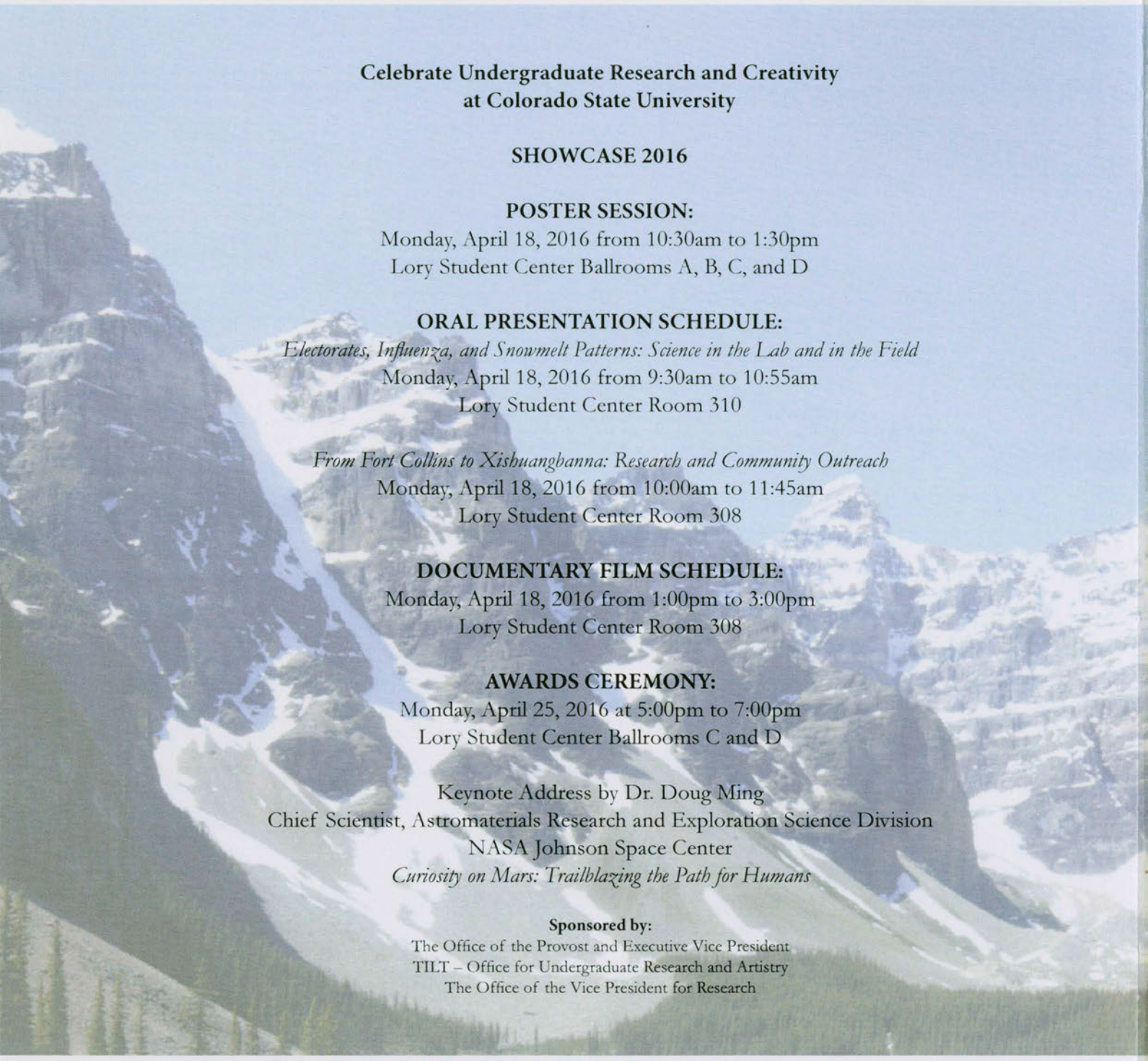
CURC

2016

Celebrate Undergraduate Research and Creativity



Celebrate Undergraduate Research and Creativity at Colorado State University

SHOWCASE 2016

POSTER SESSION:
Monday, April 18, 2016 from 10:30am to 1:30pm
Lory Student Center Ballrooms A, B, C, and D

ORAL PRESENTATION SCHEDULE:
Electorates, Influenza, and Snowmelt Patterns: Science in the Lab and in the Field
Monday, April 18, 2016 from 9:30am to 10:55am
Lory Student Center Room 310

From Fort Collins to Xishuangbanna: Research and Community Outreach
Monday, April 18, 2016 from 10:00am to 11:45am
Lory Student Center Room 308

DOCUMENTARY FILM SCHEDULE:
Monday, April 18, 2016 from 1:00pm to 3:00pm
Lory Student Center Room 308

AWARDS CEREMONY:
Monday, April 25, 2016 at 5:00pm to 7:00pm
Lory Student Center Ballrooms C and D

Keynote Address by Dr. Doug Ming
Chief Scientist, Astromaterials Research and Exploration Science Division
NASA Johnson Space Center
Curiosity on Mars: Trailblazing the Path for Humans

Sponsored by:
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Celebrate Undergraduate Research and Creativity

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Special thanks to:

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Margit Hentschel, Director, TILT Office of Service Learning
The Office of the Vice President for Research

A Letter from the Editor

JUR Press is proud to present the 2016 CURC Abstracts Program. The breadth of undergraduate work featured is truly remarkable, and our organization feels fortunate to be a part of its showcasing. JUR Press also publishes the Journal of Undergraduate Research and Scholarly Excellence (JUR). As a publication invested in undergraduate research, JUR has published seven issues, showcasing multidisciplinary undergraduate research from around the world.

JUR is a peer-reviewed, undergraduate journal registered with the Library of Congress that accepts submissions of any subject, from any accredited undergraduate institution. We receive hundreds of submissions for publication every year, from institutions ranging from small liberal arts colleges to international institutions. The review process for publication includes peer, graduate, and faculty referees, ensuring that the Journal publishes competitive material that follows the Journal's standards for academic, creative, and passionate work.

On behalf of the entire staff of JUR Press, I hope you enjoy this edition of the 2016 CURC Abstracts Program, and we invite you to submit standard manuscripts or creative work for our regular issues. If you are interested in submitting work or would like to become part of our team as a referee, please visit *jur.colostate.edu* to find out more.

Yours truly,

Anna S. Chopp
Editor in Chief
The Journal of Undergraduate Research and Scholarly Excellence
JUR Press

Doug Ming, PhD

Chief Scientist for the Astromaterials Research and Exploration Science Division at NASA Johnson Space Center in Houston, TX

DOUG MING is the *Chief Scientist* for the Astromaterials Research and Exploration Science Division at NASA Johnson Space Center (JSC) in Houston, Texas. His research interests include Mars geochemistry and mineralogy, soil mineralogy and chemistry, bioregenerative life support systems, and Moon/Mars resource utilization. His current research focuses on characterization of the mineralogy and geochemistry of Mars and the aqueous processes that have occurred on the Red Planet. Doug has extensive experience in the development of instruments and conducting mission operations. He has participated on the science teams (*Co-Investigators or Participating Scientist*) for the Mars Polar Lander (MPL), Mars Exploration Rovers (MER) Spirit and Opportunity, Mars Phoenix Scout, and Mars Science Laboratory (MSL) *Curiosity* missions. He was the Operations Lead for the MSL CheMin instrument where he developed the experimental operations plan including training documentation for payload uplink and downlink leads. He led tactical science operations on Phoenix in the role of Science Lead. Doug currently leads tactical science operations for MSL as a *Science Operations Working Group Chair.*

Doug was previously the *Manager* for the Human Exploration Science Office at NASA JSC where he led daily activities for NASA's Orbital Debris, Hypervelocity Impact Technology, Image Science and Analysis, Crew Earth Observations, and Exploration Science Programs. He was instrumental in developing science operations for NASA's Desert Research and Technology (Desert-RATS) analog missions in Arizona's San Francisco Volcanic Field. He has served on numerous NASA advisory committees including the Mars 2020 Rover and 2011 Mars Science Laboratory *Science Definition Teams*, Mars 2020 Sampling and Cache System, Mars 2020 Mission Operations Concept, and MSL Surface Sampling System Risk *Review Boards*, and Mars 2018 Mid-Range Rover Science Analysis and Mars Science Planning Synthesis *Science Teams.*

Doug received a B.S. and M.S. in Agronomy and Soil Science from Colorado State University in 1979 and 1981, respectively. He received his Ph.D. in Soil Science from Texas A&M University in 1985. He has published over 155 peer-reviewed journal articles, over 25 peer-reviewed book chapters, over 20 technical articles, Editor of 3 books (including *Lunar Base Agriculture*) and the Inventor of 2 U.S. Patents. One of his most recent publications appeared in the journal Science in January, 2014, that described the first results on the volatile and organic compositions of a sedimentary rock analyzed by *Curiosity.* He has received numerous awards including the *Pioneer in Clay Science Award* from the Clay Minerals Society (2014), NASA's *Outstanding Leadership Medal* (2013), *Antarctica Service Medal* (2011), NASA's *Exceptional Service Medal* (2010), *Marion L. & Chrystie M. Jackson Soil Science Award* from the Soil Science Society of America (2005), NASA *Invention of the Year Nominee* (1999), National Rotary

Foundation *Stellar Award Nominee* (1997), and numerous NASA *Group Achievement Awards.* He has held numerous positions for professional societies, including the Chair of the Soil Mineralogy Division for the Soil Science Society of America, *Council Member* for the Clay Minerals Society, and *President* of the International Natural Zeolite Association.

CURC Award Ceremony Keynote Speech:

Opportunity, Spirit, Curiosity, and Creativity! Mars Rovers or Your Future?

Monday April 25, 2016 at 5:00pm

Lory Student Center Ballrooms C and D

Guest Lecture:

Curiosity on Mars: Trailblazing the Path for Humans

Tuesday, April 26, 2016 7:00pm to 8:00pm

Colorado State University Plant Sciences Building Room C101

The Mars Science Laboratory rover Curiosity has successfully explored Gale crater on Mars for over 3 Earth years. Curiosity has discovered fine-grain sedimentary deposits that appear to have been deposited in ancient lake environments. These fine-grained sediments contain clay minerals and the elements necessary for life (C, H, O, N, P, S). The data being acquired by Curiosity will help NASA mission planners prepare for the journey of humans to the Red planet. What is the radiation environment on Mars? Will the martian dust be toxic to humans? Are there chemicals in the martian regolith that might be corrosive to spacecraft parts? Can we build habitat structures on the surface? Curiosity is "blazing a trail" for human exploration on Mars by answering these important questions.

Poster Session

Monday, April 18, 2016 from 10:30am to 1:30pm
Lory Student Center Ballrooms A, B, C, and D

Documentary Films

Lory Student Center Room 308

Micha Bennet, Hailey Osborne, and Emily Teitell
Redefining Normal
Time: 1:00pm to 1:30pm

Film Synopsis: In Redefining Normal, we discuss the issue of inclusivity related to individuals with disabilities. We explore what we all can do to create a more understanding and inclusive community, through the realms of home, work, and community for people with disabilities.

Alexandra Huff, Will Baker, and Ben Ward
Subdermal
Time: 1:30pm to 2:00pm

Film Synopsis: Subdermal is a short documentary about tattoos and the stories behind them. The documentary looks at the personal and professional culture of tattoos to discover the roles they play in the lives of individuals, and in society as a whole. We sought to answer the questions: What do tattoos mean to the people who get them? How is the professional world responding to the proliferation of tattoos in the workplace? How has the art of tattooing evolved over time?

Michael Ball and Marissa Isgreen
Climb
Time: 2:00pm to 2:30pm

Film Synopsis: This documentary is about climbers as athletes, and their stories surrounding the sport and the community. Climbers are often blasé in the face of challenges or adversity, and love the adrenaline that is associated with the sport. Even after harsh injuries, those who love the sport stick with it, because of the feeling itself but also because of the community surrounding it

Megan Rakoczy, Weston Dockter, and Elizabeth Ruiz
Bean to Bar: Chocolate Unwrapped
Time: 2:30pm to 3:00pm

Film Synopsis: Following the story of chocolate, our team of three worked with Toby Gadd, his wife, and a variety of local Ft. Collins collaborators to fully capture the story of the bean to bar process and what it did for the community it sprawled from. With hard work and dedication from all parties, the entire project came together beautifully, in efforts to share the impact of one local chocolate-maker.

Oral Presentations

Electorates, Influenza, and Snowmelt Patterns: Science in the Lab and in the Field

Lory Student Center Room 310

Coby Lasater, Jory Coates, Norman Revere, Thomas Shaw, Kyra Ferguson, Alexander Liberman, Lindsey young, Erin O'Kray-Murphy, and Beth Mitchell
Plasma Ball Project
Time: 9:30am to 9:55am

Nick Dannemiller
The Impact of Body Condition on Avian Influenza Infection Dynamics in Mallards After a Secondary Exposure
Time: 10:00am to 10:15am

John Shannon
Investigating Antigen-Specific T-Cell Responses to Influenza Infection
Time: 10:20am to 10:35am

Amanda Weber
Patterns of Snowmelt Rates across the Southern Rocky Mountains, U.S.A.
Time: 10:40am to 10:55am

From Fort Collins to Xishuangbanna: Research and Community Outreach

Lory Student Center Room 308

Kayla Fertman
Meet Rwanda
Time: 10:00am to 10:15am

Jacob Moore
Building SHOREline: Understanding the Impact of Disaster on the Children of Bayou La Batre
Time: 10:20am to 10:35am

Matthew Juneau and Mike Davis
The Echo- Educational Wildlife Film Series
Time: 10:40am to 11:05am

Francis Commercon
Participatory Processes and the Contribution of Local Knowledge for Restoration in a Rubber Dominated Landscape
Time: 11:10am to 11:25am

Megan Monacelli
Analyzing Compassion Fatigue Risks and Developing Coping Mechanisms Specific to Literacy Workers
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Carly Bergman
American Dream
Major: English

Eric Bleem
Nightlight
Four Chambered Heart
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Sri Krishna Bohora
Poem
Major: Mechanical Engineering

Lauren Brady
4:23
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Blake Burchard
Coma Toes
Major: Undecided

Bethany Calahan
The Contradiction
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Alexis Camella
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James D. Cao
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Dylan Drendel
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Courtney Ellison
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Emily Kingston
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Tristan Kubik
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Petra Leskanich
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Hannah Padbury
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Krystina Stellway
Red Haze
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John Vollinger
Singing Low
Major: English

Lindsey Whittington
Girl, Washed Up
Major: Biochemistry

Tianna Zachariah
"They are not you, and we are not the same"
Major: Business Administration

The Multicultural Undergraduate Research, Art and Leadership Symposium (MURALS) took place on Friday, April 1, 2016. This is a comprehensive list of the participants for this event. For complete abstracts, please go to www.murals.colostate.edu.

