University of Colorado
Denver | Anschutz Medical Campus

22nd Annual Student

Research and Creative Activities Symposium

Friday, April 26, 2019
Student Wellness Center

University of Colorado Denver

University of Colorado Anschutz Medical Campus

With great enthusiasm, we welcome you to the 22nd Annual Research and Creative Activities Symposium (RaCAS)! This year's event continues our CU Denver tradition by celebrating student research, artistic work, and community-based scholarship at the University of Colorado Denver and Anschutz Medical Campus. Each year, students present their original work to each other and to faculty, staff, family, and community members. RaCAS spotlights the rich and varied scholarly activities of our students across the disciplines and honors the vibrant intellectual life of the university. The name RaCAS invokes the raucous spirit that we hope this event embodies: a boisterous celebration of scholarship and creativity.

We believe that all CU Denver and Anschutz students must develop as scholars in their own right and that research and scholarly pursuits prepare and challenge them to contribute to our knowledge of the world. Many students who present their work are approaching the summit of their academic careers with us. Their RaCAS presentations represent hundreds of hours of work, remarkable commitment to their studies, and a synthesis of all that they have learned. Other presenters are at different points in this journey; they may be first-year students just beginning to explore ideas in depth, or they may be sophomores and juniors in the process of developing the skills and insights that will serve their scholarly work in the future. We are thrilled to have participation from every CU Denver School and College and AMC this year

The kind of individualized education celebrated at RaCAS would not be possible without the unflagging dedication of faculty advisors. CU Denver and AMC faculty often work one-on-one with students on these scholarly pursuits. In this process, they are both demanding and supportive, guiding research methods, thoughtful interpretations, and effective presentation. Many CU Denver staff members –lab technicians, writing specialists, digital media specialists, librarians, and community-engagement staff—also work closely with our student-scholars. We thank all members of the CU Denver and AMC communities who offer a wide range of skills and expertise that enrich our students' academic experiences.

We would like to thank Dr. Robert H. Eckel, Professor of Medicine and Interim Vice Chancellor for Research, and Dr. Roderick Nairn, Provost and Executive Vice Chancellor for Academic and Student Affairs, for their continued support of RaCAS. We are especially grateful to Provost Nairn for his championing of our Education through Undergraduate Research and Creative Activities (EURēCA!) programs. We also thank Chancellors Dorothy Horrell and Donald M. Elliman for being generous and devoted supporters of RaCAS, in particular for the awards for outstanding faculty mentors.

We hope you find this year's RaCAS rewarding and inspiring. Our students' achievements are many and we join together on this day in celebration of their work, which shows us what is possible, what the future promises, and what the fruits of university learning look like at their best.

Jeff Franklin, PhD
Associate Vice Chancellor
Office of Undergraduate Experiences

Lindsey Hamilton, PhD
Director of Undergraduate Research
and Creative Activities

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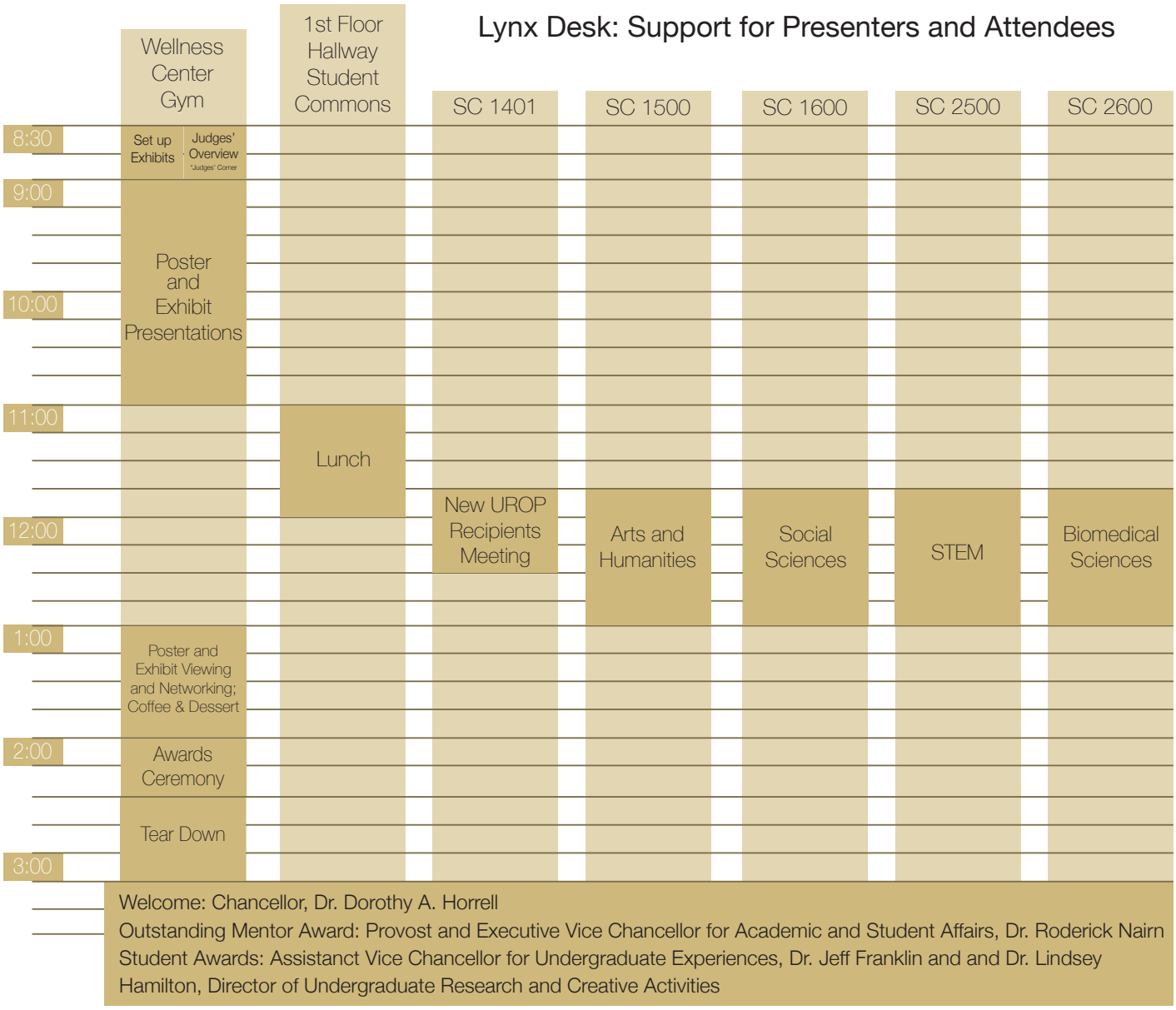
Research and Creative Activities Symposium



The RNA Demethylase, FTO, is Localized to The Cytoplasm in Mouse Embryonic Stem Cells

Hannah Abroe
DC - College of Liberal Arts and Sciences

Mentor: Christopher Phiel, Associate Professor
Department of Integrative Biology

Abstract:
Proteins have evolved to optimally function in specific subcellular locations, hence, the location of a protein in a cell is crucial to its function because it provides the biological context for their purpose. Knowledge of the subcellular location of a protein could improve our understanding of that proteins function and distinct cellular processes. Fat mass and obesity-associated (FTO) protein is an enzyme encoded by the FTO gene. FTO is a protein of interest because it has been discovered to be an mRNA demethylase, removing methyl groups from adenosine bases (termed m6A). Originally, FTO was found to demethylate m6A, but further work has suggested that FTO more specifically acts on m6Am, or dimethyladenosine. More recently, it was shown that FTO could demethylate m6A or m6Am, but the subcellular location of FTO protein was key to which substrate FTO acted upon; if FTO was in the nucleus, it only demethylates m6A, but if FTO is in the cytoplasm, it can demethylated both m6A and m6Am. To examine the subcellular location of FTO in mouse embryonic stem cells, we performed cellular fractionation. Cellular fractionation is the process of separating cells into three fractions: nuclear/cytoskeletal, membrane/organelle, and cytoplasmic. The separated cell fractions were then analyzed by western blotting to determine the location of FTO. We found that FTO is predominantly located in the cytoplasm of mouse embryonic stem cells, suggesting it can demethylate both m6A and m6Am in this cell type.

Living on the Margins: Queer Muslims in the Face of Adversity

Mais Al-Nima
DC - College of Liberal Arts and Sciences

Mentor: Candan Duran-Aydintug, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
In spite of the growing research on role-identity and sexual minorities, matters pertaining to Muslim queerness remain obscure. It can be argued that queer Muslims encounter unique challenges due to their traditional upbringing, patriarchal and heteronormative structures, and islamophobia. Managing multiple stigmatized identities becomes more difficult as these individuals navigate daily life. They are alienated from their Muslim communities for straying from the heterosexual norm, while simultaneously facing prejudice and Islamophobia in a Western context, and feeling isolated from a majority of the queer community. Through convenience and snowball sampling, in-depth interviews with self-identified queer Muslims will be analyzed to determine the ways in which this complex intersectional identity influences their experiences. This study will explore how queer Muslims seek meaning and belonging in a context where their identities are contested. The research contributes to the literature by applying an intersectional perspective to an often-neglected population, uncovering the uniqueness of their struggles, and exploring whether marginalized identities conform to, or resist the dominant narrative, or create alternate ways of navigating their reality.

Education and Pedagogy in United States Prisons: A Frame to Understand the Interlocking Systems of Oppression and its Impacts on Criminal Justice Reform

Ashley Anaya
DC - School of Public Affiars

Mentor: Stephen Hartnett, Professor
DC - College of Liberal Arts and Sciences

Abstract:
The policy process in America engineered mass incarceration. As a result, the United States is the only country with a prison population exceeding 2 million, which does not include the 4.5 million individuals involved in the criminal justice system via probation or parole (Kaeble & Cowhig, 2016). Scholars have researched pedagogy in prisons, the environments and failed systems that have led individuals into the criminal justice system, and recidivism factors. However, scholars have not taken an in-depth approach of linking the policy process to oppression and its effects on rehabilitation tools. More specifically, its effects on education and pedagogy in prisons. Therefore, this research paper will explore the policy process that engineered mass incarceration via John Kingdon's Multiple Streams Framework, analyze the relationship of oppression, prison education and pedagogy via Paulo Freire's Pedagogy of the Oppressed, and examine how policy pervades oppression and permeates education and pedagogy in prisons. Moreover, this paper will conduct a literature review on recent prison pedagogy, which will facilitate the discussion on the interlocking systems of oppression that are inhibiting effective criminal justice reform in the United States.

Can overwintering insects actively limit the energetic costs of warming climates during dormancy?

Lalitya Andaloori
DC - College of Liberal Arts and Sciences

Mentor: Gregory Ragland
DC - College of Liberal Arts and Sciences

Abstract:
Winters are generally becoming shorter and warmer as our climate warms. This poses a risk to organisms that go dormant (e.g., hibernate) during winter, because warmer temperatures generally lead to higher metabolic rate (especially in ectotherms), which in turn depletes energy reserves. We used temperature-controlled laboratory experiments to ask two questions about regulation of metabolic rate in Rhagoletis basiola, a fruit fly native to Colorado that overwinters in diapause (dormancy in insects) and whose metabolism is highly temperature-sensitive: 1) does long-term exposure to warm temperatures lead to active suppression of metabolic rate, 2) do populations at low and high altitudes that experience different temperature conditions exhibit differences in the capacity to suppress metabolic rate? Suppression of metabolism is a common strategy for energy conservation during diapause, but it is unclear whether and how it might be buffered against temperature changes. Respirometry is a way to measure carbon dioxide production in individual pupae and is a reliable way of estimating metabolic rate. By measuring metabolic rates via respirometry during short- and long-term exposures to warm temperatures, we assessed different strategies that the pupae utilize to mediate diapause metabolic rates. Populations at higher altitudes spend most of the winter under an insulating layer of snow, while those at lower elevations experience greater temperature fluctuations. Therefore, we also tested whether populations sampled from high and low elevations use different modes of metabolic regulation to deal with these different environments.

Trends in Microclimatic and Floristic Variability 30 Years After the 1988 Yellowstone Fires

Andrew Jesus Andrade
DC - College of Liberal Arts and Sciences

Mentor: Diana Tomback
DC - College of Liberal Arts and Sciences

Abstract:
In the Greater Yellowstone, wildfires initiate profound changes in forest ecosystems that may last for several decades, including a more variable and harsher microclimate in burned compared to adjacent unburned areas. However, the association between microclimate and post-fire plant diversity is mostly unexplored. Using permanent field plots, our lab has examined ecosystem recovery for nearly 30 years after the 1988 Yellowstone fires on southerly slope-faces of Henderson Mountain (HM) and northerly slope-faces of Mt. Washburn (MW). Plots were established in study sites with similar environmental conditions, including moist-burned, moist-unburned, dry-burned, and dry-unburned. In 2016-2017, we assessed plots for total plant species and conifer regeneration and deployed microclimate sensors on a random subset of plots (n=34) for ~60 days during the growing season to characterize seasonal soil temperature (ST) and soil moisture (SM) by study site. Microclimatic parameters were estimated using bootstrapping and auto-regressive models. At HM, ST was more variable in burned (4-61°C) than in unburned sites (1-27°C), possibly related to high solar radiation on southerly slope-faces and sparse conifer regeneration. The dry-burned site had the most variable ST, lowest average SM, and was dominated by grasses, including blue wild rye (Elymus glaucus). At MW, ST showed similar variability between burned and unburned sites (2-41°C), possibly related to canopy closure in burned sites. Microclimate may influence post-fire species composition in exposed locations or where conifer regeneration is minimal (HM) bit appears less important where conifer regeneration has reduced microclimatic variability (MW).

Judicial Discretion

Ashley Annan
DC - School of Public Affairs

Mentor: Stacey Bosick, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Culture of the courtroom and Judicial Discretion: Courtroom culture and legal procedure for the work group, defendants, and gallery observers in Denver, CO. The courtroom is the symbolic embodiment of what we know to be justice. It is space where judgements are made both in the legal sense and where the raw forms of the human condition are allowed to surface. Judgement and prejudice are typically unaccepted behaviors in society as they fall outside the norm, but the courtroom appears to be gray area when dealing with these issues. Through courtroom observation we are able to explore and witness firsthand how much of our inherent beliefs, cultures, and environment come into play when it comes to justice. This ethnographic study investigates the culture of the courtroom and what physical setting as well as the pieces that fill it influence the defense, prosecution, judge, defendants, and gallery observers. With special attention paid to judicial discretion. Through participant observation in the courtroom this study will begin to explore how each role of the courtroom influences the outcomes for defendants. The conclusion focuses on the results my original qualitative data has on the initially assumed factors that influence a final ruling with considerations to race, age, education level, and familial support.

Eye Tracking in Correlation with OXTR rs53576, Altruism and VERP to Negative Images

Bethelehem Ashebo
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Mentor: David Albeck, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Social behaviors have been correlated to variations in the single nucleotide polymorphism (SNP), rs53576, of the oxytocin receptor (OXTR) (Israel et al., 2009). For example, altruism levels tend to vary with rs53576 genotype (Israel et al., 2012). A recent study in our lab found that those with a GG allele genotype in the OXTR exhibit a significantly greater visually evoked response potential (VERP) during the LPP when viewing negative images compared to A allele carriers (Fowler et al., 2018). The amount of attention people with the two different genotypes pay to negative images could play a role in why there is a difference in VERP magnitude. This study will investigate attention allocation, as measured using eye tracking, to see if there is a correlation to OXTR genotype. We will also measure subjective altruism score and VERP to emotionally valanced images. We hypothesize that participants with an A allele will pay less attention to negative images than those with the homozygous GG OXTR genotype. Similarly, we expect participants to react with a smaller VERP if they do not spend as much time looking at negative images as do those who have a greater VERP. Lastly, participants who pay less attention to negative images overall may also have lower subjective altruism scores.

Zinc Coordinated Oligomeriztion of the Amyloid-Beta peptide in Alzheimer's Disease

Dan Fai Au
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Brian Kierl
DC - College of Liberal Arts and Sciences

Mentor: Liliya Vugmeyster, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
Aggregation of the amyloid-beta (Aß) peptide is an initiating event in Alzheimer's Disease (AD) according to the amyloid cascade hypothesis. Aß aggregation occurs as several polymorphs, with oligomeric species thought to be more toxic than fibrillar Aß. The presence of zinc ions in concentrations normal at neuronal synapses promotes the formation of the oligomeric Aß. Zinc coordination is likely a result of binding of Aß histidine residues and the carboxylate side chains of two other residues. Transmission Electron Microscopy (TEM) images confirm the formation of amorphous, oligomeric Aß aggregates in the presence of zinc, versus fibrillar Aß in the absence of zinc. Dynamic light scattering (DLS) techniques are employed to demonstrate the heterogeneity of the zinc aggregates. Solid state Nuclear Magnetic Resonancce (NMR) experiments suggest that flexibility in the disordered N-terminal domain of Aß, particularly in the histidine 6 residue, contributes to the zinc-induced aggregation state. The role of zinc in AD pathology is complex and nuanced-- zinc may promote formation of more toxic aggregates but evidence also suggests zinc can mitigate Aß-induced cell leakage. Understanding the roles of zinc in AD pathology is important to developing therapeutics.

Proton Transport in E. coli CLC Transport Protein by Adaptive QM/MM Dynamics Simulations

Baris Aydintug
DC - College of Liberal Arts and Sciences

Mentor: Hai, Lin, Professor
DC - College of Liberal Arts and Sciences

Abstract:
The CLC transmembrane proteins are Cl– channels and Cl–/H+ antiporters. Highly conserved in all domains of life, CLCs serve a variety of functions, including high-acid response, controls of cell volume and neural resting potential, and lysosome acidification. It has been established that a prototypical E. coli CLC (EcCLC) transports Cl– and H+ stoichiometrically 2.2:1, but many details are not completely clear for the actual H+ translocation process. Here we apply multiscale combined quantum-mechanical/molecular-mechanical (QM/MM) simulations to study H+ migration via the Grotthuss mechanism through the transmembrane domain of EcCLC. In particular, we employ the novel adaptive QM/MM algorithm, which reclassifies atoms as QM or MM on-the-fly in a continuous and smooth manner during molecular dynamics simulations. This is the first time that adaptive QM/MM is applied to model H+ translocation through a biological channel. Our data suggest that the H+ relay dynamic described by adaptive QM/MM is essentially the same as that revealed by conventional QM/MM, but with potentially much reduced computational costs.

Role of the dorsal striatum in fear extinction and relapse

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Additional Student Co-Authors:
Jennifer Jaime

Mentor: Bejamin Greenwood, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
The poor long-term success of fear extinction-based exposure therapy is often caused by the relapse of previously extinguished fear. We have established that when activated during fear extinction, the nigrostriatal dopamine (DA) pathway enhances extinction memory and reduces renewal. Although the specific neural circuits attributed to this effect are unknown, their identification could pave way for the development of innovative methods to reduce fear relapse in clinical settings. A target of nigrostriatal DA is the dorsal striatum, which consists of two regions: The dorsomedial striatum (DMS), responsible for goal directed learning, and the dorsolateral striatum (DLS), concerning more inflexible, habitual behaviors. Using a GABAA/GABAB agonist cocktail, we temporarily inactivated the DMS or DLS in adult, male Long-Evans rats during fear extinction to investigate the roles of these regions in extinction learning and memory. Inactivation of the DLS enhanced fear extinction memory, while inactivation of the DMS reduced renewal. To investigate the involvement of DA, D1 receptor signaling was blocked in either the DMS or DLS during fear extinction. D1 blockade in the DMS impaired extinction retrieval in the extinction context, but the extinction memory remained susceptible to renewal. D1 blockade in the DLS had no effect on extinction memory or renewal. This suggests that the DMS supports context-specific fear extinction through a mechanism involving D1 receptor signaling, whereas fear extinction supported by the DLS is resistant to contextual modulation and fear renewal, but D1 receptor signaling does not contribute to extinction learning in the DLS.

Model Arab League - Rocky Mountain Conference, Spring 2019

Esther Bellinsky
DC - College of Liberal Arts and Sciences

Walter King
DC - College of Liberal Arts and Sciences

Ana Mcknight
DC - College of Liberal Arts and Sciences

Mentor: Bassem Hassan, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Activity Type: Mock Parliament

2019 EUReCA Grant Recipients

The Model Arab League is an annual event put on by the National Council on U.S.-Arab Relations. The participants play the roles of politicians in the aim of formatting resolutions addressing sets of issues currently arising in Middle East politics and society. Through the processes of parliamentary procedure, participants work with their fellow delegates to finalize the most effective resolutions possible. A goal of all delegates is to bring forth their knowledge of the issues at hand and take initiative in putting forth their priorities.

The event is attended by college students from several schools. The team members from each school come to the conference as a group of delegates representing one of the Arab League member states. At the end, after a process of all members rating the performance of their colleagues, a winning team that showed the highest level of knowledge and leadership in the proceedings is recognized at the closing ceremony.

Each member of our delegation to the conference will take their place in one of five councils of the Model Arab League. Those councils are each concerned with a separate category of issues and ours are:

Council on Political Affairs;

Council of Arab Social Affairs Ministers;

Council on Political Affairs.

The Piece Between Us; A Video Series on the Israeli-Palestinian Conflict.

Esther Bellinsky
DC - College of Liberal Arts and Sciences

Mentor: Dale Stahl
DC - College of Liberal Arts and Sciences

Abstract:
The purpose of this project is to create a platform where Israeli and Palestinian youth can come together to talk about their differences and find common ground. Through a series of questions, open discussions and personal narratives this video series touches on themes of identity, culture and belonging while simultaneously tackling the issues that have caused great conflict between Israelis and Palestinians for almost a century: Palestinian Refugees and the Right of Return, Israeli settlements in Palestinian territory, the Status of Jerusalem, Terrorism and Violence, and Water Distribution.

This video series was created for anyone struggling to understand their place in the Israeli-Palestinian conflict and anyone who simply wants to educate themselves on the issue. This video series is meant to serve as a symbol of coexistence and aims to break negative social stigmas and stereotypes regarding Israeli and Palestinian collaboration. Ultimately, this project is intended to advocate for a future-focused, inclusive Israeli and Palestinian community.

Acid Base Titration-Neutralizing Capabilities of Toothpaste

Silas Benischek
DC - College of Liberal Arts and Sciences

Mentor: Rebecca Cherry
DC - College of Liberal Arts and Sciences

Abstract:
In this experiment, Tom's, Crest, and Colgate toothpaste samples were analyzed via a back-titration method to determine which brand had the greatest number of moles of acid neutralized per toothpaste sample. This experiment idea was inspired by another general chemistry lab where antacids were dissolved in excess hydrochloric acid and titrated with sodium hydroxide to determine the moles of acid neutralized per antacid tablet. The idea to use toothpastes was inspired from a post-lab question that asked each student to propose two experiment ideas related to the titrations performed in lab. Toothpaste was one experiment idea proposed in response to that question because it has ingredients that neutralize acid in teeth. Unfortunately, the neutralization results were inconclusive because the active ingredients in the Crest and Colgate toothpastes were producing hydrofluoric acid when reacted with hydrochloric acid, a weak acid that was also neutralized by the sodium hydroxide during the back-titration. Other side reactions with the inactive ingredients likely also interfered with the titration. Further research is needed to determine ways in how to determine which ingredients contribute to each toothpaste's neutralizing capabilities.

Newly Discovered and Ubiquitous Nitrogen Cycling Microbe is Resilient to Diverse Environmental Changes

Owen Berg
DC - College of Liberal Arts and Sciences

Munira Lantz

Michael Kain

Andrew Boddicker

Additional Student Co-Authors:
Ashley Luntsford

Mentor: Annika Mosier
DC - College of Liberal Arts and Sciences

Abstract:
Nitrite-oxidizing bacteria (NOB) play an important role in maintaining the health of natural and engineered ecosystems across the globe. NOB metabolism converts nitrite into nitrate, thus reducing nitrite accumulation and toxicity to animals, fish, and humans. NOB metabolism can minimize pollution (e.g., wastewater or fertilizer runoff) by producing nitrate that is removed from a system via other widely occurring nitrogen cycle pathways. In freshwater ecosystems, NOB are often faced with fluctuating environmental conditions and contaminants from wastewater effluent or agricultural drainage. If NOB activity is reduced or halted due to environmental perturbation, nitrite concentrations will build up and the negative effects will propagate through the ecosystem (e.g., nitrite toxicity, low oxygen, loss of biodiversity). Here, we evaluated the environmental limits of a newly described NOB, Candidatus Nitrotoga sp. CP45, cultured from the anthropogenically-impacted South Platte River system in Colorado. Ca. Nitrotoga sp. CP45 oxidized nitrite over a wide range of temperatures (4-28˚C), pH values (pH 5-8), and antibiotic classes and concentrations (5-500 nM Erythromycin, Penicillin, Sulfamethoxazole, and Trimethoprim). These results suggest that Ca. Nitrotoga sp. CP45 is resilient and able to maintain nitrogen cycling—a critical ecosystem service—in the face of drastic environmental changes. By improving our understanding of nitrite oxidation under natural and stressed conditions, this research can inform management strategies including in-stream temperature regulations and mitigation of antibiotic pollution.

Quantitative Assessment of Equilibration in Molecular Dynamics Simulations

Shamik Bhat
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Sahitya Talachutla
DC - College of Liberal Arts and Sciences

Mentor: Hai Lin, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Molecular modeling and simulations play an important role in modern chemical research by providing detailed atomic-level descriptions and understanding of the mechanisms and dynamics for chemical processes. Many simulations require the model system to be in equilibrium (a stable state) before the thermodynamic properties (e.g. energy) can be accurately calculated. However, it is not trivial to determine if a system has been properly equilibrated, and many studies only carry out simple qualitative assessments such as visual inspections of the simulated trajectories and/or the plotted time series of thermodynamic variables such as energy and temperature (Grossfield and Zuckerman, 2009). Algorithms for quantitative assessments have been published (Schiferl and Wallace, 1985), but their application has been hindered by the lack of user-friendly computer programs that are freely available. To address this issue, we have developed a program called EquCheck to determine equilibration based on statistical analyses of time series of thermodynamic variables, and we will make it freely available to the scientific research community. Four test-statistics are implemented: the Mann-Kendall test for trend (Bradley, 1968), Shape test for normality (Snedecor and Cochran, 1967), Shapiro-Wilk test for normality (Shapiro and Wilk, 1965), and Von Neumann test for correlation (Hald, 1952). Our code is supplemented by 6 test runs and one user's manual.

Sex differences in the neural circuits controlling voluntary exercise behavior

Kelsey Bonar
DC - College of Liberal Arts and Sciences

Mentor: Benjamin Greenwood, Benjamin Greenwood, Assistant Professor Department of Psychology
DC - College of Liberal Arts and Sciences

Abstract:
Regular exercise provides numerous benefits for mental and physical health, and has been shown to protect against the negative impacts of aversive events, yet participation has decreased, while rates of mental health disorders have increased, particularly in females. A better understanding of the underlying neural circuits that motivate exercise behavior could lead to novel strategies to increase participation in exercise. This study's goal was to identify the neural circuits that support the initial acquisition and later maintenance of voluntary wheel running in male/female Long-Evans rats. When rats are exposed to voluntary wheels, their running behavior follows a characteristic pattern of two distinct phases consisting of an acquisition phase, where behavior is first acquired and learned, followed by a maintenance phase, where running behavior reaches a plateau. We temporarily inactivated dorsal striatum subregions, which are implicated in different learning strategies. In males and females during phases of the estrous cycle other than proestrus, temporary inactivation of the dorsomedial striatum (DMS) reduced voluntary exercise during the acquisition phase, but not the maintenance phase. In contrast, temporary inactivation of the dorsal lateral striatum (DLS), which is a circuit important for habit formation, reduced voluntary exercise during the maintenance phase, but had no effect on exercise during the acquisition phase. Interestingly, we observed that females in proestrus phases rely on the DLS to support the acquisition of wheel running, rather than the DMS. These data suggest that the neural circuits that support voluntary exercise behavior depend on exercise history and sex.

