University of Colorado
Denver | Anschutz Medical Campus

18th Annual

Research and Creative Activities Symposium

Friday, April 17, 2015
Student Commons Building

WELCOME TO THE 18th Annual RESEARCH and CREATIVE ACTIVITIES SYMPOSIUM

BIGGER, *faster*… and a bit more **raucous!**

Symposium Schedule

9:00 – 9:45AM **Check-in and Set-up** **Lynx Desk, Student Commons Building (ACAD)**

10:00 – 11:30AM *Students assigned **odd-numbers** will be available to present and discuss posters, exhibits, and demonstrations showcasing their scholarly activities.*

- **Session 1**: Humanities and the Arts, including Media, Social Sciences, Architecture and Planning, Business, Education, Public Affairs
  Location: 1st floor hallways, Student Commons Building (ACAD)
- **Session 2**: Life Sciences, Health Sciences, Natural and Physical Sciences
  Location: 2nd floor hallways, Student Commons Building (ACAD)

9:30 – 12:30PM **Contributed Session** **ACAD 1500**, 1st Floor, Student Commons Building (ACAD)
Undergraduate and graduate students in the behavioral sciences, life sciences, and natural and physical sciences will deliver oral presentations showcasing their research.

- **Panel Discussion**: Funding opportunities (scholarships, grants) for undergraduates undertaking research in the behavioral sciences, life sciences, and natural and physical sciences.

10:00 – 12:00PM **Contributed Session** **ACAD 1401**, 1st Floor, Student Commons Building (ACAD)
Undergraduate and graduate students will deliver performances and oral presentations showcasing their scholarly activities.

10:00 – 11:00AM **Informational Session** **ACAD 2000**, 2nd Floor, Student Commons Building (ACAD)
Program Directors from the Humanities and Social Sciences will discuss graduate programs in these disciplines at CU Denver.

11:00 – 12:00PM **Informational Session** **ACAD 2000**, 2nd Floor, Student Commons Building (ACAD)
Program Directors from the STEM disciplines at CU Denver will discuss graduate programs in these disciplines at CU Denver.

11:00 – 1:00PM **LUNCH**

12:00 – 1:30PM *Students assigned **even-numbers** will be available to present and discuss posters, exhibits, and demonstrations showcasing their scholarly activities.*

- **Session 3**: Humanities and the Arts, including Media, Social Sciences, Architecture and Planning, Business, Education, Public Affairs
  Location: 1st floor hallways, Student Commons Building (ACAD)
- **Session 4**: Life Sciences, Health Sciences, Natural and Physical Sciences
  Location: 2nd floor hallways, Student Commons Building (ACAD)

12:00 – 1:00PM **Informational Session ACAD 2000**, 2nd Floor, Student Commons Building (ACAD)
Program Directors from the Health Sciences at CU Anschutz Medical Campus will discuss graduate programs at CU AMC.

12:30 – 1:30PM **WiSTEM Panel** **ACAD 1401**, 1st Floor, Student Commons Building (ACAD)
Women in STEM (WiSTEM) will lead a panel discussion addressing the challenges faced by women pursuing careers in science, technology, engineering, and mathematics.

1:30 – 2:30PM **Convened Session** **ACAD 2600**, 2nd Floor, Student Commons Building (ACAD)

Welcome	Dr. Richard Traystman, Vice Chancellor for Research
LYNx Talk	Dr. Ellen Gethner (CEAS), Shannon Steinmetz (CLAS), and Joey Verbeke (CAM)
Awards and Closing Comments	Dr. Jeff Franklin, Associate Vice Chancellor for Undergraduate Experiences

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Student Affairs	Media Productions	Paul Rakowski	Kelly Hupfeld, Brendan Hardy, & Nora Scanlon	University Honors and Leadership
Graduate School	University Honors and Leadership	Mary Francavilla	Academic Success and Advising Center	Amanda Weaver

Save the Date!

19th Annual Research and Creative Activities Symposium

Denver Campus

Friday, 29 April 2016

WELCOME TO THE RESEARCH AND CREATIVE ACTIVITIES SYMPOSIUM

Welcome to the 18th annual Research & Creative Activities Symposium (RaCAS). This year's RaCAS—even more than in previous years—is about celebrating student research, creative, and other scholarly work. Let's spend today learning, critiquing, admiring, questioning, and marveling at the work that our students, and the faculty members who mentored them, have accomplished. RaCAS shows us what is possible, what the future promises, and what the fruits of university learning look like at their best.

Things similar to the RaCAS of previous years:

- A dual-campus event, bringing together the Denver Campus and Anschutz Medical Campus.
- An event that honors both research and creative work of all types from all disciplines—a truly multidisciplinary event.
- An opportunity for students who present to "taste" what it's like to be a professional in their discipline.
- An opportunity for other students to get ideas and inspiration, perhaps even connect with a mentor, a start toward presenting at next year's RaCAS.

Things different from the RaCAS of previous years:

- Broad representation of disciplines from 11 schools and colleges.
- No formal judging; rather, spectators will be able to cast votes based on a range of criteria, and the day will end with many "people's choice" awards to presenters, along with great prizes.
- More opportunities for spectators to provide constructive feedback to presenters.
- Even more varied presentation formats, from scientific posters to visual-arts displays to engineering demonstrations to spoken (sung, read, performed) presentations.
- More concurrent presentations and a printed program from which spectators may choose which presentations to attend at which time of the day—hard choices, we hope.
- Greater emphasis on the mentor-mentee relationship, with presentations by faculty-student pairs and how they work together.

RaCAS depends, this year as in previous years, on the support of Dr. Richard J. Traystman, Distinguished University Professor and Vice Chancellor for Research. If you see him, thank him, 'cause it wouldn't happen without him. We also thank Provost Roderick Nairn.

This year Dr. Leo Bruederle stepped into the role of Director of RaCAS. His knowledge and experience is largely responsible for the new energy behind this event, which he is working to make one of the most exciting annual events on the University calendar. Many thanks to him, and also to the staff of the CU Denver Experiential Learning Center, especially Lesley Bishop.

Student research, innovation, discovery, and creativity are among what the national literature on higher education calls High-Impact Practices, experiences through which student learning accelerates by engaging with real-world problems and opportunities. RaCAS truly celebrates Learning with Purpose, the CU Denver way.

Jeff Franklin, Ph.D.
Associate Vice Chancellor for Undergraduate Experiences
University of Colorado Denver

University of Colorado
Denver | Anschutz Medical Campus

UNDERGRADUATE Participants - 2015

Smashy Claw

Austin Aeschliman, Music, Recording Arts, DC - College of Arts and Media

Faculty Sponsor: Mr. Owen Kortz, DC - College of Arts and Media

Smashy Claw is an experimental nerd-rock band from Longmont, Colorado. Always striving for each song to be different from the last, the group is distinguished by their quirky lyrics and catchy, layered orchestration. Co-founder and soon-to-be CU Denver CAM graduate Austin Aeschliman will showcase the songs he's written throughout his college career, to entertain and demonstrate his creative growth.

Clutch Development to Combat Backdrivability in Upper-Limb Prostheses

Jacob Altholz, Bioengineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Dr. Richard Weir, DC - College of Engineering and Applied Science

Backdrivability refers to an issue faced in many gear systems that are highly efficient. In gear systems that carry torque over many gears easily, it is potentially possible to physically push the system into other positions that are not necessarily desired. In these cases there are usually two ways to mitigate the issue: 1) Increase friction between the gears. 2) Provide power to the motor that moves the gears in an effort to combat the external pressure. Our design attempts to eliminate the inherent disadvantage in both of these solutions, namely inefficiency. By using a nitinol wire clutch that locks the gears when not in use, we can create a design that requires very little power to maintain a motor's position rather than exerting the energy unnecessarily. The clutch can be used to force the motor to either open or close the system and this creates a comprehensive solution. Depending on how often the system is used, either situation may be more efficient, however in prosthesis development it is more efficient to expend energy when the prosthesis is in operation, rather than to expend energy when it is not. So the goal is to create low energy solution to maintain a given posture by inhibiting back drivability when the motor is not in use.

Daedala

Erin Arata, Music, Music Business, DC - College of Arts and Media

Faculty Sponsor: Dr. Judith Coe, DC - College of Arts and Media

Possibly the most admired and discussed symbol of Buddhist religion and art, the mandala represents the sacred spiral that occurs in nature. The mandala has been honored in religious architecture and visual art for centuries. They represent the flow of each human being, playing a significant and connected role in the workings of the universe. My work will showcase a unique creative exploration of this art form. Using intricate line work to form a spiraling or circular design, the sacred geometry within the mandala can be observed. These mandalas are created to express the minute decisions made throughout a day, decisions that create a lifetime. Using a sharpie pen and white paperboard the space is filled with intricate lines that all together create a sea of movement that spirals around a centered focal point. Each line is a decision, a person, or a breath, the negative space interconnects around the lines depicts the air, the climate, the time. These pieces represent appreciation of every small breathe taken in throughout a day. They are meant to inspire meditation and self-examination.

Quantification and Manipulation of Neural Octopamine to Study Aggression

Sarah Bardwell, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. John Swallow, DC - College of Liberal Arts and Sciences

Teleopsis dalmanni (TD) is a sexually dimorphic species of stalk-eyed fly in which males aggressively compete for access to food and mating privileges. Competitions between males are characterized by a stereotyped, predictable fighting escalation in which larger eye span is commonly correlated with success. However, in size-matched competitions neurochemicals, including monoamines, appear to play a significant role in fight outcome. Octopamine (OA), an invertebrate norepinephrine analog, has been implicated in aggressive behaviors of several invertebrate species including insects. In order to investigate the behavioral effects of OA in TD, a method of manipulating neural OA must first be determined. In my experiment we orally administered OA to groups of male and female at concentrations 10, 15, 20, 25, 100 mg/mL in a corn medium for four days. At each concentration of OA, we assessed mortality and identified the concentration at which 50% of the flies died (LC50). Brains were isolated and analyzed using High Performance Liquid Chromatography (HPLC) with electrochemical detection to identify elevated neural OA in individual brains. The LC50 occurred at 100 mg/mL. Using neural monoamine data from each treatment group, we will establish an appropriate OA concentration for use in behavioral studies of aggression in this important model species.

Hydroponic Fodder as Livestock Feed

Sean Beagle, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Amanda Weaver, DC - College of Liberal Arts and Sciences

Given current trends in climate change and the reduced availability of freshwater, it is necessary to study more sustainable agricultural practices. Currently 70 per cent of all available freshwater is allocated to field crops grown to feed livestock. Hydroponic systems that recirculate a nutrient rich water solution may offer a sustainable and environmentally responsible alternative to soil based agriculture. Hydroponic fodder systems have become a popular method of growing barley and other forage crops for livestock animals. These current systems only require water, minimal light, and seven days of germination. Fodder systems have come under the scrutiny of universities that evaluate the economics and nutrient content of whole grain feed versus sprouted green fodder. It is important to continue researching hydroponic fodder systems with the mission of reducing energy input and time-to-harvest while increasing palatability and incorporating balanced nutrient content. The reduction in dry matter of sprouted grains and lack of studies involving the performance of livestock fed hydroponic fodder maintain skepticism of these systems. The incorporation of a nutrient rich solution, companion planting, and extended growth periods will allow hydroponic fodder to satisfy the nutrient requirements of livestock. This research will further the progression of studies and improve the sustainability of agriculture by minimizing water usage and producing a superior feed for the livestock that provide meat, milk, and fiber for a growing global population.

Grind

Curtis Bean, Fine Art, Painting, DC - College of Arts and Media

Faculty Sponsor: Ms. Patti Hallock, DC - College of Arts and Media

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Auraria Gardening Workshop: Addressing Sustainability

Lana Bilbo, International Studies, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Amanda Weaver, DC - College of Liberal Arts and Sciences

The dominant food system is a prime example of an unsustainable and destructive system - it is environmentally degrading, socially unjust, and damaging to human health. Food is also a universally vital and evocative topic. Due to it′s importance and potential for improvement, food is an optimal conduit for introducing discussion and affecting change in the broad realm of sustainability. The Auraria Gardening Workshop, which will be held May 7th, aims to contribute to environmental, social justice, and health sustainability by increasing access to healthy foods

through gardening, and by using that as a conduit to encourage discourse about these issues. In layperson's terms the Auraria Gardening Workshop's goals are to give students access to affordable food that benefits their health and benefits the environment. Students will leave the workshop with the resources and knowledge to start growing some of their own food immediately, regardless of their circumstances. The workshop will be environmentally beneficial because implementing the skills learned will reduce demand for the current damaging food system and teach alternative sustainable practices. An additional goal of is to improve food security by converting individuals into producers through gardening, making them less reliant on their purchasing power. Last, by allowing participants to experience the benefits and detriments of food production they will be better equipped to contribute to the food discourse.

Soil Sampling and Sky Exposure Measures from Leeward Treeline Microsites

Liana Boggs, Biology, DC - College of Liberal Arts and Sciences
Holly Bevency, Biology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Diana Tomback, DC - College of Liberal Arts and Sciences

In treeline ecotones, tree islands form leeward of a nurse object, such as a lone tree or rock. This facilitation-protection of a plant by a nurse object-creates microsites with better conditions for seedling survival. Different types of leeward microsites may be more suitable than others. The carbon and nitrogen levels, which are critical to seedling development, may determine suitability. Canopy cover, which is associated with decreased sky exposure, protects seedlings from radiation, cold temperatures, and wind. We hypothesized that whitebark pine (*Pinus albicaulis*), a keystone species, has leeward microsites with higher carbon and nitrogen content and lower sky exposure than subalpine fir (*Abies lasiocarpa*). We sampled soil and sky exposure from whitebark pine, subalpine fir, rock, and open microsites at twenty random locations at treeline on White Calf Mountain, Glacier National Park, Montana. We analyzed soil samples at the Ecocore Lab, Colorado State University to determine the percent available Carbon and Nitrogen in each sample by weight. We analyzed sky exposure data obtained from photos taken at each microsite using Adobe Photoshop. To determine differences in carbon, nitrogen, and sky exposure among microsite types we performed Kruskall-Wallace 1-way Nonparametric Anovas and Wilcoxon Rank Sum post hoc tests. Whitebark pine and subalpine fir have lower sky exposure than open and rock microsites, which may mean that they are better facilitation objects.

Escape.

Cosette Bojorquez, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Ms. Rian Kerrane, DC - College of Arts and Media

We are a reflection of our infrastructure. Or so they say. What can we do when it all becomes too much? How can we really escape the everyday conventions? Surrounded by so much, yet trapped in our little technology infiltrated worlds, we are unable to see past what we have right in front of us. My work is a social commentary on the invasion of the built world and the technology we hold on to so tightly in this present day. It is additionally a study on the materials of the world most of us experience on a day to day basis that we overlook so continuously. There is a beauty that has become lost. I hope my work is able to bring some interest in. I hope we can learn to digress from our distracting worlds filled with phone signals and waves of overwhelming information to just appreciate what we have around us.

Enhanced Endocannabinoid Signaling Reduces Anxiety in Rats

Emma Boxer, Biology and Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Sondra Bland, DC - College of Liberal Arts and Sciences

The endocannabinoid (eCB) system of the brain is involved in many behaviors and cognitive processes, including anxiety and aggression. Anxiety can be assessed in animal models using the social interaction test. Previous studies have shown that eCBs reduce anxiety in rats. Here, we enhanced eCB signaling, particularly the eCB 2-arachidonylglycerol (2-Ag), by administering the novel drug MJN110, which inhibits the enzyme that degrades 2-Ag. We observed dose-dependent alterations in social behaviors produced by MJN110. We found that the administration of a low dose of MJN110 (1mg/kg) in adolescent male rats significantly increased play behaviors (nape attack and pinning) in the social interaction test, whereas a high dose of MJN110 (5mg/kg) produced a significant reduction in total social interaction, pinning, rearing, and a marginal reduction of nape attack. These observations suggest that increased 2-Ag signaling may elicit an anxiolytic response at a low dose, and induce sedative effects at a high dose during a social encounter.

The Chronology of Rock Art Panels Found Along Chinle Wash Using Cross-Dating Methods

Blair Boyles, Anthropology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Tammy Stone, DC - College of Liberal Arts and Sciences

Three panels found along Chinle wash of the Northern San Juan River in Utah were photographically documented and surface surveys immediately around the rock art sites were performed to document ceramic materials. The rock art events were analyzed for diagnostic symbols, stylistic attributes and other physical characteristics to infer the typological classifications and relative age of ancestral Pueblo phases represented. Historical chronology for the rock art events was diverse but was concluded to center upon activities around and prior to A.D. 900 with high associations of late Basketmaker-Early Pueblo styles.

Your Brain on Exercise: Exercise Increases mTOR Signaling in the Prefrontal Cortex

Jennifer Burns, Psychology, DC - College of Liberal Arts and Sciences

Esteban Loetz, Psychology, DC - College of Liberal Arts and Sciences

Jonathan Herrera, Department of Integrative Physiology, University of Colorado Boulder

Peter J. Clark and Monika Fleshner, Department of Integrative Physiology, University of Colorado Boulder

Faculty Sponsor: Dr. Benjamin Greenwood, DC - College of Liberal Arts and Sciences

Previous research demonstrates benefits of exercise, including enhancing learning and memory and producing resistance against stress-related psychiatric disorders such as depression and anxiety. The mechanisms underlying these beneficial effects of exercise, however, remain unknown. The mammalian target of rapamycin (mTOR) is a transcription-regulator important for cell growth, proliferation, and survival. mTOR has recently been implicated in providing antidepressant effects through actions in the prefrontal cortex (PFC), but the effects of exercise on PFC mTOR signaling have not yet been investigated. The present study sought to examine the effects of exercise on levels of mTOR in the PFC of rats. Rats remained sedentary, or were allowed voluntary access to running wheels for 6 weeks. An additional group of rats were forced to run in motorized running wheels for 6 weeks following a running pattern similar to that of voluntarily running rats. Prior work has shown that both voluntary and forced wheel running can increase resistance against anxiety- and depression-like behaviors following stress. Following 6 weeks, rats were sacrificed during their active cycle following at least 2 hours of voluntary or forced wheel running, and levels of activated (phosphorylated; pmTOR) were quantified in the PFC. Compared to sedentary rats, both voluntary and forced wheel running elevated levels of pmTOR in the PFC. Thus, exercise increases mTOR signaling regardless of exercise controllability. These data are consistent with a role for mTOR in the stress-protective effects of

exercise. Additional brain regions such as the striatum and hippocampus are currently being analyzed.

Aristotle's Protrepticus and the Case for Pure Research

Joseph Chase, Philosophy, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Candice Shelby, DC - College of Liberal Arts and Sciences

The *Protrepticus* is one of the earliest works credited to Aristotle. It takes the form of a dialogue between Aristotle, Heraclides, and Isocrates. The latter argues from the position that all knowledge should have tangible benefit, e.g. that a land surveyor needs only the math necessary to fulfill his craft, and has no use for the pure geometry that spawned his techniques. Aristotle takes the opposite view- that the universal is more important than the particular, and studying these macro concepts is the true course for the student of both philosophy and science. The viewpoint he expresses was inspiring at the time of its writing, several thousand years ago, and still provides a foundation for academic research to this very day, in every field. This paper explores this concept in the *Protrepticus*, alongside further clarifications on the subject in Aristotle's *Metaphysics*.

Crafting Yourself

Peter Costea, Psychology , DC - College of Liberal Arts and Sciences

Rachel Jones, Biology, DC - College of Liberal Arts and Sciences

Cortney Thurmes, Business Administration, Management, DC - Business School

Faculty Sponsor: Dr. Georg Gadow, DC - College of Liberal Arts and Sciences

Crafting Yourself is a program developed to promote the personal growth and efficacy of middle school students through the use of art and group activities. The road to becoming an individual who has the knowledge and knowhow to affect a change within a community is a long one. Crafting Yourself aims to kick-start this process at a young age. The program is divided into three separate modules aimed at promoting different aspects of this individual growth. Each module contains three Friday sessions each lasting an hour and a half. A unique 4th Friday session ends each module. The first module focuses on the growth of the student′s sense of self identity. Once this skill has been established the second module revolves around interpersonal skills and the interactions amongst the student′s in a group. Finally, the third module uses the integration of these two previously learned skills to guide the students in community engagement. The special 4th days of each module are days on which we bring in elders from the community to share and work side by side with the youths. This interaction helps promote the sense of community while at the same time allowing for a free transfer of ideas and knowledge between middle school students and elderly. These two groups are both at stages in their lives

where feeling needed and having meaningful interactions is key to having a fulfilling life. Over the medium of art we hope that we can help accomplish this.

Introduction to Chemical Literature and Research as a First-Year Student: Identification of Unknown Salts Through Boiling Point Elevation

Stephanie Cung, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Margaret Bruehl, DC - College of Liberal Arts and Sciences

This project describes the design of a new laboratory experiment suitable for a first-year general chemistry laboratory course. It was inspired by the "Design Your Own General Chemistry Lab" in Honors General Chemistry II lab, and is related to the research on the importance of the introduction to scientific research during the first year of student's college experience. This new laboratory experiment compares the effect that different salts have on the boiling point of water. This was done by heating the water on a hot plate and using a Vernier Temperature Probe to track the temperature changes over time. The temperature was recorded every thirty seconds, and the data was later plotted to create a section of a typical heating curve. The heating curve was analyzed to give the boiling point of the water. This was then repeated with solutions of different molalities on different solutes, and the boiling point of each solution was compared to the boiling point of water. Using the boiling point elevation equation, the Van't Hoff factor can be calculated, which helps the students identify the solute that was in the solution. This experiment will cover the importance of identifying and acknowledging experimental error, as well as familiarize students with the equipment in the General Chemistry lab.

Combined QM/MM Study of the Translocation of Chloride Ions Through Escherichia coli Chloride Ion Transporters

Christal Davis, Chemistry and Biology, DC - College of Liberal Arts and Sciences

Christina Garza, Public Health, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Hai Lin, DC - College of Liberal Arts and Sciences

Chloride ion transporters (ClC) move Cl- across cellular membranes and are associated with numerous physiological and cellular processes. However, despite several decades of research, many details about the mechanism of ion transport by ClC proteins are not well understood at the molecular level. Our recent quantum calculations[1,2] revealed significant charge delocalization in Cl- binding, which contributes significantly to the effectiveness of the broken helical structure of the binding sites to coordinate Cl ions. The marked loss of partial charges of the Cl ions to the surroundings, especially to the residues having π bonds, may impact Cl transport. Here we report

a molecular dynamics study of the movement of Cl through *Escherichia coli* ClC where we compare the free energy profiles obtained by employing both the molecular mechanics (MM) and combined quantum mechanics/molecular mechanics (QM/MM) methods. [1] Smith, M.; Lin, H. "Charge delocalization upon chloride ion binding in ClC chloride ion channels/transporters." Chemical Physics Letters, 2011, 502, 112-117. [2] Church, J.; Pezeshki, S.; Davis, C.; Lin, H. "Charge transfer and polarization for chloride ions bound in clc transport proteins: natural bond orbital and energy decomposition analyses." Journal of Physical Chemistry B 2013, 117, 16029-16043. Acknowledgments: This project is supported by the NSF (CHE-0952337), XSEDE (CHE-140070), and Camille and Henry Dreyfus Foundation (TH-14-028). C.D. is grateful for the support of the Undergraduate Research Opportunity Program at the University of Colorado Denver.

The Relationship of Social Media and Area Marketing in Promoting Boybands

Susanna Diller, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Casey Allen, DC - College of Liberal Arts and Sciences

During summer 2014, I spent a month in England examining correlations between how the boyband One Direction is marketed and the density of social media dialogue surrounding the band. One Direction′s presence first spread online, and their popularity has been cultivated by and sustained in social media. Taking England as a case study, I analyzed the correlation between social media dialogue and local marketing efforts utilizing a variety of analytical methods. First, during my time in England I visited a number of major cities (e.g., London and Manchester) and smaller tourist destinations (e.g., Bath and Windermere).These comparisons allowed me to understand what marketing for the band looked like in diverse regions around the country. Second, I collected and analyzed social media data from Twitter, by tagging location parameters on a search for tweets relating to One Direction during the timeframe I was in the country, and then compiled the replies into a data table. This allowed for an understanding of where the conversation relating to the band was concentrated. At the same time, I developed a series of spatial visual representations using GIS (Geographic Information System), some to display baseline demographic information for England, and some to showcase the social media data I collected. The resultant maps represent the central output of this research, and allow for further analysis of emergent trends linking demographics, marketing, and social media.

Advanced Atherosclerosis in Premenopausal Women

Heather Dirkmaat, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Michael Greene, DC - College of Liberal Arts and Sciences

Atherosclerosis, better known as heart disease, is the hardening and narrowing of the arteries. This disease affects many Americans more so than other parts of the world, indicating that environmental factors are contributing to the number of affected Americans every year. The most common cardiovascular risk factors include: diabetes, hypertension, dyslipidemia and obesity. Research also suggests a gender disparity between the sexes and the onset of heart disease. Women have protection from this cardiovascular disease until menopause when estrogen levels decrease. Estrogen and its cardiovascular protection is controversial, but it is suggested that nitric oxide and estrogen′s ability to alter gene expression is one of the reasons for this protection. This cardiovascular protection is being compromised by other factors and women are dying with atherosclerosis before menopause, therefore the onset of the disease is premature. There must be other factors that affect the timing and severity of atherosclerosis. The aim of this study is a novel approach examining other possible variables including surgeries.

Lithic Analysis of Late Mousterian Assemblages at Riparo Bombrini

Rebecca D'Occhio, Anthropology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Julien Riel-Salvatore, DC - College of Liberal Arts and Sciences

We present a preliminary analysis of the Late Mousterian lithic assemblages from Riparo Bombrini, in Northwestern Italy. Riparo Bombrini is an important site because it contains some of the most recent Neanderthal occupations for that region. Our analysis includes both retouched pieces and unretouched debitage, focusing especially on piece dimensions; the presence, kind, and intensity of retouch; platform and termination types; as well as raw material procurement. These multiple dimensions combine to provide a fine-grained view of, among other behaviors, Neanderthal mobility in the various Late Mousterian levels at Bombrini, and thus shed light on the adaptations and behavioral strategies of Neanderthals immediately prior to the arrival of modern humans in Northwest Italy.