Fatma Al Ghassani and Lauryn Calvert
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Major: Zoology and Biological Science

Bethany Andrade
"I am Xicana"
Major: Sociology

Luz Castaneda
Congress Needs to Grant Undocumented College Graduates Citizenship
Major: Sociology

Keith Christian
The Effects of TPC2 on Melanosomes
Major: Biochemistry

Meagan Chriswell
Identification of Cryptosporidium species in Colorado animals
Major: Biomedical Sciences

Briana Compton
The Ethics of Seeing
Major: Political Science

Jamez Crawfordn
La Conexión: A Necessary and Beneficial Program for First Generation Students at CSU
Major: Political Science

Timothy Curry
Untitled
Major: Art

Jasmine Donkoh
Mosquitocidal Properties of IgG Targeting the Voltage Sodium in Malaria Vector Anopheles gambiae
Major: Microbiology

Deena Duwaik
A Binary of Palestinian Resistance
Major: International Studies

Oghene-okuko Efagene
Investigation of transcription-coupled DNA repair in Thermococcus kodakarensis
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Chynna Fayne and Kahlea Khabir
Was Integration a Sham?
Major: Sociology and Ethnic Studies

Kyra Ferguson
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Selena Gonzales
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Lydia Gonzalez
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Major: Human Development and Family Studies

Sharon Guzman
The Experiences of Minority Groups that Decide to Remain in STEM Majors at CSU
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Stephanie Herrera
Bridging the Gap Between DACAmented – ASSET Students and Higher Education Through Nuestro Sueño
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Tabythia Lee
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Colleen McCollum
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Hannah Mullaney
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Annie Ngo
Health Equity in the United States
Major: Human Development and Family Studies

Omoyemen Odia
The Power of the "Black Vote"
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Blessed Otabil
Purification of an archaeal transcription termination factor for in vitro studies and characterization
Major: Biomedical Sciences

Marcus Padia
Wind Energy: Moving Forward with a Little Direction
Major: Biomedical Sciences and Electrical Engineering

Jose Angel Saenz
RAW Image
Major: Undeclared

Dianahi Sanchez (International Studies)
Loss of Native Language by the second generation Latinos who moved from Mexico to America and have assimilated to the American culture
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Brissa Santacruz
Effects of Habitat Fragmentation on Potential Medicinal Values Found in the Rainforests
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Destiny Story
"What are you anyway?" A qualitative study of biracialism at CSU
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Donovan Tate
Modern Slavery: The epidemic of mass incarceration
Major: Social Work

Diane Thajeb
Beethoven Tempest 3rd Movement
The Music Box
Major: Business Administration

Lisbel Torres and Chiara Flores
Conditional Targeting of SMYD2 in Hematopoiesis
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Stephanie Torres Molinar
The Effects of Gender Role Attitudes and Behaviors of Parents on the Self-Esteem of their Children
Major: Social Work

Melba Torres Sosa
My Average, Fantastic, Unseeable Day
Major: Biological Sciences

Yohana Tuquabo
How Community Gardening is Saving Humans and Bees
Major: Health and Exercise Science

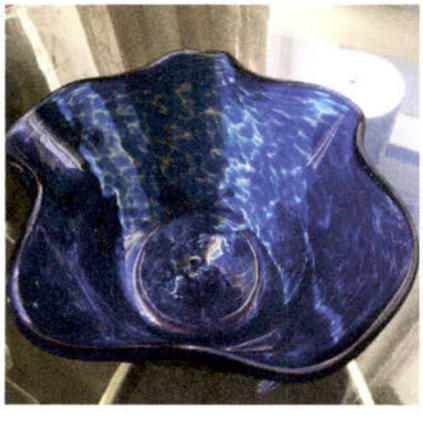
Jaysun Usher
The identity construction of fandoms of deviance
Major: Sociology

Tianna Zachariah
"They are not you, and we are not the same"
Major: Undeclared

Art Exhibition

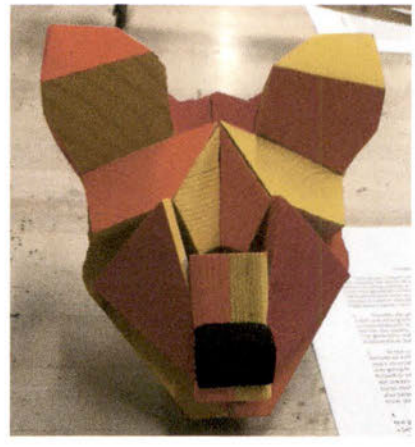
Joshua Horton
DarkSide of Tha CO
Major: Natural Resources, Recreation and Tourism

Noah Barkley
Explorer and the Explored
Major: Neuroscience



Tesia Barnes
CSU Themed Glass Bowl, Dream Dragon (not pictured)
Major: Biological Science

Angela Natrasevschi
Snowdrop
Major: Art



Britton Hart
Crystalligraphic Fox, Mixed Whiskey on the Rocks
Major: Art

Liz Hicks
Generation: Possibility
Major: Human Development and Family Studies

Jordyn Heyn
Window
Major: Art

Kristin Maxwell
Old Man Israel
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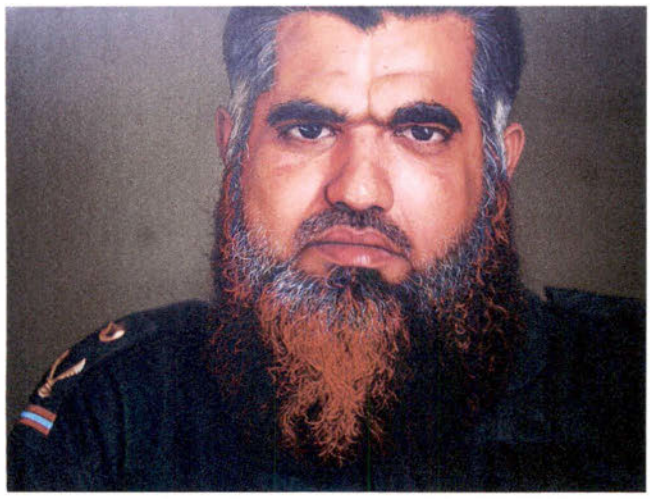
Allison Fyfe
Time Travelers
Major: Art

Andres Flores
Voices of War
Major: Art

Nicolette Tiongson
Last Flight (Front, Bottom, Open)
Major: Art

Douglas Hawkins
Cubist Study, The Portrait
Major: Art



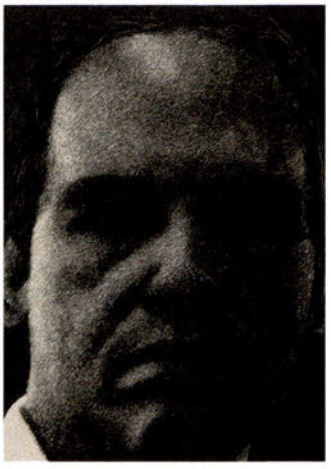
Matthew Knopf
Malik, The Elder
Major: Mechanical Engineering

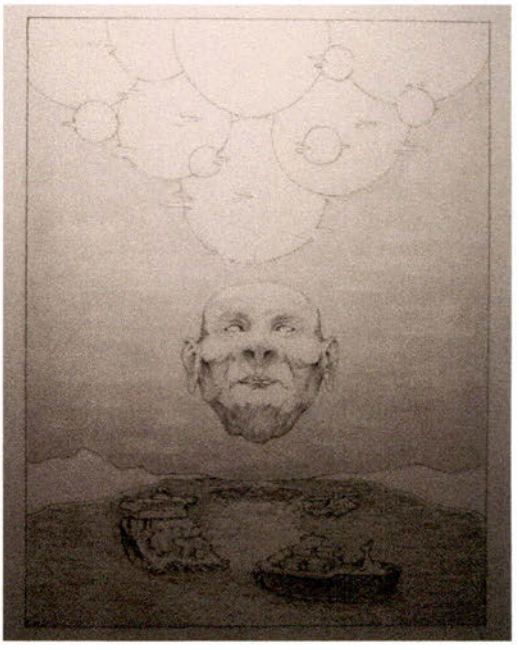
Haiyin Liang
Coming True, Going Back
Major: Art

Liheng Wang
Flower Dance
Major: Psychology

Cienna Semsak
Rainbow Lorikeet
Major: Zoology

Megan Kocina
Wildlife from Within
Major: Forestry





Dylan Trinkner
Degrading Perpexity
Major: Art

Noel Rodriguez Galvan
Untitled
Major: Forestry

Guillermo Michelena
My Dad, Choroni
Major: Physics

Paulina Svec
The Playful Instincts of the King and His Majesty
Major: Zoology

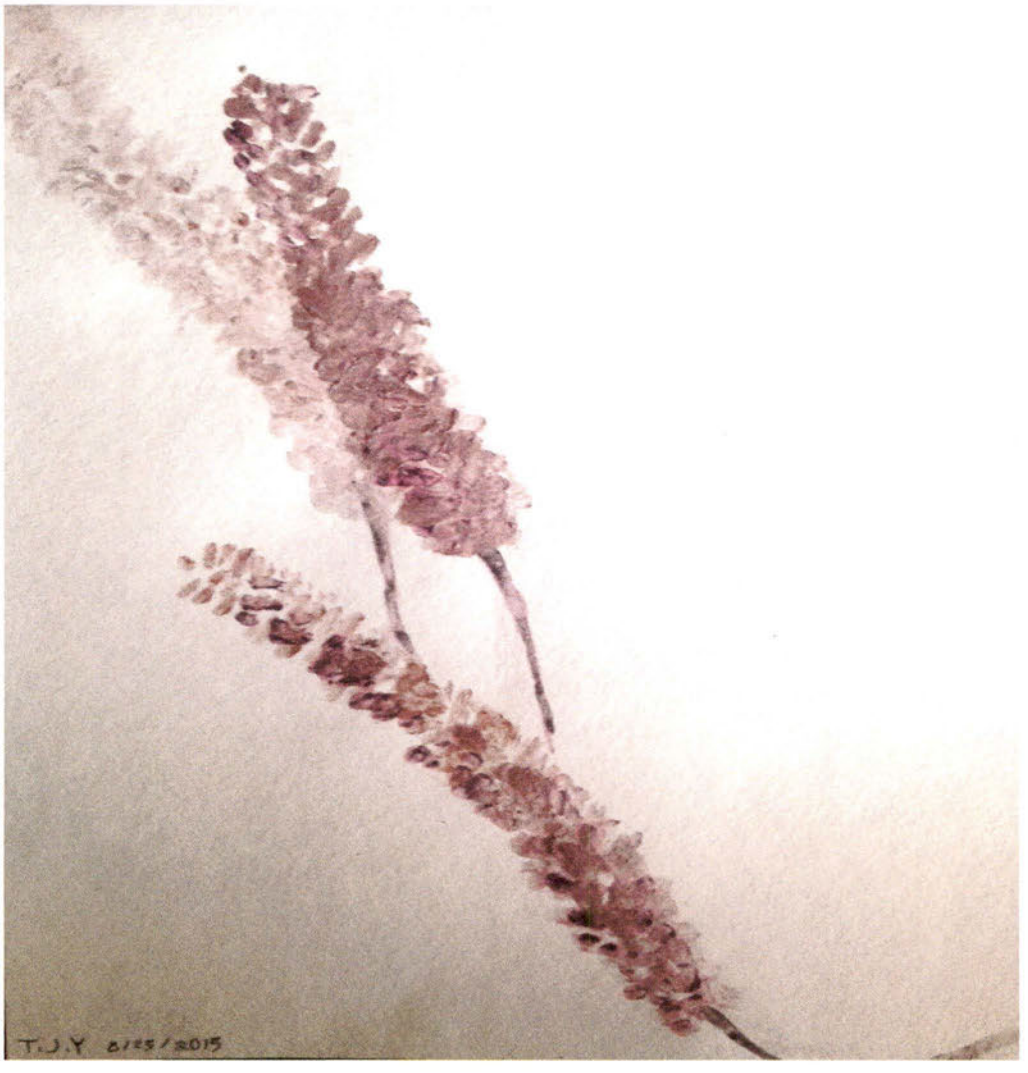
Tzu jui Yu
Lavender
Major: Computer Science

Lauren O'Brien
Beautiful Strength
Major: Journalism & Media Communications

Art Attributions

Cover art for the 2016 CURC Abstracts Program features work from all of CURC's art exhibitors. Several artists are also featured on section dividers for each college within the booklet.

College of Agricultural Sciences – Tzu jui Yu
College of Business – Andres Flores
College of Engineering – Allison Fyfe
College of Health and Human Sciences – Matthew Knopf
College of Liberal Arts – Douglas Hawkins
College of Natural Sciences – Noah Barkley
College of Veterinary Medicine and Biomedical Sciences – Cienna Semsak
Warner College of Natural Resources – Liheng Wang



College of Agricultural Sciences

14 Vending Machines with Local Products

XAVIER BARRIOS

MAJOR: AGRICULTURAL BUSINESS

FACULTY ADVISOR/MENTOR: TIM BRODERICK

Proposal for local & healthy vending Introduction In this alternative vending machines project we have chosen to foster local businesses as the main criterion for choosing products; nevertheless, there will also be emphasize on snacks with healthier nutritional values and sustainable practices. Creating greater awareness is important for the project to be successful, one way of doing this is by providing the nutritional information of the products. The main points that will be addressed in this analysis are: 1. The current economic impact of 'Eat Healthy' vending machines, as they are a good proxy for projecting the performance of a pilot project 2. A quick market segmentation study in order to identify the ideal location for launching the project 3. Shape our value proposition by both acknowledging consumer trends and using similar projects as benchmarks 4. Establishing our value proposition and a design that is congruent with it 5. Justification for optimal mix Value Proposition and design The focus of this project is to bring local alternatives to the current vending machines; looking at the main reasons why the CSU population buys snacks we see that eating something healthy is not mentioned anywhere. For this project to be feasible we must understand that vending machines offer treats and we know that processed foods are generally speaking less healthy than fresh foods. Of course we could offer fresh food if the vending machine where to be refrigerated and replenished on a daily basis, but this is not what we are proposing. What we are proposing is a Coloradoan vending machine; we want to offer local products to the CSU population. Without getting too caught up in nutritional comparisons we should avoid sugar packed snacks and instead focus on natural, minimally processed goods. This is a reflection of how Colorado in general is more conscious about eating healthy and about how food is made. Colorado based snack producers have a different approach than big umbrella companies and this enhances our value proposition because it is not only local products we will offer but also healthier ones. Another important aspect of this proposal is that consumers should have greater access to the nutritional information of a product (without having to buy it). The classic Colorado C design is public domain so it may be used by anyone. This would be a fairly simple design that people would identify with; it would also stand out in the monotonous academic buildings and the message would be clear; buy local products. It would not be hard to launch a marketing campaign that appeals to Coloradoan pride; nevertheless, there is a downside to focusing on local products only. Basically the new vending machines would have multiple products from the same brand and the total number of brands would be limited. In order for the criterion of only local products to intersect with healthy alternatives we will do an in depth analysis of Colorado brands and products focusing on nutritional contents.

22 Characterizing Root Architecture of Aegilops Tauschii for Wheat Germplasm Enhancement

MORGAN BOWEN

MAJOR: SOIL AND CROP SCIENCES

FACULTY ADVISOR/MENTOR: PATRICK BYRNE, ANGELA C. MOORE, AND SCOTT D. REID

Genetic diversity is required for progress in wheat breeding. However, there are concerns that adequate diversity to achieve major gains in yield potential, or for complex traits like drought tolerance, is lacking in modern wheat germplasm. Bread wheat (Triticum aestivum L.) is a hexaploid with three ancestral genomes. The D genome originating from the wild grass Aegilops tauschii (goatgrass) is known to have especially limited genetic diversity, thought to be result of evolutionary bottlenecks. We evaluated 45 accessions of goatgrass, comprising a mini-core collection representing the major genetic diversity available in germplasm banks, for root traits under water-limiting conditions. The experiment was conducted using 1 m deep, 10 cm diameter tubes filled with a calcined clay rooting medium. Seedlings were established with irrigation for 25 days, and then irrigation was withheld for an additional 21 days to observe root system traits in response to the fixed water supply. Differences among the goatgrass accessions were observed for root mass (and water extraction) at depth, and for root size fraction distributions with rooting depth. These results can help guide the selection of goatgrass accessions for introgressing novel variation to improve future diversity in bread wheat.

