University of Colorado
Denver | Anschutz Medical Campus

21st Annual Student

Research and Creative Activities Symposium

Friday, April 27, 2018
Student Commons Building

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University of Colorado Denver

University of Colorado Anschutz Medical Campus

Welcome to the 21st annual Research and Creative Activities Symposium! RaCAS is a celebration of student research, artistic work, and community-based scholarship at the University of Colorado Denver and Anschutz Medical Campus (AMC). 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.

The 2018 RaCAS is the largest one to date, featuring over 230 research presentations, creative works, and performances of students from both the downtown campus and AMC. It is organized into two poster sessions and 15 student-organized mini-symposia featuring oral presentations.

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-years just beginning to explore ideas in depth, or they may be sophomores or juniors in the process of developing the skills and insights that will serve their scholarly work in the future. The artists who participate in the symposium—the poets, fiction writers, dancers, composers, and photographers—bring to their work a combination of technique, cultural and intellectual context, ways of thinking and seeing the world, and raw talent that is nurtured in CU Denver's liberal arts environment.

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 interpretation, 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 enriches students' academic experience.

Finally, we are sad not to have with us this year Dr. Richard J. Traystman, formerly Distinguished University Professor and Vice Chancellor for Research, who not only supported but nurtured RaCAS over the past decade. His support has been continued this year by Dr. Robert H. Eckel, Professor of Medicine and Interim VC for Research—thanks to him. We also thank Chancellors Dorothy Horrell and Donald M. Elliman for their support, in particular for the awards for outstanding faculty mentors.

Please join us this day in celebration of our students' 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

WELCOME TO THE 21st Annual RESEARCH and CREATIVE ACTIVITIES SYMPOSIUM

SYMPOSIUM SCHEDULE

9:00 – 10:00 AM **Presenter and Judges Check-in, Set-up, Support** Lynx Desk
Registration for presenters is not necessary this year; support staff will be available to answer questions.

10:00 – 11:30 AM **Poster Sessions**
101-149 1st floor Student Commons Building
150-199 2nd floor Student Commons Building

10:00 – 2:00 PM **Data to Policy Poster Presentations** (400-422) SC 2504

Students will deliver oral presentations showcasing their scholarly activities during Mini-Symposia

10:00 – 11:00 AM **Mini-Symposium I:** The Power of Virtual Reality and the Technology of Leap Motion (300-302) SC 1401

10:00 – 11:30 AM **Mini-Symposium II:** Broadening Participation in Neuroscience through BRAiN (303-307) SC 1500

10:00 – 11:30 AM **Mini-Symposium III:** Art History (308-314) SC 1600

10:00 – 11:30 AM **Mini-Symposium IV:** Social Justice Organizing in Diverse Communities (315-319) SC 2000

10:00 – 11:30 AM **Mini-Symposium V:** Biomedical Research: Recent Studies from the Anschutz Medical Campus (320-325) SC 2500

11:00 – 1:00 PM **LUNCH** SC 2600

11:30 – 12:30 PM **Mini-Symposium VI:** Cutting the Equations: Uncertainty Quantification Summarized Simply (326-329) SC 1401

11:30 – 12:30 PM **Mini-Symposium VII:** Was Late-20th Century Denver "Liberal," "Conservative," or Something Else? (330-333) SC 2000

11:30 – 12:30 PM **Mini-Symposium VIII:** Membranes and Molecular Modeling (334-337) SC 2500

12:00 – 2:00 PM **Mini-Symposium IX:** Behavioral and Cognitive Neuroscience: Bright Ideas (338-343) SC 1500

12:00 – 1:00 PM **Mini-Symposium X:** UROP: Undergraduate Research Opportunity Program Presentations (344-347) SC 1600

12:30 – 2:00 PM	**Poster Sessions**	
	201-249	1st floor Student Commons Building
	250-299	2nd floor Student Commons Building
12:30 – 2:00 PM	**Mini-Symposium XI:** LGBTQ-Centric Fiction (348-351)	SC 1401
12:30 – 2:00 PM	**Mini-Symposium XII**: Deceptive Development: Space, Power, and Agency in the Strategic Gentrification of Denver's Brighton Boulevard (363-365)	SC 2500
1:00 – 2:30 PM	**Mini-Symposium XIII:** Human Stories (352-357)	SC 1600
1:00 – 2:00 PM	**Mini-Symposium XIV:** Contesting Masculinity from the Nineteenth-Century American West to the Second World War (358-361)	SC 2000
2:30 – 3:30 PM	**Convened Session**	SC 2600
Welcome	Chancellor, Dr. Dorothy A. Horrell	
Mentor Award	Provost and Executive Vice Chancellor for Academic and Student Affairs, Dr. Roderick Nairn	
LYNx Talk	"Dime con quién andas, y te dire quién eres; Tell me who you walk with and I will tell you who you are" Dr. Ruben Viramontez Anguiano, Professor of Human Development, Family Relations and Education, School of Education and Human Development	
Awards	Associate Vice Chancellor, Jeff Franklin, Office of Undergraduate Experiences Dean Pamela Jansma, College of Liberal Arts and Sciences Dr. Lindsey Hamilton, Director of Undergraduate Research and Creative Activities	

Exploring a Food Environment and Food Related Behavior in Skagway, Alaska

Lindsay Adams (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jean Scandlyn,
Health and Behavioral Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
In my ethnographic study, I assessed the nutritional adequacy of restaurants and grocery stores in Skagway, while also exploring the ways in which Skagway's food environment and seasonal tourist economy effected food related behavior amongst the seasonal employee and local resident population of Skagway. As the number of dietary related diseases in the US continues to increase, many studies have been devoted to addressing food security and factors that influence food related behavior. However, areas such as Skagway, which are heavily reliant on tourism yet geographically isolated, tend to get overlooked. Using a mixed methods approach I learned more about food related behavior within the population through participant observation and semistructured interviews. To assess the consumer nutrition environments in Skagway, I used a Nutrition Environment Measures Survey (NEMS), which scores food outlets on the availability, quality, and cost of fresh fruits and vegetables. I was able to gain further insight as to how the population of Skagway perceived the nutrition environment by administering surveys. Many food outlets had a low NEMS scoring, but the food environment had less of an impact on behavior than I had anticipated. My findings suggest that food choice was influenced more by social and occupational factors. Individuals with strong social bonds (and therefore people to cook and share food with) reported having diets comprised of high quality foods, such as fruits and vegetables; in comparison to individuals that reported a lack of social connectedness, as they opted for more low quality and prepackaged foods.

Using ArcGIS to Analyze the Chihuahuan Layer Upon Layer :Queer-Muslim Identities

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

Mentor: Associate Professor
CANDAN DURAN-AYDINTUG, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
While sociological and social psychological research on role-identity and social identity keeps growing, there is almost no published research in sociology on multiple identities and their effects on daily life, interactions in small groups and/or institutions, and mental health when it comes about being a non-heterosexual Muslim, Arab-American, especially in case of queer Muslim Arab-Americans. Managing multiple identities is challenging for any individual and/or social group. Yet in this case, the challenges might stand out more as these individuals experience being (perceived) female and living in a patriarchal society, being a sexual minority in a heterosexist culture, being Arab-American and specifically Muslim Arab-American in the face of growing discrimination, and being members of an organized religion in which non-heterosexual identities are contested. In this study, being guided by the rejection-identification model and stigma hypothesis, we have started conducting in-depth interviews with a small group of self-identified queer Muslim Arab-Americans in order to explore their multiple identity management and whether self-perceived discrimination is related to an increase in one social identity (either being non-heterosexual or Muslim or the ethnic identity of being Arab-American) as the model suggests. Preliminary analyses suggest that participants define the term "queer" in various ways based on their own understanding. Participants experience double and sometimes even triple stigma and rely on support systems and also on their own identity navigation and stigma management strategies. Data is still being analysed to gain an in-depth understanding of rejection-identification techniques as employed by the participants.

Sweet Tooth

Amar Alic
DC - College of Liberal Arts and Sciences

VStevenson Yip
DC - College of Liberal Arts and Sciences

Mentor: Ms. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Phosphoric acid is a prominent acid in sodas that has negative effects on teeth as well as overall health. The purpose of this experiment was to experimentally determine the concentration of phosphoric acid in Coca-Cola and Dr. Pepper. This was done by performing a pH titration of soda. Because the soda did not only contain phosphoric acid, efforts were made to decrease the probability of side reactions with the natural flavors, caffeine, and carbonic acid. The efforts involved leaving the sodas open for a few weeks prior to the actual experiment in order to allow for carbon dioxide to escape, which lowered the amount of carbonic acid in the sodas. A titration curve was created by graphing the pH of the titration versus volume of sodium hydroxide added. Once this was done, the equivalence points and pKa values could be determined. The equivalence points were used to determine the concentration of phosphoric acid in each soda. The pKa values helped verify that the main acid present was phosphoric acid. The average concentration of phosphoric acid in Dr.Pepper was about 0.00119M, while it was 0.00180 M in Coca-Cola. The experimental average for the first pKa value for both sodas was 1.00 while the literature value for the first pKa value was 2.15. Ultimately, the results were inconclusive, but from what we determined, there is more phosphoric acid in Coca-Cola than in Dr. Pepper on average.

Decolonizing through fellowship

True L Apodaca
DC - College of Liberal Arts and Sciences

Mentor: Professor Donna Martinez, Ethnic Studies,
DC - College of Liberal Arts and Sciences

Abstract:
Traditional educational institutions follow pedagogy that intill a sense of self which excludes Latinx histories. Latinx students consequently come to understand their identity within a white power structure. Generation Latino and the Colorado Latino Leadership, Advocacy and Research Organization (CLLARO) break that cycle through two fellowship programs designed to promote civic engagement among Latinx students by placing them in government internships with legislators, lobbyists, the governors office and the supreme court as well as progressive non-profit organizations. Students collaborate on projects and are educated through weekly culturally competent trainings designed to empower and decolonize their minds. This is done through instruction on the importance of narratives, power mapping, strength finding and leadership development. Each fellow is introduced to decision makers of color in Colorado and instructed in the art of networking. By introducing these fellows to the people of our state who hold traditional notions of “power” the two programs both humanize these icons and allow the fellows to see themselves as leaders and players in the realm of public policy.

Kinetic and Morphological Characterization of Post-Translationally Modified IsoD7 in the A-beta Peptide in Alzheimer's Disease

Dan F Au
DC - College Engineering and Applied Science

Jonathan B Hill
DC - College of Liberal Arts and Sciences

Chase R Riedel
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Liliya Vugmeyster, Chemistry,
DC - College of Liberal Arts and Sciences

Isaac B. Falconer, B.S. Chemistry UC Denver;
Dr. Wei Qiang, Asst Prof Biophysical Chemistry,
Binghamton University

Abstract:
The effects of variation in the amyloid beta (Aβ) peptide on the dynamics of the plaque formation implicated in Alzheimer's Disease are incompletely understood. Post-translationally modified isomerization of the seventh residue aspartate (isoD7) has been found in amyloid plaques of diseased brains. isoD7 has been studied with a fragment representing the relatively flexible N-terminal domain of Aβ, however has not been studied in the 40-42 residue peptide that forms the fibrillar structures found in plaques. The 40-residue isoD7 Aβ peptide is examined for its effects on the mass per length and kinetics of fibril formation by dark field transmission electron microscopy and Thioflavin T (ThT) fluorescence kinetic assays. The isoD7 peptide was cross-seeded with the wild type Aβ peptide to form the 3-fold fibril structure, and in comparison to the wild type fibrils exhibited mass per length in the range of wild type 2-fold and 3-fold fibrils but more similar to the 3-fold fibril, with a central value of 26.5 kDa/nm by a one Gaussian fit. ThT kinetic assays on the 3-fold wild type and isoD7 fibrils showed nearly two times slower growth kinetics in the isoD7. The isoD7 modification may present an additional kinking in the N-terminal domain, however further analyses are required to determine a model. isoD7 Aβ fibrils are formed when cross-seeded with wild type fibrils in morphologies similar to the wild type, as may occur in a diseased brain.

Proton Transport in E. coli CLC Transport Protein by Combined QM/MM Calculations

Baris O Aydintug
DC - College of Liberal Arts and Sciences

Mikias Negussie
DC - College of Liberal Arts and Sciences

Adam Duster

Christina Garza

Mentor: Dr. Hai Lin, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
The family of CLC transmembrane proteins comprises channels and antiporters that facilitate transport of Cl– and/or H+. Highly conserved in all domains of life, CLCs are involved in variety of functions, including the high-acid response, regulation of cell volume and neural resting potential, and lysosome acidification. Although it has been established that a prototypical CLC protein, E. coli CLC (EcCLC) transports Cl– and H+ with 2:1 stoichiometry , the actual H+ translocation process has not been well understood. Here, we test the hypothesis that a Cl– ion bound in the protein's central binding site facilitates the translocation of H+. We carried out molecular dynamics (MD) simulations of H+ translocation through the transmembrane domain of EcCLC Cl–/H+ antiporter. We employ combined quantum-mechanical and molecular-mechanical algorithms, which allow for proper descriptions of bond-breaking and bond-forming during H+ relay. We have examined the H+ migration from the internal gating residue Glu203 to the external gating residue Glu148, with and without Clcen present in the central binding site. Our results suggest that the Cl– leads to more frequent and faster H+ transfers..

Acknowledgments: This project is supported by the NSF (CHE-1564349), XSEDE (CHE-140070), NERSC (m2495), the Camille and Henry Dreyfus Foundation (TH-14-028), and the Undergraduate Research Opportunity Program of the University of Colorado Denver. We thank Prof. E. Tajkhorshid for the geometries from MM simulations.

Fools In Love: Women of the Rococo and the Men Who Painted Them

Nicole N Baccarella
DC - College of Arts and Media

Mentor: Doctor Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
The conversation around feminist thought, as well as the male centered perception within any given society is highly relevant throughout history, though not always discussed in various cultures in time. This paper considers the French Rococo period of the 18th century, and how women have been portrayed through art, and if the misogynistic tones are due to the culture in which they were created, or the individual male artists who may have conformed to patriarchal views, beyond that of what may have been considered typical within societal terms. By analyzing portrayals of women in Rococo paintings, through feminist theory and contextualizing this analysis through scholarly sources on gender norms in French society, this paper argues that this derogative narrative was multifaceted. The thought process did not depend solely on being a product of the times, but rather a continuum of how women have been seen throughout history, and how that plays into patriarchal views. This demonstrates how entrenched art and society is within the male perception, even those paintings that seem to celebrate women instead mock them, regardless of a woman's true place within French society at the time. In conclusion, this paper closely examines the relationship of misogyny in the 18th century French Rococo and the artists who painted these women, in conjunction with society as a whole—a lens not often acknowledged in a time led solely by the male gaze.

Soil Characterization of Carex scirpoidea

Nick W Bard
DC - College of Liberal Arts and Sciences

Mentor:Associate Professor Leo P Bruederle, Biology,
DC - College of Liberal Arts and Sciences

Dr. Kristine B. Westergaard, Researcher,
Norwegian Institute for Nature Research

Abstract:
Carex scirpoidea Michx. (Cyperaceae), is comprised of four subspecies, each with distinct habitat types and geographic ranges. The two focal taxa described herein (C. scirpoidea subsp. scirpoidea and subsp. convoluta (Kük.)) seem to exhibit edaphic endemism, (isolation to soils with unique physical and chemical properties). C. scirpoidea subsp. scirpoidea, spans boreal and alpine habitats from East Russia across Canada, the northern USA, and Greenland, to Norway. C. scirpoidea subsp. convoluta, on the other hand is restricted to alvar, natural limestone pavements, and cobble beaches near or on the Lake Huron shoreline. As part of a study on the genomic basis of adaptation, we assessed differences in growing season temperature and soil chemistry. Soil cores were collected across the ranges of the two taxa at sites where plants were present, and assessed for 65 chemical and physical properties. Additionally, temperature loggers were deposited at each site to monitor annual soil temperature fluctuations. Growing season length and average temperatures showed variation between and among both subspecies. Soils were characterized and analyzed for similarity between sites representing both taxa. In general, soil types could be placed in four distinct groups based on soil characteristics, and typically corresponded with geographical proximity. However, one site in Michigan had a markedly different soil type than all other proximal sites; while Alaska and Colorado sites shared a common soil type. Additionally, both taxa seemed to share a common soil type for sites near the Great Lakes region. Forthcoming research aims to incorporate soil chemistry analysis with ecological niche modeling and genomic data to seek an association between putatively adaptive loci and atypical edaphic conditions.

The Light Curves of the Active Galactic Nuclei 3C 454.3 and 4C 29.45

Steven Bates
DC - College of Liberal Arts and Sciences

John Feldmann
DC - College of Liberal Arts and Sciences

Nicholas Pesavento
DC - College of Liberal Arts and Sciences

Mentor: Professor Alberto Sadun, Physics Dept.,
DC - College of Liberal Arts and Sciences

Abstract:
Active galactic nuclei (AGN) are astronomical sources of extremely high intensity radiation most commonly found at the center of very old distant galaxies where supermassive black holes reside. We are able to observe these AGNs by using computer-accessed remote-controlled telescopes located in Nova Scotia and New Mexico through the utilization of broadband optical CCD photometry. The telescopes chosen for all of our observations were selected due to their capability of isolating the wavelengths of electromagnetic radiation between 550 [nm] to 800 [nm] by use of a filter. Using this method of observation, we were able to obtain visual data over the course of a couple months of two specific AGNs: 3C-454.3 and 4C-29.45. Then by use of a third-party program called Mira Pro-7, we extracted from each image the observed optical flux intensity of our objects by comparing them to neighboring standard comparison stars of known magnitudes. The graph of these observed intensities with respect to their Julian Dates (JD) gives us a light curve, of which, helps provide us valuable information on supermassive black holes. Our observations directly contribute to the bridging of lower and higher wavelength observations of the same AGNs obtained by other collaborators within the astrophysical community.

Osteogenic Response to Exercise with Obesity (OREO)

Beatriz Bermudez (UROP Recipient)
DC - College Engineering and Applied Science

Mentor(s): Assistant Professor Vanessa D. Sherk,
Department of Medicine ,
AMC - School of Medicine

Dana R. Carpenter, University of Colorado Denver, Mechanical Engineering Department, Vanessa D. Sherk, Rebecca M. Foright, David M. Presby, Ginger C. Johnson, Julie A. Houck, Janine A. Higgins, Matthew R. Jackman, Paul S. MacLean, School of Medicine

Abstract:
Obesity is commonly associated with better bone health because additional weight is carried by the skeleton. However, physical inactivity and a high fat diet (HFD) can lower peak bone mass, and increase bone loss during adulthood. Exercise is expected to improve bone health, but obesity may impair the beneficial adaptations to exercise. 32 female rats were fed HFD (6 months) to establish an obesity prone (Obese) and obesity resistant (Lean) phenotype. Rats were then calorically restricted to induce and maintain a 15-18% weight loss with a medium fat diet plus treadmill exercise (EX: 8-10 wk, 1 h/d, 6 d/wk at 15 m/min) or sedentary control (SED). Body composition was measured using quantitative magnetic resonance. Characteristics of hindlimb bones were quantified with microcomputed tomography, mechanical testing, and finite element modeling. Lean mass was positively correlated (r=0.36-0.72) with all tibia outcomes. Fat mass was not correlated with bone parameters. Obese had more fat mass and tended ($p=0.064$) to have more lean mass than Lean. Unadjusted bone parameters were similar among Lean and Obese. When adjusting for lean mass, Lean had a higher minimum bending resistance (Imin), minimum modulus (Zmin), and energy-to-failure ($p<0.05$). Cross-sectional area, cortical thickness, and Zmin increased ($p=0.01$-0.04) with exercise. The effect of exercise on Imin and polar modulus (Zpol) became significant ($p<0.05$) when adjusting for lean mass. Increased lean mass was predictive of bone health, but may obscure deficiencies in bone associated with diet-induced obesity and Exercise can improve bone health similarly among Lean and Obese rats.

How does cooking time affect coffee acidity?

Shamik Bhat
DC - College of Liberal Arts and Sciences

Ryan Tseng
DC - College of Liberal Arts and Sciences

Mentor: Dr. Kyoung N Kim, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Coffee's worldwide popularity and benefits have led to passionate interest in the effects of cooking procedures on its taste, a quality likely affected in large part by acidity. Since heating a solution is known to increase the solubility of a solute, it was hypothesized that a longer cooking time increases the acidity of the coffee due to the increased breakdown of chlorogenic acid into caffeic acid. Based on this, it can be predicted that an increase in cooking time will cause the pH of coffee to lower (become more acidic). Two trials were conducted - the methodology of the second trial was a refinement of the first trial in minor procedural methods. Coffee solutions were first cooked at constant temperatures for predetermined and variable amounts of time. All solutions were then titrated with sodium hydroxide to obtain a linear relationship between base added and solution pH. Looking at the results, the most acidic solution in trial 1 was the most cooked. In trial 2, however, no concrete relationship could be determined. To conclude, cooking coffee does decrease the pH. Conclusions on the relationship between time cooked and acidity, however, have yet to be formed based on these data. Further trials with statistical analysis would help form solid conclusions on this relationship. The limited number of runs and contradictory data in this experiment prevented the formation of strong conclusions on the relationship between cooking time and coffee pH.

A Non-Destructive, Rapid, and Economic DNA Extraction Method from Single Parasitoid Wasps

Jackie Billotte
AMC - School of Medicine

Jonathan A. Shortt
AMC - School of Medicine

Mentor: Dr. David D. Pollock,
Biochemistry and Molecular Genetics,
AMC - School of Medicine

Abstract:
Parasitoid wasps are one of the most diverse families of eukaryotes and have large impacts on agriculture, conservation, and pest management. In spite of their importance, of the 100,000 parasitoid wasp species, only four have had their genome sequenced, three of which are in the same genus. One reason why parasitoid wasps are so understudied is the difficulty in obtaining sufficient amounts of DNA for research. As many of the species are quite small, obtaining enough DNA for analysis has typically required that multiple individuals of the same species be ground together in a single extraction, however this approach imposes constraints on what information can be gained in testing because lab-grown lineages required to attain enough individuals are not necessarily representative of the diversity found in natural populations. Conversely, although museum collections often contain an abundance of diverse DNA samples, including unique specimens or cryptid species needing classification, most institutions are hesitant to offer their collections to research that ends in the destruction of their specimens, as would be required for typical DNA extractions. In the method outlined here, specimens are subjected to heat in a 5% Chelex mixture, to extract usable DNA from a single wasp without incurring visible damage to the specimen. From single wasps, the method yields an average of 1.07 µg of high molecular weight DNA, sufficient for the creation of next generation sequencing libraries, without incurring visible damage to the wasp. This method thus provides an opportunity to expand the genetic research of parasitoid wasps.

Influences on Wild Bee Richness and Abundance Along an Urban-Rural Gradient

Kristen R Birdshire
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Christy Briles,
Geography and Environmental Sciences,
DC - College of Liberal Arts and Sciences

Dr. Peter Anthamatten, PhD, University of Colorado Denver; Dr. Adrian Carper, PhD, University of Colorado Boulder

Abstract:
Over a third of the world's crops--including fruits, vegetables, nuts, and spices--require insect pollination. Reliance on the pollination services that promote these food products continues to rise due to increasing demands from our growing human population; therefore, it is imperative to understand the ecology of insect pollinators. While extensive research exists to understand pollination services in agricultural settings, fewer studies examine pollinator activity along an urban-rural gradient, and to my knowledge never from a high elevation semi-arid environment. My study demonstrates different pollinator assemblages in 12 sites along an urban-rural gradient in Denver, Colorado, USA, and hypothesizes that bees thriving in an urban landscape will be smaller-bodied and have ecologically generalized characteristics (e.g., polylectic and eusocial) than rural bees, which are hypothesized to exhibit more specialized traits (e.g., oligolectic and solitary). Local and landscape site characteristics were defined using ArcGIS, and characteristics from collected bees will be correlated with the landscape classifications to demonstrate how increasing urban intensity allows certain bee species to prosper, while others to struggle in the urban landscape. When a positive correlation exists between the ecological characteristics of collected bees and local and landscape habitat characteristics, those characteristics will be highlighted as effective strategies to better manage bee populations along the urban-rural gradient. A set of guidelines will be provided to land managers so they can better maintain and promote existing and new bee populations, or to explore alternative methods to attract native bee species along the urban-rural gradient.

Differentiation of SH-SY5Y cell line in bioprinted 3-D culture

Kateryna Biryukova (UROP Recipient)
DC - College Engineering and Applied Science

Mentor: Dr. Steven Lammers, Bioengineering,
DC - College Engineering and Applied Science

Abstract:
Maintaining cell cultures in 2D cell environments, such as flasks or petri dishes, negatively affects experimental results, as 2D cultures don't represent native cellular environment adequately. Notable success in improving in vivo mimicry was achieved by bioprinting 3D culture constructs, primarily tumor models for cancer research; however, to date, physiologically relevant artificial models for application in neuroscience-related research are underrepresented; currently available neuron cultures have high maintenance cost and require intricate handling. Consequently, there is a need for a method to generate cost effective and easy to handle models for neuroscience research that are more representative of native cellular environment than existing artificial models. In this study, SH-SY5Y neuroblastoma cell line was combined with gelMA and photoinitiator to create a cell-laden bioink that was subsequently bioprinted to form 3D culture constructs. The cells used for the bioink were differentiated, that is, driven towards neural phenotype, pre-printing and post-printing. The results in two groups will be compared in order to determine the optimal time of differentiation.

Solar Eclipse Effects of VLF Wave Propagation: Observations and Modeling

James R Bittle
DC - College Engineering and Applied Science

Chad Renick
DC - College Engineering and Applied Science

Mentor: Dr. Mark Golkowski, Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
On August 21, 2017 a total solar eclipse occurred over the United States providing an opportunity to observe how the rapid day-night-day transition changed the chemistry of the upper atmosphere, specifically the ionospheric D-region. The ionospheric D region is the lowest layer of the atmosphere that is in the plasma state and hence it reflects very low frequency (VLF) electromagnetic waves. To observe these solar obscurity effects, VLF receivers were deployed in two locations: One in the path of totality in Lakeside, Nebraska as well as another south of the totality path in Hugo, CO. The locations were chosen in relation to the eclipse path and US Navy VLF transmitter in North Dakota, which operates at 25.2 kHz.

VLF amplitude and phase changes were observed in both Lakeside and Hugo during the eclipse. As the 25.2 kHz signal passed through the path of totality a negative phase change was observed at both receivers as solar obscuration progressively increased. The observed phase changes became positive as solar obscuration reduced. The opposite trend was observed for the amplitude of the transmitted signal: growth as max totality approached and decay during the shadow's recession. Comparing the observations made at the two sites shows that the phase and amplitude changes observed at Lakeside (in the path of totality) had a more gradual gradients than observed at Hugo (south of the path of totality).

The Long wave Propagation Capability (LWPC) code developed by the US Navy is used to model the observations.

Effect of Socioeconomic Status on Emergency Department Length of Stay and Crowding

Rebekah Boyd (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Meng Li, Health and Behavioral Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
In 2012, the Centers for Medicare and Medicaid Systems began collecting data on emergency department length of stay as part of performance evaluation, with longer length of stay as a sign of poor performance on timeliness. While the goal of reducing emergency room crowding is justified, using length of stay as a performance measure overlooks factors that are out of the control of emergency departments. There is evidence that patients with low socioeconomic status tend to utilize emergency departments more often. We hypothesize that low socioeconomic status patients also have longer lengths of stay in the emergency department. If so, using the length of stay as a performance index can penalize hospitals that serve larger percentages of low socioeconomic populations. In this research, we test the hypothesis that patients with lower socioeconomic status have a longer length of stay in emergency departments by gathering original data. This study enrolls 300 patients at Lutheran Medical Center in Denver, Colorado and collects: annual income, number of people in the household, educational level, and occupation. These data are used to tabulate a socioeconomic index that is correlated with length of stay, which we obtain from their medical record following consent. We control for possible confounders of insurance status, whether patients had a primary care physician, and the number of diagnostic tests ordered in the emergency department. The aim of this study is to test the above hypothesis with the goal of identifying areas where intervention may have a lasting impact on reducing crowding.

White Women's Right to Good Light: The City of Denver's strategic use of lighting to create Gendered Gentrification (This paper is part of the Deceptive Development Symposium)

Sarah E Brown
DC - College of Liberal Arts and Sciences

Hannah Smith
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jordan Hill,
Humanities and Social Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
ABSTRACT: In 2014, the Mayor of Denver, Michael B. Hancock, released the "Brighton Boulevard Redevelopment Project." This report outlined strategies intended to revive an arterial and industrial road in Denver and transform it into a representational space that both echos and extends the ongoing gentrification in the city. Denver is becoming brighter; street lights and light up art installations are being touted as advances that make the space safer and increase the mobility of users in a previously shadowed space. In this paper, we discuss lighting as a de Certeauian strategy that influences spatial representation and practice. Specifically, we use a gendered analysis to cast light as a disciplinary technique used to control not just women's spatial practice, but their perceptions and sensory experience of the patriarchal built environment. City plans promise (white) women a right to the (bright) city. This promise strengthens white, wealthy women's support for problematic development while it harms both women and communities of color. We argue that strategic lighting and the safety it implies encourages white women to embrace gentrification and the guise of mobility that accompanies newly brightened space. We call this gendered gentrification. Strategic lighting used in gendered gentrification is disadvantageous to women and communities of color as it normalizes both sexist and racist assumptions and spatial practices. Instead of providing safety to white women, strategic lighting and gendered gentrification restrict female mobility and maintain unequal gendered and racial access to public space. Rather than embracing a false security and guise of mobility in lit gentrified space, wealthy white women must begin to problematize the association between lightness, whiteness, and safety.

One Does Not Simply Integrate: Assessing Integrated vs. "Silo-ed" Anatomical Sciences Presentation in Online Learning Module

Cory Ann Buenting
AMC - School of Medicine

Mentor(s): Dr. Lisa M.J Lee,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Janet Corral, Ph.D, Todd Buenting, BS

Abstract:
Anatomical sciences are fundamental medical competency; however, classroom contact hours are minimal due to nation-wide, integration-driven curricular reform, which correlates with increased adjunct online learning resources. Such resources vary in content, format, and accuracy, for there are few evidence-based guidelines for developing effective resources that yield measurable learning. Thus, the objective was assessing the educational value of two types of online module presentations: integrated vs. "silo-ed" presentation of the peritoneum. The two versions of online learning modules contained identical embryology, histology, and gross anatomy content and interactive features. The control module presented the subjects sequentially, and the experimental module integrated all three subjects for each organ. First-year graduate and health professional students were recruited and randomly assigned to access either module. Participants completed a prequiz and after module interaction, a postquiz/survey. Analysis of prequiz vs. postquiz scores from 133 participants revealed a significant increase in postquiz performance in both control and experimental groups. However, the amount of postquiz increase between groups was not statistically significant. Survey analyses revealed that more experimental group participants reported enhanced understanding of gross anatomy and embryology of the peritoneum after module use, compared to the control group. This may suggest students' slight preference for the integrated presentation of some anatomy subjects. This study highlights the educational value of online learning resources for anatomical sciences which, regardless of integration, can yield measurable learning outcomes. However, student perceptions and module preference have implications for resource development, motivation studies, and instructor or course evaluations.

Liberation and Ecstasy, Courtesy of the God Dionysus: The Iconography of Maenads and Gender in the Ancient World

Adrian C. Butler
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
The issue of gender in the ancient Graeco-Roman world has long been debated and scrutinized, with disparate views ranging from issues of female agency to oppressive patriarchy. The figure of the Greek god Dionysus and his retinue of maenads and satyrs is of particular interest to the discussion of gender roles and status within antiquity. However, most scholarship only focuses on one area of the vast historical and iconographical resources available. This limited perspective of Dionysus in relation to gender has produced an incomplete body of analysis that fails to fully illuminate the unique status of women within the ancient religious practice. My paper rectifies this scholarly absence by synthesizing historical and literary records that relate to the god and his followers, along with their representations in art, to develop a more complete analysis of gender relations in the ancient world. By employing this synthesized approach, I argue it will become apparent that through the worship of Dionysus, women were able to gain a level of agency and freedom in an otherwise patriarchal society. Through focusing on the iconographical evidence of Dionysus in conjunction with other historical resources, a more holistic understanding can be gleaned on the unique circumstances of women and gender relations in the Graeco-Roman world.

The Power of Images: Decoding the Relationship between Iconography, Symbols, and Ideology of the Ancient World's Mystery Cults and the Emerging Formation of Early Christianity.

Adrian C Butler (UROP Recipient)
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
The relationship between the religion of Christianity and the mystery cults of the gods Dionysus and Mithras during the Roman empire has been hotly contested, debated and analyzed for a thousand years, from commentary by ancient writers such as Clement and Origen to modern scholars. However, there has yet to be a comprehensive study on the visual artifacts these religions produced, thereby shadowing an important dynamic concerning the influences and appropriation between the two. My research fills this gap in scholarship by examining the religious iconography of the early Christians in conjunction with that of Dionysus and Mithras. Specifically, early Christian funerary art from roughly 200 C.E. onward will be examined and compared with contemporaneous and preceding Mithraic and Dionysian iconography. By analyzing the visual evidence through this paradigm, it will become evident that the early Christians, through their iconography, appropriated and absorbed mystery cult imagery relating to the gods Dionysus and Mithras. In doing so, aspects of early Christian art operated to both assimilate new converts and imbue their own faith and deity, Jesus Christ, with pagan-derived divine attributes. This project, by closely examining the significance and meaning of mystery cult-inspired iconography in early Christian art, will shed new light on the complicated and influential relationship between the ancient pagan world, specifically of the Dionysian and Mithraic mystery religions, and the burgeoning Christian faith.

Adaptive coupling of diapause phenotypes in the apple maggot fly, Rhagoletis pomonella

McCall B. Calvert,
DC – College of Liberal Arts and Sciences

Mentor: Dr. Gregory J. Ragland,
Department of Integrative Biology,
DC – College of Liberal Arts and Sciences

Abstract:
The transition of reproductive isolation in the face of gene flow from a property of individual loci to that of the whole genome still a cryptic process. Under scenarios of multifarous selection, where selection is acting on more than one ecological axis, coupling of multiple barriers is necessary to ensure that complexes of locally adapted alleles persist under gene flow. Genetic and genomic architectures that reduce the rate of recombination, and by extension blunt the force of gene flow, might be favored to produce divergence on ecological time scales and possibly complete the speciation process. Physical linkage is one such architecture that reduces recombination through the physical clustering of adaptive alleles in the same genomic region or rearrangement (e.g. chromosomal inversion) thereby limiting the chance that adaptive complexes are broken apart. Here, we show that clinal patterns in genetic loci underlying two diapause phenotypes in apple maggot flies (Rhagoletis pomonella) display patterns consistent with a role for linkage and possibly inversions in maintaining locally adaptive complexes of alleles. In the last 200 years, novel, reproductively isolated R. pomonella populations (termed “host races”) evolved changes in life history timing during adaptation to apples. Host adaption requires adjustment of diapause (overwinter strategy) phenotypes to time emergence with the availability of hosts and to resist pre-winter warmth. Gene flow is prevalent (~4%) among host races, which begs the question of how complexes of locally adapted alleles controlling different diapause traits remain intact in this example of primary divergence.