Enhancing Over Sustaining: Hybridizing Nature and Architecture

Zachary Dohallow, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Ms. Rachel Brown, DC - College of Architecture and Planning

Sustainability has fallen short of its purpose. This is why I investigate a more radical form of architecture that I will explain with two projects. These projects are entitled Mutualism: An Environmentally Reparative Public Space, and Assymil8: A Concept of Resource Management Reform. Mutualism is a design concept in which the use of architectural design principles offers ecological benefits. From passive water filtration of the Platte River, to a fleet of trained crows collecting litter and spreading wildflower seeds, Mutualism embodies the idea of responsible cooperation with nature through architecture. Assymil8, ushers in a notion of grid independence in energy, food and waste management. Located in a low-income neighborhood on the brink of gentrification, the facility is a public space comprised of an agricultural ecosystem, and a cutting edge cellulosic ethanol plant. This is a conceptual representation of what new emerging technologies and methodologies in food production could become, and the benefits that they could bring to every neighborhood of our society. These designs speak to my commitment towards architecture here at University of Colorado Denver. It is my goal to integrate natural systems into the practice of architectural industry, to promote social business and behavioral economics and to foster environmental stewardship. The time for sustainability is past, and now looking forward we must revise our thinking of the built environment and its interplay with the natural environment. We must begin designing for the purpose of enhancing the world around us, not merely sustaining it.

Establishing a Core Bacterial Flora for Human Skin

Helen Dupree, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Timberley Roane, DC - College of Liberal Arts and Sciences

The bacterial flora of the human skin is thought to be highly diverse and important in maintaining a healthy skin environment, and the question remains as to whether a core microbiome exists with healthy skin. Disruption of a core flora may lead to skin diseases and abnormalities, such as eczema. The objective of the present study is to develop a method for collecting bacterial DNA from human skin using tape adhesives. Preliminary data is being collected from the pronated forearm, using a series of tape strips applied in succession to the same area to collect DNA with depth through several skin layers. The strips are then submerged in a digestive buffer to remove the DNA from the adhesive, extracted and purified. Using the 16S rRNA gene for bacterial identification, Illumina high throughput sequencing is being used to generate bacterial community profiles for comparison. Preliminary data shows that bacterial DNA can be collected with depth, indicating the presence of bacterial DNA below the surface of the skin. The generation of profiles with depth in the skin will allow for a better understanding of whether a core skin microbiome exists and where in the skin the core flora can be found.

Sisters in Arms Celebration

Gabrielle Engelmann, Biology, DC - College of Liberal Arts and Sciences
Christine Garcia, Public Health, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Ms. Trishia Vasquez, DC - College of Liberal Arts and Sciences

In 2015, The American Cancer Society estimates that in the United States 231,840 new cases of invasive breast cancer will be diagnosed in women, and about 40,290 women will die from breast cancer. In 2010, it was estimated that 1500 people per day died in the United States as a result of cancer. Even though the number of cancer survivors is growing, 89% of women still suffer from issues dealing with body image even after 4 years of remission. This should come as no surprise considering society typically views curvy women as beautiful, and once a woman loses her curves, she may also lose touch with her personal beauty. Statistics show that the quality of life drastically declines from the time of diagnosis to eight years after remission. The first two years after remission are the hardest, where the woman slips into depression and refuses to show her body to anyone, including her partner. About 54% of women say that they hate their body after cancer, and no amount of plastic surgery can fix that. As a way to honor breast cancer survivors and raise awareness, The Sisters in Arms Celebration event was developed as a means to celebrate strength and courage, and inner beauty. The women in attendance will be pampered with complimentary hair and makeup services before being invited to share their story in an intimate environment. The night will allow the attendees to not only feel beautiful and renewed, but also supported by each other and the community in order to ignite the flame that makes them feel womanly and rebuild lost self-esteem.

Violent Video Games and Physiological Responses

Ryan Farero, Psychology, DC - College of Liberal Arts and Sciences
Joshua Fowler, John Host, Kaitlyn Cochran, and Katie Braley Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. David Albeck, DC - College of Liberal Arts and Sciences

Previous research has shown that playing violent video games alters a person′s behavior and physiology. In the present study electrical signals from the brain were recorded (electroencephalography) in order to capture the neural response to emotionally charged visual images before and after playing a violent video game. Participants were shown a total of 360 images; with a total of 24 violent, 24 positive and 312 emotionally neutral images, as rated by previous similar studies. EEG responses to the violent images were isolated, filtered and averaged. The preliminary results indicate an increased neural response to the violent images after playing a violent video game for 15 minutes. A greater visually-evoked EEG response implies the brain is allocating more cortical activation to the stimulus, thus a greater level of

attention when viewing the images. This increase may suggest that playing the violent video game sensitized the brain toward violent images, during the short time-span between playing the game and viewing the images for a second time. Additionally, heart rate was recorded before and during the violent video game play. The variability between the beat to beat intervals will be investigated.

Gym rats: Involvement of Dopamine Circuits in the Rewarding Effects of Voluntary and Forced Exercise in Rodents

Sofiya Fedynska, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Benjamin Greenwood, DC - College of Liberal Arts and Sciences

Exercise can prevent stress-related psychiatric disorders such as depression and anxiety, but the neurochemical mechanisms underlying these effects are unknown. Dysfunctions in brain dopamine reward pathways have been implicated in these disorders, so it may be through these pathways that the positive effects of exercise are manifested. Stress protective effects of exercise have been demonstrated following both voluntary and forced exercise in rodents. If the rewarding effects of exercise are important for the stress protective effects, then we would predict that both voluntary and forced wheel running would be rewarding and similarly recruit brain dopamine circuity. The goals of the current study are to determine whether exercise reward is dependent on exercise controllability, and to begin to dissect the roles of dopamine pathways in exercise reward. After training rats to associate one side of a chamber with voluntary or forced exercise, and the opposite side of the chamber with no exercise, rats were allowed to explore both sides of the chamber and preference for the exercise-paired side was recorded. Then, rats were restricted to either the exercise-paired or the non-exercise-paired side, and neural activity in the nigrostriatal and mesolimbic dopamine pathways were assessed. The results collected to date indicate that both voluntary and forced exercise are rewarding, and the rewarding effects are associated with similar activation patterns of both the nigrostriatal and mesolimbic dopamine systems. These results are consistent with exercise reward being involved in the stress-protective effects of exercise, and shed light on the mechanisms underlying these effects.

Disruption of Fertilization Pathway for *Xenopus laevis* by Methyl-β-Cyclodextrin (MβCD) a Membrane Raft Cholesterol Inhibitor and Herbimycin A a Src Tyrosine Kinase Inhibitor

Robin Feldman, Biology, DC - College of Liberal Arts and Sciences
Alesia Blanchard, Psychology , DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Brad Stith, DC - College of Liberal Arts and Sciences

The fertilization pathway for *Xenopus laevis* is not fully defined, however a previous publication by our lab reports that sperm binds to egg rafts increasing phosphatidic acid (PA) through the hydrolysis of phsophadtidylcholine (PC) which is catalyzed by Phospholipase D (PLD). PA then activates Src tyrosine kinase, which in turn activates Phospholipase C (PLC). PLC catalyzes the production of IP3 and subsequently releases intracellular calcium, which induces the later events of fertilization. Our previous research showed that methyl-beta-cyclodextrin (MβCD), which has been reported to disrupt membrane rafts and inhibit fertilization, inhibits the induction of fertilization events by the addition of sperm to *Xenopus* eggs. We have supported the ability of MβCD to inhibit fertilization by observing fertilization events such as gravitational rotation and first cleavage after MβCD addition. Eggs were incubated in 25mM MβCD for half an hour, then treated with sperm to induce fertilization. We also set out to confirm that MβCD acts by removing cholesterol from egg membranes to disrupt membrane rafts. In this test *Xenopus* eggs were treated with cholesterol after initial MβCD treatment to see if rapid induction of fertilization events can be rescued. Furthermore, using the same MβCD treatment protocol, eggs were treated with a Src tyrosine Kinase inhibitor: Herbimycin A. As noted, Src tyrosine kinase has been identified as an important enzyme in fertilization of *Xenopus laevis*. Eggs were treated Herbimycin A and incubated for an hour, and were then inseminated. We are supporting previous research that showed blocking Src tyrosine kinase inhibited fertilization.

University of Colorado Denver Motorsports

Alex Fenstermacher, Mechanical Engineering, DC - College of Engineering and Applied Science
Chris Allen, Michael Baker, Zack Landgren, Byron Pindell Matt Bunsness Mark Haden, Austin Voss, Drake Soule, David Richards, Orlando Paredes, Arthur Boo, Tabitha Martinez, and Curtis Sharpsteen, Mechanical Engineering, DC - College of Engineering and Applied Science
Faculty Sponsor: Dr. Ronald Rorrer, DC - College of Engineering and Applied Science

The CU Denver Motorsports Formula SAE (FSAE) team is designing and building a competition racecar to compete in the Lincoln Nebraska SAE competition in June 2015. FSAE is a competition intended to combine engineering and innovation into racecar design. Applying knowledge ranging from the fundamentals of engineering such as dynamics to cutting-edge analytical techniques including aerodynamics, the CU Denver FSAE team has designed and will build, from the ground up, a competition vehicle. FSAE is based on the premise that a design team has been formed to create a Formula-style racecar for the non-professional weekend

autocross racer. To be successful, the design team must consider factors such as budget, manufacturing, and material selection in order to optimize the performance of the vehicle. The SAE competition requires that all competition cars follow a strict set of rules and regulations to ensure the utmost safety. As such, the FSAE team has designed a vehicle with an estimated weight of 425 pounds to be powered by a Suzuki GSX-R600 engine, providing 75 hp. A steel space frame, surrounded by a carbon fiber body, will form the base of the vehicle. Suspension and braking has been designed so as to achieve a maximum of 1.2g cornering and braking. The drivetrain consists of a 6-speed transmission running through a limited-slip differential. The vehicle will accelerate from 0-60 mph in around 4 seconds. This vehicle will then compete in multiple events including autocross, acceleration, and endurance tests.

Differential effects of 2-AG on Aggression in Female Isolation Reared Rats

Jazmin Fontenot, Biology, DC - College of Liberal Arts and Sciences

Mathew Ishiki, Halimah Hamidu, and Esteban Lopez, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Sondra Bland, DC - College of Liberal Arts and Sciences

Exposure to abnormally high levels of stress early in life increases vulnerability to anxiety, depression, and addiction in adulthood. Adolescent social isolation of rats is a common animal model for early life adversity. Previous work in our laboratory has shown that isolation reared rats display increased aggression and anxiety. The endocannabinoid system is known to regulate pathways that are important for regulation of aggression and anxiety. Two lipids, anandamide (AEA) and 2-arachionoylgerol (2-AG) are known ligands for endocannabinoid receptors. Our study used a novel drug, MJN110, that increases 2-AG concentration by inhibiting the enzyme responsible for its breakdown. In the present study we assessed the effects of MJN110 on social behavior with a novel rat after isolation rearing. Female isolation-reared rats displayed more aggressive behavior than female grouped-reared rats, and MJN110 decreased overall aggressive behavior in both groups. These results replicate our previous finding of increased aggression in isolation reared female rats, and suggest that MJN110 has possible anxiolytic effects.

Role of Acetylcholine on Sniffing Behavior

Jazmin Fontenot, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Diego Restrepo, AMC - School of Medicine

Sniffing is an active process necessary for odor detection and discrimination. In rodents, a single sniff can distinguish odors with a one-carbon chemical difference, however this requires attention to an external stimulus. Previous studies have linked acetylcholine in the brain with

attention and learning. In addition to this, the olfactory bulb is known to receive cholinergic projections from the Basal Forebrain, particularly from the Horizontal Limb of the Diagonal Band of Broca (HDB). In this study, we examine the role acetylcholine plays in olfactory driven behavior. To test the effect acetylcholine has on sniffing behavior, an optogenetic approach was used to activate cholinergic neurons in the HDB. An optetrode, consisting of a movable optic fiber and a tetrode bundle, was inserted into the HDB to record and active cholinergic neurons. Mice genetically modified to express channelrhodopsin allowed for precise stimulation of targeted neurons. To measure sniffing, a cannula was inserted into the nasal cavity and connected to a pressure sensor. Preliminary results indicate activation of cholinergic neurons changes sniffing frequency in anesthetized mice. We predict that increasing acetylcholine release in the HDB will momentarily increase sniffing frequency.

Cannabinoid Receptor Activation Shifts Temporally-engendered Patterns of Dopamine Release

Jacqueline Gallegos, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Erik Oleson, DC - College of Liberal Arts and Sciences

Cannabinoids are thought to disrupt temporally controlled behaviors, possibly by increasing dopamine (DA) concentrations in the mesocorticolimbic system. Timing can be assessed using fixed-interval (FI) schedules, which reinforce behavior on the basis of time. It remains unknown how cannabinoids modulate DA release when responding under FI conditions, or how subsecond DA release is related to time in these tasks. Here, we hypothesized that cannabinoids would accelerate timing behavior in an FI task while also augmenting a temporally relevant pattern of DA release. To assess this, we measured DA concentrations in the nucleus accumbens using fast-scan cyclic voltammetry while mice responded for food under the influence of cannabinoids in an FI task. Our data reveal that DA concentrations decrease proportionally to interval duration, suggesting that DA encodes time in FI tasks. Furthermore, the cannabinoid receptor agonist WIN 55 212-2 dose-dependently increased DA release and accelerated timing behavior in a CB1 receptor-dependent manner, suggesting that cannabinoid receptor activation can modify timing behavior by enhancing time-engendered patterns of s release. Additionally, we uncovered a specific role for endogenous cannabinoid tone, as elevations in only one of the two well characterized endocannabinoids (i.e.2-arachidonoylglycerol) increased the temporal response pattern similar to WIN 55 212-2.

Your Plate: A Physical Representation of Healthy Eating While Acknowledging Cultural Backgrounds and Health Restrictions

Sanju Garimella, Biology, DC - College of Liberal Arts and Sciences
Akshay Kumar, Biology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Ms. Trishia Vasquez, DC - College of Liberal Arts and Sciences

The current format for conveying healthy eating guidelines by the United States Department of Agriculture (USDA) is My Plate. This initiative delivers the basic information in regards to eating in a healthy manner. However, this format of healthy eating recommendations is not easily translatable to people with different cultural backgrounds and health problems. Thus, this project delves into the issue of making breakfast, lunch, and dinner meal plans that are targeted towards particular populations in terms of culture and health restrictions. For example, it has been found that Diabetes has a higher prevalence in South Asians; however, when culture specific care was developed, researchers noticed a decrease in HbA1c levels, better lipid profiles, or a decrease in BMI (Middelkoop 2001). Furthermore, studies have found that immigrants may not necessarily understand the terminology of Western Medicine; studies have found that immigrants with diabetes and/or cardiovascular disease cannot articulate the disease that they have, the risk factors of their disease, or the preventative measures of the diseases (Rankin 2001). This project investigates how this cultural gap can be reduced by incorporating images in sample plate diagrams of breakfasts, lunches and dinners. Familiarizing the target population of Asian immigrants with healthy eating while staying culturally sensitive may be the key to living healthier lifestyles in foreign countries.

Amache Internment Camp Restoration

Piotr Gibala, Civil Engineering, DC - College of Engineering and Applied Science
Faculty Sponsor: Mr. Peter Marxhausen, DC - College of Engineering and Applied Science

Located in Granada, Colorado, the Amache Japanese American Internment Camp was one of ten camps that were created by the administration of President Franklin D. Roosevelt, following the Japanese attack on Pearl Harbor, Hawaii on December 7, 1941. The camp opened in August 1942 and had a maximum population of 7,318 persons. The camp was listed on the National Register of Historic Places on May 18, 1994, and designated a National Historic Landmark on February 10, 2006. In cooperation with the Colorado Preservation Society and the private architectural firm, this project includes an engineering review of the site and a structural review of the historical buildings. The project goals include preservation, protection, and enhancement of this landmark.

Observations of Very Low Frequency Waves and Science Outreach in Akhiok, Alaska

Ryan Gillespie, Electrical Engineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Dr. Mark Golkowski, DC - College of Engineering and Applied Science

Very low frequency electromagnetic waves are used by scientists and engineers to study the near-Earth space environment. A rich variety of phenomena can be observed at high latitudes near the north and south poles since this is where the Earth's magnetic field is almost vertical and connects the atmosphere to locations in space tens of thousands of kilometers away. Some of the observed processes are related to the aurora borealis (northern lights), while others are important for modern communication technologies. In order to make observations of these waves, special hardware is needed and an appropriate site must be found. The site needs to be remote in order to avoid interference from the electrical power grid. Here we present the custom hardware and discuss our deployment of the hardware in the remote community in Akhiok Alaska. In seeking to combine research and education, we have performed several outreach activities with the local school that hosts our receiver equipment. The goal of the outreach efforts are to help the students understand the scientific instrument at their school and also be exposed to STEM disciplines and future career paths.

Music Performance

Arias Goldanloo, Music, Recording Arts, DC - College of Arts and Media

Gavi Torres-Olivares, Music, Performance , DC - College of Arts and Media

Faculty Sponsor: Dr. Karin Hauger, DC - College of Arts and Media

We are going to play our original elctro funk music using ableton live plus live guitar and bass. Our electro funk duo is called FLOATGOAT.

Sound Healing: The Effects of Sonic Vibrations and Tonality on Emotional and Physical Well Being

Bryan Goldstein, Music, Music Business, DC - College of Arts and Media
Anthony Manzanares, Music, Recording, DC - College of Arts and Media
Ted Leininger, Music, Recording, Cello/Performance, DC - College of Arts and Media
Sarah Reichardt, Music, Singer/Songwriter, DC - College of Arts and Media
Faculty Sponsor: Dr. Chris Daniels, DC - College of Arts and Media

The lyrics of a song can be comprehended and connected with by anyone who speaks and understands the language. The words can be relatable and touch on a feeling that the listener shares with the performer. A verbal and emotional connection is made and there is a potential for healing through this poetry, but what happens when the words are taken away? The communication is still there, but in the more abstract form of musical vibrations. These Vibration are similar to sun, radiation, and other forms of energy in that it is electrifying and can penetrate. After experimenting extensively with the art of sound healing, and its real world use, I see how it is a healing power that should be used on a larger scale. I spent time working at a non-traditional non-westernized healing center in Santa Fe. There, I would perform tonal and rhythmic background music while someone laid on the bed or floor for treatment. Words often bring someone to a different emotional state where issues can be resolved, and music does too. The Power of a Live Drone can penetrate deep into ones soul. Our findings will be shared with a double bass, cello, and vocalist. We will demonstrate various styles of drone and show how it can connect to certain emotions.

Stories Worth Publishing

Kimberlie Grady, English, Creative Writing, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Mr. Drew Bixby, DC - College of Liberal Arts and Sciences

Worth Publishing is a series of three distinct online publications that aim to encourage and inspire writers/creators of varying ages and levels of skill/experience to learn about the submission process and become published. Kids′ Stories Worth Publishing encourages early literacy and authorship by working with children ages 5-17 and their parents to write, revise, and then publish their stories. Rejected: Stories Worth Publishing′s purpose is to encourage writers whose work has previously been rejected by more mainstream publications. It also works with writers who want to learn how to navigate the publishing industry. Denver Stories Worth Publishing provides exposure exclusively to storytellers, writers, artists, musicians, etc. in the Denver metropolitan area. Each publication aims to provide a path for writers/creators to gain valuable knowledge about and experience in the publishing industry, with the hope that they will go on to become published in more mainstream publications.

Aggrecan in the Down Syndrome Brain

Halimah Hamidu, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Kimberly Bjugstad, AMC - School of Medicine

Aggrecan is a proteoglycan found in the extracellular matrix (ECM) of the brain. Higher levels of aggrecan expression in areas of the hippocampus correlate with lower levels of amyloid beta plaques and neurofibrillary tangles, both of which are trademark characteristics of Alzheimer′s disease (AD). Since Down syndrome (DS) is closely linked to AD, we measured aggrecan expression in TS65Dn trisomic-mice. To determine whether potential results were DS specific or indicative of general cognitive dysfunction and not age-related AD, homocystinuric (HO) mice were used as another model of cognitive dysfunction. We measured the aggrecan expression in regions of the hippocampus in DS mice at 4 months, 12 months, and 18 months, control mice at 4 months and 12 months, and HO mice at 5 months using immunohistochemistry. Our results indicate that aggrecan levels increase within the Lacunosum-moleculare (LM) of the CA1 between 4 months and 12 months in both DS and control mice. Interestingly, aggrecan expression decreased in 18 month DS mice. Young adult HO mice had significantly elevated levels of aggrecan in the LM when compared to their DS and control young counterparts, suggesting that aggrecan expression in the LM may not be directly involved in other forms of cognitive dysfunction. This work confirms previous studies demonstrating increases in aggrecan expression as mice age. The results of this study provide the basis for further research exploring aggrecan expression in older mutant mice strains, which may provide additional insights into differential aggrecan expression in DS or AD.

Lipid Coated Gold Nanoparticles as Models of Faceted and Highly Curved Membranes

Desmond Hamilton, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Scott Reed, DC - College of Liberal Arts and Sciences

Octahedral gold nanoparticles (GNP) provide a stable support for hybrid lipid membranes with defined facets and curvatures, which are useful as biosensors. Here, we synthesized octahedral and spherical GNPs and coated them with L-α-phosphatidylcholine (PC) and a hydrophobic anchor, propanethiol, to form a hybrid lipid membrane. An optimized concentration of PC and propanethiol were used to ensure that the GNPs were fully encapsulated within the membrane. Octahedral and spherical GNPs with similar surface areas required different concentrations of PC and propanethiol to achieve an ion impermeable membrane as determined by a cyanide stability assay. The lipid coating process was monitored by measuring the localized surface plasmon resonance (LSPR) of the GNPs, which reports on small changes in refractive index near the GNP surface. Octahedral GNPs were found to be more sensitive than spherical GNPs to changes in refractive index. LSPR measurements were also used to obtain binding constants for an α-helical amphipathic peptide to the hybrid lipid membrane coated octahedral and spherical GNPs.

Naturalized Epistemology: Bergson and Kornblith

Samuel Helgeson, English, Literature, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Candice Shelby, DC - College of Liberal Arts and Sciences

Contemporary naturalistic epistemology attempts to provide neurological and psychological accounts of what knowledge is and how humans come to possess it. In this presentation, I place the work of one philosopher from this school, Hilary Kornblith, into dialogue with the work of the early twentieth-century French philosopher Henri Bergson. Both philosophers believe that the study of knowledge should concern itself with evolutionary adaptivity and should proceed empirically. I argue that Kornblith and Bergson employ evolutionary psychology to explain instances where knowledge fails in strikingly similar ways, but that Kornblith relies on an overly simplistic conception of empiricism, one which can be ameliorated by Bergson′s account of how humans relate to the world. Bergson′s account is also helpful in displacing Kornblith′s anxieties about constructivist theories of knowledge, anxieties which commonly create distance between researchers in the science and humanities.

Mercado Humano Cultural: Westwood - Creating Identity and Expression within the Greater Denver Area

James Hillard, Architecture, DC - College of Architecture and Planning

Jesse Ledin, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Mr. Amir Alrubaiy, DC - College of Architecture and Planning

The undergraduate architecture and planning capstone studio is set up as a collaborative design project with the business school - addressing the issues of the built environment from both architectural and business perspectives. The studio examined the Westwood neighborhood in Denver as the location for a new grocery store and adjoining greenhouse. The design team studied how this historically undervalued neighborhood and its rich culture could be expressed, creating a strong and unique identity within the Greater Denver area, taking a unique and innovative approach to the design brief. The design concept of the Mercado Humano Cultural is based on a design strategy which creates a centralized marketplace and flexible infrastructure acting as an incubator space, highlighting the existing communal activities, and is allowed to grow and adapt with the natural evolution of the community. The building design takes after a petri dish, in which an element is introduced and allowed to flourish organically in a micro climate of urbanism and capitalism. This dynamic and rich platform allows for natural connectivity between people in which relationships and joint ventures form organically. The marketplace is representative of the beautifully unique spirit, sparking a sense of pride and ownership, by highlighting the rich heritage present in the community known as Westwood.

Leveling the Relationship Between the Abled and Disabled Through Design Fabrication

Mariah Himelspach, Architecture, DC - College of Architecture and Planning
Tanner Morrow, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Mr. Amir Alrubaiy, DC - College of Architecture and Planning

The undergraduate College of Architecture and Planning Studio′s project is a collaboration with the Business School. This year′s project involves designing a new facility for a non-profit organization, The Chanda Plan Foundation. The organization fosters healing and recovery through an emerging field, integrative therapy. The foundation solely caters to those who have been diagnosed with some form of paralysis that is permanent, and has left them wheelchair bound. After appropriate site selection, we determined that the new facility would be placed adjacent to Rocky Mountain Lake and Park. This site has a vibrant community, and a natural landscape that conforms to the needs of Chanda′s patients and our program. The design approach is rooted in the heart of the Foundation: the process of healing and recovery with an added primary care aspect. The building design is based on a contrast between two ideas: a rigid outer shell, and soft, organic inner core. These two worlds are expressed in the building form through a fracture and the gesture of a healing process. This fracture represents a damaged sensory neuron, which is the root cause of paralysis. The expression of the form and the quality it provokes is a result of digitally fabricated building systems that are reminiscent of a natural environment rather than a clinical atmosphere. This new space challenges what it means to be in a treatment facility, by creating a space that addresses the needs of less abled people.

Peer Mentor Quality and First Year Student Perceptions of Resourcefulness, Connectedness, and Academic Skill in Higher Education

Chelsea Honea, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Mitchell Handelsman, DC - College of Liberal Arts and Sciences

Peer mentors can help first year students make the transition to college life via answering common questions, providing pertinent advice, and informing students of resources to help with a variety of life situations. Researchers have found a variety of positive impacts of peer mentoring in higher education. These positive impacts include increases in first year students′ perceptions of their own resourcefulness, connectedness, and academic skill. Resourcefulness involves finding appropriate campus and university support to balance multiple areas of life. Connectedness entails feelings of social support, interaction, and creating and maintaining relationships with other peers and staff. Finally, academic skill involves organizational ability,

time management, and development of effective study habits. All of these areas are shown to increase in conjunction with first year student involvement in a peer-mentoring program (Chester, Burton, Xenos, & Elgar, 2013; Ward, Thomas, & Disch, 2012; Fox, Stevenson, Connelly, Duff, & Dunlop, 2010). To further our understanding of peer mentoring in higher education, we will examine the relationship of peer mentoring quality with outcomes of resourcefulness, connectedness, and academic skill. These data will be drawn from first year students enrolled in First Year Seminar classes, which include peer mentors. This research may inform and guide future practices in peer mentoring in higher education to help with successful student transition from high school and student retention.