The Man Upstairs - Personal and Shared Perspectives,through the eyes of one man.

Migeul Brañas
DC - College of Arts and Media

Mentor: Jessica McGaugh, Professor
DC - College of Arts and Media

Abstract:
The Man Upstairs is a short documentary that is meant to raise questions about how we perceive reality. The film follows a man, Roger G. Scott, a quirky landlord who has been employed by a yoga organization for the last 40 years. We follow him and his unconventional life; from his unorthodox living conditions, his daily habits, the contact he has with his family, and his view on the world. Although not successful by common definitions of success that involve material wealth or spiritual development, Roger's view of the world challenges how we view others and how we view success, and as viewers, we are encouraged to think about our own commonly held definitions of the world around them, the effect that a subjective perspective has on them, and the way we think about how reality is perceived and interpreted by shared perception.

Forget Me Not

Robin Buchanan
DC - College of Arts and Media

Mentor: Vivian George, Senior Instructor
DC - College of Arts and Media

Abstract:
Several decades ago, my great great grandfather immigrated to America to escape the Armenian Genocide. He was a photographer, and was spared because of it, and made to take pictures of Turkish officials. When he came to America he brought with him hundreds of photographs, of officials and of his family and friends, some of the only documentation of an awful event that most of history denies even happened. I've struggled with my identity and the weight of my family's past for a long while. I know so little about my history, and it's always felt like a piece of me that's missing. I carry a lot of anger and grief over what happened that I'm not sure where to place. I wanted to communicate my grief and explore my identity through a series of paintings of my great great grandfathers old photographs, painted in acrylic and intertwined with Forget Me Nots, the official flower of remembrance for the genocide. The flowers represent the Armenian people and their resilience, interweaving with my family members who survived and wilting in the presence of tragedy and death. I've also made some more abstract pieces, not showing my grandfather's photographs but pieces centered about my experience with Armenian traditions in america. I hope I can bring awareness to what happened and show how it still affects Armenian families generations later.

Accessibility to Gynecological Care in Adolescent Girls in Rural India

Molly Burns
DC - College of Liberal Arts and Sciences

Mentor: Sara Yeatman, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
This study aimed to assess barriers to accessing gynecological care in adolescent girls as well as parental attitudes and perceptions surrounding care in rural areas around Manipal, India. It is important to place an emphasis on adolescent health as it lays the groundwork for health throughout an individual's life. There are significant health disparities among men and women in India, making it important to focus on women's health and empowerment. Semi-structured interviews were conducted among mothers of adolescent girls after giving consent. The interviews took place in Kannada and were translated to English via a translator. The results revealed that the majority of participants discussed gynecological issues with their daughters and felt that their daughters were comfortable coming to them with any questions or concerns. The results also showed that almost all of the participants' daughters had received some kind of gynecological or developmental education in school. Results also showed that most of the adolescents had never seen a conventional doctor and had reported stomach aches, backaches, and irregular periods as their only gynecological issues. Furthermore, results indicate that there is a high level of communication concerning certain reproductive health issues but discomfort discussing others. There is a lack of knowledge and utilization of conventional healthcare services leading to a potential underreporting of gynecological problems. Further research is needed to examine the knowledge and accessibility of gynecological health services for adolescent girls in India in order to make improvements in women and girls' quality of life.

Automatic Classification of Calcifications and Masses In Breast Mammograms Using Deep Neural Network

Samantha Butler
DC - College of Engineering, Design and Computing

Mentor: Chao Liu, Assistant Professor
DC - College of Engineering, Design and Computing

Abstract:
Mammography is one of the most widely used techniques today to screen for breast cancer. Due to mammographic screening's manual nature many breast masses are misdiagnosed or missed completely. A considerable amount of research has been done on computer aided detection's (CAD) effects on better helping detect early breast cancer. Achieving high diagnostic accuracy requires expertise acquired over many years of experience as a radiologist. In this paper we present an approach to better help detect early breast cancer by developing a software that acts as a 'second-opinion' to the radiologist without compromising their medical expertise. Briefly, a deep learning model is trained to recognize a small region of the whole image, i.e. image patches. Irregular breast lesions are extracted through these patch images. Then the trained deep learning model is used to "scan" a whole image and make predictions for all image patches and better highlight areas of concern and irregularity. We tested our methodology using the publicly available dataset DDSM and the InBreast dataset. Our highest accuracy achieved was 98.3% and 99.1%, respectively.

Addressing Dental Anxiety via Innovative Technologies

Hunter Call
DC - College of Liberal Arts and Sciences

Nisa Far
DC - College of Liberal Arts and Sciences

Katherine C Ketcham
DC - College of Liberal Arts and Sciences

Sherleen Tran
DC - College of Liberal Arts and Sciences

Mentor: Larry Erbert
DC - College of Liberal Arts and Sciences

Abstract:
It is common for patients to avoid visiting healthcare professionals about their health concerns. The impact of dental fear and anxiety is a commonly overlooked issue that has extreme health consequences in regards to physical and mental health as well as interpersonal relationships. Although theories and models have been used to explain why patients do not go to the dentist as often as is necessary, more research is necessary to form alternative solutions to decrease dental fears and anxieties. As the topic of dental anxiety is becoming more prevalent, there is a need for more innovative techniques for improving patient health and well-being. In our study, we surveyed CU Denver students about barriers to dental care and interviewed third-year dental students from the University of Colorado School of Dental Medicine about their perspective on virtual reality (VR) as a potential method to address dental anxiety. These results will provide insight to the prevalence of dental anxiety and improve the overall health of dental patients.

The genomic basis of ecological speciation in the apple maggot fly, Rhagoletis pomonella

McCall Calvert
DC - College of Liberal Arts and Sciences

Mentor: Gregory Ragland, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
The process of speciation formation is fundamental to the production of biodiversity on Earth. Despite its importance to shaping the world around us, we still know little about how it works and the selective factors that give rise to it. Ecological speciation, where two formerly interbreeding population split as a result of adaptation to different environments, is hypothesized to be an important generator of biodiversity. Adaptation to novel ecological environments often involves selection on multiple traits. When the genetic basis of different ecological traits are not independent, e.g. the same gene controls multiple traits (a phenomena known as pleiotropy), it can facilitate adaptation and ecological speciation through correlated responses to natural selection. The same process can also constrain adaptation if pleiotropy is acting to produce trait combinations that are detrimental in the new environment. Animals that are currently undergoing adaptation events provide useful snapshots in the process of speciation and to address questions about how genetic relationships among traits facilitate or constrain adaptation and speciation. Here we show evidence for strong relationships between the genetic elements underlying two distinct ecological traits in the apple maggot fly Rhagoletis pomonella. In the last 200 years, novel, reproductively isolated R. pomonella populations evolved changes in life history timing during adaptation to apples. Despite the rapid rate of this adaptation event, the genetic relationships among life history traits R. pomonella suggest that adaptation should be constrained. We discuss different genetic processes that could account for this paradoxical pattern.

Do current distress screening tools work equally well for male and female caregivers?

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Abstract:
Phase 1 clinical trials (P1CT) are typically reserved for cancer patients who have exhausted standard treatment or have a rare cancer diagnosis. Participation in a P1CT requires patient and family caregiver commitment to adhere to dose regimens, attend infusion appointments, monitor and manage potential side effects and attend follow-up appointments. Not surprisingly, caregivers of cancer patients participating in P1CT are a highly distressed population that can benefit from intervention (Kessler et al., 2014). Distress screening can be used to identify caregivers with the greatest need for psychosocial intervention (Northouse et al., 2010). However, the question arises, "How effective is distress screening in identifying caregiver specific distress?" In the current study, the Patient Health Questionnaire (PHQ-4) was utilized to assess psychological distress as a means of determining eligibility for a psychosocial intervention study. This project explores the potential limitations of this measure. Caregivers of P1CT cancer patients were recruited at Anschutz Medical Campus to participate in a nine-week longitudinal study examining the impact of a telephone-based stress management intervention. Participation was determined by distress screening scores of > 3, mild to severe distress, on the Patient Health Questionnaire (PHQ-4). A binary variable was created in which caregivers who screen failed were coded as 1 and those who did not screen fail were coded as 0. A binary logistic regression model was used to assess the association between gender and screen fail. A total of 26 P1CT caregivers consented to the larger study. Of the 26 consented caregivers, 13 caregivers (51.9%) were deemed ineligible as determined by a PHQ-4 total score of < 3 and 69.2% (9/13) of these ineligible caregivers were male. On the depression subscale of the PHQ-4, 77% of screen fail males reported an absence of depression with a total score of zero and 22% reported a total score of 1. On the anxiety subscale of the PHQ-4, 56% of screen fail males reported an absence of anxiety with a total score of zero and 44% reported a total score of one. Male gender (OR= 7.5, 95% CI,1.3-43.0) was associated with increased odds of screen fail. Data from the present sub study suggests male caregivers are less likely to meet the distress eligibility criteria compared to female caregivers. Male caregivers may be excluded from potentially beneficial psychosocial interventions because distress screening tools are not sensitive to the types of distress commonly experienced by men or men may be less likely to acknowledge common symptoms of distress. More research is needed to determine if the current distress screening tools are appropriate for different caregiver populations. Further research exploring the manifestation of distress in cancer caregivers is warranted.

Sex Differences in Endotoxin-Induced Neonatal Lung Injury: Insights into the Pathogenesis of Bronchopulmonary Dysplasia

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Mentor: Clyde Wright
Department of Pediatrics/ Section of Neonatology

Abstract:
Bronchopulmonary Dysplasia (BPD) is a chronic lung disease that affects the premature population across the globe. Research in our lab focuses on the pathogenesis of BPD. Inflammatory stress is a contributing factor for developing BPD. It is known that males are more susceptible to certain types of lung injury.

There has been research indicating that the master regulator of the immune system may contribute to the pathogenesis of BPD: The NF-kB pathway. It is of great importance to conduct research at the cellular level and target specific components that could lead to the origination of BPD. The protocol followed for this experiment involves using murine models and giving an intraperitoneal injection of LPS –an endotoxin that initiates an inflammatory response— followed by monitoring their survival.

Mice were identified as female or male via PCR and looking for the SRY gene. The mice lungs were inflated and fixed for morphological assessment, using the MetaMorph analysis software. The next set of experiments were carried out to determine cytokine activation of pro-inflammatory and anti-inflammatory genes. Assessment of cytokine activation was possible using RT-qPCR and RNA extraction. Results for this set of experiments showed that there was only a slight difference between male and female lung injury following an inflammatory response. This is a groundbreaking finding as it reflects the potential of the NF-kB pathway being an essential regulator for lung development despite being female or male.

Discovering Circular RNAs in Mouse Embryonic Stem Cells via Nanopore Sequencing

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Abstract:
While circular RNAs (circRNAs) are a diverse group of non-coding RNAs, there is limited research on their features and functions. The primary objective of this project was to isolate circRNAs from wild-type (WT) and Glycogen Synthase Kinase-3α-/-; β-/- double knock-out (DKO) mouse embryonic stem cells (ESCs). This was innovative research as it was the first time circRNAs in mouse ESCs were studied using Nanopore sequencing technology. Quantitative analysis of data obtained from these experiments showed that 3.0% of total RNA species in WT ESCs were circular, while the amount of circRNAs in DKO ESCs was approximately 1.3% of total RNAs.
Later, isolated circRNAs were sequenced and aligned against the mouse reference genome. Through these processes, numerous genes in the mouse genome were found to form circular RNAs. According to this data, some of the histone genes in mouse ESCs form circular RNAs. Several of these aligned genes have been reported previously to generate circular RNAs, which validated our experimental approach. One of these genes is RPPH1, which has been suggested as a prognostic biomarker for the diagnosis of gastric cancer. In order to confirm the results obtained from Nanopore sequencing, we designed PCR primers for thirteen genes that are predicted to form circRNAs; the primers were designed as to only detect circRNAs. To definitively identify the regions of these genes that form circRNAs, we cloned and sequenced 6 circRNA PCR products. Analysis of the DNA sequencing revealed the nature of these circRNAs genes. In summary, this research concludes that circular RNAs represent a diverse, stable and abundant group of RNA in mouse ESCs.

Implications of Attitudes Towards Homelessness

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Abstract:
Throughout major metropolitan areas around the United States, there are countless individuals that are homeless or perceived as homeless. It is a public health problem that has plagued cities throughout history. It is a problem that is salient to society without outright solutions and therefore brings to question the role that the public at large has in the care and services that are provided to the homeless. Federal and state governments have taken action to implement laws and initiatives to end homelessness, yet the no problem still exists. This study investigates a population of U.S. college students (ages 18 years old to 35 years old) to examine their attitudes of the homeless population by a bivariate correlation of measuring empathy and political attitudes towards public policies. Researchers surveyed students anonymously at the University of Colorado Denver with a questionnaire to measure their responses on politically driven questions opposed to those of driven by empathy in order to understand if a implicit bias could be rendered by comparing the emotional empathy to their political empathy.

A Transient Dopamine Signal Represents Avoidance Value and Causally Influences the Demand to Avoid

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Mentor: Erik Oleson
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Abstract:
Although an abundance of literature upholds the idea that mesocorticolimbic dopamine (DA) plays a predominant role in regulating the price animals will pay for reward, its role in avoiding harm remains controversial. To investigate whether dopamine plays a role in regulating the price animals will pay to avoid harm, we required rats to press a lever to avoid electrical footshock; the price to avoid increased steadily within each daily session. Using fast-scan cyclic voltammetry (FSCV), we measured dopamine concentration in rats as they completed the number of lever presses. The concentration of dopamine was inversely related to price. Finally, we applied optogenetics to determine how modifying dopamine release influences the price rats will pay to avoid. Using a behavioral economics approach, we fit demand curves, which represent the relationship between avoidance and price, to our data. If avoidance became more sensitive to price, the demand curve would decay at a faster rate; suggesting the value is decreased. If avoidance became less sensitive to price, the demand curve would decay at a slower rate; suggesting the value is increased. We found that increasing dopamine release at an avoidance predictive cue made animals more sensitive to price, depicting a negative reward prediction error. Contrastly, increasing dopamine release at an avoidance outcome made animals less sensitive to price, depicting a positive reward prediction error. These results suggest that short-lived dopamine release events represent the valuation of avoidance outcomes. Specifically, these dopamine release events allow us to predict the value of avoiding harm.

Understanding the Impact of Fascination on Creative Problem Solving

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Abstract:
Mysterious pictures of nature have been shown to have correlations with attentional benefits that are proportional to the degree of fascination an image elicits. However, studies researching other potential cognitive benefits of these images through Attention Restoration Theory (ART) are lacking. This study aims to determine if creativity has a similar relationship by presenting participants with sets of high or low mysterious images prior to solving a creative problem and comparing the two scores for 40 trials. The creativity problem will present participants with three words and be asked to produce another that is related (e.g. cottage, swiss, cake = cheese). The participants are tested on their accuracy and proficiency when solving a creativity problem and will be compared using t-tests.

Automatic detection and quantification of hand movements toward development of an objective assessment of primary motor symptoms in Parkinson's disease

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Yan Pang

Mentor: Chao Liu, Assistant Professor
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Abstract:
Background: Parkinson's disease (PD) is the most common movement disorder and the second most common neurodegenerative pathology (De et al 2006). Currently, movement disorder clinicians depend on their own experience and training to determine the severity of the canonical motor symptoms: tremor, bradykinesia and rigidity. In practice, clinicians assess the severity of motor impairment using a set of validated scales, thereby arriving at a disease profile by means of observation. Currently, there is not an objective approach to measure and analyze impaired movement in PD. We propose a method to differentiate and quantitate the performance of phalanx joints, with respect to bradykinesia, using automated analysis of hand gestures.
New Method: We built a hand/finger motion capture prototype to record hand/finger motion of control subjects and Parkinson's disease patients. Two cameras are mounted in fixed positions inside the prototype, where the distance and angle between the cameras are known. The two-dimensional (2D) Human Hand Motion Estimation was implemented on the hand motion videos captured by these two cameras and then fused together to create a three-dimensional (3D) representation. Based on the 3D coordinates, the detailed motion features were extracted by using Discrete Wavelet Transform (DWT). These features were used to determine variations between control and subject data on the same joints.
Results: Using our prototype, we discovered that a unique combination of phalangeal joint points contributed to detection of PD pathology; we found the following: "Postural Tremor of Hands" was differentiated by the middle and index finger; "Finger Taps" could be distinguished by the proximal phalanx joint on each finger; The middle and the proximal phalanx on the index finger could be used as key points to analyze "Hand Movements"; and we should focus on the proximal phalanx of the thumb, the distal and middle phalanx of the ring finger to analyze "Hand Movements and Rapid Alternating Movements of Hand".
Conclusions: DWT analysis of hand movements using phalangeal joint targets revealed significant differences between control subjects and Parkinson's disease patients. The phalangeal joints under four hand motions: postural tremor; finger taps; hand open/close and hand pronation/supination were assessed. Accordingly, this may help doctors to focus more on these key joints to diagnose the Parkinson disease.

A Low-Cost Lung Simulator for Respiratory Therapists in Training

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Abstract:
Mechanical Ventilators are devices used to prolong life for patients that have suffered from acute respiratory illnesses. Since mechanical ventilation is a necessary procedure, physicians need to be trained to recognize improper ventilation associated with a variety of diseases and follow proper mechanical ventilation technique. In a survey conducted across medical students, 89% of the participants said they do not have the proper training in medical school to adjust settings in a mechanical ventilator such as volume control, pressure, and other parameters within the equipment. Without this knowledge, barotrauma and ventilator-related injuries can occur in as little as six incorrectly calibrated breaths. Current training devices on the market, aka lung simulators, cost upwards of 50,000 dollars and are difficult to use effectively. There is a need for a low-cost lung simulation device that can accurately represent respiratory patterns in order to properly train respiratory therapists. A lung simulation device was developed that can mimic the respiration patterns of infants or adults who have a condition requiring ventilation. Our device simulates normal lung capacity and varying disease states by altering pressure outputs/inputs, volumes, and flow rates. This easy-to-use, low-cost simulator can be used in hospitals across the nation to increase the number of the well-trained respiratory therapists. Proper use of mechanical ventilators will decrease barotrauma and ventilator related injuries and therefore increase patient outcomes and quality of life.

Graduate Early Childhood Psychology Training

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Mentor: Rachel Stein
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Abstract:
This study was a nation-wide collection of graduate level course syllabi to determine what early childhood focused training is provided to students preparing to work as school psychologists. Two hundred and twenty-seven graduate programs across the nation were emailed and thirty-eight programs sent syllabi for analysis. Out of the thirty-eight programs that sent in syllabi, thirty of them sent one syllabi, six sent in two syllabi, one sent in three syllabi, and one sent in more than four syllabi, making the total number of syllabi received forty-eight. A content analysis of syllabi was conducted to look for patterns of similarity across training programs. Analysis of the course descriptions from the syllabi revealed that twelve mentioned early childhood, three mentioned preschool, two mentioned the word prenatal, twenty-three mentioned assessment, and twenty-six mentioned development. Although analysis is still ongoing, preliminary results suggest the majority of graduate level school psychology content is presented as part of assessment or lifespan development courses, with a smaller number of courses that focus on early childhood more broadly.

City Bees: Local Ecological Drivers of Bee Abundance and Bee Richness in an Urban Environment

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Mentor: Rebecca Hufft
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Abstract:
Pollinating animals are vital for natural, agricultural, and urban ecosystems. A majority of flowering plants and human-consumed crops rely on animal pollination for their reproductive success. Pollinator populations - especially bees - have significantly declined worldwide over the past century. A key driver of this decline is habitat loss, including the conversion of natural land to urban development. Understanding how wildlife interacts with this expanding urban interface, and how best to manage wildlife in these areas is becoming increasingly important. Previous urban bee surveys found cities can support a diverse bee assemblage, with research focusing on determining drivers of bee richness and abundance in urban environments, including assessing the impacts of local ecology on these bee populations. While Colorado has an extensive list of bee species (almost 1000), the Denver Metro Area, the largest urban center in Colorado, has not been thoroughly sampled. Results from a baseline survey of the bee community (species richness and abundance) along a 114-kilometer urban corridor (High Line Canal) that traverses the Denver Metro Area will be presented. These bee community measures are presented in relationship to several local-scale plant metrics (including floral richness and floral abundance, percent vegetative cover, percent bare ground cover, and percent rock cover). Effectively managing this urban corridor's bee and floral communities is an important aspect of ensuring it remains a diverse and functional ecosystem, and a quality natural area for the citizens of the Denver Metro Area to recreate.

LGBTQ Representation in Film and TV

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University Honors and Leadership Program

Abstract:
TV and film are not just entertainment. While cynics often dismiss shows and movies as mindless nonsense, TV is a powerful socializing agent. This is due to the way in which fictional visual media shows viewers the world in ways they may never see it in real life. It can be a valuable way to promote acceptance and understanding of various individuals and minority groups, one such groups is the LGBTQ community. Via focus groups and online surveys, our research group intended to determine the overall importance of LGBTQ representation in Film and TV, the issues of current representation and recommendations for how filmmakers can create characters that promote better understanding of LGBTQ individuals within audiences.

Consequences of warming climates for the development and population growth of an important forest pest

Manaal Dalwadi
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Mentor: Gregory Ragland
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Abstract:
Beetles are one of the most diverse animal groups on the planet. This abundance also means diversity in the food consumed by the beetle species, which includes nearly every plant of economic importance, including trees. Beetle populations are expanding and moving due to climate change, posing challenges for management of affected crops and forests. This experiment measured the effects of warmer temperature on the life cycle of the spruce beetle Dendroctonus rufipennis, a major forest pest that is now at epidemic levels in Colorado. The beetles typically only complete a full generation every two years, and this was thought to be limited by an obligate, reproductive dormancy that temporarily arrests the life cycle. We hypothesized that when exposed to warmer temperatures that may be experienced under climate warming, beetles could be flexibly induced to skip dormancy and reproduce immediately, which in nature would lead to more rapid generation time and greater population growth rate. In summer of 2018, we cut infested spruce trees from Colorado and Wyoming that were brought to lab and held at 22°C. Beetles were collected three times per week for 22 weeks and either inserted into bolts with a mate to test for reproductive success, or frozen then later scored for reproductive maturity. We found that indeed, a small but substantial proportion of beetles can skip dormancy, a trait that could potentially evolve and cause more rapid population growth in response to warming temperatures.

From Vietnam to Aztlan: The Transformation of Chicano Politics in Denver's Lincoln Park Housing District 1973-1982

Madeline Davies
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Mentor: William Wagner
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Abstract:
This paper examines the conflict that erupted between the Chicano and Vietnamese communities of Denver during the summer of 1979. The end of the Vietnam War brought an influx of Vietnamese immigrants to Denver, many of whom settled in the predominantly Latino neighborhood of Lincoln Park. In 1979, growing tensions between the two ethnic groups came to a head when three Chicano youths broke into the house of a Vietnamese woman, put a knife to her throat, and stole her television set. When police arrived, they met one hundred Chicano youths who brandished rocks and glass bottles in their clenched fists. While scholars have yet to theorize about this particular conflict, I believe that it holds implications for the Chicano movement as a whole due to Denver's importance to the history of Chicano politics. Historians overwhelmingly argue that the grassroots efforts of the movement ended in the early 1970s along with the end of the Vietnam War. However, by examining the conflict that developed between Chicano and Vietnamese communities in Denver, research shows that the 1970s actually represented a transformation of Chicano grassroots politics into a youth-driven movement that worked to fight injustice alongside mainstream immigrant activism. By seeing the Chicano project as a dynamic movement that did not naturally evolve to conform to a more legislative political agenda, we can better understand the importance of youth participation within political movements and can begin to develop a new and more comprehensive dimension to the history of Chicano politics.

Sex differences in voluntary exercise

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Mentor: Benjamin Greenwood, Assistant professor
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Abstract:
Allowing access to running wheels increases physical activity status in laboratory rodents. The effects of wheel running in rats resembles many of the health benefits of exercise in humans. Current literature focuses on effects of exercise in male rats, thus wheel running behavior in males is well characterized. The goal of our study was to characterize the pattern of wheel running behavior in female rats. Adult, male and female Long Evans rats (n = 64) ran voluntarily in running wheels for 4 weeks. Males displayed a typical pattern of escalation of nightly running distance followed by a plateau occurring around week 3. In contrast, female nightly running distances exceeded that of males. Females also escalated faster; reaching a plateau after 1 week. Female running distances depended on the phase of estrous cycle. Females in proestrus, when levels of ovarian hormones are highest, began running prior to the start of the active (dark) cycle, whereas males and females in other estrous phases began running at the start of the active cycle. Most interestingly, if females were in the proestrus phase during the start of running (day 1 or 2), these females displayed greater running distances on subsequent days compared to females who started running in other phases of the estrous cycle. These data reveal novel sex differences in voluntary wheel running behavior and suggest that ovarian hormones have a profound influence on voluntary exercise. Future experiments can use this knowledge to further investigate sex differences in the effects of exercise.

Social fear conditioning in differentially housed adolescent rats exposed to the Escapable Social Interaction Test

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Mentor: Sondra Bland, Associate Professor
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Abstract:
Social fear is a learned behavior and can be adaptive, however, heightened social fear is frequently a component of stress-related disorders. Individual differences in vulnerability to conditioned social fear (CSF) may be critical in the development of stress-related disorders. Post-weaning social isolation (PSI) is a model of early life adversity that consists of housing rats in isolation during a critical period of adolescence, altering social behavior. We developed a novel procedure in male and female rats in which a stimulus rat is paired with a footshock to produce CSF following 4 weeks of PSI or social rearing (SR). Previous research indicated that CSF PSI male and female rats had increased escape behavior compared to controls when re-exposed to the stimulus rat in a novel environment. We further investigated escape behavior by combining CSF with an escapable social interaction test (ESIT). The ESIT consists of a social interaction chamber and a door leading to an escape chamber. A tether prevents the stimulus rat from entering the escape chamber. Rats were assigned to four groups: CSF and three controls. On Day 1, CSF rats were exposed to a novel conspecific paired with 4 footshocks while stimulus rats did not receive a footshock. On Day 2, all rats were exposed to the ESIT for 10 minutes with the same stimulus rat from day 1. Male rats exposed to CSF displayed an increase in latency to interact and spent more time in the escape chamber compared with the social stimulus only rats.

A Protocol of Model Construction for Polymer Electrolyte Systems in Advanced Computer Simulation

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Adam Duster
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Mentor: Hai Lin, Professor
DC - College of Liberal Arts and Sciences

Abstract:
The computational analysis of molecular structures and systems is a crucial tool in the development of novel green energy materials, such as fuel cells, and provides insights to molecular interactions inaccessible by experimental models. In electrolyte materials development, complex solvation interactions govern ionic diffusion and thus impact battery performance and lifetime, meaning that correct modeling of these interactions plays a pivotal role in analysis and design. For this reason, the first and most crucial step in computational chemistry is building an accurate model system, which provides as solid foundation to carry out the simulations and analysis. In this work, we describe in detail a protocol for building a solid-state electrolyte model system of a polyethylene-oxide (PEO) polymer network in complexed with Li+ and PF6— ions. This protocol can be easily modified for and extended to other electrolyte systems.

Identity Negotiation of Adopted Minority Children in White Families

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Mentor: Candan Duran-Aydintug, Associate Professor
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Abstract:
This on-going research provides insight on the effects of white families adopting children of color at birth, and how these children's racial and cultural identities are formed by a culture of whiteness. This research is based on a critical review of existing literature. The three main groups studied for the literature review includes children of color adopted into white families and then surveyed at multiple ages. The literature shows that children in target group can connect to those in their direct family, but have a difficult time connecting to those of the same cultural and racial identity outside of the family group. Suggestions for more comprehensive research are stated.

Dynamical Models of Rheumatoid Arthritis

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Mentor: Randall Tagg
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Abstract:
We are using a dynamical model of Baker et. al* to explore the possibility of predicting onset of Rheumatoid Arthritis. The model is based on nonlinear interaction of pro-inflammatory and anti-inflammatory cytokines. In the model, a parameter measures the effect of the pro-inflammatory cytokine concentration on further growth of pro-inflammatory cytokines. As this parameter increases, a healthy state jumps to a disease state through a fold bifurcation. By adding noise to the model, we observe precursor flickering and large-scale fluctuations that might appear clinically as early clues to incipient onset.