Apotheosis: The Commodification and Hypersexualization of the Male Figure in Contemporary Mass Media

Giovanni Cantor
DC - College of Arts and Media

Mentor: Assistant Professor Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
Contemporary mass media is responsible for the objectification and commodification of the male figure. The idealized figure of a male body creates unrealistic expectations for young males who try to achieve this specific look. While a robust body of scholarship examines the objectification of the female figure in visual culture, relatively few scholars have examined the portrayal of the male figure. The idealized and and perfect male figure can be dated back to the Ancient Greeks, whose paintings and sculptures featured male figures with athletic and muscular builds have set the standard of representation of men through the centuries. Commercial advertisements have adapted this idealized figure and distributed its image in mass media in order to sell products to the general populous. These marketable images mislead consumers into thinking they can achieve this look by purchasing the advertised products. It is difficult to ignore these advertisements in consumer culture, and they are effectively perpetuating an unrealistic body image of males that has been greatly overlooked in mass media. These theories of the objectification of the male body will be explored through the analysis of advertisements from major brands such Versace and Calvin Klein. Versace employs muscular male models for their cologne ads and Calvin Klein is known for their peculiar underwear ads. The analysis of these advertisements will prove the fact that they are creating images that can be toxic towards the expectations of males in our society.

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

Odalis Castro (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor(s):Dr. Clyde J. Wright,
Department of Pediatrics -Section of Neonatology,
AMC - School of Medicine

Sarah McKenna, B.A., Jeryl Sandoval, B.S.

Abstract:
Bronchopulmonary Dysplasia (BPD) is a chronic lung disease affecting the premature population. Research in our lab focuses on the pathogenesis of BPD. Inflammatory stress is a contributing factor for developing BPD; Supplemental oxygen and ventilation machines are frequently utilized to help a baby grow throughout their early gestational age. It is known that males are more susceptible to certain types of lung injury. This finding then leads us to question: How does lung development differ in males and females following exposure to inflammatory stress?

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. It is important to begin by knowing what mice are females or males. This can be identified by genotyping mice and looking for the SRY gene –a gene found only in the Y chromosome- that lets us identify who is male or female. After knowing the sex of each of the mice genotyped, we collect their lungs and inflate them. The lungs are then sent to a histology lab for them to be stained and put into microscope slides. Once ready, we take pictures of the peripheral section of a lung and use radial alveolar counts (RAC) and mean linear intercept (MLI) as objective measures of lung development. The result of this experiment will help us determine if there are sex-specific differences how the innate immune response to inflammatory stress affects the developing lung.

Crime in Denver neighborhoods based on income level

Oniza Chaman
DC - College of Liberal Arts and Sciences

Iman Shah
DC - College of Liberal Arts and Sciences

Alicia Privett
DC - College of Liberal Arts and Sciences

Kathyrn Maerz
DC - College of Liberal Arts and Sciences

Mentor: Dr. Audrey Hendricks, Mathematics,
DC - College of Liberal Arts and Sciences

Abstract:
Along with the increasing urbanization, it is important to keep track of the ways safety and health are affected in the Denver area to establish what new regulations are needed and how existing regulations can be most effective. Low-income communities face different burdens than higher income communities, including high crime rates. Our goal is to explore the relationship between crime rate and per capita income throughout Denver communities. We will use datasets provided by the City of Denver Open Data Catalog. We hypothesize that higher crime rate will be correlated with lower per capita income in Denver. As a result, this will allow for more benefits to those communities who need it most, and establishing a safer Denver community.

Phylogenetic delineation and geographic distribution of Laccaria nobilis and phenotypic relatives.

Chelsea E. Charley-Suarez
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Lindsey Hamilton, Psychology,
DC - College of Liberal Arts and Sciences

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Chicago Botanic Garden,
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Denver Botanic Gardens,
909 York Street, Denver, Colorado

Abstract:
Laccaria nobilis Smith is one of the larger and more charismatic species of the genus, originally described from the Rocky Mountains of Colorado. However, its species distribution includes Alaska, the Pacific Northwest, Mexico, the Midwestern United States, and Eastern Canada. Cryptic species within Laccaria is a very real possibility so the question is whether this distribution accurately reflects the distribution of L. nobilis or whether there are other morphological similar Laccaria species within this distribution. The purpose of this paper is to establish the phylogenetic identity of L. nobilis from its home range and compare this to specimens of L. nobilis from other parts of the continent. Molecular sequence data from the nrITS region, as well as the single protein coding genes RPB2 and EF1-alpha are used for phylogenetic evaluation. Maximum likelihood analysis of molecular sequence data for specimens of L. nobilis will identify a monophyletic clade of specimens from Colorado and then evaluate which specimens from a broader geographic range fit within this clade. This will ultimately help evaluate the hypothesis that large specimens of L. nobilis outside of Colorado, actually represent non L. nobilis species.

CRANIOTOMY TRAINING DEVICES WITH REUSABLE THERMOPLASTICS TO HELP TRAIN EMERGENCY ROOM AND TRAUMA SURGEONS

Jaqueline Chavez
DC - College Engineering and Applied Science

Anne Lyons
DC - College Engineering and Applied Science

Ean Petersen
DC - College Engineering and Applied Science

Jonathan Platt
DC - College Engineering and Applied Science

Ian Garvin, Michael Manzanares, Mikala Mueller, Sarah Lamb

Mentor(s): Instructor (MS) Craig Lanning, Bioengineering,
DC - College Engineering and Applied Science

Cassandra Howard, Bioengineering,
College of Engineering and Applied Science

Abstract:
When people suffer traumatic head injuries, the cranial cavity can fill with surplus fluid or swollen nervous tissue which causes increased intracranial pressure (IICP). If IICP is not treated within 24 hours, it can lead to life-long disabilities or death. Current medical training devices for IICP procedures are either non-reusable or computer simulations. A reusable and anatomically accurate medical device for physicians to train and practice relieving IICP is needed. Since the skull undergoes considerable damage during IICP procedures, through drilling or the removal of a bone flap, this damage must be quickly repairable in the model to facilitate multiple uses. Polycaprolactone (PCL) is a specific type of thermoplastic that is low-cost, moldable, and repairable. When heated to approximately 60°C, PCL can easily be press-molded to accurately resemble a human's cranial cavity in both shape and thickness in 2-3 minutes. After cooling for 4-7 minutes to room temperature, PCL will harden to approximately the same strength as a human skull. A full scale anatomically accurate head using PCL for the skull has been designed and prototyped. It can be used for 3-5 different IICP procedures before being completely repaired for reuse in less than 10 minutes. A device like this will enable hospitals and surgeons to practice high-risk craniotomy procedures multiple times and then repair the device within a short duration for additional training.

CRANIOTOMY TRAINING DEVICES WITH REUSABLE THERMOPLASTICS TO HELP TRAIN EMERGENCY ROOM AND TRAUMA SURGEONS

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You Catch My Eye: A study of initial attention bias towards threat in trans-diagnostic adolescents

Yaswanth S Chintaluru
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Benjamin Mullin,
Pediatric Mental Health Institute,
AMC - School of Medicine

Emmaly Perks (MS)

Abstract:
Historically, psychopathology has been classified using discrete diagnostic categories as established in the Diagnostic and Statistical Manual (DSM). However, recent research suggests that many putative casual mechanisms of psychopathology are shared across diagnoses. In the current study, we sought to examine one key transdiagnostic mechanism of psychopathology: attention bias, which refers to the tendency to orient toward certain stimuli over others. Eye tracking is a novel method for examining overt attention in response to stimuli. In this study, eye tracking was used as a method to examine attention bias in response to emotional faces. Previous literature has shown that individuals with anxiety exhibit an initial attention bias towards threatening faces relative to neutral faces (Schecher, et. All, 2013). In the current study, subjects completed a passive viewing task involving 24, 10-second trials in which they were presented with 4 faces of varying emotions (angry, neutral, sad, and happy). In these initial analyses, we were interested in examining the proportion of trials in which participants first oriented to the angry face, suggesting increased vigilance for threat. This poster will present on the findings after data analysis. Anxiety scale scores on the parent-rated Behavior Assessment System for Children, 3rd edition (BASC-3) (Kamphaus, et. All , 2015) were used as predictors to examine probability of fixation by emotion. , we found that participants with BASC were ---- predictable for attention bias towards threat.

Structural Features for Synaptotagmin 1 and Synaptotagmin 7: A Computational Study on the Wild-type and Chimeric C2B Domains

Nara Chon
DC - College of Liberal Arts and Sciences

Sherleen Tran
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Hai Lin, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Jefferson Knight, Chemistry Department

Abstract:
The synaptotagmin (Syt) proteins bind to membrane and initiate many physiological functions during exocytosis, e.g. the release of hormones and neurotransmitters. Syt1 and Syt7 are two well-studied Syt isoforms, containing two C2 domains (C2A and C2B). They display significantly different membrane-docking characteristics through C2 domains despite their structural similarity. Here, we perform atomistic molecular dynamic simulations for the C2B domains of the wild-type (WT) Syt1 and Syt7, and a chimeric (CH) Syt1:7 (Syt1:7C2BCH). The chimera is a hybrid of the Syt1 C2B “body” (beta sheets and alpha helices) and Syt7 C2B “legs” (calcium binding loops). Strikingly, our simulation results show that the Syt1:7C2BCH model only holds the first two calcium ions (1st and 2nd Ca2+) tightly in the binding site. For the outermost calcium ion (3rd Ca2+), it hangs loosely in the binding site by interacting with chlorine ions recruited from bulk solution. Our findings suggest that CH Syt1:7 C2B has higher affinity to anions than the WT Syt1 and Syt7. This observation correlates with the experimental stopped-flow fluorescence spectroscopy, particularly, the dissociation kinetics of CH Syt1:7 C2B from anionic phospholipids to be at least two-fold slower than WT Syt1. [This work is supported by National Science Foundation (CHE-0952337) and Camille & Henry Dreyfus Foundation (TH-14-028). This work used the Extreme Science and Engineering Discovery Environment under grant CHE-140070, which is supported by NSF grant number ACI-1053575, and the National Energy Research Scientific Computing Centre under grant m2495.]

Finding and Understanding New Parent Resource Deserts Using GIS

Alexandria N Clark
DC - College of Liberal Arts and Sciences

Mentor: Dr. Candan Duran-Aydintug, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
Research has found that when parents bring newborns into their lives, the physical distances they travel decreases significantly. This study aims to explore where parents find the resources to take care of their newborns and whether resource deserts are systematically located throughout cities based on neighborhood income, race, and education. Using a quantitative approach, including analyzing city resources via Geographic Information Systems (GIS), this study hopes to understand the distribution of resources for parents of newborns and explore the impact of resource deserts within city limits.

Sticking Around: Wallpaper's Influence on 19th through 20th Centuries European Fine Art

Mercedes R. Coon
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
While art history has long documented the influence of avant-garde aesthetics on decorative arts and design, the discipline has largely neglected the impact of the decorative arts on so-called "fine arts." This paper investigates the under-recognized mutual dependence between the fine arts and the decorative arts form of wallpaper design between the early 19th and mid-20th centuries in Western Europe. By comparing wallpaper designs and works that are generally considered fine art, my paper reveals a surprising visual dialogue between the two and suggests a co-dependence between wallpaper and fine art. I argue that wallpaper design kept various art movements thriving not just financially, but also inspired artists through its mass circulation. By examining wallpaper manufacturers alongside artists, this paper enhances our understanding of the importance of wallpaper—and by extension, decorative arts—in the art world.

Activation of Oxytocin Neurons in the Paraventricular Nucleus of the Hypothalamus of Male Rats exposed to Post-weaning Social Isolation and Conditioned Social Fear

Kim Cowie (UROP Recipient)
DC - College of Liberal Arts and Sciences

DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Sondra Bland, Psychology,
DC - College of Liberal Arts and Sciences

Dr. Benjamin Greenwood

Abstract:
Social interactions and human connection are reported to improve well-being and longevity while increasing human resistance to biological diseases (Eisenberger and Cole, 2012). Early life adversity, which often includes disrupted social-interactions, has been linked to depression and anxiety (Cohen et al., 2001). Human trust and bonding have been associated with oxytocin, which regulates pro-social behavior and relieves anxiety. Somewhat paradoxically, some studies indicate that oxytocin may modulate antisocial and aggressive behaviors (DeWall et al., 2014; Shamay-Tsoory and Abu-Akel, 2016). Male Sprague-Dawley rats were assigned to one of two housing groups Post Weaning Social Isolation (PSI) or Social Reared (SR). After four weeks a novel social fear-conditioning was completed with the rats either assigned to the fear conditioning or one of two controls. This study assessed behavior and the activation of oxytocin neurons in the paraventricular nucleus of the hypothalamus. The behavior analysis presented a significant main effect of housing with the PSI group being more aggressive than the socially reared (SR) group. The social fear conditioning produced a significant main effect of housing by condition with an increase in aggressive grooming by the male SR group. A double-label immunohistochemistry (IHC) assay was completed to identify phosphorylated CREB, which is used as a neuronal activation marker, and oxytocin. The double IHC allowed for the quantification of activated oxytocin neurons. The data indicated a main effect of housing with the PSI group having a higher percentage of activated oxytocin neurons compared to the SR group.

Train Riders: The Modern Day American Nomads

Courtney Crawford (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Professor Steve Koester, Anthropology,
DC - College of Liberal Arts and Sciences

Abstract:
Many research papers and ethnographies cover homelessness but not many go over the different types of homelessness. My research covers nomadic homeless lifestyles, primarily younger people who travel across America using different modes of transportation. Members of the group identify with the names such as dirty kids, travelers, and train riders, all of which relate to the lifestyle. Although homeless, this group travels across the country hitch-hiking and riding freight trains. This papers analyses the paradox of the freedom of the road and the fatal dangers of this lifestyle. This paper is written from an autoenographic viewpoint to elaborate this lifestyle from a first-hand experience.

Denver's Raison d'etre: A Formal and Historical Analysis of Union Station

Christina Critchell
DC - College of Arts and Media

Mentor: Dr. Yang Wang, College of Arts and Media,
DC - College of Arts and Media

Abstract:
From the time it was erected in 1881, Union Station has been a point of connectivity for the state of Colorado and was the catalyst for the development of Denver as a city. Had the railroad system not come through Denver as a result of the Union Station, Denver would not be the metropolis it is today. Originally known as the Denver Depot, the train station located at 17th Street and Wewatta has long symbolized the power of a regional approach to infrastructure and growth management, as well as the economic advancement for Denver. This study takes the position that the building, through its various renovations, is a barometer of Denver's development as a whole. Moreover, the various redevelopments of this historic landmark, both structural and formal, repeatedly and successfully contributed to the revitalization of Denver. As a result, Union Station continues to be a destination for regional, national, and even international travelers. A major part of the building's success is the use of land around the station, the design of the building, and its multifunctional layout that combines not only aesthetic considerations but also the creation of an environment that promotes community. Through a historical and visual analysis of Union Station, this study argues that the building is not only a centerpiece of Denver but also put the city on the map as a major metropolis.

Uncertain Wanderers: Victorian Constructs of Morality and a Family's Migration into Wisconsin, 1830s–1840s

Micaela T. Cruce,
DC – College of Liberal Arts and Sciences

Mentor: Dr. William Wagner, History,
DC – College of Liberal Arts and Sciences

Abstract:
In the late 1830s and early 1840s, several members of Vermont's Strong family migrated from New England to Wisconsin. Motives for and experiences of migration varied among the family members who opted to relocate. One theme, however, weaved throughout the story of the Strong family's migration: Victorian-era constructs of morality. Ideas about morality were central to the processes that pushed and pulled Euro-Americans west. Notions of morality helped to shape the ideological paradigms of 'manifest destiny' and the 'cult of domesticity,' both of which played key roles in necessitating and justifying expansion and conquest in the minds of nineteenth-century Euro-Americans. Using the Strong family's story as a case study, this presentation explores the complex ways in which nineteenth-century concepts of morality shaped individual experiences and broader trends in the narrative of westward migration into the Upper Mississippi Valley.

Formation of Protein Coronas on Metallic Nanoparticles and Removal of Metallic Cores

Formation of Protein Coronas on Metallic Nanoparticles and Removal of Metallic Cores

Mentor: Dr. Scott Reed, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
The binding of proteins to metal nanoparticles results in a protein corona surrounding the core of the nanoparticle. The resultant materials are toxic, although it is unknown whether the metallic nanoparticles themselves or the mis-folding of proteins within the corona produces this toxicity. We seek to investigate the relative toxicity of uncoated metallic nanoparticles, metallic nanoparticles encapsulated in a protein corona, and the protein corona absent the metallic core. Silver nanoparticles were synthesized using tannic acid and trisodium citrate and gold nanoparticles were synthesized via reduction of chloroauric acid with trisodium citrate. Nanoparticles were encapsulated in C-reactive protein (CRP) as a model serum protein. Localized surface plasmon resonance measurements were used to optimize the amount of CRP needed to form the protein corona and to determine the amount of cross-linking agent required to covalently link CRP into a continuous shell. A technique was developed for removing the metallic core using a cyanide etch and the resulting corona was purified with dialysis prior to toxicology studies. The characterization of the nanoparticles and their protein corona with dynamic light scattering and ultraviolet-visible spectroscopy will be presented.

The Importance of mTOR Signaling in Fear Extinction Augmented by Acute Voluntary Exercise.

Jazmyne Davis
DC - College of Liberal Arts and Sciences

Nicolette Moya
DC - College of Liberal Arts and Sciences

Margaret Tanner
DC - College of Liberal Arts and Sciences

Jennifer Jamie
DC - College of Liberal Arts and Sciences

Mentor(s):Dr Benjamin N. Greenwood,
Psychology department,
DC - College of Liberal Arts and Sciences

Esteban C. Loetz Professional Research Assistant, Psychology Department
Holly S. Hake Post Baccalaureate Research Assistant NIDA

Abstract:
Exercise has beneficial effects on learning and memory. In rats, for example, a single session of voluntary exercise following fear extinction training enhances fear extinction memory and reduces relapse. These effects of acute voluntary exercise on fear extinction memory could lead to novel strategies for treating trauma-related disorder, such as Post-Traumatic Stress Disorder (PTSD). However, the mechanisms by which exercise augments fear extinction is unknown. The mammalian target of rapamycin (mTOR), a translation regulator and protein kinase involved in cell motility, growth, and synaptic plasticity, may contribute to the beneficial effects of exercise. mTOR signaling is sensitive to monoamines, metabolic signals, and growth factors that are increased during exercise. mTOR signaling is also increased after chronic exercise in brain regions involved in learning and emotional behavior. Therefore, mTOR is a promising potential mechanism for the enhancement of fear extinction memory following exercise. The goal of the current study was to determine if mTOR signaling is crucial for exercise-augmentation of fear extinction. An acute session of voluntary exercise increased mTOR signaling in fear extinction-related brain regions of adult, male Long-Evans rats. Moreover, an intracerebral-ventricular administration of the mTOR inhibitor rapamycin reduced mTOR signaling and eliminated the enhancement of fear extinction memory produced by acute exercise, without itself impacting running or freezing behavior. These data indicate that mTOR is important for the memory-enhancing effects of exercise and suggest that factors that increase mTOR signaling could be potential new strategies for the treatment of stress-related psychiatric disorders, such as PTSD.

Social Fear Conditioning in Differentially Housed Adolescent Rats

Lamya'a Dawud
DC - College of Liberal Arts and Sciences

Esteban C Loetz
DC - College of Liberal Arts and Sciences

Elizabeth Hoeffkin
DC - College of Liberal Arts and Sciences

Rachel Beam
DC - College of Liberal Arts and Sciences

Tassawwar Khan, Kim Cowie

Mentor(s): Dr. Sondra T Bland, Psychology,
DC - College of Liberal Arts and Sciences

Dr. Benjamin Greenwood, Department of Psychology University of Colorado Denver

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, because not all individuals exposed to fearful experiences develop these 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. Social history may increase vulnerability to an aversive social event. We have developed a novel procedure in rats where a footshock was paired with exposure to a stimulus rat to produce conditioned fear to a social cue. We then assessed social behavior of the experimental animal when re-exposed to the same stimulus rat the next day in a different context. Immunohistochemistry was used to assess phosphorylated mammalian target of rapamycin (p-mTOR) in the medial prefrontal cortex (mPFC), a region implicated in fear learning. mTOR regulates mRNA translation and the stability of long-term memories.

Results indicate an increase in aggression in CSF socially reared rats and an increase in fearful behavior in CSF PSI rats. In addition, there was a trend for increased p-mTOR in the mPFC of rats that had experienced conditioned social fear. Conditioned social fear affects social behavior differently depending on housing conditions, and may impact mTOR activation in the PFC.

International Design-Build Community Center in Nicaragua

Mitchell Deans
DC - College of Architecture and Planning

Sarah Vanderpool
DC - College of Architecture and Planning

John Bonet
DC - College of Architecture and Planning

Derek Chavez

Alena Uchaykin

Mentor(s): Professor Joan Vandenburg, Architecture,
DC - College of Architecture and Planning

Professor Maria Delgado De Leon

Abstract:
During the fall semester of 2017, select students studying architecture at CU Denver were working with a community in Santa Marta, Nicaragua to design a community center. This building would serve as a place to organize meetings, parties, as well as for political assembly and a preschool. Unlike most design projects in an architecture firm, where the client asks the architect to design the project then bids a contractor to build it, the client, contractor, and the architect all work together to design the project and actually construct it together. This makes for a design much more engrained in what is getting built, rather than focusing on how it is being drawn.

We were in contact with the community for many months, and as they sent in suggestions we would send the community drawings for them to give us responses to, until we created a finalized design. A group of us then travelled to Nicaragua to build the project with the community, seeing it to its near-completion. We worked with a very small budget of $15,000 for the building (that we raised ourselves), and this was enough to build a community center, a bathroom, and to design a fence for the project.

An Inspection of the Cause of Change in Median Housing Prices after the 2008 Financial Crisis

Sebastian Del Barco
DC - College of Liberal Arts and Sciences

Mentor: Doctor Audrey Hendricks, Statistics,
DC - College of Liberal Arts and Sciences

Abstract:
The 2008-2009 housing bubble proved devastating to financial institutions, governments, and individuals throughout the world. This resulted in housing prices considerable dropping in value shortly thereafter. However, there were several cities where the median housing price did not change substantially or even where a slight increase in housing value was seen during the same 2008-2009 bust. This study will investigate the housing price distribution in the cities that had a stable or increasing median housing price during the 2008-2009 crash. Our hypothesis is that lower valued houses leaving the market rather than stability in individual housing prices substantially influenced the median housing prices in the cities of interest: Boston, San Francisco, Los Angeles, and Washington D.C.

Ion Solvation and Transport in EC and EMC Electrolyte Batteries

Julia Deyanova
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Adam Duster
DC - College of Liberal Arts and Sciences

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

Abstract:
The development of efficient energy storage devices is crucial for the utilization of alternative energy resources. For batteries, the efficiency highly depends on the electrolyte solution, which contributes to the rate of ion diffusion and the energy capacity of the battery. Here, we characterized Li+ and PF6— ion solvation and diffusion through various electrolyte systems using molecular dynamics simulations. Three different electrolyte solutions were studied: ethylene carbonate (EC), ethyl methyl carbonate (EMC), and a mixed 3:1 EC/EMC. Each model system included 1.2 M LiPF6, similar to the concentration of commercial batteries. We also computed the pairwise radial distribution functions between Li+ and PF6— and their coordinating O or H atoms for each system to better understand the structure of the ion solvation shells. The diffusion coefficient was determined for the involved ions. Our results agreed with literature values [1, 2].

Acknowledgments: This project is supported by the NSF (CHE-1564349), XSEDE (CHE-140070), NERSC (m2495), the Camille and Henry Dreyfus Foundation (TH-14-028)

Endocrine Basis of ADHD in Males and Females

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DC – College of Liberal Arts and Sciences

Alex Mitchell,
DC – College of Liberal Arts and Sciences

Vanessa Landin,
DC – College of Liberal Arts and Sciences

Mentor: Dr. Lindsey Hamilton, Psychology,
DC – College of Liberal Arts and Sciences

Abstract:
Hormonal influences on behavior are often overlooked when dealing with childhood and adolescent mental disorders. For our literature review, we read eighteen articles focusing on the endocrine basis of Attention Deficit Hyperactivity Disorder (ADHD). This particular behavioral disorder is associated with limited attention and hyperactivity and is more prevalent in young males than it is in young females. Our review sought to determine a potential endocrine factor underlying that prevalence rate sex difference: gonadal sex steroids. Estrogen, progesterone, and testosterone impact brain chemistry and circuitry, and, therefore, influence emotions, mood and behavior. Ovarian hormones, in particular, can influence brain regions important to higher cognitive functions, such as learning and memory, acting at structural, cellular and functional levels, and modulating neurotransmitter systems. We conclude that these sex steroid differences may be a biological basis as to why males are more vulnerable to the development of childhood-onset ADHD rather than females.

Modeling a disjunct distribution pattern of arctic-alpine plant species in western North America

Audrey V. Dignan
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Joseph Reichert
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Mentor: Dr. Leo Bruederle,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Current distributions of plant species have been largely shaped by historic climatic patterns, as well as edaphic (soil) conditions. During the Pleistocene, continental ice sheets covered approximately 30% of the Earth's surface, with the Cordilleran ice sheet limiting the availability of suitable habitat and fragmenting distributions of previously widespread species in northwestern North America. Here, we examine a recently-described biogeographic disjunct distribution that has been reported for 12 herbaceous arctic-alpine species occurring in northern British Columbia, on the Beartooth Plateau of Montana and Wyoming, and in the Southern Rockies of Colorado. In order to test hypotheses regarding this disjunction, we created climatic niche models using MaxEnt. Specifically, we modeled suitable habitat for Juncus biglumis (two-flowered rush) and Kobresia sibirica (Siberian bog sedge) under current climatic conditions and paleoclimatic conditions during the Last Glacial Maximum (LGM), approximately 21,000 years before present. Although the current suitable habitat for both species was predicted to match the disjunct biogeographic pattern, the paleoclimatic predictions refuted the hypothesis that arctic-alpine plants were more widespread during the LGM than they are today. In addition, the niche models did not support the previous finding of a northern British Columbia glacial refugium. This study raises further questions about the mechanisms of post-glacial colonization as well as the location and persistence of glacial refugia. Future research should focus on the phylogenetic lineages of herbaceous arctic-alpine species in western North America.

Assessing 3D Learning Resource Preference and Performance in Embryology Education

Angelique Dueñas
AMC - School of Medicine

Mentor(s): PhD Lisa MJ Lee,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Ernesto Salcedo, PhD, Department of Cell and Developmental Biology, AMC - School of Medicine; Dr. Jennifer Stratford, PhD, Department of Psychology and Neuroscience, UC Boulder

Abstract:
Embryology, the study of embryonic development, is one of the fundamental anatomical sciences, mastery of which aids in understanding gross anatomy and congenital abnormalities. Embryology is also perhaps one of the most challenging subjects to teach and learn, due to the complex nature of morphogenesis. With advents in technology in imaging and 3D printing in the recent years, more 3D figures and even 3D virtual and printed embryo models are beginning to emerge. However, whether these resources are effective in teaching and learning embryology is yet to be formerly assessed. The purpose of this study was to assess students' preference for dimensional depictions in embryology text, and whether 3D virtual and printed models yield a greater learning outcome. First year students enrolled in anatomical sciences courses in medical, dental and graduate programs were recruited to participate. In the first part of the study, recruits were randomly assigned into two groups, receiving an educational text about neurulation, with either 2D or 3D figures. In the second part, the recruits were randomized into 3 groups, each receiving one of 3 embryonic learning objects; pamphlet with embryo images, 3D virtual embryo model, or a 3D printed embryo model. Educational value of resources was assessed by prequiz vs postquiz performance and survey results were analyzed to assess students' preference and perceived value. Results indicate that exposure to the learning resources, in the absence of formal lecture, leads to measurable learning outcome and that in general, students value and want more visual resources for embryology.

Mapping the Body: Poetry and Anatomical Art - New Student Exhibit Merges Humanities and Sciences in Higher Education Collaboration

Angelique Dueñas
AMC - School of Medicine

Mentor(s): PhD Danielle Royer,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Brian Barker, PhD, Department of English, CU Denver;
Dr. Nicole Beer, PhD, Department of English, CU Denver

Abstract:
The Modern Human Anatomy (MHA) program at CU Anschutz and the English Department at CU Denver collaborated on an innovative, interdisciplinary, student-led exhibit "Mapping the Body: Poetry & Anatomical Art" for the Health Sciences Library Gallery (February 5 to March 30, 2018). The exhibit featured 21 pieces of original anatomical art created by MHA affiliates, paired with 9 pieces of original poetry directly inspired by some of the anatomical pieces. For its merits in humanities outreach, this project has been awarded a University of Colorado President's Fund for the Humanities grant. This unique collaboration between scientists and poets offers numerous benefits to both parties. Anatomists are able to take research and educational experiences and present them in a new, artistic and humanistic light. English students receive unique inspiration for their writing on a range of subject matter not easily accessible to those outside of the scientific community, and have the opportunity to share their art with a new audience. This project sheds new light on the creative potential of the anatomical sciences, the complementary nature of scientific and artistic modes of inquiry, and serves to better educate the public and CU communities about the incredible diversity and beauty of anatomical study and the poetry that it can inspire.

Stereological Analysis to Determine the Structural Basis for Loss of Gas Exchange

Jessica Durr (UROP Recipient)
DC - College Engineering and Applied Science

Mentor: Dr. Bradford Smith, Bioengineering,
DC - College Engineering and Applied Science

Abstract:
Asthma is a chronic respiratory disease affecting 1 in 13 Americans with healthcare costs of $56 billion dollars a year. Environmental factors can cause an increase in severity of the inflammation leading to reversible airway obstruction and hyperactivity that result in approximately 10 deaths per day. Preclinical development of new treatment strategies for severe asthma hinges on the use of animal models. However, in order to assess the efficacy of novel treatments we must first understand the structural and functional changes that characterize these asthma models. We have therefore developed techniques to quantify alveolar size, inflammation severity, and the surface area available for gas exchange. The analysis of three different cohorts of mice that were exposed to intratracheal (IT) instillations of saline (control), house dust mite (Group 1), and freund's adjuvant (Group 2). Asthma severity was assessed by measuring bronchoconstriction following inhalation of nebulized methacholine using the forced oscillation technique. The functional state of the lung was also quantified by measuring carbon monoxide diffusing capacity (DFCO). The formalin-fixed lung samples were then paraffin embedded and 5 μm sections were stained with hematoxylin and eosin. Images selected via systematic uniform random sampling were used to estimate the volume fraction of parenchyma in four classes of graded inflammation. The gas exchange area per unit volume was determined using line intercepts and the volume weighted average alveolar volume was calculated using point sampled intercepts. These measurements allow correlation of mechanical and gas-exchange function to the structural changes caused by allergen exposure.

Diurnal variation in neuroplasticity-related signaling pathways within the prefrontal cortex in response to conditioned fear extinction training.

Devin P Effinger
DC - College of Liberal Arts and Sciences

Mentor: Dr Sondra Bland, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Conditioned fear is a type of emotional learning that involves the pairing of a sensory stimulus cue to a foot shock. Conditioned fear extinction involves the disassociation of the aversion to the paired cue. Malfunctions in this system have been associated with stress disorders such as post-traumatic stress disorder. In previous studies, it was found that time of day contributed to conditioned fear extinction memory (Woodruff et al., 2015). Rats that underwent extinction procedures during their active period (ZT16) were more apt to show extinction when compared to rats tested during the inactive phase (ZT4). Conditioned fear extinction involves several neuroplasticity-related factors including the mammalian target of rapamycin (mTOR) pathway. Here we investigated diurnal variation in intercellular signaling in the prelimbic (PL) and infralimbic (IL) subregions of the prefrontal cortex in response to conditioned fear extinction: the neural activity marker c-Fos, and phosphorylated (p)ERK and pS6, components of the mTOR pathway. Male Sprague-Dawley rats were exposed to auditory conditioned fear involving a tone paired with a footshock. The following day, rats underwent extinction during either ZT16 or ZT4. Immunohistochemistry was performed for pS6, c-FOS and pERK. There were significant interactions of treatment (Extinction or Control) by time of day (ZT4 or ZT16) on pS6 and c-Fos in both the PL and IL. However, there were no significant differences found in p-ERK. This data suggests that activation of the mTOR pathway during fear extinction is impacted by the time of day in which extinction occurs.

EL Mano: A Method for Designing a Realistic and Practical Intravenous (IV) Training Arm

Hassan El-Batal
DC - College Engineering and Applied Science

Isha Kanu
DC - College Engineering and Applied Science

Hend Elzarad
DC - College Engineering and Applied Science

Parker Jesberg
DC - College Engineering and Applied Science

Zachary Johnson, Christian Padgett, Luis Rodriguez, Yapheth Wolday

Mentor(s): Instructor (MS) Craig Lanning, Bioengineering,
DC - College Engineering and Applied Science

Cassandra Howard, Instructor (MS), Bioengineering, College of Engineering, Kyle Rosen, Simulation Operations Specialist, University of Colorado Hospital, WELLS Center, Dr. Nee-Kofi Mould-Millman, Assistant Professor (MD), University of Colorado Hospital, Center for Global Health

Abstract:
First responders in Ghana, Kenya, Ethiopia, and South Africa struggle to properly train others in administering intravenous (IV) therapy after traumatic impact collisions. The first responders work in environments that may not have access to paved roads and current IV mannequin trainers are prohibitively expensive. A cost-efficient, rugged, anatomically-correct portable mannequin IV training arm was developed to meet this need. This model was made out of ABS plastic and it is covered with a silicon-based rubber. It also accommodates an internal pressurized tank system that holds 1.5 liters of fluid. The tank system fits inside the arm model and pressure is controlled by a blood pressure cuff that adds 20 mmHg of pressure to the arm model. There are multiple insertion points on the veins of the hand and arm that can be pricked 100 times as well as draw and insert 10cc of fluid. Overall, this device will make a positive impact in the confidence and competence level of prehospital providers.

Drawing as a Learning Tool in Undergraduate Microbiology Education

Kaitlyn Elliott (UROP Recipient)
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Mentor: Assistant Professor Annika, C, Mosier,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
In biology education research, there are few studies focused on the use of drawings to improve educational outcomes. Here, we propose that drawing is a fundamental learning tool in the sciences. We demonstrate the functionality of drawing as an educational practice to improve student understanding and to develop skills of creation and interpretation of visual models. Layers of contextual, spatial, and process information can be captured through drawing. This creation of a complex drawing model can aid students in critical thinking and problem solving situations. The process of creating a drawing is metacognitive, which has been shown to improve student performance and independence. Overall, the skills developed through drawing are vital in the transition from novice to expert learners. With an increased understanding of drawing in STEM education we can provide students with the tools necessary to succeed in their academic and professional science careers.