"Water Colors" (or a Triptych) "Garlic Flower"

Billie Hull, Fine Art, Photography, DC - College of Arts and Media

Faculty Sponsor: Ms. Carol Golemboski, DC - College of Arts and Media

Chaos that accentuates what the mind creates. A mind uses chaos, its patterns and emotions to explore the abstract and mundane as a motif, expresses the matrix of illusion and disillusion. What starts out as yearning soon becomes corroded into a dialect of temptation, leaving only a sense of what could have been and the unlikelihood of a new beginning. By experimenting with chance, or indeterminate elements, my photographs look to seduce the viewer into a world of quiet equilibrium and the interval that articulates the stream of daily events. The results are deconstructed to the extent that meaning is shifted and possible interpretation becomes multifaceted. My images feature coincidental, accidental and unexpected connections which make it possible to punctuate the human drama in order to clarify our existence and to find poetic meaning in everyday life. The inherent visual seductiveness, along with the conciseness of the exhibitions, further complicates the layers of meaning.

Synthesis of Photoreleasable Aldehyde Protecting Groups

Madelyn Hunsley, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Scott Reed, DC - College of Liberal Arts and Sciences

Photoreleasable protecting groups (PPGs) are protecting groups that can be removed via irradiation. The photorelease of an acetal protecting group containing a single chromophore has been demonstrated in other studies. We describe the synthesis of PPGs with multiple chromophores on the same PPG, which can potentially be released using multiple wavelengths of light. To obtain a PPG that is a diol with multiple chromophores, we synthesized an aromatic nitrile. A nitrile can be reacted with a single Grignard to introduce the first chromophore and hydrolyzed to a ketone prior to the addition of a second, different Grignard to introduce the second chromophore and to form the benzylic alcohol of the diol. A phenol group on the original nitrile provides the second branch of the PPG. Initial syntheses indicated the free phenol was

interfering with the transformation of salicylamide to 2-hydroxybenzonitrile, so salicylamide was protected with a benzyl ether protecting group and dehydrated to 2-(phenoxymethyl)benzonitrile. Using the general route described above, we have synthesized 2-[hydroxy(3-methoxyphenyl)(4-methoxyphenyl)methyl]phenol, which is a PPG containing two different chromophores. This shows that sequential addition of Grignard reagents to nitriles allows for introduction of two chromophores to an aromatic nitrile as a prelude to preparing an acetal PPG. Future work includes the synthesis of additional PPGs with different combinations of chromophores via the same general synthetic process.

Improving Patient Rehabilitation Prognosis Following TKA

Jennifer Huynh, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Brian Loyd, AMC - Graduate School

Total knee arthroplasties (TKA′s) are the most commonly performed elective surgeries in the United States. Approximately 700,000 TKA′s are performed every year and these numbers are projected to increase to over 3.48 million operations per year by 2030. While TKA is widely known to be very successful for improving knee pain, recovery of physical function has been shown to be a strenuous and unpredictable process. This unpredictability is evident in previous reports of population based averages demonstrating that recovery of function to a pre-operative level may require as much as one full year. However, population based averages do not accurately reflect prognosis at the individual level. The use of population averages fails to account for variability at the individual level including age, sex, comorbidity status, and prior level of function. Furthermore, previous recovery models failed because they were limited in 3 key areas: small sample sizes, insufficient covariates, and restrictive eligibility criteria. In order to improve individualized patient prognosis we have proposed the use of individualized prediction models commonly used in other scientific disciplines to better inform clinicians and patients about the expected rate of recovery. Using a statistical approach referred to as ″patients like me″ or ″nearest neighbors″ we will use a database of 500 patients to develop individualized patient prognosis (IPP). These models will allow us to map an individual patient′s recovery and progress through rehab, in order to allow for a more precise tailoring of interventions.

Molecular Mechanisms of Chromosomal Segregation by Epigenetic Regulators Polycomb Protein Cbx2

Thao Huynh, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Xiaojun Ren, DC - College of Liberal Arts and Sciences

Accurate chromosomal segregation is of fundamental importance for inheritance of genetic materials and cellular physiology. Altered chromosomal segregation often causes aneuploidy, a

hallmark of human cancers. Thus, understanding the mechanisms of causes of aneuploidy will open potential therapeutic targets. Our data demonstrate that mouse embryonic stem (ES) cells depleted of Cbx2 exhibit defects in cell proliferation, cell-cycle profile and chromosomal segregation. The Cbx2 knockout mouse ES cells show aneuploidy. Our findings indicate that the chromosomal segregation proteins Condensin complex and Sgo2 associate with Cbx2, but not with other Cbx family members. In this project, we will investigate the physical interaction between Cbx2 and Sgo2 by bimolecular fluorescence complementation (BiFC) in live cells. The two fragments of YFP protein (VN and YC) are fused separately to Cbx2 and Sgo2. The fusion proteins are expressed in mouse ES cells. The live-cell images are acquired by microscopy. Based on their physical interaction, further study will be conducted to determine functional interdependence of these two proteins for chromosome segregation.

EBV Nuclear Antigen-1 Epitope Reactive to Intrathecal Antibodies in the Cerebrospinal Fluid of Patients with Multiple Sclerosis

Nadeen Ibrahim, Public Health, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Xiaoli Yu, AMC - School of Medicine

Background: Multiple sclerosis (MS) is a chronic inflammatory demyelinating disease of unknown etiology. The most common laboratory abnormality associated with MS is increased intrathecal IgG synthesis and the presence of oligoclonal bands (OCBs) in the brain and cerebrospinal fluid (CSF). However, the major antigenic targets of the antibody response are unknown. The risk of MS is increased after infectious mononucleosis and MS patients have higher serum titers of EBV antibodies than control populations. Objectives: To identify disease-relevant epitopes of IgG antibodies in MS. Methods: We screened phage-displayed random peptide libraries (12-mer) with total IgG purified from an acute MS brain. We characterized phage peptide binding specificity to intrathecal IgG from patients with MS and controls by ELISA, phage-mediated Immuno-PCR, and isoelectric focusing. Results: Two phage-displayed peptides were identified that share linear sequence homologies with EBV nuclear antigens 1 and 2 (EBNA-1 and EBNA-2), respectively. The specificity of the EBV epitopes to panning MS brain IgG was confirmed by ELISA and competitive inhibition assays. Using a highly sensitive phage mediated immuno-PCR assay, we determined specific bindings of the two EBV epitopes to CSF from 50 MS and 5 inflammatory control (IC) patients. Antibody binding to EBNA-1 epitope, but not to EBNA-2 epitope, was found in 25 of the 50 MS patients and 1 of the 5 IC patients. Furthermore, EBNA-1 epitope was recognized by OCBs in multiple MS CSF by isoelectric focusing. Conclusions: EBNA-1 epitope is reactive to MS intrathecal antibodies corresponding to oligoclonal bands.

Enhanced Signaling of the Endocannabinoid 2-AG Produces Dose-dependent Disinhibition of the Basal-lateral Amygdala and Medial Prefrontal Cortex

Raleigh Jonscher, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Sondra Bland, DC - College of Liberal Arts and Sciences

The endocannabinoid system has been implicated in many important bioregulatory processes, including emotional modulation. More specifically, work in our lab has demonstrated that enhanced 2-arachidonylglycerol (2-AG) signaling through administration of the 2-AG breakdown inhibitor MJN110 produces an anxiolytic response in adolescent male rats. Here, double-label immunohistochemistry was performed in the basal-lateral amygdala (BLA) and medial prefrontal cortex (mPFC) to assess the expression of the proteins c-fos (a marker of neuronal activity) in GABAergic interneurons (expressing parvalbumin). We show that MJN110 leads to dose-wise and regionally specific alterations of activated parvalbumin cells. At a low dose (0.5 mg/kg) double labeled cells were reduced in the BLA and at a high dose (5mg/kg) double labeled cells were reduced in the mPFC. These results suggest that both the BLA and mPFC are involved the mechanism of 2-AG′s anxiolytic effects, and imply that the complex dose-wise behavioral effects of MJN110 may be due to dose-dependent disinhibition of the BLA and mPFC. Additionally, current work is being done examining 2-AG′s influence on the protein p-mTOR, in neuronal and glial populations in the mPFC.

Using Shorter Lipid to Enhance Sensitivity in Lipid Coated Gold Nanoparticles

Rupinder Kaur, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Scott Reed, DC - College of Liberal Arts and Sciences

In the past lipid coated gold nanoparticles have been used as biosensors. Here we aim to make a more sensitive model of the cell membrane by testing the sensitivity of GNPs coated with a shorter lipid hybrid membrane. Gold nanoparticles (GNPs) were used as templates to support a propanethiol anchored lipid membrane with well-defined curvature. Localized surface plasmon resonance (LSPR) was used as a sensor to monitor changes in the GNPs refractive index as it was coated. Increased sensitivity will allow even smaller changes to the GNPs surface to be detected, making this a more accurate biosensor. GNPs were lipid coated using sodium oleate, 1,2-dilauroyl-sn-glycero-3-phosphocholine (DLPC), and propanethiol. Data for the L-α-phosphatidylcholine (PC) lipid coating was obtained from previous experiments. Changes in centroid, full width at half max, and optical density obtained from the LSPR are reported. Stability of the membranes was tested using cyanide permeability of the thiol anchored lipid coated GNPs and was quantified using ultraviolet-visible spectroscopy. A linear regression of changes in the centroid upon serial additions of sucrose to thiol anchored lipid coated GNPs will be used as an assay for sensitivity of the system. Sucrose studies will be conducted on DLPC and

compared to the previously done studies with PC to determine the effect of a shorter lipid on the system′s sensitivity.

The Gap Between Student Views of Their Preparation and the Preparation Required to Earn Their Desired Grade: An Analysis of General Chemistry II Student Exam Preparation

Judas Kelley, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Robert Talbot, DC - School of Education and Human Development

Numerous students take General Chemistry II with the hopes of earning a grade that will allow them to pursue their future endeavors in chemistry, biology, or a health care profession. General Chemistry II can be a class that encourages students to continue their path in the physical sciences or consider an alternate path. The exams in General Chemistry II are generally considered to be more challenging than the exams taken in General Chemistry I, and many students are surprised by the difficulty they have in achieving their desired grade. In this study, student survey responses were collected and analyzed to see if students used the online chemistry problem-solving supplement they had purchased and if it was valuable to their preparation for the exam. Students were also asked if they felt prepared for the exam and if they earned the grade they wanted. The results of the survey showed that the majority of students felt prepared for the exam, but did not earn the grade they wanted. A difference between how prepared students felt and how prepared they actually were has been identified.

Finding the Diamond in the Rough

Zachary Kloska, Business Administration, Accounting and Financial Management, DC - Business School

Faculty Sponsor: Dr. Yosef Bonaparte, DC - Business School

The focus of this research is to develop a methodology, the G-R Indexing Algorithm, which evaluates and ranks equity stocks. Investors currently use security screening processes that overlook many of the undervalued stocks that appear insignificant upon preliminary evaluation. The G-R Indexing Algorithm assists in discovering hidden investment opportunities by utilizing multiple metrics. These metrics include, but are not limited to, financial analyst recommendations and financial ratios. By using this algorithm, with the click of a button investors can identify superior stocks that may otherwise be overlooked by traditional screening processes. The methodology of the G-R Indexing Algorithm can even be extended beyond the field of finance and applied to other areas as well. The algorithm′s concept has been successfully used in the field of sports, such as to accurately predict matchups in the NCAA Basketball Tournament. The research into this new model strives toward the ultimate goal of saving time

and increasing the accuracy of the screening of finding undervalued securities that will assist investors in making more accurate and successful investment decisions.

Molecular Mechanisms of Epigenetic Inheritance of Transcriptional States Mediated by Polycomb Repressive Complex 1

Marko Kokotovic, Biology and Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Xiaojun Ren, DC - College of Liberal Arts and Sciences

The Polycomb group (PcG) proteins have been a long-standing paradigm for studying cell fate transition during mammalian development and cell differentiation. Mutation and dysregulation of PcG genes are known to cause developmental defects and cancer. PcG proteins control gene expression by histone modification and chromatin configuration and have been divided into two complexes, Polycomb Repressive Complex (PRC) 1 and PRC2. PRC2 is a methyltransferase that methylates histone H3 at lysine 27 (H3K27me3) and PRC1 is an ubiquitin ligase that ubiquitylates histone H2A at lysine 119 (H2AK119Ub). PRC1 has been further divided into the canonical PRC1 (Cbx-PRC1) and variant PRC1 and the functions and mechanisms of individual PRC1 complexes remain largely unresolved. We are investigating how the PRC1 complex assembles on chromatin during cell cycle progression, which will shed light on molecular mechanisms for the epigenetic inheritance of transcriptional states mediated by PRC1. We hypothesize that the assembling of the PRC1 complex during mitosis is different than the mechanism of assembly during interphase. By linking PRC1 complex proteins with fluorescent tags we will utilize Fluorescent Resonance Energy Transfer (FRET) to elucidate the mechanisms by which PRC1 complex components assemble through the cell cycle. The assembling and disassembling of PRC1 complex during cell cycle progression will be monitored by FRET efficiency.

Regulation of RNA Methylation in Embryonic Stem Cells

Hanna Kozlowski, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Christopher Phiel, DC - College of Liberal Arts and Sciences

The methylation of adenosines (m6A) is a newly appreciated functional modification to mRNA. The discovery of enzymes mediating this reversible modification have facilitated the study of the biological relevance of mRNA methylation. One important insight is the finding that decreased mRNA methylation is associated with increased pluripotency in mouse embryonic stem cells. Recently, we unexpectedly identified a previously unknown avenue for the regulation of mRNA methylation. Details on this regulation will be presented.

Creating Novel Devices To Improve Modern Neuroscience Techniques

Gregory Krzystyniak, Physics, DC - College of Liberal Arts and Sciences
Haydar Ibrahim, Public Health, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Erik Oleson, DC - College of Liberal Arts and Sciences

Our lab has been innovating new devices to use during in vivo behavior manipulations. We have developed a new setup to use for an optogenetics task that incorporates voltammetry techniques. Not only have our devices made modern neuroscience techniques more efficient, but they have also been developed using simple cost effective resources.

Increasing Phosphatidic Acid to Induce an Acrosomal Reaction Between Sperm and De-Jellied Eggs

Andrew Lamp, Chemistry, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Brad Stith, DC - College of Liberal Arts and Sciences

Fertilization involves the fusion of the sperm and egg membranes to form a zygote and is marked by the acrosomal reaction (AR) of the sperm. The egg jelly, which forms around the egg during its descent through the oviduct is crucial to the AR, with egg fertilization dipping from 90% to 10% with the removal of the egg jelly. Fertilization rates can be rescued with the addition of jelly water, indicating that the interactions of the sperm with the egg jelly play a crucial role in the AR. PA plays a crucial role in exocytosis from a cell, indicating a possibly mechanism of action of the egg jelly′s role in the AR. The purpose of this project was to examine if increasing PA levels in sperm was sufficient to induce an AR in the absence of egg jelly. Endogenous PA was increased by the addition of propranolol, a PA-phosphatase inhibitor shown to increase PA levels in a cell. Sperm were perfused with propranolol and added to dejellied eggs to see if fertilization could be induced. The PA levels of propranolol perfused sperm was also measured using an HPLC method developed previously in the Stith lab to insure PA was being increased.

Assimilation of Asian Immigrants in U.S. Labor Markets

Siyuan Lin, Economics, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Laura Argys, DC - College of Liberal Arts and Sciences

My research presents evidence regarding the pay differentials earned by Asian immigrants to the US. In particular, this study examines the economic performance of Chinese, Philippine, Korean, Thai, Japanese and Indian immigrants in the U.S. labor market. These countries have similar

economic conditions in Asia and are the countries of origin of the majority of the Asian immigrants in the U.S. By using longitudinal data of the American Community Survey from 2005 to 2012, this thesis concludes that the average earnings for immigrants from major East Asian countries are higher than native-born Americans. Moreover, this positive differential is explained in large part by higher education attainment rather than larger market rewards for these ethnic groups. My results suggest that, controlling for higher education levels. Many Asian migrants groups earn less than US natives would earn when they first arrive (except migrants from India). As time in the US elapses, migrant earnings raise faster and their earnings eventually exceed those of natives. These results suggest that such immigrants are not likely to need assistance through expensive public support program. I was motivated to conduct my research because, as a student from China, I was very interested in understanding the pattern of wages earned by Asian immigrants and their strengths and weaknesses in the US labor market.

The Remnants of Relocation: Displaced Aurarians

Katelyn Lobato, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Brian Page, DC - College of Liberal Arts and Sciences

As a descendant of a Displaced Aurarian and a student at CU Denver, Katelyn Lobato has conducted research on the relocation patterns of the residents of Auraria. In 1969 the historical neighborhood of Auraria came to a standstill as the Denver Urban Renewal Authority relocated them for the creation of the Auraria Higher Education Center. During a four year period the residents of Auraria were relocated to different neighborhoods of Denver. DURA used fair compensation as a payment for the resident′s relocation. Today the neighborhood is comprised of the Auraria Campus, home to three universities including the University of Colorado Denver. The Denver Urban Renewal Authority′s relocation survey in 1972 provides the records of the relocation address and demographics of each resident that lived in Auraria. The analysis of this document helps to provide reasoning behind the relocation that the displaced Aurarians endured. By using Geographic Information Systems there is an ability to address the relocation patterns and conclusions that can be made from the relocation addresses of those that were displaced in Auraria. These patterns that are extensively researched include: distance, compensations, relocation types, and community.

PLC Gamma Activity Characterized

Jordan Long, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Bradley Stith, DC - College of Liberal Arts and Sciences

Fertilization in all species involves activation of the enzyme phospholipase C (PLC). However, the mechanism of PLC activation fertilization has not yet been fully elucidated. Due to our lab′s work (summarized in Bates et al., 2013) and that of K.-I. Sato (Sato et al., 2006), we know that

sperm and egg binding leads to activation of phospholipase D1b, production of Phosphatidic acid (PA). This then leads to activation of Src tyrosine kinase, and then phospholipase C-gamma (PLCgamma). PLCgamma moves to specialized areas in the plasma membrane (areas called rafts), and makes IP3 which releases calcium inside the zygote. Dr. Stith′s lab has found evidence for a second, unknown mechanism for the activation of PLC and subsequent production of IP3. This project elucidates mechanisms of PLC activation by different pathways, perhaps PA would activate PLCgamma directly (bypassing Src), or perhaps calcium would activate different types (called isoforms) of PLC. In addition, we have shown that lipids other than PA bind to PLCgamma, and they might activate PLC as well.

Effects of Social Isolation of Aggressive Behaviors in Stalk-eyed Flies

Abigail Luman, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. John Swallow, DC - College of Liberal Arts and Sciences

Aggression is a vital behavior in many animal species as a means of obtaining resources, mating, and overall survival. Therefore, the presence of aggressive behaviors in a species can also be an indicator of evolutionary fitness. Stalk-eyed flies, *Teleopsis dalmanni*, have elongated eyestalks that protrude laterally out of their heads with eye bulbs residing on each end. Males and females of this species and other related species in the Diopsidae family are often sexually dimorphic, meaning that males and females are morphologically distinct. As stalk-eyed flies exhibit aggressive behavior in competition over access to food and mates, they are a useful model species for studying aggressive behaviors in invertebrates. This study examines the effects that social isolation has on aggressive behavior in stalk-eyed flies. Social isolation implies the removal of a sexually mature fly from a normal population cage into separate housing for the period of 7 days. We hypothesized that socially isolated stalk-eyed flies would exhibit an increased quantity and intensity of aggressive behaviors. This was tested by pairing a size-matched isolate with a control fly in a partitioned fighting coliseum. After a period of 24 hours, the flies were provided with corn medium to encourage fighting and the number and intensity of each behavior was recorded and analyzed. Preliminary data suggests a trend toward isolates exhibiting a larger number high intensity aggressive behaviors and overall wins. We will discuss the results in the context of a larger sample of fights.

Investigating the Differences in Lipid-Binding Affinities and Kinetics Between C2A Domains of Synaptotagmins 1 and 7

Favinn Maynard, Biology, DC - College of Liberal Arts and Sciences
Beatriz Salazar, Psychology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Jefferson D. Knight, DC - College of Liberal Arts and Sciences

Synaptotagmins (Syts) are ubiquitously expressed membrane trafficking proteins that are characterized by two C-terminal C2 domains (C2A and C2B). Eight of the 17 types of mammalian synaptotagmins act to facilitate and regulate the secretion of molecules from vesicles within cells. Syt1 is predominantly involved in rapid neurotransmitter release while Syt7 triggers slower secretion events, such as insulin release. Our previous work has shown that the C2A domain of Syt 7 binds and releases from membranes at rates that are ~2 and ~60 times slower than the corresponding domain of Syt1 (Brandt DS, Biochemistry; 51(39):7654-7664.). In this study, the structural origins of these kinetic differences were investigated by mutating individual amino acids within the C2A domains of Syt1 and Syt7. The rates of binding and release of these mutants were tested using stopped-flow fluorescence spectroscopy. These rates were measured on lipid vesicles either approximating the inner leaflet of a biological cell membrane (PM) or a simplified 3:1 phosphatidylcholine and phosphatidylserine composition (PC/PS). We find that the phenylalanine-167 of Syt7 is responsible to a significant extent for this domain′s stronger lipid affinity. Mutation of this residue to methionine (which is found at the corresponding position in Syt1) produced release rates between 2- to 10- fold faster than wild-type Syt7 C2A without affecting binding rates. These preliminary results suggest that F167 may serve as a secondary lipid anchor for Syt7 providing substantial favorable membrane interactions.

CU Denver: Growing Food. Growing Community.

John McConnellogue, Geography, DC - College of Liberal Arts and Sciences
Elise Martinez, Communications, DC - College of Liberal Arts and Sciences
Kate Farley, Geography, DC - Graduate School
Syliva Wilson, Business Administration, DC - Business School
Faculty Sponsor: Dr. Amanda Weaver, DC - College of Liberal Arts and Sciences

The Geography Department at The University of Colorado Denver is developing a farm-to-school garden collaboration, modeled after the Community Supported Agriculture model. The project is implemented through student volunteers completing the Urban Agriculture Certificate Program at CU Denver. Our goals of this project are connecting CU Denver students and faculty with the surrounding community and a local school, Kullerstrand Elementary; while at the same time, addressing issues regarding land usage/availability, food security, and other large themes that govern food systems. During the summer, elementary students do not have access to the meals provided during the school year through Federal nutrition programs. Food access and affordability can be a concern for families, along with students at the university. CU Denver′s

farm-to-school garden will work under a one-for-one model, meaning for every share that is donated to a family from the elementary school, another share will be donated to the volunteers and interns. This community and University partnership gives interns the opportunity to develop skills in agriculture, business, and land management. Both interns and volunteers work to establish community relationships that are necessary in order to successfully run the CSA garden program. The garden creates a learning space for the elementary school students to understand the production of agriculture. The garden provides both college and elementary school students the accessibility to land with the goals and potential demonstrate the diverse, creative, and life changing experience of understanding food and where it comes from.

"Sanction" Web Series

Samantha Merten, Fine Art, Film and Television, DC - College of Arts and Media

Ryan Ferlic, Megan Foster, and Nicole Mahoney, Fine Art, Film and Television, DC - College of Arts and Media

Faculty Sponsor: Mr. Craig Volk, DC - College of Arts and Media

This web series revolves around two estranged sisters and their struggle to attain a lasting domestic peace under the shadow of their mother's terminal illness. A heartfelt drama about familial loss, atonement, and forgiveness, "Sanction" explores the bittersweet consequences of the inescapable claims of mortality. This is the fifth series produced by the award-winning University of Colorado Denver′s Program of Film and Television. A group of junior level-film students came together harmoniously to write, produce, direct, edit, and promote the series. The production was run as though it were a professional endeavor, educating the student crew on the trials, and ultimate reward, of seeing a film or television series from start to finish. It was honored with being selected for screenings at the Starz Denver International Film Festival in 2014.

Imagine a Great City: A Story of Denver′s City Beautiful Revival

Kelsi Miles, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Brian Page, DC - College of Liberal Arts and Sciences

Background: The urban special movement, City Beautiful, became popularized after the Chicago World Fair of 1893. Denver is one city in the United States that participated in the original City Beautiful movement and sought to replicate the White City: Chicago. Robert Speer is considered Denver's original City Beautiful mayor. Speer pushed for renovations within the city; his strong leadership created archetypal infrastructure in Denver that is still seen today. After Speer, the city of Denver lost devoted leadership to creating infrastructure that possessed both beauty and utility until Mayor Federico Pena took office in 1983. Pena ran on the platform "Imagine a Great

City″ and promised Denver citizens to revitalize the city. Conclusion: The period between 1983-present is the age of the City Beautiful revival in Denver. This poster analyzes the Central Platte Valley′s transformation into a City Beautiful space through analyzing the original City Beautiful ideals coined by William H. Wilson.

Watching Bugs: Automated Video Tracking to Study Insect Movement

Joshua Morrison, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Raibatak Das, DC - College of Liberal Arts and Sciences

We have developed tools to automate the detection and tracking of stalk-eyed flies and their larvae. Stalk-eyed flies are members of the fly family Diopsidae. They are commonly used to study sexual selection because of their unique morphology, with eyestalks projecting out from the sides of their head. We are working together with the lab of Dr. John Swallow in the Department of Integrative Biology at CU Denver. In a series of ongoing experiments, the Swallow lab is measuring the effect of drugs, such as the antidepressant fluoxetine (Prozac), on aggression, locomotion and other animal behaviors. The lab uses video imaging to observe larvae and adult flies. We implemented object detection and tracking algorithms in Matlab to automate the analysis of movies from these experiments. Here, we present our results from tracking stalk-eyed fly larvae in agar dishes.

Lafayette Flood Protection Measures

Moktar Moussa, Civil Engineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Mr. Peter Marxhausen, DC - College of Engineering and Applied Science

Located in unincorporated Boulder County, a small community of approximately 15 properties has experienced repetitive flooding problems over time. Some residents have speculated the flooding is due to introduction of large paved surfaces nearby. Presently, the flooding has jeopardized the local wells and septic systems. Flooding has also contributed to local steam pollution. The community has reached out to the University of Colorado Denver for evaluation, research, and remediation recommendations to reduce or stop the flooding. The department of Urban Drainage and Flood Control is also involved and should review the student's data.