Challenges and lessons learned from recruitment of pregnant couples into a longitudinal couples-based physical activity study.

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Grant Morales
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Chloe Rodgers

Sydneyjane Varner
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Mentor: Krista Ranby
DC - College of Liberal Arts and Sciences

Abstract:
Couples-based research is necessary for understanding the dyadic processes underlying health behaviors. Given the challenges of recruiting both partners within couples, work is needed to improve recruitment and retention of dyads, especially within underrepresented populations. Relevant to this, there are no studies examining health behavior change within a dyadic context across the transition to parenthood (TTP). The TTP represents a life-changing shift for couples in which the needs of the new baby take priority over individual health behaviors. Given that partners tend to influence one another's health behaviors, the TTP may be a critical time point in which to leverage interdependence to promote lasting healthy behaviors. The Pregnant Couples Study assesses health and relationship factors among first-time parents from the first trimester to 6 months postpartum. All participants (N=100 couples, 200 individuals) are asked to complete five surveys throughout the year and N=42 couples (84 individuals) agreed to wear Fitbit activity trackers to monitor their daily activity. Given the broader study's unique population and methods, this project will discuss the various methods and procedures utilized as well as the difficulties encountered in recruitment and retention within a longitudinal couples-based study during this significant life transition. These insights are likely to be of interest to couples-based researchers working with a broad range of populations.

Neural Network Corrections to Semiemprical Quantum Chemical Methods for Accurate Descriptions of Proton Transfer

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Mentor: Hai Lin, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Combined quantum-mechanical/molecular-mechanical (QM/MM) simulations are an important component for accurately describing proton transfer reactions in complex environments. However, the high cost of accurate first-principles treatments means that, in practice, it is necessary to employ empirical methods to achieve adequate sampling for predicting thermodynamic variables for these processes. Here, empirical corrections from neural networks are added to the PM3 semiempirical QM potential to correct the energy surface to the RI-MP2 level for proton transfer dynamics in water clusters. This provides an accurate and efficient methodology which will should be extensible to proton transfer through larger systems, such as ion channels.

The Experience of Hope by Couples in Counseling Using a Reflection Team

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Mentors: Robert Allan
DC - College of Liberal Arts and Sciences

Abstract:
Historically, hope has been studied from a cognitive, not experiential, lens and rarely from an attachment perspective. The aims of this research project were to explore how couples experience hope when using a reflecting team as part of their counseling process as well as if their experience of hope differed based depending on their attachment style. To examine these questions, three couples were completed attachment and hope measures as well as participated in interviews assessing their experience of hope in relation to the reflecting team. The research was methodologically directed by interpretative phenomenological analysis, which draws on the participants' meaning-making of the reflecting team process. Three themes emerged from the participants experience including the both/and experience of being seen by a reflecting team, the benefits of outside perspectives, and the experience of hope differing depending on attachment style.

Development of multiple-particle tracking capabilities for translational research investigating complex biological fluids

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Mentor: Chelsea Magin
DC – College of Engineering, Design and Computing

Abstract:
One consequence of chronic pulmonary diseases, such as asthma, is decreased mucociliary clearance (MCC), a critical defense mechanism for protecting the lungs from the injurious effects of inhaled pollutants, allergens and pathogens. These deficiencies lead to accumulation of mucus in higher than normal concentrations on airway surfaces and result in clinically significant events such as airflow obstruction or chronic infections. Preclinical studies show that reduction of mucus viscosity may increase MCC. However, more research is required to determine how mucus production and secretion are influenced by these new therapeutic options. To enable investigators to answer questions about MCC dysfunction in pulmonary diseases, we performed multiple-particle tracking (MPT) experiments that follow fluorescent bead movements in biological fluids, such as mucus, to evaluate the viscoelastic properties of these materials before and after treatment. First, fluorescent plastic beads were treated with a polymer coating (poly (ethylene glycol) to block nonspecific interactions between the beads and the suspending fluids. Measurements show this coating was successfully applied (7.76 nm difference in radius between uncoated and coated beads). Next, videos of coated fluorescent bead movement were collected using an Olympus BX-63 microscope. Then a custom software program was used to combine data from multiple movies, calculate the mean-squared displacement (MSD) of each particle track averaged over time, convert the MSD to a self-diffusion coefficient and substitute the values into the Stokes-Einstein equation to calculate the viscosity of the suspending fluid. Here we showed that the custom program was functional using water as a standard. An average viscosity of 0.84 mPa/s was obtained which is within 10% of the dynamic viscosity of water (0.89 mPa/s). Collectively, these results show that it is possible to use the software written for this project to obtain the viscosity of suspending biological fluids using MPT. Future work will focus on additional verification using mucus samples obtain from animal models before and after treatment.

Knomadic Learning: Creating Boundaryless Learning Opportunities

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Renee Martin

Felix Chen

Mentor: Dennis DeBay
DC - College of Liberal Arts and Sciences

Abstract:
Learning is a process by which understanding and/or skills are gained. The form learning takes is becoming more agile and mobile, shifting how individuals and groups engage in the process. Join us for a conversation on what learning looks like and what it could look like. While traditionally constricted by contexts (school learning, job learning, hobby learning), must learning always look the same? If it didn't, what would be different? In an era of endless creativity and collaboration supported by technology, could the boundaries of a classroom be broken? We will explore the idea of life learning in innovative and imaginative ways and what it may mean to be a knomadic learner. Brainstorm ideas of technology and techniques that support learning anytime, anywhere, and with anyone and start the conversation of what learning tomorrow may look like.

Streamlining Dark Matter Data Analysis with Docker and JupyterLab

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Mentor: Amy Roberts, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
On a small scale, data analysis can be done easily with popular tools such as Microsoft Excel thanks in large part to its accessibility and ease of use. Often, however, scientists end up working with huge sets of data that programs like Excel aren't well-equipped to handle. While there is software optimized for large data, it's often extremely difficult to install and manage, and more time can be spent messing with programs than data. To alleviate some of this headache, I've developed a web-accessible virtual environment that users can log into and start playing with dark matter data. The solution is a Docker container which includes relevant analysis software, as well as JupyterLab - an interactive Python-based web interface for file interaction, text editing, live code testing, and more. This model for deployment ensures that everyone is using the same software environment, and that this environment is user-friendly, stable and up to date. My presentation will focus on a version of this model specifically tailored for the Super Cryogenic Dark Matter Search.

The Effect of Embedded Positive Reframing on Perceived Situational Stress Among College Undergraduate Students

Kaitlin Englert
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Jennifer Lambert
DC - College of Liberal Arts and Sciences

Rafael Najera III
DC - College of Liberal Arts and Sciences

Frank Oden
DC - College of Liberal Arts and Sciences

Mentor: Patricia A. Zornio
DC - College of Liberal Arts and Sciences

Abstract:
Undergraduate students often confront exorbitant levels of stress associated with accumulating demands, responsibilities, and stressors in and outside of a collegiate environment. Previous research has established benefits to interpreting physiological stimulations as a challenge response, namely in reconsideration of cognitive processes as increasing test performance. Similarly, exposure to information about stressors has been shown to correlate with higher levels of perceived stress. In spite of this, the evidence demonstrating an association between receiving information about stressors and perceived stress has not been overwhelming. To this end, the focus of the research at hand is to discern if stress perceived by undergraduate students can be moderated through positive and unconscious reframing methods. In person positively and neutrally worded surveys were provided to a random anonymous sample of undergraduate students. 25 participants completed an eight-question survey comprised of Likert scale and open-ended questions on sleep, exercise, nutrition, and academics followed by a validated assessment evaluating perceived stress. Stress scores on the positive survey ranged from 14 - 31 with M = 22.64. Scores on the neutral survey ranged from 8 - 34 with M = 24. An independent measures t-test was run and the difference between means was not significant ($p = .616$). The null hypothesis cannot be rejected with these results; while the average stress score for the positive survey was lower than the score for the neutral survey, the difference was not large enough to conclude that the type of survey made an impact. Further analysis with a larger sample is needed.

Resilience: a potential protective factor for acute pain and pain catastrophizing

Madisen Frederick
DC - College of Liberal Arts and Sciences

Caitlin Kienzler
DC - College of Liberal Arts and Sciences

Mentor: Amy Wachholtz
DC - College of Liberal Arts and Sciences

Abstract:
A considerable amount of research regarding character trait resilience has been examined in various chronic pain contexts. Despite this large body of research, very little research has focused on resilience and how it relates to an acute pain experience and pain catastrophizing. Pain catastrophizing refers to a set of exaggerated and ruminating negative cognitions and emotions during actual or perceived painful stimulation (Leung, 2012). Acute pain is often followed by negative emotional, cognitive, and physical affects. However, research has suggested that resilience resources may in fact serve as a protective factor by decreasing acute pain sensitivity and pain catastrophizing. The current study will attempt to explore how resilience influences both an acute pain laboratory task using cold water and pain catastrophizing in a sample of college students. The study aims to distinguish: (1) how trait resilience relates to an acute pain experience (2) how trait resilience relates to pain catastrophizing and (3) discuss how resilience potentially decreases acute pain sensitivity, pain catastrophizing, and thus develop adaption to future chronic pain. Our study hypotheses are: (1) high-resilient individuals will exhibit greater decreases in acute pain catastrophizing compared with low-resilient individuals and (2) high-resilient individuals will exhibit greater decreases in acute pain experience compared with low-resilient individuals.

The Relationship Between Sleep and Opioids in Chronic Pain Patients

Amy Frers
DC - College of Liberal Arts and Sciences

Mentor: Amy Wachholtz
DC - College of Liberal Arts and Sciences

Abstract:
Opioids are among the most common pharmacological treatments for chronic pain; however, sleep is negatively impacted by these drugs. Additionally, the long-term effects of opioids on sleep are unknown. In the current study, we hypothesized that opioid-naïve participants would have better sleep quality than both current and previous chronic users of opioids. We also explored whether methadone and buprenorphine have differing effects on sleep quality, and whether time since abstaining from opioids is associated with better sleep. Participants were 120 people with chronic pain divided into 4 equal groups: 1) methadone users 2) buprenorphine users; 3) a history of medication-assisted therapy for OUD but currently opioid-abstinent for at least 6 months; 4) those who took less than one month of lifetime cumulative opioids. Participants completed the Pittsburgh Sleep Quality Index (PSQI) and the Short Form Health Survey (SF-36). Groups 1, 2, and 3 were significantly different from the opioid-naïve group on the sleep quality, sleep duration, sleep disturbances, and daytime dysfunction subscales of the PSQI. We also found a significant relationship between weeks since abstaining from opioids and sleep disturbances in the opioid-abstinent group ($r = -.604$, $p < .001$). The results of this study suggest that opioids interfere with sleep quality, and clinicians should be aware that sleep problems in this population may persist even upon sobriety. Further research into the long-term effects of opioids is warranted and may emphasize the importance of addressing sleep problems in this population.

Japanese Beetles and Bees: Examining Pesticides Recommended by Garden Centers and Stores

Rebecca Friend
DC - College of Liberal Arts and Sciences

Mentor: Christ Briles, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
Pollinator populations have been under stress due to loss of habitat, infectious mites, food shortages, and pesticides. The Japanese beetle, an invasive species, has been moving into the Denver metro area, drawn to its irrigated landscapes and abundance of ornamental plants. Pesticides are used by homeowners and landscapers to control populations of Japanese beetles. Since Japanese beetles use the same plants as bees, the pesticides the bees take back to the hive can weaken or kill bee colonies. For this study, ten garden centers and stores were surveyed to see what pesticides were recommended for Japanese beetles. The store recommended pesticides were examined against a pesticide listing provided by the Colorado State University Extension Service that notes the toxicity levels of pesticides to pollinators. From the ten garden centers in the Denver Metro area, nine of them recommended pesticides with highly hazardous active ingredients. The most recommended pesticide was Sevin, containing Carbaryl which remains lethal days after application. Only one garden center recommended the non-hazardous biologic, called Milky Spore, which is a bacterium that damages the beetles digestive tract.

Intersex Fish Over the Years

Angela Geiger
DC - College of Liberal Arts and Sciences

Mentor: Alan Vajda, Primary Investigator
DC - College of Liberal Arts and Sciences

Abstract:
The primary objective of this project was to utilize preserved museum collections to determine whether the recently observed high incidence of intersex in largemouth bass (Micropterus salmoides) and smallmouth bass (Micropterus dolomieu) precedes the widespread use of synthetic estrogenic contaminants. Gonad samples of these species, between 50 and 188 years ago, were obtained from several museum collections and analyzed. The tissues were dehydrated in a graded series of alcohol, embedded in paraffin wax and sectioned with a microtome. Slides were stained with hematoxylin and eosin, and cover slipped before microscopic evaluation. Investigation of archived museum samples to address long-term trends in the effects of environmental contaminants. Initial observations indicate that although intersex was found in historical samples, this condition was less prevalent and less severe compared to modern samples. These findings were utilized as a baseline for intersex occurrence. Further research will focus on analyzing the increase in intersex occurrence over the years in order to relate historical trends in intersex to historical trends in environmental contamination. Further research will be conducted to determine the exact set of years intersex in these species exponentially increased.

Understanding the ritual of peri-abandonment deposit behavior evidenced by Late Classic Maya figurines at the site of Baking Pot, Cayo District, Belize

Amy Gillaspie
DC - College of Liberal Arts and Sciences

Mentor: Christopher Beekman
DC - College of Liberal Arts and Sciences

Abstract:
The Belize Valley Archaeological Reconnaissance Project is an archaeological field school operating in the Cayo District of Western Belize, and has excavated at multiple sites in Belize annually since 1988. In the past five years, the project has focused on excavation of peri-abandonment deposits, or deposits of artifacts built up during and after the abandonment of city centers during the Late Classic period of Maya history (approximately 750 – 900 AD). This poster will present data on two specific artifact types, ceramic figurines and musical instruments, that were recovered from peri-abandonment deposits at the site of Baking Pot, Cayo District, Belize.

In looking at these figurines and instruments, this poster will first detail the iconography of the Baking Pot collection, which includes 214 items. Next, a brief discussion of the composition of the collection will be outlined, showing categorical differentiation of the items into groups of figurines versus instruments, hand-made versus mold-made items, and anthropomorphic, zoomorphic, and unknown representations (with unknown representations being undiagnostic fragments of these items). Finally, the poster will discuss hypotheses of ritual behavior, and conclude why these items were included in these specific peri-abandonment deposits made by the Maya of Baking Pot during the Late Classic.

The Headache of Migraine Management: Prevalence and Efficacy of Treatment Type in a National Migraine Population

Dustin Goerlitz
DC - College of Liberal Arts and Sciences

Bahroze Rakeen
DC - College of Liberal Arts and Sciences

Mentor: Amy Wachholtz, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
In the present study, we aimed to learn about the prevalence and efficacy of complementary and integrative medicine (CIM) vs. conventional medicine (CM) within a national migraine population. We hypothesized that a comprehensive approach utilizing a combination of CIM and conventional approaches would be more efficacious than standalone treatments of either approach. Data was collected from 1866 respondents to the 2015 MigraineinAmerica.com survey (Mage = 45.13 years, 95.8 % female, and 90.4 % Caucasian). Number of migraine attacks per month in relation to treatment type was analyzed to determine treatment efficacy. Treatment types were categorized into three groups: CIM, CM, and CIM + CM. Prevalence of reported treatment types were CM (52.5%), CIM + CM (26.3 %), and CIM (21.2%). Next, we analyzed number of migraine attacks per month in relation to treatment type. A Kruskal-Wallis H test showed the mean rank of CIM alone to be significantly different than CM and CIM + CM ($H= 45.607$, $df (2)$, $p<.001$, $\eta 2=.02$), with mean ranks of 777.53, 973.75, and 978.85 respectively. Contrary to our expectation, although CIM + CM was associated with a reduction in number of migraine attacks, CIM alone was associated with the least number of attacks per month. These findings show promising efficacy for complementary and integrative medicine. Particular benefits of CIM are autonomy in self-management, prevention of symptoms, and utilization of cost-effective approaches. As the current study used cross-sectional and ordinal self-report measures, future research is encouraged to assess more objective measures across multiple time points.

Effects of Sleep on Short-term Memory in an Undergraduate Population

Ethan Gottula
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Jorge Cruz
DC - College of Liberal Arts and Sciences

Yesica Gonzalez
DC - College of Liberal Arts and Sciences

Celeste Yang
DC - College of Liberal Arts and Sciences

Gabrielle Jones
DC - College of Liberal Arts and Sciences

Mentor: Patricia Zornio
DC - College of Liberal Arts and Sciences

Abstract:
The importance of sleep has been widely studied, with past studies acknowledging it as a vital regulatory process for humans. Regretfully, studies have also demonstrated that a significant portion of the human population is getting less than the recommended amount of sleep, sometimes to a significant degree. As sleep is important for normative functioning of cognition and memory, this importance may be more heavily stressed in a collegiate population, yet fewer studies have examined this impact directly. The following study used an online survey and correlational design to examine individual's short-term sleep habits. Effective short-term memory levels of undergraduate college students, as well as long-term sleep habits and long-term cognition levels were also examined. Data was processed and graphed using a statistics program (SPSS). Correlations between sleep and memory were analyzed, taking into account confounding variables including caffeine intake. Results suggest more emphasis should be placed on the relationship between healthy sleep patterns and college student cognitive performance.

HyperLynx

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Mentor: Satadru Dey, Assistant Professor
DC - College of Engineering, Design and Computing

Abstract:
Hyperlynx is a multidisciplinary project which includes students from both the University of Colorado Denver and Metropolitan State University. The ultimate goal of the project is to build a high-speed, vacuum-compatible electric vehicle and take part in the 2019 SpaceX Hyperloop Pod Competition. Over 200 teams from around the world submitted an intent to compete. In February 2019, Hyperlynx was selected by SpaceX as one of 21 finalists worldwide. The 2019 pod design followed the philosophy of “Steamline and Execute”. To be selected, teams need to prove that their design was not only innovative, but also achievable. By streamlining the 2019 design and focusing on execution during manufacturing, the team has put together what will hopefully be the fastest American vehicle. The pod uses a 100kW (135hp), 240N-m (177ft-lb) electric motor to propel itself to 396 ft/s (270mph). The competition happens in a 4150ft (1.25km) tube which is capable of evacuating atmosphere to 1/100th ‘normal’ atmospheric pressure. This near-vacuum condition requires the pod to be autonomous. Autonomy is achieved via a State Determination Algorithm (SDA) fed by a network of sensors and crew inputs. In order to reach top speed and stop safely within the allotted distance, the braking system will create a 7g deceleration with twelve spring-actuated, pneumatically-retracted, custom machined brake cylinders. Finally, the 269lb pod is designed to carry a 270lb payload, proving that the system can scale to achieve the ultimate goal of the Hyperloop; high-speed, long distance transportation for the future.

Minimizing Noisy, High-Dimensional Functions

Jordan Hall
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Mentor: Varis Carey, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
We present novel methods to minimize noisy, high-dimensional functions, a problem which arises naturally in all areas of scientific research. We discuss the power of dimension reduction in this setting, which may greatly reduce computational expense by providing faster convergence. Finally, we show the results of a fully-automated algorithm which requires that the user specify only the noisy function and an initial “iterate” or guess. Our full automation greatly lowers the barrier to entry for scientists using our algorithm since no mathematical terms or “hyperparameters” need specification.

Navigating AWP

James Hartz Jr.
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Mentor: Christopher Merkner, Clinical Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
The AWP (Association of Writers and Writing Programs) Conference is an annual event where writers, publishers, literary journals, and writing programs come together for three days of keynotes, panels, readings, and a massive "Book Fair." The 2019 conference in Portland had over 14,000 attendees, 500 panels, and 500 literary journals and writing programs attendees could meet over the course of 3 days. This poster presentation will provide an overview of the conference as a whole, including specific commentaries on panels I attended, as well as advice for aspiring AWP-goers on how to approach the Book Fair, talk to editors, and network both within and outside the conference.

How Stars Orbit Galaxies: Computation of Circular Velocity Profiles in Disc Galaxies

Raphael Hatami
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Judit Bergfalk
DC - College of Liberal Arts and Sciences

Mentor: Anthony Villano, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
The orbits of stars in disc galaxies have been one of the strongest pieces of evidence for the existence of dark matter. Our understanding of the gravitational force shows that the circular velocities of stars in disc galaxies are sensitive to the total mass of matter inside the orbits--mass from stars, interstellar gas, and dark matter. Although these "rotation curves" have been analyzed for many decades, making them a precision tool for measuring galactic dark matter distributions is still ongoing. We examine the mathematical details of calculating the rotation velocity profile of galaxies and focus primarily on the contribution from the central bulge. The resulting theoretical rotation curve will then be compared to the measured rotation curves of galaxies to conceptualize their possible distributions of dark matter.

Landscape context mediates the effect of shortening fire intervals in boreal systems

Katherine Hayes
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Mentor: Brian Buma
DC – College of Liberal Arts and Sciences

Abstract:
Warming temperatures have been linked to increased frequency and severity of wildfires across a variety of ecosystems. This trend is especially apparent in the boreal, where average time intervals between fires have decreased from 50-100 years to 10-15 years within three decades. Shortening fire intervals have been shown to change successional pathways in semi-serotinous boreal forests via seedbank limitation, but the role of landscape context in promoting resiliency to increasing disturbance remains unclear. To investigate how landscape context alters resilience of species to shortening fire intervals, we established plots across a gradient of fire histories (1-3 fires in 70 years) in two Interior Alaska sites. We compared recruitment between conifers, deciduous trees, shrubs and graminoids, sampling across factors such as differing hydrology, slope, aspect and elevation. All stands were originally dominated by black spruce (Picea mariana), but spruce recruitment was significantly lower following three fires, compared to unburned stands and stands burned once under longer fire return intervals. Recruitment of shrubs and graminoids increased after two fires, and solidified after three fires, indicating a transition to shrubland and grassland ecosystems. Organic soil layers in dry, sloped sites – but not flatter, higher moisture sites – became more homogenous after multiple fires, indicating importance of landscape context. Our results show local variations in hydrology and slope may mediate effects of shortening fire intervals by introducing heterogeneity in organic soil consumption and seedbank availability. Results of this study offer strong empirical evidence that landscape context may promote resiliency to changes in local disturbance regimes.

Next Gen Hockey Puck for the visually impaired

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Jacob Caldwell
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Jeffrey Quick
DC - College of Engineering, Design and Computing

Andrew Smith
DC - College of Engineering, Design and Computing

Mentor: Craig Lanning
DC - College of Engineering, Design and Computing

Abstract:
A puck that can be easily located by players and officials of the National Blind Hockey League (NBHL) while moving or stopped. Activity Type: Undergraduate need-based design and prototyping. Unique challenges present themselves to the players of the National Blind Hockey League, many of which are a direct result of the current puck with which they play. During gameplay the puck is often lost and the game paused in order to reset the puck for player interaction. These numerous delays disrupt ideal game duration for both players and viewing fans. A more sophisticated puck that can be located by players with visual impairment at all moments of gameplay is needed. We've developed a puck which addresses these issues and improves the ability to be located at all times of game play by emitting a velocity dependent sound.

Hockey Puck

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Jeffrey Quick
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Mentor: Craig Lanning
DC - College of Engineering, Design and Computing

Abstract:
A puck that can be easily located while moving or stopped by players of the National Blind Hockey League. Unique challenges present themselves to the players of the National Blind Hockey League, many of which are a direct result of the current puck with which they play. The current puck used is essentially a metal canister with ball bearings inside that rattle when struck but does not emit sound when still. During game play the puck is often lost and the game paused in order to reset the puck for player interaction. These numerous delays disrupt ideal game duration for both players and viewing fans. A more sophisticated puck that can be located by players with visual impairment at all moments of game play is needed. We've developed a puck which address these issues and improves the ability to be located at all times of game play. As the puck undergoes tremendous physical abuse and is subjected to freezing temperatures, it needs to be resilient enough to remain in operation throughout normal game play conditions. Vulcanized rubber provides an adequate insulation, ideally interacts with the ice surface, resists physical deformation due to impact, is low-cost, and readily available. Additionally, achieving a variance in sound that is dependent on the puck's velocity is relatively void of numerous parts only needing a power source, accelerometer, Arduino circuit board, and speakers. Life expectation needs to meet or exceed twice standard game play times and be rechargeable. The use of vulcanized rubber will improve the puck's resistance to physical deformation when compared to aluminum. Additionally, the puck's ability to emit a sound which is dependent on its velocity will provide not only a constant sound which can be used to be tracked at all times but also provide information to the players as to the puck's current state, whether moving or not. Wireless charging ability allows for the puck to be completely sealed providing insulation and keep all electronic equipment separate from moisture.

The Dynamics of Pet Relinquishment

Emily Held
DC - College of Liberal Arts and Sciences

Marco Zocchi
DC - College of Liberal Arts and Sciences

Mentor: Larry Erbert, Associate professor
DC - College of Liberal Arts and Sciences

Abstract:
The purpose of this investigation is to develop a framework to identify the issues associated with pet abandonment and the mechanisms through which pets reach shelters from the perspectives of shelter workers and pet owners in the Denver area. This framework will identify key issues surrounding pet abandonment through the acquisition of qualitative data. Interviews of shelter workers will be used to evaluate how pets arrive at shelters and the reasons given by pet owners who relinquish their pets directly to the shelters. These interviews will be compared to qualitative data gleaned from pet owners about their history of pet ownership. This data will be used to speculate about the intentions of pet owners when they relinquish pets and why they end up choosing relinquishment over keeping the animal. Through this, factors that affect the decision making process will be evaluated to develop a framework incorporating these factors that will allow dialectical evaluation to be performed on the data.

A Shocking Presentation of Coronary Artery Disease: An Inside Look from the Susan Potter Dataset

Haylie Helms
Aaron Griffin DC - College of Liberal Arts and Sciences

Mentor: Victor Spitzer
AMC - School of Medicine

Abstract:
Coronary artery disease (CAD) is the most common type of heart disease affecting 16.5 million Americans. CAD is caused by plaque buildup in the walls of the arteries. As the plaque builds up, blood flow becomes increasingly reduced until ultimately the flow is blocked and a heart attack occurs. Every 40 seconds, someone in the United States has a heart attack. This exhibit provides a never before seen look at CAD utilizing virtual reality and three-dimensional (3D) printed models created from color photographic images in the Susan Potter dataset. Susan Potter had multiple medical conditions including CAD, cancer, diabetes, and chronic pain. Susan donated her body to be frozen, sectioned, and imaged like the Visible Human, from head to toe, but in 63 micron increments. Each exposed surface was imaged and segmented to create 3D models of anatomical structures. Ultrasound, contrast CT, and angiograms demonstrate and quantify restricted blood flow in coronary arteries but the images are formed by physical processes unfamiliar to most. The images of Susan's cardiac vessels present the disease in a medium familiar to everyone – color photography. The shocking color photographs and derivative animations from this data, we hope, will serve as a strong motivator for viewers to reduce their risk factors for CAD through diet and exercise.