29 The Effects of Deworming Schedules on Fecal Egg Counts

CLARISSA CARVER AND STARLA DALE

MAJOR: ANIMAL SCIENCE

FACULTY ADVISOR/MENTOR: TANJA HESS, DVM, PHD

In the past many professionals in the equine industry believed that administering dewormer to horses on a regular schedule of about every 6 weeks, rotating through a few different deworming drugs, was the best way to prevent parasitic infections. In this experiment the number of parasite eggs found within the feces of study horses was used to determine when a deworming drug was appropriate to administer and which drug to administer. The samples were collected from fresh feces and then individually mixed with Fecasol floatation solution to isolate the eggs from the other material within the feces. The solution containing the eggs within it was then analyzed under a microscope and the egg cells present were counted. Horses with a total egg count below 500 were not given any medication to address the parasites, while horses with more than 500 eggs in the sample were given a dose of deworming medication. The most common parasitic egg seen within the experiment were strongyles and the vast majority of horses maintained a low level of fecal egg counts throughout the experiment with little medication given. syndrome. Understanding the effects of season on pasture can help owners properly manage horses that are susceptible to insulin resistance.

123 reNEW Hughes

AUSTIN LUCERO
MAJOR: LANDSCAPE ARCHITECTURE
FACULTY ADVISOR/MENTOR: BRAD GOETZ

This study explores the possible future uses of Hughes Stadium. The main research problem is to preserve the existing infrastructure, and with it create a space that benefits the Fort Collins and CSU communities. This project focuses on exploring design concepts that are both innovative and attainable. Through the investigation of site programing, construction and cost estimation, this study found three plausible alternatives for the future of Hughes Stadium. These design alternatives were found to be constructible, both in a practical and economic sense, as well as desirable by the surrounding city and University community. Due to a certain lack of precedent projects, most research comes from examining specific design and program elements devoid of a "stadium" context. Each program element is firstly examined using the criteria set forth, being constructability, cost and viable use by the community. The following elements were researched in this manor: terraced gardens, track and field facilities, amphitheater, housing, sports complex, agricultural land, greenhouse, park, green roofs, constructed water body, recreational trails, sledding hill, ski slope, horticultural and agricultural research centers. All these elements were then developed within the context of Hughes Stadium and found to be either plausible or implausible, due to any number of conflicts with cost, construction or community engagement. Program elements that were deemed feasible were then combined to form the design alternatives. Also included in this study are renderings and plans associated with each alternative. It is important to give an idea of the look and feel of each alternative to help further evaluate which design might be best suited for the future of Hughes Stadium.

151 Evaluating Bee Diversity and Abundance in fields of Genetically Modified Herbicide Tolerant Canola

COLTON O'BRIEN
MAJOR: SOIL AND CROP SCIENCES
FACULTY ADVISOR/MENTOR: ARATHI SESHADRI

Widespread integration of Genetically Modified Herbicide Tolerant (GMHT) crops into modern agriculture has resulted in serious unintended consequences, the most important being the elimination of flowering weeds along field margins. GMHT varieties are especially popular as herbicides that act selectively on weeds facilitate the growth of crops that are otherwise sensitive to weed competition. Extensive herbicide application thus eliminated prairies and wildflower habitats that provided critical nutrition and nesting sites for bees. Canola (Brassica napus), a mass flowering crop, provides a wealth of pollen and nectar but elimination of noncrop flowering vegetation near canola fields has seriously impacted pollinators due to loss of forage options after canola bloom. Ecological studies in GMHT canola fields found reduced bee abundances but bee visitation is critical to increase yields in crosspollinated canola. In this study, we aimed to determine the efficacy of a field management protocolwildflower borders in GMHT canola fields. Using two GMHT canola fields, one restricted to canola only while the other field included a wildflower strip on the field edge, we evaluated bee abundance and diversity in canola fields and the wildflower strip. Preliminary analyses indicate that several bee species not found in canola fields, inhabited the wildflower strip supporting our premise that bee diversity is higher in the presence of noncrop vegetation. Bee abundance in canola fields and wildflower strips was similar indicating that these strips provide spillover habitat. Our results also reveal that conserving seminatural habitats while simultaneously incorporating crop diversity into farmland help sustain pollinator diversity.

212 Metabolism of Chlorsulfuron in Kochia Scoparia

OLIVIA TODD
MAJOR: SOIL AND CROP SCIENCES
FACULTY ADVISOR/MENTOR: TODD GAINES

Kochia (Kochia scoparia) is an invasive weed highly resistant to acetolactate synthase (ALS) inhibitors, such as chlorsulfuron. The genetic mechanism for this resistance has been normally observed to be a target-site (TS) mutation in the ALS gene. However, it is suspected that kochia has evolved a non-target site resistance (NTSR) mechanism to the ALS inhibiting herbicide chlorsulfuron in two populations referred to as J9 and J10, collected from eastern Colorado. J9, J10 and two control populations with the TS mutation were sprayed with chlorsulfuron, with and without malathion, an insecticide known to inhibit cytochrome P450 activity, preceding the treatment to assess resistance and re-induce susceptibility. Growth following the combination of chlorsulfuron plus malathion in J9 and J10, measured in plant height and biomass following treatment, supports the hypothesis that the candidate populations J9 and J10 have an NTSR mechanism. Analysis of the ALS gene in J9 and J10 revealed no target site mutation, thereby supporting the idea of resistance due to increased chlorsulfuron metabolism.

College of Business

104 Integrating Databases at Great Sand Dunes National Park and Preserve

AARON ILLENBERGER
MAJOR: BUSINESS ADMINISTRATION
FACULTY ADVISOR/MENTOR: GRETCHEN CASTERELLA

The great outdoors and especially America's National Parks have always been a part of my life. My father and my grandfather have both worked as rangers in the National Park Service at some point in their lives. I have just completed my forth season as a ranger at Great Sand Dunes National Park and Preserve. I have been very fortunate to be given the opportunity to welcome visitors to this beautiful park. I may have lived in the area all my life but the ecosystem and the wildlife of the sand dunes and the surrounding mountains still amaze me. I find joy in my work seeing visitors in awe when they see the immensity of the dunes as it sits in the middle of the Rockies. Working in fee collections, I have had first-hand experience on the operations of how national parks collect and process fees. The methodology of this process has remained the same for many years. Working in this field for many summers has subtlety diverted my focus to the inefficiencies and shortcomings of the current process. As a business and computer information systems major, I have been always piqued by how technology can improve daily tasks. Technology has changed the way we interact with the world around us and here it can also be instrumental in removing the barriers that the current system presents. This thesis will allow me to explore solutions to improve information management and data collection. This project explores ways to improve the daily tasks and processes of fee collection and management.

117 Plasma Ball Project

COBY LASATER, JORY COATES, NORMAN REVERE, THOMAS SHAW, KYRA FERGUSON, ALEXANDER LIEBERMAN, LINDSEY YOUNG, ERIN O'KRAY-MURPHY, AND BETH MITCHELL
MAJOR: BUSINESS ADMINISTRATION
FACULTY ADVISOR/MENTOR: BRIAN JONES

We are getting a group together to research and create a plasma ball and see what has to happen for it to work and get to the point of what we want it to be for others to see and watch. We are starting from the very beginning with building the tesla coil and seeing what we need to get what we want and then figuring out how to put the tesla coil in an 18" glass ball while finding a way to get all the air out and putting in the gas we want for it to look the way that we want it to and then constructing a base around it while being able to have people still see the inside of it. and computer information systems major, I have been always piqued by how technology can improve daily tasks. Technology has changed the way we interact with the world around us and here it can also be instrumental in removing the barriers that the current system presents. This thesis will allow me to explore solutions to improve information management and data collection. This project explores ways to improve the daily tasks and processes of fee collection and management.

136 Sustainability in Finance

MALIA MICHEL
MAJOR: BUSINESS ADMINISTRATION
FACULTY ADVISOR/MENTOR: FRANK SMITH AND ALAN BRIGHT

I am analyzing the link between companies who utilize sustainability practices in their business and the positive influence that can have on earnings. Specifically, looking at Bloomberg's Environmental, Social, and Governance (ESG) scores and the companies earning announcements. I am trying to prove the significance of doing good for the planet will positively correlates to an increase in profits.

143 Effect of National Recessions on Major League Baseball Fan Attendance

KELLY MOORE, AND SPIRO HRISTOPOULOS
MAJOR: BUSINESS ADMINISTRATION
FACULTY ADVISOR/MENTOR: DR. NANCY JIANAKOPLOS

For this project, we have researched the effects of major national recessions on major league baseball fan attendance. We have evaluated to which extent a decrease in disposable income will cause Americans to forgo their favorite pastime.

221 Modeling Uncoupling Affect of Benzoic Acid on Mycobacterium Tuberculosis

KATARINA WERST AND NICOLE SEGALINE
MAJOR: BUSINESS ADMINISTRATION
FACULTY ADVISOR/MENTOR: DEBBIE CRANS AND BENJAMIN PETER

Latent Mycobacterium tuberculosis (TB) is estimated to be infecting one third of the world's population. At certain concentrations, benzoic acid mimics the lethal pH dependent effects of a commonly used drug, pyrazinamide. At these concentrations, benzoic acid collapses the pH across the membrane of TB. This data is supported by a pH dependent penetration of a membrane (1). To study these pH and concentration effects further, a liquid membrane model system was used in a novel way. Over a twelve hour period, pH was monitored as benzoic acid diffused across a bulk liquid membrane. This data was compared to minimum inhibitory concentration (MIC) values of benzoic acid on TB. There is a strong correlation between the two. By exploring this correlation further, it could be possible to study certain bacterial effects in a much simpler way, and demonstrates a potential model membrane system. References: (1) Benjamin J. Peters, Debbie C. Crans. (2016). "Benzoic acid interactions with model membrane interfaces." Manuscript in preparation.

College of Engineering

8 Improvement of Ice Nucleation Device

FADIL ALZAYER

MAJOR: MECHANICAL ENGINEERING

FACULTY ADVISOR/MENTOR: ARUN KOTA

Proper characterization of ice nuclei was found to be significant for the understanding of cloud formation. True understanding of the ice nucleation particles can, in the future, lead to human stimulation of rain. There is an ice nucleation devices that have the capability of measuring ice nuclei properties under certain conditions of temperature and supersaturation. This device consists of two ice coated concentric copper tubes. Air, containing aerosol particles, is sent in between the concentric copper tubes and clouds form in accordance with the physical and chemical properties of those aerosol particles. As previously mentioned, this device need to operate in a specific thermal conditions. This is why every time measurements are to be taken, the copper chamber has to be coated with ice and specific temperature and pressure is maintained in between the copper cylinders. The problem here is that annular gap between the copper cylinders is very small (about 10 mm). Because of the hydrophilic nature of copper, the ice forms a jagged layer on the surface. This induces errors in the device measurements. My project is mainly focused on chemically modifying the copper tubes surface structure to produce a superhydrophilicity on its surface. The superhydrophilic surface chemistry would make the ice layer formed on the copper thin and smooth. That would ultimately reduce a lot of errors in the ice nuclei measurements. This project is carried out in collaboration with CSU's atmospheric sciences department.

52 Potential Effect of Nitrogen Deposition on the Mountain Harebell and its Pollinators

RYAN DAVIS

MAJOR: ENVIRONMENTAL ENGINEERING

FACULTY ADVISOR/MENTOR: JILL BARON AND CHERYL BESELER

Campanula rotundifolia (mountain harebell), a slender rhizomatous perennial herb flowering from June to September, is found from the foothills to the alpine in meadows and slopes across the globe. Mountain harebell is pollinated by insects such as bees, but little is known about the biodiversity of these pollinators in the Colorado Front Range. The Front Range has an ecological heterogeneity that may serve as a sample area for the greater North American subalpine and alpine. The Front Range is also an area with a strong gradient in the amount of wet atmospheric nitrogen (N) deposition, with greater N deposition occurring at high elevations east of the divide and lower deposition occurring west of the divide and at lower elevations. N deposition has been shown to alter the foliar nutrient composition of plants, but little is known about whether it influences the stoichiometry of flowers and nectar, thus influencing insect behavior. I plan to establish plots containing mountain harebell along an elevational transect in the Colorado Front Range at locations east and west of the continental divide in summer 2016, and observe the numbers and types of pollinators during the flowering season. Insects will be identified to species. Tissue samples (leaves, flowers, stamen and pollen) will be collected and analyzed for foliar nutrient concentrations. This exploratory study will help to identify whether there is a potential effect of N deposition on insects.

53 Lithium Ion Sieve

KELSEY DEAN

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: DR. YAN (VIVIAN) LI AND AARON WANG

The demand for lithium has increased significantly during the last decade and has become critical for development of industrial products, such as batteries for electronic devices and electronic vehicles. Brine lake deposits, pegmatites, seawater, and clays are all major sources of lithium. In seawater, lithium can be recovered by membrane processes, ion-exchange resins, co-precipitation, solvent extraction, and adsorption. Adsorption using manganese dioxides (MnO2) to recover lithium as a chloride salt is promising because of its high selectivity and sorption capacity in alkaline medium.The goal as an undergraduate was to continue researching and createing lithium ion-sieve nanoparticles, with selectively and absorptivity of lithium from brine water.

63 The Demonstration of a Physiologically-based Pharmacokinetic Model to Predict Rifapentine and 25-desacetyl Rifapentine Disposition in Humans

GARRETT EPPERS

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: DR. BRAD REISFELD AND TODD ZURLINDEN

Rifapentine (RPT) is a rifamycin antimycobacterial and, as part of a combination therapy, is indicated for treatment of pulmonary tuberculosis. The use of RPT is a viable option to shorten treatment duration and enhance completion rates, but an optimal dose and exposure are currently unknown. To inform an optimal RPT dosing regimen, a physiologically-based pharmacokinetic (PBPK) model was developed to predict drug concentrations of RPT and its metabolite, 25-desacetyl rifapentine (dRPT), in human tissues over time. The PBPK model was developed and tested using tissue-specific concentrations in rats. The model was then extrapolated and verified using human-specific pharmacokinetic data under single- and repeated-dosing scenarios. Finally, the model was used to predict RPT and dRPT concentrations in the lung through simulations of the intensive and continuation phases of a current recommended TB regimen. It is anticipated that this model will be useful in optimizing and evaluating dosing regimens for RPT and characterizing the resulting tissue-specific concentrations.

77 Skills for Success: Developing Innovative Workshops for University Students

MICHELLE FYLAK, HALEY KRAMPETZ, AND ALEX SZABO
MAJOR: MECHANICAL ENGINEERING
FACULTY ADVISOR/MENTOR: DARRIE BURRAGE

College students are expected to demonstrate various skills in both academic and professional contexts such as problem solving, collaboration, and stress management, among numerous others. Many of these competencies are perceived to be innate; however, attaining and maintaining these pertinent skills often require extra time and assistance to develop. In an effort to help students advance their skills, The Institute for Learning and Teaching (TILT) at CSU offers a semester-long Academic Success Workshop series. These free workshops provide all university students with the tools needed to sharpen existing skills and succeed academically and professionally. In Fall 2015, feedback was gathered from diverse faculty, staff, and students on a proposed list of novel academic-related topics. A small group of TILT student staff, in collaboration with various university offices, developed new workshops that were piloted this Spring. Collaborators included offices such as Conflict Resolution, the Kendall Anderson Nutrition Center, and the CSU Health Network. Each week throughout the semester, a different workshop is offered to students that varies from becoming proficient in Excel to learning which foods promote optimal brain activity. Surveys are administered to all attendees, and interviews are conducted with randomly selected students who attend the workshops to ensure that content is as beneficial as possible. Unique to CSU, the newly created Academic Success Workshops are far-reaching in their impact on student development as they seek to enrich skills that will supplement their personal and academic endeavors.