Personal History of Sports Activity & Current Physical Activity Motivation

Kaylae Nakamura, Biology, DC - College of Liberal Arts and Sciences
Stephanie Hooker, Clinical Health Psychology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Kevin Masters, DC - College of Liberal Arts and Sciences

The health benefits of physical activity (PA) are well-researched. PA reduces the risk for cardiovascular disease, type 2 diabetes, some cancers, and hypertension. However, most U.S. adults do not meet minimum PA recommendations; self-report estimates that only 45-65% of adults meet recommendations. Moreover, an objective measurement by accelerometer estimates that only 5% of adults meet the recommendations. Efforts to increase PA in U.S. adults may improve health and well-being in this population. One possible method to increase PA is by promoting sports activity engagement. Previous literature has shown that a personal history of sports activity, or previously engaging in sports, is positively correlated with intrinsic motivation to engage in physical activity, and intrinsic motivation is positively correlated with PA maintenance. Therefore, this study investigates current PA motivations of adults and its relation to an individual′s personal history of sports activity engagement. It is hypothesized that a greater level of engagement in sports previously in life will be positively correlated with a greater level of intrinsic motivation for ongoing PA and thereby, greater PA. Previously sedentary adults (N = 53; M age = 44.47, SD = 12.22; 75.5% female; 79.1% white) starting exercise programs were recruited from the Anschutz Health and Wellness Center. They completed surveys at the beginning of the study and again 4 weeks later. Data to investigate the relationship between sports participation, PA, and PA motivation is still being. From this study, we will better understand whether new PA interventions should incorporate sports activities to increase PA maintenance.

Metal Detoxification and Remediation of Acid Mine Drainage by the Bacterium *Pseudomonas* sp. S8A

Anna Nguyen, Biology and Public Health, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Timberley Roane, DC - College of Liberal Arts and Sciences

Toxic metals from mining waste, or acid mine drainage (AMD), such as arsenic, cadmium, lead, and mercury cause a variety of serious health conditions including liver damage, cancer, and neurological disorders. Because metal-contaminated sites have many physical, chemical, and biological complexities, there is no consistent remediation technology available for the detoxification of metals. Consequently, there is a growing need to further elucidate the observed high degree of metal-resistance in non-pathogenic, environmentally-isolated bacteria, such as *Pseudomonas* sp. S8A, to fully explore the ability of bacteria to detoxify and potentially remediate metals. Originally isolated from mine tailings, *Pseudomonas* sp. S8A demonstrates resistance to the toxicity of extremely high concentrations of cadmium and lead. Many metal-

resistance mechanisms that *Pseudomonas* sp. S8A utilizes have yet to be identified. Mechanisms identified to date, including surfactant and exopolymer production, do not account for its high degree of resistance. In order to identify novel mechanisms of metal-resistance potentially useful for new metal-remediation technologies, the ability of *Pseudomonas* sp. S8A to tolerate and detoxify metals was examined by growing it in AMD and monitoring for reduced metal concentrations. To characterize the extreme metal-resistance of *Pseudomonas* sp. S8A, protein profiling revealed a previously unidentified protein uniquely expressed following exposure to cadmium. More detailed two-dimensional protein analyses showed differences in overall protein expression in the presence and absence of cadmium. Isolation and identification of differentially expressed proteins may lead to identification of novel mechanisms of metal-resistance useful for new metal-remediation technologies.

Effects of Caloric Restriction and the Loss of Ovarian Function on Mitochondrial Respiration

Robera Oljira, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Paul MacLean, AMC - School of Medicine

Loss of ovarian function adversely affects energy balance and metabolic function. Our primary questions addressed obesity and or weight loss prior to surgically induced menopause (ovariectomy = OVX) on the susceptibility to a decline in metabolic health. Secondly, can we use a clinically relevant intervention such as exercise to counter measure to effects of the loss of ovarian estrogen on the metabolic drive to regain lost weight? To address this we looked at the impact of prior weight loss, and loss of ovarian function on isolated skeletal muscle mitochondrial capacity in obese and lean rats with or without exercise. We hypothesized that if obesity is protective, we would see an attenuation of the decline in mitochondrial function when comparing obese to either lean or weight reduced animals. Mitochondrial capacity was measured under three substrate conditions, pyruvate + palmitoyl carnitine, pyruvate + malate, and glutamate + malate. Following unrestrained feeding, the capacity to oxidize pyruvate + malate was reduced in both lean and obese rats. Similarly, a decline in the capacity to oxidize pyruvate + palmitoyl carnitine, as well as glutamate + malate was observed in both lean and obese rats. Our findings indicate that exercise can offset the weight loss and OVX detriments to mitochondrial oxidative capacity in lean, but not in obese rats. Additional studies are ongoing to determine to if these mitochondrial capacities are magnified with respect to whole muscle capacities.

Characterization of Childhood Obesity and Behavioral Factors in Urban and Rural Michigan

Jessica Olson, Nursing, AMC - College of Nursing

Faculty Sponsor: Dr. Bonnie Gance-Cleveland, AMC - College of Nursing

The prevalence of childhood obesity in the United States continues to be alarmingly high. Nationally, 31.8% of youth were in the overweight or obese categories (BMI ≥ 85th percentile). Children seen at school-based health centers are typically of lower socioeconomic status, putting them at greater risk for obesity during childhood. The purpose of this research was to characterize childhood obesity levels and risk behaviors in two school-based health centers in Michigan, one urban and one rural. In this secondary data analysis, we evaluated data about weight status, physical activity, screen time, nutritional habits, and sleep habits collected in a study that trained school-based health center providers on childhood obesity guidelines. The HeartSmartKids′ survey was completed by children with the assistance of their parents at well-child visits or sports physicals at the Michigan school-based health centers. Differences by urban/rural status were evaluated with independent samples t-tests or Pearson′s chi-square tests. A multiple logistic regression model was used to examine the potential association between health behaviors and weight status. Our results demonstrated a prevalence of 58.1% overweight or obese children, compared with the national average of 31.8% and the Michigan average of 33%. The number of overweight/obese children was greater in the urban sample (p=0.05). Significant predictors of obesity included nocturnal hours of sleep (p=.041) and breakfast consumption (p=.041). Knowledge of factors that contribute to childhood obesity will help providers in multiple settings address this significant public health issue. Obesity interventions should encourage children to eat breakfast daily and get adequate sleep.

A Detailed Method for Building Fast-scan Cyclic Voltammetry Microelectrode Sensors for Sub-second Dopamine Detection

Brian Peters, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Bruce Mandt, DC - College of Liberal Arts and Sciences

Dopamine (DA) is a neurotransmitter known to have significant influence on the brain processes in reward-reinforcement learning and as such plays a role in the addictive nature of stimulants such as cocaine. Additionally, nerve cells use DA to help control muscle functions, therefore the loss of DA producing cells in the brain can lead to motor symptoms as seen in Parkinson′s disease. The electrochemical technique of fast-scan cyclic voltammetry (FSCV) allows in vivo DA detection on a sub-second temporal scale. Although microdialysis studies have shown the effects of tonic DA in drug addiction on a minute-to-minute scale, FSCV allows data capture of phasic DA on a sub-second scale, allowing for the correlation of dopamine signaling and the immediately following drug-seeking behavior. This study describes the construction of chronically implantable microelectrodes capable of in vivo DA detection over the course of

months. Microelectrode sensors were constructed from an isolated strand of 7m diameter carbon fiber encased in 19.3m polyimide-fused silica and manufactured under microscopic magnification. Carbon fiber was threaded through the capillary using 2-propanol lubricant. The carbon fiber was then coated with epoxy and internally fused to the silica capillary. Electro conductive silver epoxy was used to fix a connector pin in contact with the body, and insulated in epoxy. Self-fabrication techniques applied ensure electric insulation, biocompatibility and minimal postoperative external protrusion. To improve on the published method for constructing microelectrodes, a unique technique of applying epoxy in multiple increments to a secured carbon fiber was developed.

Understanding Latino Community Recovery after the September 2013 Colorado Flash Floods

Issamar Pichardo, Geography, DC - College of Liberal Arts and Sciences

Jeannette Rodriguez, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Deborah Thomas, DC - College of Liberal Arts and Sciences

In September 2013, Colorado experienced several days of extreme rainfall, which resulted in flash floods coming down from the mountains to towns along the rivers. President Obama announced a Federal Disaster Declaration on September 12th. For this disaster, the Latino population in some of the affected areas was up to half of the total population. Disaster impacts and recovery are often disproportionately experienced between subpopulations. Barriers, such as language and legal status, contribute to social vulnerability. One of the major factors that encouraged the path of our project is a lack of research on the effects that natural disasters have on Latino communities in the U.S., particularly during recovery. Our research is composed of three elements: 1) collecting articles and conducting a content analysis of, Spanish-language media sources, such as newspapers, radio, and TV news; 2) interviewing of organizations and/or people that played a key role in the response and recovery process to the Latino Communities (identified from the content analysis); and 3) interviewing households to capture their experiences. Household interviews reveal that with a tighter community comes greater resilience following a disaster. For the Latino community in these areas, women seemed to be at the center of forming community cohesion. During and after the disaster, the flood victims relied heavily on the resources that their neighbors were utilizing, as well as looking to one another for financial and emotional support and guidance with paperwork. However, accessing formal organizations for assistance was sometimes a challenge because paperwork was not always available in Spanish.

Healthy Couples in the Food Growing Culture

Tiffany Pinkley, Public Health , DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Krista Ranby, DC - College of Liberal Arts and Sciences

My research of interest is the concordance of couples and their health objectives being fulfilled through the activity of growing produce. The form of planting will range from rural and urban farming, gardening, and through whatever means like hydroponics, aquaponics, monoculture and polyculture. My hypothesis is that by couples setting the generic health goal of being more active and have better eating habits with the reinforced activity of growing produce the couple will be successful in their goals. With growing independent food set from the global market, healthier eating habits occur and the pride of creating the food a couple consumes make the couple aware of eating portions, level of activity needed to sustain a good harvest, and the ability to work together in a major goal of pursuing healthier lifestyles through growing their own meals. My research is through literary analysis and set out proposal of why research generated towards this issue is critical to understand individual, couple and community health and healthy behaviors.

Measuring Calcium and Magnesium in Stream Water: A General Chemistry Experiment

Hinal Rathi, Biology, DC - College of Liberal Arts and Sciences

Ann Rowland , Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Margaret Bruehl, DC - College of Liberal Arts and Sciences

In this project, we designed a new laboratory experiment suitable for a first-year general chemistry laboratory course. General Chemistry topics that were investigated are calibration curves and dilutions. These topics were applied with Flame Atomic Spectroscopy to identify unknown concentrations within water samples of different sources. Our experiment was inspired from the "Design Your Own Gen Chem Experiment" and expanded upon the Atomic Spectroscopy lab performed first semester providing a practical application to the creation of dilutions and the use of the flame atomic absorption instrument. Originally, it was planned to test a single water sample for multiple metals, but when a majority of the approved metals were unable to be identified, it was required to look for other metals. Two metals were found in noticeable concentrations so it was decided to change the experiment to become more comparative between different water samples determining the differences in concentrations of the two metals in each. We were able to identify the concentration of calcium within the stream water as 10.5ppm and the concentration of calcium within tap water as 2.78ppm. The concentration of magnesium within stream water was identified as 11.1ppm and the 4.84ppm within tap water. This experiment fits into the General Chemistry I Laboratory curriculum as a separate part of the Atomic Spectroscopy lab so that rather than only determining the absorption of calcium and learning how to interpret a calibration curve, these skills can be practically

applied to determine the concentrations of the calcium and magnesium ions within water samples.

Targeting Upstream Neuromodulators of Dopamine Release Rectifies a Pro-psychotic Response in a DREADD-induced Hyperdopaminergic State

Noah Rauscher, Psychology, DC - College of Liberal Arts and Sciences
Karl Sanders, Psychology, DC - College of Liberal Arts and Sciences
Taylor Coomer, Biology, DC - College of Liberal Arts and Sciences
Patrice Ello, and Jacqueline Gallegos, Psychology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Erik Oleson, DC - College of Liberal Arts and Sciences

Psychosis is a positive symptom of schizophrenia. Commonly prescribed anti-psychotic drugs, all of which are antagonists at the dopamine D2 receptor, often prove ineffective or cause numerous undesirable side effects. Our research aims to explore the neurochemical cause of the pro-psychotic response in a classic pharmacological screen for anti-psychotic drugs and to test whether targeting upstream neuromodulators of dopamine release is capable of producing an anti-psychotic response. To achieve this, our group artificially induces a psychotic state in transgenic rats by using DREADD virus technology to raise dopamine neural activity in the midbrain. We then systemically administer antagonists of the cannabinoid and orexin systems, which we previously demonstrated modulate dopamine activity in this same brain region. Preliminary results show a DREADD-induced hyper-dopaminergic state produces a pro-psychotic response in a classic pharmacological screen; whereas, an anti-psychotic response is observed when either the cannabinoid or orexin antagonist drug is administered separately, an effect that appears to be additive during combined administration. Interestingly, our anti-psychotic treatments are more potent when tested in a hyperdopaminergic state vs. wild-type controls. These results show promise for developing new upstream modulators of dopamine function as anti-psychotic therapies and offer novel mechanistic insight into the neural basis underlying the predictive validity afforded by a classical anti-psychotic screen.

Application of Organic Reaction Metrics to Preparations of Nanoparticles

Bradley Reid, Chemistry, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Scott Reed, DC - College of Liberal Arts and Sciences

Organic reaction metrics give a convenient, numerical insight into the efficiency of a reaction procedure. Inefficient procedures have unnecessary, negative effects both monetarily and to the

environment. As the field of nanochemistry continues to grow, it will be important to extend this awareness of inefficiency to preparations of nanoparticles. It has been shown previously that wasteful procedures (according to reaction metrics) correlate closely with negative environmental effects and to date, there is little history of applying reaction metrics to the preparations of nanoparticles. Here, the efficiency of three different thiolate-monolayer gold nanoparticle preparations was assessed according to E-factor, reaction mass efficiency (RME), and atom economy (AE). It was determined that a procedure developed by Jin was the most efficient preparation of thiolate-monolayer gold nanoparticle preparations according to all three metrics, followed closely by a procedure developed by Murray. The preparation of thiolate-monolayer gold nanoparticles developed by Brust was the least efficient according to the metrics. It was also found that atom economy was the least effective at distinguishing between the efficiencies of the three preparations.

University Resource Collaboration to Enhance Career Development of Psychology Students

Meghan Rickel, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Vivian Shyu, DC - College of Liberal Arts and Sciences

Only 25% of psychology undergraduate students continue on to pursue graduate degrees. The remaining majority of psychology baccalaureate graduates enter into business-related fields such as retail, management, insurance, advertising and marketing, or human resources. The CU Denver Department of Psychology has revised much of its curriculum goals to ensure interdisciplinary skill development among psychology undergraduate students. Prospective employers desire employees with a broad set of interdisciplinary skills. As such, employers are currently seeking more psychology graduates to fill positions in the business field. Therefore, undergraduate psychology students will benefit from collaboration to foster the development of their prospective careers. CU Denver has established entities that provide resources for student career development. However, collaboration among these resources remains limited. Industrial/ organization psychology applies methods and principles of psychology to the workplace. Recent research has used industrial/organizational principles to maximize the efficiency and success of the structure of academic institutions. By applying these principles to the existing resources and structure of the university, the goal of this project is to identify opportunities for collaboration and make suggestions for partnership between the Psychology and Business to incorporate the interdisciplinary approach to career development of psychology majors at CU Denver.

Exercise as a Supplemental Treatment for Anxiety and Depressive Disorders

Meghan Rickel, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Benjamin Greenwood, DC - College of Liberal Arts and Sciences

Depression and anxiety disorders are the most common mental health disorders in the world. Conventional treatment techniques include medication, psychotherapy, or a combination of the two. The efficacy of these methods is limited by medication non-compliance and relapse. These limitations establish the need for novel supplemental treatment strategies. A growing body of preclinical research illustrates how the anxiolytic and antidepressant effects of exercise can fulfill this need. Clinical research exploring the potential beneficial use of exercise as an adjunct treatment method for depression and anxiety disorders remains preliminary, and limited in scope. As such, the use of exercise as a supplemental treatment to anxiety and depressive disorders is not widely implemented in the clinical setting. The field will benefit from the use of preclinical research as a means to inform future clinical research in the assessment of exercise integration into current treatment strategies of mental health disorders. The current review introduces the contribution of medication non-adherence and fear relapse to the poor long-term efficacy of current treatment options for anxiety and depression. Next, we discuss preclinical research findings that support the notion that exercise could minimize these contributors and strengthen current clinical treatment techniques. Specifically, exercise could 1) reduce the anxiogenic side effects associated with the onset of treatment with SSRIs, and 2) help limit the relapse of fear following exposure therapy. These effects of exercise could increase medication adherence and improve the long-term efficacy of psychotherapy. These preclinical findings provide rationale and direction for future clinical research.

I Can Do This: (Re)Defining Who Is Smart

Jenny Romero, Biology and Chemistry, DC - College of Liberal Arts and Sciences

Trina Fernandes, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Carlos Hipolito-Delgado, DC - School of Education and Human Development

During the summer, we helped design and participate in the Critical Civic Inquiry Summer Institute (CCISI). High school students, undergraduates, and doctoral students engaged in a Participatory Action Research (PAR) project in which we collected, reduced and analyzed data on educational inequities experienced by students and teachers primarily in the Denver metropolitan area. Our goal was to investigate the following research question: What are the barriers and resources to access higher education for students who are first-generation, low-income and/or students of color? In addition to being participants, we as undergraduates were also enrolled in the process of investigating the design and implementation of the project, recording through cognitive ethnographies (field notes), and video/audio recordings of both

planning sessions and team meetings. For this poster, we draw on the findings from the summer and undergraduate field notes. With the data from the summer, we highlight findings from high school graduate and teacher surveys as well as demonstrate the academic process engaged during the summer. Second, we discuss ways participants developed critical thinking around issues of educational inequities by challenging traditional ideas of who wears the "scholar cap," or who can discover and produce knowledge. Through our preliminary findings, we seek to describe the qualitatively different ways participants discovered their scholar caps, including: participating and envisioning themselves in higher education practices, increased confidence in expressing thoughts, and locating themselves and others in a larger social context.

The Relationship Between Infant Temperament, Maternal Emotional Availability, and Postpartum Depression

Kristen Ruhl, Psychology, DC - College of Liberal Arts and Sciences
Tamair Curley, Biology and Psychology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Peter Kaplan, DC - College of Liberal Arts and Sciences

It has been shown that 10-15% of women experience postpartum depression within two years after giving birth. Mothers who develop depressive symptoms in this period are more likely to experience difficulties in initiating interaction and caretaking behaviors with their infant and the infant is more likely to develop problems with self-regulation and emotional reactivity. This can lead to developmental deficits, including language and cognitive deficits. The purpose of this study is to determine if rated infant temperament is related to maternal depression, maternal; emotional availability, and infant outcomes. 30 mother-infant participants (infants' ages range from 4 months old to 13 months old) will be evaluated with the Infant Behavior Questionnaire-Revised (IBQ-R), Emotional Availability Scales (EAS), Postpartum Depression Screening Scale (PDSS), and Beck Depression Inventory II (BDI-II). We are especially interested to see if infants rated as temperamentally difficult are linked to mothers with greater symptoms of depression, and whether temperamental difficulty interacts with maternal depression to affect maternal emotional availability and infant responsiveness to the mother. This study could contribute to the development of more effective interventions for mothers of difficult infants and mothers who suffer symptoms of postpartum depression because targeting the mother's emotional availability can be used to further develop intervention strategies for the mother. Being aware of the level of difficulty of an infant can also help assuage the mother's cognitive symptoms in her postpartum depression, as well as help researchers and clinicians understand the level of difficulty that the mother is dealing with.

A Computational Method for Rapid Image Processing

Eric Rupert, Physics, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Douglas Shepherd, DC - College of Liberal Arts and Sciences

Fluorescent imaging continues to provide new insights into biological regulation at the nanoscale. Specialized techniques such as super-resolution imaging have emerged to allow measurements below the diffraction limit of light by manipulating the photophysics of fluorescent molecules. Another approach to increasing the resolution of the fluorescent imaging is computational reconstruction of the image, accounting for the properties of the microscope and light, to limit blurring due to out-of-focus light. This blurring leads to a large uncertainty in the position of individual fluorophores, effectively lowering the resolution of fluorescent imaging experiments. Simple deblurring algorithms (operating on a single image plane) remove photons from other planes that are blurred/out of focus; however this blurred light contains important information on the axial location of fluorescent molecules that is lost by a deblurring algorithm. In contrast, a restoration algorithm (simultaneously operating on all pixels in stack of images along the axial direction) shows an improvement over other techniques, as it can restore the photons to their origin plane. In applications requiring large volumes of data, such as wide-field single-molecule imaging of biological samples, restoration algorithms are computationally expensive essentially limiting their use to small numbers of images. Here we present a Matlab program using graphic processing unit (GPU) computing to automate the deconvolution process for big data systems. We demonstrate a two-fold reduction in the uncertainty of an individual fluorescent molecules′ position at the added cost of less than one-minute computational time per image.

Project Stratus: Providing Spatial Intelligence to Machines

Skyler Saleh, Electrical Engineering, DC - College of Engineering and Applied Science
Xin Li, Electrical Engineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Dr. Dan Connors, DC - College of Engineering and Applied Science

The field of computer vision seeks to develop machines with the capabilities to perform tasks that currently can only be performed by humans. Important aspects of human vision such as the ability to identify obstacles, plan paths around them, learn from one′s surroundings, in real time, area crucial to many societal uses of technology. Each year, computer systems running complex vision software collectively step closer to emulating each stage of human vision. However, accurate and efficient computer systems have always been obstacles to integrating greater amounts of automated robotics to help people. To enable next-generation robotics to perform field sensing in dangerous and remote environments, Stratus will deploy a sophisticated real-time Simultaneous Location and Mapping (SLAM) algorithm to provide precise odometry, high-resolution 3D environmental maps, and awareness of specific adverse environments. The Stratus team will investigate the use of 3D sensing and computer vision technology available for mobile platforms and design custom algorithms that trade-off execution time, accuracy, and power

efficiency. Overall, the goal is to demonstrate a large-scale near-field mobile 3D mapping system to aid in rapid disaster recovery and environmental analysis scenarios.

In Vivo Optogenetic Manipulation of Dopamine Neurons During Cue Motivated Behavior

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Gregory Krzystyniak, Psychology, DC - College of Liberal Arts and Sciences
Dylan Rakowski and Haydar Ibrahim, Biology, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Erik Oleson, DC - College of Liberal Arts and Sciences

The mesolimbic dopamine system is thought to underlie the generation of reward-seeking actions. Currently accepted theories suggest that transient mesolimbic dopamine release events are involved in assessing the value of reward predictive stimuli and/or in generating motivated action sequences directed toward obtaining reward. During the pursuit of reward, critical associations are formed between the reward stimulus and otherwise neutral stimuli that begin to predict reward availability. Through experiences, dopamine neurons, which initially represent the receipt of reward, begin to represent the earliest conditioned predictor of reward availability. The resulting concentration of dopamine release scales proportionally to the magnitude of reward predicted. We are investigating the role of cue and reward-evoked dopamine release on cue-motivated behavior. We first developed a novel behavioral economics based food-seeking task. In this task, food is provided to rats across 10 different unit-prices (response requirement/reward magnitude). We sought to assess the causal role of cue and reward evoked dopamine release in this task using optogenetics. We selectively activated channelrhodopsin-2 expressing dopamine neurons within the ventral tegmentum during either cue or reward presentation. Preliminary data (n=6) reveal that optically facilitating cue evoked dopamine release decreases the maximal price animals will expend for food; whereas, facilitating reward evoked dopamine release increases the maximal price animals will expend for food. It is possible that facilitating cue-evoked dopamine release decreases food motivation in our task because we are violating the animal′s expectation and vice versa. These findings suggest antagonistic roles for cue- and reward-evoked dopamine release in influencing cue-motivated behavior.

An Introductory Investigation into the Substituent Effect on Regio-selectivity of Bromination Across Vinyl Systems: Fostering Experiential Learning in the Teaching Laboratory

Andrew Schildkret, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Vanessa Fishback, DC - College of Liberal Arts and Sciences

For students at the University of Colorado Denver campus, the honors organic synthesis lab is the culmination of multiple semesters of undergraduate chemical education. The lab consists of an independent research project which requires the utilization of student′s chemical intuition, advanced laboratory techniques, collaboration with peers, as well as introducing students to the finer points of research and literature searches. An example project required a three step synthesis in order to investigate the para-substituent effect on the regio-selectivity of bromination across vinyl systems. The synthesis utilized many benzaldehyde derivatives where substituents varied in their electron donating/withdrawing nature. The first step consisted of the formation of homoallylic alcohols from their corresponding carbonyl compounds, an allylhalide, and various organometallic catalysts. The second synthetic step resulted in the formation of a vinyl system by performing an adapted base catalyzed dehydration of the aforementioned alcohols. Finally, the vinyl system was brominated by elemental bromine and characterized by FTIR, 1H NMR and mass spectroscopy. This project not only allowed students to gain insight into organometallic chemistry, but required students to develop procedures to obtain the desired vinyl intermediates based on the substituent present. The project also facilitated proficiency in complex characterizations by 1H NMR and mass spectroscopy.

Exploring Vietnamese History through a Charcoal Lens

Olga Serenchenko, Geography, DC - College of Liberal Arts and Sciences

Christopher Andersen, History, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Christy Briles, DC - College of Liberal Arts and Sciences

The long-term role of humans on ecosystem development is widely debated. Northern Vietnam has a >2000-year history of land-use and warfare. Superimposed on the human impacts are variations in precipitation related to monsoon intensity and ENSO variability. Two paleoecological records from the Red River Delta region, including one from an island and another from a mainland estuarine/mangrove environment, help to untangle both human and natural factors influencing the northern Vietnam environment. Proxy data, including pollen and charcoal, from the island suggests it supported a tropical forest of fern and arboreal (oak and birch) species with limited fire activity between 400 and 1600 cal yr BP. After 400 cal yr BP, sparse vegetation of non-arboreal species, indicated by pollen from agricultural (grass >40um & pine) and weed (daisy) sources, and increased fire activity, suggest significant human modification. The mainland mangrove core extends back 4700 cal yr BP and records approximately twice the number of fires after 3500 cal yr BP than before. The amount biomass

consumed by fires doubled after 2400 cal yr BP along with sustained low levels of charcoal during periods of documented warfare. The only other charcoal record from the region suggests that burning was more prevalent during warfare. Our data suggests that it was used heavily during settlement and for agriculture, but decreased significantly during periods of warfare.

