While most U.S.-based transition memoirs have historically presented life narratives as palatable to heterosexual, gender-normative audiences, they have also included accounts of several stressful life events (e.g., undesirable experiences structurally rooted in social and economic conditions), chronic stressors, (e.g., emergent in social roles that become enduring conflicts in daily life), and major traumas (e.g., divorce, arrest, etc.) because of heteronormative and transphobic contexts. This project will present findings from a content analysis of nine transgender memoirs published between 1954 to 2019. Overarching research questions that guide our content analysis include: 1) if gender and racial identity influence both the type, and total number, of social stressors; 2) if there are identifiable patterns of social stressors (type) during certain time periods as measured by proxy (publication date); and 3) how gender nonbinary memoirs (2 total) differ from gender binary memoirs (7 total) regarding social stressors in particular.

NOTES

The History of MOUNTAIN LION RESEARCH DAY

Mountain Lion Research Day began in 2009. It was the brainchild Dr. Michael Larson, who at the time was the Associate Vice Chancellor for Research and Innovation. At its inception, there were two major objectives for 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.

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.

For that first Mountain Lion Research Day, 80 faculty and students across the university submitted abstracts and then prepared poster presentations to document the research work being done. The event was held in The Lodge during the Spring Semester and was co-sponsored by EPIIC (El Pomar Institute for Innovation and Commercialization) and the Office of Research. Mountain Lion Research Day quickly outgrew the Lodge and then moved to what is now Berger Hall. We also moved the event to the Fall Semester to not compete with the Colorado Springs Undergraduate Research Forum (CSURF) held each spring. The Office of Research now sponsors and organizes this event; but always with the help of many partners on campus.

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