Evidence of ant-mediated seed dispersal in Colorado Front Range populations of Lilac Penstemon (Penstemon gracilis Nutt., Plantaginaceae)

Kelsey R Estes (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Leo P. Bruederle, Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Mutualistic relationships (mutualisms) are those that benefits all species involved. One type of mutualism, myrmecochory, involves dispersal of seeds by ants, which has resulted in the evolution of certain traits that facilitate these relationships. With myrmecochory, one such trait is the presence of a structure referred to as an elaiosome, composed of substances (e.g., fatty acids, lipids) that attract ants to seeds. The seed is brought to the nest, elaiosome consumed, and the seed either discarded in the tunnels of the nest or just outside. This behavior can aid in the survival of the seedling by reducing potentially negative effects of density-dependent factors such as competition, as well as aiding in avoidance of predation. Studies have shown that among myrmecochorous plants, elaiosome size normally increases with seed size, and influences rate of dispersal. Various fatty acids have been shown to attract ants to disperse seeds, often without a proportional reward. This study investigates the relative size and chemical composition of elaiosome-like structures in Lilac Penstemon (Penstemon gracilis) along the Front Range of Colorado. Assay via gas chromatography revealed the presence of linoleic acid, a fatty acid that Hymenoptera (bees, wasps, ants) are unable to synthesize and therefore must incorporate into their diet. Linoleic acid is present in the elaiosome of other known myrmecochorous seeds. The relative size of the seed is significantly smaller than previously documented myrmecochorous species however the trend seen in other studies is still followed. Overall, this study reveals evidence for the development of a myrmecochorous relationship.

Mothers' Marital Status at Birth: Exploring its Relationship to Children's Problem Behavior in Adulthood

Alexander Feldman
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Mentor: Dr. Teresa Cooney, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
Unmarried cohabiting unions are now the norm for unmarried parentage. Whereas much attention has been paid to differential behavioral outcomes for offspring from continuously married biological two-parent families and single-mother families, little has addressed differences between other unconventional family structures. This paper reports on a preliminary study of differences in deviant and criminal behavior reported by young adult children of divorce, cohabiting unions, and single-mother births in adulthood. Applied theories include the new household economic theory, social control theory, and family transition theories. The data examined are from the public use samples of wave one and three of the National Longitudinal Study of Adolescent to Adult Health (Add Health). At wave one (1994-1995) the children were aged 11-18. At wave three (2001-2002) they were aged 18-26. Dependent variables included propensity toward violence and crime, binge-drinking, substance use, functional limitations resulting from alcohol use, and functional limitations resulting from substance use. Eleven controls were included based on the implications of the applied theories. The results showed that children of divorce tend to fare worse across all five outcomes than those born to single-mothers. The effect was significant with respect to substance use and approached significance with respect to functional limitations resulting from alcohol use. These results suggest that in the examination of unconventional family structure, family transitions may be the foremost influence on deviant behavioral outcomes for adults born within such family structures.

Photogrammetric Comparison of Carnivore Tooth Pitting and Scoring on Bone Assemblages

Joseph M. Findeiss
DC - College of Liberal Arts and Sciences

Gabrielle Jones
DC - College of Liberal Arts and Sciences

Mentor: Doctor Charles Musiba, Anthropology,
DC - College of Liberal Arts and Sciences

Abstract:
Recently there has been a rise of interest in research surrounding the identification and classification of bone surface modification using advanced digital imaging techniques. This research revolves around the arena of carnivore type tooth marks such as pits and scores present in archaeological bone assemblages. Techniques like microscopy and photogrammetry have been employed with the intention of extracting qualitative and quantitative data that can be applied to bone surface modifications for consistent replicative identification. The identification and specificity of tooth markings offers insight into the dynamics between humans and carnivores in paleoenvironmental context. For this study, we have used macro-photogrammetry to record carnivore tooth marks extant on faunal remains and spatial data rendering software to create high-resolution three-dimensional geometric morphometric models. The models were then utilized as templates for comparison in attempt to consistently identify and differentiate carnivore tooth marks on various specimens within bone assemblages.

Two Roads, Converged: Health and the Intersection of Work and Family for Mothers

Gracie Finnigan-Fox
DC - College of Liberal Arts and Sciences

Mentor: Dr. Adam M. Lippert, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
The combination of work and motherhood is increasingly common in the United States, with over half of mothers employed in some capacity. However, research to date has focused primarily on broad aspects of both work (eg, employed vs. unemployed), and family life (married vs. unmarried); the health implications of detailed combinations of employment and family circumstances have received less attention, both in respect to mental as well as behavioral and physiological well-being. Understanding the relationships between mental strain, behavior, and physiological functioning earlier in the life course may benefit disease prevention initiatives. This study aims to address these gaps by using data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) to explore 1) how detailed aspects of work-family circumstances relate to perceived stress and depression among young working mothers, 2) whether work-family characteristics that bear upon stress and depression are similarly related to a vector of coping behaviors, and 3) whether any aspects of work-family circumstances found to be correlated with stress, depression and coping behaviors are also correlated with biomarkers gauging cardiometabolic health. Results from multivariate regression models show that certain characteristics—such as partner status—are significantly associated with multiple dimensions of health, while others were associated with one dimension (eg, psychological distress) but not another. Taken together, the results from this study illustrate the nuanced ways in which work and family life combine to influence physiological and mental well-being, as well as the health behaviors that often compound these health outcomes.

Enforcing anergy of autoreactive B cells through inhibition of the PI3K pathway

S. Elizabeth Franks
AMC - School of Medicine

Mentor(s): Dr. John C. Cambier,
Immunolgy and Microbiology,
AMC - School of Medicine

Andrew Getahun

Abstract:
Variations in expression and/or function of a number of genes confer increased risk of development of autoimmunity. Among these variations is the expression of negative regulators of the PI3K pathway, whose activity is critical in maintaining B cell anergy. Anergy, in which autoreactive B cells are unresponsive to antigen, is maintained via upregulation of the inositol phosphatases PTEN and/or SHIP-1, which hydrolyze PI(3,4,5)P3, the product of PI3K, yielding PI(4,5)P2 and PI(3,4) P2, respectively. Levels of these negative regulators are reduced in SLE due to aberrant regulation by miRNA-7 and miRNA-155. Deletion of miRNA155, which raises SHIP-1 expression, has been shown to reduce autoantibody responses in the lpr autoimmune mouse model of Lupus. Acute deletion of SHIP-1 or PTEN in autoreactive B cells leads to autoimmunity. We report that it is possible to pharmacologically correct defects in PI3K pathway regulation which confer risk of autoimmunity, thus preventing autoimmunity while conferring minimal disruption of adaptive immune function. This intervention does not prevent autoimmunity caused by compromise of other risk allele emulating conditions, such as reduced SHP-1 expression. We hypothesize that PI3K inhibitors can be used therapeutically to compensate for decreased negative regulation of the PI3K pathway. The knowledge gained from these studies will aid in the development of precision treatments for autoimmunity that act by correcting effects of specific risk alleles.

NOVEL MEASUREMENT METHODS FOR ASSESSING MAGNETIC MATERIAL PROPERTIES OF FERROMAGNETIC MATERIALS USING A VIBRATING SAMPLE MAGNETOMETER

Todd W Fulton
DC - College Engineering and Applied Science

Mentor(s): Dr. Stephen D. Gedney, Electrical Engineering,
DC - College Engineering and Applied Science

Dr. Carl S. Schneider, PhD, US Naval Academy,
Prof Emeritus, Dept of Physics

Abstract:
The focus of this research is the development of novel measurement methods to assess non-linear hysteretic susceptibility properties of ferromagnetic materials. Accurate measurement methods for extracting essential physical properties of ferromagnetic materials, such as initial susceptibility, saturation magnetization, coercive field, and nucleation magnetization are being developed. The measurement of such parameters using measurement facilities such as a vibrating sample magnetometer can be hampered by rate dependent effects, such as eddy currents or magnetic viscosity, sample geometry, which can have non-linear demagnetizing field affects, as well as volume fraction effects. In this research, we have developed novel apparatus and measurement techniques to augment a standard vibrating sample magnetometer facility in order to overcome these difficulties. Experimental results will be shown demonstrating the efficacy of the newly developed apparatus and methods. Initial results show promise in our final goal of ascertaining an updated model for ferromagnetic hysteresis that is based uniquely on the physical parameters of the material without the need of fitting parameters, which is an inadequacy of contemporary models.

Defying Categorization: The Art/Craft of Andrea Zittel

William Edward Funk
DC - College of Arts and Media

Mentor: Professor of Art History Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
Art history has always been focused on ideas of categorization. One of the strongest areas of debate over the past century has been the line between what is considered fine art and what is defined as design. Some scholars see these as strongly opposed while others feel that the definition is fluid. Movements like the Arts and Crafts and Bauhaus challenged this categorization while proving that art and design can be one and the same. Regardless of the success of these movements, the debate centered around what is art and what is design continues today. The lines may have been blurred since the 1920s, but artists like Andrea Zittel are still challenging these categories and pushing the boundary of what art can be. My research will analyze the practice of Zittel through her multimedia and multidisciplinary practice established in the early 1990s and is still going strong today. Zittel's work can be seen as part of the D.I.Y. movement, a rejection of consumerist culture, a philosophical approach to living, and a response to the art-world discussion around what fine art is. I will analyze Zittel's practice through Bauhaus and later utopian theories, and in the process, show how her aesthetically pleasing work bridges the gap between functional design and fine art. I argue that Zittel's work reveals practical and philosophical understandings of how we live today and as such, is one of the most important contemporary artists of her generation.

Reaching Beyond Boundaries: How Environmentalism Ended Denver Water's Unrestricted Operations and Limited Urban Expansion

Brian Galea,
DC – College of Liberal Arts and Sciences

Mentor: Chris Agee, History,
DC – College of Liberal Arts and Sciences

Abstract:
In "Reaching Beyond Boundaries: How Environmentalism Ended Denver Water's Unrestricted Operations and Limited Urban Expansion," Brian Galea shows how Denver officials during the 1970s saw free access to the state's water supplies as critical to the city's physical and economic expansion. Officials in other Colorado municipalities, by contrast, sought to limit Denver's access to Front Range water because they regarded Denver's continued growth as a threat to their own economic interests. But while these opponents of Denver expansion were motivated by economic concerns, they campaign against Denver's water acquisition with the language of environmentalism. By embracing environmentalist rhetoric, non-Denver officials built a surprising coalition with many white-collar, middle-class residents of Denver. Together, this unlikely alliance of Denver competitors and Denver residents brought an end to Denver's unimpeded access to Front Range water.

Everyone Needs Iron, Man; Determining the Most Cost-Effective Iron Supplement

Kavya Ganuthula
DC - College of Liberal Arts and Sciences

Katherine E. Feldman
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Kyoung Kim, Chemistry,
DC - College of Liberal Arts and Sciences

Jennifer Samudio, Teaching Assistant,
Chemistry Department

Abstract:
Anemia is a condition where red blood cells lack elemental iron and thus, reduce the concentration of oxygen in the body. 1.6 billion people globally suffer from this condition due to various factors like diet and menstrual flow . To combat this, over the counter iron supplements are prescribed; however continuous purchase of iron can get expensive. In this experiment, two different iron supplements, Nature Made Iron and Spring Valley Iron were compared for concentration of iron and cost effectiveness. This was done by isolating the iron compound and then analyzing the concentration through the use of spectrophotometry. Although our data concluded that the Nature Made Iron was more cost effective: $263,627 per mol compared to $313,488, there were errors in our experimental procedure during spectrophotometric analysis and creation of a standardization curve.

3D Printed Custom Mask For Pediatric Sleep Apnea Therapy

Ryan Gerstenberger (UROP Recipient)
DC - College Engineering and Applied Science

Mentor(s): Jennifer Wagner,
Bioengineering,
DC - College Engineering and Applied Science

Dr. Stephen Hawkins, Assistant Professor, Pediatric Pulmonary & Sleep Medicine: Breathing institute, Children's Hospital Colorado.

Abstract:
The purpose of the project is to create patient specific continuous positive airway pressure (CPAP) masks. With the use of 3D imaging scanning, computer aided design (CAD) and 3D printing a custom printed CPAP mask can be created for any individual. Children's Hospital Colorado has a 3dMD face scanner that was used to capture a subjects face. Scans can be transferred onto CAD platforms such as Geomagic and Solidworks. Once the design of the mask has been fitted to the facial images provided from the 3D images actual 3D masks can be 3D printed. Results show that the process of utilizing 3D printing to create a custom CPAP mask is feasible and could be used for a wide range of patients that suffer from cranial facial abnormalities. First, a reliable scanner was needed to ensure that a complete facial recognition can be generated. Second, the 3D image is uploaded onto CAD software to construct the actual mask. Finally, the mask is fitted to the 3D image provided the CAD file can be build on a 3D printing platform. Future work to be completed on the project are to enhance the cushion feature of the mask, create molds of the actual mask for softer wearable materials and actual patient trials are needed. For actual patient use to finally be achieved all steps in the above statements need to be highly precise fitting for the individual.

Attention Through Learning: An electrophysiological investigation of intertrial priming in visual search

Adam Goldstein DC - College of Liberal Arts and Sciences

Mentor: Doctor Carly, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Current models of attention often refer to a dichotomy of top-down, goal-oriented search, versus bottom-up, salience-based search (Leonard & Egeth, 2008). In a normal search task, we may look for a specific characteristic such as Waldo's red and white striped shirt, or a stimulus may capture our attention, such as the shiny reflection of a metallic object. Moving beyond this top-down/bottom-up dichotomy, there is an interest in a third category, known as intertrial priming. Priming occurs when the target has a certain characteristic that repeats from trial to trial, which in turn decreases the reaction times (Maljkovic & Nakayama, 1994). As more targets repeat of similar type, presumably an expectation builds up. To better understand at what stage of processing these priming benefits occur, electrical signals can be measured from the head. The Event Related Potential is a pattern of spikes in electrical activity across the scalp that occur at very specific times after the display of a stimulus (Luck, 2012). A common component used to measure "WOW" factor is the P300 (Dien, Spencer, Donchin, 2003), which is a positive spike at 300 ms after the onset of a stimulus. This P300 either intensifies or has an increased latency when an expectation is not met or the opposite of the expectation occurs. However, this component has not been examined in the context of intertrial priming. In the proposed experiment we will examine the effect of priming on the P300 and how they are related to attention in terms of learning.

Concentric Annular Ring Slot Antenna (CARSA) for Non-Invasive Blood Glucose Monitoring

Andrew K. Gras (UROP Recipient)
DC - College Engineering and Applied Science

Mentor(s): Dr. Mark, Golkowski, Electrical Engineering,
DC - College Engineering and Applied Science

Dr. Ashanthi Maxworth

Abstract:
Blood glucose monitoring is an important part of patient care which traditionally involves physically drawing blood. The process of drawing blood can be painful and intrusive, which predicates the necessity of a non-invasive monitoring method. One method for reliable collection of blood glucose levels is through impedance spectroscopy, which uses the correlation between blood glucose levels and impedance through the top layers of the skin to determine blood glucose levels. Ruwansiri, Kulasekere, Senarathna, Dayawansa's research, "Evaluation of Compact CARSA Sensor and Penetration Depth of EM Signal for Non-Invasive Blood Glucose Measurement" demonstrates that a small antenna sampling a shallow portion of skin at 25-42 MHz is more accurate than a large sensor, which inherently interacts with deeper layers of the skin. Their study concluded that the smallest sensor tested was the most accurate. For this reason, my research focused on replicating results presented by Ruwansiri et al. in addition to testing a CARSA slightly smaller than the most accurate sensor presented through their research. The tested sensors were milled from copper plated plastic sheets and measurements were taken using an ENA Network Analyzer. In order to interface with the Network Analyzer the sensors were fitted with SubMiniature version A (SMA) connectors (semi-precision coaxial RF connectors). In order to confirm measurements from Ruwansiri et al. the two smallest sensors from their research have been reproduced. By testing an even smaller CARSA sensor, this project aimed to demonstrate that accurate Non-Invasive Blood Glucose Monitoring can be achieved by means of extremely compact sensors. Data was collected in order to demonstrate that the sensors performed as expected and clinical trials would assist in establishing a more precise correlation coefficient.

Characterization of deuterium isotope effect on protein stability and intermolecular interactions of HP36 via analytical HPLC.

Aaron Griffin DC - College of Liberal Arts and Sciences

Mentor: PhD Liliya Vugmeyster, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
A major assumption in protein biophysics studies is that isotope labeling does not affect the structure and dynamics of peptides. The effect of isotope labeling on protein stability and intermolecular interactions is relatively poorly understood and must be accounted for to provide more accurate results in context of NMR spectroscopy, x-ray crystallography, neutron diffraction and other biophysical studies. In this work we quantify the effect of non-exchangeable proton deuteration on protein stability of HP36 by measuring enthalpy and entropy differences from binding to reversed-phase (RP) HPLC columns. A series of analytical HPLC thermo-profiling experiments were carried out to measure retention time of villin headpiece subdomain protein (HP36) as a function of temperature and gradient rate. This data was fit to the linear solvent strength model (LSS) and parameterized to yield ΔΔH, which is the difference between the enthalpy (ΔH) of binding to the column at high and low temperatures and is directly related to protein stability The results show a smaller ΔΔH value for the deuterated versus protonated form of HP36, suggesting that deuteration has a destabilizing effect on peptides and lowers the energy barrier required for unfolding.

Experiential Learning in the European Union: An Investigation of Ambisonic Content Creation, Live Music Broadcasting, and Live Music Industry.

Karl E. Gunselman (UROP Recipient)
DC - College of Arts and Media

Mentor: Mr. Chris Daniels,
Music Entertainment & Industry Studies,
DC - College of Arts and Media

Abstract:
The European Union has one of the most vibrant and active live-music scenes in the world. That energy puts their industry on the vanguard of technological development for ambisonic sound engineering. My research targeted this cutting-edge knowledge in Germany and revealed the ideal functionality and utilization of a high order ambisonic system. Ambisonics describes the utilization of audio sources to create a three dimensional, fully immersive soundscape. The majority of my ambisonic research was conducted at HAW Hamburg, Faculty of Design, Media, and Information; which houses a 29 speaker system that provided a highly specific localization of audio sources in a soundscape. I utilized the digital audio workstation, Reaper, to manipulate audio to create either channel-based or sound-field based results. My results were facilitated through the use of plugins created by Mattias Kronlacher. I utilized these plugins not only to create sound fields, but also to decode an ambisonic recording of La Bohme, an opera by Puccini. While at HAW I also researched the workflow of live music broadcasting, in a case study of MUTESOLO. Equipment used included Vister X mixing console for mastering, black magic router for broadcasting, and other rudimentary sound recording devices. Additionally my research included a live performance in Copenhagen. This experiential research provided knowledge of venues in Copenhagen, crowd and cultural expectation, basis of payment and venue funding, and booking experience. The performance occurred at Studenterhuset, a music venue and coffee house organized by students. This experience emphasized funding and how that relates to a live performers success.

Effect of physical activity on cricket behavior

Mikayla Haburchak
DC - College of Liberal Arts and Sciences

Oluwatosin Ibrahim
DC - College of Liberal Arts and Sciences

Erin Sanders

Margaret K Tanner

Mentor(s): Dr. John Swallow, Integrative Biology,
DC - College of Liberal Arts and Sciences

Dr. Benjamen Greenwood

Abstract:
Physical activity in mammals has been shown to modulate behaviors important for survival by acting on monoamine neurotransmitters, such as dopamine and norepinephrine. Monoaminergic systems are present in invertebrate species; however, little is known about the effects of physical activity on monoamine-dependent survival behaviors in non-mammalian species. This is an important question, as factors related to activity can contribute to fitness, health and survival of species. In the common house cricket (Acheta domesticus), the norepinephrine analog octopamine is involved with experience-dependent changes in survival behaviors, such as aggressive behavior and bite-force. By exposing crickets to aggressive confrontations followed by exercise, we plan to determine the effects of exercise on the bite-force capacity of the defeated and non-defeated crickets in male common house crickets. A Tekscan Flexiforce Measurement System was used to determine bite-force in which crickets bit a thin sensor, and recorded the force in Newtons. Pilot studies were conducted to determine the optimal rate and duration of exercise to be 260 cm/min for 10 minutes. Data is currently being collected to determine whether physical activity increases bite force following an aggressive confrontation. Initial data suggests that following aggressive behavior, cricket bite force increased in those deemed non-defeated, and exercise further increased their bite force. A decrease in bite force was observed in crickets that were defeated, while exercise had variable effects. Further studies will be conducted to determine whether exercise restores bite force in the defeated cricket.

Estimation of the Ignition Point of a Wildfire by Data Assimilation of Satellite Detections

James Haley
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jan Mandel,
Mathematical & Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
The recent wildfires in Northern California caused billions of dollars in property damage and killed more than twenty people while upsetting the lives of thousands more. These kinds of fires are a part of nature and it is not always possible to prevent them. However, it is possible to create better strategies for dealing with them when they do occur. By creating mathematical models which predict the behavior of fires we can hope to take positive steps like issuing better evacuation warnings or more efficiently deploying containment resources in order to mitigate the potential damages. Unfortunately, predicting the behavior of a fire is not an easy things to do. The behavior of fires, like that of the weather that influences them, is termed chaotic.In this presentation we will present an intuitive description of what it means for a system to be chaotic by examining a simple double pendulum system. In particular, we will demonstrate how small changes to the starting position of the pendulum lead to large changes in its behavior as time progresses. We then relate the starting position of the pendulum system to the starting position (ignition point) of a wildfire and demonstrate the results of a mathematical method which allows us to pick the best ignition point of a wildfire simulation by using information obtained from satellites orbiting the Earth.

What is Dimension Reduction?

Jordan R Hall
DC - College of Liberal Arts and Sciences

Mentor: Dr. Varis Carey,
Mathematical & Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
Many models studied in applied mathematics depend on a large number of variables. Dimension reduction seeks to explain the output of such a model using fewer variables. After performing the reduction, one might create a computationally less expensive model at the cost of introducing error due to approximation, a technique known as surrogate modeling. We introduce the audience to these techniques through the lens of an accessible example problem for which dimension reduction will be performed to create a surrogate model.

A Panel on LGBT-centric Fiction Writing

Jessie Hawk
DC - College of Liberal Arts and Sciences

Mentor: Professor Joanna Luloff, English,
DC - College of Liberal Arts and Sciences

Abstract:
The panel will discuss the nuances and aspects of writing LGBT-centric fiction. Each panelist will present their own experiences in a brief summary and discuss why it's important to them to write LGBT fiction. There will also be a Q&A segment that will allow the audience to have any questions they might have answered by the panelists themselves and it will allow the panelists to facilitate discussion about their own work or work they have read.

Variations in Migraine Treatment Methods Used by Socioeconomic Status

Daniel Hernandez Altamirano
DC - College of Liberal Arts and Sciences

Joseph McNabb
DC - College of Liberal Arts and Sciences

Paige Barrette
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Amy Wachholtz, Psychology,
DC - College of Liberal Arts and Sciences

Amrita Bhowmick, MPH, Health Union

Abstract:
Introduction: Previous research suggests that lower socioeconomic status (SES) individuals have an increased migraine risk yet may face limited treatment options. Analyzing migraineurs' treatment patterns in relation to their SES may reveal underutilized treatments. Hypothesis: Lower SES brackets use less treatment methods. Method: 3549 adult US-based respondents to the 2015 Migraine.com survey provided SES, demographic, migraine, and treatment data. Annual incomes were organized to establish SES: <$30k(19.4%), $30k-50k(18.6%), $50k-75k(22.5%), $75k-100k(15.3%), and $100k+(24.2%). Results: Several treatment methods had significant differences within SES brackets: acute prescription medication, with less use in <$50k; BOTOX, with less use in <$50k; head-based TENS units, with $30k-50k using less than higher SES groups; unprescribed substances (e.g. THC, alcohol), with <$30k using more; complementary and alternative medicine (CAM), with less use in <$75k; and rescue prescription medications, with more use in $100k+. Preventative medications only had differences between the <$30k and $100k+ groups. Discussion: Migraineurs earning <$30k are more likely to self-medicate using illicit drugs. Informing migraineurs of treatments like pain management psychotherapy may lower self-medication among lower-SES migraineurs. TENS units are also a viable long-term treatment option because of its minimal risk of abuse. Low SES migraineurs are less likely to be prescribed rescue medications (e.g., opioids). Increasing CAM usage among low-SES has long-term treatment potential and has less risk of secondary gains. Identifying underutilized treatments in SES brackets can lead to discussions for treatments not previously explored, increasing migraineurs' treatment options.

A Method for Triggering Disparate Types of Scientific Instrumentation and LTE Network Equipment

N. Chris Hess
DC - College Engineering and Applied Science

Mentor(s): Dr. Mark Golkowski, Electrical Engineering,
DC - College Engineering and Applied Science

Jason Coder,
National Institute of Standards and Technology

Ryan Jacobs,
National Institute of Standards and Technology

Aziz Cord, National Institute of Standards and Technology

Abstract:
The objective of this research is to quantify the interference between different types of electrical wireless devices. The work is being done at the National Institute of Standards and Technology (NIST) as part of the Professional Research Experience Program (PREP) fellowship. Being able to measure various interfering effects, such as Wi-Fi sharing the same band on a cellular LTE signal is crucial in today's wireless environments. However, measuring, or even defining what interference is can be problematic. Attaching metrology-grade instrumentation to commercial LTE network hardware (e.g., a UE traffic generator or base station/eNodeB) enables such interference measurements to take place. However, synchronizing the LTE hardware with the instrumentation is still a challenge. Test equipment, in general, keeps track of time through internal clocks set with GPS. LTE hardware uses GPS as well, but the way LTE synchronizes via the air interface is through data subframes, more specifically, information contained within the subframe headers. The two main parameters used to accomplish this synchronization are the timing advance and the system frame number. In measurements or experiments involving LTE network hardware and RF instrumentation there is no direct method to synchronize the instrumentation with the network hardware. To solve this problem, we devise a stand-alone unit that serves as the master GPS clock and also tracks the LTE frame numbers for either event triggering and/or monitoring. This unit utilizes a software program to decode and count the number of LTE subframes. This is a useful way to track frames for a short period of time. After about 10 seconds, the LTE frame number recycles. For testing periods that exceed this, we couple the LTE frame number with a GPS-based timestamp. The software developed as part of this work has the ability to decode and distinguish unique LTE frames. The hardware interface will be through a software defined radio (SDR) and a stand-alone computer. Once the SDR is programmed, the computer will simply monitor data flow, it will not manipulate data or control the SDR. This timing and triggering solution should provide enough precision to trigger instrumentation at the subframe level (~1 ms). This enables detailed analyses of transient effects on LTE systems and is important in defining conditions in which multiple devices can be used simultaneously.

LGBT Fiction Panel: Queer influence in Horror

Ven Hickenbottom,
DC – College of Liberal Arts and Sciences

Mentor: Dr. Joanna Luloff,
English Department,
DC – College of Liberal Arts and Sciences

Abstract:
Gothic fiction and horror have long influenced pop culture. Notable cultural icons like Dracula, Carmilla, and Dorian Gray have had their images distributed across pop culture. These very characters as well as horror as a genre, however, have long been entrenched in queer theory and influence. Outside of the horror genre, villains and monsters have long been queer-coded and steeped in homoeroticism. Horror and gothic media has long been an outlet for minorities and LGBT writers when other forms of media would not include these stories. In recent horror media, however, there has been a dialing back of queer influence. How have the classical roots of horror been championed by LGBT creators, and how does that still impact media? This presentation will examine how modern horror, suspense, and monster stories are influenced by queer theory, and how LGBT identity can often weave together with gothic narratives as a natural culmination of social and political experience.

Personalized Medicine & Pressure Ulcer Prevention

Alexander B Ho (UROP Recipient)
DC - College Engineering and Applied Science

Mentor(s): Assistant Professor
Levin Sliker, Bioengineering,
DC - College Engineering and Applied Science

Kelly G. Waugh, PT, MAPT, ATP

Abstract:
Pressure ulcers are severe open wound injuries to the skin and tissue as a result of prolonged pressure and deformation. This may occur more frequently over bony prominences, such as the ischial tuberosity whilst sitting. For wheelchair users, such deformations are observed in the buttocks tissues due to long hours of wheelchair use. Pressure ulcers greatly decrease the quality of life of such wheelchair users, impairing health, daily activities, and employment of those affected. Treatment of pressure ulcers has an estimated cost of $100,000 for a single ulcer, which an individual may develop multiple times. Personalized medicine is a procedure which separates patients in different groups based on their risk of disease or response to therapy. This allows for the development of a treatment plan that is catered to the individual based on their past history. By using new measurement techniques developed at Georgia Institute of Technology in observing tissue deformation, personalized medicine can be applied to measure risk of developing and preventing pressure ulcers. As one of the data collection centers located in Denver (the other located in Kessler, NJ), clinical and MRI sessions are being held to gather data that will be used to make connections between pressure ulcer history and risk factors (called Biomechanical Risk, which is the characteristic of an individual's soft tissues to deform in response to external force).

Complexometric Titration of Zinc Oxide in Sunscreen

Matthew N Hoang
DC - College of Liberal Arts and Sciences

Jillian M Oviedo
DC - College of Liberal Arts and Sciences

Mentor: Ms. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Commercial sunscreens can have zinc oxide as the active ingredient, which acts as a physical barrier, reflecting and scattering UVA and UVB rays. The purpose of this experiment was to determine the mass percent of zinc oxide in two commercial sunscreen brands, Banana Boat and Coppertone. A complexometric titration was used to first standardize an EDTA solution. Then the sunscreens were titrated with the standardized EDTA solution to determine the zinc oxide concentrations. The calculated mass percent of zinc oxide for Coppertone and Banana Boat were 0.014% and 0.0411%, respectively. The advertised mass percent of zinc oxide for Coppertone and Banana Boat were 14.5% and 4.0%, which were greater than the values calculated. This information could be useful in determining the cost effectiveness of zinc oxide sunscreens.

Opioid Addiction & The Hormonal Factors Associated With It

Nicholas Hoins
DC - College of Liberal Arts and Sciences

Krystle Dooley

Brooke Thompson

Samantha Molinaro

Mentor: Lindsey Hamilton, CLAS-Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Stress is the primary cause of addiction. Opioid addiction is responsible for one of the biggest health epidemics to plague North America. The United States has experienced a dramatic increase in opioid abuse that is unfortunately continuing to grow. According to the U.S Department of Health and Human Services (HHS), approximately 42,000 - 52,000 people have perished due to opioid abuse or misuse in 2016. On average, 116 people die per day due to the opioid crisis. Each case varies with sex differences, hormonal effects caused by the drug, as well as the type of treatment (if at all) the individual received. This review will address specific aspects of opioid addiction treatments, ultrarapid opioid detoxification, the potential use of Oxytocin as a treatment, and the use of Methadone and Buprenorphine. Another area of focus will be on the role of certain hormones such as corticotropin-releasing hormones on withdrawal. We will also discuss how the sex of the users influences how the individual reacts to opioids. The stress response is also an integral part of drug abuse as hormones like glucocorticoids may affect the reward pathway associated with drug use.

Ground Observations of Electromagnetic Waves from Space

Poorya Hosseini
DC - College Engineering and Applied Science

Mentor: Dr. Mark Golkowski, Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The near-Earth space environment is in a plasma state and is also extremely variable due to the solar driven phenomena. This region hosts a large number of electromagnetic wave modes, which interact with the high energy particles of the Earth's radiation belts. The waves are known to play an important role in the dynamic of the Earth's radiation belts and the state of the radiation belts affects communication and electrical power technologies in space and on Earth. Although these waves can be observed on spacecraft, ground-based observing stations can provide orders of magnitude higher data volumes and decades long data coverage essential for certain long-term and statistical studies of wave properties. The research being pursued involves studying the theoretical and numerical aspects of the wave-particle interactions in the near-Earth space environment with ground based observations. The main impact of my work will be to further understanding of these waves generation, propagation, and their impact on the Earth's radiation belts. This will allow for improved forecasting of space weather which affects a large class of technological systems.

Stories in the Stones: Finding the Source of Stone Tool Material in NW Colorado

Denise Hoth (UROP Recipient)
DC - College of Liberal Arts and Sciences

Courtney Crawford
DC - College of Liberal Arts and Sciences

Roger Oberdier

Mentor: Department Chair Tammy Stone, Anthropology,
DC - College of Liberal Arts and Sciences

Abstract:
The prevailing hypothesis for lithic material use and procurement patterns in Northwestern Colorado is that materials were primarily sourced and used locally (Reed & Metcalf 1999). We identified the local cultural area as the previously established Green and Yampa River Unit (Reed & Metcalf 1999). Our research focused on a knoll, near the Yampa River, in Moffat County, Colorado. There we were able to identify open air artifact concentrations. Using private collections analysis on assemblages from Moffat County, we were able to estimate a possible usage range for this area beginning approximately 11,500 B.C.E. and ending in the mid-1900s C.E. We determined that the lithics identified in our open air sites are sourced from the local area, which fits the hypothesized pattern of lithic material procurement and use for the proposed date ranges. Thus, our research supports the prevailing hypothesis.

"Glamour Girls:" American Print Media Perspective on Women's Military Corps in World War II

Brittany A. Huner
DC - College of Liberal Arts and Sciences

Mentor: Dr. Rebecca A. Hunt, History,
DC - College of Liberal Arts and Sciences

Abstract:
After the United States entered World War II in 1941, the country faced shortages of manpower. To make up for the shortages, the military established women's corps for women to take on non-combat jobs. The United States first established the Women's Auxiliary Army Corps (WAAC), later brought into the Army as the Women's Army Corps (WAC). Other branches of the military created their own corps to allow women to serve in various capacities, which included: the Navy's Women Accepted for Voluntary Emergency Service (WAVES), the Army Air Forces' Women Airforce Service Pilots (WASP), and the Marine Corps' Women's Reserve (WR). Analyzing American newspaper and magazine articles, from large publications like the New York Times and Life to small town local papers, reveals patterns in the coverage of women's corps. In some cases, the articles showed a patriotic support of the women's service and work. Many newspapers and magazines, however, used language and descriptions of the women's corps in ways that emphasized their femininity as unsuitable to their work and reassured readers that the women's role was temporary and that the women would return to their "pre-war selves." This paper focuses on how articles focused on the women's appearance to oversexualize them or portray them as "glamour girls" who cared more for their clothes and makeup than the important work they were doing in the corps.

Dopamine Signalling Modulation Following Administration of Heroin and Opioid Agonist Treatment

Dominic Isaacs
DC – College of Engineering and Applied Science

Mentor: Dr. Erik B. Oleson, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Dopamine signaling is heavily implicated in executive functions like motivation and evaluative behaviors. We know opioids increase dopamine concentrations, but how an abused opiate does this versus one used in agonist therapy is not understood. Currently, Suboxone is one of the most common opioid agonist therapy treatments, therefore it is important to understand how the active opioid in this drug (buprenorphine) compares to an illicit one, like heroin. Additionally, there is a need to understand opioid addiction as its prevalence and lethality rises in the United States. To do this, we utilize Fast Scan Cyclic Voltammetry to assess transient dopamine activity in awake, behaving rats. Dopamine concentrations are quantified using principal component analysis. Understanding the changes to mesolimbic dopamine signaling in awake-behaving rats following heroin and buprenorphine administration will provide critical knowledge to clinicians and researchers attempting to end addiction to opioids.