The Effect of Tablet Size on Cognitive Performance: A Randomized Control Trial Using Caffeine

Daniel Hernandez Altamirano
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Caitlin Kienzler
DC - College of Liberal Arts and Sciences

Mentor: Amy Wachholtz
DC - College of Liberal Arts and Sciences

Abstract:
Background: A capsule's physical design (e.g. shape, size, and color) affects individuals' perception of drug efficacy. This study aims to objectively assess the effects tablet size may have on participant's performance on cognitive tests. Method: 120 participants were randomly assigned to one of four groups: 5 mm diameter sucrose pillule with/without caffeine; and 1 mm pillule with/without caffeine. After 30 minutes post-pill consumption, participants completed the Stroop test, Trial Making Tests (TMT) A and B, and Rey's Auditory Verbal Learning Test (RAVLT). Results: The main study design was not supported; pill size, caffeine content, nor an interaction between the two factors were associated with significantly different performances across the cognitive tests($p's > .05$). Post-hoc analyses revealed significant differences among the testing appointment times for the RAVLT ($F(2,117)=3.104$, $p<.05$) and TMT-A tests ($F(2,117)=3.180$, $p<.05$). Females also performed better than non-females on the RAVLT ($F(2,117)=4.630$, $p<.05$). Discussion: Future studies may increase caffeine doses or adjust pill designs to more familiar disc shapes to possibly enhance the main effects. The post-hoc analyses showed that time of day created varying performances; with the RAVLT, the 8:00am group did worse than the 9:30am group, but in TMT-A the 8:00am group did better than the 9:30 and 11:00am groups. Most likely, simple visual processing is less cognitively taxing than verbal memory storage. Since college students often take early classes, these results support further research into how time of day influences academic performance. Females performing better on the RAVLT may be due to body mass differences influencing caffeine metabolism.

Geospatial Applications at the National Park Service

Caroline Hildebrand
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David Smith
DC - College of Liberal Arts and Sciences

Morgan Cameron
DC - College of Liberal Arts and Sciences

MalloryRedmon
DC - College of Architecture and Planning

Mentor: Rafael Moreno, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Behind the scenes of the National Park Service lies a network of content management systems and data analysis software. Park Service employees address social and ecological problems by incorporating spatial, non-spatial, and temporal components into data analysis and visualization that can be consumed by the public. Though the public may interact with GIS products such as paper or web maps, they often do not see the processes that compile and manipulate these datasets into a visual form that can be easily consumed and contributes to knowledge production. Offices across the National Park Service (NPS) that offer such support to individual national park units include the Air Resources Division, Wildland Fire Program and the Resource Information Services Division (RISD). David, Morgan and Caroline are interns on the RISD team who design, create and support NPS geospatial services such as web mapping, national datasets, and web content management at the federal level. Their duties are wide-ranging across the spectrum of geospatial services. Most of David's focus has been on web map development and creating a Python tool to automate the data correction process of the National Dataset. Morgan focuses on technical resource development, including documentation, program organization, and scientific communication. Caroline's projects have focused on using Python to automate the migration and management of national datasets from other departments (like the USGS) into NPS administrative boundaries. These internship positions are part of a newly-created (2018) internship agreement between the NPS and the Department of Geography and Environmental Sciences managed by Dr. Rafael Moreno. This collaboration enables students to apply to the NPS for these paid internship positions that mutually benefit the NPS and add to students' experiences and professional portfolios. We invite you to come take a look at our recent projects and understand the goings-on in internships behind the scenes at the National Park Service.

Colorado Pollen Atlas

Hillary Hillam
DC - College of Liberal Arts and Sciences

Mentor: Christy Briles, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
As part of my EuRECA! work study position, I am creating an image-based pollen atlas for Colorado. Both entomophilous (insect pollinated) and anemophilous (wind pollinated) pollen types are part of the atlas. The pollen comes from plants commonly found in Colorado and from those sourced by the CU Denver bees on campus. The atlas contains pollen images taken from known pollen grains mounted on glass microscope slides. The images are taken at 400x magnification using a light microscope and a high-definition microscope camera. The purpose of a pollen atlas is to provide a pollen analyst printed images and descriptions to compare their unknown pollen to for identification purposes. From this identification you can determine what plant(s) a pollinator has visited, past forest changes and food resources of native peoples, where a person has been (e.g., crimes), and authenticating food products such as honey. For my RaCAS presentation, I will be showing eleven entomophilous-types (animal pollinated): Tilia (linden), Rhus (sumac), Spirea (spirea), Plantago (plantains), Melilotis (clover), low-spine Tubuliflorae (ragweed), high-spine Tubuliflorae (daisies), Amaranthaceae (goosefoot/tumbleweed), Fraxinus (ash), Prunus (fruit trees), and Cannabis (hemp/marijuana) and also nine anemophilous-types (wind pollinated): diploxylon Pinus (yellow pine) , haploxylon Pinus (white pine), Picea (spruce), Abies (fir), Poaceae (grass), Artemisia (sagebrush), Quercus (oak), Juniperus (juniper), and Nuphar (lily pad) pollen. The atlas will be online, in a spiral bound book, and posters created of some of the more common pollen types.

Understanding IRE1-Dependent Decay in Mammalian Cells

Haven Himmighoefer
DC - College of Liberal Arts and Sciences

Mentor: Jay Hesselberth, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
The unfolded protein response (UPR) is a highly conserved response to endoplasmic reticulum (ER) stress caused by an accumulation of unfolded or misfolded proteins in the ER. Activation of the UPR resolves to protein homeostasis or apoptosis. Inositol-requiring enzyme 1 (IRE1) is an essential ER transmembrane protein that activates the UPR through its RNase enzymatic activity resulting in its anomalous splicing of X-box protein 1 (XBP1) mRNA. IRE1 also functions in regulated IRE1 dependent decay (RIDD), where IRE1 cleaves Er-associated mRNAs to maintain cellular homeostasis. RNA fragments produced by IRE1 during the UPR has been suggested to cause misactivation of retinoic acid inducible gene 1 (RIG-I), a pattern recognition receptor (PRR). Misactivation of RIG-I causes an inappropriate interferon response, which activated immune cells like macrophages. We propose to identify RNA fragments produced though RIDD that may misactivate RIG-I by identifying IRE1-downregulated mRNAs in XBP1 null cells. We are generating XBP1 knock-out cells using CRIPSR-Cas9 technology, and have validated a ribonucleoprotein complex in vitro. In order to determine IRE1 specific cleavage of RNAs during RIDD, we are using the pharmacologic inhibitor, 4u8C. 4u8C produces comparable XBP1 splicing to basal, even when IRE1 is activated. Finally, we will use mRNA sequencing to determine which RNAs are specifically downregulated by IRE1 during RIDD. Identifying RNAs produced though RIDD is necessary to determine possible endogenous RIG-I activators. These conclusions will allow for a better understanding of how RNA detection by PRRs can contribute to autoimmune disorders.

The Importance of Children's Picture Book Character Development and the Use of Anthropomorphism

Melissa Jacobi
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Mentor: Rebecca Heavner
DC - College of Arts and Media

Abstract:
Well-crafted children's picture book characters leave an imprint on the human heart and mind. Successful children's book illustrators focus on ways to establish a point-of-view through memorable and impactful character creation. A picture book exposes a young mind to its first visual representations of narrative and imagery. Characters are literacy advocates, laying the foundation for successful reading comprehension and opportunity. Successful illustrators craft characters with emotive design principles and a contextual relationship to the written word to express concepts such as empathy, friendship, loneliness, etc. This study focused on methods of successful character creation based on first-hand observational exploration of children's literature archives; research in the history of children's books; and a course in character development. The children's literature archives visited were in the eastern United States and London, England. This study was limited to the process work of two author illustrators, Beatrix Potter and Tomi Ungerer, both recognized, prolific illustrators whose work uses anthropomorphism. Through an analysis of Potter's "The Tale of Peter Rabbit" and Ungerer's "Rufus the Bat Who Loved Colors" it is possible to understand how to effectively create an anthropomorphic character. To test these ideas, further study was gained through a book illustration course at the Chelsea College of Arts in London, England. The course focused on the fundamentals of character design, visual sequencing and professional attributes of the book publishing industry. These experiences led to a discovery of the fundamental elements of character development and an exploration of important cultural implications of anthropomorphism. Successful anthropomorphic character creation involves three primary elements: 1) The essence of the creature/object must be understood before attributing human characteristics; therefore, an in-depth study of form, movement and structure of the animal/object is necessary for it to be anthropomorphized; 2) Environmental narrative and/or experience for the character to interact and exist is crucial for relatability; 3) Expression of personality with facial and/or body movement, and/or the addition of specific accoutrements as indications of likes/dislikes provides depth of character. The study evolved into the creation of an original children's picture book, "Hound Dog and Frog." The creative process includes a prototype or "dummy book" and several full-page color illustrations and spreads formatted to submit for publication. The original story features an illustration of a hound dog who loves to read and lives in an underground den. One day he hears a sound and is drawn up from underground. The sound turns out to be a frog playing the fiddle who inspires the hound to become a writer. Anthropomorphism structures the visual narrative and triggers empathy in the audience as they find the value of friendship and creative inspiration for children.

Mammalian sterile-20-like kinase (MST4) is implicated in pituitary tumorigenesis and is a potential target for future therapeutic approaches

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Abstract:
Currently, the genetic and molecular mechanisms that initiate and maintain tumorigenesis in the pituitary are poorly understood. Tumors can overproduce hormones (ie prolactin, growth hormone) or block normal hormone production by their size. Pituitary tumors results in a number of negative health outcomes that include visual disturbance to blindness and suppression of normal hormone function called hypopituitarism. Understanding how these pituitary tumors are initiated and progress is crucial for developing novel therapeutic interventions. The lab has shown that human pituitary adenoma gonadotrope samples overexpress the mammalian sterile-20-like kinase (MST4) compared to normal pituitary tissue. To understand the functional role of this kinase, we mimicked the hypoxic microenvironment of the pituitary by depriving L□T2 pituitary gonadotrope cells of oxygen, using a hypoxia chamber. In hypoxia, cells over expressing MST4, show increased cell proliferation and colony formation. Additionally, testing of mutant MST4 constructs showed the importance of the kinase sequence in the functional effects. Current work is focused at understanding the mechanism through which MST4 functions and it is hypothesized that MST4 works through autophagy, a metabolic process that disassembles unnecessary components in a cell after hypoxic stress to recycle them and allow continued growth. Studies are ongoing to block autophagy using Chloroquine, to understand how pituitary tumor growth adapts. Additionally, we are inhibiting MST4 with Herperadin, and MST4 inhibitor, in addition to Chloroquine to block autophagy to measure impact on tumor cell growth. Understanding how pituitary tumors are initiated and maintained is crucial to develop novel therapeutic treatments.

The Art and Science of Forensic Facial Reconstruction

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Mentor: Tiffany Terneny, Senior Instructor
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Abstract:
The debate on whether forensic facial reconstruction has scientific merit or whether it is merely an artistic endeavor has raged since the origins of the discipline in the late nineteenth-century. Forensic facial reconstructions are utilized in medicolegal settings as a last resort technique to engender recognition of an unidentified set of human remains. In this setting artistry is seen as an impediment, as the objective is the identification of an unknown individual, rather than the perfection of artistic technique and idealized forms. reconstructions have also been applied to archaeological cases. Although identification is not always the objective in such cases, often there is no likeness with which a reconstruction can be compared for identification debate over the scientific merit of archaeological facial reconstructiopns still abound. Some see the endeavor as a legitimate source of insight and others as a shameless publicity stunt. There are several methodologies and mediums employed in the discipline.

Comparative analysis of proximal ulna joint surface areas among hominoid species

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Mentor: Caley Orr, Assistant Professor
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Abstract:
In the human lineage, the upper limb evolved considerably as our ancestors gave up arboreality (life in the trees). Understanding how and when specific changes occurred requires analyses of the comparative anatomy of our closest living primate relatives and our fossil ancestors. The presented project contributes surface area data on the articular facets of the proximal ulna to help better understand the functional anatomical differences among hominoids. Throughout this project the individual surface areas of 3D polygon models of the bone samples were segmented and measured in a 3D model editing software called Geomagic. The particular ulnar surfaces measured were the radial notch as well as the medial and lateral aspects of the trochlear notch (as divided by the guiding ridge). After these surface areas were measured they were quantified and an Analysis of Variance (ANOVA) was conducted to compare the articular surface proportions among hominoid species. The results show differentiation among humans, gorillas, and chimpanzee proximal ulnae that likely relate to different loading patterns at the elbow across species that correlate with elbow use during locomotion and/or the manual manipulation.

Morphology of Male Abdominal Ctenidia in North American Camel Spiders

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Mentor: Paula E Cushing, Curator of Invertebrate Zoology
DC – College of Liberal Arts and Sciences

Abstract:
Solifuges, commonly referred to as camel spiders, are an enigmatic group of desert-adapted, cursorial arachnids. Notoriously hard to rear in captivity, many aspects of camel spider biology remain unknown. Ctenidia, swollen setae on the ventral side of the fourth abdominal segment, are taxonomically diagnostic yet functionally obscure. Ctenidia are sexually dimorphic characteristics, being prominent on males and highly reduced in females, yet play no obvious role in courtship or mating. They can vary in shape, size, and number across species of solifuges. The present study utilizes scanning electron micrographs (SEM) and traditional light microscopy to survey the morphology of these structures.

Methodological improvements for measuring key nutrients in natural and engineered ecosystems

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Mentor: Annika Mosier
DC – College of Liberal Arts and Sciences

Abstract:
The ability to reliably and accurately measure key nutrients in natural and engineered ecosystems is important for monitoring and maintaining ecosystem health. Measurement of Nitrite/Nitrate (NOx) is essential in drawing connections between living systems and the environment, such as predicting algal blooms in aquatic ecosystems or meeting water quality regulations in wastewater effluent. Traditional tools for detecting NOx require the use of expensive equipment, large sample volumes, and toxic chemicals. Here we present an efficient, inexpensive, and less toxic method for NOx detection in both aqueous and soil samples based on a colorimetric assay with the Griess-Ilsvay reaction. The method was optimized for reagent chemistry, incubation time, incubation temperature, and predictive modeling. The improved method detected NOx across multiple samples.

Sexual Dimorphism and the Scaling of Intrinsic Thumb Muscle Physiological Cross-Sectional Area and Trapeziometacarpal Joint Size

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Mentor: Caley Orr, Assistant Professor
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Abstract:
The thumb is a common site for the development of osteoarthritis (OA) and studies show that there is greater prevalence of OA of the thumb joint in women. One possible contributing factor is the generally smaller size of females. Given constraints on size at the trapeziometacarpal (TMC) joint (which is locked into the wrist complex), it is possible that stress (force per unit area) tends to be greater in smaller individuals. However, increased stress requires a similar muscle force acting on a relatively smaller joint, and this might be the case if females must maintain a minimum level of grip strength for day-to-day function. Thus, we hypothesize that females have higher TMC joint stress due to scaling constraints (small joint surfaces with relatively large muscles). To test this hypothesis, cadaveric samples from the University of Colorado School of Medicine were used to measure the physiological cross-sectional area (PCSA) of intrinsic thumb muscles and scaled against the surface area of the TMC joint. Data suggests that females, despite having generally lower values for TMC joint surface area, have a lower general measurement of stress (PCSA per unit area) on the thumb joint than males. This suggests a more complicated relationship between joint size and thumb muscle force potential, and in turn could provide a background for future research into methods of preventing OA.

Non-Contact Respiratory Analysis using Thermal and CO2 Imaging

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Mentor: Min-Hyung Choi
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Abstract:
Medical professionals prefer respiratory analysis that is both accurate, and comfortable for their patients. Most contact methods which perform respiratory analysis require sensors to be placed on a patient's body. These methods provide accurate results, but they are also uncomfortable for the patient and impacts their natural breathing behaviors. On the other hand, existing non-contact respiratory analysis methods which monitor respiration remotely and comfortably calculate results with lower accuracy.
The goal of this project is to conduct non-contact respiratory analysis using computer vision and image analysis technologies. A thermal infrared camera embedded with special filters for CO2 is used to collect carbon dioxide density videos of a patient while they exhale. Through mathematical analysis of the frames of these videos, and Neural Networks we estimate respiratory behaviors such as breathing rate, breathing capacity, and exhale strength.

Literature Review of Biochemistry and Biophysics that may Contribute to the Onset of Rheumatoid Arthritis (RA)

Katherine Ketcham
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Mentor: Masoud Asadi-Zeydabadi
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Abstract:
Rheumatoid arthritis (RA) is an autoimmune disease that causes joint inflammation and tissue damage. Once an individual has RA, they can have a diminished quality of life, increased mortality, and have to undergo expensive treatment. In combination, these issues lead to high individual and societal costs of RA. The standard of care for RA now is for a patient to develop the signs and symptoms of joint inflammation (e.g. pain, stiffness, swelling), seek health-care, then get a diagnosis of RA and begin treatment. However, it is known that an auto-antibody blood marker called anti-cyclic citrullinated peptide (anti-CCP) is present in the blood, on average, three to five years prior to the development of the joint inflammation or what is called 'clinically apparent RA'. Based on that, I conducted a scholarly review to discover potential biochemical and biophysical explanations of the clinical onset of RA and hypothesized treatments based off those bio-markers.

Mice with Decreased Matrix Bound SOD3 Demonstrate Early Robust Inflammatory Response and Exaggerated NFkB Signaling After Intratracheal Bleomycin

Sara Khatib
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Mentor: Eva Grayck, Professor
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Abstract:
The naturally occurring R213G single nucleotide polymorphism (SNP) in the antioxidant enzyme extracellular superoxide dismutase (SOD3) lowers matrix binding affinity, redistributing SOD3 from the lung into the extracellular fluids. We recently reported that mice expressing R213G SOD3 are protected from bleomycin-induced fibrosis. Furthermore, R213G mice exhibit early inflammation 3 days post-bleomycin but enhanced resolution at 7 days. NFkB is a redox regulated transcription factor regulating inflammation. We hypothesized the R213G early inflammatory response after intratracheal bleomycin is mediated by NFkB signaling.

WT mice and mice expressing R213G SOD3 were treated with intratracheal bleomycin and lung tissue harvested at 1, 3 and 7 days. At 1 and 3 days, bleomycin increased lung nuclear p65 in both strains, with higher nuclear p65 after bleomycin in R213G compared to WT. ($p<0.05$, n=5-6). At 3 days, bleomycin increased downstream gene targets of NFkB, TNFα and IL-1β, in cells within bronchoalveolar lavage fluid (BALF) , with a greater increase in TNFα and IL-1β in R213G compared to WT. ($p< 0.01$ for exposure, n=6) At 3 days, bleomycin increased the NFkB repressor protein, IKBβ only in R213G mice ($p=0.03$, n=3).

In summary, R213G mice have an early inflammatory response after intratracheal bleomycin, with higher cytokine expression in BALF compared to WT mice. Bleomycin induces NFkB signaling in the lungs of both WT and R213G mice, with exaggerated activation of both NFkB and its inhibitory protein in R213G mice at early time points. Future work will interrogate how R213G SOD3 leads to enhanced resolution.

"Dirty" Energy: The Investigation of Bacterial Communities in Sediment Microbial Fuel Cells and Optimizing Power Production

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Mentor: Timberley Roane
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Abstract:
Sediment-based microbial fuels cells (SMFCs) are established on the premise that certain types of bacteria (called electrogens) can metabolize organic substrates and transfer electrons extracellularly onto electrodes. The resulting flow of electrons through a circuit from anode to cathode generates an electrical current. If this technology can be perfected, the use of SMFCs as an innovative sustainable energy supply would be ground-breaking. The objective of this project was to identify the bacterial communities found within different SMFC reactors and discern the communities that led to more productive (>100 millivolts, mV) SMFCs. To do this, using graphite fiber felt pads as electrodes, replicate SMFCs were filled with environmentally-available sediments suspected to harbor electrogens including acidic mine tailings and garden soil. The garden soil reactors were saturated with sterile tap water, while the mine tailings reactors were supplemented with either nutrient broth or tryptic soy broth. The reactor voltages were recorded continuously to monitor their power output and to determine if power was sustained over time. Preliminary results showed that garden soil SMFCs as well as mine tailing reactors supplemented with tryptic soy broth could provide voltages up to 440 mV and sustain peak voltages for an average of 6-8 days. Additionally, DNA sequencing analyses (currently underway) on the bacterial communities from the SMFCs will identify the bacterial diversity and species abundance differences between productive and non-productive reactors and among the different sediment types examined. With this data, this project has identified parameters associated with SMFCs that warrant further investigation for the continued optimization of SMFCs as a sustainable source of electricity.

To Journal or Not to Journal: Migraine Journal Use Among 2015 Migraine in America Cohort

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Mentor: Amy Wachholtz
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Abstract:
Migraine journals have been shown to improve patient outcomes (Baos et al., 2005). We conducted this study to assess the associations between participant demographics and factors influencing different migraine journal use. Method: 4,502 U.S. adult migraine participants completed the 2015 Migraine.com survey. A $\chi 2$ test of independence and multivariate logistic regression were performed to assess the associations between age, gender, race/ethnicity, avoidance of migraine triggers, and type of care provider seen with migraine journal use via paper, computer, or smartphone. Results: Age was significantly related to the type of journal keeping used. Individuals ages 56+ used paper media more while individuals ages 18-55 used electronic migraine journals ($\chi 2(4,N=1399)=52.92$, $p<.001$, Cramer's $V=.138$). Multivariate logistic regression showed that there was a significant association between age, type of migraine care provider, avoidance of migraine triggers, and any use of a migraine journal ($\chi 2(32)=348.54$, $p<.001$). Overall journal use was related to an active avoidance of triggers and showed a negative association with age. Naturopaths and headache specialists were the primary providers most associated with journal use ($p<.001$). Gender and race/ethnicity were not significantly associated with migraine journal use (p=NS). Discussion: The results of this study suggest that, while journal type varies by age, older adults show less overall journal use. Provider type and active avoidance of triggers were predictive of any journal use. More active avoidance of triggers predicts more journal use across all ages. Further examination of these factors may illuminate how and when journals should be used to improve patient outcomes.

Breastfeeding Patterns, Postpartum Depression, and Cognitive Development: Effects of Mode of Delivery

Susan Kim
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Mentor: Peter Kaplan
DC - College of Liberal Arts and Sciences

Abstract:
Background: Mode of delivery has been shown to influence the relationship between a mother and her infant. Given the surgical nature of cesarean sections, the interactions between a mother and baby have been found to be more minimal than interactions between a mother and baby that is born vaginally. This may be due to the lack of mobility that the mother has, which in turn may lead the mother to develop postpartum depression (PPD) from not being able to take care of her own infant. PPD has been linked to delays in infant cognitive development. We examined effects of mode of delivery and breastfeeding on measures of postpartum depression and cognitive development in mothers and 4- to 14-month-old infants.

Methods: Participants (mother and baby) were recruited through Facebook and asked to complete anonymous surveys assessing their depression levels, breastfeeding patterns, and mode of delivery (vaginal vs. cesarean section). We measured child cognitive performance using the Bayley Scales of Infant and Toddler Development, 3rd Edition (BSID-III), which assesses cognitive and communicative development in relation to age-based norms.

Results: Preliminary findings with a sample of 101 mothers show that breastfeeding mode was significantly correlated with maternal self-reports of depressive symptoms. Mothers who reported that they were exclusively breastfeeding had the lowest scores on the Edinburgh Postnatal Depression Scale (EPDS), those that reported both breast and bottle feeding their infant had intermediate scores on the EPDS, and those that reported exclusively bottle-feeding their infants had the highest EPDS scores (i.e., most symptoms of depression). However, both EPDS scores and use of breastfeeding were also negatively correlated with infant age. An analysis of covariance (ANCOVA) examining effects of breastfeeding and infant age on EPDS scores showed a significant effect of infant age, $F(1, 97) = 5.98$, $p = .02$, but no significant effect of breastfeeding mode, controlling for infant age, $F(1, 97) = 1.62$, $p = .21$. Mode of delivery data have been entered for 50 of the mothers. Mothers who had a caesarian delivery were significantly less likely to breastfeed than mothers who had a vaginal delivery (30.1% vs. 65.8%). Infant age did not factor into this. Neither mode of delivery nor breastfeeding was related to the infant's performance on the BSID-III scales.

Conclusions: Although preliminary evidence suggested a link between breastfeeding and maternal depression, the effect of breastfeeding mode was no longer significant after infant age was taken into account. Older infants naturally transition away from exclusive breastfeeding, and episodes of PPD eventually relent in most cases. Mothers who gave birth through caesarian section were less likely to breastfeed, an effect not explained by infant age. More data will soon be available to further analyze for effects of c-section on cognitive and communicative development, and with more data we may yet show a separate effect of breastfeeding mode on PPD. However, so far we found no evidence that either variable influences infant cognitive development.

Clustering Neural Spikes Using FGPA

John Kincaid
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Mentor: Tim Lei, Associate Professor
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Abstract:
Neural activity can be measured via a metal electrode inserted into the brain. When neurons around the electrode fire, the sensor will detect a voltage spike. The same neuron will generate neural spikes with similar temporal shapes each time it fires, and by classifying similar spikes, we determine which neurons around the electrode are firing and when. This method of investigation gains us a deeper understanding of brain activity, which may lead to treatments for neurological ailments such as Parkinson's disease. Previously, clustering of neural spikes was done in software, which is limited by processor speed and complexity. This research implements the clustering algorithm developed by Dr. Tim Lei and Ms. Zeinab Mohammadi in the fabric of a Field Programmable Gate Array (FPGA). The FPGA realizes the algorithm as custom hardware, allowing us to greatly simplify and parallelize the process so that we can achieve the ultra-low latency clustering needed for real-time analysis of neural activity.

The understanding of Acid Sensing Ion Channels

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Mentor: John Bankston
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Abstract:
Acid Sensing ion channels (ASICs) are sodium selective proton gated ion channels. These channels are found in the central and peripheral nervous system. ASIC detect the presence of acidification extracellularly. At neutral or basic pH ASICs are closed, while in an acidic environment, the ion channel opens and Na+ moves from the outside of the cell to the inside of the cell. ASICs play a key role in tissue injury, pain, inflammation, ischemia, stroke, and some tumors. The function of ion channels in general is governed by how they assemble, what other molecules bind and regulate them, where they are localized within the cell, and how individual components of the protein rearrange structurally during function. Fluorescence methods provide us with a method to understand a great many of these questions. Fluorescence measurements can be performed in living cells, with small amounts of protein, and over a wide range of time scales. There are a number of ways to label ASICs with a fluorescent tag, but much of the work in the lab uses genetically encoded intrinsically fluorescent proteins derived from the Green Fluorescent Protein (GFP). In order to do this, we used Gibson Assembly to engineer a number of DNA plasmids that contain different ASIC isoforms with different color fluorescent proteins (FPs). In addition, we labelled a protein called Stomatin with FPs as well. Stomatin interacts with ASICs and alters their function in neurons. Knockout of genes of the Stomatin family lead to deficits in touch sensation in mice. With these fluorescently labelled proteins, we are able to perform experiments that look at where these proteins localize in the cell and how these proteins interact with one another. Using an approach called Fluorescence Resonance Energy Transfer (FRET) we can measure the interaction between two proteins. FRET is a non-radiative energy transfer that occurs between two different fluorophores that are close to one another. The intensity of this energy transfer is related to the sixth power of the distance between the two fluorophores making FRET a powerful tool for measuring distances. We measured FRET between Stomatin and both ASIC1 and ASIC3 and were able to show that Stomatin interacts only with ASIC3. This result is consistent with our functional measurements that show Stomatin regulates ASIC3 but not ASIC1. In addition, we used FRET to look at how ASICs assemble with one another. ASICs form trimers and can form both homo- and heterotrimers. Our FRET data, to this point, has shown that ASIC1a/2a, ASIC1a/3, and ASIC2a/3 can all form heterotrimers. Overall, we have developed a powerful set of fluorescent tools for filling in the gaps in our understanding of ASIC function.

Probing the Dynamics of the Villin Headpiece Protein's Subdomain HP-36

Tanja Kovacevic
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Mentor: Hai Lin, Professor
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Abstract:
The folding of many globular proteins and aggregation of non-globular proteins arises from the dynamics of hydrophobic side chain interactions. A headpiece subdomain on villin, HP36, has a hydrophobic core, which is ideal for studying side chain interactions similar to those found in more complex proteins. It is important to obtain the free-energy profiles for flipping of the hydrophobic core residues in order to comprehensively understand the dynamics of the hydrophobic core. Solid-state NMR measurements of the three phenylalanine residues (F47, F51, and F58) implied that the three residues are flexible and frequently undergo ring flipping1. To compare with experimental results, here we use umbrella sampling, a form of biased molecular sampling, to compute the free-energy profiles of these three phenylalanine residues at various temperatures.