Understanding Allergies Using Computational Image Processing

Evan Shapiro, Physics, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Douglas Shepherd, DC - College of Liberal Arts and Sciences

Biological processes at the microscopic level can be represented a series of random chemical reactions, requiring precise measurements and analysis techniques to determine the nature of the underlying regulatory networks. Recent developments in single-molecule, single-cell imaging studies have provided an unprecedented view into the spatiotemporal patterning of genetic expression. Here we present a method to extract three dimensional cell morphology in a wide-field fluorescence experiment, allowing for correlation of cell morphology to gene expression. We demonstrate this technique utilizing rat basophil leukemia (RBL) cells exposed to a synthetic allergen. The membrane of the RBL cell is fluorescently labeled, as are individual Interleukin-4 (IL4) messenger RNA (mRNA) transcripts, using single-molecule fluorescence in-situ hybridization, at discrete time points following stimulation of the RBL cells. Large imaging datasets characterize the spatiotemporal response of IL4 mRNA, RBL morphology in a dose-response experiment for the synthetic allergen. These images are then processed in a custom Matlab program that extracts a three-dimensional outline for every measured cell. This method provides a computational method to quantify the correlation between three-dimensional cell morphology and gene expression in wide-field fluorescent imaging.

Cultural Awareness Certificate Program

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Faculty Sponsor: Dr. Georg Gadow, DC - College of Liberal Arts and Sciences

The Cultural Awareness Certificate (CAC) program is the capstone project of Cultural Campus Connection, a group of the University Honors & Leadership Senior Seminar, and organized in partnership with the Office of Student Life, the Educational Opportunity Program, and the Office of International Affairs. The program is designed to promote cultural awareness and diversity at CU Denver, increase student participation at culturally relevant events, and connect students of different backgrounds. The CAC is a co-curricular certificate offered in recognition of

participation in culturally relevant events. To earn the certificate, students must attend five events from a pre-approved list, and submit a short reflection paper and survey. The program uses OrgSync as an easy access portal, and participation is tracked through the Spot-on system. The CAC program provides a centralized hub for students to learn about events. Any student club or office can submit an application for their event to be considered for the CAC. The CAC boats numerous benefits for both students and the campus community at large. Students receive a tangible document showcasing their extracurricular involvement and commitment to cultural awareness. The certificate makes a great addition to a resume or grad school application. Participating in the program gives students the opportunity to make friends from diverse backgrounds and learn about other cultures. For the campus at large, the CAC helps increase attendance at events by offering an incentive, and promotes cultural understanding. The CAC was launched in early February, and more than 60 students have already signed up.

Body Mass Index (BMI) Mapping and Community Engagement

Denise Swack, Geography, DC - College of Liberal Arts and Sciences
Dillon Riebel and Erica Reynolds, Biology, DC - College of Liberal Arts and Sciences
Filiberto Morales, Psychology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Deborah Thomas and Peter Anthamatten, DC - College of Liberal Arts and Sciences

Obesity and obesity-related diseases have become a global pandemic with particularly high rates in the US. As such, investigation of the socio-economic and environmental factors associated with BMI (Body Mass Index) has become a key public health initiative. As part of a larger project, BMI data from three health systems, including Children's Hospital, Denver Health, and Kaiser Permanente in Colorado, were integrated and mapped for the Denver metropolitan area. This study utilizes these Denver BMI maps as part of a community engagement initiative to generate dialogue on how these maps can be used to address obesity. By displaying and explaining the content of these maps to focus groups of Denver community members, we can: 1) obtain evaluations of the usefulness of the maps; 2) understand community interpretations of maps, providing meaning and context to the displayed data; and 3) strategize about how the maps could be used for formulating solutions, changing policy, or identifying interventions. Translation and community engagement is the next logical step for understanding the meaning behind the maps. This poster will present results from focus groups conducted in the Denver community.

Interdisciplinary Practices: Feminism in Pre-Columbian Archaeology since the 1990s

Katie Toler, Art History, DC - College of Arts and Media

Faculty Sponsor: Dr. Maria Buszek, DC - College of Arts and Media

This paper looks at interdisciplinary practices within Pre-Columbian studies and what current understandings of sex and gender mean through the controversy surrounding the Tomb 7 at Monte Alban in Oaxaca, Mexico. Tomb 7 was originally excavated by Alfonso Caso in the early 20th century, but Sharisse and Geoffrey McCafferty suggested that he might have incorrectly identified the principal individual buried there as male. The McCafferty's insights were developed out of their understanding of osteological evidence and period weaving techniques. Rosemary Joyce later suggested that their findings make assumptions about the relationship between sex and gender, and employs Judith Butler′s notion of gender as performative as pertinent to interpreting this tomb. In response to Joyce, Kent Flannery and Joyce Marcus argue against the use of such feminist viewpoints in art historical archaeological practice. Tracing this ongoing scholarly dialogue over Tomb 7, this paper argues that through a more heterogeneous understanding of a pre-Colonial society and a more compassionate theoretical approach which strives to respect a former culture, the progression of feminism in art historical and archaeological practices can be better understood.

Incorporation of Photoactive Probes into RNA Nucleosides

Justin Townsend, Biochemistry, DC - College of Liberal Arts and Sciences

Joseph Nguyen, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Marino Resendiz, DC - College of Liberal Arts and Sciences

The purpose of this study is to incorporate photoactive probes into nucleosides of RNA. These probes consist of a thiophene unit, located on the C2 and C3 positions of our target nucleosides. The molecules under study are modified versions of adenosine, guanosine, and uridine. Protection of the exocyclic amines of adenosine and guanosine was achieved by benzoylation and acetylation, respectively. The C5 positions of the nucleosides were protected with a trityl group. The chosen synthetic route involved treatment of each monomer with lithium bis(trimethylsilyl)amide (LiHMDS) in the presence of 2-chloromethylthiophene. The synthesis of the desired regioisomers ie., C2 and C3 functionalized ribose, was achieved in yields < 20%, not optimized. We found that regioselectivity of this reaction is concentration dependent, with lower values corresponding to higher formation of the desired species. Current focus is on photochemical studies of the obtained modified monomers.

The Creative Method

Jennie Tran, Fine Art, Film and Television, DC - College of Arts and Media
Hanna Reeves, Fine Art, Film and Television, DC - College of Arts and Media

Faculty Sponsor: Ms. Jessica McGaugh, DC - College of Arts and Media

The Creative Method is a documentary that explores the reality of pursuing a degree and career in the arts. It follows the journey of three students from different stages in their lives who are studying the arts at the University of Colorado Denver. Jack Roberts is a Music and Entertainment Industries Study (MEIS) student who is passionate about music and is driven to become an entrepreneur in the Denver music scene. Lahne Annandale is a talented Visual Arts student focusing on painting and drawing, with a strong interest in the abstract. Ryan Ferlic is a nontraditional Film and Television student who, at 40 is trying college for a second time to be immersed in every aspect of the film industry. These three students show us the struggles of pursuing a degree in the arts in an environment that is defunding arts programs across the nation.

Zar Regulates Gene Expression in Eggs and Embryos

Kenneth Valles, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Amanda Charlesworth, DC - College of Liberal Arts and Sciences

A *Xenopus laevis* (African Clawed Toad) egg embarks on its journey to adulthood by rapidly dividing after fertilization. There is very little time available to utilize the genes from both the mother and father, so the embryo uses genetic messages previously placed by the mother as instructions to make new material for the developing animal. Zar is a protein that controls when the genetic messages for specific genes are decoded and new material is synthesized. Currently, only two messages are known to be controlled by Zar, Wee1 and Mos, but we think there are more. Zar binds to messages at a specific sequence site called the TCS. We looked for TCS sites in other messages and found them in FZR1 and Oct-4, which have important roles in stem cells and development. To test if Zar binds these messages we shone UV light onto crushed eggs, creating a strong chemical bond between Zar and the adjacent molecules. Because we found Wee1, Mos, FZR1, and OCT-4 alongside Zar, we conclude that Zar binds to these new genetic messages in eggs.

A Lesson in Beer's Law: Recreating the Breathalyzer Reaction

Brooklyn Vanhook, Biology, DC - College of Liberal Arts and Sciences
Danielle Miller, Chemistry, DC - College of Liberal Arts and Sciences
Faculty Sponsor: Dr. Margaret Bruehl, DC - College of Liberal Arts and Sciences

Drunk driving is a prevalent problem in today′s society. As an attempt to decrease the danger caused by drunk drivers, laws have been enacted that prohibit driving under the influence. In order to enforce these laws, police need an accurate way to determine how much alcohol a person has consumed. In the modern breathalyzer test, a redox reaction occurs, which results in a quantitative measure of the ethanol in a suspect′s system. In this project, a new laboratory experiment suitable for a first-year general chemistry course was designed to analyze the reaction occurring inside the breathalyzer test that uses photospectroscopy to create a calibration curve that reflects the linear proportionality of Beer's Law. The design of this experiment began with a procedure published laboratory documents and was then adapted to incorporate more aspects of Beer′s Law. Throughout the design process, the experimental procedure was adapted to overcome the limitations put forth by Beer′s Law. Originally, the design created solution concentrations that landed outside of the limitations. Upon further investigation, adaptations were made to ensure Beer′s Law was obeyed. Once the calibration curve successfully fell within the limits of Beer′s Law, the experiment was expanded to include a false positive test and sensitivity test. For the false positive tests, the reaction was run using different alcohols found in common household products. The sensitivity test incorporates the lower limits of Beer′s Law as well as the accuracy of the photospectrometer at high absorbances. Although many obstacles were faced during the design of this experiment, the final result proved to be very successful.

Open Windows - An Interactive Art Piece for DIA

Joseph Verbeke, Music, Computer Science Minor, DC - College of Arts and Media
Faculty Sponsor: Mr. Jeff Merkel, DC - College of Liberal Arts and Sciences

For too long, Art and Science have been thought of as two completely separate worlds. With metaphors like left-brain/right-brain furthering the perception that these two doctrines do not have anything in common, both sides have lost touch of their interconnectedness. During my second year at the University of Colorado, Denver I was introduced to, and became a part of, my professor Jeff Merkel′s interdisciplinary collective Signal-to-Noise Media Labs. The group is comprised of scientists, hackers, artists, makers, engineers, and everything in-between. Recently, we were presented with an amazing opportunity to create a permanent art installation for the Denver International Airport, resulting in the conception of Open Windows. The piece is 11-feet tall, comprised of 7,680 LEDs, and makes use of an ASUS Xtion (an open-source version of the Microsoft Kinect) to allow for an interactive experience. During the creation of this installation I took on the roll of programmer, designing and writing the code that runs Open Windows. Using

all open source software, such as Processing, I was able to aggregate and use depth data from the Xtion to assist in the creation of multiple interactive scenes that are iteratively displayed.

Optical Range Variability of Active Galactic Nuclei

Rosa Wallace, Physics, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Alberto Sadun, DC - College of Liberal Arts and Sciences

Active galactic nuclei (AGN) are the compact central regions of distant galaxies that emit substantially more radiation than can be accounted for by normal stellar processes. AGN are some of the most distant visible objects in the universe, hence the furthest back in time, so by studying them we can examine the conditions of galaxy formation in the early universe. Current models posit that these high-energy phenomena are caused by the accretion of mass onto supermassive black holes located in the galaxy centers, releasing radiation across the entire electromagnetic spectrum. My associates and I have made observations of AGN S4 0954+65 at optical frequencies, as a contribution to broad spectrum databases maintained by WEBT and VERITAS, using a CCD equipped telescope in the Sierra Nevada mountains of California. Using two optical filters, we have been able to plot the light curve of S4 0954+65 and track its variability over the course of several months. By combining this data with observations across the electromagnetic spectrum, we hope to further our understanding of the formation and evolutionary processes of galaxies in the early universe.

Homeless Bath Shelter

Freddie Washington, Architecture, DC - College of Architecture and Planning
Bernard Jeffers and Jesse Ledin, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Mr. Kirsten Coe, DC - College of Architecture and Planning

The primary objective of our research is to investigate and apply architectural methodologies to problems not conventionally associated with the practice of architecture. Our investigation was conducted with the analysis of a chosen problem as an example for a case study. The deciding criteria for the case study was chosen for its ability to demonstrate a complex dilemma. The most appealing problems, exhibited the lack of a singular solution and a great need for innovation. It is inherent in our research to apply architecture not only as an organization tool, but as a point of interruption designed to disrupt a stagnant ordering system. In this event we hypothesize that new possible outcomes can be generated, leading to a new understanding of a given problem. For its complexity and historical need for innovation, we looked at the problem of homelessness for investigation as a case study. The inherent nature of homelessness allowed a survey of the conceptual structure of a system, while analyzing the lack of a physical structure for shelter. Looking at the structure of the approach to fight homelessness two methodologies become prominent. The Linear Residential Treatment (LRT) model addresses the problems of individuals

who are homeless by using a linear step-by-step program. This model was compared to the Assertive Community Treatment (ACT) where services are not predetermined and the individual participates in the path to independent housing. From this analysis we have unconventionally intervened with the proposal of a homeless bath shelter.

Hydrologic Response to Regional Climate Variations in Headwater Basins

Tim Wick, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Fred Chambers, DC - College of Liberal Arts and Sciences

This study introduces findings and analysis on climate variability in the Yampa River basin, the River itself being an iconic symbol of Northwest Colorado, running wild and free for most of its 250 mile course. The Yampa River is critical in providing water for energy, mining, and agriculture downstream, and the amount and timing of water released from snowpack is a great concern, especially since agriculture represents a major part of the economy in the basin. The change in weather and climate is also likely to have a greater impact on the expected regional population increase, and gradual decline of snowmelt in the headwaters could have an everlasting effect on the residents of surrounding small mountain communities. Compiling and analyzing data in a GIS leads to better understanding of the spatial and temporal variations surrounding the region in question, as well as increasing knowledge of climate dynamics, and will be important for long range forecasting capabilities. Snowpack and streamflow records, specifically in alpine regions where water demand and availability vary by season, were integrated into the project's GIS to help provide accurate future projections. Relationships of data for precipitation, snow water equivalent, temperature, stream flow, and population change were also included in the parameters to provide information that will help determine projections and models for future water needs.

Cultural Effects on Women: Photography in Surrealism

Andrea Wulf, Art, Art History, DC - College of Arts and Media

Faculty Sponsor: Ms. Maria Buszek, DC - College of Arts and Media

This project came from my interest in the Dada movement and the dramatic change in cultures during the beginning of the 20th Century. For my Methods in Art History class I decided to write a paper on the role women played in the changing culture due to the expanding industry and the First World War. Through this paper I was able to identify many of the women that were important to the change in culture. This change came through their art, specifically the Dada movement. The reason I am most interested in female Dada artists is because this movement was critical of technology and the war. Dada was different from other movements of that time, which

were in support of both the war and technology. These women, like Sophie Tauber-Arp, Emmy Hennings, Beatrice Wood, and Hannah Hoch were all members of this dramatic and revolutionary art movement. Their personal lives, as well as their art work, demonstrated the goals that these women were trying to push for. Goals such as women's rights and equality. Through this paper I was able to focus on the cultural changes that influenced the art that women and some men, like Marcel Duchamp, Man Ray and Hugo Ball were making. This artwork referenced the changing world around them during 1900-1918. For my Thesis paper I am focusing on a similar topic, women during the Dada and Surrealist movements. In this paper my goal is to look specifically at photography and photomontages during both of these revolutionary art movements. I am still interested in focusing on the female artists of these movements to demonstrate the change in cultures during the early 20th Century. My interests also lie in exploring how women were drawn to these particular art styles due to their acceptance of women within these groups. However, while these women were creating revolutionary art, alongside their male counterparts, they were still left out of the art history canon.

Secondhand Smoke Prevalent Low Molecular Weight Polycyclic Aromatic Hydrocarbon Effects on Lung Cell Communication

Julie Xiong, Public Health, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Alison K Bauer, AMC - Colorado School of Public Health

Secondhand and thirdhand smoke constitutes a major source of exposure for polycyclic aromatic hydrocarbons (PAH) in humans and is a worldwide health concern. These PAHs can be divided into the carcinogenic high molecular weight species and the lesser studied, but more abundant, low molecular weight (LMW) group. We hypothesize that LMW PAHs act through distinct mechanisms to initiate lung injury and inflammation contributing to human lung diseases. We investigated responses from two LMW PAHs, 1-methylantracene (1-MeA) and Fluoranthene (Flthn), in single and binary exposures, in both a mouse (C10 non-tumorigenic type II pneumocyte cell) and a human (Beas-2b, non-tumorigenic, normal bronchial epithelium) cell line for their ability to dysregulate gap junction intercellular communication (GJIC) and activate mitogen activated protein kinases (MAPK). A scalpel loaded dye transfer assay was used to examine GJIC as well as immunoblotting for MAPKs, P38 and ERK1/2. These PAHs were able to dysregulate GJIC in a dose dependent manner in both cells lines while also activating MAPKs, P38 and ERK1/2. Prior to treatment with PAH, a P38 inhibitor was found to reverse the dysregulation of GJIC observed with PAHs to control levels in both cell lines. Future directions for this project will focus on using co-culture with epithelial cells and macrophages to create a more relevant lung microenvironment to test the effects of these PAHs. We will also investigate induction of inflammatory mediators (TNF, COX-2, MCP-1), the tumor promotion potential of these PAHs, and use a gene array to identify signaling pathways altered following PAH exposure.

A New Model to Characterize Congenital Myopathy Disease Mechanisms

Heidi Yen, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Aaron Johnson, DC - College of Liberal Arts and Sciences

Congenital myopathies (CMs) are muscle disorders that result in extreme muscle weakness. CMs can be progressive, leading to paralysis and premature death. Nemaline myopathy (NM) is the most prevalent of the CMs, and is often associated with mutations in genes encoding sarcomeric proteins. Within the sarcomere, muscle contractions are regulated by Tropomyosin, which binds to thin filament actin. NM is caused by mutations in genes related to actin function, including α-tropomyosin (TPM3), β-tropomyosin (TPM2), α-actin (ACTA1), and cofilin 2 (CFL2). The current clinical model is that muscles develop normally in NM patients, but sarcomere contractility is compromised. Our preliminary data led us to hypothesize that TPM2 regulates actin dynamics during muscle development. We predicted that NM patients fail to develop the correct number and size of muscle cells prior to birth. To test our hypothesis, we generated and expressed human TPM2 alleles associated with NM in *Drosophila* embryos. TPM2 NM alleles are gain-of-function mutations in which a single dominant mutation can cause myopathies. We analyzed muscle-related defects by live imaging and found embryos that expressed TPM2 alleles showed dramatic muscle development defects. This is the first in vivo phenotypic analysis of TPM2 mutations during muscle development. Our results strongly suggest that patients harboring TPM2 alleles suffer from developmental actinopathies before muscle contractions initiate. Thus, we have developed a novel model of NM in *Drosophila*, and will use this model to further characterize disease mechanisms contributing to congenital myopathies.

GRADUATE STUDENT Participants - 2015

Perturbation and Restoration of the Fathead Minnow Gut Microbiome After Low-level Triclosan Exposure

Munira Albuthi-Lantz, Integrative & Systems Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Alan Vajda, DC - College of Liberal Arts and Sciences

Background Triclosan is a widely used antimicrobial compound and emerging environmental contaminant. Although the role of the gut microbiome in health and disease is increasingly well established, the interaction between environmental contaminants and host microbiome is largely unexplored, with unknown consequences for host health. This study examined the effects of low, environmentally relevant levels of triclosan exposure on the fish gut microbiome. Developing fathead minnows (*Pimephales promelas*) were exposed to two low levels of triclosan over a 7-day exposure. Fish gastrointestinal tracts from exposed and control fish were harvested at four time points: immediately preceding and following the 7-day exposure and after 1 and 2 weeks of depuration. Results A total of 103 fish gut bacterial communities were characterized by high-throughput sequencing and analysis of the V3-V4 region of the 16S rRNA gene. By measures of both alpha and beta diversity, gut microbial communities were significantly differentiated by exposure history immediately following triclosan exposure. After 2 weeks of depuration, these differences disappear. Independent of exposure history, communities were also significantly structured by time. This first detailed census of the fathead minnow gut microbiome shows a bacterial community that is similar in composition to those of zebrafish and other freshwater fish. Among the triclosan-resilient members of this host-associated community are taxa associated with denitrification in wastewater treatment, taxa potentially able to degrade triclosan, and taxa from an unstudied host-associated candidate division. The fathead minnow gut microbiome is rapidly and significantly altered by exposure to low, environmentally relevant levels of triclosan, yet largely recovers from this short-term perturbation over an equivalently brief time span. These results suggest that even low-level environmental exposure to a common antimicrobial compound can induce significant short-term changes to the gut microbiome, followed by restoration, demonstrating both the sensitivity and resilience of the gut flora to challenges by environmental toxicants. This short-term disruption in a developing organism may have important long-term consequences for host health. The identification of multiple taxa not often reported in the fish gut suggests that microbial nitrogen metabolism in the fish gut may be more complex than previously appreciated.

DesignBuildBLUFF

Becca Barenblat, Architecture, DC - College of Architecture and Planning

Dan Mitchell, Sam Palmer, Roshan Jason Patel, Zane Levin, and Johnny Mathews, Architecture, DC - College of Architecture and Planning

Faculty Sponsor: Mr. Rick Sommerfeld, DC - College of Architecture and Planning

The Mexican Water Chapter of the Navajo Nation partnered with the University and the DesignBuildBLUFF program to design and build two rentable cabins to bolster the local tourism industry. Influenced by the landscape and distant views of mountains and Monument Valley, the programmatic design and materiality led to the development of two "sibling" cubes. One rests on the landscape while the other emerges from it. Each cabin establishes its own identity while simultaneously evoking the same language together. The orientations of the Sunrise and Sunset Cabins are influenced by the Navajo tradition of eastern entry. While entering the Sunset Cabin requires a journey through the patio first, the journey of the Sunrise Cabin is through the building and out toward the cantilevered patio. Both patios, located on the northern side of the cabins, provide shade in the summer. In order to diversify the sleeping arrangement possibilities between the two 300 square foot spaces, the Sunrise Cabin includes a two-person sunken bed platform and the Sunset Cabin, with a bed, loft, and futon, can sleep up to six visitors. Beauty and craft can be seen in the treatment of interior and exterior finishes. Concrete floors, sinks, and counters contrast the reclaimed barn wood on the interior walls and bedrooms while the weathered steel exterior resembles the red sand of the landscape. Apertures in both cabins frame views of the surrounding natural environment. Additionally, the carefully placed windows, skylight, and electrical lighting fill the spaces with soft light to emphasize materiality.

Teratogenic Medications and Concurrent Contraceptive Use in Women of Childbearing Ability with Epilepsy

Janki Bhakta, Pharmacy, AMC - School of Pharmacy

Faculty Sponsor: Dr. Laura Borgelt, AMC - School of Pharmacy

Currently, eight antiepileptic drugs (AEDs) have potential teratogenic effects (an agent that can cause a birth defect in a fetus). Women with epilepsy (WWE) may need one or more of these AEDs for seizure control, but may be unaware of the potential teratogenicity associated with their use. In utero exposure to AEDs increases the risks for both congenital malformations and other teratogenic defects. Given that approximately 50% of pregnancies are unintended, it is likely that women with epilepsy taking these medications could unknowingly put a growing fetus at risk. For women using contraception while taking these medications, many choose combined hormonal contraceptive (CHCs). Drug-drug interactions exist between AEDs and CHCs that may decrease contraceptive efficacy. The aim of this study was to evaluate prescribing patterns for potentially teratogenic AEDs and contraceptive use in WWE of childbearing ability, including those with potential drug-drug interactions. This study also determined the number of WWE of

childbearing ability prescribed potentially teratogenic AEDs with a concurrent contraceptive and documentation of a pregnancy or contraception plan. Results: Of the women, 30/115 (26%) had a documented contraception method when taking a potentially teratogenic AED. Of these women prescribed contraception, most (18/30, 60%) used an oral combined hormonal contraceptive or progestin-only pill; a majority of which had a potential for a drug-drug interaction with their AEDs (16/18, 89%). Less than 7% of women received counseling on a contraception plan and 18% of subjects received counseling on a pregnancy plan.

Activation of Dopamine 1 Receptors in the Dorsal Striatum During Fear Extinction Reduces Fear Renewal

Courtney Bouchet, Biology, DC - Graduate School

Faculty Sponsor: Dr. Benjamin Greenwood, DC - College of Liberal Arts and Sciences

Behavioral treatments for anxiety and trauma-related disorders focus on extinction-based exposure therapy, during which patients are exposed to an anxiety-eliciting stimulus in a safe environment in order to extinguish fear. One factor contributing to the poor efficacy of exposure therapy is that extinction memory is context dependent. Thus, exposure to fear-inducing cues outside of the safe environment precipitates return of fear; a phenomenon termed fear renewal. Identification of means to reduce fear renewal is of utmost importance to mental health. Dopamine has been implicated in fear learning and memory processes, but the role of dopamine in extinction is not clear. The dorsal striatum is an important terminal region of dopamine pathways, but the involvement of the dorsal striatum in fear extinction has not been investigated. Here, Long Evans rats were conditioned to fear a tone. The next day, rats were exposed to fear extinction training in a novel context. Immediately prior to fear extinction training, rats received bilateral microinjections of the D1 receptor agonist SKF38393 or saline into the dorsal striatum. Drug- or saline-paired extinction training was repeated the following day. One day following the second fear extinction session, rats were placed into either the same extinction context or a novel context drug-free and freezing was scored as an index of fear. Data suggest activation of D1 receptors in the dorsal striatum during fear extinction reduces fear renewal. These data reveal a novel pathway involved in fear extinction and may lead to new treatments for anxiety disorders.