105 Examining the Role of the Endoplasmic Reticulum in Arterial Dysfunction

DILLON JARRELL
MAJOR: CHEMICAL ENGINEERING
FACULTY ADVISOR/MENTOR: CHRISTOPHER GENTILE, MICAH BATTSON, AND DUSTIN LEE

Cardiovascular disease (CVD) is the leading cause of death in men and women both in the United States and globally. Dysfunction of the innermost layer of blood vessels, the vascular endothelium, is an independent risk factor for CVD and predicts future cardiovascular events. Although the underlying mechanisms by which endothelial dysfunction develops are unclear, accumulating evidence suggests that endoplasmic reticulum (ER) stress may be one important factor. The general aim of ongoing studies in our laboratory is to examine the role of ER stress in the development and progression of endothelial dysfunction. Data presented herein were generated from recent studies in cell culture models and experimental animals. Collectively, the data suggest that ER stress plays an important role in the development of endothelial dysfunction, and identify ER stress as a potential therapeutic target.

111 Identification of Poly-(C) Binding Protein Associated RNA Decay Factors

WAHIDA KHAN
MAJOR: CHEMICAL ENGINEERING
FACULTY ADVISOR/MENTOR: JEFFREY WILUSZ AND JOE RUSSO

Poly-(C) Bindings proteins (PCBPs) regulate various stages of gene expression including transcription, mRNA stabilization, and translational activation. Two PCBPs of interest are PCBP3 and PCBP4. Based on previous research, PCBP3 is highly expressed in induced pluripotent stem cells (iPSCs); however, it is barely detectable in human foreskin fibroblasts (HFFs). The converse is true of PCBP4; it is highly expressed in HFFs but barely detectable in (iPSCs). Therefore, the long-term goal is to investigate how robust changes in these PCBPs affect mRNA decay within differentiated cell lines (HFFs) and undifferentiated cell lines (iPSCs, and cancerous cells). The aim of this project is to identify additional mRNA decay factors that are directly associated with these PCBPs through protein-protein interactions. To address this problem, we created stable HeLa cell lines that express a FLAG-tagged PCBP of interest. The expression was confirmed with qPCR and Western blots of extracted mRNA and FLAG proteins from whole cell lysates. These FLAG-tagged proteins were extracted from whole cell lysates by co-immunoprecipitation with a FLAG-specific antibody. Proteomic mass spectrometry was used to identify associated proteins. These results were then confirmed with Western blotting.

113 Canine Exoskeleton for Mobility and Rehabilitation

HALEY KING, KATELYN HARADA, JEREMY VALADES, JACOB BRYANT, AND DANIEL VANCE
MAJOR: MECHANICAL ENGINEERING
FACULTY ADVISOR/MENTOR: ANURA JAYASUMANA

The purpose of this interdisciplinary project, consisting of biomedical, computer, electrical, and mechanical engineers, is to develop an electronically controlled active exoskeleton that improves mobility and rehabilitation in the partially paralyzed/weakened hind limbs of canines. Many dogs suffer from conditions that cause paralysis or weakness of the hind limbs. However, owners have very limited options to use wheelchairs or other relief devices that do not help the dog regain strength or neurological function. There is a need for a physical therapy device that not only provides mobility, but has the capability to rehabilitate the canine as well. After extensive research and collaboration with the CSU Veterinary Teaching Hospital veterinarians and our corporate sponsor Orthopets, customer requirements determined that a fully actuated, wearable hind limb exoskeleton was the best way to load legs for rehabilitation while still providing mobility. A biomechanically accurate hind limb dog model was developed for use with testing the system. A dog was measured and a custom brace system instrumented with sensors was fabricated. Then, a second, actuator brace system was created that supported

the hind-limb dog model previously fabricated. With the design and manufacturing of a cart attached to the actuator brace system, the data from the live dog brace sensors is inputted into the actuator brace system, which moves the cart forward. This two-brace system provides proof of concept and, with further testing, will eventually be combined into one system that will rehabilitate and mobilize a paralyzed canine.

115 Electrolytic Degradation of 1,4-dioxane with Titanium Dioxide Catalyst

ALEXA KINSINGER

MAJOR: ENVIRONMENTAL ENGINEERING

FACULTY ADVISOR/MENTOR: JENS BLOTEVOGEL AND JERAMY JASMANN

Emerging ground water contaminants are a large issue for environmental and human health. 1,4-dioxane has been widely used as a stabilizing agent in chlorinated solvents, and has commercial uses in production of textiles, plastics, and personal care products such as shampoo and cosmetics. It is classified as a carcinogen and can have serious health effects on humans if exposed to large dosages through contact, inhalation, or consumption. In recent years, 1,4-dioxane has emerged as a groundwater contaminant throughout the United States. The low sorption coefficient, low vapor pressure, and high miscibility of 1,4-dioxane in water make treatment difficult. Current treatment processes are not economically feasible and can not be performed in situ. The purpose of this study is to develop an effective and economical in situ treatment of 1,4-dioxane contaminated groundwater using Advanced Electrochemical Oxidation (AEO) and titanium dioxide (TiO2) catalysts.

129 Plasma Polymerization and Characterization of an Antibacterial Thin Film Derived from Essential Oils

MATTHEW MAYNARD

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: ELLEN R. FISHER AND MICHELLE N. MANN

Plasma polymerization and characterization of an antibacterial thin film derived from essential oils (Matthew R. Maynard1, Michelle N. Mann, and Ellen R. Fisher, Department of Chemical and Biological Engineering, Colorado State University, Fort Collins, CO 80523 Department of Chemistry, Colorado State University, Fort Collins, CO 80523) Porous polymers, such as biomedical devices and ultrafiltration membranes used for water filtration, have surface properties that encourage the attachment of bacteria and adsorption of biomolecules, limiting their use in environmental and medical applications. Specifically, bacterial attachment leads to biofilm formation, which causes device failure and increases healthcare costs and risk to human health. To mitigate bacterial attachment, various techniques to coat polymeric materials have been explored, including plasma polymerization to deposit films. Here, we use eucalyptol (1,8-cineole), a constituent of tea tree oil, as a plasma precursor, and the resulting films demonstrate a significant decrease in attachment and viability of Escherichia coli. Both bulk and surface composition of the resulting films are characterized using Fourier Transform Infrared Spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS), respectively. Film wettability, measured using water contact angle (WCA) goniometry, and film stability are optimized by varying plasma parameters. Optical Emission Spectroscopy (OES) is utilized to identify excited state species present in the plasma over the parameter space. By monitoring the gas phase species present in the plasma and observing the composition and properties of the resultant plasma polymerized films, we can deposit films to optimize the performance and extend the lifetime of polymeric devices.

140 Development of TLUD Gasifier Cookstoves

JEFFREY MOHR

MAJOR: MECHANICAL ENGINEERING

FACULTY ADVISOR/MENTOR: ANTHONY MARCHESE, JESSICA TRYNER, AND JAMES TILLOTSON

Approximately 2.8 billion people worldwide currently use biomass-burning cookstoves that contribute to household air pollution by emitting particulate matter and harmful gases such as carbon monoxide (CO). This pollution is believed to contribute to 3.5 million deaths annually. Cookstove performance is rated using a system that consists of Tiers 0 through 4 with Tier 4 having the lowest emissions. Many conventional and improved cookstoves perform in the Tier 0 to Tier 3 range. Top-lit up draft (TLUD) gasifier cookstoves show potential for achieving Tier 4 emissions; however, small changes in design and operational parameters can result in drastic changes in emissions. Inside of a gasifier cookstove, a bed of solid biomass fuel is ignited from the top and supplied with a limited amount of primary air from the bottom. A combustible gas comprised mainly of CO and hydrogen is released from the fuel bed and rises through the stove until it mixes with secondary air and burns. This process has been investigated by measuring emissions from a modular TLUD test bed in a laboratory fume hood and by collecting planar laser-induced fluorescence and chemiluminescence images of the secondary combustion zone using a model TLUD with optical access. The knowledge gained from these experiments is currently being used to develop a prototype commercial TLUD that achieves Tier 4 performance ratings. Developmental challenges include methods of air delivery that provide the required velocities and control of the cooking temperature.

156 The Study of Vitamin K Analogs in their Structural Confirmation and Interaction with the Novel Enzyme MenJ

THOMAS OLSON

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: DEBBIE CRANS AND JORDAN KOEHN

As of 2014, 1,300,000 people died of Mycobacterium Tuberculosis (TB) and 9,600,000 contracted TB yielding a mortality rate of 15%1 . Current medical practices are incapable of curing the drug-resistant mutant. In 2014, there were 489,000 cases of Multidrug-resistant (MDR) TB with a 25% death rate. Also, there were 40,000 cases of extensively drug-resistance (XDR) TB with an expectancy rate of 50%. 2 In recent experiments, a new enzyme-MenJ-was discovered. Not much is known about MenJ and is subsequently the center of research. It's known that this novel enzyme is a reductase for vitamin K and has been linked to the electron transport chain and virulence. Vitamin K is a menaquinone couple to an isoprene tail. Our group has conducted synthesis and NMR analysis of vitamin K analogs. These vitamin K analogs are of interest because they resemble vitamin K but have some structural differences in the tail of the molecule. So far, experiments have been conducted to synthesize and purify several menaquinone couplings with isoprene tails. These isoprene tails are unsaturated at the second isoprene. These analogs can be assayed with MenJ and we will test the electrochemistry of the reduction. We will also test the conformation of the molecule in the cell membrane by 2d NMR. These analogs will provide us with valuable information of the analogs including their interaction with the cell membrane, electrochemistry with MenJ, and effect on the virulence of MenJ. This information will assist in the understanding of the enzyme MenJ and TB.

181 DNA Replication in the Archaeal Organism Thermococcus Kodakarensis

TREVOR ROSS, JENNA KLINK, AND BROOKE DAVIS

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: CHRISTOPHER GENTILE, MICAH BATTSON, AND DUSTIN LEE

Throughout the three domains of life, DNA replication is a vital function necessary for the survival of all organisms. The hyperthermophilic model archaeal organism Thermococcus kodakarensis, living in thermal vents up to 95C, has evolved DNA replication mechanisms that are able to function at these high temperatures. Unlike members of the model bacterial and eukaryotic domains, DNA replication in archaea is not fully understood. Certain members within the archaeal domain have been characterized and are more similar in replication architecture to eukaryotes. The availability of genetic tools allows the DNA replication process and factors involved in Thermococcus kodakarensis DNA replication to be more understood. The replicative process contains a number of different mechanisms, including a helicase, primase and a DNA polymerase complex that are believed to be specific to archaea and Thermococcus kodakarensis. These different processes reflect the environment in which the organism is found as well as their evolutionary history. A number of additional elements are also present in the replication mechanism and they will be discussed in further detail in the presentation. The presentation will also compare and contrast this mechanism with that of the more known bacteria and eukaryotes.

185 Small Molecule Inhibition of SMYD2

RYAN RYKHUS, JEFFERY BENNETT, MEGAN HAMRICK, KRISTA HENDERSON, MICHAELA GOOD, AND CHRISTINE SOBOLEWSKI

MAJOR: MECHANICAL ENGINEERING

FACULTY ADVISOR/MENTOR: DR. MARK BROWN

The goal of this project was to find a small molecule inhibitor for the SMYD2 lysine methyltransferase protein. SMYD2 should become inactive in humans after the gestational period; however, in some adults SMYD2 is expressed and instigates a tumorigenic cascade which leads to colorectal, hepatocellular, and breast carcinomas. The initiation of this cascade starts when nuclear proteins are methylated by SMYD2. To prevent the cascade from starting, SMYD2 must be inhibited. The aim was to design a small molecule that outcompetes SMYD2's cofactor S-adenosylmethionine (SAM) that will not methylate nuclear proteins like SAM, therein stopping these tumorigenic cascades. Based on the structure of SMYD2 around SAM's binding site, we first created a library that contained millions of possible small molecules to replace SAM. To reduce the number of possibilities, we used computational dynamics to determine the feasibility of each molecule. We then modeled the behavior of the subset group of proteins with the SMYD2 protein to isolate a smaller set which could be tested in a lab. A continuation of this research would be to create or order the small library of inhibitors and test them in a cell line. Progressing, the successful inhibitors would be tested on rats. If one or more were shown to be effective the inhibitor could eventually become a commercial drug that prevents the spread of the most common cancer in the U.S. (breast) or the most deadly cancers (colorectal and hepatocellular).

202 Nitric Oxide Releasing Polysaccharide Coated Titanium Dioxide Nanotube Stent

JOSEPH STAVER

MAJOR: CHEMICAL ENGINEERING

FACULTY ADVISOR/MENTOR: MELISSA REYNOLDS, KETUL POPAT, AND MATT KIPPER

Stents are commonly used to treat coronary artery disease by opening blood vessels. The two main categories of stents in use today are bare metal stents and drug eluting stents. The bare metal stent has been found to cause restenosis, while the drug eluting stents are prone to induce clotting issues such as thrombosis. These

pathological responses can lead to failure of the stent. The ability to create a stent that mimics the endothelial glycocalyx, which is a polysaccharide rich extracellular matrix found on the interior lining of blood vessels, would greatly reduce these side effects. For a novel stent design, we are coating titanium dioxide (TiO2) nanotube arrays with a series of polysaccharide bilayers composed of heparin and chitosan-thioglycolic acid. We then nitrosate the surfaces, which allows them to release nitric oxide. Nitric oxide, which is a free radical produced naturally by endothelial cells, serves to inhibit platelet adhesion, aggregation and activation on the stent surface, thereby decreasing the potential for clotting. The polysaccharide coated nanotube surfaces are glycocalyx-mimetic, which is designed to increase the blood compatibility of the stent. Results from in vitro plasma studies have been promising, showing a significant decrease in platelet adhesion, as well as a decrease in platelet aggregation and activation on the coated surfaces.

233 Characterization of a Lobe Pump Design for use in Air Sampling Applications

KIRSTEN ZIMMERLE

MAJOR: MECHANICAL ENGINEERING

FACULTY ADVISOR/MENTOR: JOHN VOLCKENS AND DAN MILLER-LIONBERG

Exposure to gas and particulate matter in the workplace is a major contributing factor to respiratory diseases around the world. Occupational exposure alone accounts for approximately 15% of asthma and COPD cases worldwide (American Thoracic Society, 2003) (Schulte, 2005). However, it can be very costly to perform personal exposure measurements to determine to what degree groups of people are being exposed to aerosols. Hardware costs, particularly the cost of sampling pumps, contribute substantially to this issue, particularly in high flow rate applications. A lower cost, high flow personal air sampling pump would reduce the financial burden of conducting measurements, thus allowing more measurements to be conducted over a wider range of applications. In this project, an air sampling pump design which utilizes a rotary lobe design is investigated, and its utility as a pump for personal air sampling is evaluated. While this type of design is common in many pumping applications, it is not seen in air sampling pumps currently on the market. The flow capability, pressure capability, and power consumption of the device, as well as the ability to control the air flow level, were characterized using an automated test bench. It was found that the lobe pump design can pull up to 10 LPM at a load of 15 inches of water, or up to 20 LPM at a load of 5 inches of water. These results are commensurate with commercially available pumps, and the design shows merit as a possible alternative device for personal exposure monitoring applications.

College of Health and Human Sciences

15 RE-Mind

JESSICA BARTMANN, KYLE FOWLER, AND STEPHANIE HULSEBUS
MAJOR: HUMAN DEVELOPMENT AND FAMILY STUDIES
FACULTY ADVISOR/MENTOR: KAREN BARRETT

RE-Mind is a program designed to aide children work on their emotional, peer, hyperactivity, conduct, and pro-social difficulties through identifying emotions and working through various scenarios. This intervention strategy is meant to keep the child in mind while teachers administer it in their early childhood classrooms. Once researchers are able to train the teachers in the process of helping students with naming and working through their negative emotions, they are then trusted to use the Re-Mind intervention continually in their classroom to yield positive results in child problems in emotionality, peer relations, hyperactivity, conduct, and pro-social behaviors. When children are displaying these difficulties it can negatively impact their connections with peers and teachers. In this context of early childhood centers, it is key to work with these children to insure they thrive in that environment. This means being aware of their own emotions and how they are potentially impacted others around them either positively or negatively. This study compared students enrolled at two different centers with problems that parents were seeing from their children before the RE-Mind intervention was administered and again after it began. However, currently no significant changes in child emotional, peer, hyperactivity, conduct, and pro-social difficulties could be found. More analyses will be done with research that is being continually collected from these two centers with more complete data sets about children difficulties. This research is a continuous process, so more data will be evaluated as it is received in hopes of finding significant results.