Designing Primers For the Selective Enrichment of Low Abundance Environmental Microbes

Connor Jacobs
DC - College of Liberal Arts and Sciences

Mentor: Dr. Chris Miller, Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Information contained in the genome of a bacteria or archaea illuminate the origins of eukaryotic life, lead to new pharmaceutical developments, and inform our climate change models. Shotgun metagenomics involves gathering an environmental sample such as soil, water, rock, etc., breaking up the genetic material into small fragments, and then sequencing as many of these small fragments of DNA as possible. Once these short sequencing “reads” are generated they need to be assembled into complete genomes. Trying to assemble genomes for organisms that are low abundance in the sample often results in fragmented genomes, missing key genes and predicted functions. Our primary goal in this experiment is to target and enrich one of these less abundant species with the ultimate goal of inferring its function in the environment. In our experiment we are interested in a low-abundance archaea known as ANME-2D found in a wetlands ecosystem. ANME-2D is predicted to be a vital component of the methane cycle in this, and other environments. Using input data from the existing low qualityANME-2D assembly, we wrote the SWGA program. This program designs primers targeted to the ends of the existing fragments. These primers were used to guide phi 29 polymerase in a multiple displacement amplification reaction, the goal being to selectively amplify regions of the ANME-2D genome that were not covered in the original assembly. Preliminary analysis indicates that some enrichment of the ANME-2D DNA was achieved. Future analysis of the improved ANME-2D genome will clarify its functional role in the methane cycle.

Duration-dependent neural control of voluntary exercise

Jennifer Jaime
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Margaret K Tanner
DC - College of Liberal Arts and Sciences

Natalie Haddad
DC - College of Liberal Arts and Sciences

Nicolette A Moya
DC - College of Liberal Arts and Sciences

Mykola Ostrovskyy, Megan Miner, Benjamin Greenwood

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

Abstract:
Lack of physical activity contributes to chronic illness. Identifying how dopamine (DA) promotes exercise could help facilitate exercise behaviors. Rodents allowed voluntary access to running wheels display distinct phases of acquisition, during which rats learn how to wheel run, and maintenance, during which voluntary exercise reaches a steady state. Our goal was to begin to isolate the neural circuits underlying voluntary exercise behavior during these distinct phases. DA projections from the midbrain to the dorsomedial striatum (DMS) are thought to be involved in the acquisition phase of skill learning, whereas DA projections to the dorsolateral striatum (DLS) are thought to support habitual behavior. Thus, we hypothesized that DA-DMS circuits are preferentially recruited during the acquisition phase compared to the maintenance phase of voluntary exercise. Moreover, we hypothesized that the DMS would be required to acquire voluntary exercise, but the DLS would support exercise during the maintenance phase. A bout of voluntary exercise during the maintenance phase increased pCREB in DMS-projecting midbrain neurons that were identified with a retrograde tracer injected into the DMS. Interestingly, running in the maintenance phase no longer increased pCREB in DMS-projecting midbrain neurons. Inactivation of the DMS during the acquisition phase with Mucimol/Baclofen reduced wheel running during the acquisition phase. These data suggest that DA-DMS circuits support exercise during the acquisition phase, but as voluntary exercise becomes habitual, exercise no longer recruits DA-DMS circuits. Future studies will determine the role of the DA-DLS circuit in the acquisition and maintenance of voluntary exercise.

The Role of Implicit and Explicit Memory in Visual Search Performance

Amber Johnson (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Carly J Leonard, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
While engaging in our everyday environment, we visually encode the surroundings using implicit or explicit memory processing. These memories can then go on to influence our responses. In the current study, we are interested in examining individual differences in these memory systems. Priming is an implicit memory effect where exposure to one stimulus can influence a response to a subsequent stimulus. Previous studies reveal that the response to a pop out target is faster and more accurate when the target color is repeated on consecutive trials. When the target color switches in subsequent trials, individuals respond slower with less accuracy. One goal of this experiment was to use a priming of pop out paradigm to investigate individual differences in how priming changes when the likelihood of repetition changes. In terms of individual differences, it is well known that individuals also vary in working memory capacity, which is a more explicit form of memory. In our task, working memory was measured using a change detection task where participants had to identify a color that changed between visual displays presented at different times. We hypothesized that working memory capacity would correlate with priming in the pop out search task. Our results found faster reaction times with repeated stimulus than switched, which replicates previous findings, but no effect of probability. We found there was a trend for a relationship such that those with higher working memory had lower priming.

FARADAY MEASUREMENT OF MAGNETIC HYSTERESIS AND MAGNETOSTRICTION OF MILD STEELS

Sean M Joyce
DC - College Engineering and Applied Science

Mentor: Dr. Stephen Gedney, Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The objective of this research is to develop novel measurement procedures for the quantification of the non-linear hysteretic susceptibility and magnetostriction of mild steels. While at sea, naval vessels will endure tremendous changes in magnetic properties and mechanical stress due to maneuvering in the earth's magnetic fields as well as continual changes in hydro-dynamic stresses from wave motion. Such changes in stress change the magnetic properties of the steel, impacting the ship signature. This research aims at providing the ability to predict the changes in the magnetic properties of steels undergoing dynamic changes in magnetic and mechanical stresses. Doing so will facilitate the prediction and removal of magnetic signatures from naval vessels – providing the cloaking from underwater sensors that is essential to the survival of the vessel. Novel experimental methods have been developed in our laboratory using a Faraday coil measurement system. These methods have enabled the accurate prediction of the essential physical parameters needed to predict non-linear susceptibility of mild steels as a function of magnetic fields and axial mechanical stresses. The apparatus and experimental results will be presented demonstrating the capabilities of the measurement system.

Histrionic Personality Traits, Substance Use, and High Risk Sexual Behavior in Men Who Have Sex with Men, Men Who Have Sex with Women Only, and Women

Brenda Kane
DC - College of Liberal Arts and Sciences

Mentor(s): Associate Professor Dr. Elizabeth Allen,
Department of Psychology,
DC - College of Liberal Arts and Sciences

Dr. Eric Benotsch,
Associate Professor, Virginia Commonwealth University
Dr. Christopher D. Nettles, Project Director,
American Psychological Association

Abstract:
Behavioral health research has shown the importance of understanding the psychological correlates of substance use and high risk sexual behavior (HRSB). Individuals high in histrionic personality traits often crave novelty, stimulation, and instant gratification, are highly suggestible, and display inappropriate, sexually seductive behavior. The present study examines the associations between histrionic traits, substance use, and HRSB in three groups: MSM (men who have sex with men), MSW (men who have sex with women only), and women. Survey data were collected from 398 patients seeking community health services via audio computer-assisted self-interviewing. Results show that MSM scored significantly higher in histrionic traits, used poppers/inhalants and "other drugs" significantly more frequently, and reported having significantly more sexual partners than both MSW and women. However, these significant differences in histrionic scores were no longer present when controlling for use of poppers/inhalants and "other drugs." The three groups did not differ significantly in the frequency with which they used alcohol, marijuana, ecstasy, cocaine, or heroin, and they did not differ significantly in their number of times having sex after too much to drink, number of times having sex after using drugs, or total number of unprotected sex acts. Higher histrionic scores were significantly linked to higher levels of substance use and HRSB in MSW and women, but not in MSM. These findings may help inform future studies and interventions that link maladaptive personality traits, substance use, and HRSB for various groups of individuals.

Historical Occurrence of Intersex in Fish

Harmanpreet K Kang (UROP Recipient)
DC - College of Liberal Arts and Sciences

Marian C Evans
DC - College of Liberal Arts and Sciences

Beatriz Y Oliva
DC - College of Liberal Arts and Sciences

Angela Geiger
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Alan, M, Vajda, Integrative Biology,
DC - College of Liberal Arts and Sciences

Dr. David Norris, Professor Emeritus, CU Boulder

Abstract:
The primary objective of this project was to utilize 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 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 coverslipped 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.

A tale of three substrates: Effects of trampling on ostrich eggshell and applicability to the archaeological record

Hannah M Keller
DC - College of Liberal Arts and Sciences

Mentor: Dr Jamie M Hodgkins, Anthropology,
DC - College of Liberal Arts and Sciences

Abstract:
Trampling experiments have previously been undertaken to describe post-depositional effects on faunal remains. Few taphonomic experiments have looked at Ostrich eggshell, despite its ubiquity at archaeological sites in Africa and Asia. This experiment seeks to fill some of the gaps in taphonomic knowledge by determining the effect of trampling on ostrich eggshell. One hundred and twenty pieces of ostrich eggshell were trampled in sand, soil, or gravel. Two sets of experiments were undertaken on each substrate, for ten minutes or two hours. The more intense trampling and increasingly compact substrate yielded a higher number of fragments, and lower average length. An increased number of marks were noted after trampling, however, many of these were identical in appearance to marks occurring from the process of fragmentation. Discoloration of fragments subjected to two hours of trampling was significantly higher, with variation between substrate. Comparison of ostrich eggshell recovered at a Middle Stone Age site in South Africa suggests that the surface modification observed was not caused by trampling. Further studies should consider additional taphonomic effects, including trampling eggshell placed subsurface, and tying together subsistence and ecology during environmental shifts in the late Pleistocene.

Urban Wildlife Monitoring in the Denver Metro Area

Thomas Kennedy
DC - College of Liberal Arts and Sciences

Sarah St. Onge
DC - College of Liberal Arts and Sciences

Mentor: Dr. Laurel Hartley, Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Cities around the world continue to expand to support the world's ever-growing human population. This expansion of cities leads to the urbanization of the surrounding natural and rural landscapes, to which many species call home. Some native species will disappear while others will adapt. Additionally, other non-native species will appear in these newly developed urban areas. This creates a unique opportunity to study the dynamic interactions of these urban landscapes and the wildlife that inhabit them. We have partnered with the nationwide Urban Wildlife Information Network (UWIN) out of Chicago, IL, where many cities are working together with the goals of supporting land and wildlife management decisions, wildlife and habitat conservation, urban biodiversity, disease dynamics awareness and help with human-wildlife conflicts, both regionally and nationally. The goal of this project is to set up a long-term wildlife monitoring protocol in order to assess mammalian species distribution and population dynamics across an urban to rural gradient along Colfax Avenue in Denver, CO using motion-activated camera surveys. We will show the preliminary data that has been collected over four seasons of 2017, providing a foundation for future urban wildlife research in the Denver metro area.

Assessment of Subject's Willingness to Participate in Rheumatoid Arthritis (RA) Prevention Studies: Research Participation Influences (RPI) Study

Katherine C Ketcham (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor(s): Dr Kevin Deane, Rheumatology,
AMC - School of Medicine

Chelsie Fleischer, MA,
University of Colorado,
Professional Research Assistant/Clinic Manager
Marie Feser, University of Colorado,
Research Study Coordinator

Abstract:
Rheumatoid arthritis (RA) is an autoimmune disease that causes joint inflammation and damage. It is known that an autoantibody blood marker called 'anti-CCP' is present in the blood years prior to the development of clinically apparent RA. StopRA is a randomized, placebo controlled clinical trial in individuals who are anti-CCP positive to determine if taking the RA drug hydroxychloroquine for one year can prevent or delay progression of clinically-apparent RA. It is unknown, however, how subjects will respond when asked to participate. The Research Participation Influences (RPI) study is being performed in parallel with StopRA with the goal of understanding what factors influence a study subject's willingness to participate in an RA prevention study. The RPI Study administors questionnaires online through SurveyMonkey and through phone interviews to individuals who are eligible for StopRA and have chosen to participate, or not. These questions evaluate a subject's reasons for participating (or not). Since the start of RPI on 3 June 2016, 42 subjects who were offered participation in StopRA completed the RPI survey. Before we perform in-depth analyses, we would like to enroll additional subjects. Possible reasons for this loss of capture includes potential misunderstanding of the study and consent forms. Specifically, upon reviewing the on-line consent for RPI, many people click decline, which stops the study. To correct this, a better explanation of the process will be added to the emails that contain the survey link. Once we correct this issue, we will continue with planned enrollment and complete full analyses.

DNA Methylation level of OXTR SNP genotypes: Influence Altruistic Behavior

Jennifer T Khong (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentors: Dr. David Albeck, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Altruistic behaviors are important for human society to function well. Levels of altruistic behavior vary greatly between individuals due to the influence of both genetic and environmental factors. Our lab has previously found that the magnitude of a person's neural response, as measured using EEG scalp recordings, differs across people possessing different single nucleotide polymorphism (SNP) genotypes on their oxytocin gene receptor (OXTR) when shown negative pictures. Further, there was a significant correlation between a person's EEG response to negative pictures and their level of self-report altruism, measured using a survey on altruistic behavior. Given these findings, that there seems to be a genetic factor that influences both neurophysiology and level of self-reported altruistic behavior, we hypothesize that there may also be an environmental influence acting on the OXTR. To address this question, we postulate that levels of DNA methylation on the OXTR potentially also correlate with participants' EEG response and / or their reported altruistic level. The DNA methylation measurement procedure has not yet been performed on the DNA samples, however we believe that individuals with the GG allele genotype may express higher levels of DNA methylation in comparison to A allele carriers. We plan to perform the DNA methylation measures this semester to get the data that we need to test our hypotheses. If the results support our hypotheses, this will imply an interaction between a person's environmental experience, and changes in levels of DNA methylation. More importantly, in turn, differences in DNA methylation level may alter brain physiology and altruistic behavior.

Migraine self-management activities and the relationship between loci of control, and physician migraine management.

Caitlin Kienzler
DC - College of Liberal Arts and Sciences

Trelsie Sadler

Mentor(s): Dr. Amy Wachholtz, PhD Dr. Amy Wachholtz,
Clinical Health Psychology,
DC - College of Liberal Arts and Sciences

Amrita Bhomwick, MBA, MPH

Abstract:
Introduction: Few research studies examine the link between avoidance of migraine triggers and patient feelings regarding internal (migraine self-management) and external loci of control (perception of physician treatment). We hypothesized that both internal and external loci, as rated by participants, would be significantly related to whether or not a migraineur reported taking active steps to avoid migraine triggers. Method: 4,502 U.S. adult migraine participants completed the 2015 Migraine.com survey. 4,341participants identified specific migraine triggers and steps in migraine self-management (e.g. make lifestyle/diet changes, actively seek out information on migraine medications). Locus of control ratings were assessed across multiple questions using a 7-point Likert scale. Results: Chi square tests on migraine self-management and perceived internal locus of control ($X^2(24)=43.3$, $p< .05$), showed a significant relationship to whether a participant took active steps to avoid specific migraine triggers. However, the items related to external (physician) locus of control (e.g. physician evaluation and treatment of symptoms) did not show a significant relationship with active migraine self-management ($X^2(24) =23.9$, $p>.05$). Discussion: Avoidance of migraine triggers and migraine self-management showed a relationship with feelings of internal loci of control but did not show a relationship with feelings of external loci of control. Further examination of perceptions of loci of control may provide intervention points to help providers encourage patients to take more active steps in preventing and reducing their migraines through self-management.

Analysis of Wnt, Insulin, or FTO Activated Cells with Nanostring Gene Expression Profiles

Kathryn L. Kilpatrick
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Mentor: Dr. Christopher J Phiel, Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Epigenetic regulation is difficult to study and unravel because multiple processes and participants converge to create a unique gene expression that is often dependent upon external stimuli. As such, these outcomes can be altered by small changes in any of many different activities, such as in signaling cascades or kinase activity. Determining what is interacting can be difficult. Changes in these pathways can lead to altered phenotypes. The inhibition of the kinase Gsk-3 causes stem cells to remain persistently pluripotent. In this study, we analyzed gene expression profiles of cells with activation of two Gsk-3 related signaling pathways, wnt and insulin signaling. We also overexpressed the demethylase FTO, implicated in m6A-tag removal and subsequent renewal of pluripotency.

A numerical method for elucidating the chest wall's non-linear elastic contribution to respiration

Matthew Kiselevach (UROP Recipient)
DC - College Engineering and Applied Science

Matthew M. Kiselevach
DC - College Engineering and Applied Science

Mentor: Dr. Bradford J. Smith, Bioengineering,
DC - College Engineering and Applied Science

Abstract:
Improved ventilation has decreased mortality rates for patients with acute respiratory distress syndrome (ARDS) from 80% to nearly 40%, but the lack of individualized ventilation patterns has prevented reducing the mortality rate further. Ventilator induced lung injury (VILI) is one of the main contributors to mortality in ARDS patients and can be prevented by keeping alveoli open using positive end expiratory pressures (PEEP) to prevent atelectrauma, while also preventing overdistension and volutrauma. In order to understand the pathogenesis of ARDS and VILI, morphometry is used to analyze lung structure over a range of airway pressures. However, this approach requires preserving physiological volumes. The airspace volumes in fixed tissue are dependent on the airway pressure at the time of fixation. Because perfusion fixation may be performed with the chest wall of the mouse retracted to provide surgical access, the contribution of the chest wall to pulmonary system mechanics must be accounted for in order to achieve the desired state of lung inflation. To this end we have implemented a numerical model that translates airway pressures in open-chested mice to an equivalent airway pressure in a normal, closed-chested mouse. Pressure-volume loops were measured in 5 mice with the chest wall intact and retracted. A single compartment viscoelastic model was then numerically fit to the data in order. The simulations demonstrate that at low airway pressures the chest wall serves to maintain patency. As airway pressure is increased the stiffness of the chest wall increases nonlinearly and restricts expansion of the lung.

Opening the Black Box: A Novel Classification of Prolonged Labor Phenotypes

Katherine Kissler
AMC - School of Nursing

Mentor(s): Dr. Nancy K. Lowe, College of Nursing,
AMC - School of Nursing

Dr. Teri Hernandez, PhD, RN, Anschutz Medical Center School of Medicine

Abstract:
The rate of cesarean deliveries (CD) in the United States is 26.5%, well above the goal targeted by HealthyPeople 2020 aimed at preventing maternal and infant complications associated with this significant abdominal surgery. Prolonged labor accounts for about half of cesarean deliveries performed during labor in the United States. The most common management for prolonged labor is augmentation with Pitocin, a form of exogenous oxytocin. Pitocin treatment has been shown to reduce the length of labor by an average of 2 hours, but does not reduce the risk for CD. Novel biomarkers of prolonged labor suggest multiple phenotypes of prolonged labor with different underlying physiologies. Through this metasynthesis of the extent research on prolonged labor, we hypothesize that uterine fatigue explains, in part, the difference in response to Pitocin between women who go on to have a vaginal birth and those that undergo CD. This novel classification will contribute to a framework for future research to develop innovative protocols for management of prolonged labor that promote vaginal birth and reduce complications from unnecessary CD.

A Real-Time Framework for Semantic SLAM

Tish Konz (UROP Recipient)
DC - College Engineering and Applied Science

Andrew Hill
DC - College Engineering and Applied Science

Duc Le
DC - College Engineering and Applied Science

Shawn Bachlet
DC - College Engineering and Applied Science

Ameen Sassi

Mentor: Dr. Farnoush Banaei-Kashani,
Computer Science and Engineering,
DC - College Engineering and Applied Science

Abstract:
Simultaneous Localization and Mapping (SLAM) is a computational problem where an agent (e.g., an aerial or terrestrial robot) autonomously explores an unknown environment to construct a map of the environment using sensor data, while simultaneously keeping track of its location within the map. SLAM is a computationally hard “chicken-and-egg” problem with numerous applications in disaster response, autonomous vehicle navigation, and bomb threat response. In particular, a real-time SLAM framework balances the trade-off of map accuracy and robustness with real-time execution constraints. With this research and development project, we introduce and implement a real-time semantic SLAM framework, where map construction is augmented by on-the-fly object recognition to produce semantic labels within the map. Our proposed semantic SLAM framework enables an indoor land vehicle, equipped with both depth sensor and RGB camera, to efficiently and autonomously explore and map an arbitrary unknown environment. Our implementation uses a graph-based algorithm for map construction, along with a deep learning component, (namely, a convolutional neural network (CNN)) to recognize and classify objects in real-time. To demonstrate a specific application of our real-time semantic SLAM framework, we extend the implementation by introducing a machine learning based anomaly detection algorithm that uses the constructed semantic map (including the recognized and classified objects) to detect and report anomalous presence of objects in the environment. Such an extended SLAM framework is applicable in numerous scenarios, e.g., can be deployed on a security patrol robot to detect abandoned baggage in a terminal or an active shooter on campus.

Monkey-see, Monkey-do: An Eye-tracking Study Assessing the Efficacy of Feed-forward Training in Histology Visual Literacy Development

Hannah Koury
AMC - School of Medicine

Mentor(s): Associate Professor Lisa M.J. Lee,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Carly J. Leonard, PhD, Department of Psychology - University of Colorado Denver
Patrick M. Carry, MS, Musculoskeletal Research Center, Department of Orthopedics, Children's Hospital Colorado

Abstract:
Histology requires competency in visual identification of tissues on virtual microscopy (VM) slides. It is currently unknown how visual literacy is efficiently developed utilizing VM. Feed-forward training utilizing experts eye movements has been shown to be an effective training method in other virtual environments. Novices who see expert's eye movements perform better on subsequent visual identification tasks than those who don't. The objective of this study was to assess whether feed-forward training would yield higher efficiency in visual literacy development in histology. In an IRB-exempt study, first-year graduate students enrolled in a histology course were randomly assigned to two groups. The experimental group (n=11) viewed videos of the experts' scan-path completing blood cell identification tasks on VM. The control group (n=9) viewed the same videos, but without the expert's scan-path overlaid. Both groups completed a series of blood cell identification tasks. The following parameter averages were analyzed utilizing linear mixed model regression: (1) time to identification; (2) total number of fixations; and (3) average total scan path distance. On average, identification time was 1.4% lower (p=0.892), number of fixations per slide was 10% lower (p=0.1893), and average scan path distance was 41.7% lower (p=0.1959) in the experimental group compared to the control. The eye movement patterns in the two groups are noticeably different, with the experimental group being more like expert eye movement profiles reported in literature. This provides preliminary data that feed-forward training may be a viable method to teach pattern recognition skills and visual literacy development in histology.

A Computational Study of the Villin Headpiece Subdomain HP-36

Tanja Kovacevic
DC - College of Liberal Arts and Sciences

Danielle Miller
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Hai Lin, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Liliya Vugmeyster, Chemistry Department, College of Liberal Arts and Sciences; Dr. Michael Crowley, Chemistry Department, College of Liberal Arts and Sciences

Abstract:
Hydrophobic side chain interactions are a major dynamic force in the folding of globular proteins and the aggregation of many non-globular proteins. HP-36, a headpiece subdomain on villin, has a hydrophobic core ideal for studying side chain interactions similar to those found in more complex proteins. The internal motions of the hydrophobic core residues have yet to be detailed. Solid-state NMR of 3 phenylalanine residues (F47, F51, and F58) implies the three residues are flexible and undergo frequent ring flipping. However, preliminary computational results suggested F58 was an order of magnitude less flexible than F47 or F51. Biased molecular simulations, which use biasing potentials to enhance sampling, were used to investigate the motions of these three phenylalanine residues within the hydrophobic core of HP-36. Our initial studies determined the free-energy barriers to ring flipping for each of the phenylalanine residues.

Acknowledgments: This project is supported by the NSF (CHE-1564349), XSEDE (CHE-140070), NERSC (m2495), the Camille and Henry Dreyfus Foundation (TH-14-028), and the Undergraduate Research Opportunity Program of the University of Colorado Denver.

The Infiltrator: How BPA is seeping out of plastics and into our gene expression

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Tiare K. Poleschook
DC - College of Liberal Arts and Sciences

Jariel Ara V. Jusi
DC - College of Liberal Arts and Sciences

Mentor: Dr. Lindsey R. Hamilton, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Bisphenols are chemicals that disrupt normal functioning of the hormonal system in various species. Especially concerning, bisphenols are prevalent in consumer products including, but not limited to, canned foods, plastics, medical devices and thermal receipt paper. Bisphenol-A (BPA) is our primary focus due to its widespread presence in our environment; BPA is found in 95% of products containing polycarbonate plastics and epoxy resins. Research links BPA exposure to a myriad of detrimental effects in animals and humans. Our research will look to answer how epigenetic changes are caused by the presence of BPA in both males and females. We have examined 24 scholarly articles that have tested the effects of BPA on epigenetic modifications including reproductive functions; an overwhelming body of evidence points to the dangers of BPA. Low-dose BPA exposure can affect the fertility and reproductive physiology in humans. For males, the impact of BPA can affect semen quality, pubertal timing, and estradiol levels. Females have exhibited changes in estrogen receptors, egg quality, and increased infertility as a result of altered BPA levels. Exposure in-utero has been linked to obesity, insulin resistance, and an increase in adult-onset diabetes in both genders. It appears maternal and paternal BPA exposure can induce negative effects in a developing fetus; these heritable changes affect the individual and subsequent generations.

“I don’t live in an apartment”: Defining The Urban Kid

Leah Link
DC - School of Education and Human Development

Mentor: Instructor Robin, Brandehoff,
School of Education,
DC - School of Education and Human Development

Abstract:
This research suggests what the urban child is, defined by both urban and rural children to gain a better understanding of what urban life is like as an outsider. While interning at an after-school program in the Five Points neighborhood, questions mostly revolved around how the lives of urban children differed from children living in non-urban areas. The focus of the internship was to explore the roles that children play beyond being “students” in the classroom, and to instead see them as people (Bronfenbrenner, 1977). To deepen the understanding of this research, the focus shifted from how adults view children to how children view themselves and each other. This study explores the research questions of “how do urban children see themselves and how are they viewed? Data included small group interviews with children who are a part of the Five Points community and separate interviews with children who are a part of a community in the town of La Salle, Colorado. Questions surrounded their ideas of the “urban kid” identity and where their ideas came from. Additionally, children were asked to draw their neighborhood and discuss how their neighborhood impacted their thinking about “urban kid” identities. Findings suggest that both rural and urban children view themselves as isolated and confined to their neighborhood (Jenson & Fraser, 2015), whereas their ideal of the “urban child” is one who lives in a condo in Downtown Denver and experiences daily activities outside of their home.

Effect of Temperature on the Acetic Acid Buffer System

Ricky Lippincott
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Raphael M Angoulvant
DC - College of Liberal Arts and Sciences

Mentor: Ms. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
The objective of this experiment was to investigate the effect of temperature changes on the acetic acid buffer system. Buffers are systems that contain approximately equal amounts of a weak acid and its conjugate base that resist changes in pH when small amounts of acid or base are added to them. If acid or base is added in large excess, the buffer will no longer be able to regulate pH. The buffer tested was a acetic acid and sodium acetate buffer. To test its capacity, we added 0.1 M hydrochloric acid or 0.1 M sodium hydroxide to the acetic acid buffer at 1.0 °C, 20.0 °C, and 40.0 °C until the buffer broke. The buffer broke after the addition of 20.00 mL of hydrochloric acid or sodium hydroxide at each temperature. The experimental pKa values for 1.0 °C, 20.0 °C, and 40.0 °C were 4.73, 4.63, 4.70 and literature pKa values are 4.78, 4.74, and 4.77, respectively. When compared to literature values and each other, experimental pKa values showed a maximum of 3% difference. The low percent differences and consistency of observed breaking points indicate that temperature has no profound effect on the capacity of the acetic acid buffer system.

Permanence: The Placement of Body Art in Art History

Nicole Lockhart
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
Even though tattoos are considered “body art,” they are left out of art history as an artistic practice. By excluding the practice of tattooing from the art historical canon, we are, in effect, excluding a significant aspect of visual culture, complete with styles, designs, and modes of practice from various cultures around the world. This study seeks to bridge the gap between tattoo and the fine arts by analyzing the former within the definition of the latter. By comparing the work of tattoo artists like Don Ed Hardy with theoretical texts that provide definitions for “fine art,” this paper sheds new light on tattoos. This paper will specifically examine scholarship that places tattooing in an anthropological rather than art historical context. In doing so, I will show that while tattooing holds to artistic conventions, it is problematically left out of art history and categorized as anthropological. When tattooing is held to the same standards as painting, drawing, sculpture, and other recognizable forms of “fine art,” we can see how it is indeed an equally valid form of visual culture.

Diurnal variation in neuroplasticity-related intracellular signaling within the prefrontal cortex in response to conditioned fear extinction training.

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Nicholas J. Tuta

Elizabeth R. Woodruff

Brian A. Lloyd

Mentor(s): Associate Professor Sondra T. Bland, Psychology,
DC - College of Liberal Arts and Sciences

Dr. Robert L. Spencer,
Department of Integrated Physiology,
University of Colorado Boulder

Abstract:
Conditioned fear is a form of associative emotional learning, and impairment in conditioned fear extinction learning contributes to the persistent pathology of post-traumatic stress disorder. We have previously found a reliable time of day variation in auditory tone conditioned fear extinction learning in rats (Woodruff et al., 2015). Rats trained and tested in the middle of their active period exhibit superior conditioned fear extinction memory compared to rats in the middle of their inactive period. This learning and recall depends on medial prefrontal cortex (mPFC) and the amygdala fear circuit. This study examined whether there may be diurnal differences related to intracellular signaling in the mPFC in response to conditioned fear extinction training. Mammalian target of rapamycin (mTOR) is a protein kinase that regulates a number of processes including protein synthesis and is thus important for synaptic plasticity and memory formation. Downstream targets of mTOR include protein S6, that when phosphorylated initiates mRNA translation, which is critical for memory consolidation. The present study assessed diurnal modulation of conditioned fear extinction-induced expression of phosphorylated (p) S6. Immunohistochemistry was performed. There were significant interactions of treatment (Extinction or Control) by time of day. Time of day had no effect on pS6 expression in either the PL or IL of home cage controls. Thus, activation of the mTOR pathway resulting from conditioned fear extinction is influenced by the time of day in which extinction takes place, and perhaps paradoxically, we observed less activation during the time of day when we see superior extinction learning.

A robotic stereotaxic platform for small rodents based on 3D computer vision

Phuong Ly
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Mentor: Dr. Tim C. Lei,
Department of Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
Many neuroscience behavior studies require injecting DNA material or fluorescent dyes to specific brain regions of small rodents. Currently, this type of injections or surgical procedures are done manually by skilled researchers using mechanical based stereotaxic platforms. However, the alignment can be very time-consuming and prone to errors due to the small sizes of the brain nuclei.

Here we propose to develop a computer-assisted robotic 3D computer vision stereotaxic platform for brain surgeries of small rodents with improved accuracy and speed. With our approach, the rodent is placed on the top plate of a 6 degree-of-freedom Stewart platform with pneumatic controls. A video projector is then used to project a series of structured illumination patterns to the animal's skill. Two video cameras are used to capture 2D images of the animal skull and the images are then processed to create a 3D skull profile of the animal. Using 3D reconstructed skull profile, the animal can now be positioned using the Stewart platform to align the brain nucleus to a surgical tool precisely and rapidly.

Comparison of Seasonal Spatial Patterns in Residential Burglaries in Neighborhoods of Denver

Shalini R. Mahanthege
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Mentor: Professor Joshua P. French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
The number of residential burglaries have substantially reduced over the years, but the costs of burglaries remains high with an estimated $4.6 billion loss in 2010 as reported by the FBI. On average, an individual suffers a loss of $2119 due to residential burglaries. Residential burglary data in each neighborhood in the city/county of Denver obtained from 'Denver open catalog crime database' from 2013 to 2018 was used in this study. Data indicates that more burglaries occur during summer compared to winter. Hence this study investigates whether there is a significant difference in the spatial patterns of residential burglaries during summer and winter. Spatial patterns of past burglaries will indicate high risk neighborhoods for each season, which would help to optimize police surveillance in neighborhoods and give accurate information about awareness of home burglaries. This study can also impact the long-term and short-term allocation of police officers to precincts in Denver.

Patterns in the Residential Burglary Crime Rates and the Number of After School Programs in the Elyria Swansea and Hampden South Neighborhoods of Denver

Matthew J Manfredo
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Safa Mechergui
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Karima Osman
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Elena Parapunova
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Mentor:Assistant Professor Dr. Audrey Hendricks,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
In the past five years, four of the top five Colorado cities where crime has increased the most are in the Denver-Metro area (FBI's Crime in the US Report, 2012 & 2016). To try and understand this issue, we utilized the Denver Open Data Catalog and researched information about residential burglary and the number of after school programs in the Elyria Swansea and Hampden South neighborhoods of Denver. We performed statistical tests to see if we could observe patterns and if the rise in crime rate was partially due to the relationship between the two variables.

Monoamine effects on individual roles of pavement ants in an intercolony war

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Elishaba Fay

Kyle Hash-Dabney

Mentor: Associate Professor Michael, Greene, Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Specific Aim 1 Question:
Q1: What is the shape of the aggression decision threshold curve for live ants?

Restated: How do the brain monoamine levels of fighting ants differ from nestmates who are not fighting or from ants recruiting others to fight?

Monoamines are primary drivers of action in animals with primitive brains. When studying the impact of these drivers, it is easiest to study simple, primal behaviors like fighting. It is also known that interaction with other animals, specifically familiar animals belonging to the same group, can influence monoamine levels serotonin (5-HT) and octopamine (OA, an invertebrate analogue to norepinephrine). Pavement ants (Tetramorium caespitum) engage in inter-colony wars initiated by individual ants that come into contact with conspecific non-nestmate ants during foraging expeditions. A pavement ant has a high probability of fighting if: 1. It has had a recent history of interactions with nestmates; and, 2. It detects a mismatch between nestmate recognition cues coded in cuticular hydrocarbons and internal template. Interactions with nestmates elevates brain levels of the monoamines 5-HT and OA. A single ant cannot wage war alone; however, hundreds of nestmates must be recruited on each side to engage in ritualized combat that lasts hours. While most of the ants recruited will join the war as fighters, some will join as recruiters and others will remain bystanders, neither recruiting nor actively fighting. In this paper we see to understand how do differences in brain monoamine concentrations for ants assuming these different roles? In other words, what brain states promote a decision to fight, recruit, or refrain from fighting in pavement ant wars, and what is the shape of the decision curve formed by these data points?

Assessing Methodology of Hormone Concentrations and Sexual Differentiation of Behavior

Samantha A. Martinez
DC - College of Liberal Arts and Sciences

Zophie Young

Annissa Moreno

Mentor: Dr. Lindsey Hamilton, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Research on behavioral endocrinology is sparse while research on transgender/intersex persons is even more limited. Existing research on transgender/intersex individuals either lacks effective methods or is rooted in cultural taboos. This area of research has generally been done in a fairly non-standardized manner; nomenclature must be standardized for effective communication. This literature review examined eight scholarly journal articles regarding the relationship between hormone concentrations and sexual differentiation of human behavior. The focus of this review is to identify limitations of methodology practices currently used in behavioral endocrinology research and to provide suggestions for future experimentation. More endocrinological research is certainly needed, both on the intersex and transgender community. Most studies on transgender persons utilize self-report measures, which are insufficient for precise scientific needs. Less research is available on hormone concentrations and how this relates to behavior of intersex individuals. Furthermore, studies in both cases tend to be small and subject to cultural confirmation bias. Given that nurture affects brain development, and brain development may change with age, researchers need to control for cultural bias and demographics. More precise techniques for measuring hormone concentrations are being developed but remain in their early stages. To gain suitable knowledge on hormone concentrations and sexual differentiation of human behavior, different methods must be implemented in addition to current procedures. Particularly, adopting research methods which collect data from health care facilities and transgender/intersex community centers, adopting adequate techniques for measuring hormone concentrations, and continuing to accept self-reported data would be the optimal course of action.