David vs. Goliath: Heightened Serotonin Increases Aggressive Behavior in Smaller Competitors and Influences the Larger Competitor′s Fighting Strategy

Andrew Bubak, Neuroscience, AMC - School of Medicine

Faculty Sponsor: Dr. John Swallow, DC - College of Liberal Arts and Sciences

In aggressive encounters, size discrepancy between competitors is often a primary determining factor of contest outcome, usually resulting in smaller competitors conceding to larger rivals. Because winning contests can lead to significant fitness advantages, understanding the mechanisms that alter aggression is of great importance. The stalk-eyed fly, *Teleopsis dalmanii*, aggressively defends food resources and roosting sites daily, with a high probability of males winning a contests when faced with a smaller rival (> 5% difference in eye span). Serotonin (5-HT) has been implicated in the escalation of aggressive behaviors in both invertebrates and vertebrates. Studies in our lab have demonstrated an increased probability of winning size-matched contests as well as increasing willingness to engage in high-intensity behaviors by pharmacologically elevating neural 5-HT in this species. We hypothesized that smaller flies with pharmacologically-increased brain 5-HT in a size-mismatched contest would show more aggressive behaviors and a greater win percentage compared to non-treated counterparts. To test this, size-mismatched males were placed in a 10-minute forced fight paradigm where the smaller fly was either treated or untreated with the 5-HT precursor, 5-hydroxytryptophan, and aggressive behaviors were scored. Although probability of winning was not significantly altered by the treatment, aggressive behaviors including contest initiation, total interactions, and high-intensity behaviors were significantly higher in treated animals. Interestingly, untreated larger opponents also demonstrated altered aggression by significantly increasing the initiations of high intensity behaviors in response to opponents with increased brain 5-HT, warranting future studies investigating the role of 5-HT in rival assessment in stalk-eyed flies.

Environmental Risk Assessment Using Bacterial Communities as Indicators of Metal Toxicity

Ashley Burns, Environmental Science, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Timberley Roane, DC - College of Liberal Arts and Sciences

Acid Mine Drainage (AMD) is a form of water pollution caused by mining activities and is characterized by high metal concentrations and acidity. AMD affects over 20,000 km of rivers in the US alone and is an international problem. However, there are no consistently available biological indicators of the presence of AMD and its associated toxicity, complicating environmental risk assessment efforts. The purpose of this study is to determine if specific bacterial communities can be linked to AMD impacts and indicate the degree of contamination. The bacterial communities can then be used as bioindicators of AMD pollution severity. For this study, soil and water samples were collected in 2014 from AMD sites throughout the Colorado

Mineral Belt. Currently underway, bacterial DNA is extracted from the soil samples and analyzed using a genetically based bacterial identification method called Illumina high throughput 16S rDNA sequencing. Resulting sequence comparisons allow for identification of site (AMD)-specific bacteria. Along with bacterial identification, metal concentrations are being determined in each of the samples. Results from our previous work have shown that bacterial community composition is reflective of metal contamination. Continued analysis of 2014 samples is shedding light on the temporal stability of this relationship. This type of bacterial profiling will assist agencies and organizations in prioritizing sites for mitigation.

Ca2+-Induced Membrane Associations of Synaptotagmin 1 and 7 C2A Domains: Molecular Dynamics Simulations

Nara Chon, Chemistry, DC - Graduate School

Jack Henderson, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Hai Lin, DC - College of Liberal Arts and Sciences

Synaptotagmins (Syt) are membrane binding proteins that regulate the release of hormones and neurotransmitters through exocytosis. Previous works suggest that the C2A domains of Syt1 and Syt7, two members of the Syt protein family, have different membrane-association mechanisms despite their structural similarity. Here, we report the MD simulations of both Syt1 and Syt7 C2A domains associated with membrane of mixed POPC and POPS (3:1) to identify the origin of the differences. We also analyze how the simulation results depend on the initial orientations of the C2A domains with respect to the membrane.

A Miniature Split-Ring Resonator Microstrip-Fed Antenna for Penta-Band Applications

Hamid Chorsi, Electrical Engineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Dr. Mark Golkowski, DC - College of Engineering and Applied Science

Antennas are the key to virtually all forms of modern telecommunication. They are used in systems such as radio broadcasting, broadcast television, communications receivers, radar, cell phones, and satellite communications, as well as other devices such as garage door openers, wireless microphones, Bluetooth-enabled devices, wireless computer networks, baby monitors, and RFID tags on merchandise. Antennas can be very big or very small depending on the application for which they are designed. For medical implants applications, RFID tags and hand held systems we need small and compact antennas. Three features of antennas are particularly important, namely their bandwidth, gain, and radiation efficiency. An antenna's bandwidth is the range of frequencies over which it works effectively. The broader the bandwidth, the greater the range of different radio waves you can pick up. That's helpful for something like television,

where you might need to pick up many different channels, The gain of an antenna is a very technical measurement but, broadly speaking, boils down to the amount by which it boosts the signal. The radiation efficiency is a measure of the efficiency with which an antenna converts the radio waves accepted at its terminals into radiated power. In this work we have designed and fabricated a compact microstrip patch antenna by embedding two symmetric H-shaped feed lines along with a split-ring resonator (SRR)-shaped stub for achieving penta-band operation. The proposed antenna printed on a thin FR4 substrate of small size of 30:20:1 mm3, and provides a wide bandwidth from 3.4 GHz to 12.2 GHz with low VSWR level (≤ 2) and good radiation properties. By properly tuning two H-shaped feed lines along with a single unit cell of a SRR, the radiation efficiency of 85% and the gain of about 4 dB have been achieved. The antenna has the properties of low profile, easy fabrication and low cost. We also presented modeling and simulation results which were in good agreement with measurement data. The results prove that the proposed antenna has promise for use in UWB communication.

Dispersion Analysis of Whistlers

Hamid Chorsi, Electrical Engineering, DC - College of Engineering and Applied Science

Faculty Sponsor: Dr. Mark Golkowski, DC - College of Engineering and Applied Science

Lightning can be described as a giant discharge of electricity. Lightning strokes emit a broadband pulse of radio waves with frequency range from 0 Hz to over 100 kHz. A fraction of the energy from the lightning discharge (Very Low Frequency (3 kHz to 30 kHz)) gets injected into the magnetosphere and propagates within as whistler wave. A whistler is a VLF electromagnetic wave that originates from a lightning strike which propagates into the earth′s magnetosphere and follows a field line to the opposite hemisphere of the earth. It undergoes dispersion of several kHz due to the slower velocity of the lower frequencies through the plasma environments of the ionosphere and magnetosphere. Thus they are perceived as a descending tone which can last for a few seconds. Lightning strikes are everyday example of phenomena made from plasma which is the fourth state of matter. Plasma is an electrically charged gas and can be created by heating a gas or subjecting it to a strong electromagnetic field. The purpose of this work is to analyze dispersion of whistler waves both theoretically and experimentally. To achieve this goal we used advanced equipment (VLF receiver antenna, low-noise amplifier, GPS synchronizer) to receive VLF signals from lightning discharges. We then used a whistler analysis software which is written in MATLAB to deeply analyze observed whistlers and determine their McIlwain L-parameter and equatorial electron density. Analyzing whistler waves will lead to an improved understanding of the nature and properties of the magnetosphere and near-earth plasma.

Changes in Forest Fragmentation in Mexico from 2002 to 2013

Lisa Clay, Environmental Science, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Rafael Moreno, DC - College of Liberal Arts and Sciences

This analysis presents a national level assessment of how fragmentation of temperate and tropical forests in Mexico has changed over three years: 2002, 2008, and 2013. The National Institute of Statistics and Geography of Mexico (INEGI) vegetation data was used to categorize temperate and tropical forests in Mexico. Then, the European Union's GUIDOS Toolbox was used to determine forest fragmentation classes for each year for both temperate and tropical forests. Using a Geographic Information System (GIS), each forest fragmentation class from 2002 was clipped to the temperate and tropical forest fragmentation classes in 2008 to determine what each fragmentation class in 2002 turned into in 2008. Additionally, each forest fragmentation class from 2002 was clipped to all land uses, excluding forests, in 2008. This same process was repeated from 2008 to 2013. This process portrays what the original fragmentation classes of the forests have changed into from 2002 to 2013. The area of each resulting land use was then calculated to determine how much of the original fragmentation classes have been further fragmented or converted to a different land use from 2002 to 2013. This information is beneficial to visualize how the fragmentation of forests in Mexico has changed over time, as well as determine how much forest is being further fragmented, conserved, or turned into a different use. For example, the results can determine how much of the edge of a forest has been turned into agricultural land in the entirety of Mexico.

Zygote arrest (Zar) Protein-mediated Translational Control in *Xenopus laevis* Development: Requirement for the Poly(A) tail and Protein Interactions

Jonathan Cook, Biology, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Amanda Charlesworth, DC - College of Liberal Arts and Sciences

Zygote arrest (Zar) proteins, Zar1 and Zar2, are required for successful fertilization and embryogenesis. Synthesis of developmentally important proteins is crucial to embryogenesis and is regulated by translation of mRNA. Zar proteins bind the mRNA of developmentally important proteins via a specific sequence found in the RNA called the Translational Control Sequence (TCS). It is already known that RNAs containing a TCS are translationally repressed in immature eggs and activated in mature eggs. It is also known that Zar represses translation when tethered to reporter mRNA. The purpose of this study was to show Zar proteins are bona fide translation factors and are candidates for mediating translational regulation by the TCS. In a dual luciferase tethered assay, both Zar proteins repressed translation up to 50% in immature *Xenopus* eggs and repression was relieved during egg maturation, consistent with translational regulation of developmentally important mRNAs. Interestingly, Zar1 required the reporter mRNA have a poly(A) tail to repress translation, whereas Zar2 did not. Furthermore, Zar1 and Zar2 interacted

with overlapping but distinct sets of proteins. Some interactions changed during egg maturation, coincident with translational de-repression. Proteins recovered from GST affinity purifications included many known translation factors, such as CPEB, 4E-T and poly(A)-binding protein. In particular, eukaryotic initiation factors were identified such as eIF4E. These interactions changed during maturation, coincident with change in Zar function. Together, these data suggest Zar proteins do have roles as translation regulators and may mediate repression by the TCS. They also suggest mechanistic differences between Zar1 and Zar2.

The Role of Phosphatidic Acid in *Xenopus laevis* Fertilization

Elana Costanza, Biology, DC - Graduate School

Courtney Warren, Biology, DC - Graduate School

Faculty Sponsor: Dr. Brad Stith, DC - College of Liberal Arts and Sciences

Fertilization occurs after the initiation of a complex cell signaling pathway, involving membrane fusion events and biochemical reactions in the sperm and egg. It has been shown that Src tyrosine kinase is activated upon the addition of egg to sperm, which then activates phospholipase C (PLCγ) to produce IP3 and subsequent intracellular calcium release. Previously published data from our lab showed that the Phospholipase D (PLD) hydrolysis of Phosphatidyl-Choline (PC) into Phosphatidic Acid (PA) and choline in the egg plays a critical role in subsequent fertilization events. It is not known whether the PA produced during fertilization comes from the egg, sperm, or both. FIPI was used to inhibit PLD in order to investigate the role of PLD and PA in fertilization. By using FIPI to inhibit PA production on *Xenopus* sperm or eggs, results indicated that PA production was necessary in the egg but not sperm for successful fertilization. Western blotting was done to examine the effect of adding synthetic PA to *Xenopus* eggs on activation of proteins such as Src and PLCγ in lipid rafts. The results showed that Src was already present in lipid rafts and that PA addition did not increase in Src at five minutes, whereas the amount of PLCγ in lipid rafts doubled. As a PA-induced increase the amount of Src in rafts was not detected, this suggests that PA does not activate Src by translocation but rather by alteration of Src conformation to induce downstream intracellular calcium release.

Differentially Scaled Oral Clearance of Hepatically Versus Renally Cleared Antiretroviral Drugs in HIV-1 Infected Children and Adolescents

Scott DeBacco, Pharmacy, AMC - School of Pharmacy

Faculty Sponsor: Dr. Peter Anderson, AMC - School of Pharmacy

Adolescents and young adults continue to represent a rapidly growing proportion of the HIV-infected population. Changes in physiology and maturation of organ systems during adolescence

can result in variable drug concentrations. It is important that dosing regimens for the management of HIV/AIDS appropriately reflect these changes to provide optimal viral suppression. The primary objective of this study was to evaluate pharmacokinetic parameters of antiretroviral therapies in HIV-infected children/adolescent individuals as well as to evaluate the comparability with adult values. Eight males and eight females were included in the study; the average age was 14 years. Participants underwent a pharmacokinetic evaluation measuring plasma and intracellular drug concentrations. Oral drug clearance values (CL/F) were compared with average adult values through the use of a percentile score, 50th percentile indicating the adult mean, based on different scaling methods. Variability in CL/F was found depending on the primary route of elimination (renal v. hepatic). Average subject CL/F for renally-eliminated drugs when compared to average adult values as L/hr, L/hr/kg and L/hr/m2 were in the 24th, 59th and 42nd percentile, respectively; hepatically-eliminated drugs were in the 54th, 79th and 69th percentile. A positive, linear relationship in plasma to intracellular drug concentrations was also observed in certain therapies, which may indicate the potential for improvement in therapeutic drug monitoring. Further evaluations of these relationships are warranted in larger pediatric populations to determine if there are pharmacokinetic dosing strategies that may improve therapeutic outcomes.

Our City is Growing: Exploring Urban Agriculture Through Experiential Learning at Five Fridges Farm

Ariel Diamond, Social Sciences, DC - Graduate School

Kyle Helton, Geography, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Amanda Weaver, DC - College of Liberal Arts and Sciences

In recent years, the “eat local” craze has captured the interests and imaginations of urban populations across the country, but the implications of this movement extend far beyond weekend farmers markets and foodie trends. Although often overlooked, the function, and dysfunction, of local and global food systems impact the daily lives of every person on the planet. From its application and relevancy in everything from education to environmental health, Sustainable Urban Agriculture students Ari Diamond and Kyle Helton are exploring the multifaceted role food and agriculture plays in our local and global societies. Key to this educative process is their ongoing involvement in the apprenticeship/internship program at the CU Denver research site Five Fridges Farm in Wheat Ridge, Colorado. Under the direction of Amanda Weaver, PhD, Kyle and Ari have worked on projects ranging from fence building to animal husbandry as a means of broadening their understanding of social and environmental sustainability through the lens of urban agriculture. As a site of multidisciplinary graduate and undergraduate studies, Five Fridges Farm is not only an arena for diverse experiential learning and the incubation of ideas, but also, a place of friendship, fun, and creativity.

Perceptions of Public Safety: Sensemaking in Changing Denver Neighborhoods

Ida Drury, PhD, DC - School of Public Affairs
Maren Trochmann, PhD, DC - School of Public Affairs

Faculty Sponsor: Dr. Danielle Varda, DC - School of Public Affairs

Few issues harness community attention like those that directly impact public safety. When public safety concerns arise in neighborhoods where rapid socioeconomic and/or demographic changes are also occurring, the community response seems further intensified and polarized. The purpose of this study is to better understand how Denver residents experience rapid neighborhood changes in relation to their perceptions and experiences with public safety and crime where they live. This research explores the diverse lenses with which residents of these neighborhoods view and perceive these issues. Further, the study seeks to better understand what factors contribute to shared or diverse views on public safety in these neighborhoods. Using qualitative data from a field observation of a community public safety meeting and seven semi-structured interviews of community leaders in selected Denver neighborhoods, this research addresses two primary questions. First, how do Denver residents experience rapid neighborhood demographic and socioeconomic changes in relation to public safety? Next, how do these perceptions differ between new residents and residents who have longer tenure? This research also highlights the necessity of reflexive qualitative practice, as both researchers are residents of the neighborhoods under study. Preliminary findings suggest that perceptions of public safety are a function of the robustness of dialogue between community members as well as the immediacy of neighborhood changes. The research findings suggest productive paths forward in confronting the contentious and potentially divisive community issue of public safety in neighborhoods experiencing such dynamic changes.

Investigate Mechanisms of Immobilization of Polycomb Cbx2 protein on Mitotic Chromosomes by Live-Cell Fluorescence Resonance Energy Transfer (FRET) Imaging

Huy Duc, Chemistry, DC - Graduate School

Faculty Sponsor: Dr. Xiaojun Ren, DC - College of Liberal Arts and Sciences

Accumulating evidence shows that Polycomb Repressive Complex (PRC) 1 plays essential roles in the control of cell identities and cell proliferation by epigenetically repressing gene expression. The Cbx2 protein of PRC1 complex has been described to be required for the mitotic phase of embryonic stem cells. In previous publication, we made a discovery that the Cbx2 protein weakly binds chromatin during interphase, but stably binds to chromosomes during metaphase. In this report, we investigate what factor(s) determines the dynamic/kinetic transitions during cell-cycle progression. Using live-cell Fluorescent Resonance Energy Transfer (FRET) imaging, we found that the Cbx2 protein does not form dimers and they do not change

conformation throughout the cell cycle. The difference in dynamics of the Cbx2 protein between interphase and metaphase is probably due to the interaction between Cbx2 protein and other substrates such as other proteins.

Parameterization of Semiempirical Methods to Reproduce Proton Transfer to and from Glutamic and Aspartic Amino Acids

Adam Duster, Chemistry, DC - Graduate School

Faculty Sponsor: Dr. Hai Lin, DC - College of Liberal Arts and Sciences

Biological macromolecules use proton transfer mechanisms to create electrical gradients or as part of chemical reactions. Accurate computational models which incorporate quantum mechanical (QM) phenomena are essential in exploring the fine details of these processes in many proteins. However, high-accuracy QM methods are extremely expensive for molecular dynamics simulations of long (>100 ps) simulation time. The goal of this research is to reparameterize computationally efficient semiempirical methods to achieve high accuracy at a fraction of the cost of more expensive QM approaches. In this project, we focus on proton transfer involving water and the side chains of two amino acids (glutamic acid and aspartic acid). Following the strategy established in a previous study,[1] we develop new semi-empirical Hamiltonians which reproduce interactions between the targeted species by employing empirical parameters fitted to high-level QM calculations. With these new parameters, one will be able to carry out large-scale and long-time combined quantum-mechanical/molecular-mechanical dynamics simulations. [1] Wu, X.; Thiel, W.; Pezeshki, S.; Lin, H. "Specific Reaction Path Hamiltonian for Proton Transfer in Water: Re-parameterized Semi-empirical Methods." Journal of Chemical Theory and Computation 2013, 9,2672-2686. This work is supported by NSF (CHE-0952337) and Camille & Henry Dreyfus Foundation (TH-14-028). This work used the Extreme Science and Engineering Discovery Environment (XSEDE) under grant CHE-140070, which is supported by NSF (ACI-1053575).

Characterization of a lncRNA Associated with Bipolar Disorder

Jennifer Egelston, Biology, DC - Graduate School

Faculty Sponsor: Dr. Christopher Phiel, DC - College of Liberal Arts and Sciences

We recently identified a previously uncharacterized long non-coding RNA (lncRNA), LINC00486, by virtue of differential DNA methylation patterns in cells from patients with bipolar disorder (BPD) compared to unaffected siblings. Quantitative measurement of lncRNA expression also showed a difference between BPD patients and unaffected siblings. Three distinct transcripts for LINC00486 have been annotated from RNA-seq experiments, and we have cloned these transcripts into mammalian expression vectors. We have also developed

sensitive assays to specifically detect each transcript in both cultured cells and human tissues. Finally, we have begun the biochemical characterization of LINC00486 transcripts in an attempt to understand their biological function. Our ultimate goal is to provide molecular insights into the pathogenesis of BPD.

Urban Agricultural Study of the Urban Farm at Stapleton

Jennifer Freeman, Landscape Architecture, DC - Graduate School

Haixu Li and Brian Dickson, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Mr. Jody Beck, DC - College of Architecture and Planning

This project is an effort to support the Sustainable Food Policy Council and their research regarding urban agricultural food production on publicly owned land. We focused on the existing Urban Farm at Stapleton site, and looked at how it can be redeveloped into an urban agricultural hub within the City of Denver. The majority of the 23-acre site is currently used as an equestrian center, and this function is expected to be maintained within the site redevelopment. After conducting a site analysis, our team designated six broad categories of land use that utilize existing programming and structures while also putting new emphasis on urban food production. These categories include commercial greenhouse production, commercial row crop production, composting, public orchards and park space, leasable garden plots, and existing equestrian functions. Our group devised a strategy that employs all six methods of land use, emphasizing both commercial and public access to the site. Based on this design, we estimated food production yields and the resulting gross income of each designated land use area.

Outcome Based Code: Changing the Shape of Our Cities

Susan Hacker, Architecture, Historic Preservation, DC - Graduate School

Faculty Sponsor: Mr. Fred Andreas, DC - College of Architecture and Planning

As we strive to generate a more aggressive energy savings in existing buildings there is the very real risk that conventional energy codes could prescribe more damaging and ineffective interventions to existing and historic buildings. Buildings account for 40-50% of the energy consumed in the United States. There is a need for an alternate compliance path that can be moved beyond the pre-construction component based compliance to a regulatory framework that is based on actual performance and allows owners flexibility and innovation in their approach. This is where outcome based codes will pave the way for our cities historic structures to contribute to our carbon neutrality. Outcome based codes allow for multidisciplinary collaboration to determine a level of energy savings needed to meet the building's goal and the methods to reach that point of compliance without sacrificing key architectural features. Using the Secretary of the Interior Standards, energy modeling and the energy benchmark defined by the IECC 2009 a historic structure will be examined and documented. A plan to upgrade the

building will be determined and hypothetical modeling will determine how outcome based code compliance will save key historic features of the structure. This type of code application could revolutionize the shape of our cities: allowing for communities to preserve existing building stock, keep additional materials out of landfills and decreased the chase to become a more energy efficient country.

A Transportation Economic Resilience Rating System for Measuring Expenditure Impacts of Fuel Price Shocks

Alejandro Henao, Civil Engineering, DC - Graduate School

Faculty Sponsor: Dr. Wesley Marshall, DC - College of Engineering and Applied Science

This study examines changes in transportation expenditures by developing a transportation economic resilience (TER) rating system based upon the additional percentage of income consumed by transportation due to a fuel price shock. We seek to help researchers, planners, and policy makers better understand resiliency and vulnerability across different geographical areas. In this case study the TER scoring system is applied at the traffic analysis zone level of geography across the Denver Metropolitan region. Using the TER scores, we map zones that are resilient or vulnerable to fuel price shocks. TER scores range from 0 to 100; for this study, the average TER score is 80.6, which is equivalent to a 1.94% increase in the percent of income dedicated to transportation. Tour distance, income, and transit share are the most significant variables contributing to TER score differences at the regional scale. The results of this report illustrate that transportation choice helps create network redundancy and facilitates adaptability under extreme conditions. The most resilient residents are those living in cities and regions that plan for and invest in diversifying and expanding transportation choice. Those living in places that continue to promote the automobile as the only viable mode of transportation might be not currently view themselves as at risk, but they will be the most vulnerable should a fuel price shock event occur.

Urban Garden / Food Production

Jeff Hoge, Landscape Architecture, DC - Graduate School

Allie Vostrejs and Nick Patin, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Dr. Jody Beck, DC - College of Architecture and Planning

Denver Sustainable Food Policy Council Proposal: This is a Masters of Landscape Architecture (1st year, studio two) Design Project to be presented to the Denver Sustainable Food Policy Council (SFPC). The goal of this project is to maximize food production for communities within the City and County of Denver, and ultimately apply adaptive reuse strategies within the boundaries of the site. This design uses row-beds, terraced-beds, a large greenhouse and several

small grow-houses in order to create an agriculturally productive urban landscape. This project is proposed on a 3.39 acre in a south Denver neighborhood, which includes an abandoned elementary school. There is a public park that wraps around the site from the south border to the northeast corner, which is still heavily used. Precedent (regional and general) projects were researched and analyzed for gross, net, and final yield of individual crops in order to study and show how urban agriculture can be economically viable. The next step in this project is to draft a grant proposal for wide-spread support for urban agriculture within the city and county of Denver.

Detecting Change in a Noisy World

Kevin Hoover, Biology, DC - Graduate School

Faculty Sponsor: Dr. Douglas Shepherd, DC - College of Liberal Arts and Sciences

The definition of life under operator theory proposes that life is the organization of autonomous entities, or "operators," that produce effects within their environment without losing their individuality. Living operators grow in complexity from prokaryotic cells to animals to whole societies. In order for these operators to create effects they must first be able to sense the changing state of their environment. Information theory has demonstrated promising results in quantifying how well operators can discern signals from a heterogeneous environment filled with noise. Here, we present a study on two different types of cellular response in populations of individual cells: one in which the majority of individual cells respond to the external stimuli and another in which smaller proportion of cells respond. We are particularly interested in the case where the mean level of response to external stimuli (e.g. protein production) is the same, but the distribution of responses among the individual cells is different. We find that information theory can help us enumerate the differentiable states of external stimuli and thus help to isolate the mechanisms by which living organisms respond to changes in their environment.

Microwave-induced Thermoacoustic Imaging Hybrid FDTD Modeling and Experimental Study

Ryan Jacobs, Electrical Engineering, DC - Graduate School

Mohand Alzuhiri, Electrical Engineering, DC - Graduate School

Faculty Sponsor: Dr. Mark Golkowski, DC - College of Engineering and Applied Science

Microwave imaging is an imaging technique that gives high image contrast but poor image resolution (due to its relatively long wave length). Conversely ultrasonography has high image resolution (with a diagnostic frequency of up to 20 MHz) and poor image contrast of similar soft tissues. So by these two imaging techniques one is able to create a hybrid imaging technique with high contrast and high resolution, this method of imaging is Microwave-Induced

Thermoacoustic Tomography (MI-TAT). This noninvasive hybrid modality, improves contrast by using thermoelastic wave generation induced by microwave absorption. Samples are illuminated with sub-microsecond electromagnetic microwave pulses inducing an acoustic wave in the sample that are then received with an unfocused transducer. The advantage of this technique lies in combining the high contrast of microwave absorption coefficients for different biological tissues and the superior spatial resolution of ultrasonic waves. Such technology is important in providing a low-cost alternative to MRI or for Non-Destructive Testing (NDT). The MI-TAT simulation setup shows that samples with a higher conductivity emit a stronger acoustic signal. We introduce an improved simulation, a redesigned experimental setup with a custom designed amplifier for the transducer. Samples tested in the experimental setup include simulated tissue phantoms to concrete samples. The tissue samples are used to determine the effectiveness for medical imaging applications and the concrete is to test the nondestructive testing (NDT) applications.