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Multispectral Human Behavior Detection and Prediction via Deep Fusion Neural Network

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Mentor: Chao Liu, Assistant Professor
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Abstract:
Automatic recognition of human actions is an important and challenge problem in surveillance and intelligence transportation areas. Many researches that focus on Real Time Multi-Person Pose Estimation have already achieved great accuracy on the conventional visible color imaging data. However, the accuracy would be affected by lighting and distance conditions as well as the cluttered backgrounds. Thermal cameras, which have long-wavelength infrared, are stable by the intensity of light. On the contrary, thermal data always lose the fine visual details of human objects, especially at long distance.

In this paper, we proposed a human action recognition and prediction model using a deep learning framework based on the state of art object detection and pose estimation methods, which utilized the advantages of both visible and thermal data. The model could capture the interaction information between human and their surroundings, and then predict trajectories and behaviors of human. The experimental results demonstrated, after fusing thermal captured information with visible color imaging, the overall accuracy of human behavior recognition and prediction was improved under different situations.

Smart Phone Usage on Social Habits and Attention Span

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Daisy Cruz
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Mentor: Trish Zornio, Professor
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Abstract:
The use and presence of technology has increased over the years in homes, education systems, and entertainment, with people engaging at progressively younger ages. In this study, we research the influence of technology usage on adolescents and consider generational differences, as well as influences on social development and attention span. Our sample consists of CU Denver students 18 and older on a nontraditional campus.

Collegiate Recovery

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Mentor: Candan Duran-Aydintug, Associate Professor
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Abstract:
It is no secret that college campuses are havens for alcohol and drug use which leads some students into addiction. It is, however, largely a secret that some students are already in recovery from addiction (an estimated 1.5% of college students). In order to support the diverse needs of recovering students, Collegiate Recovery Communities (CRC) were first established on campuses in the 1980s. CRC's are defined as "institutionally sanctioned and supported programs for students in recovery from addiction seeking a degree in higher education." Today, some form of a CRC exists on 301 campuses nationwide. Initial studies on the impacts of CRCs are promising, with participating students having a higher than average GPAs and low relapse rates. However, there is a serious dearth of literature on CRCs and because there is no formal "model" for a CRC, CRCs nationwide provide varying degrees of resources.

In this research project, I will use a phenomenological qualitative study design and conduct in-depth interviews with students on campuses across Colorado, including Auraria, who are involved in a CRC on their campus. The interviews will provide an understanding of recovering student's needs and what dimensions or elements of a CRC most effectively meets these needs. The intention of this research is to formalize a "model" of a CRC that new CRCs can look to as an ideal for their program.

Re-parameterization of the semi-empirical Parameterized Method 6 for the geometry optimization of gold clusters using Density Functional Theory

Dmitri LeeNatali
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Mentor: Emilie Guidez, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
In the century following its use as the global monetary standard, gold has found many applications in technological and biomedical developments, from superconductors to nanotechnology and cancer-radiative therapies. And while the growing number of applications indicate a need for the further understanding of gold's various molecular properties, the current catalogue of ab initio (first principle) computational methods, while generally accepted to be the most accurate, prove to be far too costly in time and resources for large nanoclusters (hundreds of atoms or more). Using the geometries and energies that ab initio methods provide for small clusters as reference data, the aim of the project is to refine the semi-empirical Parameterized Method 6 (PM6) fitted parameters for gold, which would allow the optimization of gold clusters at a computational efficiency two orders of magnitude faster than the popular ab initio methods (Density Functional Theory, or DFT). In this study, over 100 reference data points in the form of optimized structures and relative ground state energies of various gold isomers (Aun clusters for n=2-19) were computed using DFT, largely through the application of group theory.

Alterations in the sound localization pathway in fragile X syndrome knock out mice

Jennifer Libby
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Mentor: Achim Klug, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Worldwide, Fragile X Syndrome (FXS) is the most common single-gene cause of autism. The mutation of the Fmr-1 gene causes the fragile X mental retardation protein (FMRP) to turn off, affecting the development and connectivity of neurons that rely on this protein. FXS is characterized by many clinical symptoms including auditory issues related to sound localization problems which make it particularly difficult to differentiate sounds in noisy environments. These sound localization deficits point to the sound localization pathway in the auditory brain stem as one possible region contributing to the auditory symptoms. Using an Fmr-1 knockout mouse line, we studied the connectivity between areas of the sound localization pathway and found anatomical differences to one brain region. Now, we are measuring the output current from neurons in this brain region to determine if fewer or smaller connections and/or neuron numbers will lead to decreased synaptic currents. In addition, we are identifying if a decrease in specific chemical signals changes the current output from this region to other regions in the brain stem. We are also testing to see if these differences affect the time required for these cells to reset before sending a signal again. Since this pathway requires precision timing, any changes in these parameters will upset the balance required for this system to function optimally. Findings from these studies are critical for understanding how these changes lead to altered sound perception in people with FXS and will help identify potential targets for future treatment.

Relative Effectiveness of Cue Types in Visual Search

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Mentors: Carly Leonard
DC - College of Liberal Arts and Sciences

Abstract:
When observers take in sensory information, they often need a cue provided to help direct their attention to relevant information. The goal of this study was to compare the role that different types of informative cues have in speeding up visual search for a target. Results from prior studies suggest that specific cues hold more influence in allocating attention to the target item than other cues. Compared to other attributes, color has been found to be especially effective in guiding attention. In this task, participants were given an informative cue on each trial about an upcoming target's color (red or blue), shape (circle or square), or both (e.g., red circle). On other trials, a neutral cue (unique) was provided meaning the target had to be found only based on it being a novel object among a set of three other homogeneous distractors. Then a search display was presented briefly and participants made a speeded response about a line inside the target object. Preliminary results from this task showed that as expected, neutral cues had the slowest reaction times. The shape cue only seemed to be marginally helpful, while color and both cues had the fastest reaction times, indicating that participants favor color over other cue types. The next step is to run this behavioral task as an EEG study so that we can examine neurophysiological measures of how the different cues are encoded and how they affect attentional allocation.

Effects of drugs of abuse on transient dopamine release as they relate to drug class

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Thomas Everett
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Ryan Leman
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Mentor: Erik Oleson, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
The rewarding and reinforcing effects of abused drugs are thought to be mediated by their ability to increase brain dopamine levels. The canon holds that all drugs of abuse increase dopamine release in a brain region called the nucleus accumbens (NAc) but, due to the temporal constraints of previously available neurochemical techniques, it remains unknown how distinct drugs of abuse alter dopamine release in real time. A real time assessment is important due to the nature by which dopamine neurons fire. In awake and behaving rats, dopamine neurons fire in two distinct patterns. At 'rest,' dopamine neurons fire in a low-frequency pacemaker fashion that is thought to produce a tone on high-affinity dopamine receptors in the NAc. When presented with motivationally relevant stimuli, dopamine neurons fire in high-frequency bursts. The phasic bursts of dopamine neural activity contribute to the generation of subsecond release events in the NAc that are sufficient in concentration to occupy low-affinity dopamine receptors. As the activation of these low-affinity receptors is thought to be particularly important in strengthening action-outcome associations, we are especially interested in investigating how drugs of abuse alter their patterns of release. Fast-scan cyclic voltammetry (FSCV) allows for the detection of dopamine release events with a temporal resolution of milliseconds, making it an ideal tool with which to examine how drugs of abuse alter transient dopamine release events in real time. We obtain two primary dependent measures of dopamine release, the frequency at which they occur and the total concentration of each event. Here, we are using FSCV to compare how different drugs of abuse alter the frequency and amplitude of dopamine release events in the awake and behaving rat. Drugs of investigation include: ethanol, diazepam, zolpidem, WIN55,212-2, methamphetamine, methylenedioxymethamphetamine (MDMA) and heroin. Preliminary data show that the sedative-hypnotics ethanol, diazepam and zolpidem all increase the frequency but decrease the amplitude of dopamine release events. Heroin, the synthetic cannabinoid WIN55,212-2, and the psychostimulant methamphetamine increase both the frequency and amplitude of dopamine release events. The psychostimulant and tryptamine psychedelic MDMA increases the amplitude of dopamine release events without affecting their frequency. Together, these data reveal that the effects of abused drugs on transient dopamine release events varies across drug classes.

Modeling the Response of Rayleigh - Van der Pol Oscillators to Stochastic Excitation Near the Hopf Bifurcation

Bingshen Lu
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Mentor: Masoud Asadi-Zeydabadi, Associate Professor
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Abstract:
In this research project we study the Rayleigh-van der Pol oscillator with additive noise. This dynamical system is a fundamental model that can be tested experimentally by the Wien-bridge electrical circuit. The analysis of the Rayleigh-van der Pol oscillator in the presence of noise provides a good understanding of the stochastic nonlinear dynamical system. The Rayleigh-van der Pol oscillator is a two- variable nonlinear system with one control parameter. As the control parameter varies at the bifurcation (transition) point the state of system changes from steady to self-sustained oscillation. This transition is known as Hopf bifurcation. The focus of this project is on the behavior of the system near bifurcation point in the presence of noise.

Risk Factors for Interpersonal Violence Against Women: A Meta-Analysis

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Sadie Law
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Ivy Yang
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Mentor: Patricia Zornio
DC - College of Liberal Arts and Sciences

Abstract:
This study used meta-analysis to examine the relationship between SES, family structure, and previous childhood trauma, and a woman's likelihood of being in an abusive, intimate relationship. We hypothesized that women with low economic status, a non-traditional family structure, and/or a history of child maltreatment would increase the likelihood of them ever being in an abusive relationship with a romantic partner. We collected research from 30 previous studies that provided relevant data. Many of these sources supported our hypothesis as well as introduced confounding variables including race, age, etc. This study is not correlational nor causational in nature and is meant to bring awareness to the potential pre-existing factors that might increase the likelihood of a woman being in an abusive relationship.

Optimizing Electrospun Cardiac Patches for Prevascularization Using Polymer Composites

Anne Lyons
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Mentor: Jeffrey Jacot
DC - College Engineering, Design and Computing

Abstract:
The goal of this project was to develop biomaterial scaffolds that support cardiac tissue viability and long-term function for the repair of congenital heart defects. Electrospun scaffolds can be designed to mimic the morphology and mechanical properties of native heart tissue and are suturable. Current electrospinning methods do not generate sufficient porosity for vascular network formation. Vascular networks are needed for perfusion of highly metabolic cardiomyocytes. In this study, five groups of polyurethane (PU) and polycaprolactone (PCL) polymer composites were electrospun. Each group was electrospun with and without sacrificial polyethylene oxide (PEO) particles using a custom co-electrospinning apparatus. The addition of PEO was hypothesized to increase scaffold porosity for cellular infiltration and improve scaffold mechanical behavior to more closely approximate native heart tissue. Using scanning electron microscopy, dynamic mechanical analysis, and histology for analysis of fibroblast infiltration, this hypothesis was confirmed. In subsequent experiments, vascularization through the patch will be assessed in vivo. Scaffolds that received PEO and had higher PU concentrations experienced significant scaffold shrinkage. Therefore, it is anticipated that scaffolds with lower percentages of PU that received PEO will have optimal cell infiltration and vascular network formation.

Further understanding the relationship between intertrial priming in visual search and visual working memory capacity

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Kelsey Donovan
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Mentor: Carly Leonard
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Abstract:
Visual search is a type of perceptual task that requires participants to scan the environment for a target (the object of interest) among other objects that are present. The visual search task we used involved participants identifying a diamond that is a different color from the rest (the target) and responding to whether the top or bottom of the diamond is cut off. The time it takes to respond is the measure of interest. Intertrial priming occurs when the target color is repeated from the previous trial, which results in a faster reaction time than if the target color is not repeated. In some blocks, target color repeats are likely while in other blocks they are random. Previous research found there was a significant negative correlation between individual working memory capacity and priming magnitude in the repeat-random condition, but not the repeat-likely condition. Even though this patter was significant, it's important to take into consideration counterbalancing. The previous experiment presented the repeat-random condition before the repeat-likely condition. This experiment investigates if presenting the repeat-likely condition before the repeat-random condition will change the relationship between working memory and priming magnitude. The results will inform us if the correlation is due to the order the conditions were presented, or if it actually is because repeating the target in subsequent trials was random.

Rituals as Art

Samantha Manion
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Mentor: Melissa Furness, Associate Professor
DC - College of Arts and Media

Abstract:
My great Grandmother made abstract artwork decades before the Modernist movement. I have no doubt that Clement Greenberg would have uplifted her work if she had been born a white man. Nonetheless, she created. Her work consisted of elaborate blankets and quilts made exclusively from found materials(scraps). I grew up with this artwork. Of course, the tradition of quiltmaking has been inherited. My grandmother taught my mother and in turn my mother taught me. These women in my family, and the stories I grew up with about them are both the question and the answer to my work.

Through this series, Guera Things, I shed light on the bi-racial-woman experience. An experience that is an amalgam of white things and hispanic things alike. I chronicle the moments in a household that are filled with both tortillas and french fries. Side by side and equal. I like to juxtapose the poetry of growing up listening to Selena Quintanilla and Madonna. I want to give context to individual's bi-racial experiences in relation to my own. Paired with this is a fascination of rituals that we as women of color have. Much like the first time you watched your mother put on red lipstick, I find myself transfixed by these traditional and untraditional "acts" that our mothers, sisters, primas and friends teach us.
By means of saturated color I paint vivid narrative portraits. The use of fabric into my pieces makes a textural claim on womanhood. We appear soft and cozy.These paintings are quilt-like with some areas of purposeful incompleteness. The incompleteness illustrates feelings that many biracial people are innately aware of within themselves.

This work communicates that girlhood and womanhood are inherited in beautiful ways as well as painful ones. In many traditional families the daughters are still expected to be quiet, respectful, and feminine. We are expected to be quiet about the weight of this generational womanhood. It is a beautiful burden that we carry. I simply seek to honor that weight that we women are given.

Availability of Affordable Housing: A Quantitative Study of Which Factors Contribute to the Availability of Affordable Housing in Denver Neighborhoods

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Sarah Janssen
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Marc Richman
DC - Business School

Mentor: Joshua French
DC - College of Liberal Arts and Sciences

Abstract:
This paper analyzes which factors are most influential in determining the availability of affordable housing in various neighborhoods in Denver, Colorado. This is an important question to consider, since lack of affordable housing is an increasingly pervasive issue in the Denver area. Approximately one third of Denver residents currently face unaffordable housing, mostly due to a large increase in housing demand without a corresponding increase in housing supply. Studies have shown that the populations most affected by this problem are the poor, less educated, disabled, and elderly. Not only does this issue directly affect those without affordable housing, but also has negative effects on the community as a whole. Using data collected from the Data to Policy database provided by the Auraria Library, we investigate a number of factors related to neighborhood demographics, neighborhood characteristics, and community characteristics to determine which ones are associated with the availability of affordable housing. Examples of our variables include the percent of residents in poverty, the percent of residents over 65 years of age, and per capita income.

Exploring the Academic Impact of School-Based Health Centers in Colorado

Lisette Martinez
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Safa Mechergui
DC - College of Liberal Arts and Sciences

Marisa Westbrook
DC - College of Liberal Arts and Sciences

Mentor: Sara Yeatman, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
School-based health centers (SBHCs) are comprehensive health clinics located within school settings that provide services to students regardless of their ability to pay. Poor health is a significant barrier to educational outcomes, and insufficient access to health care services during adolescence can impair development and academic success. By removing major barriers to health care, SBHCs have the potential to increase the likelihood that a student remains in high school and continues to graduation. Although Colorado's first SBHC opened in 1989, the last decade has been marked by a sizeable expansion of SBHCs within high schools across the state, including many in rural areas where access to other forms of care is more limited. In both rural and urban areas, SBHCs in Colorado serve a disproportionate percentage of Medicaid enrollees and uninsured patients. In this study, we examine the relationship between within-school access to a SBHC and high school graduation rates between 2006 and 2017. Using a combination of analytic techniques to account for selection in the schools that get SBHCs, early findings indicate that on average, there is a small increase in graduation rates following the introduction of a SBHC. This evidence points to the potential for SBHCs to improve student educational success. Our findings build on other research in this area to show the benefits of SBHC adoption in more school districts, and will support public health professionals in determining the most effective interventions to advance educational and health equity in Colorado.

A Device for Individuals with Quadriplegia to Independently Control their Beds' Orientation to Prevent Decubitus Ulcers and Alleviate Pain

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Mentor: Craig Lanning
DC - College of Engineering, Design and Computing

Abstract:
Activity Type: Undergraduate Human-Centered Needs-Based Design Patients with paraplegia and quadriplegia suffer from a variety of problems and complications due to their injuries. Up to 66% of patients with spinal cord injuries develop decubitus ulcers (bedsores) that cause irritation and pain from staying in the same position over prolonged periods of time. Though preventing bedsores is as simple as changing the bed's position every two hours, patients with quadriplegia and paraplegia have little to no motor function and have to rely on caretakers to adjust the bed manually. Patients require a device to independently control their bed's orientation to prevent the development of bedsores. We have designed and prototyped a device that utilizes the voice recognition software of an Amazon Echo Alexa to control and change the foot height, head height, and bed elevation. This device uses a Raspberry Pi and six solenoids housed in a 3D-printed case to apply force to buttons on a hospital bed remote when the Alexa is stimulated by the patient's voice commands. The use of a generic lambda function hosted on a virtual server allows for other voice-activated assistants to be used as voice recognition, providing scalability and easy customization for settings in hospitals and outpatient care. The device will also allow caregivers to control and change the position of the bed using vocal commands or by removing the remote from the case. Our solution can be used as a framework to allow paraplegics, quadriplegics, and caretakers in hospitals and at home a new degree of freedom.

Identifying Hidden Ancestries of Heterogeneous Populations in the Genome Aggregation Database

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Ian Arriaga-MacKenzie
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Mentor: Audrey Hendricks
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Abstract:
The Genome Aggregation Database (gnomAD) has aggregated human genome sequencing data for thousands of genomes. This data is open to the public with the purpose of being used for studies in disease and population genetics. However, this data is far from perfect. There is heterogeneous ancestry in gnomAD, which can complicate or bias subsequent analyses. And while some of the ancestry information is highly specific (i.e. Finnish, Japanese, Korean) many of the ancestral populations are broad. For example, the African continent contains the most genetic diversity of any ancestry and yet there no finer scale ancestry information available in gnomAD. Furthermore, the African ancestry group in gnomAD includes African Americans, who have both African and European ancestry. Imprecise ancestry information can cause confounding associations, misclassification, and misdiagnoses when using allele frequencies for association analysis or genetic variant lookups in the study of very rare diseases. To address this, our team has developed a model that identifies the proportions of ancestries present in a given population. Our method implements a Sequential Least Squares algorithm to accurately estimate the proportion for each genetic ancestry. Using this model, our team was able to determine the ancestry composition of three broad ancestry categories in gnomAD: African/African American, Latino/Admixed American, and Other. Here we present our findings on the ancestry composition of these three categories in gnomAD. We also present a sample of the code we developed in order to detect these hidden ancestries.

Probing the lipid dependence of Src membrane binding with fluorescence spectroscopy

Majd Matti
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Mentor: Jefferson Knight
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Abstract:
Src is a non-receptor protein kinase that belongs to the family of tyrosine kinases, it adds a phosphate group to tyrosines. Src may play a role in cell growth and embryonic development; elevated levels of Src are also associated with cancer progression. Src is involved in various signal transduction pathways. Previous studies from the Stith group have shown that Src plays an important role in the events of fertilization of Xenopus laevis by stimulating phospholipase Cγ which triggers other events that eventually affect the intracellular Ca2+ levels. Src is believed to bind lipid rafts via intermolecular and electrostatic interactions. In this study, we test Src's binding ability to different lipid compositions using Fluorescent Resonance Energy Transfer (FRET) and lipid titration. The SH4, unique lipid binding region (ULBR) and the SH3 domains in the N-terminal end of Src bind to negatively charged lipids due to the presence of several lysines and arginines in the SH4 domain.

The Invisible Youth

Marcia Morgan Maxson
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Mentor: Rene Galindo, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Research indicates that more than 70% of youth in foster care aspire to continue their education at the post-secondary level, but due to unique barriers they face only 25% will graduate high school and 2% earn a college degree. A disproportionate number of these children are minorities, LGBTQ+, and from low-income families. Youth in foster care face unique barriers to entering and completing post-secondary education including inadequate academic preparation, limited support, financial challenges, ongoing mental health issues, and lack of housing/employment. There is an unacceptable disparity present due to this vulnerable population becoming invisible once they turn 18 and age out of the system. The state has a unique relationship to foster youth because the child welfare system has made the determination to remove these children from the custody of their parents and assume full legal responsibility. Given this unique relationship, it is our responsibility to provide support and close the achievement gap for this unrecognized population in our university education system. Four models for improving educational outcomes for foster youth will be discussed. I will analyze the defining features of these models including financial, academic, social/emotional, and logistical support. The identification of defining features will facilitate a discussion of how programs for this population can be built. Improving equitable access and educational outcomes for foster youth is crucial given the gaps in higher education access and graduation rates. I provide unique insight on this issue due to my personal and professional experience with the foster care system.

The Relationship Between Access to a School-Based Health Center and County-Level Teen Fertility in Colorado

Safa Mechergui
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Lisette Martinez
DC - College of Liberal Arts and Sciences

Mentor: Sara Yeatman, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
Adolescent fertility has fallen dramatically nationwide, and in Colorado, yet disparities persist between rural and urban populations, and among underserved populations. Having reproductive health services readily available for adolescents who otherwise would not locate services themselves may increase their likelihood of effective contraceptive use. School-based health centers (SBHCs) could be uniquely positioned to address the inequitable geographic spread of health services by providing services to adolescent populations who may otherwise be distrustful of a more conventional health source. SBHCs provide a comprehensive range of services to adolescents on school grounds, including behavioral and reproductive health services and sexual health education. They deliver health services in ways that are most accessible, convenient, and available regardless of ability to pay. Existing studies of SBHCs have demonstrated relationships between students' use of a SBHC and a variety of positive sexual health outcomes, including contraception. However, individual-level studies are limited due to student self-selection into use of services. In this study, we examine the relationship between access to a high school SBHC and teen fertility in rural and urban counties in Colorado between over a 15-year period. Identifying population-level relationships between access to SBHC and teen fertility will offer new insight into the potentially unique role that SBHCs may have in minimizing persistent inequities in the state.

Technology, Social Media, Play and Human Affect

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Mentor: Larry Erbert
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Abstract:
Over the past few decades, a variety of technologies have developed and integrated into human life. The recent technological advancements such as the Internet, social media, smart phones, video games, etc. have all contributed changes in the way humans lead their lives. More specifically, educational tasks have been made easier via the advent of the Internet. The Internet has given humans the ability to self-educate and gain access to a vast pool of information. However, the Internet is culprit of the issue of information overload that greatly hinders deep comprehension and memory. Additionally, increased social media use has been linked to an increasing number of mental health issues including depression and anxiety. These new emerging issues have collided within this new technological world, leading to a variety of studies that address the influence of technology on humans. Furthermore, non-technological child-like play has been credited with enhancing emotional mood and creativity, both of which have been found to be hindered by social media use. This research studies the effects that technology and play have upon the brain, particularly in regards to comprehension, emotion and creativity.

Queosine Knockout Improves Sense Codon Reassignment at Histidine and Asparagine Codons with the Orthogonal M. jannaschii tRNA/aaRS pair

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Mentor: John Fisk
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Abstract:
Sense codon reassignment is useful in expanding the genetic code to 22 or more amino acids, however the efficiency of reassigning mRNA codons is highly variable, because multiple biological factors affect sense codon reassignment efficiency. Decoding U-ending codons within E. coli cells by an A34 tRNA was hypothesized to energetically outcompete wobble base pairing because the orthogonal tRNA A34 anticodons can Watson-Crick base pair with a U-ending codon, while the E. coli anticodons cannot. One factor that may significantly affect these reassignments is the presence of the guanosine analog, queosine, at the wobble position 34 in E. coli His, Asn, and Asp tRNAs. The presence of queosine at this anticodon position of the endogenous tRNAs allows them to read both the C and U nucleotides with high efficiency. Queosine therefore poses a potential challenge for sense codon reassignment at the U-ending codons, because the endogenous tRNAs may out compete orthogonal A34 tRNAs. Consequently, sense codon reassignment may be improved by removing Q34 of the endogenous tRNAs by knocking out queC, a gene essential for queosine biosynthesis. QueC was knocked out in E. coli Top10 cells, which were evaluated for sense codon reassignment at His CAU, Asn AAU, and Asp GAU codons using a fluorescent screen. Reassignment efficiency of His CAU codon was improved 2-fold in the queC knockout strain compared to the starting strain of E. coli. The Asn AAU codon was also shown to have a 1.25-fold improvement in the queC knockout strain. Asp, however, did not show improvement.

Multispectral Pedestrian Detection via Deep Fusion Neural Network

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Mentor: Chao Liu
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Abstract:
Pedestrian detection and tracking have become an important field in the computer vision research area. Accurate detection and identification of humans is key to successful behavior analysis tasks, which also benefits the development of potential applications in surveillance and autonomous driving. As deep learning is improving so are the methods being used to detect objects and people. The conventional visible color imaging used to detect pedestrians works great under normal circumstances where there is clear visibility to the person. However, factors such as dim lighting, large distances, and cluttered backgrounds can greatly reduce accuracy. As ambient lighting has less effect on thermal imaging, thermal cameras which use long-wavelength infrared become widely used in human tracking and activity recognition. However, thermal images always lose fine visual details of human objects while the optical cameras can capture more details. Therefore, our system utilized the advantages of both visible and thermal sensors by proposing a deep fusion neural network which is based on the state of the art YOLOv3 model. The results showed that fusing thermal captured information into visible color imaging detection systems can vastly improve the accuracy of pedestrian detection under different conditions.

Computing Host-Guest Free Binding Energies With a Combined QM-MM Mining Minima Method

Kilinoelani Montgomery
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Mentor: Emilie Guidez
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Abstract:
One issue with many drug molecules is that they are hydrophobic, therefore insoluble in the human body. Drug carriers have a hydrophilic character on the exterior and a hydrophobic interior. Therefore, drug molecules can be encapsulated in these systems which improves their solubility in the body and bioavailability as they travel to the target site. Since the drugs are bound to the carrier through weak, noncovalent interactions, the binding energy between them is difficult to predict accurately. The VM2 software utilizes molecular mechanics (MM) methods to predict the binding energy between a host (drug carrier) and a guest (drug). Although molecular mechanics models are computationally fast and inexpensive, they are not as accurate as quantum mechanical (QM) methods. Therefore, a combination of QM and MM is important to develop accurate yet cost beneficial software. The QM-VM2 scheme searches for host-guest conformers using an MM mining minima method, then runs QM calculations to get accurate free binding energies. The main issue with this scheme is the high computational cost involved with optimizing a large number of conformers with QM. The new proposed algorithm will develop and test a progressive scheme, which filters productive conformers by running partial QM geometry optimizations. Only these productive conformers are then fully optimized. Multiple screening steps are implemented in order to make sure a conformer can be ruled out. The resulting software will aid drug developers as they work to model new types of medications.

Contemporary Applications of the Cyanotype

Sharifa Moore
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Mentor: Carol, Professor
DC - College of Arts and Media

Abstract:
The cyanotype is a nineteenth century photographic process that was invented in 1842. The cyanotype carries a modern identification as an architectural blueprint. It is one of the most stable archival processes in photography, and uses a two-part combination of ferric ammonium citrate and potassium ferricyanide. The solution is mixed with distilled water and brushed onto watercolor paper, dried, and placed under a photographic negative before being placed in the sun. Cyanotypes utilize a printing out process, which means that the final image is the same size as the negative. When exposed to UV light, the chemical solution turns a characteristic Prussian blue. The goal of this research was to explore contemporary connections between the cyanotype process and modern digital technologies in photography printing. In addition, various bleaching and toning options were employed to change the color of the original Prussian blue formula. Classic formula cyanotype prints will be displayed along with results from both film and digital negatives and corresponding toned images in an exhibition style format. Interest in this project originated from the desire to thoroughly examine and experiment with low-cost, historic processes that can be shared in an educational environment in the future.