16 Bellevue Dental Center

CECILIA BATISTA
MAJOR: INTERIOR DESIGN
FACULTY ADVISOR/MENTOR: LAURA MALININ

Bellevue Dental Center is located in the heart of Bellevue, Washington, which is in the suburbs of Seattle. This community is currently growing rapidly and is a great place to introduce a dental healthcare center. The purpose of Bellevue Dental Center is to change the dental experience for the residents in the community. Negative thoughts and experiences are often linked to dental healthcare one has experienced in the past. This space will give a safe, convenient and welcoming environment for patients to feel comfortable entering, not only once, but for regular check-ups. The main key for Bellevue Dental Center is to encourage residents and facilitate the process of visiting a dental healthcare specialist on a regular basis. The state of Washington has high numbers of untreated dental issues. These issues could develop to more serious health issues if not taken care of. Aside from the dental healthcare providers, Bellevue Dental Center will also be a base for hands on experience in connection to a Hygiene School that will be connected to University of Washington to help engage the community.

19 Exploring Experiences in the "Enliven Mama Africa" Seamstress Class

SARAH BIBBEY
MAJOR: SOCIAL WORK
FACULTY ADVISOR/MENTOR: EUNHEE CHOI, CARIDAD SOUZA, AND REUBEN ADDO

This presentation uses qualitative research to address the experiences of students in a seamstress class in Ghana which is sponsored by an NGO, Enliven Mama Africa. The research provides suggestions for the NGO to strengthen their practices.

30 A Comparison of Accelerometers and Force Platforms in Measuring Postural Stability

NOLA CATLOW
MAJOR: HEALTH AND EXERCISE SCIENCE
FACULTY ADVISOR/MENTOR: RAOUL REISER II, BRIAN TRACY, AND KIMBERLY BURKE

Force platforms are an important tool for quantifying postural stability. However, they are not practical for many settings because they are expensive, require training to operate,and are not portable. The goal of this study is to assess iPod accelerometers, which are inexpensive, easy to use, and widely accessible, as potential replacements for force platforms. Twenty young adult (YA) and twenty older adult (OA) subjects participated in two trials. The first was quiet stance with eyes open (EO), the second was quiet stance with the eyes closed and head tilted back (EC). Both trials were completed on a force platform with an iPod attached at the hip; data was collected concurrently on both devices. Both the force platform and iPod data showed a significant decrease in postural stability from the EO to EC trials for both age groups ($p</=0.001$). The force platform data showed significant decreases in postural stability in OA compared to YA ($p</=0.05$).However, the iPod data did not show a difference between age groups ($p</=0.052$). Additionally, though significant, only low correlations exist between analogous force platform and iPod variables ($r=0.685$). These findings indicate that the simple acceleration variables computed from the iPod are not suitable replacements for force platforms. Additionally, increased variability in the iPod data suggests that the accelerometer may be too sensitive in comparison to the force platform. Future research should seek to resolve this issue, as well as investigate the use of more complex variables in this comparison.

31 Type II Diabetes Prevention in Adolescent Girls

ELLA CHAFFIN, HALEY KRAMPETZ, AND CHARLOTTE WOOD
MAJOR: HUMAN DEVELOPMENT AND FAMILY STUDIES
FACULTY ADVISOR/MENTOR: DR. LAUREN SHOMAKER

This research poster will be a preliminary look at a research study

that is being preformed at CSU, focused on preventing adolescent girls from developing Type II Diabetes. We will introduce the topic by discussing the prevalence of Type II Diabetes, and how it is rising significantly among adolescents. We will also explain the correlation between depressive symptoms and insulin resistance, which is a physiological precursor to Type II Diabetes. Since there has been previous research that has shown that psychotherapy has been correlated with reduced insulin resistance in adults, the research that we have been a part of is testing the feasibility of a 6-week mindfulness group for adolescent girls aimed at reducing depressive symptoms, which will in turn improve insulin sensitivity. This group is being compared against a 6-week cognitive-behavioral depression prevention group. This research poster will include data from the initial analysis of the results of the study. The two research questions we will aim to answer in this presentation are as follows: 1. The feasibility and acceptability of a mindfulness group for adolescent girls at risk for Type II Diabetes, who also have mild to moderate depressive symptoms. 2. Explore the effect of a mindfulness group versus a cognitive-behavioral group approach on reducing depressive symptoms and increasing insulin sensitivity.

41 We all Need to Pee: Gender Inclusive Restrooms at Colorado State University

KELLY CONNOR

MAJOR: SOCIAL WORK

FACULTY ADVISOR/MENTOR: MARY ONTIVEROS, MARIE VILLESCAS ZAMZOW, AND DR. EUNHEE CHOI

In collaboration with the Office of the Vice President for Diversity I conducted a university-wide survey that intended to inform the Colorado State University (CSU) community about diverse needs of persons of all gender identities and to gather opinion on the preferred language and symbols to designate gender inclusive restrooms. Through partnership with the School of Social Work and the GLBTQQA Resource Center the survey was created and distributed to campus visitors, staff, faculty, and students. Responses from the over 900 participants revealed a campus climate that strongly supported a new university policy requiring gender inclusive restroom access and adoption of universal signage. Experiences of gender nonconforming and transgender students, in regards to restroom access, were also offered by survey participants. With assistance from staff at Institutional Research, Planning and Effectiveness at CSU, survey results were analyzed and used to make recommendations to the Office of the Vice President for Diversity. A standard language and icon were decided upon to designate all single-stall restrooms on CSU's campus as "All Gender". New signage has been created and is expected to be installed by the end of the academic year.The signage change and updated campus map locating these restrooms allows for greater inclusiveness and safety of persons of all gender identities at CSU.

44 Determining Effective Approaches to Promoting Consumption of Slow Fashion Apparel: The Types of Appeal and Message Content

DANIELE CROTEAU

MAJOR: APPAREL AND MERCHANDISING

FACULTY ADVISOR/MENTOR: RUOH-NAN YAN

In today's society, overconsumption and excessive waste are becoming prominent problems, specifically in the apparel industry. The fast fashion business model produces poorly made apparel products, causing chemical misuse, mistreatment of workers, and degradation of our natural resources. Additionally, this fast fashion model, focusing on selling trendy, yet inexpensive clothing, has triggered overconsumption of apparel and led to excessive amounts of waste ending up in our landfills as those products are not made to last. This research project was created in an effort to determine effective ways of informing consumers about these problems and to influence their future purchase decisions. The goal of the study was to determine which type of communication messages in the advertising campaigns most effectively warns about the negative aspects of overconsuming fast fashion apparel, while supporting the purchase of slow fashion apparel. This study utilized a 2 x 2 experimental approach to examine how college-aged consumers would respond to four different advertisements by manipulating the content and images in the advertisements when conveying the negative impact of fast fashion and positive impact of slow fashion. A survey was administered measuring participants' knowledge, views and shopping behaviors, and looking at their new opinions and shopping intentions after viewing the advertisement. With the collection of data, we hope to be able to determine how to better promote the understanding, purchase, and consumption behavior of sustainable slow fashion apparel over damaging fast fashion products.

45 A Review of School Garden Programs and Their Implications for Fuel for Fun

ADDIE CUTLER

MAJOR: NUTRITION AND FOOD SCIENCE

FACULTY ADVISOR/MENTOR: LESLIE CUNNINGHAM-SABO, PH.D., R.D., AND JESSICA CLIFFORD, MS

Purpose: To review the methodologies and best practices of school gardens, specifically when in combination with cooking and nutrition programs and the implications of these findings on the potential use of school gardens alongside the Fuel for Fun curriculum. Methodology: A PubMed MeSH search was used with the key terms elementary school, obesity prevention, and garden. 34 articles met the criteria and the selection was narrowed for review based on level of description of intervention and the inclusion of nutrition, cooking, garden education, and recency of within the last 10 years. Articles cited within these were added if the criteria were met. In total, 17 articles were reviewed. Results: The reviewed articles discussed 11 different interventions and one review of best practices. Each of

these interventions included nutrition, cooking, and garden education components and took place in elementary or middle schools. Four of the interventions were entirely out-of-school or had after school components. More than half of the interventions reported positive health impacts and/or increased willingness to taste fruits and vegetables. Conclusion: Nutrition, cooking, and garden education interventions improve the health and behaviors of the communities in which they are implemented. It would be possible to combine a school garden with the Fuel for Fun program and may increase the impact of the intervention.

46 Allegro: An Experience-Based Boutique

EMILY DACUS

MAJOR: INTERIOR DESIGN

FACULTY ADVISOR/MENTOR: LAURA MALININ AND CASSIE WHITE

Being located in what as known as the Music City, there was no better way to display a concept than through music itself. Allegro in music means fast, lively, and cheerful, which is exactly the vibe the store, is meant to give off. The concept syncopated resonance encompasses everything about this project. Syncopated is all about creating unique sounds and rhythms and producing the unexpected. Being a boutique, Allegro will be syncopated with the design, materials, and fashion. Every time a customer walks through the door they will receive a unique and unexpected experience. Resonance has to do with a reverberating sound. It also has to do with creating a memorable experience. Since Allegro is an experience-based large-scale boutique, resounding memories will be captured making this store truly unique.

87 Gold Atom Interaction on Metallothionein Sequences in Archael Organisms

NICHOLAS GUNDERSON

MAJOR: HEALTH AND EXERCISE SCIENCE

FACULTY ADVISOR/MENTOR: TOM SANTANGELO AND HALLIE FEBVRE

Electron microscopy and electron tomography offer the highest resolution images of cellular architecture. Both methodologies have limitations, with arguably the greatest limitation being the unequivocal identification of electron-dense structures within cells. Immuno-gold staining can be used to identify some proteins within ~20-40 nm of their original locations, but this resolution is insufficient for many applications (non-specific staining is also a concern). An alternative technology, explored here, is to directly tag specific proteins with metallothionein sequences capable of binding gold atoms that assemble into gold nanoparticles that are then directly associated with the molecule of interest. Cultures can be grown in the presence of gold salts and gold nanoparticles spontanenously form only at the positions of metallothionein fusion proteins. The toxicity of gold salts has limited such approaches in bacterial and eukaryotic species. The harsh environments dominated by archaeal species suggested that archaea may better tolerate gold salt exposure and permit tagging and identification of metallothionein-fusion proteins in situ. We are generating strains of the model archaeal species wherein genes encoding subunits of the RNA polymerase and ribosomal proteins are tagged with metallothionein-encoding sequences. We will present recent progress of gold toxicity, strain construction, and improvements in imaging technologies.

132 The interaction of HPTS and Cu2+ in Reverse Micelles

Jackson McCue

MAJOR: NUTRITION AND FOOD SCIENCE

FACULTY ADVISOR/MENTOR: DR. DEBBIE C. CRANS, ESTELLA S. MAGALLANES, AND RICHARD L. COLE,

Cu2+ complexation has been shown to induce beta amyloid plaques, a hallmark feature of Alzheimer's disease (AD), and thus, studying this complexation may allow for a better understanding of AD etiology. Compared to other leading causes of mortality, relatively little progress has been made in the understanding of and treatment of this disease. Fundamental information on the coordination of Cu2+ may help lay the groundwork for characterizing the complexation behavior of the amyloid peptides. Fundamental studies on a simple model system, using reverse micelles, will allow for the examination of the molecular interactions and will provide information on the coordination of 8-hydroxypyrene-1,3,6-trisulfonic acid trisodium salt (HPTS), a photoacid, in the presence of Cu2+. We propose that the change seen in HPTS in the presence of Cu2+ is the result of the coordination between the phenol group and Cu2+. For the past 10 years the Crans' group has been using reverse micelle to study how molecules interact with interfaces. This reverse micellar system is particularly useful because it is simple, accessible, and can be probed by absorbance spectroscopy that will give molecular information. We plan to test this hypothesis by investigating how HPTS and Cu2+ interact in AOT/isooctane reverse micellar model membrane system at different pHs using UV-Vis spectroscopy. The results obtained using UV-Vis spectroscopy are shown and interpreted.

138 Smartphone-based Assessment of Changes in Balance After Exercise Intervention in Neurologic Patients

DELANEY MILLER

MAJOR: HEALTH AND EXERCISE SCIENCE

FACULTY ADVISOR/MENTOR: DR. TRACY BRIAN AND ARLENE A. SCHMID

Objective: The ability to measure balance is important in the laboratory, clinic, and community exercise settings for a wide array of health and patient populations. The current gold standard for measuring postural sway is a force platform, which is an expensive lab-based piece of equipment. The purpose of this study was to assess the validity of an inexpensive iPod to detect changes in postural sway

after a yoga exercise intervention in stroke survivors and neuropathy patients. Method: Twenty-four stroke and neuropathy patients (52-92 yrs) were tested before and after a yoga intervention. Standing postural stability was measured with the eyes open and closed. During the trials, the force platform measured the fluctuations in the center-of-pressure underneath the feet. Simultaneously, the iPod measured the fluctuation acceleration at the hip. Data from the two devices was time-aligned and the standard deviation (SD) was measured as an indicator of the variability in the signal. Values were obtained in the antero-posterior and medial-lateral directions. The average of two trials was computed. Changes in the SD value from pre- to post-training were correlated between the two devices for eyes open and eyes closed trials. Results: The pre-post change values from the force platform and the iPod were consistently positively correlated. In the M/L direction, the R-squared value was 0.753 for the eyes open condition and 0.538 for eyes closed. In the A/P direction, the R-squared value was 0.770 for the eyes open condition and 0.847 for eyes closed. For the total sway values (M/L plus A/P), the R-squared value was 0.882 for the eyes open condition and 0.781 for eyes closed. When values were pooled for eyes open and eyes closed, the R-squared value for the total sway was 0.860. Conclusion: Small changes in postural sway resulting from an exercise intervention in neurological patients can be detected reasonably accurately with inexpensive, portable, user-friendly, smartphone technology. These devices may provide a suitably sensitive quantitative tool for balance measurement in clinical settings and remote community locations.

149 The Denver Wellness Center

CHRISTINE NICOLAYSEN
MAJOR: INTERIOR DESIGN
FACULTY ADVISOR/MENTOR: LAURA MALININ

The Denver Wellness Center was designed to address some of the most pervasive health issues in the United States including heart disease, stroke, diabetes, obesity and smoking. Using the salutogenic model of health, Maslow's Hierarchy of Needs and the idea of supportive design, all through the lens of catalyzing transformation, the Denver Wellness Center was designed to facilitate health. The center aims to change lives by being a place people will return to time and time again. The facility fuses Eastern and Western traditions to provide a healthy outcome for all. Through research, innovation and thoughtful design the center will reaching it's goal of spreading health.

189 Can Post-exercise Protein Supplementation Restore or Enhance Adaptations to Aerobic Exercise in Prediabetic Adults Taking Metformin?