Changes in African Americans' Mental Health Status Associated With Hurricane Losses

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Mentor(s): Professor, Chair Deborah S.K. Thomas,
Geography & Environmental Science,
DC - College of Liberal Arts and Sciences

Peter J. Anthamatten, Associate Professor

Abstract:
Hurricanes differentially affect socially vulnerable, marginalized populations. A growing body of research documents the disparities for short- and long-term impacts on vulnerable populations. Community mental health is a crucial dimension of resilience and recovery in the aftermath of hurricanes, and often varies for subpopulations. This study evaluates how the mental health of African Americans in areas heavily affected by hurricane losses along the Gulf Coast differs from African Americans living in comparable unaffected areas. Using Behavioral Risk Factor Surveillance System (BRFSS) and Spatial Hazards Events and Losses (SHELDUS) data, spatial and temporal patterns of change in mental health status associated with losses from hurricanes during 1992-2009 are assessed. Measures of the percent of African Americans reporting frequent mental distress and mean mentally unhealthy days from the BRFSS are combined with fatalities and property losses resulting from hurricanes in SHELDUS to evaluate associations between mental health status and major hurricane events.

Development of volume-changing shape memory polymer to promote bone regeneration

Cameron Mattson (UROP Recipient)
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Mentor: Dr. Daewon Park Daewon, Bioengineering,
DC - College Engineering and Applied Science

Abstract:
In this research I exploited the properties shape-memory polymers (SMPs) to regenerate bone in amorphous defects. The physical and chemical composition determined the rigidity and shape-memory effect (SME) exhibited in polymeric materials. These materials were subjected to physical and chemical stimuli to obtain an optimal SME. Polymer properties were optimized by changing the chemical structure and catalysts involved in each reaction. Porous structures decreased the volume of the polymer by increasing the vacancy. Porosity changed with material structure, and the ability of the solvent to promote material dissolution. The results of this process were verified by SEM microscopy and percent volume change of the SMP. A few studies have suggested that optimal bone regeneration is dependent on the pore size of the polymer. In contrast, this research focused on the porosity and pore size required to develop the optimal SME in bone regeneration applications.

Identifying Auto Theft Hot Spots in Denver County

Alisa C. Mavrotheris
DC - College of Liberal Arts and Sciences

Alisa Mavrotheris
DC - College of Liberal Arts and Sciences

Mentor: Dr. Joshua French, Mathematics,
DC - College of Liberal Arts and Sciences

Abstract:
Car theft has become increasingly more common in the United States and Colorado is no exception, moving into the eighth highest spot for the number of car thefts annually. In Colorado, four of the five top spots for auto thefts are in the Denver area. Typically, crime is not spread evenly across maps and this allows for the identification of potential auto theft hot spots within the 78 neighborhoods identified in the county of Denver, the largest in the state. Crime hotspots are areas on a map that have a higher crime intensity and hotspots are used to analyze geographical areas in relation to crimes. To identify potential hot spots, I analyzed the 5562 reported auto thefts in Denver county in 2017 through use of the Denver open data catalog through the Data to Policy (D2P) Project. Data provided established locations of auto theft crimes and application of spatial statistics methods utilized regional count data to identify hot spots within the greater Denver county boundary lines.

Modeling Weapons-Related Crime Rates in the City and County of Denver

Samuel P May
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Yanbo Li

Elizabeth Doe

Mohammed Alnuaimi

Michael Talley

Mentor: Assistant Professor Joshua French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
Weapons-related catastrophes - of which the Front Range has had its fair share - frequently spark news coverage and policy discussions. However, these discussions rarely cover smaller scale weapon-related crimes. We aim to understand who in the City and County of Denver is most affected by weapon-related crimes. Using data that records the time, type, and place of all crimes committed in the City and County of Denver during 2013 - February 2018, we develop a model to describe and predict the annual number of weapons-related crimes in a neighborhood. Our model accounts for a neighborhood's demographics, education levels, income levels, and housing vacancies. Using our model and these neighborhood characteristics, we describe what types of neighborhoods in the City and County of Denver are the most at risk of experiencing high rates of weapons-related crimes on an annual basis. By knowing the characteristics that best predict a high weapons-related crime rate, policymakers can target certain communities and craft policies designed to reduce weapons-related crime rates.

The Concentration of Weapons-Related Crimes in Denver and Potential Ways to Address It

Samuel May
DC - College of Liberal Arts and Sciences

Mentor: Assistant Professor Joshua French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
Certain neighborhoods in the City and County of Denver bear badges of infamy for high rates of weapons-related crimes. It is hard to discern at face value just how true the public's perception is. Using crime data recording the type, time, and place of crimes in the City and County of Denver from 2013 – 2017, I investigate the spatial distribution of weapons-related crimes among the neighborhoods in Denver. Knowing if weapon-related crimes tend to cluster in certain areas of Denver will help policymakers target certain areas for preventative efforts. The array of possible preventative efforts, however, is very large, and officials need to know what neighborhood factors to address to lower the local rates of weapons-related crimes. I investigate what neighborhood characteristics predict the spatial distribution of weapons-related crimes. Using this model, I identify what neighborhood characteristics contribute to high rates of weapons-related crimes. With this research, officials can understand what neighborhood characteristics contribute to higher rates of weapons-related crimes and begin to address such contributing factors.

Mayor-ionettes and the Hand of Rhetoric: Public Outreach Strategies on Brighton Boulevard

Kelli A McAntee
DC - College of Liberal Arts and Sciences

Jazz Fitzgerald
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jordan Hill, MHMSS,
DC - College of Liberal Arts and Sciences

Abstract:
Rhetoric shapes space. As Brighton Boulevard develops rapidly, Mayor Hancock and the North Denver Cornerstone Collaborative hold public meetings, update websites, write newsletters, and speak to local media touting the benefits of redevelopment in that space. However, the inundation of rhetoric is intended not to inform all people, but rather to construct a particular "public." These outreach efforts strategically exclude impacted communities and fail to adequately address the rhino in the room: gentrification and its negative effects. Through a discourse analysis and an investigation into the accessibility of discourse, we call into question the notion of "public." We argue that the "partnership" politicians claim to have forged with residents forms only a small and privileged community.

Classroom observation protocols: Implications of sampling design and frequency

Andrew L. McDevitt
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Laurel Hartley,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Dr. Robert Talbot,
School of Education and Human Deveopment

Abstract:
Classroom observations are used to describe learning environments based on the occurrence of student or instructor behaviors. Observation protocols are utilized for a variety of purposes ranging from instructor feedback/ reflection, to job performance evaluation, to course characterization. In this study we focus on the use of observation protocols for course characterization since sampling design and frequency impact the data's ability to accurately represent the course(s) of interest. A review of recent education literature reveals that there is common misalignment, in some but not all studies, between sampling design, sampling frame, sampling frequency and the intent of their research question. Through the simulation of plausible educational scenarios, we demonstrate how changes in sampling decisions impact statistical inferences. Based on our findings, we provide suggestions to help guide researchers in designing sampling protocols, thinking about the properties of their sample distribution, reporting the sampling distribution, and improving the communication of their statistical inferences.

Exploring Recurrent Neural Networks (RNNs) to Recognize Human Gestures in Edge Computing Environments

Kyle J McGrath (UROP Recipient)
DC - College Engineering and Applied Science

Mentor: Dr. Daniel A Connors, Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The goal of the project is to identify a set of general human gestures and activities in edge computing scenarios. Edge computing is any computer environment in which data processing occurs at the edge of the network generally characterized with limited connectivity to high-performance centralized or cloud systems. The research project deploys an edge camera system with BodySLAM (Body Simultaneous Localization and Mapping), a deep neural network framework comprised of both convolutional neural networks (CNNs) and fully connected networks (FCNs) trained to detect human position of body joints segments (arms, legs, head,etc.) BodySLAM generates in real-time the human joint positions as a set of 3D (x,y,z) points over short time durations. The primary project work investigates the training and building of a new recurrent neural network (RNN) to characterize simple human movements (raising a hand, reaching out, waving, or crouching) from the BodySLAM pose results. An RNN is a class of artificial neural network that can capture connections between a sequence of data to detect temporal behavior over a time sequence. The platform used is an NVIDIA TX2 with on-board graphics processing unit (GPU) that can execute 2 TFLOPS (trillion floating point operations per second) and relay simple event results of a scene. The resulting edge computing system impacts many enable new automated opportunities to assess worker efficiency, detect unsafe scenarios, and judge athletic performance.

Testosterone, Epinephrine, and Stress Response and their Effect on Adolescent Behavior: A Literature Review

Joseph J McHugh
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Imani D Johnson
DC - College of Liberal Arts and Sciences

Alejandra Bueno
DC - College of Liberal Arts and Sciences

Robert T Alexander
DC - College of Liberal Arts and Sciences

Mentor: Dr. Lindsey Hamilton, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Adolescence is known to be a rough stage filled with impuslivesness, moodiness, and emotionality. In many instances adults have a difficulty understanding why teenagers behave different from them and how they are unable to cope with these drastic changes. To better understand the behaviors of adolescents, we must focus on what is happening to the brain and body of an adolescent. Many hormones have been known to affect behaviors that explain why adolescents behave certain ways. Testosterone at high levels has been linked to aggression and risk-taking in males and associated with sensitive to rewards in both males and females. The developmental stage of puberty is known to be stressful on the body, resulting in anxiety, high blood pressure, and weight loss. During stressful events, the first response is the release of epinephrine. This release is increased during puberty implying that stress may be more impactful on teenagers than adults. Through this literature review, our purpose is to seek how testosterone, epinephrine, and stress responses contribute to teenage behavior. Our hypothesis is how testosterone presence and the release of epinephrine as a stress response create behaviors that differentiate adolescents from adults. The behaviors such as risk taking, impulsivity, more emotionally driven and rebellious behaviors. We read 12 articles which supported our hypothesis on the effects these hormones have on adolescent behavior and stress. Based on this literature review, we will suggest future research as well as suggestions of how to use this knowledge to help people understand teenage behavior.

Decoding Brighton's Architecture (Part of "Deceptive Development" Symposium)

Jenna M. McKnight
DC - College of Architecture and Planning

Mentor: Dr. Jordan Hill, MHMSS,
DC - College of Liberal Arts and Sciences

Abstract:
A critical understanding of local gentrification requires an investigation into the visual aesthetics of the Brighton Boulevard corridor and an examination of the types of architecture that characterize the area. Informing this analysis is the belief that architecture is more than structure and shelter. Architecture is a form of communication and a reflection of a culture's values; it is a symbol that conveys decodable messages. I argue that a "faux gritty" modern design vocabulary is being deployed to redefine the industrial area and to convey rhetorical messages to members of the "aspirational class."

A review of neuro-protective agents of estrogen against neurodegenerative diseases

Sophia Meichtry
DC - College of Liberal Arts and Sciences

Melissa Walters
DC - College of Liberal Arts and Sciences

Christy Thanh
DC - College of Liberal Arts and Sciences

Jennifer Jaime
DC - College of Liberal Arts and Sciences

Mentor: Dr. Lindsey Hamilton,
Department of Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Estrogen in an important hormone that regulates multiple tissues and functions in the body. Additionally, estrogen exerts neuroprotective factors that facilitate neurogenesis, recovery from brain injury, and delayed onset of neurodegenerative diseases. Understanding the mechanisms of how estrogen impacts the brain is important to develop novel strategies that prevent and treat neurodegenerative diseases and facilitate the recovery from brain injury. Furthermore, a number of studies have documented that women have increased "protection" from several neurodegenerative injuries to the brain when compared to males. Therefore, it is also of importance to understand how estrogen contributes to these sex differences. Following this, there appears to be a link between certain diseases and a drop in estrogen in menopausal women. Not only do we study the effects of estrogen, but also what changes occur to the body when there is very little of the hormone present. Our proposed study, aims to evaluate the literature on estrogen. We also propose future directions for studies based on the gaps found in the literature.

Synthesis of L-Serine Analog in Preparation for Deuterated Ser-8-phosphorylated Aβ: a comparison of two deuterated probes for characterizing amyloid-β aggregation linked to Alzheimer's disease

Cristiana Meuret
DC - College of Liberal Arts and Sciences

Dillon Rickertsen
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Scott M. Reed, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Liliya Vugmeyster, PhD, Department of Chemistry

Abstract:
Plaque aggregation between neurons consisting of misfolded amyloid-β (Aβ) proteins is a hallmark of Alzheimer's disease (AD). This misfolded protein (fibrillar Aβ) exists in polymorphic states indicative of varying conformational roles contributing to AD. It has been observed via solid-state nuclear magnetic resonance (SSNMR) spectroscopy that residue-specific analogs contribute to conformational changes in Aβ. The residue containing serine 8 was reported to initiate the transition to fibrillar Aβ from its native state when phosphorylated (1).To further explore this misfolding process, deuterated protected N and C terminus serine will be compared to a synthesized phosphorylated version outside the peptide chain as a reference prior to solid-phase peptide synthesis which will insert these two probes into separate Aβ for further comparison. Two devised synthetic routes to phosphorylated protected L-serine are under investigation. One using 2-cynaoethyl N,N--diisopropylchlorophosphoramidite for phosphorylation, and the other bis-(cyanoethyl)-diisopropylphophoramidite in conjunction with an acidic azole. Both undergo subsequent oxidation to produce a phosphodiester.

Reference:
(1) Hu, Z.-W.; Meng-Rong; Cheng, Y.-X.; Zhao, Y.-F.; Qiang, W.; Li, Y.-M. Phosphorylation at Ser 8 as an Intrinsic Regulatory Switch to Regulate the Morphologies and Structures of Alzheimer's 40-residue B-Amyoild (AB40) Fibrils. Phosphorylation at Ser 8 as an Intrinsic Regulatory Switch to Regulate the Morphologies and Structures of Alzheimer's 40-residue B-Amyoild (AB40) Fibrils, 2016.

Spatiotemporal patterns of habitat use during incubation by a uniparental shorebird in a heterogeneous landscape

Tyler Michels
DC - College of Liberal Arts and Sciences

Mentor(s): Associate Professor Michael B. Wunder, Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Angela M. Dwyer, Bird Conservancy of the Rockies; Kristen Philbrook, USDA Forest Service

Abstract:
The mountain plover (Charadrius montanus) is a migratory shorebird that breeds in rangelands of the western Great Plains. Populations have declined sharply since the 1960s and the species is of conservation concern in most states and provinces where it occurs. Nesting behavior involves an unusual split-clutch mating system; females typically lay 3 eggs in a nest tended entirely by the male, before laying another 3 eggs in a different nest for the female. Mated birds do not provision each other during the incubation and brood-rearing periods (~29 and ~35 days, respectively). Because of this, nesting habitat must also provide efficient foraging for incubating adults. Plovers are known to have nested on fallow cultivated fields since the 1980s, but little information exists about adult plover behavior and habitat use during the incubation period on croplands. To determine how incubating plovers use habitat in a mixed habitat and ownership landscape, we deployed and recovered 11 miniature global positioning system (GPS) dataloggers on adult plovers incubating nests on cultivated fields in Weld County, Colorado. We estimated home-range size using 95% kernel density contours and report a median of 78.85 ha (range 3.784-350.7). We recorded the proportion of foraging locations per habitat type throughout the deployment period and found plovers foraged the most on cropland. These data will help understand how landscape level habitat fragmentation brought about by changes in farming economics, energy development, and/or climate may impact mountain plover breeding biology.

A Computational Study of the Villin Headpiece Subdomain HP-36

Danielle E Miller (UROP Recipient)
DC - College of Liberal Arts and Sciences

Tanja Kovacevic
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Hai Lin, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Liliya Vugmeyster, Chemistry Department, College of Liberal Arts and Sciences
Dr. Michael Crowley, Chemistry Department, College of Liberal Arts and Sciences

Abstract:
Hydrophobic side chain interactions are a major dynamic force in the folding of globular proteins and the aggregation of many non-globular proteins. HP-36, a headpiece subdomain on villin, has a hydrophobic core ideal for studying side chain interactions similar to those found in more complex proteins. The internal motions of the hydrophobic core residues have yet to be detailed. Solid-state NMR of 3 phenylalanine residues (F47, F51, and F58) implies the three residues are flexible and undergo frequent ring flipping. However, preliminary computational results suggested F58 was an order of magnitude less flexible than F47 or F51. Biased molecular simulations, which use biasing potentials to enhance sampling, were used to investigate the motions of these three phenylalanine residues within the hydrophobic core of HP-36. Our initial studies determined the free-energy barriers to ring flipping for each of the phenylalanine residues.

Acknowledgments: This project is supported by the NSF (CHE-1564349), XSEDE (CHE-140070), NERSC (m2495), the Camille and Henry Dreyfus Foundation (TH-14-028), and the Undergraduate Research Opportunity Program of the University of Colorado Denver.

Correlational Analysis of Illegal Opium Distribution and Proximity to Hospitals

Matthew K. Mitchell
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Yaswanth S. Chintaluru
DC - College of Liberal Arts and Sciences

Mentor: Dr. Audrey Hendricks,
Biostatistics and Informatics,
DC - College of Liberal Arts and Sciences

Abstract:
Opium abuse is the largest category of prescription drug abuse in The United States. In 2015 alone, 38% of the American population legally prescribed opiates. Many of these prescriptions were filled in emergency room pharmacies or other, in-hospital pharmacies. This study aims to identify if a statistically significant correlation can be found between increasing proximity to Denver hospitals, and instances of illegal opium and opium derivative distribution.

Creating An Embryonic Stem Cell Line Expressing Green Fluorescent Protein Using CRISPR/Cas9

Matthew K. Mitchell (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Christopher J. Phiel,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Laura J. Sedivy Professional Research Assistant, University of Colorado Denver

Abstract:
CRISPR (Clustered regularly interspaced short palindromic repeats) is one of the most revolutionary molecular biology techniques discovered in the past decade. Cas9, the protein that mediates CRISPR activity, binds to DNA by using a short guide RNA (gRNA) to find homologous DNA sequences, allowing Cas9 to make dsDNA breaks. One advantage of CRISPR allows for the insertion of exogenous DNA into the sites of dsDNA breaks. We chose to take advantage of this modification to insert GFP (green fluorescent protein) into the Rosa26 locus in mouse embryonic stem cells. The Rosa26 locus was selected for GFP insertion because other transgenes inserted at Rosa26 have high levels of constitutive transgene expression. I will describe the details of how we have approached this exciting use of CRISPR/Cas9 technology.

Microtubule Mystery:
Investigate the Consequences of α-Tubulin Mutants on Brain Development
as a part of Building Participation in Neuroscience through BRAiN mini symposium

Danae N Mitchell
DC - College of Liberal Arts and Sciences

Mentor: Dr. Emily A. Bates, Pediatrics,
AMC - School of Medicine

Abstract:
Microtubules (MTs) are made up of the tubulin proteins α- and β- tubulin and can be described as a cell's skeleton. MTs are involved in several neuron roles such as neurite initiation, axon stabilization and trafficking, and neuron migration. Mutations in a neuronally expressed α-tubulin result in numerous brain malformation disorders but it is unknown how the α-tubulin mutations affect MTs themselves and, in a mouse model, it is unknown how this mutation leads to an apparent neurodegeneration disorder with a motor phenotype. To investigate a potential cause, I examined the motor neurons in the lumbar region spinal cord of heterozygous mice at three months and ten months by using a nissl body stain in order to see if their numbers decreased over time. My findings showed that there was no significant difference in the number of motor neurons at these two times points suggesting that there was another reason behind the motor phenotype.

Real time spike clustering for electrophysiology recording

Zeinab Mohammadi
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Mentor(s): Dr. Tim C. Lei, Electrical engineering,
DC - College Engineering and Applied Science

Dr. Liu

Abstract:
In order to analyze neuronal data recording from the brain, clustering neuronal spikes into different groups based on their temporal features originating from different neurons is a necessary step. The capability to cluster neural spikes in real time (within several milliseconds) will help understand brain encoding and decoding, as well as the opening up new opportunities to control neural activity in a feedback manner. Generally, most behavioral neuronal studies for small animals are performed with a single or multi electrodes in the extracellular recording configuration. In this configuration, neural spikes originating from neighboring neurons are often picked up by the same electrodes, which requires mathematical algorithms to separate them prior to performing other data analysis. Currently, there exists many "off-line" neural spike sorting algorithms that can sort pre-recorded neural spikes effectively after the experiments are finished.

Here we propose a new on-line spike sorting technique, named Enhanced Growing Neural Gas (EGNG), which can sort neural spikes in real-time. I will compare this techniques with several existing off-line spike sorting techniques, including Kohonen's self-organizing Map (SOM), K-mean and Expectation maximizations (EM), to demonstrate its capability and accuracy in neuronal spike sorting. Based on the results, we plan to implement this method using digital Field Programmable Gate Arrays (FPGA) and will test the system with real behavior neuronal studies in the near future.

PREDICTING DENVER CRIME WITH LINEAR REGRESSION—USING POVERTY, TREE CANOPY COVERAGE, AND COMMUNITY DEMOGRAPHICS

Mitchell Montepagano
DC - College of Liberal Arts and Sciences

Alexandra Younkes
DC - College of Liberal Arts and Sciences

Iman Dwebi
DC - College of Liberal Arts and Sciences

Morgan Larson
DC - College of Liberal Arts and Sciences

Mentor: Dr. Joshua French Joshua, French,
Mathematics,
DC - College of Liberal Arts and Sciences

Abstract:
This project investigates the relationship between crime rate in Denver and community demographics including: poverty, tree canopy coverage, number of liquor licenses, and other statically significant predictors of crime. The result of this investigation is a predictive model that estimates average crime rate by neighborhood using linear regression. The predictors listed in this model are useful explanatory variables for crime rate, but do not imply any causal relationship. The model output should be useful to both police and city planners to ensure adequate resources are allocated to account for the expected average crime rate by neighborhood. Furthermore, the predictor variables identified in this model may serve as useful starting points for continued research between crime rate and community demographics and may provide city planners insight into community support strategies that can reduce expected crime rate.

In vitro Comparison of Mineral and Chemical Based Sunscreens

TKilinoelani K Montgomery
DC - College of Liberal Arts and Sciences

Mentor: Ms. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Oxybenzone and other active ingredients in chemical based sunscreens have been found to be harmful to coral reef ecosystems, therefore, mineral based formulas have been proposed as an alternative. Chemical based sunscreens absorb UV radiation, while mineral based sunscreens provide a physical barrier on the skin that reflects UV radiation. In order to compare the efficacy of chemical and mineral based sunscreens, an in vitro analysis was performed on four different sunscreens, using a UV-Vis spectrophotometer. Absorbance spectra for each sample was taken from wavelengths of 250 to 800 nm and maximum absorbance was recorded. The Mansur SPF equation was applied to calculate experimentally determined SPF values. Calculated SPF values were found to deviate from the labeled value by over 50%. Mineral based sunscreen formulas were found to only absorb radiation in the UVC region (200-290 nm) with calculated SPF values below 2. Although SPF values for chemical values were lower than expected, from 14-19, maximum absorbance was found in the UVB region (290-320 nm) and percent transmittance values correlated with the labeled SPF. Further research on mineral based sunscreen formulas should be performed. Alterations on solvent selection and other analytical techniques could improve the solubility of zinc oxide particles and increase the accuracy of measured absorbance spectra.

Marijuana Legalization and Crime Rates

Kilinoelani K Montgomery
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Desiree Salais
DC - College of Liberal Arts and Sciences

Celine Lumowa
DC - College of Liberal Arts and Sciences

Mentor: Marijuana Legalization and Crime Rates, Audrey Hendricks, Statistics,
DC - College of Liberal Arts and Sciences

Abstract:
The legalization of marijuana has raised concerns regarding crime rates in the Denver county. Using data collected from each precinct, statistics were calculated in order to compare the frequency of crimes before and after legalization. The police precincts in Denver are categorized into six different districts and are the primary geographic areas of interest. Proportions were calculated to determine the district with the highest frequency of crimes. Further analysis was done in order to determine what type of crime was the most prevalent in that location and whether most of the crimes were industry or non-industry related. All districts will be evaluated to compare the number of assault and burglary crimes before and after marijuana was legalized to determine if crime rates increased. A Chi-Squared goodness of fit test will be conducted to validate our results. A histogram and time-plot graph will be utilized to display statistical results.

PORNOGRAPHY: HOW CHRONIC EXPOSURE ALTERS THE BRAIN CHEMISTRY AND NEURONAL NETWORKS OF MALES

Alexander S Morales
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Mentor: Senior Program Coordinator Jessica A Luna, TRiO McNair,
DC - College of Liberal Arts and Sciences

Abstract:
The significance of the literature review is to identify the effects of internet pornography on neurological processes in males using explicit, virtual cues. Much of the analyzed literature focuses on healthy males between the ages of 21 and 45. Thus, the review emphasizes the effects of pornography on the mesolimbic dopamine pathway, the brain's reward system, as well as its effect on neuroplasticity, the process in which neuronal connections form and/or reposition themselves. Inasmuch, the review recognizes the correlation between pornography and the volume of grey matter in a region of the memory processing center of the brain, the right caudate. Furthermore, the literature review explains how technological methods such as Voxel-Based Morphometry and Functional Magnetic Resonance Imaging (fMRI) detected the biochemical and neuronal changes in the participants.

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

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Margaret K. Tanner
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Jennifer Jaime
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Esteban C. Loetz
DC - College of Liberal Arts and Sciences

J.K.P Davis, Holly S. Hake

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

Abstract:
Exercise produces beneficial effects on cognition and mental health. In rats, these effects include enhancing the extinction of traumatic memories, wherein a single bout of voluntary exercise after fear extinction training can enhance fear extinction memory and reduce relapse. 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 fear extinction following exercise is the mammalian target of rapamycin (mTOR). mTOR is a translation regulator involved in synaptic plasticity, cell growth, and proliferation. mTOR signaling is sensitive to many exercise signals such as monoamines, growth factors, and metabolic signals, and is increased after chronic exercise in brain regions involved in learning and emotional behavior. mTOR is therefore a compelling potential facilitator of the memory-enhancing benefits of exercise. The goal of the current study was to test the hypothesis that mTOR signaling is critical for the enhancement of fear extinction memory produced by acute, voluntary exercise. We observed that, like chronic exercise, a single session of voluntary exercise increased mTOR signaling in extinction-related brain areas. Moreover, intracerebral-ventricular (ICV) administration of the mTOR inhibitor rapamycin reduced mTOR signaling and eliminated the enhancement of fear extinction memory produced by acute exercise, without reducing voluntary exercise behavior or altering fear extinction learning. These results suggest that mTOR signaling contributes to the memory-enhancing benefits of exercise, and factors that increase mTOR signaling could be novel targets for the treatment of psychiatric disorders like PTSD.

Bisexual Erasure in Queer Spaces

ACharles B Myers
DC - College of Liberal Arts and Sciences

Candan DURAN-AYDINTUG
DC - College of Liberal Arts and Sciences

Mentor: Associate Professor
CANDAN DURAN-AYDINTUG, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
Viewing sexual orientations in a binary manner, sexuality in this way disregards the plurality and complexity of sexuality and renders individuals such as bisexuals invisible by characterizing them as confused over their own sexuality. This alleged confusion contributes to the stereotypes for bisexual individuals as being promiscuous and indecisive. Negative views toward the bisexual community have been referred to as ”bi-phobia” or “monosexism”. Monosexism in heterosexual and in lesbian and gay communities is directly related to prejudicial attitudes, discrimination, and micro aggressions toward bisexual individuals, and ultimately may lead to their voluntary or involuntary exclusion from the communities they want to belong to. In order to gain an in-depth understanding of the degree, source, and consequences of perceived discrimination by non-monosexual individuals themselves and also monosexual individuals’ attitudes toward them, we designed a qualitative study. In our study, we conducted in-depth interviews with seven participants; three of whom were self-identified monosexuals and four of whom were self-identified non-monosexuals. Preliminary analyses of the findings suggested that non-monosexuals explicitly complained about overt and covert discrimination by gays and lesbians more than by heterosexuals and mentioned how this particular type of discrimination affected their visibility and participation in LGBTQ+ community. Monosexual participants, on the other hand, regardless of their sexual orientation, held quite favorable attitudes toward non-monosexuals, but they commented on their awareness of the intense discrimination non-monosexuals may experience in the LGTQ+ communities. Result are further examined using Social Identity Theory. The study’s limitations, implications, and further avenues for research are considered.

Glutathione Antioxidant System is Transiently Upregulated in Juvenile Oligodendrocytes: Implications for Development and Ischemic Response

Mikaela C Neal
AMC - School of Medicine

Mentor: Dr. Wendy B. Macklin,
Cell and Developmental Biology,
AMC - School of Medicine

Abstract:
Oligodendrocytes are the cells of the central nervous system (CNS) that wrap axons with myelin, which allows for the fast transduction of electrical signals. Oligodendrocytes rapidly produce myelin during development (in the juvenile developmental stage of the organism), entering a myelin maintenance stage once myelination is complete. The process of myelination generates reactive oxygen species (ROS) byproducts; however the mechanism by which myelinating oligodendrocytes mitigate oxidative stress is unknown. Because we have previously seen resistance to oxidative stress induced by ischemic/reperfusion (I/R) injury in juvenile oligodendrocytes, we are investigating the differences in antioxidant activity, specifically glutathione (GSH) metabolism, between juvenile and adult oligodendrocytes in both healthy and stroked tissue. GSH is a common antioxidant across many cell types that is known in the literature to be expressed at a low level in oligodendrocytes, but it may be required during active myelination to mitigate ROS by-products. Comparison of gene expression in oligodendrocytes acutely isolated from juvenile or adult striatum by qPCR revealed increased levels of GSH-regulating genes in juvenile oligodendrocytes relative to adult cells, along with an upregulation of GSH-related genes in response to I/R injury in juvenile oligodendrocytes. Furthermore, immunohistochemical (IHC) analysis of juvenile and adult striatum revealed increased expression of glutathione-synthesizing proteins, as well as maintenance of these proteins after stroke injury in juvenile oligodendrocytes. These results indicate that juvenile oligodendrocytes utilize the antioxidant GSH pathway during the process of active myelination, and that this pathway may provide for their protection from stroke injury.

Measurement and characterization of body wearable and small form wireless devices in reverberation chamber using continuous-mode stirring.

Vincent T Neylon
DC - College of Liberal Arts and Sciences

Mentor(s): Dr Hamid Z. Fardi, Electrical Engineering,
DC - College Engineering and Applied Science

Dr Kate Remley NIST CTL RF Technology
Dr Robert Horansky, NIST CTL RF Technology
Dr Maria Becker, NIST CTL RF Technology
Dr Damir Senic, NIST CTL RF Technology

Abstract:
The industry of wireless devices is both growing in scope and shrinking in physical size. Due to this the ability to precisely and accurately measure and characterize these devices has increased in importance. The new challenges, thanks to the size and the quantity of the devices, has made it essential to create more accurate and faster methods of testing that yield comparable levels of accuracy and repeatability. The current practice is to use anechoic chambers utilising stepwise mode stirring, which is time intensive. The problem with this is that the devices under test tend to have smaller shorter life power sources that may not last the duration of the measurement and does not introduce real world obstacles such as body parts. In this work I will be using a reverberation chamber utilizes continuous paddle stirring in the attempt to accelerate the process of gaining data without losing accuracy. Once this has been developed I will introduce simulated body parts called “phantoms” to produce an accurate measurement in a simulated real environment. The work is being done at the National Institute of Standards and technology (NIST), boulder campus, as part of the Professional Research Experience Program (PREP) fellowship.

A Method to Reduce Temperature Related Complications for People with Multiple Sclerosis

Kenny H Ngo
DC - College Engineering and Applied Science

Kelly Smith
DC - College Engineering and Applied Science

Ashleigh N Hanne
DC - College Engineering and Applied Science

Ahmed Abdu, Serena Kishek, Seth Drake, Anthony Pagliaro, Sean Hansen

Mentor(s): Craig Lanning, Bioengineering,
DC - College Engineering and Applied Science

Cassandra Howard, MS,
College of Engineering and Applied Sciences;
Dr. Kathy Bodine, Ph.D.,
Assistive Technology Partners

Abstract:
People with multiple sclerosis (MS) have varying levels of damage to the myelin sheaths on the axons of their neurons. This lack of neuron insulation leads to a variety of problems due to the inability for nervous signals to effectively reach their destinations. The complications that are caused by this include an inability to effectively regulate a safe body temperature. Temperature fluctuations are dangerous to people with MS because their body cannot react accordingly to maintain homeostasis and this additional physiological stress can also amplify their other MS symptoms. Heat requires more physiological effort to maintain homeostasis than cold, and thus it is more likely to cause additional problems for people with MS. A method to notify users of sudden temperature changes would help people with MS to mitigate these problems. Thus, a device was created that senses both user and ambient temperature using an integrated ambient temperature sensor and an external, detachable body temperature sensor to notify the user of those changes. The device is cost-effective, convenient to the user, and has a rechargeable battery that has at least 16-hours of life. It is lightweight and clips on to the user's clothing, and it compares the temperatures between the user and their environment. If the device registers a 2°C change over the course of a second in either ambient or body temperature, it notifies the user through LEDs and a tone emitted from a speaker. After being tested with the project sponsors and a member of the target population for feedback, it was received positively with suggestions for improving usefulness and functionality. When using this device, users with MS are more aware of changes in their environment that would accelerate their symptoms and can thus act accordingly. This increased awareness can help mitigate the dangers imposed by sudden temperature fluctuations, allowing people with MS to lead more independent and less stressful lives.

Being Vietnamese and Autistic

Emelie Nguyen
DC - College of Liberal Arts and Sciences

Mentor: Ph.D. Joan T. Bihun, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
My recent independent study course was developed after taking a child development class and doing a summer internship with autistic children. Both of these experiences inspired me to research how an Asian culture can create disparities for children with autism. As a summary of my work I wrote a book, Minh and His Family Just Need Time, to tell the story of a Vietnamese family's journey and growth once they discover their son is on the autism spectrum. To create this book, I conducted an extensive literature review using primary and secondary sources. The research focused on fundamental information about Autism Spectrum Disorder (ASD), commonly shared beliefs of mental health in Southeast Asian cultures, and how these two areas need better integration. It's important to address how cultural beliefs of Asian countries have shaped the perceptions, and often misconceptions, of developmental abnormalities such as ASD. The literature supports my hypothesis that Vietnamese children with disabilities face a multifaceted cultural barrier that hinders their ability to receive diagnosis, assistance, or acceptance of their disability. Autism can be a difficult disorder to understand, especially if there are pre existing barriers, therefore writing a children's book makes ASD friendly particularly for a Vietnamese audience. Scholarly findings and references are also provided as a supplement on several pages of this children's book. My hope is that this children's book will help facilitate discussions about this disorder within Vietnamese families because culture and healthcare don't have to conflict.

Determining Ascorbic Acid Content Through Iodine Titration

Martin Nguyen
DC - College of Liberal Arts and Sciences

Hossna Yasini
DC - College of Liberal Arts and Sciences

Mentor: Dr. Kyoung N Kim, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Ascorbic acid, also known as Vitamin C, is not synthesized by the human body itself, therefore, it must be ingested from organic or inorganic sources. Ascorbic acid is an cofactor in metabolic processes that contributes to epithelial tissue health, immune system support, and avoidance of diseases such as scurvy. Forward titration techniques were used in order to compare the amount of ascorbic acid present in different sources of ascorbic acid: Emergen-C, Airborne, and Tropicana Orange Juice. The experiment determined that Emergen-C contained a higher concentration of ascorbic acid per serving size compared to Airborne tablets and orange juice. The results support the hypothesis that Emergen-C will have the most ascorbic acid content. The rationale was that because Emergen-C does not contain the processed sugars and other carbohydrates that are present in orange juice, which decreases the concentration of ascorbic acid present in the juice. The findings from this experiment will help the average consumer identify which source of ascorbic acid is most suitable for their needs.