The relationship between working memory performance and eye movements during memory maintenance

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Mentor: Carly Leonard, Assistant Professor
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Abstract:
Visual working memory (VWM) refers to a component of short-term memory responsible for maintaining visual information for a brief duration when the stimuli are absent. While other research has focused on how instructed eye movements during maintenance influence working memory, our research focuses on naturally-occurring, or non-instructed, eye movements. The aim of this study is to analyze how non-instructed eye movements during a VWM task influence performance. The participants engaged in a VWM task where on each trial two, four, or six squares appeared in different colors and locations on the screen for 200 milliseconds., The squares disappeared and after 1,000 milliseconds, one square reappeared. The participants then had to indicate if the square matched the color of the previously-shown square in the respective location. We calculated the mean number of eye movements occurring during the delay period with respect to accuracy at the end of the trial. Participants showed significantly fewer non-instructed eye movements throughout the delay period for accurately-performed trials compared to inaccurately-performed trials. This data supports previous research that has identified an association between eye movement generation and VWM maintenance. Thus, differences in eye movements may contribute to VWM performance across trials. We will conduct further analyses to investigate how eye movement strategy differences may explain individual differences in overall working memory performance.

Utilization of Fitbit activity trackers to measure physical activity in a longitudinal study: Methodological considerations

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Chloe Rogers
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Sydneyjane Varner
DC - College of Liberal Arts and Sciences

Mentor: Krista Ranby
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Abstract:
The Transition to Parenthood (TTP) is a critical period in couples' lives marked by significant changes in health behavior, as well as physical and mental health that has been shown to have a long-term impact on the well-being of the whole family. Partners' health status and health behaviors are interdependent, yet studies have not taken a dyadic approach to understanding health during the TTP. Furthermore, very few studies have utilized objective physical activity devices to track physical activity levels in this population (or any other) for an entire year. In response to these gaps in the literature, The Pregnant Couples Study was designed to gain a deeper understanding of the natural changes in and determinants of physical activity during the TTP with an ultimate goal of informing future interventions to support couples in developing and maintaining healthy behaviors as they begin their families. In our ongoing study, 43 couples expecting their first child are asked to wear Fitbit Flex 2 activity trackers from the first trimester of pregnancy to 6 months postpartum in order to monitor daily physical activity levels. Given that this is the first study of its kind in terms of population of interest, data collection modality, and length of data collection, this poster will present the methods used and discuss practical consideration for researchers utilizing objective physical activity measurement.

The Impacts of Economic Development in Relation to Sustainability: A Comparison Between Shanghai, China and Denver, Colorado

Anjelique Morine
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Mentor: Amanda Weaver
DC - College of Liberal Arts and Sciences

Abstract:
Since the late 1970s, both Shanghai and Denver have seen increased economic development eating up more rural areas. Although this development has improved the economic value, it has decreased other natural resources in relation to sustainability. Rapid economic development and sustainability have become a topic of interest and priority in many growing cities. This research looks to further examine the effects of urban development with economical, sustainable, and agricultural lenses. Through literature review and immersive experiences in both regions, one will prove that continued rapid globalization based on profit will result in a decrease of natural spaces.

The role of mTOR signaling in enhanced fear extinction produced by acute, voluntary exercise

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Mentor: Benjamin Greenwood, Assistant Professor
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Abstract:
Exercise has beneficial effects on mental health, such as enhancing the extinction of a traumatic memory. In rats, a single, two-hour bout of voluntary exercise after fear extinction training can enhance extinction memory. Identifying mechanisms by which acute exercise augments fear extinction could reveal novel targets for the treatment of trauma-related disorders, such as Post-Traumatic-Stress Disorder (PTSD). One factor that could contribute to enhanced extinction memory following exercise is the mammalian target of rapamycin (mTOR). mTOR is a translation regulator involved in synaptic plasticity, and is a target of cellular signals sensitive to exercise. mTOR is also increased after chronic exercise in brain regions involved in learning and memory. Therefore, mTOR is a compelling potential facilitator of the memory-enhancing effects of exercise. The goal of this study was to determine if mTOR signaling is critical for the enhancement of fear extinction memory produced by acute, voluntary exercise. Adult, male Long Evans rats exposed to auditory fear conditioning received intracerebral-ventricular (ICV) injections of the mTOR inhibitor rapamycin prior to fear extinction training and acute wheel running. We observed that, like chronic exercise, acute exercise increased mTOR signaling in extinction-related brain areas. Moreover, ICV administration of rapamycin reduced mTOR signaling and eliminated the enhancement of fear extinction memory produced by acute exercise. These results suggest that mTOR signaling contributes to the memory-enhancing effects of exercise. Factors that increase mTOR signaling could be useful targets for the treatment of psychiatric disorders like PTSD.

A Second Look at Biphobia: The Male Perspective

Charles Myers
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Mentor: Candan Duran-Aydintug
DC - College of Liberal Arts and Sciences

Abstract:
In my previous study on bisexual experiences in the queer community, I explored how bisexuals and pansexuals face a unique type of discrimination due to their singular status as having attraction to both men and women. This study is a natural extension of the previous one, the purpose of which is to exclusively include bisexual and pansexual men (the likes of which were completely absent from the previous study) in order to determine if inter-group conflict and biphobia within queer spaces can be demarcated by gender. Based on the analyses of in-depth interviews, not only do bisexual and pansexual men face less discrimination than their female counterparts in the previous study, but some participants claim to have experienced no discrimination in queer spaces whatsoever, despite having a strong understanding of the stereotypes and attitudes towards bisexuals that monosexuals hold. Furthermore, bisexual and pansexual men appear to have smoother experiences with heterosexuals, and the discrimination male participants have faced is more in line with traditional homophobia than any sort of unique discrimination based on bisexuality or pansexuality. The study also gauged how bisexual and pansexual men view their sense of masculinity in the context of their sexual orientation, revealing that none of the participants found any conflict with their sense of manhood and their attraction to multiple genders.

Membrane Binding of Synaptotagmin-like Protein 4: Insight from Molecular Dynamics Simulations with Strategically Mutated C2A Domains

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Sherleen Tran
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Mentor: Hai Lin, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Synaptotagmin-like proteins (Slps) are a family of membrane binding proteins involved in secretory vesicle trafficking and membrane docking. Slps possess an N-terminal domain that binds to large secretory vesicles and one or two C-terminal C2 domains that dock to plasma membranes via interaction with anionic lipid molecules such as phosphatidylinositol-(4,5)-bisphosphate (PIP2) and phosphatidylserine (PS). In particular, Slp-4, also known as granuphilin, docks secretory vesicles to the plasma membrane primarily via its C2A domain, which has a high affinity for anionic lipid bilayers. Although the structure of the Slp-4 C2A domain is known and some of its key PIP2-binding residues have been identified, the full mechanism of its strong membrane binding remains unclear. We employed molecular dynamics simulations of the Slp-4 C2A domain to determine contributions of particular residues in binding to a lipid bilayer containing physiologically relevant levels of the anionic target lipids PS and PIP2. Simulations include mutations of two important residues: Lys398, which is known to participate in PIP2 coordination, and Phe452, which is suspected to insert into target membranes via hydrophobic interactions. Both residues were mutated to alanine in the mutant systems. Preliminary results support the experimental finding that both the K398A and F452A mutants are capable of binding membranes albeit with a different balance of lipid interactions in the two mutants. Overall, experimental and computational results indicate that high-affinity membrane binding of the Slp-4 C2A domain is sustained via many lipid-interacting residues distributed over a large, electropositive protein surface.

Judges' discretion in setting bail: A study of courtroom dynamics in post-bail-reform Denver

Caroline Nelson (equal authorship)
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Jessica Valdez (Equal Authorship)
DC - School of Public Affairs

Kaitlin Chacon (equal authorship)
DC - College of Liberal Arts and Sciences

Mentor: Stacey Bosick, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
The field of prosecution has been restructuring its principles from swift punishment to values of equality and community-based corrections. As part of these changes, Denver experienced bail reform in 2013, which focused on reducing monetary bond and lessening the number of people incarcerated pre-trial. The current project is a component of a large-scale research effort on assessing racial disparities in prosecutorial discretion (PI Stacey Bosick, Department of Sociology). The research aims to understand whether prosecutors inequitably use their discretionary power based on race/ethnic characteristics of the accused persons in the criminal justice system. Methods of data collection include courtroom observations, analysis of administrative case files, and interviews with prosecutors. In this paper, we describe our courtroom observation data and tentative conclusions. This component of the research focuses on courtroom observations from February 2019 through April 2019. These data include approximately 150 observed first advisement felony cases in the courtroom. We collected data on gender, age, ethnicity, charge, bond, supervision, other orders associated with the charge, and the support system of the defendant present in courtroom. While the research is ongoing, our findings to the date suggest judges' new approaches to setting bail reflect the intentions of the reform from 2013.

Methods of Measurements for IoT Devices in Reverberation Chambers

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Mentor: Himid Fardi, Professor
DC - College of Engineering, Design and Computing

Abstract:
With the expansion and increased prevalence of internet of Things (IoT) devices the wireless industry is investigating methods of testing these devices. These methods must be robust and accurate enough to meet industry standards while being time conservative because lab test time is expensive. One such method that is being researched is continuous stirring in reverberation chambers, in which mechanical mode stirrers called paddles are turned continuously during an over the air measurement to determine how well the radiated power and receiver sensitivity as if the device was in an isotropic environment like an anechoic chamber. One issue that has been seen with this is variance in measurement results. In this work I will be using the reverberation chambers at the National Institute of Standards and Technology (NIST), Boulder campus to investigate methods to reduce this variance that maintain time efficiency, as part of my Professional Research Experience Program (PREP) fellowship.

Socioeconomic Status Influences on Delinquent Behaviors in Adolescent Youth

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Mentor: Trish Zornio, Professor
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Abstract:
This meta-analysis examines and summarizes 35 studies reporting how various socioeconomic status (SES) factors can influence delinquent behaviors among adolescence. These studies cover a wide range of factors that contribute to the shift of delinquent behaviors in youth, each focusing on one or two specific factors. Through this meta-analysis, the roles and variety of factors contribute to delinquency in the youth including parental guidance, economic strain, drug use, peer influence, etc. Our study concludes that factors related to socioeconomic statuses strongly influence delinquency within adolescent youth.

The perception of correlations in graphical scatterplots

Tammy Nguyen
DC - College of Liberal Arts and Sciences

Mentor: Carly Leonard, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
Data is often condensed and presented in graphical representations. Viewing is often self-guided and there are many factors that can influence viewer interpretation of the data as presented. In this project participants will be presented with scatterplots designed to influence viewer perception of information. We will examine fixation times and participant responses to better understand the relationship between what viewers are choosing to look at and their interpretation of the data. Very little research has been conducted investigating the cognitive processes of data interpretation despite graphs being a commonly used means of displaying information.

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Tammy Nguyen
DC - College of Liberal Arts and Sciences

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Historical Trauma Transmission Theory as Pertaining to Immigration and Overall Mental Health

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Abstract:
Historical trauma is the emotional wounding that persists through generations as a result of genocide, warfare, and cultural suppression, among other traumatic circumstances. It affects various populations, including, but not limited to Holocaust survivors, indigenous populations, as well as immigrants and refugees. Mental health disparities often stem from historical trauma, and institutions perpetuate it by reinforcing stigma and providing inequitable resources for healing. The research project will examine how historical trauma impacts diverse populations at Auraria campus and passes through generations, and how people can heal from it.

Is the pH of pure glyphosate comparable to common household herbicides?

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Kori A Baker
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Mentor: Kyoung Kim
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Abstract:
Glyphosate (C3H8NO5P) is one of the most commonly used ingredients in herbicides in modern agriculture; this acid is well known for its high efficiency and low toxicity. However, although glyphosate is one of the less toxic ingredients in herbicides, several studies have shown that glyphosate is a endocrine disruptor and high concentrations of glyphosate can result in detrimental health effects. In this experiment, we titrated Eliminator, a common, cheap household herbicide with a reported percent by volume value of 18% glyphosate, and compared the titration curve, pKa values, equivalence and end points to that of pure glyphosate. This experiment was carried out by first titrating Eliminator through a strong base, NaOH, and measuring the pH with both a pH meter and phenolphthalein. Next, calculations were preformed in order to ensure a comparable glyphosate concentration for our second titration of pure glyphosate. These calculations were used to follow the same titration procedure for the pure glyphosate titration. After obtaining results from both titrations, the data of the titration curves and calculations were compared to each other in order to draw conclusions about our data. From this experiment, the data concludes that Eliminator does compare to that of pure glyphosate, however more research is necessary to draw further conclusions regarding the health concerns about glyphosate poisoning.

A Method To Enhance The Repairability Of IV Trainers In Low-Resource Areas

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Abstract:
The ability of medical personnel to properly administer intravenous (IV) fluids is a cornerstone to healthcare. Trauma patients who were administered IV fluids were 16% more likely to survive at a given point during prehospital care than those who did not receive an IV. Trauma clinicians in rural areas have observed inadequate training of personnel in IV administration due to insufficiencies of provided training devices. IV trainers currently on the market are expensive and cannot be reused indefinitely, impeding medical training in rural areas. A method is needed to enhance the repairability of IV trainers in low-resource areas by using accessible materials in order to improve trauma care. Our design is built with low-cost vinyl plastic, silicone rubber to replicate skin, and an anatomically correct latex vein network. The veins are able to withstand at least 150 punctures within 20 minutes, allow the infusion of 1 liter of fluid without leakage, and maintain system pressure of up to 50 mm Hg. The device produces blood flashback, an important indicator for successful venipuncture. The device is easy to disassemble, making the replacement of worn latex tubing and silicone skin simple. Our device meets the demand for proper IV administration by providing a long-term training solution for medical staff in rural areas.

A Novel Biomarker and Potential Therapeutic Peptide for Atherosclerosis in Type 1 Diabetic Patients

Sabitra Niroula
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Mentor: Martin Yussman
AMC - School of Medicine

Abstract:
Type 1 Diabetes (T1D) affects an ever growing population. While this disease typically has been associated with juveniles, the disease in adult population is rapidly increasing. The defining clinical component is insulin loss, which occurs because of sustained inflammation in the islets. At present there is no means to prevent or reverse insulin loss. A major inflammatory pathway in T1D that contributes to insulin loss is the CD40-CD154 dyad. CD40 is expressed on a wide array of cells and when engaged by CD154 creates localized inflammation. This pathway is decisive in T1D; blocking the interaction prevents diabetes onset and reverses hyperglycemia in new onset diabetic mice. A major impediment to drug development in diabetes has been the failure of therapeutics to translate from mouse to human. Mindful of this, we discovered that CD40 provides a link between mouse and human during T1D. We discovered that NOD mice, the industry standard model for T1D, increase CD40 expression, including on a sub population of T cells during diabetes development. Those cells, termed Th40, not only expand in number as diabetes develops but Th40 cells are singularly capable of transferring T1D to scid recipients. In a translational approach, we discovered that Th40 cells become prominent in human T1D patients, regardless of the age, HLA haplotype, auto-antibody status, or duration of disease. Like in the mouse model, Th40 cells start at low percentage but increase as human subjects progress to T1D and remain at high level even up to 40 years after diagnosis. New onset as well as long-term diabetes patients have highly expanded numbers of Th40 cells when compared to non-autoimmune, or type 2 diabetic controls. A portion of TrialNet defined Pre-TID subjects also have expanded Th40 cell numbers, suggesting that these cells become pathogenic over time, depending upon CD40 expression. Controlling CD40 therefore will be therapeutically advantageous. Methods to control CD40 have relied upon monoclonal antibodies or randomly generated, small organic molecules. Both those options have failed clinically. To address this, we developed a series of peptides derived from the CD154 protein sequence that are designed to target CD40 binding sites. These peptides do not function like antibodies and unlike the random generated organic molecule approach, have high specificity for CD40. In preliminary work we determined that some of the peptides prevent diabetes onset in NOD mice and one of the peptides (thus far) reversed hyperglycemia in new onset diabetic mice.

The effects of social buffering on social fear conditioning

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Additional Student Co-Authors:
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Mentor: Sondra Bland
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Abstract:
Social fear is a learned behavior that often contributes to stress-related disorders like PTSD and Social Anxiety Disorder. We have developed an innovative animal model for observing social behaviors following an aversive social event in order to examine whether social buffering occurs in a social fear conditioning model. Social buffering is a phenomenon observed in social animals, in which an animal better recovers from a stressor if another animal of the same species (conspecific) is present. We exposed male and female experimental rats to a same-sex conspecific social stimulus during fear conditioning using a two-by-two design to test for social buffering. All experimental rats received footshocks on Day 1, either with or without a social stimulus and were re-exposed to the conditioning chambers on Day 2, either with or without a social stimulus. The conspecific rat was the conditioned stimulus while the footshock was the unconditional stimulus. Social stimuli did not receive footshocks. Experimental rats were assigned to one of four groups: the conditioned social fear (CSF) group that received a social stimulus on Day 1 but not Day 2, the CSF group that received a social stimulus on Day 2 but not Day 1, a social stimulus only group, and a footshock only group. Freezing behavior was the dependent variable. Rats that received footshocks with a social stimulus had a decrease in freezing behavior compared to rats that received footshocks with no social stimulus. These results suggest that both male and female rats display social buffering of fear conditioning.

Nogales Border Field Research

Stephanie Ortega
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Dulce Chavez
DC - College of Liberal Arts and Sciences

Mentor: James Walsh, Clinical Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
The issue of immigration in our country has continued to be an ongoing discussion, the mass militarization at our U.S-Mexico border and the violation of human rights against communities of color raises the question as to why the negative sentiment against immigration and immigrant communities continues to be pushed in today's modern day political agendas. Our study intends to analyze the conditions in which our current political climate have produced statutes and laws in border communities and the implications thereof that in which they have on their populace. Our project raises ethical questions about the morality of immigration policies and border control. The violations of human rights were apparent with the death and disappearance at the border, privatization of detention centers, border violence, and we evaluated the organization of the border social movement, as well as the relation of immigrants with the United States. At the end of our field research, we determined that the violation of human rights within the border communities and of immigrants continues to happen. The deaths, disappearances, and overall violence targeted at communities who are predominantly living under the poverty line and come from ethnic backgrounds has led to the overall social movement against the border wall and the current political climate.

Beta-catenin localization in ES cell lines and tumors

Jillian Oviedo
DC - College of Liberal Arts and Sciences

Mentor: Masanori Hayashi, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
The Wnt signaling pathway regulates adult stem cell proliferation and development. Wnt signaling is involved in several cellular functions related to metastasis. These include cell motility, self-renewal, and cell proliferation. Wnt signaling transduction is either beta-catenin dependent (canonical) or independent (non-canonical). Canonical Wnt signaling leads to beta-catenin accumulation in the nucleus, which drives gene expression. Non-canonical Wnt signaling leads to changes in intracellular concentration of calcium, which is responsible for calcium-dependent cytoskeletal or transcriptional responses. We studied the role of beta-catenin in Ewing Sarcoma (ES), cancer that forms in bone and surrounding soft tissue in long bones of young adults. The cause of ES is unknown and has a high tendency to metastasize, often returning after treatment. Moreover, the non-canonical, beta-catenin independent Wnt signaling pathway is not well researched. In the current study, several ES cell lines and mouse xenografts were stained by immunohistochemistry (IHC) and immunofluorescence (IF) and analyzed. Results show that beta-catenin is highly localized in the cytoplasm which is suggestive of a heterogeneous distribution. By further elucidating heterogeneity of Wnt signaling in ES, we will be able to help deepen our understanding of ES at the molecular level and eventually help to fill the unmet need for improved prevention and treatment.

Metabolic analysis of the lipid preference in cancer cells with increased CPT1A expression

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DC - College of Liberal Arts and Sciences

Gergana Stoykova
DC - College of Liberal Arts and Sciences

Mentor: Isabel Schlaepfer, Assistant Professor
AMC - School of Medicine

Abstract:
In recent years, the connection between nutrition and cancer has been established but not explored in depth. Different cancer cells are more likely to obtain energy from different nutrients. If the link between prostate cancer and the conditions that prostate cancer cells thrive in were to be analyzed, the results could potentially suggest modifications that should be placed on the diets of cancer patients to help improve their conditions. Recently, there have been societal trends that state what foods/oils are considered “healthy.” Carnitine palmitoyltransferase 1A (CPT1A) is an enzyme abundant in the liver. It aids in fatty acid oxidation, a process that metabolizes fats to convert them into energy for the cell. Previous studies have shown that CPT1A is found in an excessive amount in prostate cancer cells1,2. Using that knowledge, an overexpression of CPT1A can be carried out in a cancer cell line to imitate prostate cancer cells. They can be compared to a control which has a normal amount of CPT1A expression. Using the Seahorse XFe96 Analyzer coupled with clonogenic assays, the fats that the cancer cells preferred to burn were determined.

What Are You Going to Do With 390 Photographs of Discarded Christmas Trees?

Emily Owens
DC - College of Arts and Media

Mentor: Carol Golemboski, Professor
DC - College of Arts and Media

Abstract:
In the Spring of 2018, I applied for and was pleased to receive a UROP Grant through CU Denver which helped to partially fund my BFA Photography thesis, What Are You Going to Do With 390 Photographs of Discarded Christmas Trees? The project, a direct homage to late author Richard Brautigan and Polaroid inventor Edwin Land, was shot entirely on Polaroid Originals film. Over the course of two weeks, I traversed the Denver metro area in search for abandoned Christmas trees appropriating a short story written by Brautigan of roughly the same title. Due to the vulnerable nature of Polaroid's emulsion, each photograph is its own document of what Brautigan called, "the going away from Christmas." The images will be presented in late April-early May at the Red Line Gallery in Denver, alongside the graduating BFA students of this May 2019. For the RaCAS Symposium, I would particularly like to highlight the temperature vulnerability and unique nature of the individual images as I know there will be many scientists in the crowd! During development, Polaroid film requires shielding from the light as well as particular temperatures to create a "normal exposure." Thus, if the emulsion is colder than "recommended" the hue becomes notably blue. If too warm, a pinker/yellow hue appears throughout the image as well as visible variations in the contrast. Individually, they are simply images of trees. Together however, they culminate in the documentation of a two-week performance, which brought to life a short story by one of literature's famed lost authors.

Mindfulness to Meaning: The Correlation Between Trait Mindfulness and Life Meaning

Mackenzie Peckham
DC - College of Liberal Arts and Sciences

Mentor: Kevin Masters
DC - College of Liberal Arts and Sciences

Abstract:
It has been proposed that those with higher degrees of trait mindfulness will find greater meaning in life. Multiple studies have shown a correlation between mindfulness and meaning which provides evidence for the mindfulness-to-meaning theory. The mindfulness-to-meaning theory states that mindfulness enhances cognition which allows for the deeper capacity to make meaning in life. A positive correlation between learned mindfulness practices and meaning has been seen in multiple experiments, but trait mindfulness has not yet been tested with the theory. Trait mindfulness is the characteristic or baseline mindfulness without training. The goal of my study is to test the mindfulness-to-meaning theory by conducting a quasi-experimental design investigating the correlation between trait mindfulness and meaning. In the experiment, participants will complete surveys measuring demographic information, trait mindfulness, and meaning. Participants will be randomized into one of two groups; an experimental meaning group or a control group. Each group will perform a task, and in the experimental group, the task should elicit feelings of life meaning. Meaning will be measured before and after the task to see whether those with higher trait mindfulness gained more meaning from the task. The results will be analyzed with the intention of looking at the levels of meaning and whether they increase with increased trait mindfulness.

A Comparison of Dual Military, Male Military Only, and Female Military Only Couples

Mónica Peniche
DC - College of Liberal Arts and Sciences

Mentor: Elizabeth Allen
DC - College of Liberal Arts and Sciences

Abstract:
Female service members have higher divorce rates than male service members. The goal of this study was to explore possible sources/markers of stress for couples where at least one partner was a female service member. Using a large (662 couples) survey study of couples where at least one partner was in the U.S. Army, this goal was accomplished in two ways. First, self-reported marital quality, mental health, and Army specific support/stressors were quantitatively compared for both husbands and wives in three types of couples: Dual Military, Male Military Only, and Female Military Only. The purpose of this set of analyses is to determine if couples with female service members report significant differences that could be related to their higher divorce rates, such as less Army support, or more conflict between the spouses. Second, themes of stressors were evaluated based on open ended question regarding problems related to military service for couples where the wife was a service member. The purpose of this thematic review is to see what the couples themselves identify as stressors particularly salient to couples with a military wife. Results will be discussed in the context of gender roles and family expectations and how these might interact with the demands of Army life.

A New Paradigm in Open Science

Michael Pilosov
DC - College of Liberal Arts and Sciences

Mentor: Troy Butler
DC - College of Liberal Arts and Sciences

Abstract:
One of the main barriers-to-entry for implementing technology into curriculums is the various platform and software dependencies that can get in the way. Fortunately, recent open-source projects have made world-class performance in scientific computation accessible to anyone. We will discuss the Jupyter ecosystem of web-applications that can dramatically improve the experience of learning programming for students and new scientists alike. It also allows for true reproducibility of results.

Students benefit from a leveled playing field and professors are given the ability to monitor and aid their progress. The infrastructure that has recently been deployed in the CU Denver Department of Mathematics & Statistics will be used as a case-study to demonstrate the capabilities and benefits of using modern open-source software in both educational and research settings.

The same system can be leveraged to benefit students in Social Sciences and Business programs who have interest in pursuing Data Science-influenced research directions. Students in the Arts may also find many creative uses for image/film creation and manipulation/processing using this platform.

Understanding the retention of under-represented faculty and administrator in higher education

Leah Porter
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Mentor: CandanDuran-Aydintug, Associate Professor
DC - College of Liberal Arts and Sciences

Abstract:
This on-going research is about gaining an in-depth understanding of the career paths of administrators and faculty members of color at higher education settings, and the obstacles in their paths as they enter and pursue their careers. With the increased population of people of color, the ratio between students and the people with power (professors and administrators) in higher education is definitely tilted to the uneven side. This poses potential problems for students of color when they try to find their place in higher education and lack appropriate role models. My research would also include what the higher education institutions can do to help encourage more people of colors in academia to support the student population. Academia needs to acknowledge that faculty of color is unique and needs to create an adequate support system for them in order for them to find success they deserve and increase their recruitment and retention.

Inversion Breakpoint Mapping of Rhagoletis pomonella

Erina Rader
DC - College of Liberal Arts and Sciences

McCall Calvert
DC - College of Liberal Arts and Sciences

Mentor: Gregory Ragland, Assistant Professor
DC - College of Liberal Arts and Sciences

Abstract:
Do genetic inversions contribute to speciation-with-gene-flow?The process of species formation has generated the vast network of biodiversity that makes up our biosphere. Yet, we still do not understand exactly how it happens because speciation events occur in an ‘eyeblink’ in evolutionary time. However, some examples of contemporary speciation can be observed in nature including our study system, a fruit-infesting fly Rhagoletis pomonella, that has recently evolved novel populations that infest apples introduced to North America ~300 years ago. In this species, populations infesting native fruit are segregating into two genetically distinct populations that infest different fruits, despite continued interbreeding, which should genetically homogenize populations (i.e., prevent speciation).

It has been hypothesized that genomic structural variants, such as inversions, could facilitate speciation in the face of interbreeding. Chromosomal inversions occur when a section of chromosome breaks and becomes oriented in the opposite direction. This orientation prevents the random shuffling of genes that ordinarily occurs during meiosis, prior to reproduction, ensuring that the entire sequence is conserved in future offspring. If these inverted regions contain genes contributing to trait divergence, hybrids would be poorly suited to either parental environment, thus encouraging reproductive isolation (limited interbreeding).

Testing this hypothesis has been historically challenging, but this project leverages new long-read, low-cost DNA sequencing technology to determine if genetic breakpoint locations can be accurately mapped in the genome of R. pomonella for the first time. These data are absent from the literature but are critical for determining the role of genetic inversions in speciation.