Creating a Locally-Led "Bottom Up" Reform to the Affordable Care Act

Johanna Jamison, Public Administration, DC - Graduate School

Faculty Sponsor: Mr. Brendan Hardy, DC - School of Public Affairs

Implementing the Affordable Care Act is a complex, relevant, and timely policy challenge faced by American communities of all sizes and types. Graduate students pursuing degrees in public policy and administration from across the western U.S. came together to tackle this challenge in a student competition hosted by the Network of Schools of Public Policy, Affairs, and Administration (NASPAA). Using a state-of-the-art simulation tool and skills they learned from their academic and professional experience, the teams aimed to create a locally-led, “bottom up” reform to the Affordable Care Act for the fictional town of Urbis, USA. The winning policy package included a variety of intervention tactics and financing strategies. It addressed stakeholder interests to achieve positive individual and community health outcomes. This experience and insights from this effort will be illustrated through a poster presentation and can help inform community members and policymakers interested in balanced and effective approaches to health care reform.

Influence of an SSRI on Larval Stalk Eyed Fly (*Teleopsis dalmanni*) Phototaxis and Locomotor Behavior

Harper Jocque, Integrative & Systems Biology, DC - Graduate School

Faculty Sponsor: Dr. John Swallow, DC - College of Liberal Arts and Sciences

Fluoxetine, used as an antidepressant and anti-anxiety drug and branded as Prozac, Sarafem, or Rapiflux is a common pharmaceutical contaminant which is found in waterways at biologically relevant levels. The possible impacts on invertebrate behaviors by chronic environmental exposure to fluoxetine are explored in this study. Fluoxetine is a selective serotonin reuptake inhibitor (SSRI) which increases the serotonin available to bind postsynaptic cells. Serotonin is a conserved biogenic monoamine found primarily in the central nervous system and enteric (gut) nervous system in both invertebrates and vertebrates. Serotonin influences such diverse processes as behavior, cognitive function, appetite and locomotion. Fluoxetine perturbs the serotonergic system by increasing available serotonin, and the drug can cause locomotor changes in molluscs and alter light seeking behavior in crustaceans. Activity levels and light response can have important fitness consequences for an animal. This study examines the influence of fluoxetine on locomotor behavior and light response in stalk eyed fly (*Teleopsis dalmanni*) larvae. Larvae experienced chronic oral dosing of either 0.1, 0.2, 0.4 mg/g fluoxetine or received control food lacking any drug. Third instar larvae locomotion light preference and phototaxis were quantified. The results of the study will be discussed in the context of the serotonergic system, behavior and the presence of pharmaceuticals in the environment.

Evaluation of Urinary Tract Infection Fail Rates in Adults Aged 65-89 Years Old Treated with Nitrofurantoin

Aubrey Jones, Pharmacy, AMC - School of Pharmacy

Faculty Sponsor: Dr. Sunny Linnebur, AMC - School of Pharmacy

Purpose: Guidelines recommend nitrofurantoin as a first-line treatment of acute uncomplicated cystitis. Nitrofurantoin is dependent on kidney function to achieve therapeutic levels. Nitrofurantoin labeling contraindicates it in patients with a creatinine clearance (CrCl) less than 60 mL/min. Despite this, many providers prescribe nitrofurantoin in older adults with CrCl less than 60mL/min. Methods: This was a retrospective cross-sectional of patients 65 through 89 years of age who received nitrofurantoin. Two analyses using Cockcroft-Gault equation were performed. Analysis 1 utilized ideal body weight for each patient, unless no height was available; then actual body weight was used. Analysis 2 utilized actual body weight, unless the patient was obese (BMI ≥30) and then, an adjusted body weight was used. If no height was available and the patient was obese, the actual body weight was used. Results: No statistical difference in treatment failures was found between the groups (OR 0.81 [CI 0.55 -1.19]) in analysis 1; documented adverse events were similar between groups (p=0.771). Analysis 2 showed a statistical difference in treatment failures between the groups (OR 0.71 [CI 0.52 -0.98]);

documented adverse events in analysis 2 were similar between groups (p=0.652). Conclusions: Creatinine clearance estimates are affected by type of weight used; there may be a statistical difference in clinical failure rates in patients with CrCl ≥ 60 mL/min and < 60 mL/min but the impact is dependent on type body weight used to calculate renal clearance. Adverse event rates are not impacted by renal function.

Latinos and the Suboptimal Use of CVD Prevention Services: Examining the Influence of Fatalism and Institutional Barriers to Care

Craig Kapral, Health and Behavioral Sciences, DC - Graduate School

Faculty Sponsor: Dr. Ronica Rooks, DC - College of Liberal Arts and Sciences

Cardiovascular disease (CVD) is a leading cause of adult morbidity and mortality for Mexican Americans (MA) living in the United States. Compared to non-Hispanic whites (NHW), MA have higher prevalence rates for many established CVD risk factors, including high cholesterol and uncontrolled high blood pressure. Screening for high blood pressure and high cholesterol is critical for both the early detection and prevention of CVD. Despite widespread availability, MA are less likely than NHW to utilize these services. One common, but understudied explanation for underutilization of screening services by MA is fatalism, a general belief that life events are beyond one′s control, including the ability to prevent certain health conditions. Although well documented in the cancer literature, fatalism has not been studied widely in CVD where disparities in risk factor profiles between MA and NHW continue to grow. Moreover, despite research indicating that MA hold fatalistic attitudes towards CVD, no studies to date have directly examined fatalism in relation to the suboptimal use of cholesterol and blood pressure screening services after accounting for established institutional barriers to health care (IBHC). The proposed mixed methods research examines the relationship between specific IBHC (lack of health insurance; no usual source of health care; and perceived discrimination in the health care encounter), CVD fatalism, and use of blood pressure and cholesterol screening services by MA in Denver, Colorado. Findings hold the potential to contribute to the development of targeted and cost effective interventions designed to increase use of CVD screening services by MA.

Predicting Random and Rather Erratic Road Conditions

Ana Kenney, Applied Mathematics, DC - Graduate School

Faculty Sponsor: Dr. Alexander Engau, DC - College of Liberal Arts and Sciences

We present current research that improves the methodological use of stochastic model predictive control (SMPC) on various applications. Specifically, this presentation will focus on the optimal operation of hybrid vehicles under uncertain road conditions. To improve the performance as

well as applicability of SMPC in this context, it is important to limit its assumption of a priori knowledge and attempt to estimate road conditions more dynamically, thus providing immediate benefits for its potential use in practice. We present and analyze newly developed prediction methods and validate their performances on several numerical experiments.

Experiencing the Data Warehouse Maturity Model by Using a Computer Game: Development and Experiment

Mohammed Khojah, Computer Science and Information Systems, DC - Graduate School

Faculty Sponsor: Dr. Michael Mannino, DC - Business School

Maturity models have been used in many disciplines, including information technology (IT), to describe the development cycles of technology over time. Maturity models provide a road map to guide an organization through the required steps to increase capability and performance related to technology. Although many courses cover maturity model usage in IT areas, the courses fail to capture the complexity, ambiguity, and decision impacts that occur in real life. Simulation games offer a great opportunity to bring both knowledge and experience to students. This paper suggests a framework model to serve as the basis for a computer game that uses data warehouse maturity models and data warehouse architecture selection. The game aims to provide an experiential learning environment for students and professionals. In the game, students will select a strategy and assess the current capability of an organization. Then, students will decide on several tasks to increase the organization′s capability. Finally, students will simulate their overall decisions and observe their performance. We anticipate that this framework and game approach can be extended to other IT areas that use maturity models. The effectiveness of the game can be evaluated through an experiment. In the experiment, the control group will be taught using a conventional learning course that includes lectures and notes. The treatment group will also play the game and interact with other students about their experience. We anticipate that performance, enthusiasm, and confidence of the treatment group members will exceed these measures for the control group.

IMPACT GARDEN

Qiaochen Liu, Landscape Architecture, DC - Graduate School

Josh Spinner and Brooklyn Tieszen, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Dr. Jody Beck, DC - College of Architecture and Planning

As food accessibility and nutrition continue to grow as urban concerns, it is vital that local, healthy food becomes incorporated and available in all city neighborhoods. This project provides the design framework and processes for a community garden which not only gives to the neighborhood food pantry, but the surrounding local residents as well. In recent time, the low-income neighborhood of Northeast Park Hill in Denver has encountered an absence of affordable

foods, experienced gang violence, and an overall lack of community interaction. This community garden promotes a significant focus on the incorporation of both food production and community interaction space, providing benefits with food accessibility, community engagement, educational opportunities, and reusable/sustainable practice. With effective programming and use, this community garden becomes a space that facilitates the relationship between residents and organizations. The Impact Garden creates a network for the neighborhood, bringing together The Boys and Girls Club, Hope Center, Library, nearby schools and churches. Paying careful attention to the construction and logistics of each garden component- such as raised beds, vertical gardens, and bench structures- this design creates a modular element, allowing it to be easily implemented throughout the nearby city block for increased food production and community interaction.

Unbounded Trade-offs in Revenue Maximization Under Uncertain Consumer Demand

Anzhelika Lyubenko, Applied Mathematics, DC - Graduate School

Faculty Sponsor: Dr. Alexander Engau, DC - College of Liberal Arts and Sciences

We consider the problem of total revenue maximization under uncertain consumer demand. We model revenue by a quadratic function under two possible uncertainty realizations and examine the trade-offs associated with each scenario. We also develop conditions under which these trade-offs become unbounded using the theory of proper efficiency.

Ploidy Determination Using Flow Cytometry in *Eutrema edwardsii*

Jared Mastin, Biology, DC - Graduate School

Faculty Sponsor: Dr. Leo Bruederle, DC - College of Liberal Arts and Sciences

Polyploidy is both common and widespread in plants, where the entire genome in a species is replicated, often involving unreduced gamete formation (e.g., 2n egg). Polyploidy can occur within species (autopolyploidy) or following hybridization involving closely related species (allopolyploidy). *Eutrema edwardsii* R. Br. (Brassicaceae) is a polyploid, arctic-alpine mustard with a near circumpolar distribution. Its closest relative, *E. penlandii* Rollins is endemic to the Mosquito Range in Colorado. In order to evaluate assumptions regarding ploidy in these species, I used flow cytometry and chromosome counts to estimate ploidy in 17 populations. 1-2cm^2 of silica dried leaf tissue was macerated with an internal standard in a buffer to release nuclei. The solution was filtered and stained with propidium iodide for detection in the flow cytometer. Three individuals from each population were measured five times to obtain a mean fluorescence value for each sample. The average of all *E. penlandii* populations was used as the diploid base value for estimating ploidy in *E. edwardsii* populations. Of the 12 *E. edwardsii* populations, four

are tetraploid and eight are hexaploid. No population exhibited mix-ploidy and all *E. penlandii* populations were diploid. In addition, allozyme data were compared to FCM data to confirm allopolyploidy as the source of genome duplication for *E. edwardsii* based on fixed heterozygosity observed in all *E. edwardsii* populations. Future directions will screen *E. penlandii* for polyploidy and examine the distribution of ploidies of *E. edwardsii* in an attempt to elucidate factors that might influence the success of polyploids.

Whistler wave Propagation in the Earth′s Ionosphere and Magnetosphere

Ashanthi Maxworth, Electrical Engineering, DC - Graduate School

Faculty Sponsor: Dr. Mark Golkowski, DC - College of Engineering and Applied Science

Wave propagation in the near earth space environment is a very important phenomenon. The near earth space environments such as the ionosphere and magnetosphere are in the plasma state. Plasma is the fourth state of matter in which all the particles are in the ionized state. Whistler waves are a type of low frequency signals in the frequency range of 1 kHz - 30 kHz. Whistler waves are mainly generated due to lightning strikes. Tracing the power flow of a propagating wave is known as ray-tracing. In this work we trace the whistler mode waves in a warm plasma environment. The current available methods trace the propagation of waves in cold plasma environments in which the temperature and pressure considered to be negligible. In our work we extend that work in to warm plasma environments in which the temperature and pressure variations play a significant role. Whistler ray tracing has many practical applications in the areas of lightning protection, space physics and communications. Lightning causes $10B of damage every year (in the USA), kills hundreds worldwide, and poses a danger to air traffic. Understanding the physics of lightning requires advanced simulations. Near earth space observations can be used to detect the lightning activities without having advanced hardware equipment. The space electronic systems such as space stations and communication satellites can be protected over naturally created harmful signals by tracing the path of those signals. And the effects caused by them on the communication systems can be minimized.

Agricultural Production and Horticultural Therapy

Catharine McCord, Landscape Architecture, DC - Graduate School

Guan Wang and Alaa Hasanain, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Mr. Jody Beck, DC - College of Architecture and Planning

The North Park Hill neighborhood of Denver, CO is considered to be a food desert because it does not have ready access to affordable healthy foods from grocery stores or supermarkets. This is a design proposal for an urban farm located in the North Park Hill neighborhood. The urban

farm will be located on the grounds of an institutional facility. In conjunction with food production, the farm will be utilized as a space for horticultural therapy. Design considerations have given priority to food production with mindfulness to therapeutic aspects for patients and community members, such as raised garden beds and wide pathways. The urban farm will serve the community with opportunities for participation in farming activities and provide community gathering spaces. The farm is located adjacent to a senior apartment living facility; the design layout lends toward providing access from the apartment facility directly into the farm as well as a pleasing aerial view. Farm yields along with cooking demonstrations will be made available to community members. Farming activities and demonstrations will provide the community with education and access to growing and preparing healthy foods.

Pharmacologic Venous Thromboembolism Prophylaxis in Hospitalized Patients with Chronic Liver Disease

Kaitlyn Moorehead, PharmD, AMC - School of Pharmacy

Faculty Sponsor: Dr. Scott Mueller, AMC - School of Pharmacy

Chronic liver disease (CLD) is a common comorbidity in hospitalized patients. Since the liver is the principal site of synthesis of both procoagulant and anticoagulant factors, CLD can result in a disrupted hemostatic balance. Coagulopathy resulting from CLD does not protect from venous thromboembolism (VTE) developing in hospitalized patients, contributing to uncertainty regarding the appropriateness of VTE prophylaxis in this population. We aimed to describe patient characteristics associated with pharmacologic VTE prophylaxis and determine the clinical impact of VTE prophylaxis in patients with CLD in this retrospective cohort study. Characteristics associated with administration of prophylaxis were lower baseline activated partial thromboplastin time, INR, total bilirubin, model for end-stage liver disease (MELD), and higher Padua score, hemoglobin, platelets, and antiplatelet agent use. In the prophylaxis group, VTE and portal vein thrombosis (PVT) occurred in 12 (7.6%) and 8 (5.1%) patients versus 4 (2.8%) and 12 (8.4%) of the non-prophylaxis, respectively (P=0.07 and 0.2, respectively). In the prophylaxis group, major bleeding occurred in 47 (30%) versus 49 (34.3%) non-prophylaxis (P=0.46). VTE prophylaxis was not associated with VTE, VTE plus PVT, or bleed outcomes by multivariate regression. Use of pharmacologic VTE prophylaxis in CLD patients was not associated with a lower risk of VTE during hospitalization nor did it increase the risk of bleeding. Further studies examining the risks and benefits of VTE prophylaxis in this population are necessary.

Genome Level Insights into Methane Cycling Microbial Communities

Adrienne Narrowe, Integrative and Systems Biology, DC - Graduate School

Faculty Sponsor: Dr. Christopher S. Miller, DC - College of Liberal Arts and Sciences

Freshwater wetlands are a leading contributor to atmospheric methane emissions, yet little is known about how substrate availability, water cover, and oxygen penetration impact the distribution and metabolism of methane-cycling microorganisms inhabiting these ecosystems. To address this knowledge gap we coupled marker gene and shotgun metagenomic sequencing to geographic and chemical parameters from 87 sediment core samples collected at six sites across hydrological and depth gradients at Old Woman Creek, Lake Erie, OH. Analysis of the microbial community in this methane emitting wetland indicates that bacterial and archaeal taxa were differentially distributed in the wetland by water cover and depth. In high methane producing mud flats, methane-cycling archaea dominate; while meters away in submerged, low methane sediments, methanogens are not abundant and members of the MCG archaea dominate. Very abundant at the high-methane site are members of an uncharacterized group of archaea, the ANME-2d. Members of this archaeal group have been detected in a variety of environments and are suspected to consume methane, but are also closely related to known methanogenic taxa and their role in methane cycling has not been experimentally determined. Within the reconstructed ANME-2d genomes, we identified genes for the full methanogenesis pathway and for nitrate reduction, providing in situ evidence supporting the nitrate-dependent methanotrophic potential suggested for this clade. Recovered genomes from members of the methanotrophic bacterial genus, Methylobacter, also encode nitrate and nitrite reductase genes suggesting that nitrogen cycling may link to methane oxidation in freshwater sediments as a potentially important control on methane emissions.

Lakewood Gulch Neighborhood Edible Park

Luis Navarrete, Landscape Architecture, DC - Graduate School

Jilian Troiani and Kate Bolton, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Mr. Jody Beck, DC - College of Architecture and Planning

Our goal is to study urban agriculture within the context of Denver. The Lakewood Gulch site is located in the Villa Park neighborhood between the Perry and Knox light rail stations. The site borders the neighborhood on one side and the Lakewood Gulch on the other. Our design incorporates accessibility, safety and community engagement through the lens of edible landscaping. The primary land use is edible landscaping and the secondary is demonstration gardening. Our goal is to measure productivity on the site based on different maintenance regimes, which are low, medium and high. Our design aligns with the transit-oriented development goals set by the Denver Community Planning and Development office, with a strong focus on community development within the Villa Park neighborhood. As designers our

goals are to integrate and create a community through edible landscape and research food productivity yields through several maintenance regimes in an effort to support the Denver Sustainable Food Council.

Computational Insight into Origins of Z-selectivity and Enantioselectivity of Asymmetric Ring-opening/Cross-Metathesis Catalyzed by a Stereogenic-at-Ru Complex

John Nelson, Chemistry, DC - Graduate School

Faculty Sponsor: Dr. Xiaotai Wang, DC - College of Liberal Arts and Sciences

Density functional theory (DFT) computations (B3LYP and M06) were performed to elucidate the mechanism of a Z-selective asymmetric ring-opening/cross-metathesis reaction catalyzed by a ruthenium complex with an N-heterocyclic carbene (NHC) admantyl chelator (1cat). The reaction was also enantioselective because the catalyst employed was chiral and stereogenic at the ruthenium center. The system that has been computed consists of the full sets of the catalyst and allyl acetate substrate, as well as a truncated model for the norbornene substrate. The initial metathesis of 1cat with allyl acetate via a side-bound pathway yields two active catalytic species, which lead to the final Z- and E-products, respectively. The high enantioselective excess of both Z- and E-isomers originates from the steric hindrance imparted by the incoming norbornene substrate, which only has one favorable approach out of four possible orientations.

Unraveling the Significance of NOTCH1 Mutations in Head and Neck Squamous Cell Carcinoma

Nuria Padilla Just, Cancer Biology, AMC - Graduate School

Faculty Sponsor: Dr. Antonio Jimeno, AMC - School of Medicine

The 5 year survival rate of head and neck squamous cell carcinoma (HNSCC) is one of the lowest among aggressive cancers. NextGen sequencing in squamous cell carcinoma of the skin, lung and head and neck identified novel mutations in NOTCH1. In our HNSCC series, we performed Sanger sequencing of NOTCH1 in the tumor and matching normal stroma and found a 32% NOTCH1 mutation in the tumor; 56% of these cases were also mutated in the germline. Interestingly, these mutations were primarily identified within the extracellular domain of Notch1 receptor, an essential region for ligand binding and pathway activation, indicating a loss of function and tumor suppressor role for Notch signaling in HNSCC. The presence of these germline NOTCH1 mutations is crucial to the tumor-stroma relationship, and indeed we observed that patients with germline NOTCH1 mutation have a higher stroma-to-tumor ratio. This may help explain why cancer-associated fibroblasts, the most abundant stromal component that interacts with epithelial tumors by paracrine secretion of growth factors and extracellular

matrix remodeling, enhance tumor progression in HNSCC. Notch signaling links tumor cells with their surrounding stroma, and is this tumor-stroma interaction the first to occur in a metastatic site, a key event that dictates the outcome in HNSCC as the majority of patients are diagnosed with locally advance disease. By determining the impact of NOTCH1 mutations in disease presentation and clinical outcomes including response to therapy, we will advance the field by increasing molecular characterization leading to personalizing HNSCC treatments.

Effect of Acid Mine Drainage on the Abundance and Diversity of Freshwater Nitrifying Microbes

Bhargavi Ramanathan, Environmental Science, DC - Graduate School

Joshua Sackett, Biology, DC - Graduate School

Faculty Sponsor: Dr. Timberly Roane and Dr. Annika Mosier, DC - College of Liberal Arts and Sciences

Extremely acidic and metal-rich acid mine drainage (AMD) waters can have severe toxicological effects on aquatic ecosystems. For instance, AMD was shown to completely halt nitrification, which plays an important role in transferring nitrogen to higher organisms and in mitigating nitrogen pollution. We are evaluating whether AMD differentially impacts three groups of microorganisms involved in nitrification: ammonia-oxidizing archaea (AOA), ammonia oxidizing bacteria (AOB) and nitrite oxidizing bacteria (NOB). Freshwater sediment and water AMD-impacted samples were collected during June and August 2013 in the Iron Springs Mining District (Ophir, Colorado). Across 13 sites, pH was 3.2-8.3, temperature was 17.8-22.4˚C and dissolved oxygen was 1.1-10 mg/L. Total recoverable metal concentrations ranged from: 0-0.11 mg/L lead, 0-3.2 mg/L copper, and 0-36.8 mg/L iron. Initial analyses based on 16S rRNA gene sequencing revealed the presence of AOA (*Nitrososphaera* and *Nitrosopumilus*), AOB (*Nitrosomonadales*), and NOB (*Nitrospiraceae*) at multiple AMD-impacted sites. The overall abundance of AOA, AOB and NOB will be examined using quantitative PCR (qPCR) amplification of the *amoA* and *nxrB* functional genes. The relative abundance of specific groups of ammonia and nitrite oxidizers will be analyzed with amplicon sequencing. To evaluate the potential factors influencing nitrification in these effluents, the abundance and diversity of these organisms will be correlated to site-specific environmental factors (e.g., pH, temperature, dissolved oxygen, and heavy metal concentrations). These findings extend the understanding of the relationship between AMD and nitrifying microbes and provide a platform for further research.

The Garden at Park Hill: Creating a Neighborhood Food Hub

Kacy Roeder, Landscape Architecture, DC - Graduate School
Yayun Sun and Haipeng Zhang, Landscape Architecture, DC - Graduate School
Faculty Sponsor: Mr. Jody Beck, DC - College of Architecture and Planning

The Garden at Park Hill is formerly a restaurant providing organic food set amidst a garden of organically grown vegetables and fruits. Today, the Garden at Park Hill now belongs to Aleece Raw and is looking to transition from a one-time restaurant to a neighborhood food hub. Ms. Raw is a strong advocate of the importance of growing, accessing, and understanding healthy, fresh food; because of this, she aspires to turn the garden into a community food and events center that is managed and supported by members that use it and the community it serves. Our project looks at the given site and designs a site plan that fits the gardens upgraded persona. Included in our site plan are sections of food forests which promote an exploratory approach to food production, traditional row gardening, year round growing space in a greenhouse, and seating throughout the space to encourage interaction with the space and the users. Our project looks to further small-scale food production in Denver, specifically in neighborhoods that lack access and knowledge of healthy food.

Mo' Betta Green MarketPlace Permaculture Education Center

Makena Roeswood, Landscape Architecture, DC - Graduate School
Frank Pendrell, and Caroline Scott, Landscape Architecture, DC - Graduate School
Faculty Sponsor: Dr. Jody Beck, DC - College of Architecture and Planning

What could you do with a 1/10th acre of land and a spark of imagination? Based on organic farming principles such as permaculture, biomimicry, care of the earth, care of people, and fair share the design for this small plot seeks to accomplish a lot, both as a source of organic local produce but also as a natural classroom where visitors learn lessons about food that they can transfer into their own yards and kitchens. The small site will contain chickens, goats, and bees as well as a greenhouse for seed starts in addition to nearly 3,000 ft of planting beds. In order to accommodate all these uses, the plan attempts to stack functions whenever possible to maximize the use of space and utilizes concepts such as planting guilds, vertical growing, and companion planting to increase density, achieve a reliable yield and support a high diversity of crops. Nestled in the middle of the residential Cole neighborhood, the Mo' Betta Green MarketPlace Farm and Education center is in the direct sphere of influence for two elementary schools and several churches. It is the hope of everyone involved, that the completion of this project will directly translate to an increased quality of food, and of life, for those who have access to it. Given this shared goal, we hope to analyze, through GIS data, how this project can be recreated and replicated across the Denver metro area to begin to revitalize Denver′s urban agriculture and local organic production.

Reclaiming Sheela-na-gigs and Female Sexuality: A Feminist Tracing of Language

Rachel Shanahan, Humanities, DC - Graduate School

Faculty Sponsor: Dr. Sarah K. Tyson, DC - College of Liberal Arts and Sciences

This paper explores how traditional interpretations of Irish sheela-na-gig stone carvings have relied upon patriarchal and phallocentric beliefs about female bodies and sexualities. The sheela-na-gig is often presented naked, without hair, small breasted, and standing in a crouched position exposing an exaggerated vulva. Historians since the 19th century have used terms such as "grotesque" and "hideous" to describe the sheela's physical appearance, and this terminology is still used today. In spite of this, feminist interpretations of sheelas offer positive alternative perspectives to this field once dominated by men. In my paper, I draw upon the work of Julia Kristeva and Adrienne Rich in developing my own alternative feminist critique of the language of disgust employed in interpretive traditions of the sheela-na-gig. I conclude by discussing the sheela images of woman as a multifarious site for new knowledge about gender and sexuality.