Does Religious Attendance Moderate the Relationship Between PTSD Symptoms and Family Reintegration Problems for Returning Active Duty Service Members?

Tammy A Nguyen
DC - College of Liberal Arts and Sciences

Monica Peniche
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Elizabeth Allen, Psychology,
DC - College of Liberal Arts and Sciences

Dr. Scott Stanley, Ph.D., University of Denver
Dr. Howard Markman, Ph.D., University of Denver

Abstract:
Active Duty service members often face significant challenges with family life reintegration after deployment. The impact of traumatic experiences during service often persists through Posttraumatic Stress Disorder symptoms and diagnoses. Previous research has found that PTSD symptoms are significantly positively correlated with negative transition attitudes (Adler, Britt, Castro, McGurk, & Bliese, 2011). Even without a formal diagnosis, PTSD symptoms can pose a significant threat to successful family reintegration, as they are a great source of distress to the person suffering them as well as his or her spouse and family. However, service members suffering from PTSD symptoms may benefit from having a regular support system, such as a religious community shared with a partner, in place when transitioning back home.

This study aims to explore the relationship between PTSD symptoms and family reintegration problems, and additionally explore religious attendance as a potential moderator for the association between PTSD symptoms and reintegration scores. That is, religious attendance could possibly weaken the relationship between PTSD symptoms and reintegration problems. Participants for the current study were selected from the Army Marriage Project, a longitudinal randomized clinical trial of a marital education program for 662 Army couples. Service members completed a self-report of PTSD symptoms (the Posttraumatic Stress Disorder Checklist (PCL); Weathers, Litz, Herman, Huska, & Keane, 1993), family reintegration problems (the Complicated Family Reintegration Scale (CFRS); Sayers, Farrow, Ross, & Oslin, 2009), and frequency that they attend religious services with their spouse when not separated by deployment.

Targeted Fluorescent Detection and Thermal Ablation of Bladder Cancer with Functionalized Gold Nanorods

Kathleen NU Nguyen
DC - College Engineering and Applied Science

Mentor(s): Dr. Jared M. Brown,
Toxicology and Pharmaceutical Sciences,
AMC - School of Pharmacy

Lih-Jen Su, M.S., Division of Medical Oncology at AMC;
Thomas Flaig, PhD,
Division of Medical Oncology at AMC;
Won Park, PhD, Department of Electrical, Computer and Energy Engineering at UCB;
Suehyun Cho, M.S., Department of Electrical, Computer and Energy Engineering at UCB

Abstract:
In 2012, bladder carcinoma was the fourth most common non-skin cancer in men in the U.S. Initial bladder cancer treatment typically involves tumor removal and drug delivery via catheter, however, up to 40% of patients experience recurrences of disease within 10 years post-treatment. To preserve the non-invasive treatment, the catheterization method can be improved by other means. Nanomedicine is quickly becoming an effective technique for early-stage cancer treatment. The aim of this project is to create multifunctional nanoparticle clusters (MFNCs) for detection and treatment of bladder cancer cells. The main component of the MFNCs are gold nanorods, which will oscillate rapidly under near infrared light (e.g. plasmon resonance). The plasmon resonance creates extreme heat that can be utilized for the thermal ablation of cancer cells. Conjugated to these gold nanorods are luminescent nanoparticles that fluoresce under low-frequency light. A low frequency laser can be shined at the tumor to identify the presence of MFNC's on the tumor, then can be tuned to a higher frequency to thermally ablate the cancerous tissue. To isolate treatment on only bladder tumors, a cancer specific antibody targeted to epithelial growth factor receptor (which is overexpressed in bladder cancer) is attached to the MFNCs to ensure tumor-specific binding. We hypothesize that the MFNCs can also activate an anti-tumor immune response within the body post-treatment. Specific expression of cGAS-cGAMP-STING and PD-L1 immune pathways were evaluated in bladder cancer cells following MFNC and laser treatment, and the results suggest that anti-tumor immune responses are elevated after treatment.

The Enduring Reach of Japanese Fashion Design

Khoa Nguyen (UROP Recipient)
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
The enduring reach of 1980/1990 Japanese fashion design has long been examined as a period of explosive growth within the fashion world. However, its lasting effects on the contemporary fashion industry did not seem to last through the colorful 2000s. However, recent New York designers have started to gain inspiration for a new mode of fashion informing current street wear and avant garde styles. During the summer of 2017, my research lead me to video interview 3 designers about picking up from the past. They were all influenced by a period that championed artistry, oversized clothing, and new shapes of the body. I argue that previous Japanese fashion designers were well ahead of their time and have highly influenced contemporary styles. In conclusion, this project sheds light on the New York fashion scene and it's influx of young designers emulating 1980/1990 Japanese styles.

Use of the Oxford Nanopore MinION for Genome Sequencing of Environmental Samples

Maria Nikulkova (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Assistant Professor Christopher Miller,
Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Metagenomics uses DNA sequencing to study the genetic material collected from microbes living in their natural habitats. These microbes inhabit our everyday lives and make up an essential part of living systems. By being able to sequence DNA from these microbes, we can predict the function of these organisms. With current DNA sequencing technology, such as Illumina sequencing, short genomic reads from 150-300 base pairs long can be read, which are sampled from microbial genomes that are typically millions of base pairs long. Trying to find overlapping segments among these short reads makes it difficult to reassemble the individual genomes found in an environmental sample. A task made even more challenging by the presence of many closely related genome sequences in an environment. The new Oxford Nanopore MinION sequencing machine generates very long reads, up to 1,000,000 base pairs long, but has decreased accuracy than shorter reads. Though these longer reads can be used in concordance with Illumina's short but accurate reads to stitch-together a more accurate genome. Long reads allow for easier overlap detection, and simpler assembly of microbial genomes from complex mixtures found in natural environments. We are applying this sequencing capability to microbial DNA from temperate freshwater wetland soils, which are a large source of microbially produced atmospheric methane. Initial Nanopore sequencing suggests these long reads and short Illumina reads are sampled from the same genomes. Future work to combine these datasets should improve genome assembly for the complex community of microbes that lives in these habitats.

High-altitude Increases the Vasodilation in Myometrial Arteries of Pregnant Women.

Hisham Nsier
DC - College of Liberal Arts and Sciences

HeaMi Yi
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Ramon A Lorca,
Division of Reproductive Sciences,
Department of Obstetrics and Gynecology,
AMC - School of Medicine

Elise S. Bales, Sydney L. Coates, Dr. Lorna G. Moore (Division of Reproductive Sciences, Department of Obstetrics and Gynecology) and Dr. Colleen G. Julian (Department of Medicine)

Abstract:
The chronic hypoxia of high altitude (HA, >2500 m) reduces uterine artery (UtA) blood flow during pregnancy, contributing to an increased frequency of preeclampsia and intrauterine growth restriction among HA-resident women. Women with preeclampsia at low altitude (LA) also have reduced UtA blood flow due, in part, to impaired myometrial artery (MA) vasodilation. Gene expression patterns from Andeans, who are protected from high altitude-associated reductions in uterine artery blood flow and fetal growth, were consistent with AMP-activated protein kinase (AMPK) upregulation. However, vasodilator responses to AMPK have not been examined in human UtA or MA. In this study, myometrial tissue was collected from C-section deliveries at LA (<1600 m) or HA, then fixed for immunohistochemistry or dissected to isolate and mount MA in a wire myograph. We evaluated myometrial vascularization by immunohistochemistry using endothelial (CD31) cell-specific marker to visualize MAs. The vascular volume fraction tended to decrease in HA compared to LA (0.11±0.01 vs. 0.13±0.01, respectively, $p=0.074$), whereas the averaged vessel perimeter was increased (17.9±0.6μm at LA vs. 23.3±2.1μm at HA, $p<0.01$). In vessels pre-constricted with phenylephrine, A769662, an AMPK activator, vasodilated MA from LA women (area under the curve, AUC=318±22) and had an even greater vasodilator effect in MA from HA women (AUC=193±11, $p<0.05$ compared to LA). Our results suggest an increased vasodilator effect of AMPK at HA to maintain MA vasodilation. Future studies will aim to elucidate the mechanisms by which AMPK vasodilates in MA and its importance for UtA blood flow during pregnancy.

Early Detection of mTBI in Virtual Reality

Hawkar Oagaz
DC - College Engineering and Applied Science

Manpreet Pooji
DC - College of Arts and Media

Mentor: Dr Min-Hyung Choi, Computer Science,
DC - College Engineering and Applied Science

Abstract:
Mild traumatic brain injury (mTBI) is a condition caused by a forceful non-penetrating impact to the head that often goes unrecognized after the initial injury. It is frequently discovered only after patients report symptoms such as memory loss, headaches and vision problems. Traditional diagnostic tests for traumatic brain injury (TBI) are insensitive to more subtle symptoms of mTBI. Common to all types of TBI are visual perception abnormalities, which are not adequately assessed with conventional diagnostic tests. We present an ongoing study of cognitive function assessment that directly and accurately tests the patient's visual perception using virtual reality (VR) and a network of sensors. By placing the patient in a virtual environment, we can construct controlled scenarios that evoke certain responses from subjects. Concurrently, we are able to monitor their behaviors and physiological signals using a network of sensors in order to assess their cognitive abilities. We have developed an initial proof-of-concept that places the subject in a virtual baseball field to examine their ability to determine ball speed and projectile trajectory to predict the landing position, and analyze their response to visual stimuli such as moving their hand to the predicted landing position. This research has the potential to have a substantial impact on neuroscience and psychology, and can be adapted for a variety of other behavioral and neurological applications.

Working memory deficits in a CaMKIIa model for Schizophrenia

Amber Olson
DC – College of Liberal Arts and Sciences

Mentor: Dr. Diego Restrepo,
Cell and Developmental Biology,
AMC – School of Medicine

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 Role of Mammalian Sterile20-like Kinase 4 in Somatotroph Growth Hormone Producing Pituitary Tumors

Karima M Osman
DC - College of Liberal Arts and Sciences

Mentor: Dr. Margaret E. Wierman, Endocrinology,
AMC - School of Medicine

Dr. Katja Kiseljak-Vassiliades

Abstract:
Pituitary tumors are the most prevalent of brain tumors. Pituitary tumors arise from one of the five cell types that compromise the anterior pituitary (gonadotrophs, somatotrophs, lactotrophs, corticotrophs, and thyrotrophs). To study genetic alterations in pituitary tumors, our lab has collected over 600 human pituitary tumor samples and 150 normal pituitaries. Through expression microarray profiling as well as copy number variation we have identified mammalian ste20-like kinase 4 (MST4) to be a potential candidate gene involved in pituitary tumorigenesis. MST4 is a serine-threonine kinase that is involved in cellular growth and regulates specific intracellular signaling pathways. MST4 is a potential biomarker in pituitary tumorigenesis, as it is upregulated in pituitary tumors and not in normal pituitary glands. We have previously shown MST4 to play a role in driving gonadotroph tumorigenesis during hypoxic stress and identified AKT and p38 MAPK as downstream effectors in LβT2 cells (gonadotrophs). We hypothesize that we will see a similar role of MST4 in driving somatotroph (growth hormone secreting) tumor growth. To assess the role of MST4 in somatotroph tumors, GH4 cells were transfected with MST4 by electroporation. The GH4 transfected cells were treated with G418 to select for stable transfectants expressing MST4 and confirmed through western blot. The stably transfected GH4 cells were used to test the effects of MST4 on cell proliferation as well as downstream effectors. These data will help determine the mechanism of MST4 in various types of pituitary tumors and help support the use of MST4 as a therapeutic target.

Determining Granuphilin's Docking Mechanisms Through Mutation of a Membrane Binding Domain

Julianna M Oviedo (UROP Recipient)
DC - College of Liberal Arts and Sciences

Aml Alnaas
DC - College of Liberal Arts and Sciences

Abena Watson-Siriboe

Mentor: Doctor Jefferson Knight, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Insulin is a hormone that helps the body maintain its desired levels of glucose in the blood. Pancreatic β-cells contain a protein called granuphilin which helps dock insulin vesicles to the plasma membrane. Despite its function, more granuphilin in the cell results in a decrease of insulin secretion. The amino acid residues on granuphilin that are important for binding to the cell membrane were determined. This was done by mutating single amino acids (some mutations were at two or three residues) via site-directed mutagenesis and measuring the binding affinity through protein-lipid binding assays. The assay, fluorescence resonance energy transfer, is a technique that allows the binding or lack of binding of granuphilin to the cell membrane to be determined by difference in fluorescence peaks. Figuring out how to inhibit granuphilin through binding mechanisms could potentially serve as a way to increase insulin secretion.

Stand Count Determination via Multi-spectral Remote Sensing

Yan Pang
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Mentor:Assistant Professor Chao Liu,
Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The objective of this research is to develop an innovative system to perform stand count for evaluating crop emergence by using multi-spectral remote sensing data. Accurate counts and early intervention can mean the difference between a successful harvest or significant crop losses. However, the typical plant counting methods fail to provide unbiased and precise data, as they analyze only small parts of the field. In this project, remote sensing is used to get the information of the whole plant field without making any physical contacts. The captured multi-spectral remote sensing images are cropped into parts, and the super-resolution method is applied to improve the quality. One-shot learning neural network is incorporated into the YOLO v3 architecture to get an accurate stand count/detection algorithm which is executed the on the cropped image data in parallel.

Trophic Ecology Warrants Multi-Species Management in a Grassland Setting: Can Occupancy Modeling Predict Swift Fox–Burrowing Owl–Mountain Plover Interactions on Black-tailed Prairie Dog Colonies?

ARyan A. Parker
DC - College of Liberal Arts and Sciences

Mentor(s): Associate Professor
Dr. Michael B. Wunder, Ph.D.,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Angela M. Dwyer, MS, Bird Conservancy of the Rockies; Cristi Painter, BS, USDA Forest Service; Dr. Laurel M. Hartley, Ph.D, University of Colorado Denver; Dr. Diana F. Tomback, Ph.D, University of Colorado Denver

Abstract:
Trophic cascades occur when flora and fauna directly and/or indirectly influence co-occurring species populations at different levels of the food chain, and North American temperate grasslands provide an interesting case study to research these relationships. We address a previously proposed cascading trophic interaction in northern mixed-grass prairies between swift fox (Vulpes velox), western burrowing owl (Athene cunicularia hypugea), and mountain plover (Charadrius montanus) that co-occur on black-tailed prairie dog (Cynomys ludovicianus) colonies. Historic patterns of occurrence and co-occurrence suggest top-down control governs the spatiotemporal distribution patterns of the three species, providing prairie dogs remain active across the landscape. We present preliminary results from an occupancy-based research experiment for foxes, owls, and plovers on the Thunder Basin National Grassland in eastern Wyoming. Our occupancy models suggest that swift fox presence positively impacts mountain plover occupancy and negatively impacts burrowing owl occupancy. Similarly, mountain plover presence positively predicts swift fox occupancy. Inference from these models remains preliminary and mechanisms like colony size, impacts from sylvatic plague, and recreational shooting are still under analysis. However, a robust occupancy-based research design that informs management and conservation of these communities will aim to define the interactive components of this system moving forward.

The Spatiotemporal Airway Pressure Distribution During Manual Jet Ventilation

VRAJEN PATEL (UROP Recipient)
DC - College Engineering and Applied Science

JOSHUA PERTILE
AMC - School of Medicine

Mentor(s): Dr. Bradford Smith Bradford, Bioengineering,
AMC - School of Medicine

Dr. Daniel Fink

Abstract:
Manual jet ventilation is commonly used in tracheal surgeries to provide gas exchange while maintaining an open tracheal lumen. Clinical practice currently dictates jet pressure selection by qualitative observation rather than quantitative values. Jet pressures, durations, and frequencies are determined based on the clinical experience of the anesthetist and the observed chest wall movement of the patient. This process can potentially lead to lung damage and poor gas exchange. The purpose of this research is to characterize airflow in the lungs during jet ventilation in order to prevent lung injury and provide optimal gas exchange. Experiments were conducted using a three dimensional (3D) physical reconstruction of the first five generations of the airway tree derived from computed tomography scans of a healthy teenage patient. Jet positioning and triggering were controlled using a modified 3D printer to allow precise and repeatable positioning of the jet nozzle at various depths and angles in the model trachea. Pressure sensors were inserted at points of interest along the distal airways and data was recorded and analyzed via custom data acquisition software written in MATLAB. The experimental measurements indicate that the position of the jet in the tracheal lumen strongly influences the regional pressure distribution in the distal airways. Large spatial variations in pressure were observed indicating that jet position plays in important role in maintaining ventilation homogeneity.

“In-Through the Map...”

Nick Patin
DC - College of Architecture and Planning

Mentor:Dr. Jordan Hill, MHMSS,
DC - College of Liberal Arts and Sciences

Abstract:
Maps are a tool of power for illuminating a reality. Along with other tools of power, maps work multi-directionally and relationally. As they illuminate, maps also hold the potential for multiple, other, alternate, and transgressive realities. A cartographic history of Brighton Boulevard depicts the spatial, textual, and temporal processes that inform the spatial and political contexts of Brighton Boulevard and its adjacent areas. The following collected maps generate transgressive realities and histories as the ambivalent and conflicted content is subjectively read. The everyday practice of maps involves an everyday decisionism of spatial relations, where meaning and comprehension emerges in their reflexive read. By organizing the cartographic content in a loose historical progression provides a frame for which to read, yet does not overtly construct a historic narrative to follow. The paper thereby calls for reader participantship in writing and reading the power relations evident in the construction of Brighton Boulevard.

Baby Bump: A content Analysis of Popular Women Magazines in English and Spanish

Yovana Perez (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jennifer, A, Reich, Sociology,
DC - College of Liberal Arts and Sciences

Abstract:
Women's bodies are often scrutinized in negative ways based on cultural constructs of what the ideal body should be. Often these expectations are communicated through images and messages depicted in print media. Past research has focused on how women's bodies are portrayed in the media, how norms about the female body are communicated during pregnancy, when women experiences significant change in body size and shape, has not received as much attention. How these messages may vary across cultural contexts also deserves examination. For this research I analyzed popular online and printed copies of women magazines in two languages: English and Spanish to understand how stories and images about pregnancy represented pregnant women's bodies and to determine if there was variation between different language magazines. Data included 96 print and online magazine articles and images in English (49) and Spanish (47) collected from 06/01/2017-11/30/2017. Data were coded by categorizing images and articles into themes that included representation of bodies, birth control, pregnancy, and fertility. I found that among Spanish speaking magazines negative representations of body images were portrayed more than in English magazines, Spanish speaking magazines had no birth control information, and Spanish magazines. This information can give us an opportunity to understand how the media communicated body satisfaction during pregnancy through images and articles focused around pregnancy.

Asian American Pacific Islander Visible: Not your Model Minority

Binh Phan
DC - College of Liberal Arts and Sciences

Mentor: Asian American Pacific Islander Visible:
Not your Model Minority Binh Phan, Ethnic Studies,
DC - College of Liberal Arts and Sciences

Abstract:
The goal of this presentation is to bring to light the origins of the model minority myth of AAPI by providing a brief history of why there is a misconception that Asians tend to be more successful than other racial groups. The presentation suggests that the AAPI model minority myth stems from anti-blackness and perpetuates white norms in America. The negative consequences of this stereotype includes erasing Asians from public debates regarding racial legacies, and creating political invisibility.

Dog Treat Dispenser for Tetraplegia Patients

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Anthony N Sias
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Joanna C Jimenez
DC - College Engineering and Applied Science

Robert J Elliot
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Ana C Meza

Ramiro Alvarado Chazez

Jihan Shah

Kyra Flores

Mentor(s): Professor Craig Lanning, Bioengineering,
DC - College Engineering and Applied Science

Dr Cathy Bodine, CCC-SLP

Abstract:
Tetraplegic individuals lack the physical capability to give treats to their service dogs. The inability to reward the service dog strains the bond between the dog and the owner, making it difficult to maintain training and discipline. In order to address this need, a treat-dispenser has been developed. This treat dispenser is designed to take minimal input from the user in order to operate and can be mounted to any wheelchair. The development process was directed by the user needs and requirements. Improvements to the prototype were guided by further testing and examination. The user testing was evaluated based whether the need was meet, and if the device fulfilled all the requirements. The finished device is a fully functioning and user-ready dog treat dispenser that can hold and dispense enough treats for one day. With minimal input, tetraplegia individuals will be able to give their dog a treat without any additional assistance.

How to collect useful data in scientific experiments

Michael Pilosov
DC - College of Liberal Arts and Sciences

Mentor: Dr. Troy D. Butler,
Mathematics & Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
The testing of any scientific hypothesis requires collecting data. What to measure, when, and with what equipment all affect our predictive capabilities. Measurements are fundamentally uncertain, and handling these errors is of paramount importance. As always, the specifics will change with the system being studied and cost considerations of the experimenters, but we can look to mathematics to shed light on these critical questions. Several systems from biology, epidemiology, and physics will be shown as motivating examples.

Computational Study of Olefin Metathesis Reactions with New Ruthenium Catalysts

Chloe Pitsch (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Xiaotai Wang, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Ruthenium-based olefin metathesis catalysts have previously been shown to enable high E-selectivity. Density functional theory (DFT) calculations (B3LYP and M06) were performed to elucidate the mechanism of the ruthenium-catalyzed metathesis reactions. A variation of the Grubbs-type catalyst, 1cat, was used as a model. The high stereoselectivity was found to be a result of a four-membered metallocycle that forms between the ruthenium center and the olefin. Four different coordinations of the substrate to the metal center were considered, and of these the most energetically favorable conformations lead to the trans products.

Optimization of a human induced pluripotent stem cell derived cardiomyocyte differentiation method to increase reliability and efficiency for downstream applications.

Damon Pool (UROP Recipient)
DC - College Engineering and Applied Science

Mentor: Dr. Jeffrey Jacot, Bioengineering,
DC - College Engineering and Applied Science

Abstract:
Human induced pluripotent stem cells (hiPSCs) and their derived cardiomyocytes (hiPSC-CMs) are an important model currently used in tissue engineering, pharmacology, developmental biology, and genetic studies. With regard to tissue engineering, hiPSC-CMs can potentially be used to develop living patches to treat cardiac congenital birth defects, including Tetralogy of Fallot which affects 3-6 live births with a mortality rate of 50% for the first three years of life. Efficient cardiac differentiation involves small molecule activation of WNT signaling followed by inactivation of transforming growth factor β and WNT signaling with activation of sonic hedgehog signaling. Here, we attempt to improve cardiac differentiation efficiency from amniotic fluid-derived hiPSCs by fine tuning a robust protocol to achieve ~90% differentiation efficiency without subsequent purification of hiPSC-CMs. These homogenous hiPSC-CMs will be used in future studies to include investigation of the effect of porcine heart matrix (HM) on cell infiltration and migration into a poly(ethylene glycol)-fibrin (PEG-fibrin) biomaterial, cell maturation and contractility, and ultimately in-vivo studies in a murine model. This study, along with these future studies, is a vital step in the development of cardiac-like tissue to repair and regenerate a malformed or damaged heart.

Conformation of novel associations with asthma and serum ST2 in a population exposed to Schistosoma mansoni.

Timothy E Porfilio
DC - College of Liberal Arts and Sciences

Jianping Zhao
AMC - School of Medicine

Mentor(s): Director Kathleen, C, Barnes, BIPM,
AMC - School of Medicine

Nicholas Rafaels, MS, CCPM; Monica Campbell, MS, BIPM; Michelle Daya, PhD, BIPM; Tonya Brunetti, PhD, CCPM; Sameer Chavan, MS, BIPM; Aniket Shetty, MS, BIPM; Meher Boorgula, MS, BIPM

Abstract:
Schistosomiasis is a chronic parasitic disease that originates from snails in tropical places. For example, in Conde, Brazil, exposure to schistosomiasis is more prevalent due to exposure to endemic infested waters near the coast of Brazil. Individuals that produce the most IgE and serum ST2 (sST2), which is highly correlated with asthma, tend to be most resistant to infection of S. mansoni. Mutations that could make this population susceptible to worms like S mansoni, may be the same mutations that make them susceptible to asthma. A Genome Wide Association Study (GWAS) was performed on Brazil to identify key SNPs that can be connected to asthma and schistosomiasis. We performed a genome-wide analysis of wheeze, total IgE, and sST2 in 620 individuals from Conde, Brazil using data imputed from the MEGA-Ex Illumina chip. We confirmed imputed associations in Brazil using DNA extracted from blood using Qiasymphony, and genotyped using Taqman. We then checked concordance to confirm associations. Eight SNPs showed strong association with wheeze and sST2 (four, four, respectively; $p<1*10-3$). We successfully genotyped seven SNPs (one was monomorphic), and confirmed all seven genotype calls (concordance>98.9%). We have identified seven novel associations with traits related to asthma. We suspect that these SNPs may also be associated with traits related to S. mansoni, like egg count and IgE/IgG4. We plan to look at these traits in Conde, Brazil as well as interrogate these findings similarly exposed population in China.

A Comparative Analysis of Self-Reported Reasons for Divorce Among Active Duty Army Males and Civilian Females

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DC - School of Education and Human Development

Tammy A Nguyen
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Elizabeth S Allen, Psychology,
DC - College of Liberal Arts and Sciences

Dr. Scott B Stanley, University of Denver,
Psychology Department
Dr. Howard J Markman, University of Denver,
Psychology Department
Dr. Galena K Rhoades, University of Denver,
Psychology Department

Abstract:
Army couples experience very unique stressors on their relationships, including inflexible schedules and extended separations related to deployment. Understanding the causes for the dissolution of a marriage can help divorced individuals adjust and repair post-marriage (Rice, 2005). Many studies have focused on why civilian couples divorce (e.g. Amato & Previti, 2003; Cleek & Pearson, 1985; Gigy & Kelly, 1993; Hawkins, Willoughby, & Doherty, 2012; Scott, Rhoades, Stanley, Allen, & Markman, 2013), and correlates, consequences, and rates of divorce among Army couples have been explored (e.g. Hogan, Furst, & Seifert, 2010; Karney & Crown, 2011; Lundquist, 2007; Riviere, Merrill, Thomas, Wilk, & Bliese, 2012; Wang et al., 2015). However, no studies to our knowledge have yet to examine the reasons divorced Army couples themselves cite for their divorce, nor have these reasons been compared for service members and civilian partners.

The current study will focus on the most highly rated perceived reasons for marital dissolution among a sample of 248 divorced individuals who were in an Army marriage. Reasons include specific factors related to Army life as well as general issues that could affect military or civilian couples. Participants in this current study range in age from 24 to 50 with an average age of 32.54. 54.8% of the participants are female and 45.2% are male. A comparative analysis of perceived reasons for marital dissolution cited among service member males and civilian female partners will be provided.

Applying Optogenetics to Look at Ca2+ Regulated Transcription Factor in Beta Cells

Michaela S Pott (UROP Recipient)
DC - College Engineering and Applied Science

Mentor: Dr. Richard KP Benninger, Bioengineering,
AMC - School of Medicine

Abstract:
Diabetes is a multi-faceted disease, having many adverse effects in the body due to dysfunction of insulin secreting beta cells in the pancreas. One of these effects is high blood glucose levels, which causes many chronic complications including blindness, cardiovascular and kidney disease, as well as risk of hypoglycemia and death. Insulin secretion is required for lowering blood glucose. The transcription factor, nuclear factor of activated T-cell (NFAT), is thought to be involved in insulin granule formation and beta cell proliferation and development. Despite its importance for the pancreas and homeostasis of blood glucose, NFAT's exact mode of action is not well understood.

NFAT is regulated by an increase of intracellular Ca2+ levels. Upon increased blood glucose, a series of events lead to the activation of voltage gated Ca2+ channels. The cytosol is flooded with Ca2+ which initiates insulin secretion and NFAT activation. The purpose of this research is to utilize optogenetic management of Ca2+ levels in MIN6 cells to better understand how cells control NFAT translocation into the nucleus. To conduct this research, Ca2+ regulating membrane proteins were both stimulated and inhibited using light, cytokines and diazoxide. We hypothesize that cytokines greatly decrease Ca2+ fluctuation and that diazoxide completely halts it. Fluctuation of Ca2+ should be present when using blue light to stimulate the membrane cation channel—ChR2. The research that has been conducted supports this hypothesis. Implications of this data suggest that these forms of controlled Ca2+ fluctuation could be used to further study NFAT translocation.

Are brand name cleaners worth it?

Alexa G. Powell
DC - College of Liberal Arts and Sciences

Connor D Moos
DC - College of Liberal Arts and Sciences

Mentor: Dr. Kyoung, N., Kim,
Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Ammonium Hydroxide is an active ingredient in glass cleaners that enables it to clean glass surfaces without leaving streaks. The higher the ammonium hydroxide content there is in a glass cleaner, the better the glass cleaner because of its level of streak free cleaning abilities. Name brand glass cleaner (Windex) vs. generic brand glass cleaner (great value) was titrated against hydrochloric acid to find the ammonium content in each to determine which is a better cleaner. Another factor that was considered was the cost per mole of ammonium to determine which of the two glass cleaners was the better value. The results indicated that Windex had a slightly higher ammonium content than Great Value; however, it also had a much higher cost per mole of ammonium when compared to the Great Value brand. Windex is the "better" brand when considering its non-streaking capabilities, but the Great Value brand is the most cost effective in terms of cost per mole of ammonium. In conclusion, the Great Value brand was determined to be the better overall option due to the fact that the ammonium content difference between the two was quite minuscule, but the cost per mole of ammonium was significantly higher in Windex than Great Value. This research will help people determine which brand of glass cleaner is better suited for their needs.

Model Behavior: The Investigation Into Behaving How You Want

Brandan M. Rader
DC - College of Liberal Arts and Sciences

Mentor: Dr. Katherine Goodman,
IWKS Independent Study,
DC - College of Liberal Arts and Sciences

Abstract:
Current research on habit formation has focused on existing habits and habit extinction for undesirable habits, such as drug addiction. Albeit, there is a relative dearth of literature on habit acquisition. The gap in research stems from phenomenon a dichotomy between the field of behaviorism and neuroscience. Novel techniques in neuroscience afford psychologists the opportunity to measurably explore the black box classic behaviorists eschewed. My objective for this paper is to investigate the components of habit acquisition. The central question governing my critical analysis is: Does reducing external complexity facilitate habit acquisition? I will discuss classical conditioning, operant conditioning, regions of the brain involved in habit formation, and the external components of habit acquisition, as they pertain to this question. Fully comprehending habit acquisition may provide an alternative intervention to pharmaceuticals for psychological inflictions, such as depression. I propose a study to research the effects of environmental complexity on habit acquisition. My hypothesis is reducing a person's options (environmental complexity) facilitates habit acquisition. The proposed study would be a two-group experimental design for a total duration of 118-days. A sample (n=128) population (64 males and 64 females) would be exposed to a study design to facilitate habit acquisition of water drinking behavior. Theoretically if my hypothesis was supported, Model Behavior would provide an impetus for interventions to help people attain the daily routine they desire via habit acquisition.

Keywords: habit formation, habit acquisition, behaviorism, neuroscience

Do Natural Protected Areas in Mexico Protect Forests?

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Rafael Moreno-Sanchez

Peter Anthamatten

Juan Manuel Torres Rojo

Mentor(s): Dr. Rafael Moreno-Sanchez,
Geography and Environmental Sciences,
DC - College of Liberal Arts and Sciences

Dr. Peter Anthamatten, Dr. Juan Manuel Torres Rojo

Abstract:
Decreasing deforestation and forest fragmentation in Mexico are import to conserve ecosystems, biodiversity, soil composition, and to sequester carbon. Studies in the field have examined the relationship between forest degradation and sprawling colonization, increased and intensified agriculture and livestock production, as well as various types of resource extraction including timber. The establishment of natural protected areas is the primary strategy to mitigate forest degradation. However, few studies have determined how well natural protected areas actually perform. This research explores the relationship of natural protected areas to loss in forest canopy cover and increases in forest fragmentation. It compares what is happening in protected areas to concentric buffers surrounding them for all forests and subclasses of forests. Results are aggregated at national and regional levels to look at geographic variation. This study covers forests in Mexico from 2000 to 2010 using GlobeLand30, a 30-meter spatial resolution global land cover data set that has been assess with a near average accuracy of 80% for classifying forests in Mexico.

Economic Development Study for the City of Arvada

Rocio Ramirez
DC - College of Architecture and Planning

Nermeen Dalgamoni
DC - College of Architecture and Planning

Rebecca Buthe
DC - College of Architecture and Planning

Karl Onsager
DC - College of Architecture and Planning

Mentor:Dr. Carrie L Makarewicz,
Urban and Regional Planning,
DC - College of Architecture and Planning

Abstract:
This project focused on analyzing economic development for the City of Arvada in order to identify industrial firms with high wages that may be attracted to Arvada's industrial sites and their workforce's occupations and skills. The larger objective was to help the city determine businesses it should look to attract and businesses it should work to retain. Various strategies like population projections, economic base analysis, workforce analyses, and site selection were employed in the development of the project. Diverse sources of information, including the U.S. Census's Bureau of Labor Statistics, Esri Business Data, the City's sales tax data, and numerous GIS layers were utilized for the first stages of data gathering. The remainder of the process was divided into multiple sections. The first focused on characterizing the City's industrial parcels as opportunity sites for firm location and expansion. The subsequent step focused on identifying industries that require similarly located, sized, and zoned land. . Twelve major industries were selected to become the focus of industry profiles which highlighted the national and regional data trends, regional distribution of the industry, firm examples, and a comparison of the regional workforce to the Arvada workforce by occupation, wage, and education. The final step were recommendations focused on zoning modifications, infrastructure investments, and targeted workforce development.

Shared Rapid Prototyping Space using Hand Tracking and Virtual Reality

Christopher P. Renden
DC – College of Engineering and Applied Science

Lewis G. Sammons
DC – College of Engineering and Applied Science

Jordan Stein
DC – College of Engineering and Applied Science

Mentor: Min-Hyung Choi, Computer Science
DC – College of Engineering and Applied Science

Abstract:
Using the power of Virtual Reality and the technology of Leap Motion, Conceptual Design VR (Working Title) allows teams to design their concepts in a three dimensional space. Leap Motion technology allows for a controller free experience, instead injecting the power straight into the user's fingertips. Placing a user into a three dimensional space removes the constraints of a two dimensional screen, allowing for the user to see the precision of their design.

In our mini-symposium, we will demonstrate the capabilities of this new tool by working as a team to prototype designs requested by the crowd. As well, we will give a few members of the audience the opportunity to participate in the design process, bringing them into the application and using the intuitive nature of the hand-tracking to rapidly familiarize them with the gesture control scheme.