The Middle of the Pack: Individual Differences in Attentional Control and Memory

Daniel Raffield
DC - College of Liberal Arts and Sciences

Mentor: Jason Watson
DC - College of Liberal Arts and Sciences

Abstract:
A systematic picture of how susceptibility to false memory errors may be influenced by individual differences in the working memory capacity (WMC) of young adults will be investigated in the present study. Specifically, this study tests for associative memory illusions; classified under the Deese–Roediger–McDermott (DRM) associative list paradigm, in which some individuals are less likely to recall nonpresented critical associate words than other individuals. DRM literature holds the claim that individuals with greater WMC will recall fewer critical words than individuals with reduced WMC when participants are forewarned about the tendency of associative lists; (e.g., bed, rest) to elicit illusory memories for critical words (e.g., sleep). The present study explores a medium distribution data set to provide a completer DRM literature picture. These findings suggest that individual differences in WMC influence cognitive control and the ability to actively maintain task goals in the face of interfering information.

I was never taught to introduce myself: A journey of reclaiming an Indigenous identity that goes beyond national borders

Junior Reina Toc
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Mentor: Sheila Shannon
DC - College of Liberal Arts and Sciences

Abstract:
I was never taught to introduce myself looks into the journey and struggles of reclaiming an Indigenous identity as a form of resistance against colonialism. In particularly, it looks into what it means to be Indigenous on an individual, familial, communal and global basis. It dwells into the historical, cultural, linguist and spiritual structures that have shaped Indigeneity: an umbrella term that highlights Indigenous Peoples, their struggles, survival, leading towards revitalization of traditional ways. Through the use of methods such as storytelling, testimonio and vivencia, and frameworks that include Tribal, Critical Race Theory, Welcome-Unwelcome conceptual framework, Critical Whiteness, Transnational and Settler Colonization theories along with Historical Trauma, a greater understanding of Indigeneity will be acquired

1144 15th (Optiv Building) Sustainable Features

Matthew Reynolds
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Kyle O'Hearn
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Mentor: Caroline Clevenger
DC - College Engineering, Design and Computing

Abstract:
This video showcases the sustainable features of 1144 Fifteenth, the Optiv Building. It is the newest skyscraper to be erected in Denver in over 30 years and is the fourth tallest building in the city at 603 feet, providing 670,000 square feet of occupiable space. It was designed by the Hines Firm and completed in March of 2018 after two and a half years of construction. Hines is extraordinarily attentive to the environmental impact of its facilities which is why the Optiv Building is certified LEED (Leadership in Energy and Environmental Design) gold for shell and core; an impressive feat for a building of such magnitude. From the variable voltage motors that control the HVAC units to the mobile app-controlled elevators, no detail was overlooked to ensure maximum energy efficiency. The building is centrally located near RTD rail and bus routes, has three separate storage areas as well as showers and lockers for bicycle commuters, and several electric vehicle charging stations, each of which promotes the use of alternate modes of transportation. As the video highlights, the Optiv Building is cutting edge and serves as a paradigm for the future of sustainable construction.

Preparation of a Deuterated Phosphoserine Analog to Study Morphology Changes within the Aβ-peptide Leading to Fibril Formation

Dillon Rickertsen
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Christiana Meuret

Mentor: Scott Reed
DC - College of Liberal Arts and Sciences

Abstract:
Alzheimer's disease is caused by the formation of highly structed fibrils that are toxic to neuron cells. These highly structured fibrils arise from the Aβ-peptide undergoing a morphology change from globular to highly structured beta sheets. The cause of this morphology change is not well understood but is hypothesized that post-translational modifications can play a significant role in controlling aggregation. The phosphorylation of serine located in the disordered N-terminal is one of such modifications that can initiate a morphology change and aggregation. Here we describe a method for preparing peptides containing deuterium exclusively on the alpha and beta positions of phosphoserine. This can be used to study the morphology of the peptide leading to fibril formation. To insert this deuterated phosphoserine into the peptide sequence, serine must first be phosphorylated, and the phosphate group needs to be protected. The hydroxyl group will be phosphorylated using a phosphoramidite containing benzyl groups. These benzyl groups will protect the phosphate group during solid phase peptide synthesis. After this deuterated phosphoserine has been inserted into the peptide sequence morphological changes can be studied using 2H-NMR. Trials for creating a protected analog are currently being carried out on a nondeuterated serine.

Mechanisms of Src cycling

Chase Riedel
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Mentor: Brad Stith, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Src is a cancer-causing protein and we study how it is activated in an intact cell using our animal model system. We use in vitro fertilization with the animal (Xenopus laevis frog) by combining sperm and egg together (in vitro fertilization). We also find that the lipid phosphatidic acid (PA) binds and activates Src; as PA is elevated in many cancers, we suggest that this is a pathway for cancer. In both PA addition and fertilization, Src activity cycles up and down over at least 20 min (with 5 min cycles) and this may be due to another enzyme called a protein tyrosine phosphatase (PTP). Src would activate its own inhibitor, PTP, and PTP would turn off Src by removing an activating phosphate from tyrosine residue 416. When Src turns off, it no longer would activate PTP. This would allow Src to be reactivated and result in cycling. So, we are measuring PTP activity after PA addition or fertilization. This will be the first report of PTP activity during fertilization.

Embryonic Stem Cell Metabolism and Pluripotency Maintenance

Gabrielle Rietz
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Mentor: Christopher Phiel
DC - College of Liberal Arts and Sciences

Abstract:
Embryonic stem cells (ESCs) have the ability to maintain a state of pluripotency, where they can give rise to any cell type. However, ESCs do not sustain this pluripotent state indefinitely and naturally differentiate, suggesting that pluripotency is actively maintained. The mechanisms surrounding ESC pluripotency are not completely resolved, but are known to involve multiple cellular activities. One recent observation is that the Kreb's cycle intermediate, alpha-ketoglutarate, promotes pluripotency, suggesting an important role for glucose metabolism in pluripotency regulation. Therefore, we have investigated the role for the Kreb's cycle by manipulating this important metabolic pathway. We have assessed these manipulations by examining the expression of genes related to pluripotent ESCs (Nanog) and less pluripotent ESCs (Fgf5). Given the promise that ESCs hold in regenerative medicines, understanding the metabolic pathways involved in pluripotency will facilitate the use of stem cells therapeutically.

An Analysis on Camera Phones as Weapons of the Modern-Day Masses

Chelsea Rieu-Torrez
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Mentor: Maria Buszek, Associate Professor
DC - College of Arts and Media

Abstract:
Camera phone images have become increasingly popular in mainstream media news. Cellular devices are equipped with unique software that makes up the core operating system of emojis, downloadable apps, texts, and languages. Mobile devices have a constant connection to a global network, allowing "everyday" photographers and commentators to create newsworthy, front-page images and statements using the visual languages at smartphone users' disposal. Media sources are eager to use civilian photos as "eyewitness" accounts of events that are deemed newsworthy. This rapid-fire method of "participatory journalism" presents new and complex ethical dangers. It infringes on the privacy of an individual's death and can easily become a platform for those committing violent actions. We are now faced with the ethical debate between transparent reporting and assisting a killer's desire for affirmation. Emojis are among the most interesting aspects of a cellular device's visual communications potential, as they are consistent and universally found on keyboards. The icons are a part of Unicode Consortium—an international coding system of languages and text that have become a new universal language using quick, single-image responses. The seemingly "cute" icons have been used to communicate lost tone in "texts" and, depending on how they are used, can be interpreted with vastly different meanings. Commonly expressed concerns with the usage of emojis are that they may be negatively impacting "proper" communication and reducing literacy rates. In some cases, emojis are being used as evidence in legal cases, parsing "underlying" meanings behind messages pertaining to violence or terrorism.

Characterization of the Effects of Systemically Increasing Dopamine, Serotonin, and Noradrenaline Levels on the Valuation of Reward vs. Avoidance

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Mentor: Erik Oleson, Professor
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Abstract:
Optimal behavior and overall survival require obtaining highly-valued outcomes from our environment. These action-outcome situations are often driven by either the pursuit of reward or the avoidance of harm. The three primary monoamine neurotransmitter systems that modulate such motivated behaviors are dopamine (DA), serotonin (5-HT), and noradrenaline (NA). Of these, the mesolimbic DA system is generally considered to be a reward pathway. However, it is becoming increasingly evident that DA release events also process and influence aversively-motivated behavior. Combining operant behavior with a behavioral economic framework to model behavioral changes in response to increasing price (i.e., lever responses/outcome magnitude), we recently demonstrated that DA release events represent avoidance value and modify the price rats will pay to avoid electrical footshock. Using a similar approach, my current project will perform a broader characterization of the primary ascending monoamine systems in the valuation of reward vs. avoidance. We will pharmacologically target these systems using the selective reuptake inhibitors GBR-12909, fluoxetine, and desipramine for DA, 5-HT, and NA respectively. Based on our previous findings and the existing literature, we predict; GBR-12909 will increase reward and avoidance valuation, fluoxetine will increase avoidance value but decrease reward value, and desipramine will decrease avoidance value without affecting reward. Investigating whether these pathways produce distinct effects on reward vs. avoidance valuation will provide novel insight into how the brain controls these fundamental aspects of behavior. The implications of this work may also advance our understanding of major psychiatric conditions such as depression and drug addiction.

Working memory deficits in a CaMKIIa model for Schizophrenia

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Mentor: Diego Restrepo,
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Abstract:
Schizophrenia is a neuropsychiatric disorder where symptoms are debilitating and split into three types: positive, negative, and cognitive. Historically, research has focused on the positive and negative symptoms, with little focus on the cognitive deficits that include working memory, executive function, and impaired ability to maintain focus. Recently missense mutations of the CaMKIIα gene have been identified in human schizophrenic patients (Purcell et. al., Nature 506, 185-190). CaMKIIα is involved in long term potentiation and therefore these mutations may underlie learning deficits in these patients. Our research focuses on whether decreased expression of CaMKIIα elicits deficiencies in working memory. By using an olfactory delay non-match to sample task (DNMS) with a water reward we hope to compare behavioral performance between mice heterozygous for CaMKIIα (Hets) and wild type controls (WT) to see if there is a deficiency in working memory and executive function associated with the prefrontal cortex of the Hets, which is the phenotypic model for Schizophrenia. In preliminary studies using an associative learning go/no go task we found that the Het under performed the WT in the oLAT, and we also found differences in the theta/gamma phase LFP amplitude for Hets compared to the WT. We are following up on these findings to determine if the CaMKIIa gene also contributes to working memory and executive function differences associated with Schizophrenia.

The Effect of Listening to Audio While Falling Asleep on Sleep Quality in College Students

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DC - College of Liberal Arts and Sciences

Abstract:
Listening to music while falling asleep has been shown to relate to both sleep quality and the time it takes for people to fall asleep. This study evaluated the type of audio that college students at the University of Colorado Denver listened to while falling asleep to determine the relationship it had with the students' sleep quality. This was done by collecting responses to an online survey addressing sleep quality and the type of audio stimuli that may be present in each subject's sleeping space. The results of the survey were analyzed through Qualtrics to determine the relationships between each variable.

Arterial Line Trainer for Medical Professionals

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Abstract:
The gold standard for measuring blood pressure of critically ill patients is the arterial line due to its accuracy and reliability. Despite this, medical professionals around the world exhibit specific knowledge deficits with the process of arterial line management and interpreting results. When tested about arterial line knowledge, nurses with up to 12 years of experience had a median score of 36% accuracy of proficiency. Due to a shortage of well-implemented training systems in medical facilities, more complications occur when helping patients who might be in critical or life-threatening states. Accordingly, there is a need for an easily accessible training method for medical professionals to learn and understand arterial line management. We have developed a prototype of an analogous arterial system that produces a reliable waveform with a closed pressurized system. Different pressure waveforms can be simulated at intervals between 10mmHg to 120mmHg in order to provide an accurate model of different disease states such as hypertension and hypovolemia. This device trains medical professionals to properly interpret the pressure waveform and, in turn, better treat the patient. Our training device could potentially lead to decreased patient complications as well as a generally improved experience for practicing medical professionals.

The Role of Simulations in the Estimation of Ancestry Proportions Using Genotype Frequencies

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Mentor: Audrey Hendricks, Assistant Professor
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Abstract:
Public genetic data enables efficient and more equitable access, transforming genetic and medical research. Due to privacy concerns, data is often provided by group genotype frequency rather than individually. Grouping can mask important information, such as fine-scale ancestry. Imprecise ancestry information may lead to misdiagnoses and incorrect genetic associations. We present a method to estimate hidden ancestry proportions in genotype frequency data. To test the effectiveness of our method, we simulate scenarios in which random samples are derived from major ancestral populations: African, East Asian, European, South Asian, and Native American. The true proportions of ancestry are known, allowing us to assess the accuracy and precision of our method. By incorporating these simulations, a necessary step in our research process is fulfilled, and we are able to test our model by obtaining verifiable results prior to using any real data.

An LGBTQ+ inclusive campus is important for the wellbeing of students. Well-being predicts GPA positively.

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Mentor: Vivian Shyu
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Abstract:
LGBTQ+ Inclusivity, Well-being and Academic outcomes: A quantitative study of how well- being predicts successful academic studies within the LGBTQ+ Community. This research analyzes the relationship between inclusivity on campus, well-being, and academic outcomes. Our research was conducted in our Senior Seminar Psychology class for the LGBTQ+ resource center. Our research conducted is pertinent because the other research literature suggests the LGBTQ+ community faces hardships in their academic careers, and it may harm their academic success. Additionally, our research suggests that Auraria Campus is taking necessary precautions to provide an inclusive environment. We ran t-tests tested at the .05 alpha level to see if there were any differences between the LGBTQ+ community and non-LGBTQ+ community; when it came to GPA, safety on campus, Inclusivity on campus, and well being, there was only a significant difference between the two groups in well-being. We found significant positive correlations between all measures and noticed the LGBTQ+ community had a stronger association with higher feelings of inclusivity predicting higher GPA's. When we ran the correlations with non-LGBTQ+ students GPA was not predicted by feelings of inclusivity or well being.

The Effect of Chronic Stress on Cardiovascular Health

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Mentor: Jennifer Boylan
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Abstract:
Exposure to chronic stress increases the risk of cardiovascular disease (Cohen, Janicki-Deverts, and Miller, 2007). One way to study the effect of chronic stress on cardiovascular disease is to examine the cardiovascular response to short-term stressor tasks within the lab environment (Chida & Hamer, 2009). According to previous research, higher blood pressure and heart rate at rest are risk factors for future cardiovascular disease (Lawes et al., 2003). In addition, having an exaggerated blood pressure and heart rate reaction to short-term stressors within the lab have been linked to cardiovascular heart disease (Obrist, 1981). Given this, the current study used a measure of chronic stress (Perceived Stress Scale; Cohen et al., 1983) to examine the relationship between chronic stress and baseline blood pressure and heart rate levels as well as blood pressure and heart rate reactivity to acute stressors. The main research question was: Is chronic stress predictive of baseline physiological levels and physiological reactivity? Higher levels of self-reported chronic stress was hypothesized to predict higher blood pressure and heart rate levels at rest and higher blood pressure and heart rate reactivity to short-term stressors in the lab. Data was provided by 165 participants from the Denver metro area by recruiting participants through Facebook and other social media websites. An online questionnaire was completed by each participant prior to the lab session which included the Perceived Stress Scale, demographic and religious characteristic information as well as other measures not relevant to this particular study but instead utilized for the parent study. Each participant was randomized into various groups for the parent study and came into the lab with their spouses to complete an acute stress task. First, baseline physiological measures were taken, then participants and their spouses engaged in a 13-minute stressor task, where they discussed an issue in their relationship that they disagreed on. Physiological reactivity was defined as the difference between the blood pressure and heart rate during the stressor task and the blood pressure and heart rate at rest during the baseline task. All statistical models controlled for age and sex, and models predicting reactivity also included baseline physiology as a covariate. Results show that chronic stress was predictive of resting diastolic blood pressure and resting heart rate. Essentially, those with higher levels of self-reported chronic stress had higher heart rate levels at rest and higher diastolic blood pressure levels at rest. However, chronic stress was not significantly predictive of resting systolic blood pressure, systolic blood pressure reactivity, diastolic blood pressure reactivity, and heart rate reactivity. This is one of the first studies which directly examines the relationship between perceived stress and cardiovascular response to short-term stressors in the lab. One reason chronic stress may have not had a significant relationship with cardiovascular response is due to the fact that participants with high baseline physiological levels had less reactivity to short-term stressors. It is important to further investigate the relationship between chronic stress and cardiovascular disease in future studies for a better understanding of the magnitude of interconnection between chronic stress and cardiovascular health.

A METHOD TO PROVIDE MODULAR TRUNK SUPPORT AND CAR CONTROL TO CHILDREN WITH CEREBRAL PALSY WHO ARE UNABLE TO DO SO INDEPENDENTLY.

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Abstract:
In the United States there are over 764,000 children affected by cerebral palsy, a condition characterized by the lack of development of movement and posture, which limits their daily physical activities. These children are unable to support their trunks, resulting in poor posture and inability to comfortably operate an electric toy car. To resolve this issue, an easily operable car that provides modular trunk support has been developed. In the new model, a car seat — similar to one which is used in automobiles — is attached to the original toy car seat, providing a safer ride for the operating child. Additionally, the design's harness and cushion prevent the user from leaning forward or tilting to the side. A button is attached to the car via a repositionable 3D printed arm. The arm can be adjusted to each individual's needs. The outcome provides children with disabilities a toy car that is supportive, functional, and welcoming as a medium to better engage with their peers. In the future, a joystick can be implemented into the car in place of the button allowing children to easily turn the vehicle, similar to how an electric wheelchair operates.

Interactions between transition and alkali metals and 8-oxo-7,8-dihydroxyguanosine or guanosine. The case for: Pd(II), Fe(III), Ag(I), Cs (II), Na, K.

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Mentor: Marino Resendiz, Assistant Professor
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Abstract:
8-Oxo-7,8-dihydroxyguanosine (8-Oxo-G) is a derivative of guanosine present in DNA (Deoxyribonucleic acid) and RNA (Ribonucleic acid) and is a result of oxidation at the C8-position, commonly generated upon oxidative stress. Its presence has deleterious effects and has been linked to the progression/development of neurodegenerative and other diseases. Reactivity of certain transition metals and their potential use as therapeutics to detect this lesion has been tested with DNA but not with RNA. 8-Oxo-G was synthesized from guanosine and the ribose hydroxyl groups were protected with hydrophobic groups at the C2', C3' and C5' positions. Alcohols at C2' and C3' were functionalized with an isopropylidene group, while the alcohol at C5'-position was derivatized with a bulky hydrophobic tert-butyldimethylsilyl group. Reactivity of different transition metals was explored with silver tetrafluoroborate (AgBF4), palladium chloride (PdCl2), iron(III) meso tetraphenylporine chloride (Fe(III)-TTPCl), cesium chloride (CsCl2) and cesium carbonate (CsCO3); and Group-I metals that included potassium bromide (KBr), sodium nitrate (NaNO3) and sodium hexaflourosilicate (Na2SiF6). The results from Guanosine and 8-Oxo-G were compared and analyzed via thin layer chromatography (TLC) and nuclear magnetic resonance (NMR). Guanosine formed a gel-like compound in the presence of AgBF4 and formation of purple plate-like crystals was observed upon mixing of 8-Oxo-G with Fe(III)-TTPCl This research hopes to find a transition metal that forms complex with 8-Oxo-G and can be used as a potential tool for the detection of this toxic lesion.

How do Young Adults Understand and Experience Anxiety?

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Abstract:
This study explored the phenomenon of young adult anxiety from the perspective of a sample of 23 undergraduate students ages 18-40 at the University of Colorado Denver School of Education and Human Development. This is a concurrent mixed methods exploratory study, involving theoretical framework and an online survey that includes both a quantitative Likert scale report and a qualitative interview. Findings demonstrated that students experience a variety of perspectives in defining anxiety and identifying frequent physical and emotional symptoms. Students also shared knowledge of their triggers, their preferred practices in preventative care, and the treatment they might seek when experiencing heightened anxiety. Implications for practice and future research include the development of programming for comprehensive education in mental and emotional processing as well as exploration and classification of the various physical symptoms of heightened anxiety.

Meta-Analysis: MAYSI-2 Identification of Mental Health Needs Among Detained Youth

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Contessa Young
DC - College of Liberal Arts and Sciences

Mentor: Patricia Zornio
DC - College of Liberal Arts and Sciences

Abstract:
Mental health effects among juveniles within detention centers has been shown to receive less attention compared to other detained individuals. Specifically, the research to date focuses on the mental health screening process at intake of these detention centers. The following meta-analysis presents data obtained from 11,085 detained youth and examines the prevalence of the following mental health categories in the Massachusetts Screening Tool Instrument-2 (MAYSI-2): alcohol and drug use, anger and irritability, depressed and anxious, somatic complaints, and suicide ideation. Descriptive statistics were used to analyze data to assess for trends of mental health assessments on detained juveniles. While other research focuses on racial and gender differences, the present study sought to examine which categories are the most prevalent within this population.

Abundance and ecological role of limber pine in treeline communities in Rocky Mountain National Park

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Eric Neumeyer
DC - College of Liberal Arts and Sciences

Mentor: Diana Tomback, Professor
DC - College of Liberal Arts and Sciences

Abstract:
Limber pine (Pinus flexilis), a five-needle white pine known for tolerating windy, xeric conditions, has a broad elevational distribution (~1600-3300 m) in the Southern Rocky Mountain Ecoregion, including the eastern slope of Rocky Mountain National Park (RMNP). While previously studied in a variety of community types, little is known about limber pine communities above timberline. The aim of this study was to describe the abundance and ecological role of limber pine where it occurs in treeline communities in RMNP. We selected four treeline (>3200 m) study sites near known subalpine limber stands within RMNP. We sampled the nearest tree island and solitary trees in circular 78.54 m2 plots (5 m radius) at 40 random points at each site. Across sites, limber pine was found to compose, on average, 76% of trees in solitary plots, and was significantly more abundant than both Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa). Based on odds ratio analyses, no species had greater odds of being found in the most windward position of tree islands (the presumed island initiator) except at Ute Trail, where Engelmann spruce had the highest odds. Limber pine was found significantly less often in the windward position than expected from its greater abundance as a solitary tree. Limber pine was most abundant at the three sites with northerly aspects, and had the greatest abundance at Battle Mountain, where the prevailing wind was SW rather than W. Further investigations will determine conditions for limber pine's occurrence above treeline and its ecological importance in RMNP.

Relationship Length as a Predictor of Physical Activity Interest Among Couples Following Cancer Treatment

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Gillian Lloyd
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Krista Ranby

Mentor: Krista Ranby
DC - College of Liberal Arts and Sciences

Abstract:
Exercise is associated with improved cancer-related side-effects (e.g., reduced distress, fatigue), both for cancer survivors and their romantic partners. There are many theoretical reasons (e.g., lower drop-out rates, improved long-term maintenance) for why exercise interventions would benefit from targeting both cancer survivors and their romantic partners concurrently; however, few exercise interventions have been designed for cancer-partner dyads. It is currently unclear whether survivors and their romantic partners are interested in a couples-based exercise program and what factors influence interest. In order to design a successful exercise intervention for cancer survivors and their romantic partners, it's necessary to identify who would be interested in participating. This research involved one online survey that was individually completed by both cancer survivors and their romantic partners. Participants were randomized at the couple level to receive an educational video as part of their survey experience. Couples assigned to the control group proceeded through the survey without any educational content. Using data from this online survey, we will examine whether relationship length relates to cancer survivor or partner interest in a dyadic exercise intervention program. This association will be examined through correlational analysis and through the use of scatterplots. Age will also be considered as a covariate. This research will provide insight for successful future physical activity interventions targeting cancer survivors and their partners.

Increasing Eco-Awareness: Public Artworks on the Denver Light Rail

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Mentor: Maria Elena Buszek, Associate Professor
DC - College of Arts and Media

Abstract:
For my Undergraduate Research Opportunity Program project, Increasing Eco-Awareness: Public Artworks on the Denver Light Rail, I researched public artworks and environmental activism to propose a theoretical exhibit on the Denver Light Rail system. Based on Environmental artist Lorna Jordan's concept that public artworks can be ideas, places, and actions that regenerate the environment while triggering viewers' internal emotions and narratives, the exhibit would tap into the imaginations and narratives in our city's Denver Light Rail riders. I created a call for participation, and curated work that emphasized the surrounding landscape that we all live off of and have an investment in, the common ground serving as a source of Denver identity. I proposed integrating this artwork into the trains to replace the usual advertisements, so as to interrupt the daily dose of consumption imagery. By supplanting ads with images of raw materials from the Colorado landscape, environment, and population, a shared sense of place is set to invoke in their imaginations the value of landscape, and promoting more ecological, rather than consumerist, awareness. Many Eco-Art theorists support the notion that the aesthetic experience can educate viewers to an eco-conscious, anti-consumption lifestyle. Because the artwork is not restricted to the museum space, this project is designed to inspire engagement with a larger, more diverse audience into viewing art in their daily ride, as well as begin a dialogue surrounding raw materials from the state's landscape and how it influences the community.

Past, Present, and Future: How Eco-Art can Help Earth

Elizabeth Snyder
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Mentor: Maria Buszek, Associate Professor
DC - College of Arts and Media

Abstract:
In my research I want to take an eco-critical perspective on how our landscapes have changed over time. I will look at historical works and discuss how landscapes have changed and what society was like during that time period that has caused ecological effects. To discuss current ecological circumstance as they apply to art, I plan to look at how contemporary artist are raising awareness for our earth and everything in it. Lastly, I want to take an in-depth look at what is being done for future projects to push for a sustainable future.

Performance Transformation Through VR

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Hawkar Oagaz
DC - College Engineering, Design and Computing

Mentor: Min Choi
DC - College Engineering, Design and Computing

Abstract:
Athletes, coaches, and other sport-related professionals have been increasingly using Virtual Reality (VR) technology for a variety of purposes. VR sporting applications often mimic the environment of a real-life sport and require athletes to interact with the application as if they were playing that sport. These applications can be used for performance assessment, skill practice, and feedback collection, and can be easily controlled and manipulated in order to produce specific scenarios. Much of the research in this area has focused on endurance sports such as running, cycling and rowing, and few studies have explored the use of interactive VR in skill-based sports. We propose a VR ping pong system to examine training transfer for skill-based sports. Using this system, we will study how well athletes apply techniques they learned in VR to the real-world game and determine the success of training transfer by taking both quantitative and qualitative measurements. We have built a realistic virtual ping pong prototype system in which the player is trained to play ping pong by returning balls fired by a ball launcher. Experimental group data analysis will take place before and after the training to show the success of the training. The work has two main contributions, first, showing the validity of VR for sport-related training and transfer skills learned to the real world.

The Lotka Model: One Century Later

Gessner Soto

Abstract:
One century later, the prevalence of computational machinery allows a substantial sub-set of our species to have access to hardware that is able to adequately handle the numerous sequential steps required to analyze the solution structure of related differential-equation relationships. An arrangement related by Dr. Ilya Prigogine in the third edition of “An Introduction to Thermodynamics of Irreversible Processes” - one whose structure is simply an ornamentative modification to the arrangement Dr. Alfred Lotka formally related in his 1,920 contribution “Undamped Oscillations Derived from the Law of Mass Action” - was un-packed more fully with the aid of contemporary machinery. Two interests currently seem to both have had been nourished and continue to be nourished with this project: 1) exposure to and development of numerical algorithms related to the deconstruction of the solution sets associated with collections of differential-equation relationships (a two dimensional differential-equation collection with three parameters was partially deconstructed) and 2) an explicit grounding in the terms and logic utilized in the non-equilibrium thermodynamics lineage (one of the aspects Dr. Prigogine emphasized in the analysis he relates is the associated thermodynamically grounded conjectures and their place within the context of the associated kinetic differential-equation system). The generality potential associated with these thermodynamic constructs merits the investment.