HAYDEN SCHOENBERG
MAJOR: HEALTH AND EXERCISE SCIENCE
FACULTY ADVISOR/MENTOR: BENJAMIN MILLER, KARYN HAMILTON AND ADAM KONOPKA

Over 78 million people are prediabetic and have a high risk of developing type 2 diabetes (T2D). Prediabetes and T2D are characterized by hyperglycemia and decreased insulin sensitivity, which are linked with impaired mitochondrial protein synthesis (i.e., biogenesis) and oxygen consumption. Metformin and exercise have been shown to independently decrease the progression to T2D by improving glycemia and insulin sensitivity. However, a recent study showed that the addition of metformin to exercise did not further improve insulin sensitivity and may actually inhibit some of the positive exercise adaptations such as oxygen consumption. The purpose of this study was to test if post-exercise protein supplementation could help restore or augment the beneficial effects of exercise when taking metformin by increasing skeletal muscle mitochondrial biogenesis and consequently oxygen consumption. In a randomized, double-blinded, placebo-controlled study, 60 prediabetic participants will consume metformin or placebo during 12-weeks of aerobic exercise (3d/wk, 65-85% of maximal heart rate). After each exercise bout, participants will consume a protein or carbohydrate beverage. During the last four weeks, participants will consume labeled water (2H2O) to measure skeletal muscle mitochondrial biogenesis. Before and after the 12 weeks, participants will undergo an oral glucose tolerance test to assess whole-body insulin sensitivity and skeletal muscle samples will be obtained to evaluate mitochondrial biogenesis and oxygen consumption. If protein supplementation can enhance insulin sensitivity after combined treatment of exercise and metformin through augmented mitochondrial adaptations, then these findings may change the current recommendations for lifestyle modifications to help prevent T2D in high-risk individuals.

190 Re-Conceptualizing the Insane Asylum: How Design Can Engender More Humane and Therapeutic Psychiatric Hospitals

ALLISON SCHULTZ
MAJOR: Interior Design
FACULTY ADVISOR/MENTOR: LAURA MALININ

Located in the small borough of Norristown, Pennsylvania lies an abandoned Psychiatric Hospital. Built in 1907, it resides on a 266-acre medical campus formerly known as the, "Norristown Asylum for the Insane". With research-informed design as the foundation, my project intends to revitalize this abandoned facility to model a new system of integrative mental health care. My design proposes integration of 3 distinct units of care: a Long-Term Residential Unit, an Acute Residential Unit, and a Mental Health Crisis Stabilization Department. With in-patient and out-patient services provided in a single, holistic, psychiatric healing facility, patients will be able to receive personalized care solutions tailored to their individual illness, ensuring appropriate care is given and maximum impact on healing is made. Utilizing Trauma-Informed design choices, Patient-Centered Treatment, Environmental Psychology, and an architectural approach to neuroscience, the project is designed to support the social and biological needs of each individual in the building; fostering an environment of self-expression and inspired hope. Manipulation of

form, light, space, and perception will create an emotion-evoking experience of life, vigor, and vitality that will facilitate physical, psychological, and social healing in an environment patientswill endearingly come to know as the, "Norristown Healing Hospital for Psychological Well-Being".

195 Parental Alienation: Parenting Time and Child Coping

AMY SMITH

MAJOR: HUMAN DEVELOPMENT AND FAMILY STUDIES

FACULTY ADVISOR/MENTOR: ZEYNEP BIRINGEN AND JENNIFER HARMAN

This study examined the amount of parenting time that was issued in a court order and the amount of parenting time that was actually experienced by the alienated parent. It also examined if the amount of contact time the alienated parent had was correlated to the degree to which the involved children experienced negative behavioral effects. It was hypothesized that the alienated parents would have less parenting time than what was allocated to them in a court order. It was also hypothesized that children's negative behavioral outcomes would be worse when the alienated parent had less access time to the children. Initial impressions from listening to 15 audio recorded interviews seem to support these hypotheses. These impressions indicated a need for correlational analyses to reveal if these hypotheses were statistically supported. Data were gathered from surveys and audio recorded interviews on court ordered and actual amount of exercised parenting time. The audio recorded interviews were coded to rate the children's behavioral outcomes, as reported by the alienated parents. Results from this study provide information on the extent to which the parenting time awarded by the courts can be in contradiction with what actually occurs in reality, and whether such discrepancies are associated with parent-reported child functioning.

207 Analyzing the Accuracy of the Heart Rate Feature on the Fitbit Charge HR During Exercise

MONIKA TETER, KAYLA FOSTER, KAITLYN HEITZ, AND KATE SOWELL

MAJOR: HEALTH AND EXERCISE SCIENCE

FACULTY ADVISOR/MENTOR: RICKY PIMENTEL AND KATHY HUTCHESON

The Fitbit has been gaining popularity as a fitness tracker. It is typically used to track steps, exercise, sleep, calories burned, and monitor heart rate. The goal of this device is to help individuals become less sedentary by making them more aware of their daily activity. Recently, Fitbit has been questioned regarding the accuracy of their heart rate monitor feature. Fitbit uses a technique called photoplethysmography, which detects heart rate by using a light source to illuminate the skin and measures the amount of light propagated through the skin and surrounding capillaries. When the heart beats, the light propagation varies with changes in blood volume. Our purpose was to evaluate the accuracy of the heart rate monitor feature on the Fitbit Charge HR during various exercise intensities by comparing it to a chest heart rate monitor (Polar Heart Rate Monitor). Four female participants (average age = 21.5) underwent a maximal heart rate test using the Bruce protocol. Heart rate reserve was used to find the heart rate range for light (20-30%), moderate (50-60%), and vigorous (80-90%) exercise intensities for each participant. Each participant then exercised at a steady state for three minutes at each intensity. During these stages, their heart rate was recorded every 30 seconds on the Fitbit and Polar Heart Rate monitor (control). We will compare the heart rate values between the Fitbit and control devices and the difference between them as they vary with exercise intensity. Data collection is currently in progress.

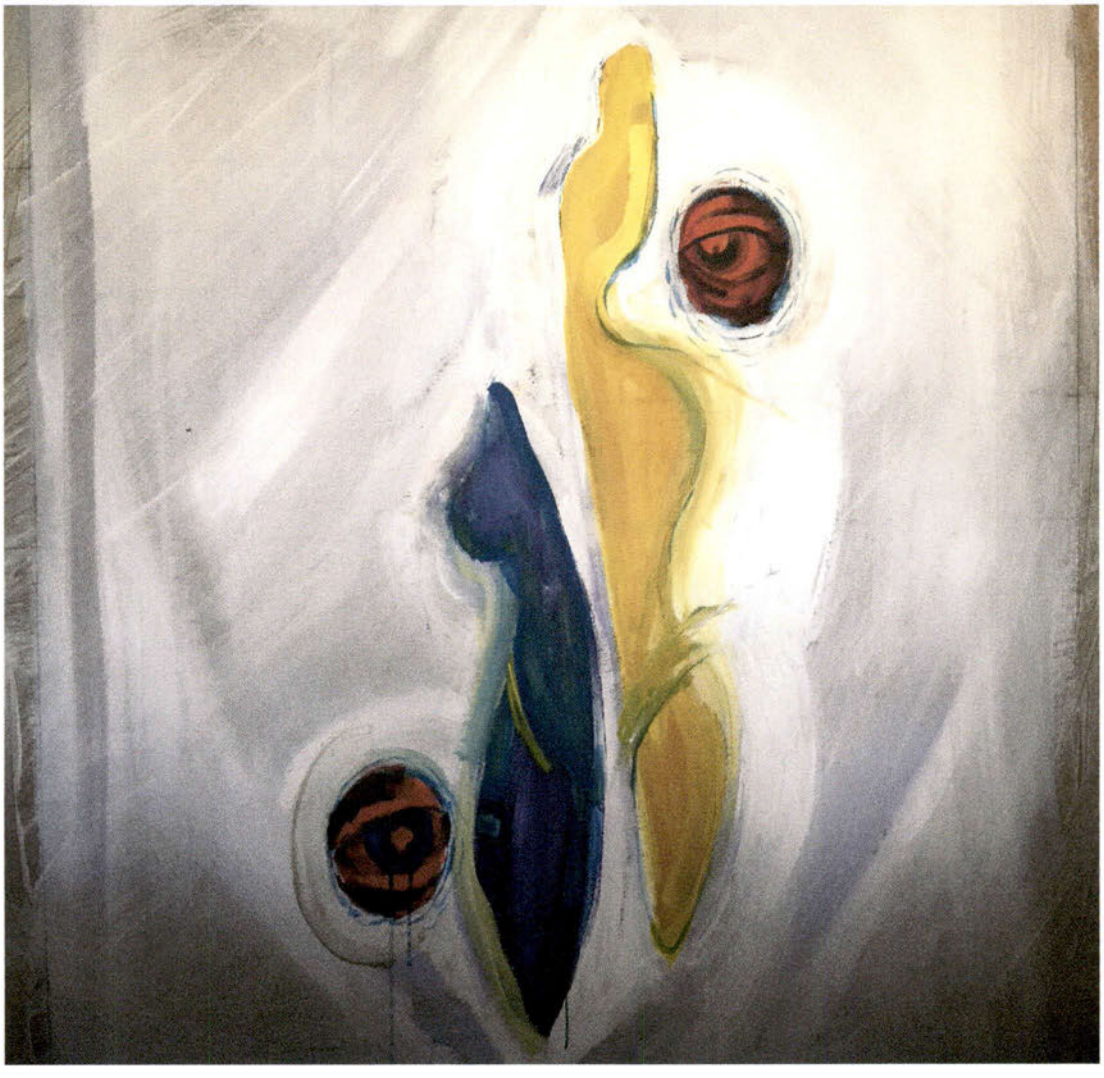
224 Coping with a Negative Social Interaction: The Role of Age and Depressive Symptoms

SAMANTHA WILSON

MAJOR: HUMAN DEVELOPMENT AND FAMILY STUDIES

FACULTY ADVISOR/MENTOR: GLORIA LUONG

Interpersonal stressors, such as arguments and disagreements, are among the most distressing types of daily experiences. It is therefore important to understand how people cope with such stressors. Previous studies suggest that older adults are more likely to use emotion-focused, avoidant, and passive coping strategies during interpersonal tensions (e.g., Birditt & Fingerman, 2003), which are among the most effective strategies for these types of stressors (e.g., Blanchard-Fields et al., 2007). Individuals with greater depressive symptoms also tend to use similar coping strategies and yet, they often exhibit lower efficacy (Coyne, Aldwin, & Lazarus, 1981). The current study investigates how age correlates with depressive symptoms and coping styles in response to a controlled negative interpersonal stressor. Younger adult (18-35 years old) and older adult (60+ years old) participants (N = 159) discussed hypothetical dilemmas with an age-group, gender, and cultural group matched confederate who was scripted to act unfriendly and disagreeable. As expected, individuals with greater depressive symptoms were less likely to engage in active coping and more likely to self-blame, use behavioral disengagement, and be in denial about the negative social interaction with the confederate. Moreover, there was an interaction effect such that with increasing depressive symptoms, older adults were less likely to vent (i.e., express negative affect) with the confederate whereas for younger adults, greater depressive symptoms was associated with greater venting. However, it was also found that depressive symptoms were more likely to be found in the young adult participants than the older adult participants. These findings suggest the importance of considering how the association between depressive symptoms and coping strategies may depend on age and other possible motivational factors.



College of Liberal Arts

6 Defense Wins Championships

SPENCER ALLNUTT
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: DR. JIANAKOPLOS

In the NFL, is the it more effective to boost your offensive stats or defensive stats? I will look particularly at the Super Bowl contenders and the outcomes of the game depending on their offensive and defensive ranking.

9 Are NBA Superstars Underpaid?

WILLIAM ANDRES, AND JOSHUA DEAN
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

Econ 492 Hypothesis

43 "The ___ Monologues"

BAILEY CROSS
MAJOR: POLITICAL SCIENCE
FACULTY ADVISOR/MENTOR: KATHARINE WORMUS

"The Monologues" is a collection of student-created pieces that focus on gendered issues facing college students today. They work to empower and encourage all genders to be allies for each other and spark important conversations about typically taboo issues through an event that educates, entertains, and provides a new perspective.

60 Racial salary discrimination in Major League Baseball

CHI DUONG AND JUNE NGUYEN
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

Racial discrimination is a concerning issue in sports, while baseball has no exception. Discrimination not only violates the law and against ethics but also pushes minorities out of employment and affects the diversity of players in a game, regardless of their performance quality. Understanding the importance of the issue, in this paper, we focus on racial salary discrimination in major league baseball (MLB) to answer the question: Are black baseball players still underpaid? To test that hypothesis, we would collect and analyse updated salary data of all non-pitching MLB players in season 2014. Take into account other factors that might also affect players' salary, we establish a regression equation with one dependent variable- annual salary and three independent variables which are performance, experience and race.

70 Child Safe Colorado Data Analysis

TODD FLEMING
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: PHILIP TURK

We preformed data analysis to determine if Child Safe Colorado's treatment had a positive effect on their clients' symptoms. We examined 189 client satisfaction surveys and results from 58 different client entry and exit surveys. We will use paired t-tests to determine if there is a statistically significant difference in before and after scores. We will also use an ANCOVA with the total problem scale scores and the total competency scores against other variables. The preliminary examination and exploratory data analysis leads us to suspect that Child Safe Colorado's treatment is effective at reducing some but not all symptoms on the competence and problem scales. Furthermore, treatment form Child Safe has a substantial effect on reducing the severity of the self reported symptoms on the client satisfaction survey.

72 Does Defense win Championships in the National Basketball Association?

ANTHONY FOX
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

We've all heard the old cliche that "defense wins championships," what were looking at here is if defense is statistically significant enough to support the cliche claim. We're analyzing the NBA because it is a time where people say the NBA is soft and the Golden State Warriors are on pace to have the best record in history with one of the most dynamic offenses. We're looking to see if it is offense, defense, or both that contribute to winning a NBA championship.

83 Transformations: An Evaluation of a Social Psychological Inmate Intervention

KELSEY GOTTBEHUET
MAJOR: SOCIOLOGY
FACULTY ADVISOR/MENTOR: DR. TARA O'CONNOR SHELLEY AND ELLEN RATAJACK

Transformations and Choices is a 40 hour (1 week) psycho-social intervention designed to help inmates understand their personality types and social contexts that have influenced their perceptions of themselves and the world, and how those perceptions potentially lead to the choices they have made in life. The program involves the presentation of multimedia materials (movies, poems, and posters), group exercises, discussions, and three homework assignments to teach and reinforce the psychological and social concepts presented in class. We wanted to investigate whether or not the intervention influenced participant's perception of themselves and the world around them. We also wanted to investigate how effectively the intervention reduced recidivism rates after participants were

released. In order to determine if Transformations and Changes is an effective program in reducing recidivism at Larimer County Jail, criminal history data provided for participants who completed the intervention groups between March 2007 and December 2011 were examined. 361 inmates participated in the class we studied, and our data contained more men than women. The study determined that general criminal activity decreased following the intervention, and the percentages of felony, misdemeanor, and violent offenses decreased by approximately 50% in inmates who had participated in the program.

90 How Does No Salary Cap in Major League Baseball Effect Team's Performance

JOEY HAMMER
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

Major League Baseball does not have a salary cap. Unlike many other sports which require a salary cap baseball does not because the MLB is a union and not an ownership. A salary cap is supposed to provide a balance so no team can have an advantage with much better players. A salary cap in baseball is not needed because there hasn't been unfair competition in which the teams with the most salary spent on players dominate the competition. With this being said, does payroll effect a team's performance? My hypothesis is that payroll does not determine a team's performance in the MLB. My dependent variable is payroll. My independent variables are team's win percentage, fan attendance and strength of schedule. The 2014 and 2015 seasons will be the years of study, looking at each team that gives 60 observations.