LWPC Modeling of Lightning Induced Ionospheric Disturbances

Chad M. Renick
DC - College Engineering and Applied Science

Mentor(s): Dr. Mark Golkowski, Electrical Engineering,
DC - College Engineering and Applied Science

Dr. Morris Cohen, Georgia Institute of Technology

Abstract:
The ionosphere is a layer of the Earth's atmosphere that is 60-1000 km in altitude. Because of the conductive properties of both the Earth's crust and the ionosphere, Very Low Frequency (VLF) waves are reflected off of these regions, forming what is known as the Earth-ionosphere waveguide (EIW). Monitoring how VLF waves propagate in the EIW can provide insight into ionospheric conditions in the lowest (60-100 km) portion of the ionosphere known as the D-region.
Lightning discharges are a source of high amplitude, broad frequency electromagnetic radiation. These electromagnetic waves can cause electron density perturbations in the ionosphere. Because changes in electron densities affect the conductivity of the ionosphere, lightning discharges can alter how VLF communication signals propagate through the EIW. This work focused on overlapping propagation paths with signals from two different VLF transmitters sharing a common path to a receiver. This allowed for the geographic area of the overlapping path to be diagnosed with two signals simultaneously.
Observations show that a lightning induced perturbation on the overlapping paths can have a large effect on the amplitude or phase of one signal, while leaving the other wave relatively unaffected. The Long Wave Prediction Capability (LWPC) software is used to simulate this phenomenon by altering the ionospheric electron densities near the location of a known lightning strike. Good agreement was found between the simulation and observations. This shows that providing additional constraints on the perturbed ionosphere has led to a more accurate model of how lightning affects ionospheric electron densities.

Preparation of Deuterated Serine Analogs to Study Morphology Changes within the Aβ-peptide Leading to Fibril Formationain

Dillon R Rickertsen
DC - College of Liberal Arts and Sciences

Cristiana Meuret
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Scott M. Reed, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Liliya Vugmester

Abstract:
The Aβ-peptide is related to Alzheimer's disease due to its unstable nature. Aβ-peptide can undergo morphology changes leading to the formation of highly structured fibrils that are toxic to neuron cells. The stability of Aβ-peptide can be studied using deuterated analogs of specific amino acids within the peptide sequence. Here we describe a method for preparing peptides containing deuterium exclusively on the methylene side chain of serine. This can be used to study the morphology of the peptide leading to fibril formation. To insert this deuterated serine analog into a peptide sequence it will need to be protected. The amine and hydroxyl groups will be protected in order to direct reactivity with the C-terminus during solid state peptide synthesis. The carboxylic acid of serine will need to be protected in order to favor reactivity of the hydroxyl during protection. After hydroxyl protection the carboxylic acid will be deprotected allowing the analog to be inserted into the peptide. Once the deuterated analog 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.

A transient dopamine signal represents the value of avoidance in negative reinforcement

Jonté Roberts
DC - College of Liberal Arts and Sciences

Katherine Pultorak

Scott Schelp

Gregory Krzystyniak

Dominic Isaacs, Brandon Busch

Mentor:Dr. Erik B. Oleson, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
The mesolimbic dopamine (DA) system has traditionally been examined under a reward based context. While accumulating evidence supports that DA release events represent the value of predicted rewards, there is little known about its role in avoidance. To investigate this role in the valuation of signaled operant avoidance, we first developed a novel economics-based shock avoidance task in which rats were given the opportunity to avoid (signaled by the presentation of a cue light) electrical foot-shock across epochs wherein the unit price (response requirement over mA shock) to avoid or escape increases. We then utilized fast-scan cyclic voltammetry (FSCV) to measure DA release events in vivo as the animals performed across a range of prices. We observed that the concentration of DA decreased as unit price increased, though both DA and avoidance were initially suppressed at session onset. To establish a causal role, we then used optogenetics to augment DA release at either cue presentation or upon successful avoidance. Increasing release at the cue made avoidance more sensitive to price; whereas increasing release at successful avoidance made it less sensitive to price. We conclude that this is likely because the neural representation of the value to avoid is greater than predicted at successful avoidance, and worse than expected at the cue on trials in which foot-shock is administered. We will next assess the role of the rostromedial tegmental nucleus (RMTg), a GABAergic neural structure believed regulate behavior by inhibiting ventral tegmental area (VTA) DA neurons, in the valuation of avoidance.

MODULATION STRATEGIES FOR MODULAR MULTILEVEL CASCADED CONVERTERS

HECTOR R ROBLES-CAMPOS
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Mentor: PhD Fernando Mancilla-David,
Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The objective of this research is to study two different Modular Multilevel Cascaded Converters (MMCC) topologies that have attracted plenty of attention within the last two decades. Some example applications of these power converters are motor drives and HVDC transmission systems. The main advantages of multilevel converters against the very famous two-level converter are: i) reduced requirements for series connection of semiconductor devices for the same voltage level, ii) increased power quality of the output voltage and currents, and iii) relatively low switching frequency. One important drawback of multilevel topologies is that as the number of levels increases so does the complexity of the control and its implementation.

Throughout this work, two important MMC topologies termed Double-Star Half-Bridge commonly called Modular Multilevel Converter (MMC), and the Double-Delta Full-Bridge called in short Hexverter will be studied.

The MMC, originally proposed back in 2003, is the state-of-the-art multilevel topology when used as an inverter, due to its salient features: modularity, high efficiency and reduced switching stress. Regarding the Hexverter, proposed back in 2011, is an MMMC directly connecting two different three-phase AC/AC systems typically are oscillating at two different frequencies.

Different modulation techniques such as: i) nearest level control (NLC), ii) NLC with harmonic elimination (NLCE) and iii) selective harmonic elimination (SHE) are modeled, implemented and analyzed when applied to those MMCC topologies. Technical solutions will be developed enabling an increased penetration of renewable energy systems into the grid, while improving the efficiency and power quality of those power converters.

Educational Equity for DREAMer College Students

Alisya D Rodriguez
DC - College of Liberal Arts and Sciences

Mentor:Professor Donna Martinez, Ethnic Studies,
DC - College of Liberal Arts and Sciences

Abstract:
What policies are needed to support DREAMer students in higher education? College graduation rates for undocumented students are low due to a lack of resources, mentoring, and support. These students are not able to apply for federally funded grants and loans in all but five states (California, Washington, Minnesota, New Mexico, and Texas). Most undocumented students are also unable to pay in state tuition, though Colorado is one of the states that allows this.

The Value of Creativity in Elementary Reading Groups

JKimberly A Rodriguez
DC - School of Education and Human Development

Mentor: Instructor Kobi Nelson,
School of Education and Human Development,
DC - School of Education and Human Development

Abstract:
This inquiry project explored the idea that students are innately imaginative beings who thrive when they use creative and artistic measures to complete and retain their literacy work. The fourth and fifth-graders in this work were consistently engaged in a small reading group when they were given creative materials (pens, colored handouts, etc.) to enhance their reading comprehension. In addition, they maintained their engagement when they were given the opportunity to make their reading notes and responses visually appealing. A short twenty-minutes in a reading group at the beginning of a school day meant the student's literacy work had to allow for creativity, and it had to uphold purpose in their lives. The school administration of the students in this inquiry required that all upper grades spend 50% of the time in their groups reading, and 50% writing. This requirement was met through the course of this work, and continues to be met today. The NxtGEN intern in charge of facilitating the reading group observed that her students learn in ways similar to the ways in which she learns. Like them, she better retains the information she reads when she makes her personal notes and responses colorful and fun. When creativity and purposeful tasks are kept throughout the process of reading and writing, they allow for deeper engagement for the intern and her students alike. As a result, reading comprehension skills are further developed for both parties.

Enhancing Electrogenic Conditions and Power Production in A Wastewater Microbial Fuel Cell

Jessica Romero (UROP Recipient)
DC - College of Liberal Arts and Sciences

Hunter Sauerland
DC - College of Liberal Arts and Sciences

Walter Emery
DC - College Engineering and Applied Science

Mentor(s): Dr. Timberley Roane,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Dr. Jungjae Lee (Chemistry), Dr. Jae-Do Park (Electrical Engineering)

Abstract:
Microbial fuel cells (MFCs) are an emerging form of sustainable energy that harvests electricity from sources of bacteria, such as wastewater. The chemical and biological conditions necessary to stabilize maximal power from MFCs are still being determined. This project aimed to set up MFCs with different chemical environments and characterize bacterial communities and power production associated with these environments. There are two microbially-active components to a wastewater MFC: (1) the anode and (2) the wastewater itself. To improve MFC electricity production, anodes were chemically modified using varying amounts of Polyaniline coating, a known conductive polymer. Modified anodes showed a 29% increase in capacitance compared to unmodified anodes. Successful anode modification was confirmed with fluorescence imaging. During operation, anode and wastewater samples were collected. From each MFC for each timepoint, 16S rDNA sequencing was performed to identify members of the associated bacterial communities. Sequences were computationally analyzed using QIIME and R software to characterize and compare bacterial communities resulting from different anode modifications. Within 30 days of operation, an MFC with an unmodified anode produced 57 mV, whereas an MFC with a modified anode produced 239 mV. Given the differences in power production observed thus far, we expect to find different bacterial community activity and therefore different electrogenic potential. Continuing studies will identify conditions yielding optimal bacterial communities for increased power production in MFCs.

Controversial: The Tradition of Exhibiting Animals at Zoos From the 1970s to Present Debate

Elizabeth Roths
DC - College of Arts and Media

Mentor: Dr Wang Yang Wang,
DC - College of Arts and Media

Abstract:
My research examines zoological exhibit design. This is a critical reflection of not only the treatment of animals in captivity but our sensitivity to their struggles to and ever-shrinking natural world. Zoos have evolved from strictly containment spaces into educational centers. The gap in literature caused by the question of what the animal's needs are. Animal needs and consideration of intelligence are important questions to research but this should not take away from the importance of providing them a dynamic environment to live in and meet their needs in the most efficient way. Exhibits of rare animals draw attention to conservation efforts, and modern natural enclosures seem to be preferred over unnatural historic enclosures. In my paper I examine how exhibit design is being paired with educational spaces to promote and provide the best environment possible to meet the needs of keepers, visitors, and of course the animals who live their lives within the spaces. My research indicates that with better exhibits comes better education and therefore more attention to conservation efforts. By investing in zoological education programs to improve educational efforts, we are foster understanding between humans and animals.

The Effect of Irrelevant Sounds on Eye Movements During Visual Search

Cailey A Salagovic (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Carly L Leonard, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
While it is well-established that current goals and visually salient events direct eye movements, the role that auditory stimuli play in the guidance of visual attention is less understood. The present study examined this crossmodal attentional behavior by tracking eye movements as participants complete a dynamic search task. Specifically, we further examined the "pip-and-pop" effect, a phenomenon wherein an uninformative sound that is synchronized with a target color change event leads participants to locate the target faster than when no sound accompanies the color change (Van der Burg, Olivers, Bronkhorst & Theeuwes, 2008). Our current study investigates how the nature of the auditory stimulus may modify this crossmodal effect, and also further examines the changes in eye movement patterns. Overall, the results indicate both faster reaction time and fewer fixations in search trials with sound events than trials with no sound. No significant difference in these measures was found between a simple, pure tone auditory stimulus and a more complex, frequency modulated auditory stimulus. This finding may suggest that the general presence of non-spatial sound in an environment affects the deployment of visual attention but that sound complexity does not further modulate this effect. Two additional experiments further manipulated the presentation of audiovisual events and participants' search strategy in an effort to produce a greater effect of sound presence. Such inquiry is important for building an understanding of how attentional behavior functions in response to the multisensory environments of the natural world.

Acid Base Titration of Acidic Home Cleaners

Desiree R Salais
DC - College of Liberal Arts and Sciences

Mentor: IMs. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Home cleaners require either a basic or acidic pH to be able to effectively clean different soiled surfaces within an average home. However, not all household cleaners will list the amount of each chemical contained in the bottle. In this experiment, two home cleaners, Heinz Vinegar (acetic acid) and Lime Away (sulfamic acid), were titrated to determine the mass percent of active ingredient. Multiple trials of titration were done to lower experimental errors. The calculated mass percents were 4.6% acetic acid versus the 5.0% listed on the bottle of vinegar, and 9.5% sulfamic acid versus the 5.0% given by the company who produces Lime Away. There were inconsistent results between trials of the sulfamic acid titration. Further research could be done to find a more precise procedure for determining the concentration of sulfamic acid in Lime Away.

Shared Rapid Prototyping Space using Hand Tracking and Virtual Reality

Lewis G. Sammons,
DC – College of Engineering and Applied Science

Jordan Stein,
DC – College of Engineering and Applied Science

Christopher P. Renden,
DC – College of Engineering and Applied Science

Mentor: Dr. Min Choi,
DC – College of Engineering and Applied Science

Abstract:
Using the power of Virtual Reality and the technology of Leap Motion, Conceptual Design VR (Working Title) allows teams to design their concepts in a three dimensional space. Leap Motion technology allows for a controller free experience, instead injecting the power straight into the user's fingertips. Placing a user into a three dimensional space removes the constraints of a two dimensional screen, allowing for the user to see the precision of their design.

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Mating-receptivity in female dipterans is mediated by daily fluctuations of dopamine levels

Erin J Sanders
DC - College of Liberal Arts and Sciences

Mentor: Dr. John G. Swallow, Integrative Biology,
DC - College of Liberal Arts and Sciences

Dr. Andrew N. Bubak, Department of Neurology,
CU Denver - Anschutz Medical Campus;
Dr. Kenneth J. Renner, Department of Biology,
University of South Dakota

Abstract:
Dipterans, like vertebrates, are subject to circadian rhythms. Circadian rhythms can cause physiological changes that lead to differences in behavioral responses throughout the day. These physiological changes include fluctuations in monoamine levels, such as dopamine and serotonin. Invertebrates, like stalk-eyed flies (Teleopsis dalmanni), are a useful model for studying the function of conserved mechanisms, like monoamines, that are also seen in vertebrates. Experimental data indicated that female stalk-eyed flies were found to have a spike in dopamine levels from 5 to 7 pm, which is when the flies tend to roost, while male levels stayed stable. This spike was not seen at other times throughout the day. We hypothesized that this spike in dopamine would lead to increased mating receptivity in females. To test this, we administered 3-Iodo-L-tyrosine 97% (3-IY), which inhibits the enzyme Tyrosine Hydroxylase and decreases the synthesis of L-Dopa, to knock down dopamine globally in female flies. Both control and treated females were isolated from males, who were also isolated from other females, for three days while the drug was being administered. Then mating-receptivity was assessed by placing each female one-on-one with a male in an arena. Their mating behaviors were recorded and scored. HPLC with ED and Immunohistochemistry were used as validation methods to ensure that dopamine was knocked down. The results supported the hypothesis that a circadian increase in dopamine plays a significant role in mating receptivity in female stalk-eyed flies.

DETERMINING THE SOURCE OF FECAL POLLUTION IN URBAN STREAMS THROUGH MICROBIAL SOURCE TRACKING

AAnna M. Scopp
DC - College of Liberal Arts and Sciences

Mentor: Dr. Annika C. Mosier,
Department of Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Freshwater ecosystems are routinely monitored for fecal contamination to protect human health and preserve natural biodiversity. Traditionally, cultivation of fecal indicator bacteria (FIB) such as Escherichia coli is used to signify fecal contamination in a water body; however, this approach provides no information about the source of fecal contamination. In this study, Microbial Source Tracking (MST) was used to identify sources of fecal pollution affecting Bear Creek and Cherry Creek (Denver, CO) using high-throughput 16S rRNA gene sequencing and quantitative Polymerase Chain Reaction (qPCR) of human-associated Bacteroides 16S rRNA genes. qPCR and gene sequencing both suggested that human fecal pollution contributes to the water column microbial communities in Bear Creek and Cherry Creek. In Bear Creek, bacteria associated with human fecal matter were distributed evenly along the creek, suggesting that there are multiple locations where human fecal contamination is entering the creek. Human fecal bacteria increased at downstream sites in Cherry Creek, suggesting that the predominant sources of human fecal pollution occur downstream of CHERRY-07. Levels of potential human fecal pollution were very low in the sediments of both creeks. Sequence analyses suggested that fecal matter from Canadian geese made a very small contribution to the overall microbial community structure in water column and sediment samples (0.4% contribution on average across nearly half of the samples). Fecal matter from other animals (e.g., duck, dog) were not identified as significant contributing sources to the Bear Creek and Cherry Creek microbial communities. Future efforts aimed at improving our understanding of fecal pollution in Denver waterways should include seasonal sampling, direct correlations between E. coli culture counts and human-associated Bacteroides qPCR counts, and testing how long human-associated Bacteroides persist in freshwater streams after fecal contamination.

Mismatched Pieces: Queer Identity in the Modern Moment

Amy B Scott
DC - College of Liberal Arts and Sciences

Mentor: Assistant Professor Joanna Luloff, English,
DC - College of Liberal Arts and Sciences

Abstract:
Before moving to Denver to pursue a creative writing degree, I grew up in suburban Texas for most of my adolescent life. Reading stories and writing my own quickly became my way of escaping my circumstances, for exploring my identity and figuring out why I was never satisfied with the social systems surrounding me. “Mismatched Pieces” is a discussion about the challenges of finding a sense of identity as a queer woman of color in American society, as well as identifying the homophobic structures that still structure Western conceptions of sexuality and gender. From the perspective of a queer writer who grew up ignorant of queer culture, I strive to include and advocate for the inclusion of nuanced and positive representations of LGBT+ experiences and individuals. “The Diaries of E.B.” is an ongoing project, a surreal epistolary novel that blends LGBT+ and feminist themes into a personal exploration of gender and sexuality dysphoria. Through this reading and discussion, this performance aims to show the importance of bringing LGBT+ culture into the mainstream literary discussion, increasing visibility where past generations have been obscured and told through media representation that they are mismatched.

Hormonal Sex Differences in Behavioral Responses to Early Life Stress: A Literature Review

Leslye Simental
DC - College of Liberal Arts and Sciences

Alexa K. Steed
DC - College of Liberal Arts and Sciences

Madelynn B Wilde
DC - College of Liberal Arts and Sciences

Briana Harris
DC - College of Liberal Arts and Sciences

Mentor: Dr. Lindsey Hamilton,
Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Many studies have been performed that look at the influence of stress on hormones. We questioned whether or not stress that occured specifically early on in life would impact hormones later in life. In addition, we intended to investigate whether or not the impact of stress on hormones was mediated by gender. Before starting the literature review on this topic, we hypothesized that we would find gender differences in hormones due to sexual differentiation that occurs early on in the development of the fetus. In order to come to a conclusion, our team read empirical, peer-reviewed articles regarding early life stress and hormones for both male and female subjects. Due to ethical issues, the majority of the research we found used animals as subjects, such as rats and chickens. However, we believe that the information taken from these studies is still applicable to human subjects as well. We concluded that there are basic differences between male and female hormonal responses to early life stress. Specifically, there are significant correlations between sex-typical behaviors and the presence of varying levels of glucocorticoids, androgens, and estrogens due to early stress postnatally. While more research needs to be conducted, we make recommendations about future directions and possible measures to protect both males and females from hormonal consequences of early life stress.

Exploration of transition metal complexes with 8-oxo-7,8-dihydroguanosine as a potential probe for oxidative RNA lesions

Austin A Skinner (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Marino J Resendiz, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
8-oxo-7,8-dihydroguanosine (8-oxo-G) is arguably the most relevant lesion present in the RNA and DNA of biological systems exposed to oxidative stress. The altered chemical properties of 8-oxo-G, as compared to its canonical counterpart guanosine (G), allow for a variety of adverse genetic effects including mutagenesis and carcinogenesis. Certain transition metals have been documented to interact with DNA and RNA. However, little is known on the reactivity of transition metals with 8-oxo-G lesions. A large panel of reactions was used to assess the reactivity of various transition metal reagents with both G and 8-oxo-G nucleosides. Reactions of interest were analyzed via ultraviolet-visible light (UV-Vis) spectroscopy and nuclear magnetic resonance (NMR) spectroscopy. This study hopes to shed light on potential transition metal probes for 8-oxo-G lesions.

Hormonal Influences on the Development of ADHD

Hailey A Smieja
DC - College of Liberal Arts and Sciences

Jacee Dinius
DC - College of Liberal Arts and Sciences

Brooke Charbonneau
DC - College of Liberal Arts and Sciences

Jacob Pitts
DC - College of Liberal Arts and Sciences

Mentor: Dr. Lindsey Hamilton, Psychology,
DC - College of Liberal Arts and Sciences

Abstract:
Attention Deficit Hyperactivity Disorder (ADHD) is one of the most commonly diagnosed behavioral disorders from children to adolescents, with males being three times more likely to be diagnosed. The research that has been done has still left a gap on how hormones, the environment, genetics, and the hypothalamus-pituitary-adrenal axis (HPA axis) all interact with one another leading to the formation of ADHD. The goal of this literature review was to define the role of hormones in the development of ADHD. To conduct this research, we analyzed 23 scholarly articles and one video to reach our conclusions. It was found that thyroid hormones play a role during prenatal development for ADHD, and after birth into adolescence. From these articles, it's known that having an under-active HPA axis, and thyroid hormones (i.e. resistance to thyroid hormones, and T3 and T4), contribute to the development of symptoms of ADHD. This review will help to bridge the gaps in how ADHD develops in children: what different factors play a role in the development of ADHD, how those factors interact with one another, as well as different preventative methods that can be tried going forward, starting prenatally. This project will give readers a better understanding on the interaction of thyroid hormones, the genetics, HPA axis, and the environment.

MODELING AND CONTROL OF POWER ELECTRONIC CONVERTERS IN RENEWABLE ENERGY APPLICATIONS

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Mentor: Dr. Fernando Mancilla-David,
Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
The objective of this research is to study power electronic converters in renewable energy applications across the power system. Nowadays, power electronic converters have become an important enabling technology in generation, transmission and distribution power systems. They are indispensable for photovoltaic and wind-based power plants. In the transmission system, converters are a reliable method to provide supplementary services to the grid. Not only converters are necessary for photovoltaic applications in distribution systems, but they will play a very important role in the future smart grid and in microgrids. During this research, models of novel converter topologies suggested for applications with fuel cells have been studied. An optimized switching strategy for a ripple canceling boost converter was tested in a converter prototyped in the laboratory. Additionally, a converter with high gain and input current ripple cancelation was prototyped and tested in the laboratory for validation of the new topology. Also, several complex non-linear control approaches were tested as a possible solution to a growing problem in distribution systems, which is the cascade connection of converters. Furthermore, state-of-the-art models of photovoltaic panels, wind turbines, maximum power point tracking algorithms and back-to-back converters for HVDC applications have been studied and extensively tested in various modeling software packages. Considering the software needed to prototype the converters and implement the controls in microcontrollers, these include Matlab, PSCAD, PSPICE, ORCAD, Ultiboard, Eagle, Atmel Studio, CodeComposer Studio and others.

An Investigation of the Mechanism behind Calcium-Inhibited Membrane Binding by the C2A Domain of Synaptotagmin-Like Protein 2

Timothy A Spotts (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jefferson D. Knight, Chemistry,
DC - College of Liberal Arts and Sciences

Abena Watson-Siriboe (UC Denver Department of Chemistry and Integrative Biology), Samuel Willstead (University of Southhampton Department of Chemistry), Dr. Hai Lin (UC Denver Department of Chemistry), Dr. David Jones (UC Denver Anschutz Medical Campus Department of Pharmacology), Dr. Thomas Lee (UC Boulder Department of Chemistry and Biochemistry)

Abstract:
C2 domains are a key component of membrane-trafficking proteins involved in a variety of cellular processes such as exocytosis, the release of chemicals from inside the cell to the extracellular environment. C2 domains may exhibit membrane-binding activity that is normally classified into two categories: Ca2+-dependent or Ca2+-independent. There is a C2 domain however, the C2A domain of synatptotagmin-like protein 2 (SLP2C2A) that exhibits a third method of membrane binding: Ca2+-inhibited. This study of SLP2C2A set out to identify the mechanism behind its Ca2+-inhibited membrane binding exhibited in vitro. In this study, the C2A domain of SLP2 was expressed, purified, and shown to dissociate from membranes with the addition of Ca2+. Data obtained using established Trp-Dansyl fluorescence-based assays suggest the concentration of Ca2+ required to dissociate half of SLP2C2A from a bound membrane (the IC50 value) is approximately 20-fold higher than previously reported and well above physiological levels. Two models were tested in an attempt to probe the nature of this Ca2+-inhibited membrane binding. In the protein-centric model, Ca2+ binds SLP2C2A in an allosteric manner and inhibits membrane binding. In the lipid-centric model, Ca2+ coordinates anionic lipids and competes with SLP2C2A for membrane binding. Although 15N1H NMR data and novel Be2+-dansyl assays backed the lipid-centric model, results did not support either model in full; this suggests a more complex mechanism that combines aspects of both models may be responsible.

Creation and Implementation of a Course-based Undergraduate Research Experience using Long Term Urban Wildlife Research

Sarah St. Onge
DC - College of Liberal Arts and Sciences

Mentor: Associate Professor Laurel Hartley,
Integrative Biology,
DC - College of Liberal Arts and Sciences

Abstract:
Urbanization is increasing rapidly worldwide, leading to highly fragmented habitats which have been shown to be the leading cause of local wildlife species endangerment. Therefore, it will be important to study urban ecosystems to investigate effects of urbanization on wildlife. Urban wildlife research has the potential to support land and wildlife management decisions, wildlife and habitat conservation, urban biodiversity, disease dynamics awareness, and help with human-wildlife conflicts. The goals of our project are to establish CU Denver as a partner in the nationwide Urban Wildlife Information Network (UWIN) and use long-term monitoring of urban wildlife as a context for a Course-based Undergraduate Research Experience (CURE) in General Biology courses. This study has established a wildlife monitoring protocol in the Denver metro area using motion-activated camera surveys along an urban to rural urbanization gradient that has provided preliminary data. Curriculum creation included developing learning objectives and identifying core experiences for scientific literacy that are consistent with current national directives and that comply with important aspects of CUREs, including relevancy of the project that results in the discovery of new scientific knowledge, use of scientific practices, collaboration with peers, and iteration. By implementing this CURE curriculum in an undergraduate general biology lab course, this project will be the start of a long-term monitoring project that will be beneficial for students, universities, land managers, and UWIN. Here we present the CURE curriculum that is currently underway, and the planned data for researching the implementation outcomes.

Let's Talk About Sects: Sexuality in Sacred and Secular Images in & 14th-Century France

Jacquelyne Staley
DC - College of Arts and Media

Mentor: Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
The medieval period was a time when religion ruled the world. Codes of acceptable and deviant sexual behavior were imposed upon medieval audiences in various forms of depictions found throughout the dark ages. While recognizing the artistic value of sexually charged images, scholars have typically analyzed these paintings in isolation from their broader cultural context. My analysis, however, will explore visual materials from fourteenth-century France alongside contemporaneous literary and liturgical text to show that codified notions of deviant sexual behavior developed from a culmination of these cultural forms. I will specifically examine the images found within the illuminated manuscript known as the Bible Moralisee (Moralized Bibles), commissioned and viewed by the ruling class, in conjunction with the bawdy, humorous poems that were circulated throughout the general population called the French Fabliaux's. Sexual behavior like prostitution, homosexuality, and adultery can be seen in these images and were represented as transgressive and harmful to individuals and society. My examination will show how art shaped sexual codes of behavior across class lines. While the culture of fourteenth-century France differs drastically from ours, sexuality and how it functioned as enforcers of social conduct offers insight into the power of images and their enduring authority to prescribe, sanction, and repress innate human behavior.

SHARED RAPID PROTOTYPING SPACE USING HAND TRACKING AND VIRTUAL REALITY

Jordan T Stein
DC - College Engineering and Applied Science

Mentor: Dr. Min Choi, Computer Graphics,
DC - College Engineering and Applied Science

Abstract:
Using the power of Virtual Reality and the technology of Leap Motion, Conceptual Design VR (Working Title) allows teams to design their concepts in a three dimensional space. Leap Motion technology allows for a controller free experience, instead injecting the power straight into the user's fingertips. Placing a user into a three dimensional space removes the constraints of a two dimensional screen, allowing for the user to see the precision of their design.

In our mini-symposium, we will demonstrate the capabilities of this new tool by working as a team to prototype designs requested by the crowd. As well, we will give a few members of the audience the opportunity to participate in the design process, bringing them into the application and using the intuitive nature of the hand-tracking to rapidly familiarize them with the gesture control scheme.

A Killer Story: The Cochran Murders and the Debate Over Journalistic Ethics in Denver

LD'Aaron Stewart,
DC – School of Education and Human Development

Mentor: Dr. William Wagner, History,
DC – College of Liberal Arts and Sciences

Abstract:
In "A Killer Story: The Cochran Murders and the Debate Over Journalistic Ethics in Denver," D'Aaron Stewart examines a mid-1980s case in which members of the local press debated over whether to expose a newspaper editor as someone who had—many years before—been convicted for murder. On the one hand, members of the downtown press embraced principles of criminal rehabilitation and argued the editor should be afforded privacy. On the other hand, members of the alternative press framed the issue on economic terms and charged that downtown newspapers were only affording the newspaper editor privacy because he was a member of the local elite. The alternative press ultimately exposed the editor's past murder conviction, and their young readership embraced that decision. The case thus chipped away at privacy privileges among members of the media.

Development and Incorporation of Virtual Pathology Slides with Instructor Simulation Tools in Pathology Residency Training and Histology Education

Ian F. Stewart
AMC - School of Medicine

Mentor(s):Dr. Lisa M.J. Lee, Ph.D.,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Brian E. Moore, M.D., Department of Pathology, University of Colorado School of Medicine

Abstract:
Curricular trends minimizing basic sciences contact hours drives virtual microscopy's (VM) replacement of optical microscopy (OM) in undergraduate medical education (UME) for histology. Simultaneously, clinical contextualization is increasing, and few VM collections feature integrated normal and pathological cases. VM's educational value is well established in UME, however, visual literacy acquisition still requires instructional encounters with experts. Additionally, little literature examines VM usage and value in graduate medical education (GME), possibly due to training modality discontinuity between UME and GME, where OM predominates in pathology residency. Recent FDA approval of a whole-slide imaging (WSI) system for routine diagnostics foreshadows more widespread VM use in GME. Thus, this project examines the educational value of incorporating VM with instructor simulation tools (IST) in pathology residency; and integrating clinical VM content in normal histology education. A neuropathological glass tissue slide collection was digitized using WSI, then the files were processed for access via a custom web-based VM app with IST. IST included annotations highlighting characteristic histopathological features, and timed quizzes with an immediate feedback system, mimicking the question-and-answer driven interactions between experts and trainees. Pathology residents and anatomy graduate students were given access to the VM with IST. Pre-test/post-test comparison before and after VM exposure revealed users' content knowledge increased following VM exposure. A post-test survey gauged users' perceived value of the VM slides. Preliminary resident data suggest positive effects of VM in GME, consistent with positive impacts reported in UME. Clinical VM exposure positively affected graduate students' interest and motivation for learning histology.

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

Adnan Syed (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Charles A. Ferguson,
Health Professions Programs,
DC - College of Liberal Arts and Sciences

Mrs. Trishia Vasquez, B.S., Health Professions Programs; Dr. Laura M. Argys, Ph.D., Department of Economics

Abstract:
Two programs offset the costs of applying to medical and dental schools: National 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 applicants invited to interview. We conducted a mixed-methodology study consisting of a survey administered to CU Denver pre-medical/pre-dental students (n = 68) and one-on-one semi-structured interviews with CU Denver pre-medical/pre-dental applicants (n = 15) to evaluate the effectiveness of FAP and the B-D Fund on improving the success and opportunities of pre-medical/pre-dental applicants. Outcome measures included 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 student, etc). We found no significant difference in the number of MD/DO schools one applied to between applicants who received FAP and applicants who did not receive FAP; no pre-dental applicants received FAP. After controlling for overall grade point average, Medical College Admission Test score and the number of MD/DO schools one applied to, receiving the B-D Fund was associated with attending two more interviews, on average, compared to non-recipients. Of the 21 B-D Fund recipients, 14 were classified as UIM. 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 students.

Regulatory Focus and Willingness to sign Advance Directives

Adnan Syed (UROP Recipient)
DC - College of Liberal Arts and Sciences

Mentor: Dr. Meng Li,
Health and Behavioral Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
Advance directives (ADs) allow individuals to specify how they want to be treated if they become seriously ill. This project investigates how a regulatory focus, that is, the focus on promoting good outcomes vs. preventing bad outcomes, affects people's willingness to sign an AD. In three experimental studies involving n = 1239 participants from a convenience Internet sample, we manipulated the promotion vs. prevention focus of a brief introduction of AD, measured participants' individual differences on regulatory focus, and intentions to sign an AD as the outcome variable. The manipulation either stated the benefits received by signing an AD (promotion framing) or the risks avoided by not signing an AD (prevention framing). All studies consistently found that participants with a greater promotion focus showed more willingness to sign an AD. The effect of promotion vs. prevention framing on willingness to sign an AD was not consistent across studies, but when we used a stronger manipulation of promotion/prevention framing (Study 3), prevention framing led to a greater willingness to sign an AD. There was no evidence that framing that matches participants' regulatory focus affects willingness to sign an AD. These results indicate that individual difference on regulatory focus serves as a consistent predictor for intentions towards AD, but framing AD in promotion vs. prevention terms seems to have variable effects on AD intentions.

Titration of Acidic Juices for Citric Acid and Ascorbic Acid

Sahitya G. Talachutla
DC - College of Liberal Arts and Sciences

Jordan Reichers
DC - College of Liberal Arts and Sciences

Mentor: Ms. Rebecca F. Cherry, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Acidic juices, such as lime and lemon juice, have been used in cooking to denature proteins in food for safe consumption. Noting the strength of such acidic juices is helpful in determining the most effective juice for denaturation. The purpose of this experiment was to determine the citric acid and ascorbic acid concentration of lime and lemon juice using acid base and redox titrations. By performing an acid base titration, the total acid content within the lime and lemon juice solutions was determined. Subsequently, a redox titration was conducted in order to determine the ascorbic acid content within the lime and lemon juice solutions. The concentration of citric acid was then calculated by subtracting the experimentally determined ascorbic acid concentration from the total acid concentration. Lime juice was found to contain a citric acid content of 0.267 M and an ascorbic acid concentration of 0.00196 M, while lemon juice contains a citric acid content of 0.240 M and an ascorbic acid concentration of 0.00391 M. These findings support the original hypothesis that lime juice would have a higher citric acid content and lower ascorbic acid content than lemon juice. Based on the results, it was determined that lime juice is a more effective cooking agent due to the fact that it has a higher acid content than lemon juice.

Duration- dependent neural circuit control of voluntary exercise behavior

Margaret Tanner
DC - College of Liberal Arts and Sciences

Jennifer Jaime
DC - College of Liberal Arts and Sciences

Natalie Haddad
DC - College of Liberal Arts and Sciences

Jazmyne KP Davis
DC - College of Liberal Arts and Sciences

Nicolette A Moya
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Benjamin N Greenwood, Psychology,
DC - College of Liberal Arts and Sciences

Esteban C Loetz, PRA, B.S.