Validity of Simulations of Light Transmission in Fiber Optic Cables

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Abstract:
The propagation of light in fiber optic cables is especially relevant to modern communications, with its growing popularity versus traditional copper transmission lines. In order to fully grasp the transmission of signals in fiber optic waveguides, it is often necessary to simulate the system in question as exact (analytical) solutions are rarely available. In this work, we set out to test the validity of an electromagnetic simulation software known as MEEP (MIT Electromagnetic Equation Propagation) by comparing numerical solutions for common waveguides to the known analytical solutions. We check the case for a step index and a quadratic index core (both with Gaussian sources) and find good agreement between MEEP’s result and the analytical solution. This indicates that MEEP could prove to be a valuable tool for simulating more complicated situations involving fiber optic cables (such as when bends, voids, or other defects/imperfections are present in the waveguide).

Mathematical Distributions for Dark Matter Detection

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Mentor: Amy Roberts
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Abstract:
In the analysis of Cryogenic Dark Matter Search (CDMS) data, a quantity, yield, can be calculated from a collision based on measured quantities. These measured quantities are phonon energy and charge energy which each have some variance and due to sensor accuracy. The yield quantity is a ratio of a cimple linear combinations of charge energy and phonon energy. This poster calculates and analyzes the distribution of the yield quantity given a model of the system in which both random variables are independent. by using algebra of random variables, the resultant distribution can be theoretically computed.

The War on Poverty In Denver 55 Years Later

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Mentor: William Wagner, Assistant Professor
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Abstract:
This presentation takes a new look at the beginning of the War on Poverty in Denver, focusing on the mid-to-late 1960s and the second term of Mayor Thomas Currigan. After the War on Poverty was initiated by President Lyndon B. Johnson in 1964, Mayor Currigan and the city of Denver immediately worked to set up organizations and programs to take advantage of new federal War on Poverty funding. Community health, young adult and youth employment and activities, and childhood development were central tenants of Denver's War on Poverty. Typically, academic War on Poverty assessments have emphasized the failures of such programs over subsequent decades. This essay takes a different approach by focusing on the initial years of these programs and the success stories and positive implications they had. Denver had significant pockets of success helping individuals raise themselves and their families out of poverty, and this presentation focuses on these individuals and the programs that made them successful.

Look Into My Eyes: Examining the Relationship Between Individual Differences in Personality and Strategic Eye Movements

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Jake Pitts
DC - College of Liberal Arts and Sciences

Molly Deberard
DC - College of Liberal Arts and Sciences

Mentor: Carly Leonard
DC - College of Liberal Arts and Sciences

Abstract:
As people, we all perceive the world in different ways and have unique behavioral patterns. Our distinct personality features may partially explain the choices we make, how we interact with our environment, and who we eventually become. When we navigate our visual world, we prioritize things in our surroundings using attention. Attention determines where we move our eyes and the stimuli, we take in from moment to moment may directly interrelate with the composition of our character traits. Accordingly, a great deal of previous research indicates that there are individual differences in the performance of visual tasks. Recent work from our lab has shown large individual differences in eye fixation patterns and exploratory behavior during a visual perceptual organization task known as contour integration. Contour integration involves putting visual information into meaningful pieces to find a visual image embedded in the screen. People varied in whether they maintained steady fixation or actively made eye movements during such a task. We propose that strategic eye movement coordination and related attentional selection may correlate with classic Big Five personality model factors. Eye movement strategy may be connected to greater cognitive function and dispositional qualities, such as extraversion and openness. Utilizing an eye-tracker and employing a computerized contour eye task, as well as two standard personality inventories (NEO-IPIP, BIS/BAS), we have begun to collect data, and plan to run 50 undergraduate study participants. With this information, we hope to better understand how visual processing relates to individual differences in personality dimensions.

Advocating Awareness of Caregivers for those with Mental Illness Through Memoirs and Written Accounts

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Mentor: Colleen Donnelly
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Abstract:
Statistically, one in six people are afflicted with some form of mental illness in the United States today. However, in reality the number of people affected by these conditions is much higher, considering the caregivers and family members who are involved with their loved ones' struggles. Mental disorders do not happen in a vacuum, and often the focus is on the individual with the problem.

The Effect of Race on Harsh Parenting, Adverse Childhood Experiences, and Child Outcomes

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Mentor: Katherine Casillas, Assistant Professor
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Abstract:
Adverse childhood experiences and corporal punishment have both been linked to negative child outcomes, but rarely is race taken into account as a moderator. Corporal punishment focuses mostly on physical punishment. Currently, the literature suggests that for White children, corporal punishment usually leads to child aggression and negative behavior, even when looking at parental warmth as a moderator. However, Black and minority families may use corporal punishment to lead to positive child outcomes in order to prepare them for the harshness of society. We propose an analysis of archival data from the effective home visiting program, SafeCare Colorado to investigate race as a moderator of corporal punishment and child outcomes. SafeCare is a program for intervention and prevention of child abuse and neglect for at-risk families, and we will gather and analyze demographic information, adverse childhood experience scores, and Parent-Child Conflict Tactics as they are interrelated. Results from this study will help inform home visitors on best intervention strategies based on racial differences in corporal punishment.

Equity in the Pre-health Application Cycle: An Analysis of Two Financial Assistance Programs

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Mentor: Charles Ferguson
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Abstract:
Two programs offset the costs of applying to medical and dental schools: Fee Assistance Programs (FAPs) provide funds towards entrance exam and application fees for low-income pre-medical/pre-dental applicants; the Bardwell Donachy Family Opportunity Fund (B-D Fund), a CU Denver program, provides funds for interview expenses to committed, diverse and low-income pre-medical/pre-dental/pre-physician assistant (PA) applicants invited to interview. We conducted a mixed-methodology study consisting of a survey administered to CU Denver pre-medical/pre-dental students (n = 112) and one-on-one semi-structured interviews with CU Denver pre-medical/pre-dental/pre-PA applicants (n = 18) to evaluate the effectiveness of FAP and the B-D Fund based on the number of schools one applied to, number of interviews attended and support of underrepresented students in medicine (UIM) (i.e. racial/ethnic minority, first generation, etc). We found no significant difference in the number of MD/DO/PA schools one applied to between applicants who received FAP and applicants who did not receive FAP. After controlling for overall grade point average, Medical College Admission Test score and the number of schools one applied to, receiving the B-D Fund was associated with attending two more interviews, compared to non-recipients. Themes from the interviews included applicants' lack of knowledge of application costs, financial assistance relieving stress but not sufficient for the application process. Both the FAP and B-D Fund were effective in aiding pre-medical and UIM applicants in the application process, but more data is required to assess the effectiveness of these programs for pre-dental and pre-PA students.

Natural vs. Unnatural: Developing a Scale to Assess Naturalness Preference

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Abstract:
“Naturalness preference refers to the preference of natural products over unnatural ones. This preference can impact medical decision making, including preference for organic foods over non-organic foods, avoidance of medical treatment and even anti-vaccination attitudes. However, because a scale to assess individuals’ naturalness bias has not yet been developed, we sought out to develop one in this exploratory study. We created a survey utilizing questions from previous studies assessing the influence of naturalness bias on flu vaccination attitudes from Li and Chapman (2012). Participants were asked to rank how much they agreed with statements they were presented based on a 5-point likert scale ranging from “Strongly Agree” to “Strongly Disagree”. Some examples of these questions include “I prefer natural remedies rather than medications and treatments that doctors prescribe” and “ If money is not an issue.”

A novel approach to resolving the brachial index issue of AL 288-1 (“Lucy”) using 3D computer models of hominid forelimb bones

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Abstract:
“Paleoanthropologists have difficulty calculating the brachial index (radius length / humerus length X 100) of Australopithecus afarensis A.L. 288-1, commonly known as “Lucy”.

Soft-no" as a barrier in the transition from palliative care to hospice

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Abstract:
Hospice care services, while covered under Medicare, are underutilized in the United States. Hospice cares for patients who are estimated to have a life-expectancy of under 6 months, either in their homes or at a center. However, entering hospice is contingent on patients ceasing all active, or curative, treatment. 26 patients receiving palliative care (e.g "comfort care") and 16 caregivers were interviewed to examine their decision-making process around entering hospice. Decisions surrounding medical treatment are often placed in two categories—acceptance or refusal. However, these two categories do not accurately depict the diversity within the decision-making process. The goal of the study conducted was to identify what and how patients are refusing. The data suggests that there are two main types of hospice refusal—hard no and soft no. Hard refusals individuals were not open to hospice and explicitly refused. While soft refusal individuals did not explicitly refuse hospice, their actions continue to postpone hospice. The interview data was closely analyzed for soft-no individuals and we determined three drivers in the soft-refusal. These include hospice being viewed as unnecessary, undesirable, or not the patient's decision to make. Our study analyzes these components and how they contribute to a soft-refusal of hospice.

Targeting the MLL2-Chromatin Interaction to Inhibit Leukemogenesis

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Abstract:
Mixed Lineage Leukemia (MLL1) is a gene that can drive acute myelogenous leukemia (AML) when rearranged by chromosomal translocation. Through prior research, it has been shown that both the non-translocated (wild-type) MLL1 allele and its close relative MLL2 play a significant role in leukemia. Specifically, our lab has shown that deleting MLL2, a chromatin-binding protein, slows leukemia cell growth in vitro and in animal models. To expand on the potential of this finding, a peptide was created to selectively target MLL2 and interfere with MLL2 and chromatin binding. It was fused to nuclear localization signals, epitope tags, and inserted into an expression plasmid using cloning techniques. The hybrid peptide was characterized through immunofluorescence and Western blotting to establish a stable, nuclearly-localized product as predicted by design. The peptide was then expressed in leukemia cells, where it was hypothesized to have an anti-leukemia effect. To test the effect of the peptide on MLL2 function, quantitative PCR was performed to analyze levels of endogenous MLL2 target genes. As a positive control, the results were compared to the effect of MLL2 deletion on gene expression to determine the effectiveness of the strategy. This proof-of-principle experiment will establish whether targeting MLL2 with small molecules, such as this peptide, would be effective in inhibiting leukemia growth. This would serve as a basis for a functional screen to identify molecules that could be developed as therapeutics for acute myelogenous leukemia.

The Effects of American Cultural Imaging on Native Americans and Stereotypical Representation

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Abstract:
This paper analyzes several Native American photos and pictures illustrated through the United States and the consequences it has had on Native American representation. Although the modern day understanding of Native Americans and the impact that the United States has had on Native Americans has increased the importance of illustration through media, photography, and television. Photos such as those found in once famous wild west shows such as Buffalo Bill's Wild West Show and The Miller Brothers' 101 Ranch Real Wild West have only served to promote the stereotypical views of Native Americans into a more unrealistic savage and "frozen in time" outlook. In addition, many picture books such as Anne Rockwell's Thanksgiving Day picture book only serve to further promote this stereotypical outlook of Native Americans. The findings of this paper were collected through the analytical review of 16 research papers in which each paper focused on the impact of Native American cultural images through media and photography. This paper will focus on the impact of Native American photos produced by American media and the stereotypical impact it has created for Native Americans. Findings suggest that many images created by Non-Native Americans are promoting stereotypical views on Native Americans often portraying them in a savage, "frozen in time", and fantasy like illustration. The goal of this paper is to demonstrate the importance of cultural imaging of Native Americans to better prevent and contest stereotypical imagery that is often not addressed by the public.

Computational modeling of the absorption spectrum of gold nanorods in explicit solvent

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Abstract:
Gold nanoparticles exhibit unique optical properties that make them suitable for a wide variety of biomedical applications such as cancer diagnostics, drug delivery, and tissue imaging. Gold nanorods are good candidates for cancer therapy due to their low biotoxicity and easy tunability of their surface plasmon resonance (SPR), which is the collective oscillation of conduction electrons in the presence of an electromagnetic wave. Few computational studies have examined how explicit solvent interactions affect the plasmonic absorption due to the high computational cost associated with modeling explicit solvent molecules. Thus, the goal of this study is to determine how the presence of explicit water molecules affects the energy and intensity of the plasmonic absorption of gold nanorods. The nanorods were modeled with quantum mechanics (density functional theory) and the water solvent molecules were modeled with the effective fragment potential (EFP) method. Results show that water molecules tend to interact with the gold nanorod via the oxygen atom. In addition, the most energetically favorable water binding site is at the end of the nanorod. Solvent interactions can induce a shift of the absorption peaks to higher energy compared to the gas phase. In addition, splitting of the absorption peaks may occur.

The effects of post-weaning social isolation on social fear conditioning and the mammalian target of rapamycin (mTOR) pathway

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Abstract:
Learned behavior such as social fear can be mediated through stressful events. Heightened and prolonged exposure to fearful events can lead to stress-related disorders such as PTSD. Individual differences such as prior experiences to traumatic social events can underlie the development of these disorders. Post-weaning social isolation (PSI) is a model of early life adversity where rats are housed in isolation during a critical period of adolescence. PSI has been shown to alter social behaviors. A novel conditioned social fear paradigm was developed in our laboratory in which a foot-shock unconditioned stimulus is paired with a social stimulus (a novel same-sex conspecific) as the conditioning stimulus. The social behaviors of the experimental rats were assessed during re-exposure to the social stimulus during a social interaction test. To investigate the neural mechanisms underlying conditioned social fear, the mTOR signaling pathway was assessed in the medial prefrontal cortex (mPFC) and amygdala, which are brain regions involved in fear learning. Behavioral results from the social interaction test show that conditioned social fear (CSF) in isolated male rats have increased escape behaviors compared to group-housed rats. Phosphorylated ribosomal protein S6, a component of the mTOR pathway, was assessed using immunohistochemistry. There was increased pS6 expression in the medial ventral (MeV) amygdala in CSF male rats and social stimulus only rats compared to foot-shock only male rats. The results show that the presence of a social animal during conditioning increased pS6 expression in the MeV amygdala and decreased pS6 expression in the mPFC.

Molecular Simulations of Granuphilin Binding to Charged Membranes

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Abstract:
The C2A domain of the protein granuphilin plays an important role in docking secretory vesicles to the plasma membrane of insulin-secreting cells in preparation for exocytosis. Experimentally, it is found that the grauphilin C2A domain binds nonspecifically to anionic lipids such as phosphatidylserine (PS), but with a strong preference to polyvalent anionic lipids such as phosphatidylinositol - (4,5) - bisphosphate (PIP2) that are found on the cytosolic face of the plasma membrane. Several regions of the protein have been identified as essential for this interaction via prior data from both experiments and molecular docking calculations.

A Correlation between Confucian Ideological Evolution and Chinese Elite Portraiture in the Song through Qing Dynasties

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Abstract:
In this project, the author proposes to look at a history of Confucianism as it relates to the Chinese elite and how they were shown in their portraits. This research will address a sample of 5 portraits from the Song thru the Qing dynasties, and will address correlations between these case studies and changes in Confucian political, religious and social beliefs during these dynasties. The reason for the use of the "case study" way of research is that if I were to examine all portraits made in each of these dynasties, then the research would become too over-cumbersome. Instead of analyzing all portraits from each of these dynasties, analyzing a work that exemplifies the type of portraits made during their respective dynasty would be much more apt. This research is meant to shed light on whether or not Confucian ideals would have changed the arts amongst the social elite in these eras. Confucianism has held a strong place in the hearts of eastern Asian cultures for millennia, and this strong connection with the people would most likely have had an effect on different aspects of their lives. This project is meant to test that linkage with dynastic Chinese society so as to help us better understand why these dynasties' portraits were made the way that they were.

Exercise and Yoga: Methods of Stress Relief

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Abstract:
Past studies have demonstrated the health benefits of yoga, exercise, or both as techniques for stress management across a wide variety of populations, yet the individual's role in active stress management is often overlooked. As college students experience high stress levels, our study sought to understand the role of college students in active stress management. A survey was conducted on 63 undergraduate college students attending the Colorado University Denver at the Auraria Campus. Participants were shown to be involved in either yoga, exercise, or both, all with benefits to stress reduction. However, participants were more likely to indicate exercise as preferred for stress management. The results obtained could help undergraduate college students learn better techniques to reduce their everyday stress.

A review of terrestrial landslide carbon cycling in southeast Alaska

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Mentor: Brian Buma, Assistant professor
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Abstract:
Predicting and managing the carbon (C) cycle at a global and local scale over seasonal and millennial time scales requires understanding the fundamental ecological processes that redistribute C throughout a landscape. Understanding C redistribution processes are vital to capturing the contemporary state of the C cycle and how it will interact with a changing climate. One set of redistribution processes are disturbances, such as landslides, which alter spatial C stocks and fluxes by redistributing large quantities of C and creating gaps in biomass and soil. Our current understanding of the relationship between disturbances and C cycling is primarily limited to single disturbance events while the relationship between C cycling and the disturbance regime remains unknown. We seek to answer the following question: How does a landslide regime influence spatial C distributions at broad spatial scales, beyond single events? Evaluating the relationship between the landslide regime and C distribution can inform both ecosystem management and conservation of C stocks, as well as provide a theoretical framework for incorporating C distributions into C cycling models. We intend to outline gaps in our existing knowledge and identify research strategies to fill those gaps.

Uranium Boom in the 1900's

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Mentor: Brandon Mills
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Abstract:
This paper examines how the rise and fall of uranium mining in Colorado during the Atomic Age affected the state's urban landscape. The presence of rich uranium deposits in the northern and western parts of the state caused Colorado to experience an economic and demographic boom during the Cold War. Surging demand for uranium through the sixties stimulated the development of major shipping and refining centers, such as Grand Junction, which survive to this day. It also fostered the growth of smaller mining towns, such as Uravan, which struggled to get by near the end of the Cold War and have since been abandoned. While uranium mining was prosperous for Colorado for a time, I argue that the boom had a number of devastating long-term effects. Among other things, the uranium boom led to the rise and fall of several Colorado towns, the need for improved health and safety regulations surrounding irradiated material, and decades of clean up.

Does Rater Anger Bias Compensation Decision-Making?

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Asher Jorgenson
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Mentor: Traci Sitzmann
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Abstract:
In a just world, salaries should be allocated based on employees' performance, but there is extensive evidence that reward allocation is often misaligned with employees' contributions to the workplace. We engage in abductive inquiry to determine the role of anger in biasing compensation decisions. Across three experiments, we manipulated employee performance and captured facial expressions of anger during the compensation decision-making process. Across all three studies, rater anger moderated the effect of employee performance on compensation decisions. When no anger was expressed, ratings were unbiased—high performing targets were offered a higher salary than low performing targets. Anger biased the evaluation process, such that there was not a significant difference in the salary offered to low and high performing targets. Studies 2 and 3 extended these findings by drawing from social comparison theory to explore how similarity to the evaluation target influenced the manifestation of anger-induced bias. In Study 2, when anger was expressed, low performing raters overvalued low performing and undervalued high performing targets, whereas high performing raters undervalued low performing targets, relative to when anger was not expressed. In Study 3, anger biased the evaluation process when raters perceived they were similar to the evaluation target, resulting in overvaluing low performing and undervaluing high performance targets. Overall, this pattern of results suggests that anger biases compensation decisions in a direction that generally protects views of the self.

Attentional Learning: Investigating the effect of intertrial priming on the P300 in visual search

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Mentor: Carly Leonard
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Abstract:
Current models of attention often refer to a dichotomy of top-down, goal-oriented search, versus bottom-up, salience-based search. Relating these to everyday search tasks, we may look for a specific characteristic or a stimulus may capture our gaze. Moving beyond this dichotomy, there is an interest in a third category of attentional guidance, known as intertrial priming. Priming occurs when the target has a characteristic that repeats from over trials, which decreases reaction time. As targets of the same kind continue to repeat, presumably an expectation builds up that leads to these benefits. If the target switches colors after a run of repeated colors, performance is often worse. Our investigation focused on the novelty that is experienced when a switch occurs after different levels of expectations have been built up. To better understand these priming expectations, electrical signals can be recorded and measured from the head. Event Related Potentials (ERPs) are patterns of spikes in electrical activity across the scalp that occur at very specific times after the display of a stimulus. A common ERP component used to measure novelty is the P300, which is a positivity at ~300 ms after the onset of a stimulus. This P300 changes in intensity or latency when an expectation is not met. Our experiment has examined the effects of priming on the P300 and how they are related to attention in terms of learning. Preliminary results show a negative correlation between RTs and number of repeats with a spike in RT for switch trials.

Estimation of the maximum radius and mass of the supermassive black hole and 3C 66A

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Abstract:
3C66A is a blazar, an active galactic nucleus (containing a supermassive black hole with an accretion disk) with a jet pointing nearly directly to our line of sight. Our goals are to obtain the magnitudes in R of 3C66A over a period of months and from our observations, to estimate the maximum radius and mass of the supermassive black hole contained therein. We use the iTelescope web site to control remotely Telescope-11 and Telescope-07, which take images for us. Then we use Mira Pro-7 software on campus to analyse the images and compute the magnitudes. Next, we plot the light curve of magnitudes versus Julian Date. Finally, we measure the maximum slope of the light curve, and from this we calculate the corresponding doubling time which gets us the maximum radius and mass.

Treating Youthful Offenders: Mental Health and Substance Abuse Policy Recommendations

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Mentor: Sheila Huss
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Abstract:
Juvenile crime is an ongoing concern. It affects youth, their families, schools, the justice system, victims, and communities. One of many complexities involved in juvenile offending is the fact that many offenders also have been victimized or experienced one or more forms of trauma in their young lives. Managing juvenile crime requires an integrated approach that considers not only accountability, but also treatment. This research includes a policy analysis and interviews of many stakeholders to come up with evidence-based therapeutic approaches that focus specifically on mental health and substance abuse, two areas that are highly correlated with youth offending.

Optogenetic Stimulation of Substantia Nigra Terminals Projecting Into The Dorsal Lateral Striatum During Fear Extinction Prevents Fear Renewal

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Mentor: Benjamin Greenwood, Assistant Professor
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Abstract:
Exposure therapy relies on the process of fear extinction, which represents new learning that the previous fear conditioned stimulus no longer predicts danger. One limitation of exposure therapy is that fear tends to return in contexts different from the extinction context, a phenomenon called fear renewal. Identification of novel strategies to prevent fear renewal could improve success of exposure therapy. We observed that activation of substantia nigra (SN) dopamine (DA) neurons during fear extinction enhances fear extinction recall and blocks fear renewal (Bouchet et al., 2018), but the specific targets in which SN DA acts to enhance fear extinction remain unknown. SN DA neurons projecting to the dorsal lateral striatum (DLS) support the formation of habitual behaviors, which can be resistant to contextual modulation. The goal of the current study was to test the hypothesis that optogenetic activation of SN terminals in the DLS during fear extinction learning will reduce fear renewal. Adult, male Long-Evans rats received bilateral intra-SN microinjections of control virus or AAV-Chr2-hSyn-mChery and optic ferrule cannulas in the DLS. SN terminals in the DLS were then optogenetically stimulated during auditory fear extinction learning. Fear extinction memory and relapse were subsequently assessed in the absence of stimulation. Results indicate that optogenetic stimulation of DLS-projecting SN neuron terminals during fear extinction reduces the renewal of fear in a novel context while having no effect on extinction memory or spontaneous renewal. These data suggest that novel therapeutic strategies aimed at the SN-DLS circuit could be effective adjuncts to exposure therapy.

3,4-methylenedioxymethamphetamine (MDMA) impairs the extinction and reconsolidation of fear memory in rats

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Mentor: Benjamin Greenwood, Assistant Professor
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Abstract:
3,4-methylenedioxymethamphetamine (MDMA) paired with psychotherapy can reduce symptoms of post-traumatic stress disorder (PTSD) more effectively than psychotherapy or typical pharmacotherapy, either alone or in combination. However, the mechanisms by which MDMA might enhance psychotherapy remain unclear. Given that fear memories contribute to PTSD symptomology, MDMA could augment psychotherapy by neurochemically targeting fear memories. We have investigated the effects of a single administration of MDMA on extinction and reconsolidation of fear memory in adult male Long-Evans rats. Our initial results indicate that low dose MDMA (1 or 2 mg/kg), administered 30 min before cued fear extinction, has no effect on fear extinction recall or fear renewal, whereas high dose MDMA (3 or 10 mg/kg) impairs cued fear extinction recall. In contrast, 5 mg/kg MDMA, but not 3 mg/kg MDMA, administered immediately after contextual fear memory reactivation, interferes with the reconsolidation of contextual fear memory. These data suggest that the therapeutic effects of MDMA could be mediated by a reconsolidation impairment, rather than an enhancement of fear extinction as previously suggested by studies in mice. However, it is unclear from these results whether the therapeutic effects of MDMA are specific to reconsolidation, or affect contextual fear memory in general. Our recent studies investigated the effects of 5 mg/kg MDMA (the dose previously observed to interfere with contextual fear memory reconsolidation) on contextual fear extinction and cued fear reconsolidation.

Supersaturated Solutions

Elexia Wright

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Mentor: Rebecca Cherry
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Abstract:
This experiment investigated the crystallization rates of sodium acetate at different levels of saturation, as well as compared the crystallization process of sodium acetate and glucose through qualitative observation. Crystallization occurs when solutes are added in excess to solvents at a higher temperature and then cooled turning the solution into crystals caused by instability. The experiment was split into two parts, the first involved the preparation of a sodium acetate solution and a glucose solution. For the first part, sodium acetate produced efficient crystallization, while glucose did not appear to crystallize due to its solubility properties. The other compared rates of crystallization among varying concentrations by preparing three different solutions, one unsaturated, one supersaturated, and the last being above the supersaturation point, resulting in a precipitate. Each of these solutions were heated and mixed until complete dissolution, and then allowed to cool. The crystallization of each was observed and recorded. The second part of the experiment yielded results that reflected the idea that the level of saturation does, in fact affect the rate of crystallization, as well as the structure of the crystals themselves. Based on these results, it is evident that the crystallization process is highly complex and varies tremendously between substances and can also be affected by the amount of solute in the solution overall. This experiment aims to allow for a basic understanding of a topic that is often overlooked in foundational coursework and apply it to topics covered in these classes.

Exam skills and metacognition: piloting a new exam type.

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Abstract:
Absorption of knowledge within the college setting is crucial to academic success. Student's need to effectively grasp a wide array of information in multiple classes and it is the hope of many teachers that this information will be retained. STEM courses tend to be anxiety inducing in many students and often they feel as though they are unable to preform due to the technical nature of these courses. Exams are a standard measure used to quantify the information that students have retained. The ThinkCheck Exam is a hybrid exam combing open note and multiple choice exams styles. This exam gives one page with broadly worded version of the questions within the exam. During the first portion of the exam students are allowed to use resources such as the book, professor powerpoints or personal notes. During the second portion of the exam students then use the one page of notes to complete the multiple choice exam. While it may see as though this type of exam is too easy the open note portion is vague enough as to provide a challenge. This type of exam provides the flexibility of multiple choice exams for professors but allows for different difficulty levels of questions as defined by Bloomburg's Taxonomy. With these exams metacognition is enhanced and students will see an improvement in their core knowledge which is reflected within an improvement in understanding of the material and an increase in exam scores particularly within STEM courses.

Computation of host-guest free binding energies with a QM-MM mining minima algorithm

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Mentor: Emilie Guidez
DC – College of Liberal Arts and Sciences

Abstract:
Host-guest chemistry is a subfield of supramolecular chemistry, which deals with the interactions between two or more molecules. The applications of host-guest complexes range from the development of drug delivery systems to cancer treatment techniques. Within the realm of drug delivery systems, a host molecule is defined as a vehicle that encapsulates a drug, which acts as a guest molecule. A significant aspect of this subfield is the amount of energy that is required to bind a guest to its affiliated host. Finding the binding energies of different host-drug systems can aid in the development of models for larger host-guest systems, such as enzymes and other proteins. Host-guest systems are ubiquitous; therefore, gaining more information about the processes and mechanisms of how guests bind to host molecules is crucial. One of the challenges that arises in drug design is accurately predicting the binding energies of host-guest systems due to the weakness of the interactions between them. This research project aims to find a specific method that predicts these energies in an accurate and computationally inexpensive way. The binding energies were calculated using a method called VM2, which was developed by the software company VeraChem LLC. This system was used in order to find a method that includes the lowest possible energy calculations that correspond to the host-guest systems that are being tested.