96 Time Series Analysis for Data from the Upper Missouri River Basin

SARAH HART
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: YEWON KIM AND PHILLIP TURK

We are students in STAT 472: Statistical Consulting. We are consulting for Derek Schook, a PhD student in the department of geosciences. His research focuses on three rivers and their precipitation, water flow, and temperature over time. These three variables were observed from three different sites; Yellowstone River, Powder River, and Little Missouri River, and observations were taken from as far back as 1895. Our task as a group is to do a time series analysis of the three different variables at the three different sites to see the change over time. These trends can help scientists discover shifts in river flow and the cause of the shift, whether it is due to climate change, or just natural shifts in the climate due to a dry season, or wet season. There are three different questions Derek would like my group to answer. Have annual averages of temperature, precipitation, and river flow changed through time? Are there seasonal trends to the changes? What time-series models best describe the datasets?

106 Predicting River Flow with Cluster Analysis

TAYLOR JOBE, RUOTAO QIU, MATTHEW VANCE, WES GROVES , AND STACEY PAN
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: PHILIP TURK AND JUSTIN RAIMONDI

The purpose of this project is to implement statistical techniques to make predictions of river flows easier for the scientific community. Our group has historical data from 19 river sites in Southern California and a corresponding 19x19 matrix displaying error terms between each site. Our goal is to use this data to construct 35 different cluster maps. After this we will use several validation tests on each cluster map and make recommendations on which map(s) are best. To obtain the different cluster maps, our group will create 7 new distance matrices from the original absolute error matrix. The seven new matrices are as follows; a maximum distance matrix, a minimum distance matrix, a midpoint-distance matrix, a row & column Euclidean distance matrix, and a row & column Bray-Curtis dissimilarity matrix. We will then run a variety of cluster analyses on each matrix. These analyses are: Single-linkage, complete-linkage, average-linkage, Ward's method, and the K-means method. With this we will have 35 cluster maps to work with, and ultimately determine which ones are best for further analysis in predicting river flows. Ideally, this analysis will allow researchers to select new sites and group these sites with similar sites based on the cluster maps. They then would be able to model the flow of these new sites with models similar to the ones contained in the cluster, which they are grouped.

126 MLB: Does better team performance lead to higher fan attendance?

MATTHEW MAC AND TRANG TRAN
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

We would like to examine the impact of team performance on fan attendance using the data of 30 MLB teams from 2009-2014.

130 There's No "I" in Team, but There's an "I" in Rich: Do Goals Matter More Than Assists for an Offensive NHL Player's Salary?

AUSTEN MCCLUSKEY
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: DR. NANCY JIANAKOPLOS

This presentation is an econometric analysis of how a hockey player's salary is determined, specifically comparing the contributions goals

and assists have. The hypothesis of this paper is that players who score more goals will be paid more money on average, regardless of their total points. So, even though players could have the same number or even fewer points than a similar player, if they have more goals they are likely to be paid more.

141 Analyzing Compassion Fatigue Risks and Developing Coping Mechanisms Specific To Literacy Workers

MEGAN MONACELLI
MAJOR: ENGLISH
FACULTY ADVISOR/MENTOR: TOBI JACOBI

Emotional heaviness. Job burnout. These experiences can be the result of compassion fatigue. There is much literature and research about the counselors and helping profession workers being at greater risk for experiencing compassion fatigue, secondary traumatic stress, and burnout. However, community literacy workers also face a high risk of experiencing compassion fatigue and it is important for community literacy and writing centers to support their volunteers and workers. One way to support them is to provide education about compassion fatigue and help them enact pragmatic self-care strategies that could help reduce and prevent experiences of compassion fatigue. A primary way to promote self-care is through writing and narrative therapy strategies which align with the work community literacy practitioners do in various community pockets. This research project allowed me to realize the scope of my experiences with compassion fatigue and provide practical steps moving forward as far as self-assessment and writing therapy tools. It draws on existing scholarship and balances it with personal experience and story.

142 Building SHOREline: Understanding the Impact of Disaster on the Children of Bayou La Batre

JACOB MOORE
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: LORI PEEK

Ten focus group transcripts, including parents, children, community leaders, health professionals, child care providers, and municipal politicians, conducted in Bayou La Batre after the BP oil spill were analyzed, resulting in a community profile of Bayou La Batre, summation of the overall impact of disasters like the BP oil spill and hurricane Katrina on children in the area, a comparison to the purpose and structure of the SHOREline project, and steps that can be taken to improve the SHOREline model. Bayou La Batre faced staggering job loss after the BP spill and the community had not fully recovered from Katrina which resulted in obstacles for children growing up. This research aims to uncover the results of disaster on the child population and illuminate potential steps moving forward to alleviate such strain on the children and to improve the SHOREline programme.

146 Do NFL teams attract more fans when they win?

ANH NGUYEN AND DAN WEYANT
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

People generally love the winner, but if the team wins too many times, the certain outcome might decrease the attractiveness of attending the game to the fans. Therefore we attempt to examine whether the winning percentage of the NFL teams would affect the attendance.

147 Salary and Performance of Quarterbacks

ANH NGUYEN AND PHOEBE PHAM
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

During a National Football League (NFL) game, two teams face off against each other in the hopes of scoring more points than the opponent by the end of the forth quarter. Teams have both an offense and a defense, the team that is trying to score is called the offense and the team that is trying to stop the offense from scoring is called the defense.The offense is lead by the quarterback, who either hands the ball off or throws it down the field. The quarterback therefore is the single most important player on the field because he has the responsibility of making the correct decisions during the game to give his team the greatest chance to win. Due to the fact that the quarterback plays a very important role he is compensated very well. Therefore, we want to study the relationship between salary and performance of quarterbacks. We will collect data about salary, age, experience and winning percentage of team of 71 quarterbacks in 2015. We expect that there is a positive relationship between quarterback's salary and performance.

152 Do Recruiting Expenses Translate to Better Recruiting Classes for Power 5 Football Programs?

EAMON O'CONNOR
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

In this research study I will examine the effect that recruiting expenses from 2012-13 have on the recruiting class rankings of the college football programs from the 52 public schools from power 5 conferences.

157 Wage Despersion and Team Performance in the Major League Soccer

KUANGKYE OO
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: DR. NANCY JIANAKOPLOS

My research is going be about wage and performance in the Major League Soccer (MLS). It will look at the factors that affected team

winning, such as wage inequality among players. My hypothesis is how wage disparity can affect team performance.

162 The MLB: An Analysis of Competitive Balance on Game Attendance

CAMERON PROSSER
MAJOR: ANTHROPOLOGY
FACULTY ADVISOR/MENTOR: DR. NANCY JIANAKOPLOS

There are many factors that will influence attendance at Major League Baseball games. Obvious factors like weather, ticket prices, and even the state of the economy can help explain the variation in demand for baseball tickets. But these variables do not illuminate why, all else held equal, that some games have higher attendance than others. Baseball games are a form of entertainment, and it is doubtful that home team fans want to attend a boring game. Competitive balance and the uncertainty of winning are what appear to make for an exciting athletic event. Competitive balance can be defined as "the degree of parity within a league" (Leeds, 2014). My hypothesis is that competitive balance has a positive effect on home game attendance at MLB games. This analysis will use data extracted from ESPN.com for the 2015 regular season of the Baltimore Orioles and the Washington Nationals. Regression analysis will compare attendance at home games for each team against 6 variables: Attend, Win, Oppwin, Oppplay, Oppworld, and Interleague (a full description of the variables can be found in the data analysis section). Previous studies on the effect of competition on game attendance have helped narrow the significant variables affecting attendance down to those being used in this analysis. Initial analysis finds that regression coefficients differ between the two teams, and that competition effects on attendance may differ between leagues.

167 Size differences in dental metrics in Coryphodon (Mammalia, Pantodonta): interspecies taxonomic variation or intraspecies sexual dimorphism

KAIA RENOUF
MAJOR: ANTHROPOLOGY
FACULTY ADVISOR/MENTOR: KIMBERLY NICHOLS

In general, unspecialized species are assumed to be less vulnerable to extinction than specialized species. An exception to this rule is the large-bodied folivorous Eocene mammal Coryphodon (Pantodonta) known from paleontological sites in North America and Eurasia. I report the results of my dental metric research on intraspecies and interspecies variation in this extinct genus. Data were obtained from fossil specimens in the CSU Department of Anthropology Paleontology Field School Lab collection from the early Eocene Willwood Formation of the Bighorn Basin, Wyoming. Additional data were obtained from the Denver Museum of Nature and Science Department of Vertebrate Paleontology Eocene collection. Coryphodon taxonomic classification is debated at the level of species which have generally been defined by body size. I test hypotheses concerning body size variation as a product of (1) intraspecies variation associated with sexual dimorphism and (2) interspecies variation due to speciation. The results may have implications for interpretation of Coryphodon evolutionary biology and the demise of this large-bodied generalized mammal.

177 Paleosol maturity, mammal distribution, and microhabitats at early Eocene fossil localities of the Willwood Formation (lower Eocene), Bighorn Basin, Wyoming

BENJAMIN RODWELL
MAJOR: ANTHROPOLOGY
FACULTY ADVISOR/MENTOR: KIMBERLY NICHOLS AND DR. TOM BOWN

Vertebrate fossil-bearing localities of the Willwood Formation in the Bighorn Basin of northwestern Wyoming date to the early Eocene (55.8-53 MYA), just after the Paleocene-Eocene Thermal Maximum (PETM). Fossil mammals from Willwood sediments include the oldest known occurrences of artiodactyls, perissodactyls, and true primates in North America. The sediments that make up localities where the fossils are recovered consist of sandstones and mudstones upon which paleosols (ancient soils) formed. These paleosols can be characterized in stages based on their relative maturity (time to form). Paleosol maturity is directly correlated with relative distance to active stream channels during deposition and soil formation, and may also be indicative of microhabitats within the paleo-landscape. In order to test this hypothesis, I examined fossil mammal specimens from the CSU Anthropology Department Paleontology Field School Lab collection (Bighorn Basin, early Eocene) to compare the spatial distribution of some elements of the fauna on the ordinal and generic level from localities with distinct paleosol stages. I report the results of my tests of the paleosol-faunal correlation, conclusions regarding the merits of the paleosol-microhabitat hypothesis, and offer suggestions for further study. This research has implications for the interpretation of the divergence of modern mammalian orders and speciation in the earliest members of the Order Primates.

200 Hit Hard & Hit Often: An analysis of Violence on Attendance in the NHL

KERK STAPLES AND LEX LUBINSKI
MAJOR: ECONOMICS

To analyze the effect of a team's violent behavior on their average attendance, this paper will use average yearly attendance data from ESPN.com and hitting statistics from Sportingcharts.com. The data will be collected from the 2012 season through the 2014-15 season, noting that the 2012-13 season was a lockout season where only 48 games were played, 24 of which were at home for each team. In order to enhance our regression, the data mentioned above will be

accompanied by other statistics such as penalty minutes per game, average goals per game for each team in each season, the metropolitan population of each team's city, the average ticket price for each team at the start of each season, and the stadium capacity of each NHL stadium to account for bias that would otherwise be seen if those variables were left out.

214 How Taxes Affect the Competitive Balance of the NHL

NIKHIL VIRMANI
MAJOR: ECONOMICS
FACULTY ADVISOR/MENTOR: NANCY JIANAKOPLOS

This project takes the highest marginal tax data from state, provincial, and federal taxes in the United States and Canada. This purpose of the project is to measure if teams in lower tax zones have an inherent competitive advantage for posting good regular season statistics. The data looks into tax effects, team value effects, playoff appearances, and salary cap spending by every team to determine if they impact the teams overall performance. We hope to see if American or Canadian teams have disadvantages because of the highest marginal tax code for each region or if a teams competitive nature comes from the ability to recognize talent and run the team effectively.

222 Monitoring and Evaluation of Students Cultural Experience at Todos Santos Center

JACK WILLIS, BERTHA MICHELLE DAYLONG, AND KELLI WICK
MAJOR: ANTHROPOLOGY
FACULTY ADVISOR/MENTOR: KATHLEEN PICKERING AND AUGUSTA AHLM

The CSU Todos Santos Center is a newly founded extension campus of Colorado State University that is aimed toward community based researched and interaction. The vision of the center is "to cultivate generations of global citizens and thriving communities through collaboration, experience, and exchange of knowledge." During the Spring 2016 semester, the center hosted its first semester-long program, "Fish, Wildlife, and Conservation Biology". The purpose of this study is to identify what the positive and negative factors that contributed to the students' semester as well as how the students feel their experience at the Todos Santos Center aligned with the center's vision. This is explored through participatory monitoring, structured surveys, structured and unstructured interviews, and quantitative and qualitative data analysis. This study specifically focuses on how age, gender, previous international travel, and level of Spanish affect the students' experience. This research also makes suggestions about possible adjustments for preparation, engagement, allocation of time of students on the program. This research also considers the focus of the students' research projects, how well they address community needs, and the accessibility of the community to this knowledge and data.

223 Mothering, Addiction, and Recovery Behind Bars: A Collaborative Essay

LARISSA WILLKOMM AND KATE MILLER
MAJOR: ENGLISH
FACULTY ADVISOR/MENTOR: TOBI JACOBI

The goal of this project is to create a collaborative essay focusing on the experiences of mothering, addiction, and recovery that incarcerated women face. Too often imprisoned women are ignored or criticized, relegated to an untenable space as a statistic or an unnamed casualty (Enos, 2000; Solinger et al, 2010; Haney, 2010; Jacobi and Stanford, 2014). The essay will be co-authored by three women who co-facilitate writing workshops through the Community Literacy Center at a county jail and four women who are held at the jail. This core group will offer their own views, their own definitions of addiction, their own experiences with mothering, and what these terms mean to them. The group will begin with stories, stories that unfold through their essay and that have been published in the SpeakOut journals that emerge twice annually across more than a decade of dedicated writing workshops. The writers are committed to collaborative authorship and will use a range of participatory methods to invite imprisoned mothers to co-author this story. They will distribute a call for contributions in the housing unit and invite the lead co-authors to engage in both reflection and autoethnographic/lifewriting. As a team the writers will review selected published poems and writing from the SpeakOut Journal in order to understand the breadth of experience that women have chosen to document. This essay will not only offer up those voices, but will actively engage currently incarcerated women in the shaping and crafting of the writing and perspectives the writers offer.

College of Natural Sciences

3 Electro-tactile Stimulation of the Human Tongue

SCOTT ALBOHN, MARINA RODRIGUEZ, LUKE CHEN, AND PIERCE VILKUS

MAJOR: MATHEMATICS

FACULTY ADVISOR/MENTOR: PHILLIP TURK AND VERONICA BURT

Imagine an efficient form of information transmission to the human brain from the human tongue. Then imagine an electrotactile stimulation (ETS) device applied to the tongue that helps people manage neurological conditions, or serves as a sensory substitution device for those subject to various forms of sensory deprivation. Such function and device is the focus of this research project. Our client, Mr. Moritz, a graduate student mechanical engineer, and his team currently have an electrode array device that uses low voltage spatial stimulation of the tongue as such means of potential information transfer. Designed experiments have been performed by the client in efforts to map out ranges and location of perceived sensitivity to applied ETS patterns. The data has been collected, and we as the statistical consultants have the task of analyzing the collected data. Due to the nature of such experimental data, with repeated measures taken on multiple test subjects, we will fit a linear mixed model to the experimental data. Since we expect variation in subject perception of ETS, it is hoped that the results of this analysis will inform a specific design algorithm for applied ETS. An effective algorithm would compensate for the expected variation and therefore uniformly distribute applied ETS patterning across all regions of the tongue. All analyses of the collected data will hopefully maximize the final design of such an electrotactile stimulation device, thereby lowering production costs.

4 Synthesis of YIn1-xMnxO3 Pigments with Microwave Technology

JOHN ALLEN

MAJOR: CHEMISTRY

FACULTY ADVISOR/MENTOR: JAMES R. NEILSON

Blue pigments have been problematic throughout the past due to problems with toxicity and durability. These problems were solved with the discovery of the YIn1-xMnxO3 pigment compounds by Kim et al. These new pigment compounds derive their blue color from green/red range adsorption between the higher energy Mn coordination states. The dark color of a pure YMnO3 pigment can be lightened by doping in indium. Currently YIn1-xMnxO3 pigments are produced with furnaces, but it may be possible to synthesize these pigments with microwaves, allowing for faster and cheaper production. Our work presented here shows the progress to achieving a reproducible synthesis of these important materials using a domestic microwave oven.