Retrospective Cohort Analysis to Evaluate the Impact of Institutional Guidelines for Venous Thromboembolism Prophylaxis in Hospitalized Medically Ill Patients

Suhair Shawar, PharmD, AMC - School of Pharmacy

Faculty Sponsor: Dr. Toby Trujillo, AMC - School of Pharmacy

Background: hospitalization for acute medical illnesses increases the risk for venous thromboembolism (VTE) yet prophylactic measures are under and inappropriately used. Purpose: The University of Colorado Hospital (UCH) has implemented institutional guidelines for VTE prevention subsequent to the release of the 2012 Chest guidelines. Implementation included guideline dissemination, provider education, and optimization of order entry options. This study aims to assess the appropriateness of VTE prophylaxis prescribing at UCH for medically ill patients before and after hospital guideline implementation, and assesses the utility of PADUA risk score to predict clinical VTE events. Methods: This retrospective comparative cohort study included patients admitted to UCH 9 months before and 9 months after implementation of institutional VTE guidelines. Patients included had a minimal hospital stay of 48 hrs. Patients admitted with VTE, bleeding or on therapeutic anticoagulation were excluded. Primary endpoint is the rate of appropriate VTE prophylaxis prescribing. Secondary endpoints are the incidence of VTE and major bleeding. A sample size of 300 patients in each group is needed to detect an absolute difference of 10% in the primary endpoint with 80% power and a significance level of 0.05. Results: appropriate VTE prophylaxis rate increased from 66.89% to 86.41% ($p<0.0001$) after implementing the institutional guidelines. VTE developed in 14

patients (4.64%) in the post-cohort compared to 26 patients (8.52%) in pre-cohort group (p=0.0535). The risk for bleeding was 21% less in the post cohort group. Conclusions: The implementation of institutional guideline has improved VTE prevention practices in UCH.

A View of Music

Shannon Steinmetz, Integrated Sciences, DC - Graduate School

Joey Verbeke, Music, Recording, DC - College of Arts and Media

Faculty Sponsor: Dr. Ellen Gethner, DC - College of Engineering and Applied Science

Inspired by the idea of synesthesia, or the intermingling of senses, we have developed an algorithm that transforms raw sound into a pictographic representation using the physics of a signal. We apply our method to music, the outcome of which is animation that is not only synchronized with the music, but that reflects well the nature of the music itself. We discuss the results of our proof of concept and its implementation, which includes illustrations provided from a variety of music sources. As well, we provide our current parameterization technique and discuss the internal behaviors. We close with a discussion of perception, consonance, and dissonance, and a road-map for future work.

Novel Method of Bioremediation and Characterization of Bacterial Communities on Arsenic-impacted Museum Collections

Sladjana Subotic, Biology, DC - Graduate School

Faculty Sponsor: Dr. Timberley Roane, DC - College of Liberal Arts and Sciences

Metal-based preservatives, including toxic arsenic salts, were widely used prior to the 1970s for the prevention of rodent and insect damage to museum collections. An estimated 80% of collections are thought to have exogenous metals applied and the use of bacteria in the removal of these metals is of interest. Research shows that *Rhodopseudomonas palustris*, a metabolically versatile proteobacterium, is able to volatilize arsenic via methylation resulting in the conversion of the metal into a gas. In preliminary laboratory studies, *R. palustris* tolerated concentrations of arsenic as high as 250 ppm. Additionally, *R. palustris* showed the ability to remove 3-4.5 ppm of arsenic from a starting concentration of 7 ppm arsenic within 14 days. In order to optimize the process of volatilization of arsenic from museum collections, the presence of in situ bacteria on the surface of collections needs to be addressed. High throughput sequencing revealed diverse bacterial communities existed on the museum collections examined, and that community composition seems strongly influenced by the materials composing the collection as opposed to whether or not the collection was treated with arsenic. Preliminary data showed that material type explained 32.5% of the variation seen among the bacterial communities. A more in-depth investigation of feathers, as a specific material type, showed that *Ralstonia*, Enterobacteriaceae,

and *Acinetobacter* represented the dominant organisms, with relative abundances as high as 91.8%, 35.79% and 48.26%, respectively.

In Vivo Assembly Stoichiometry of Polycomb Repressive Complex 1 on Chromatin Revealed by Single-Molecule Chromatin Immunoprecipitation

Roubina Tatavosian, Chemistry, DC - Graduate School

Chao Zhen and Huy Duc, Chemistry, DC - Graduate School

Faculty Sponsor: Dr. Xiaojun Ren, Dr. Christopher Phiel, DC - College of Liberal Arts and Sciences; Dr. Aaron Johnson, AMC – School of Medicine

Chromatin in eukaryotes is the convergent platform of controlling gene expression. The organization of chromatin is mediated by genetic factors and epigenetic regulators. Polycomb repressive complex 1 (PRC1) is epigenetic complex of transcription regulatory that represses gene expression by acting on chromatin. There is little mechanistic insight into how PRC1 is assembled on native nucleosomes. Here we investigate the assembly of PRC1 on native nucleosomes by using single molecule fluorescence TIRF microscopy. In this procedure, PRC1 subunit fused with fluorescence protein was stably and inducibly expressed in mouse ES cell line lack of PRC1 gene. Native PRC1-nucleosome complexes were purified from these cell lines and immobilized on the flow chamber with antibody against either histone protein or PRC1 subunit. The quantity of the PRC1 proteins on native mononucleosome was counted at the single-molecular level by using TIRF microscopy. Our results indicate that the number of PRC1 complex on native mononucleosome does not correspond to the number of histone tails of mononucleosome. We also reveal that differentiation of ES cells induces alteration of density of PRC1 on nucleosomes. Thus, our findings provide new insights to mechanisms of how PRC1 complexes act on chromatins.

39th & York Right of Way

Erin Trevathan, Landscape Architecture, DC - Graduate School

Keath Flint and Daniel Navarro-Gomez, Landscape Architecture, DC - Graduate School

Faculty Sponsor: Dr. Jody Beck, DC - College of Architecture and Planning

Our research has focused on the transformation of the post-industrial 39th & York Right of Way into an edible landscape and accessible greenspace within the Elyria-Swansea neighborhood. This proposal revolves around a natural blend of simplistic edible plantings, demonstration techniques, meandering pathways, and storm water management to create a unique and educational experience for surrounding neighborhoods and school systems. Ranging frequencies of wooden railroad ties and planting zones extend throughout the site, allowing the user to

immerse themselves within the historical and ecological experience rendered. The frequency of these pilings and plantings lead into a series of gathering spaces that range from hardspace, swales and mounds, to create a unique rhythm and interactive experience within the site, while simultaneously creating a storm water infrastructure. Overall, our main goal aims to take the most naturalistic elements surrounding Denver and blend in the industrial, cultural, and historical experience from the surrounding area to create a site that operates on multi-faceted levels.

Transcriptional Profiling of *Drosophila melanogaster* Tendon Cells and Myotubes During Myogenesis

Juliana Valera, Biology, DC - Graduate School

Faculty Sponsor: Dr. Aaron N. Johnson, DC - College of Liberal Arts and Sciences

Myotube elongation is the process by which nascent myotubes extend and identify appropriate muscle attachment sites on tendon cells. Although myotube elongation is an essential component of muscle morphogenesis and diversification, the molecular pathways that guide nascent myotubes toward tendon cells remain largely unknown. At the morphological level, tendon progenitor cell loss causes inappropriate myotube localization suggesting that tendon cells secrete essential myotube guidance cues. To identify these guidance pathways, we purified populations of embryonic tendon cells and nascent myotubes by fluorescence activated cell sorting (FACS). We isolated cell-type specific mRNAs from these cell populations and have deep sequenced and analyzed the RNA samples. This analysis has identified novel myotube guidance pathways that will provide unique insights into the molecular mechanisms that regulate myogenesis.

Assessment of Modified Ruthenium Monothiolate Carbene Catalysts in Z-Selective Olefin Metathesis Reaction

Duc VuLuong, Chemistry, DC - Graduate School

Faculty Sponsor: Dr. Xiaotai Wang, DC - College of Liberal Arts and Sciences

Ruthenium monothiolate carbene complex (2cat) was found to have catalytic capability for Z-selective olefin metathesis reactions and proven by used of density functional theory calculation in previous studies. Based on the original catalyst of 2cat, further enhancements were made by changes of functional groups within the structure in order to improve the rate of reaction. In this study, we tried to reduce the size of the bulky thiolate ligand by changing the three phenyl groups to three methyl groups or just hydrogen atoms. Density functional theory calculations (B3LYP and M06) were performed on the new catalysts to figure out the reaction pathways and activation energy. As the results, we could achieve lower activation energy of the rate limiting step however the efficiency of the Z selectivity was also reduced along with the size. This proved

that the steric hindrance from the bulky thiolate ligand contributed to the Z selectivity of the catalyst.

Limber Pine Metapopulation Dynamics in Rocky Mountain National Park: Examining the Role of Nutcracker Seed Dispersal

Tyler Williams, Biology, DC - Graduate School

Faculty Sponsor: Dr. Diana Tomback, DC - College of Liberal Arts and Sciences

Limber pine (*Pinus flexilis*) stands comprise metapopulations i.e., regional populations composed of local populations subject to colonization, extinction, and recolonization. We are studying how the limber pine metapopulation in Rocky Mountain National Park (RMNP) is affected by disturbance (extinction) and long distance seed dispersal (colonization) by the Clark′s Nutcracker (*Nucifraga columbiana*), limber pine′s primary seed disperser. Historically, fire and ecological succession primarily caused extinctions. Current threats for the RMNP metapopulation include mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, wildfire, and invading white pine blister rust (non-native pathogen *Cronartium ribicola*). Tree losses may negatively affect nutcracker seed dispersal, complicating metapopulation persistence. We will modify Hanski′s incidence function model to explore park metapopulation dynamics and response to future tree mortality. We constructed the RMNP limber pine metapopulation from GIS layers. During the 2014 field season, we examined several factors that influence metapopulation colonization rates: 1) Cone production estimates via distance sampling from three to five stands of limber pine, ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*), conifers with seeds that nutcrackers routinely use. 2) Nutcracker stand visitation by estimates of occupancy rates. 3) Nutcracker seed harvest and caching by focal behavior sampling. In 2015 we plan to radio-track nutcrackers to collect spatial use data for metapopulation connectivity information. The 2014 data indicate that limber pine and ponderosa pine seed productivity ranged from high to low throughout our study stands, while Douglas-fir productivity was primarily low. Nutcracker foraging observations shifted from limber to ponderosa pine in October; no foraging was observed for Douglas-fir.

Delineation: A Study of Rail Development in Colorado

Jaelyn Wolf, Architecture, DC - Graduate School

Faculty Sponsor: Ms. Rachel Brown, DC - College of Architecture and Planning

This project examines the process of development in Colorado, through railway expansion and mining--beginning with the discovery of gold near Denver in 1858. Mining towns sprang up shortly after and railroads were needed to transport supplies to support the mining operations. The pathways that railroads could take were restricted by access to water as well as the

unprecedented steep grade they were forced to confront. I created a series of info-graphics for this independent study. The first, a timeline of rail history and rail expansion; the second, an in depth look at the Silverton and Durango Narrow Gauge railroad. The third, an analysis of the primary mining towns that existed, the year they were founded, and the materials mined. The last graphic is about current railways that operate in Colorado, what materials they transport, track ownership, and current recreational railways operating throughout the state. My interest in this topic derives from my love of Southwest Colorado, as well as my fascination with decaying infrastructure, non-traditional architectural subjects, and spatial experiences. The remnants of a culture and way of life are made visible, as well as experienced, through the remaining rail and mining infrastructure; spread throughout the state. During my time in the architecture program, I have gained an appreciation for the way graphics are able to convey information in a precise and beautiful way. Through the layering of text, imagery, and data, my aim was to create a graphically enticing and informative composition that is evocative and educational.

The One Child Policy and Fertility among Chinese Immigrants

Da Wu, Economics, , DC - Graduate School

Faculty Sponsor: Laura Argys, DC - College of Liberal Arts and Sciences

The One Child Policy (OCP) in China dramatically reduced Chinese fertility and we examine how the OCP has affected the subsequent fertility of Chinese women. To examine fertility in an environment of unrestricted fertility, we conduct our analyses on migrants to the U.S. Using data from the American Community Survey (2001-2012) we estimate a difference-in- differences model that compares fertility of Chinese-born women born before and after the OCP with the fertility of women from other Asian countries from the same birth cohorts. Our results indicate that Chinese women born after the OCP have significantly lower fertility compared to similar women born before the OCP. These results lend support to the notion that women born into smaller families have lower fertility. These findings are robust to a number of specification checks.

Spatiotemporal Dynamics of Polycomb Repressive Complex in Live Embryonic Stem Cells Revealed by Single-Cell Single-Molecule Tracking

Chao Zhen, Chemistry, DC - Graduate School

Hayley Szocs and Jun Lee, Biology, DC – College of Liberal Arts and Sciences

Christopher Chow, Chemistry, DC - College of Liberal Arts and Sciences

Faculty Sponsor: Dr. Xiaojun Ren, DC - College of Liberal Arts and Sciences

Although the textbooks of biochemistry appreciate the importance of diffusion-controlled biochemical reactions, our understanding of biophysical and biochemical aspects of epigenetic transcriptional regulation is biased towards the idealized system where the kinetics of the

biochemical reactions are derived from the law of mass action. These reactions take place in the nucleus that is a crowded, fractal and compact environment, implying that the dynamic organization of the nucleus of the cell play critical roles in epigenetic transcriptional regulation. Therefore, it is essential to understand the roles of spatiotemporal dynamics of actions between epigenetic regulatory complexes, chromatin and the nuclear environment in transcriptional regulation and cell-fate transition. Here we are using state-of-the-art single-cell single-molecule tracking to investigate how the PRC1 complexes assemble on their endogenous target sites and how the search times and residence times of the PRC1 complexes affect genome-wide occupancy and transcriptome. We are addressing how the spatiotemporal dynamics of the PRC1 complexes coordinate cell-fate transition during cellular differentiation.

POSTDOCTORAL Participants – 2015

Postdoctoral Research Day showcases the scholarly activities of postdoctoral fellows at CU Denver. The following scientists were among those recognized for their outstanding research at Postdoctoral Research Day held 12 March 2015 on the CU Anschutz Medical Campus.

Biochemical and Biophysical Studies of the ciRNA-RNase L Complex

Daniel Eiler, Ph), Biochemistry and Molecular Genetics, AMC - School of Medicine

Faculty Mentor: Jeffrey S. Kieft, PhD, Biochemistry and Molecular Genetics and HHMI, AMC - School of Medicine

Many RNA viruses hijack or manipulate cellular machinery for successful infection and replication with non-coding elements. Seldom are such elements are found in the coding region of a virus. Within the coding region of the 3C protease of poliovirus and coxsackievirus exists the competitive inhibitor RNA (ciRNA) sequence. This RNA element of 303 nucleotides acts by competitively inhibiting RNase L, an RNase that becomes active via an interferon-triggered pathway that can be initiated by the presence of double-stranded RNA in the cytoplasm which commonly occurs during RNA virus infection. Once activated, RNase L rapidly degrades RNA and thus is a powerful antiviral enzyme. The ciRNA inhibits this enzyme, which suggests there is strong selective pressure to maintain the ciRNA sequence to depress the antiviral response facilitating successful viral infection. We are testing the previously hypothesis that the ciRNA folds into a unique structure that is able to bind and prevent the ribonuclease activity of RNAse L. We are characterizing the binding interactions between ciRNA and RNase L using fluorescence assays, ITC, and chemical footprinting techniques and are working to determine the molecular mechanism of inhibition within the ciRNA and RNase L complex. We are isolating the minimal ciRNA construct for binding and testing individual secondary structural elements.

Ca2+-Induced UCF-101 Protects Against Cold Storage Induced Renal Tubular Cell Apoptosis

Swati Jain , PhD, Renal, AMC - School of Medicine

Daniel Keys, MD, and Charles L. Edelstein, PhD, MD, Renal, AMC - School of Medicine

Faculty Mentor: Alkesh Jani (MD), Renal, AMC - School of Medicine

Purpose of study: Cold ischemia (CI) contributes to the development of Delayed graft function (DGF) and results in renal tubular cell (RTEC) apoptosis. RTEC apoptosis of donor kidneys predicts the development of DGF. X-linked inhibitor of apoptosis (XIAP) is the most potent, naturally occurring inhibitor of CC3. UCF-101 is a chemical inhibitor of XIAP degradation. We

hypothesized that: (a) CI leads to decreased XIAP expression resulting in increased CC3 and RTEC apoptosis; (b) Treatment of donor kidneys with UCF-101 will prevent activation of CC3 and RTEC apoptosis. **Methods:** RTEC apoptosis, XIAP, and caspase-3 protein and activity were examined a) in vivo in C57BL/6 mice kidneys exposed to 24 hours of CI with and without 100 uM UCF-101. (b) in vitro in LLC-PK1 cells subjected to CI in UW solution with and without 50 uM UCF-101. Apoptosis in vivo was quantified by a nephropathologist in a blinded fashion. Annexin V and PI staining was used to evaluate apoptosis in vitro by flow cytometry. **Results:** Kidneys exposed to CI in vivo, and RTEC exposed to CI in vitro had significantly decreased XIAP expression and increased CC3 protein, caspase-3 activity and apoptosis. UCF-101 treatment during CI: a) increased XIAP expression; (b) decreased CC3 protein, caspase-3 activity and apoptosis. **Conclusions:** CI injury results in degradation of XIAP and subsequent RTEC apoptosis. Prevention of XIAP degradation by UCF-101 results in decreased CC3, caspase-3 activity and prevention of apoptosis during both in-vitro and in vivo CI. UCF-101 may be an important therapy to prevent apoptosis during CI of donor organs and potentially improve DGF.

PATHWAYS2TEACHING - 2015

Pathways2Teaching is a pre-collegiate, concurrent enrollment program designed for 11th & 12th grade students to explore teaching as potential career choice while examining critical issues related to educational justice. High school students earn language arts high school credit while earning 3 college credits through the CU Denver School of Education & Human Development's Continuing & Professional Development office. Through the Pathways2Teaching program, high school students:

- gain college readiness skills as they learn to navigate the college search and application process
- earn 3 college credits upon successful completion of the year long course
- learn to write college essays and research reports
- acquire public speaking skills as they present their research findings to families & community
- interact with college students and faculty during campus visits and guest lectures
- engage in a weekly field experience working with elementary students
- critically examine historical and contemporary educational inequities
- understand that teaching is an act of love and a way to engage in social justice

Currently in its 5th year, Pathways2Teaching has served nearly 300 culturally & linguistically diverse students across school districts in the Denver metro area. To learn more about Pathways2Teaching, please see www.Pathways2Teaching.com or contact Dr. Margarita Bianco, Associate Professor, School of Education and Human Development or Ms Madhavi Tandon, Doctoral Candidate and Pathways2Teaching Project Director. Margarita.Bianco@ucdenver.edu or Madhavi.Tandon@ucdenver.edu

We would like to acknowledge the hard work of all our students and their teachers Ms. Palomino (Abraham Lincoln High School), Ms. Schroff (Collegiate Preparatory Academy), and Ms. Sellers (Adams City High School)

Legalization of Marijuana in Colorado and its Impact on Urban Schools

Josias Abeyta, Abraham Lincoln High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This study examines the relationship of youth marijuana use and its impact of secondary schools. Since Colorado legalized recreational marijuana a year ago, what have been the implications for large school districts, such as Denver Public Schools? Research and survey data from adolescent youths (ages 13 - 19) in Denver reveal the increased incidents of marijuana related tickets, suspensions, and expulsions. Living in a Denver county with more medical marijuana shops per square mile than other counties, does impact local schools. However, this paper recommends

preventative outreach and training of school staff to support students from abusing marijuana and engaging students in school.

Latino/a High School Students Impacted by Alcoholic Parents

Jenny Adame, Abraham Lincoln High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

Hispanic adolescents are the majority student population in Denver Public Schools and many large urban school districts throughout the southwest United States. Yet the support for the parents who are substance abusers is limited within the scope of the local schools. In this paper, the author discusses the impact of parents' substance abuse on their adolescents' education. Based on the author's research and on other data, a model for Latino students coping with parents who have substance abuse is presented. The model draws from support group counseling, acculturation, and social learning. Concluding with a research agenda, the paper calls for descriptive and outreach studies to understand and cope with parents' substance use among urban Hispanic population in the southwest through their local schools.

The Over-representation of Black Males in Special Education

Tramane Hudson, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will address why Black males are over-represented in the special education program. In looking at statistics, more Black males are classified as special education students than any other group of students. Surveys and interviews were done in order to determine the reason for this and what impact this has on student achievement.

The Impact of Being "Undocumented" on Students' Future Goals

Kelvin Martinez, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will look into the impact that the stigma of "undocumented" has on students in public schools. In addition, this paper will show how being undocumented limits what students are able to do after high school and how this impacts job prospects and success in their future.

Bilingual Education in Schools for Bilingual and Bicultural Students

Mario Noriega, Adams City High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

The purpose of my research is to find out why students that need Bilingual Education (BE) do not have access to it. In BE, students are taught in English and in another language, usually Spanish, in the United States. BE is used to assist children who do not speak English in learning English *and* mastering their native language while learning other content. It is also used to help English speaking students to learn new languages and master English. Data was collected using interviews with teachers and administration who work in schools with bilingual students. The objective of the study is to promote BE in schools that need it the most.

The Overrepresentation of Students of Color in Special Education: A Solution

Tobias Pittman and Paty Hernandez, Adams City High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

The intended objective of this study is to inform people of the overrepresentation of minority students in special education. The percentage of students of color in special education is far greater than that of White students. Many children of color have been wrongly placed in special education. Racism, poor facilities, and prejudices are the biggest causes of this discrepancy. Furthermore, there are many consequences of being labeled as special needs and they can be synthesized into three categories: Social Promotion, Social Skills, and Post-Secondary Readiness. The education being received by these students in special education classes becomes useless the moment they leave the classroom because they are not taught the necessary life skills. Closing the opportunity gap is important in order to create independent individuals out of these students. If schools are not doing their job of teaching all students, there are changes that need to be made. This study will provide some ideas and information on redressing this issue.

Undocumented Students and Their Future Challenges

Juan Prieto, Adams City High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

The purpose of my research is to understand the problems faced by undocumented high school students. Undocumented students are those living in the United States but without any legal status. Research shows that only 7.5% percent of undocumented high school graduates go to college. Data was collected from undocumented students in a Colorado high school using surveys that asked questions about legal residency and its effects on social and academic life. Initial data collection showed that some students were worried and stressed out about their futures while some were not.

Holding High Expectations – Why We Need More Teachers of Color to Teach Students of Color

Abdi Shongolo and Junior Dominguez, Adams City High School

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

The purpose of our research is to understand the influence teachers of color have on students of color. Research shows that on e of the reasons students of color are not performing to their potential because their teachers expect less of them - if you expect less, the students are going to give you exactly what you expect or less. Our question is: Would teachers of color expect more from students and hold them to higher standards? Our findings indicate that teachers of color are a perfect fit in schools with minority students because these teachers went through similar struggles and expect more from their students.

The Impact of Low Teacher Expectations on Students of Color

Carina Solis and Jun'Terria Davis, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will examine why different schools in the same neighborhood with similar demographics of student populations are held to different expectations. Research will show that students rise or fall based on the expectations they are held to. Observations were made at two different schools in the same neighborhood in order to find out why some schools fail to hold students to high expectations.

The Impact of Black Male Teachers on Student Achievement

Devontay Tobe, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will delve into the reasons that there are not more Black male teachers in the work-force. Research will show that students who never have a teacher who looks like them have specific perception of who holds power in the system of education and society as a whole. Black male teachers were interviewed and observed in order to find out why there are so few of them in school and what impact their presence has on students of color, in particular Black males.

The Impact of School Culture on Achievement

Wendy Vargas, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will argue for the importance of building a positive school culture and the impact school culture has on the students, teachers, parents and community. Interviews and observations were conducted at different schools to find out why some schools have a positive school culture and others do not. Research shows that a strong and supportive school culture can impact the surrounding community in addition to the people in the school.

The Impact of Drug and Alcohol Abuse on America's Youth

Fernando Vidana, Collegiate Preparatory Academy

Faculty Sponsors: Margarita Bianco and Madhavi Tandon, DC – School of Education and Human Development

This paper will argue that use and abuse of drugs and alcohol deeply impacts a student’s ability to achieve in school. Often students use drugs and alcohol because they are used in the home and are easily accessible. This paper will present findings as to how students rely on drugs and alcohol to numb the pain of what they are going through at home.

EVOLVEMENT DENVER

Evolvement is a multinational youth-led movement that advocates for healthy communities through policy change and activism. Since 2010, more than 3,000 high school teens have united as Evolvement activists to promote healthy lifestyles. Specifically in Denver, the youth are working on passing a tobacco retail licensing ordinance to keep kids safe from tobacco abuse by preventing illegal sales to minors.

Evolvement and the Licensed to Sell Tobacco Initiative

Denver Public High School Youth, EVOLVEMENT Denver

Faculty Sponsor: Ms. Nicky Harter, DC - School of Public Affairs, EVOLVEMENT Denver

Evolvement is a multinational youth-led movement that advocates for healthy communities through policy change and activism. Despite tobacco's well-known negative impacts, 5,300 Colorado youth under the age of 18 years old become new daily smokers each year. This habit is projected to prematurely kill 91,000 young Coloradans, including teens from Denver, where retail compliance with youth tobacco access laws has decreased. In Denver, you don't need a license to sell tobacco products, so Evolvement Denver youth are advocating for the Licensed to Sell Tobacco (L2ST) Initiative. Through this Initiative, they are asking City Council to pass a tobacco retail licensing ordinance to lower the accessibility of tobacco products to kids. In their work on this long-term advocacy effort, these youth have collected 5,421 surveys and over 4,000 hand-written messages of support from the Denver Public; conducted one-on-one meetings with most Denver City Council Members; attended over 40 community and school events; and presented to community organizations including the Denver Metro Chamber of Commerce, Denver Asian Chamber of Commerce, Colorado American Lung Association, and Denver Public Health. They were awarded a 2014 Denver Health Community Pillar Award for their efforts. These Denver high school students are doing professional advocacy campaign work, and will testify at the introduction of the ordinance this Spring. They are spectacular examples of the power of youth to be involved in grassroots policy advocacy.

UNDERGRADUATE RESEARCH OPPORTUNITY PROGRAM (UROP) – 2014 RECIPIENTS

The CU Denver Undergraduate Research Opportunity Program (UROP) is a competitive program designed to financially support research projects for CU Denver undergraduate students. Undergraduate research is an opportunity to extend learning outside the traditional classroom, laboratory, or studio; to utilize creativity and curiosity in the development of new knowledge, art, or innovation; to become more self-confident and independent; and to gain experience in presenting results to peers and mentors. (http://www.ucdenver.edu/student-services/resources/ue/UROP/Pages/default.aspx)

Jacob Altholz
Curtis Bean
Liana Boggs
Evan Shapiro
Christal Davis
Susanna Diller
Rebecca D'Occhio
Stephen Edwards
Joshua Fowler
Desmond Hamilton
Raleigh Jonscher
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