Abstract:
Despite the ability of exercise to increase resistance against stress-related psychiatric disorders, people have difficulty initiating and maintaining regular exercise. Identifying the neural circuits that control the acquisition and maintenance of exercise could lead to novel strategies to promote exercise participation, as well as reveal mechanisms underlying exercise-induced stress resistance. Rats given running wheels demonstrate robust voluntary exercise behavior that follows distinct phases of acquisition, during which wheel running is learned, and maintenance, during which nightly running reaches a steady state. Although dopamine (DA) and the dorsal striatum are critical for movement, the specific DA-striatal circuits used to control the acquisition and maintenance of voluntary exercise are unknown. The goal of the current studies was to identify the DA-striatal circuits controlling exercise in adult, male Long-Evans rats. In males, a bout of exercise during the acquisition phase recruits midbrain DA neurons projecting to the dorsomedial striatum (DMS), a region of the striatum important for goal-directed learning. Once in the maintenance phase; however, an acute bout of running no longer recruits DMS-projecting midbrain DA neurons. Even so, chronic exercise produces neural adaptations in the DMS consistent with stress-resistance and a hyperdopaminergic state. These changes are not observed in the dorsolateral striatum (DLS), a region supporting habitual behavior. Finally, temporary inactivation of the DMS reduces voluntary exercise during the acquisition phase. These data suggest that “goal-directed” DA-DMS circuits control the acquisition of voluntary exercise and plasticity in this circuit could contribute to exercise-induced stress resistance.

Empowering the Steps of Mini FEET

HTiffany Tasker
DC - College of Liberal Arts and Sciences

Mentor(s):Professor Donna Martinez, Ethnic Studies,
DC - College of Liberal Arts and Sciences

David McConico
Executive Director of the Financial Education and Economic Center

Abstract:
My project is focused on economically empowering underserved youth in diverse communities by providing them with financial education to assist them in their college career and future occupations. It is my responsibility as the economic empowerment organizer of the Financial Economic and Transformation (FEET) Center to assure that youth in the program achieve asset development skills.

Inner/Outer Worlds: Yan Liben's (ca. 600 - 673 CE) "Foreign Envoy with Tribute Bearers" (7th century CE) painting and the Function of Depicted Rock Tributes during Tang Dynasty (618 – 907 CE) China

Philong K Than (UROP Recipient)
DC - College of Arts and Media

Mentor:Dr. Yang Wang, Art History,
DC - College of Arts and Media

Abstract:
Yan Liben's (ca. 600 - 673 CE) Foreign Envoy with Tribute Bearers (7th century CE) painting is analyzed with a discussion and exploration of the meaning of rock tributes in the painting, rocks in the Chinese garden, and the importance of the tribute system within the Tang Dynasty (618 – 907 CE). Previous accounts record the meaning of giving land and treasures of native countries to China. Gifts and the tribute bearer genre represent China's desire to expand and develop into foreign nations and its belief in its superiority as the center of the world. This worldview, is condensed into the Chinese garden woldview, which didn't have boundaries but was defined by interactions between the hierarchies of the inner world/center (China and the throne) and the outer world/ peripheral (non-Chinese peoples); everything stemmed from and towards the Chinese center. This paper gives insights into the complex interaction and relationship between China and its trading partners via the tribute system depicted on the painting, and how the depicted rock tributes reinforce and realize the Chinese worldview.

Optimization of a Low-Frequency Near-Field Imaging System

Dalibor J Todorovski
DC - College Engineering and Applied Science

Mentor: Assistant Professor Dr. Vijay Harid,
Electrical Engineering,
DC - College Engineering and Applied Science

Abstract:
Many modern imaging systems rely on the scattering of electromagnetic (EM) waves in the near-field region to remotely identify and locate objects of interest inside a volume. Such systems have medical, industrial, and military applications like magnetic resonance imaging (MRI) and through-wall imaging. These systems operate similarly. Objects of interest are located within a “forbidden region,” and the EM fields scattered by these objects are detected by a set of receiving antennas placed outside of this space. This data can be inverted to obtain information about the object of interest such as identity or location. However, a set of challenges manifest in the low-frequency regime. Necessary information is lost when the wavelength of the EM wave is much larger than the size of the objects, requiring new techniques to be able to resolve details of these objects. This project attempts to optimize such a low-frequency near-field imaging system by both finding the optimal configuration of receivers outside the “forbidden region” and developing algorithms to accurately detect and locate objects of interest inside that region using minimal available information.

NUMERICAL MODELING OF FERROMAGNETIC HYSTERESIS IN MILD STEELS

Kyle Townsend
DC - College Engineering and Applied Science

Mentor(s): Chair and Professor Stephen D. Gedney,
Electrical Engineering,
DC - College Engineering and Applied Science

Dr. Carl Schneider, Ph.D. University of Colorado - Denver

Abstract:
The objective of this research is to develop software capable of calculating the magnetic signature of naval vessels that are subject to non-linear hysteretic susceptibility, as well as magnetostriction due to extremely large mechanical stresses that naval vessels are exposed to from both wave action of the ocean, as well as vessel guidance. This research aims to provide the ability to use a known state of magnetization, and calculate the current state of magnetization with various stress and magnetic field fluctuations. This would allow the removal of the need for ship degaussing, which in turn would allow for longer deployment periods where vessels can remain away from port. The models being developed and studied use physical parameters of mild steel, and can be compared against physical measurements made on the same mild steel tested in the UC Denver Magnetics Research Lab.

COOPERATIVITY IN MEMBRANE BINDING BY C2AB TANDEM DOMAINS OF SYNAPTOTAGMIN-7 AND SYNAPTOTAGMIN-1: A COMPARATIVE STUDY

HHai Tran
DC - College of Liberal Arts and Sciences

Mentor: Dr. Jefferson, Knight, Chemistry,
DC - College of Liberal Arts and Sciences

Abstract:
Synaptotagmin 1 (Syt1) and synaptotagmin 7 (Syt7) contain analogous tandem C2 domains, C2A and C2B, which serve as Ca2+ sensors to trigger fusion of secretory vesicles during exocytosis. Functionally, Syt1 triggers fast release of neurotransmitters, while Syt7 is involved in slower processes such as hormone secretion. It has been shown that Syt1 C2 domains bind membranes cooperatively, penetrating deeper into membranes as the C2AB tandem than as individual C2 domains. In contrast, our previous study suggested that the two C2 domains of Syt7 bind membranes independently, based on their dissociation kinetics from liposomes. Here, we investigate the interdomain interaction of Syt1 and Syt7 C2 domains by measuring Ca2+ sensitivities, dissociation kinetics, and insertion depth of individual and tandem domains using physiological-mimicking synthetic liposomes. The Syt7 C2AB tandem was found to have greater Ca2+ sensitivity than either single domain from equilibrium Ca2+ titration data. Stopped-flow fluorescence spectroscopic measurements show that Syt1 C2AB dissociates much slower than either of its isolated C2 domains while for Syt7, the largest population of the C2AB tandems has a comparable dissociation rate to the C2A domain and a subpopulation dissociates at a much slower rate. Furthermore, like Syt1, the C2B domain of Syt7 penetrates membranes more deeply when present in the C2AB tandem than it does as individual domain, suggesting cooperative insertion. Based on these findings, we propose that the C2 domains of Syt7 coinsert into membranes as they do in Syt1, but interdomain cooperativity in Syt7 contributes less to the binding energetics than in Syt1.

MODELING AND CONTROL OF POWER Essential Membrane Docking Regions in Granuphilin C2A

Sherleen Tran
DC - College of Liberal Arts and Sciences

Mikias B. Negussie
DC - College of Liberal Arts and Sciences

Nara L. Chon
DC - College of Liberal Arts and Sciences

Mentor(s): Dr. Hai Lin, Chemistry,
DC - College of Liberal Arts and Sciences

Dr. Jefferson Knight, Chemistry Department

Abstract:
Granuphilin is a protein that assists insulin secretory vesicles in docking to the plasma membrane inner leaflet in preparation for exocytosis. Experimentally, it is found that granuphilin binds nonspecifically and specially to anionic lipids. Several regions of the protein have also been identified as essential for such bindings. However, the molecular details of the binding remain unclear. Here, we perform molecular dynamics simulations to explore the roles of the β4 binding site and β3-β4 intermediate loop in membrane binding, providing insight to the protein's membrane docking mechanism.

Secret Driver: How T.E. Lawrence Led the Arabs to Victory in Aqaba

Justin Vaughan,
DC – College of Liberal Arts and Sciences

Mentor: Dr. Dale J. Stahl, History,
DC – College of Liberal Arts and Sciences

Abstract:
T.E. Lawrence gained worldwide fame as an English officer in WWI by brilliantly leading a surprise attack on what the Allied Powers had deemed a hopeless venture against a key Ottoman port in the Gulf of Aqaba. Loosely dramatized in the classic film carrying the name by which he is best known, Lawrence of Arabia wrote extensively about his perceptions of the Arab tribes in private letters, official memos, and later in his memoir Seven Pillars of Wisdom. The paper upon which this presentation is based analyzes his conceptions of bedouin cultural practices and how he applied his conclusions to quietly influence, guide, unify and ultimately lead an army of a mutually antagonistic tribal people against the biggest obstacle to Britain's victory in the eastern Mediterranean theater of war.

Crime Hotspots in Denver: Spectral Clustering and Discrete Barycenters

Natalia Villegas Franco
DC - College of Liberal Arts and Sciences

Mentor: Dr. Steffen, Borgwardt, Mathematics,
DC - College of Liberal Arts and Sciences

Abstract:
Response times for police calls are one of the most important factors dealing with crime. These times could be reduced by locating the police in strategic areas. In this project, we apply spectral clustering to partition the locations of crime incidents in the Denver area into smaller parts. Then, we implement and compare three discrete barycenter models to determine the optimal police location in each partition. A google maps html file displays the crime hotspots and suggested police placement for the whole region.

The Role of Instructor Accent on Student Learning & Instructor Evaluation in a Digital Learning Environment

Carissa L Vinovskis
AMC - School of Medicine

Mentor(s): Dr. Lisa MJ Lee,
Cell and Developmental Biology,
AMC - School of Medicine

Dr. Jennifer Stratford, PhD, Department of Psychology and Neuroscience, University of Colorado - Boulder

Abstract:
Student evaluations are one of the most common modalities by which instructors in higher education are assessed, but research indicates that evaluations are commonly subject to students' intrinsic bias and thus not an accurate measure of teaching effectiveness. As digital resources & online classes become ubiquitous, the limited in-person interaction may amplify the impact of bias in evaluations. While numerous studies have demonstrated the effect of gender & age bias, few studies have explored the impact of ethnic bias in instructor evaluations in a digital environment.

4 digital learning resources were produced with identical anatomical science content, but each module was narrated in a distinct accent (American, Chinese, Indian & British) by one individual. Subjects recruited from professional health programs were randomized to access 1 of the 4 resources. Student learning outcomes were measured by pre- vs. post-quiz comparison. Student perceptions of the digital resources and their narrators were assessed using Likert-scale surveys.

Results demonstrate a statistically significant increase in post-quiz performance for all experimental groups, regardless of assigned digital resource, indicating learning occurred irrespective of perceived instructor ethnicity. However, students rated the learning modules & instructors differently, depending on the narrator of the module. For example, despite identical content, students rated the Indian module ($p=0.013$) and Chinese module ($p=0.031$) higher than American and British modules for organization and presentation of information. This study reveals implicit ethnic bias the subjects in the study have and their impact in the evaluation of educational resources and instructors in a digital environment.

Parental Self Agency and Current Parenting Behaviors

Ashlie M Viramontes
DC - College of Liberal Arts and Sciences

Mentor: Dr. Casillas Katherine L Casillas,
Department of Pediatrics,
AMC - School of Medicine

Abstract:
This poster analyzes the relation between care giving experiences and current parenting behaviors that were partially mediated by parental self agency. The data and results for this project came from questionnaires such as the parenting self agency model, adverse childhood experiences, and the CTS-PC. This information was provided by the Safe Care Colorado that is located in the Children's Hospital Colorado. While conducting this research, we also used income and mental health as potential stressors to see if that would alter the parent's parental self agency and if it would trigger harsh or lenient parenting.

An Evaluation of Demographics and Housing Data in Predicting Crime Rates across Denver Neighborhoods

Lu Vy
DC - College of Liberal Arts and Sciences

Mentor: Dr. Joshua P. French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
A large city is rarely without a large crime count. With over 600,000 residents and 78 neighborhoods, the Denver metropolitan area is not only large, but diverse with a wide spectrum of income, ethnicities, ages and associated demographics. This investigation searches for patterns between quantitative demographics – among which are the proportions of residents in various income levels, various ethnicities, various age ranges, et cetera – and crime per capita, stratified among crime types including burglary, murder, and aggravated assault. Using all 78 neighborhoods as observations, and over 40 demographics as potential predictors, we pose the question: Are the best predictors for one type of crime necessarily the best predictors for all? Very likely, this answer will be no, and if that is the case, then this investigation seeks those demographics that are best at predicting each: murder per capita, burglary per capita, and so on. Admittedly, this investigation cannot provide casual relationships, for it is an observational study rather than a controlled experiment. Even so, regression models permit us to predict the response (crime rate) given demographic data, with the hope that the Denver Police Department can better monitor, address, and prevent various crimes starting in the neighborhoods where they are most likely to occur.

LGBTQ Fiction Panel

Grace Wagner
DC – College of Liberal Arts and Sciences

Jesse Hawk,
DC – College of Liberal Arts and Sciences

Mentor: Joanna Luloff, English Department,
DC – College of Liberal Arts and Sciences

Abstract:
This application is part of a larger panel presentation organized by Jessie Hawk and Professor Joanna Luloff. For my portion of the panel, I will address the importance of both subtle and overt representation of LGBTQ+ issues in both fiction and poetry. In a society where being queer is often seen as the core experience of a character and other important facets are ignored, it is important to have subtle representation. For example, a character can be established as queer in a sentence or two. It does not need to be the focus of every story and shouldn't be the only aspect of a character that is fully developed. Queer characters can and should be developed just as robustly as their non-queer counterparts. This works to normalize queerness. On the other hand, some queer experiences need to be more overtly discussed, mainly due to a lack of general understanding by the public. For example, in my poetry, I address the experience of ethical non-monogamy or polyamory as the main focus of a poem. This helps to educate readers and centers the experiences of less acknowledged groups. This overt representation often acts as an introduction. I have noticed in several instances that my work is often the first encounter many people have with concepts of ethical non-monogamy, and, in this way, I act as an ambassador for the polyamorous experience. This talk will highlight the importance of both subtle and overt queerness in literature and the importance of normalization and education.

Impacts of mining on a subalpine lake in the central Colorado Rocky Mountains

Bethany Walker
DC - College of Liberal Arts and Sciences

Bethany Walker
DC - College of Liberal Arts and Sciences

Mentor: Dr. Christy Briles,
Geography and Environmental Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
The long-term impacts and ecosystem recovery following mining activity are not well understood. This study examines terrestrial and aquatic ecosystems before and after mining activity in a subalpine lake ecosystem in the central Colorado Rocky Mountains. A 1-meter-long sediment core from Lily Pond was analyzed for freshwater diatoms, pollen, charcoal, and geochemistry to reconstruct aquatic communities, vegetation, burning and heavy metal inputs, respectively. The Forest Hill Mine operated upstream of Lily Pond from 1880-1920, with a short break from 1907-1916. Lead-210 dating of the last 150 years and high-resolution proxy sampling of the mine period will allow an estimation of recovery during the mine operation break and the time following its shut down. The decade halt in mining provides another temporal period to examine ecosystem recovery to pre- and post- mining conditions. Initial results indicate a shift from epiphytic and epipelic diatoms towards Fragilaria during the mining period, suggesting increased sedimentation and turbidity. Geochemistry data indicate an increase in metals and magnetic susceptibility, suggesting allochthonous inputs possibly from the mine. Charcoal increases while percentages of arboreal pollen decrease, indicating an increase in burning and decrease in arboreal vegetation. These distinct changes suggest that ecosystems in and around Lily Pond were significantly altered by the mining activity.

CRISPR/Cas-9 mediated H2-M5 knockout in a B-cell Lymphoma cell line

Brittany C. Waschke
DC - College of Liberal Arts and Sciences

Mentor(s): Associate Professor,
M.D., Ph.D. Jing H. Wang,
Immunology and Microbiology,
AMC - School of Medicine

Xiaoguang Wang, Ph.D., Postdoctoral Fellow, AMC - School of Medicine; Zhangguo Chen, Assistant Research Professor, M.D., Ph.D., AMC- School of Medicine; Rachel Woolaver, Immunology Graduate Student, AMC – School of Medicine

Abstract:
The murine H2-M5, homologous to the human variant, human leukocyte antigen complex (HLA-F), is a type of Major Histocompatibility Complex I (MHC I) that aids in the immune response against pathogens and cancerous cells. Recent studies have demonstrated both positive and negative effects of enhanced HLA-F expression in patients' cancer progression. In B-cell lymphoma, chemotherapy-mediated upregulation of HLA-F was exhibited in cured patients. By developing a murine H2-M5 knockout model via the CRISPR/Cas9 genome editing technique in the A20 lymphoma cell line, tumor growth and chemotherapeutic responses in relation to H2-M5 expression can be examined in mice. In detail, CRISPR/Cas9 plasmids (PX458) constructed with guide-DNA were transfected into the A20 cell line. Single clones were then cultured and produced mutants were identified by PCR. These mutated H2-M5 fragments were amplified and cloned in pGEM-T Easy vectors for sequencing. Comparing in-vitro growth between wild-type and mutated clones, similar growth patterns of each selected clone variant were chosen for subsequent in-vivo experimentation. This study would be beneficial for investigating the role of H2-M5 in chemotherapeutic responses and the progression of B-cell lymphoma.

Predicting petty crime: a Regression Model for Shoplifting

Nicholas E Weaver
DC - College of Liberal Arts and Sciences

Mentor: Dr. Joshua P French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
Petty crimes, like shoplifting, are crimes deemed less serious in the scope of all crime types. A question that may arise when discussing a petty crime is whether we can predict the crime frequency per capita based upon various neighborhood characteristics. We seek to find a linear model using least squares estimation that regresses shoplifting crimes per capita on relevant predictors. We use the crime data found in the D2P data frame along with Denver neighborhood characteristics including: median household income, education level, poverty rate, median age, and other factors. We then use appropriate model building techniques to create our simple model. Our results may be used to target shoplifting crime rates by helping policymakers focus on areas of importance by enacting community programs, appropriately administering necessary resources, and so on.

A Inter-Disciplinary Perspective on Heroin Abuse

Katyie Wells
DC - School of Public Affairs

Mentor: Dr. Sheila M. Huss,
School of Public Affairs,
DC - School of Public Affairs

Data to Policy Challenge - CRJU 3100

Abstract:
This research looks at the relationship between opiate use and heroin use. Specifically, we conducted a multivariate analysis to assess the relationship between prescriptive and non-prescriptive opiate use and heroin use, controlling for other potential factors. We also focused on the policy implications of our findings in light of the extant literature on heroin use.

Comparison of Digital and Visual Estimations of Vegetation Cover for Ecological Research

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Mentor: Dr. Diana F Tomback,
Department of Integrative Biology,
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Abstract:
Percent ground covered by vegetation is an important ecological variable, but different methods of estimating vegetation cover must be compared for effectiveness. We developed an Adobe photoshop CC method to determine vegetation and deadfall (fallen tree) cover from field photographs and compared digital estimates to standard visual estimates. We applied both methods to a long-term, post-fire forest regeneration study at Henderson Mtn, Custer Gallatin National Forest, and Mt. Washburn, Yellowstone National Park. Areas included moist burned (MB) and dry burned (DB) sites and unburned (MU and DU) controls; 258 plots were re-measured in 2016 and 2017. We photographed plots from the north and south holding a Go-PRO camera overhead on a selfie-stick. Total pixels, green pixels (vegetation), and brown pixels (deadfall) were extracted from photos to calculate percent vegetation and deadfall cover. Using the Wilcoxon rank sum test, we compared the two method's percent vegetation and deadfall cover. Thus far, Henderson Mountain digital vegetation cover estimates ranged from 32-77% (DB), 41-96% (MU), 37-91% (MB) and 29-93% (DU). Henderson Mountain's visual estimates ranged from 30-65% (DB), 40-85% (MU), 35-85% (MB) and 30-80% (DU). Mt. Washburn's digital vegetation cover estimates ranged from 11-65% (DB), 3-76% (MB) and 10-67% (MU). Mt. Washburn's visual vegetation cover estimates ranged from 40-75% (DB) and 25-80% (MB). Statistical tests indicated significant ($p < 0.05$) differences between estimation methods in all treatments except Henderson Mtn.'s unburned plots, which had little deadfall. Results indicate visual estimates may better detect deadfall-hidden vegetation, but photos may better estimate deadfall cover.

Operation Five Points: The Response to Gang Violence

Crist A. Whitney
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Mentor: Dr. Chris Agee,History
DC – College of Liberal Arts and Sciences

Abstract:
In "Operation Five Points: The Response to Gang Violence," Crist Whitney examines the clash between Five Points residents and city officials over how to understand and respond to an upswing in neighborhood youth violence. Five Points spokespersons wanted more responsive policing in their neighborhood, but they ultimately regarded youth violence as a product of poverty and limited opportunity. City officials and the mainstream media, by contrast, saw youth violence as a sign of low morals and a test of the city's mettle. The most effective way to reduce violence, city officials and media figures claimed, was for police to crack down on all law-breaking. This expansive, police-focused response ultimately marginalized Five Points economically and further alienated the area's young people.

An Internal War: The 10th Mountain Division's Hierarchy Strife 1942-1945

Emily B. Whitworth,
DC – College of Liberals Arts and Sciences

Mentor: Dr. William Wagner, History,
DC – College of Liberal Arts and Sciences

Abstract:
This paper discusses the unique organization of America's first ever ski troops, The 10th Mountain Division, and the impact their composition had on World War II and the military as a whole. The issue is relevant because for the first time in American history, military hierarchy was flipped upside down and set a new precedent for mountain warfare and training in future conflicts. The goal of my work is to not only explain how this unique situation came about, but also how a relatively small unit impacted the Second World War on a large scale.

Optogenetic Activation of Specific Mesolimbic Neurons During Fear Extinction

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Mentor: Assistant Professor Benjamin, N, Greenwood,
Exercise Behavioral Neuroscience,
DC - College of Liberal Arts and Sciences

Abstract:
Exposure therapy relies on the process of fear extinction, which is learning that a prior conditioned fear stimulus no longer predicts danger. One limitation of exposure therapy is that fear extinction memory is labile, and fear often returns even after successful extinction. Identification of novel strategies to prevent fear relapse after extinction is of utmost importance to mental health. Manipulations that enhance dopamine (DA) signaling can strengthen fear extinction, but the specific DA pathways involved, and whether fear extinction enhanced by DA is resistant to relapse, remain unclear. Midbrain DA neurons projecting to the nucleus accumbens (NAc) encode prediction error. Activation of these neurons during extinction could, therefore, facilitate extinction by enhancing the learning that the conditioned stimulus no longer predicts an aversive event. The goal of the current study was to test the hypothesis that activation of midbrain DA neurons that project to the NAc during fear extinction can enhance fear extinction and reduce relapse. Adult, male Long-Evans rats received bilateral intra-NAc microinjections of either AAV2-Cre-GFP or CAV-Cre. These viruses travel retrograde to midbrain cell bodies of origin and express the enzyme Cre-recombinase. A second virus (AAV-EF1a-DIO-hChR2(H134R)-EYFP) that expresses a light sensitive ion channel (ChR2) in a Cre-dependent manner was then injected into the midbrain, allowing the expression of ChR2 in midbrain neurons projecting to the NAc. Midbrain neurons projecting to the NAc were then optogenetically stimulated during auditory fear extinction. Fear extinction memory and relapse were subsequently assessed in the absence of stimulation. Data are currently being analyzed.

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

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Mentor(s): Dr. Benjamin N. Greenwood, Psychology,
DC - College of Liberal Arts and Sciences

Esteban C. Loetz, Professional Research Assistant, Department of Psychology, UC Denver; Erik B. Oleson, PhD, Assistant Professor, Department of Psychology, UC Denver; Jim Grigsby, PhD, Professor of Medicine, Department of Medicine, CU Anschutz

Abstract:
Clinical trials have demonstrated that 3,4-methylenedioxymethamphetamine (MDMA) paired with psychotherapy reduces 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. These current studies investigated the effects of a single administration of MDMA on extinction and reconsolidation of fear memory in adult male Long-Evans rats. Rats were exposed to contextual or auditory fear conditioning, followed by systemic administration of saline or 1,2,3,5, or 10 mg/kg MDMA either 30 min before auditory fear extinction training, or immediately after contextual fear memory recall (i.e. during the reconsolidation phase). MDMA (5 mg/kg) reduced later recall of contextual fear memory during a drug-free memory test, but only if administered during the reconsolidation phase. MDMA failed to enhance fear extinction, and in fact 3 and 10 mg/kg MDMA impaired drug-free fear extinction recall. These findings are consistent with a general memory-disrupting effect of MDMA, and suggest that MDMA could augment psychotherapy by impairing the reconsolidation of recalled fear memories, without necessarily enhancing their extinction.

A Graphical User Interface to Aid in the Analysis of Arteriole Stiffening in Patients Using Continuous-Flow Left Ventricular Assist Devices.

Robert F Wood (UROP Recipient)
DC - College Engineering and Applied Science

Mentor(s): Dr. Kendall Hunter, Bioengineering,
DC - College Engineering and Applied Science

Dr. Amrut Ambardekar

Abstract:
The objective of my research is a continuation of the research begun by Ambardekar, Hunter, et al. in the examination of morphology, composition, and stiffness of arterial vasculature in patients with continuous-flow LVADs. At this time over 100 mechanical studies have been performed; with this new, substantially larger dataset in mind, I have created a graphical interface to be used in the analysis of the acquired data.

The analysis is performed in MATLAB by storing strain data from each disease state in its own vector. A curve is fit to the stored data and the user has the opportunity to accept/reject specific data sets. A mean is be obtained by summing all data for each test and disease state and dividing by the number of samples. Standard error bars are calculated through variance. These group studies determine if LVAD implantation has an effect on Aortic remodeling and stiffness. Finally, regressions can be performed with independent variables being stiffness, thickness, and other histological factors with the predictors, or dependent variables being patient LV function prior to LVAD implant (or overall transplant), to assess if these factors are disease related rather than LVAD related.

HOME-RANGE SCALE HABITAT SELECTION PATTERNS DO NOT NECESSARILY IMPLY HOME-RANGE SCALE DECISIONS

Scott W. Yanco,
DC – College of Liberal Arts and Sciences

Mentor: Dr. Michael B. Wunder,
Department of Integrative Biology,
DC – College of Liberal Arts and Sciences

Abstract:
Studies investigating avian habitat preferences typically measure spatial use patterns at one or more spatial scales and draw inferences about the animals' preference for some resource or habitat type based on a resource selection function (RSF). By designing avian habitat selection studies that first assume the operative spatial scale(s) for consideration (e.g. home-range scale, micro-site-scale) and failing to verify the behavioral relevance of the selected spatial scales, researchers may be attributing selection behaviors to focal organisms that are, in truth, an artifact of the study design. In a recent analysis, Yanco and Linkhart measured habitat preferences of Flammulated Owls (Psiloscops flammeolus) at both home-range and micro-site scales in a post-fire environment. They suggested that different proportions of high-severity burned forest in owl home ranges, as compared to the entire burn scar, represented habitat selection behavior by the owls at the home-range scale. Here we use an agent-based model to explore whether the patterns of habitat proportions described by Yanco and Linkhart could have derived from processes unrelated to selection at the home-range scale. Specifically, we show that supplying a simulated "agent" with a set of decision rules that do not account for any home-range-scale decisions can produce RSFs that suggest habitat selection at home range scales. These results suggest that RSFs may incorrectly ascribe behaviors to focal systems because of mismatched scales, and we encourage researchers to use caution when interpreting results via a single explanation.

Generating Random Numbers from Any Distribution: Accept-Reject Sampling and Monte Carlo Integrals Visualized

Tian Yu Yen
DC - College of Liberal Arts and Sciences

Mentor: Assistant Professor Troy D. Butler, Mathematics,
DC - College of Liberal Arts and Sciences

Abstract:
Random processes occur in many different contexts from weather forecasting to cell biology. In order to create computer algorithms which simulate these random processes, mathematicians have developed techniques to generate random samples from any kind of probability distributions—including ones without a mathematical expression to describe them. Rejection sampling is one such technique. In this talk, we focus on visualizing the accept-reject algorithm and understanding how it can be used to calculate integrals numerically (i.e., monte-carlo integration). Finally, we show how it is currently being used in our research on the Consistent Bayes method.

Social Consciousness in Youth - Civic Engagement in Community and Career

Jihee Yoon
DC - College of Liberal Arts and Sciences

Mentor: Social Consciousness in Youth
Civic Engagement in Community and Career
Jihee Yoon, Ethnic Studies,
DC - College of Liberal Arts and Sciences

Abstract:
Description: Developing a curriculum for high school students to equip them with the tools and vocabulary to deconstruct their identities and build social consciousness. Through an emphasis on social sciences and social justice, students will reflect on the themes of civic literacy, civic engagement in their communities, and racial identity development. This course creates a space for students to be active in their communities while fighting against injustices.

A STUDY OF FACTORS THAT CAN AFFECT METHAMPHETAMINE CRIME

Xiaolun Yuan
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Yitong Cai
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Xinmiao Zhang
DC - College of Liberal Arts and Sciences

Xinyu Sun
DC - College of Liberal Arts and Sciences

Selma Hogu

Mentor: Joshua P French,
Department of Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
This paper analyzes the relationship between methamphetamine related crime rate and the following factors: the number of police stations, the number of policemen, the demographics (males, race, age), the average income level, the education level, the employment rate, the income spread (in Gini coefficient), alcohol sales, housing type, and the number of recreation areas. This is an important study because methamphetamine crime happens frequently in Denver. Methamphetamine harms its users, family, and friends. Excessive use can cause acute poisoning. In severe cases, there is mental confusion, hyper-sexuality, anxiety, irritability, hallucinations, and death. It is important to find the factors that can affect methamphetamine crime since it can hopefully be reduced by controlling factors through Denver public policy.

Patterns of Sexual Assault in Denver

Michael R. Zabawa
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Mentor: Assistant Professor Joshua P. French,
Mathematical and Statistical Sciences,
DC - College of Liberal Arts and Sciences

Abstract:
The secret is out. The city of Denver is a great place to live. Over the course of a few years, Colorado has seen large population growth. One only has to take a Sunday drive on I-25 or attempt to purchase a house to realize that migration is having a large impact on the community. This analysis investigates the rise in sexual-assaults in Denver between 2013 and 2017. Is this increase in sexual assault due to Denver's population boom or the population density of the neighborhood? Could it be equally likely that an increase in population would lead to an increase in sexual assaults? Or is there a neighborhood characteristic that may account for this increase? Using methods of spatial statistics, neighborhood incidence rates were compared to the estimated risk of sexual assault in Denver to identify potential neighborhood clusters. Furthermore, the composition of the neighborhoods are scrutinized to establish possible relationships to the increase in sexual assaults. Finally, proposed policies are compared and contrasted based on the conclusions found.

Improving Blind Hockey Players Ability To Locate The Puck

Nick A Zawadzki
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Robert Jenkins
DC - College Engineering and Applied Science

Shreemathi Harikrishnan
DC - College Engineering and Applied Science

Ruba Sus
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Vrajen Patel, Jasmine Gomez Corona and Andrew Barron.

Mentor(s): Doctor Cathy Bodine,
Bioengineering,
DC - College Engineering and Applied Science

Craig Lanning, Bioengineering,
College of Engineering and Applied Science.
Dr. Matt Davidson, Bioengineering,
College of Engineering and Applied Science.
Cassandra Howard, Bioengineering,
College of Engineering and Applied Science.

Abstract:
Blind hockey is a growing sport in the United States and the current hockey puck does not make sound when it is at rest making it hard to locate for the players. The objective of this project is to improve the player's ability to sense where the puck is located by building a custom fitted hockey puck that can project audible, sustained sounds when hit, and continues to emit sound while stopped.

The prototype utilizes a league regulation 3D printed casing size. The prototype includes a vibrating module which rattles around the bells and ball bearings which are placed inside of the puck. This sound lasts at least 15 seconds after the puck has come to a rest to help the hockey players locate the puck. The acrylic exterior prototype has generic large tin bells, steel ball bearing, an electrical vibrator, control circuitry, and a power connection. The prototype is being designed without a switch to be continuously audible, and able to be heard over 20 feet away.

The results of this prototype allow blind hockey players more able to locate the hockey puck throughout a game for better game play with less interruptions

Age-Height Regression Models for Regenerating Conifers in the Greater Yellowstone Area

Anastasia Z Zhivotov
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Elizabeth Pansing
DC - College of Liberal Arts and Sciences

Mentor: Dr. Diana F Tomback,
Integrative Biology/Ecology,
DC - College of Liberal Arts and Sciences

Abstract:
The Tomback lab has monitored post-fire recovery of subalpine forest communities in the Greater Yellowstone Area since the 1988 Yellowstone fires. In 1990, they established 150 plots in four ecological treatments (dry and moist burned; dry and moist unburned) on Henderson Mt., Custer Gallatin National Forest, and 100 plots in two treatments (dry and moist burned), on Mt. Washburn, Yellowstone National Park. From these plots, they collected age and height data for seedling and sapling Picea engelmannii, Abies lasiocarpa, Pinus contorta, and Pseudotsuga menziesii in 1990, 1991, 1992, 1994, 1995, and 2001. In 2016 and 2017, only heights were measured because of time constraints. To compensate for the absence of age data in 2016 and 2017, we developed age-to-height regression models for each conifer. Our goal here is to complete the estimation of age structure for each treatment. First, we created a Google sheet database from all ages and heights across years from 1990 to 2001. Second, we implemented a quality control procedure whereby randomly-selected sets of 100 points from the database were compared to the original data. Third, we generated age-to-height regression models using an R-Studio regression package. Finally, we used these models to estimate the ages of the seedlings and saplings collected in 2016 and 2017 and complete age and stand composition tables for each study area. These regression models will also benefit the forestry community, because they can predict growth rates of high elevation conifers.

Inclusionary Practices in the Classroom

Lea Ziegler
DC - School of Education and Human Development

Mentor: Doctor Amy L. Boele, School of Education,
DC - School of Education and Human Development

Abstract:
Classrooms that lack inclusionary practices limit multicultural students and those with disabilities, making it harder for students to succeed. The racial and ethnic demographics of students does not match the current demographics of teachers in Colorado, creating barriers to authentic engagement and meaningful relationships based on shared identities and experiences [National Center of Educational Statistics (NCES), 2013]. It becomes detrimental to students when teachers do not acknowledge diversity in their classroom. Leveraging sociocultural theory, diversity should be seen as a resource in the classroom and not a hindrance (Gutiérrez, Lopez & Tejeda, 1999). Schools operate within an ideology of normal, which does not embrace diversity or difference, making it difficult to create an inclusive environment for learning (Annamma, Boelé, Moore & Klinger, 2013). The purpose of my research is to identify instructional methods that create an inclusive classroom environment, especially for culturally and linguistically diverse students with disabilities. To answer my questions, the methods used were observation notes, work samples, ethnographies, student and teacher interviews and behavioral analysis. Results show that when teachers differentiate instruction, student engagement increases. Fewer problematic behaviors occurred when students were presented multiple ways to interact with information. I also found relationships with each student allow for insight into each student as a learner. Culturally competent instructional materials that represent a wide range of people help students build self confidence and feel recognized. Not every student learns in the same manner or in the same language, therefore teachers must incorporate diverse instructional practices.