5 Development of a Bright and Sensitive Probe for Mid-IR Microscopy

CLIFFORD ALLINGTON

MAJOR: CHEMISTRY

FACULTY ADVISOR/MENTOR: DR. AMBER KRUMMEL

Mid-IR spectroscopic experiments investigating pertinent chemical systems such as porous media and protein coronas could greatly benefit from a bright and sensitive chromophore. Porous media is an important model for applications such as petroleum engineering, groundwater contamination and carbon sequestration. In the field of petroleum engineering, research has uncovered substantial information regarding the flow dynamics involved in the phenomenon of trapped oil ganglia. These have led to a significant physical model, but little is known about the chemical interactions at the fluid interface. Developing a probe that could extract valuable interfacial dynamics is the purpose of this project. The probe under development is being tailored so it will have a bright optical signal at low concentrations, and have frequency shifts sensitive to environmental changes. The notion is to use gold nanoparticles of specific size and shape to provide ideal surface enhanced signals in the mid-infrared region. Not only are gold nanoparticles capable of surface enhancement, but their affinity for thiolates allow their ligand shell to be modified to a desired chemical construct. The desired chemical composition of the ligands will contain a metal carbonyl (a strong solvatochromic oscillator) at the exterior terminus of the ligand. These particles will not only act as a probe, but multi-dimensional infrared experiments will be able to observe the dynamics of the ligand layer itself. This will provide useful information for investigating the structure and dynamics of protein corona complexes. These complexes formed by exposing particles to serum are medically relevant for site specific binding.

7 The Effectiveness of writing and programs for Increasing Life Satisfaction of Inmates

LILY DAY ALPERS

MAJOR: PSYCHOLOGY

FACULTY ADVISOR/MENTOR: TOBI JACOBI AND MARY ELLEN SANGER

We are currently awaiting IRB approval to conduct research at the Larimer County Jail on how the inmates feel the Speak Out program (a creative writing program based at CSU and conducted by students at the jail) effects their self-reported life satisfaction, happiness, and skills set, among other variables. This information will be used for my project as an intern, as well for grant applications for the Community Literacy Center and my future undergraduate thesis through CSU. Once our self-designed survey research measure is approved we will begin conducting research at the jail and I will supplement this work with my own research on other programs of similar content that take place at other correctional facilities.

12 A Comparison of Autism-Spectrum Quotient (AQ) Factors in Non-Clinical Populations Using Mismatch Negativity

ASHER AUGUSTINIS, LISA HIRT, AND BRAD STEWART
MAJOR: PSYCHOLOGY
FACULTY ADVISOR/MENTOR: DEANA DAVALOS AND LARA PANTLIN

Autism Spectrum Disorder (ASD) is known to present atypical responses to different sensory stimuli. A typical response to alternating auditory stimuli uses temporal processing as its foundation. This depends upon an inherent recognition of auditory patterns. Therefore, individuals with this disorder may demonstrate abnormal responses to auditory stimuli in regards to temporal processing. The present study investigated the Event Related Potential (ERP) specifically known as Mismatched Negativity (MMN), which has been has frequently been proposed as an objective method to index auditory sensory memory, with individuals suggested to be symptomatic of high-functioning ASD. The Autism Spectrum Quotient (AQ) determined if participants fell under this description. The AQ measures five specific factors of ASD: social skills, attention to detail, attention switching, communication skills, and imagination. Participants (N=68) who scored above a 26 were categorized as symptomatic of HFASD (n1=31) and below a 26 were categorized as controls (n2=37). Brain activity was recorded using the EEG 10-20 system for 30 minutes while participants listened to 2880 samples (120 cycles of 24 samples) of randomized standard and a deviant tone that differed in duration (Standard = 500 ms; Deviant = 250 ms). A correlation analysis of the ASD factors revealed a significant negative correlation between the social skill factor and MMN amplitude at the Fz, Cz, and Pz electrode locations. This data may suggest dMMN as a useful tool for identifying symptoms of high-functioning ASD.

13 Functional Expression of Cytochromes P450 in a Yeast System

ABIGAIL BARKER
MAJOR: BIOCHEMISTRY
FACULTY ADVISOR/MENTOR: TODD GAINES, J. LUCAS ARGUESO AND FRANCK DAYAN

Cytochrome P450s have been extensively connected to herbicide metabolism in monocots such as wheat and corn, but only recently have been investigated for herbicide resistance in dicot species including Kochia scoparia. They pose a unique threat for the evolution of herbicide resistance in weeds due to the ability of a single P450 to metabolize herbicides with different modes of action, which could mean a reevaluation of the current mode of action system used to recommend herbicide rotation in crops. Gene constructs were synthesized for expression in yeast to study the effects of plant P450s in vivo. The yeast line WAT21 was used because it expresses a plant P450 reductase and is sensitive to chlorsulfuron. A known chlorsulfuron-metabolizing protein from wheat, CYP71C6v1, and the closest homolog in Kochia scoparia were chosen for initial testing to evaluate chlorsulfuron-resistance due to P450 expression in WAT21. A liquid assay was used with chlorsulfuron concentrations from one to one thousand M and the growth rate of yeast was measured by the OD600 to obtain growth response curves. Results indicate this system has potential to screen new and existing herbicides for cytochrome P450 metabolism.

21 Electronic properties of the anti-perovskite materials Ca3GeO and Ca3GeN

MITCHELL BORDELON
MAJOR: CHEMISTRY
FACULTY ADVISOR/MENTOR: JAMES NEILSON

At its core, materials science is devoted to understanding correlations between structure and emergent phenomena. In these many-bodied systems, electrons can behave as a collective group to produce intriguing and technologically important physical properties. One example arises with metals and semiconductors. Fundamentally, the difference between a metal and semiconductor is relatively small. In a metal, an infinitesimal amount of energy is required to conduct electrons as they are moved into the lowest unoccupied electronic states. In a semiconductor, a specific amount of energy related to the material is required to move electrons into the lowest unoccupied electronic state. Thus, semiconductors contain an energy barrier (band gap) to conduct electricity where metals do not. The anti-perovskites Ca3GeN and Ca3GeO are two structurally similar yet electronically different materials that are herein studied. The unusual oxidation state of Ge, 3- in Ca3GeN and 4- in Ca3GeO, affects the macroscopic conductivity in these materials. Ca3GeN is metallic while Ca3GeO is semiconducting. Both polycrystalline materials are synthesized at 1200 K in environmentally-controlled, solid-state reactions. The chemical compositions of the powders are analyzed using X-ray diffraction in combination with the Rietveld refinement method. Conductivity measurements are reported to study the effects of the oxidation state of Ge on the underlying electronic properties in this system.

25 3D Printing to Demonstrate Inner Ear Anatomy

ALLISON BRASCHE
MAJOR: BIOLOGICAL SCIENCE
FACULTY ADVISOR/MENTOR: TOD CLAPP AND CAROLYN MEYER

Humans and many animals have a remarkable ability to detect complex forces such as acceleration, gravity, and sound pressure waves. The detection of these forces allow humans to maintain balance, control eye movements, and detect sound. We use a group of highly specialized structures known as hair cells that are

located in a membranous labyrinth to transduce these forces. This membranous labyrinth contains structures we know of as the cochlea and vestibular apparatus. This complex anatomy is often hard for students to visualize and understand. The first project was to create a model using 3D printing to demonstrate the anatomy of the membranous labyrinth in humans. This model is approximately thirty times the size of the actual structure and the data points were taken from a magnetic resonance imaging (MRI) scan. It was printed using transparent filament and filled with fluid to assist students in visualizing how the system uses hydraulics to direct forces onto hair cells for transduction to electrical signals. A model of a single hair cell was also produced using 3D printing. This model helps students visualize the transduction of a mechanical signal into an electrical signal. The hope is that these models can be used in the functional neuroanatomy courses at CSU to accurately represent the microscopic anatomy and physiology occurring in the inner ear.

27 The Structure and Function of Archaeal Nucleosomes

Kyle Byrne

Major: Chemistry

Faculty Advisor/Mentor: Tom Santangelo and Brett Burkhart

The structure and interactions of histone proteins bound to DNA, the formation of nucleosomes, and higher-order chromatin structures have been studied in depth in Eukaryotes. Histone proteins are also encoded in archaeal genomes, but the atomic archaeal nucleosome structure and potential higher-order structure of archaeal chromatin has not been investigated in depth. The X-ray crystal structure of an archaeal nucleosome has been determined, giving insight to archaeal DNA compaction. The archaeal nucleosome of Thermococcus kodakarensis is currently under further investigation to solve the locations of DNA specific binding regions on the histones. Our most recent advances will be highlighted.

32 Sex Role Behavioral Differences in Parental Alienation

Qi Chen

Major: Psychology

Faculty Advisor/Mentor: Ellen Ratajack and Jennifer Jill Harman

Men and women deal with conflicts differently and sex differences have been demonstrated in terms of aggressive behaviors (Archer, 2004). For instance, men may be more likely to use direct aggression whereas women may be more likely to indirectly aggress (Bjorkqvist, Osterman, & Lagerspetz, 1994). The purpose of the current study is to examine if gender differences exist when separated couples with children experience parental alienation. Parental alienation occurs when one parent attempts to destroy the relationship between the other parent and child, often by criticizing the targeted parent in front of the child and eliminating contact between the targeted parent and child (Ben-Ami & Baker, 2012). Parental alienation is problematic not only because of its immediate effects on the parent-child relationship, adults who experienced alienation when they were younger also have a variety of problems, such as low self-esteem, depression and lack of trust (Baker, 2005). For the current/ongoing study, interviews have been conducted with approximately 50 individuals who self-report experiencing parental alienation. Upon completion of transcribing and coding the interviews, the data will be assessed to determine if there are behavioral differences between men and women when parental alienation occurs. Specifically, we hypothesize that men are more likely to use physical violence or threats to prevent the mother from seeing her children while women would attempt to spread rumors about their ex-husbands or ex-boyfriends in an exaggerating way and involve more people (friends, relatives, etc.) to assist with the alienation rather than using physical violence and threats.

33 Effects and Regulation of TPC2 on Melanosomes

Keith Christian

Major: Biochemistry

Faculty Advisor/Mentor: Santiago Di Pietro

Melanin production is a vital protection mechanism for humans. Without melanin, negative side effects from the sun can harm humans. Examples include ultra violet light damaging the DNA of skin cells causing melanoma, and inadequate protection from the sun leading to a reduction in folate level which gives rise to birth defects. (andrea) My project involves the study of the organelle that creates melanin known as the melanosome. In particular, a focus of the lab is to study the effects of the protein TPC2 on melanosomes. We have investigated what occurs to melanin production with the knock out and overexpression of TPC2. We have also proven through microscopy and biochemical techniques that TPC2 is indeed located on melanosomes. Furthermore we have designed new experimental tools to understand TPC2. This has been done by creating a novel pH sensor that uses the fluorophore mNectarine (a pH sensitive fluorophore) to assess the luminal pH of melanosomes. By understanding the luminal pH of melanosomes, TPC2's effect on pH can be determined. Other tools developed in lab to understand the function of TPC2 include isolating clones of crispr MNT1 cells as well as sub-cloning proteins known to locate to melanosomes with various fluorophores in order to perform more microscopy experiments.

35 San Luis Valley Soil

LUCAS CHURCHMAN, DENGKAI WANG, NOAH BENEDICT, AND PARK MILLER

MAJOR: STATISTICS

FACULTY ADVISOR/MENTOR: PHIL TURK AND RYAN HICKS

This study uses a statistical analysis of the fatty acid properties of soil found in the San Luis Valley of Colorado. Typically, pH level is thought to be the driving force behind biomass in soil. Judy Daniels collected random soil samples from ranches with differing mineral compositions and water treatment methods in hopes to show that these are driving factors as well. This study determined how these effects influence Total Biomass, Fungi-Bacteria Ratio, Stress 1 Ratio, Stress 2 Ratio, and AM fungi using a two-level linear mixed model or multivariate mixed model.

36 Quantifying and Characterizing Myod During Limb Regeneration in Gecarcinus Lateralis

SAVANNAH CIARDELLI- MULLIS AND BRIGITTE GAUDREAULT

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: LINDSAY MARTIN , SUNETRA DAS, AND DONALD MYKLES

Crustaceans have the ability to autotomize and regenerate limbs, which is accomplished throughout the molt cycle. Molting is the mechanism used by crustaceans to grow, where the exoskeleton is shed and regrown. In the blackback land crab, Gecarcinus lateralis, there are two limb regeneration stages. These stages include the basal growth phase in which cell differentiation occurs and the pro-ecdysial phase in which most growth occurs. In vertebrates and many insects like Drosophila, MyoD functions as a transcription factor for muscle differentiation. MyoD is part of the myogenic regulatory factors family that is involved in myogenesis, the development of muscle. The purpose of this experiment is to identify changes in mRNA concentrations of MyoD during the basal growth phase and the pro-ecdysial phase. Tissue samples from limb regenerating male crustaceans were staged, collected, and processed to make cDNA. We have identified the MyoD sequence in the transcriptome and confirmed its presence in limb bud cDNA from G. lateralis. Future work will involve quantifying mRNA levels and determining differential expression of MyoD using qPCR. Expression levels and nucleotide sequence will be compared to transcriptome data from Uca pugilator, a related crustacean. This project is funded by the National Science foundation, IOS-1257732.

48 Mitigation of Chronic Wasting Disease

AMY D'ARCEY AND MEGHAN ALDRICH

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: CANDACE MATHIASON

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that affects deer and elk. It is invariably fatal and is spreading across North America and other parts of the world. The topic of our research is mitigation of CWD. The specific questions we are addressing are whether sodium dodecyl sulfate (SDS), high alkaline digestion, and bleach are effective in deactivating chronic wasting disease prions. Additionally we investigated the infectivity of wastewater obtained from holding pens of CWD positive animals. To test the effectiveness of these mitigation techniques, bioassays were done with genetically altered mice that overexpress the cervid prion protein. After the bioassays were complete we tested the mice with several assays including western blots, real-time quaking induced conversion, and immunohistochemistry. Our results have indicated that both high concentrations of bleach and high alkaline digestion are effective in deactivating CWD prions. They also show that the wastewater taken from the housing of positive animals is not infectious. However, SDS is proving ineffective in deactivating them. The project is almost complete and we will be publishing a paper this spring.

49 Parent Alienation and Depression Among Targeted Parents and Children

ADAM DAVIS

MAJOR: PSYCHOLOGY

FACULTY ADVISOR/MENTOR: JENNIFER J. HARMAN, PHD AND ZEYNEP BIRINGEN, PHD

Abstract The current study focuses on depression associated with being a victim of parental alienation when child custody schedules are not adhered to. Although mothers still are awarded custody significantly more often than fathers, research has suggested that young children have more positive experiences in joint custody than sole maternal custody arrangements (Wochik, Braver, & Sandler, 1985). Joint custody is being ordered with greater frequency, and some have argued that this has resulted in a higher prevalence of parental alienation. We hypothesized that when there have been dramatic effects on family systems when court ordered parenting plans were not followed by an alienating parent (e.g., joint versus partial custody), then there would be evidence of depressive symptoms among targeted parents than when custody plans were adhered to. Researchers have linked the ability to sustain anticipations of others' in one's life (role satisfaction) to depressive symptoms, especially in fathers (Hilton & Kopera-Frye, 2006). Therefore, when an individual's expectations for being able to fulfill their parenting role within the family system are not fulfilled, depressive symptoms should be evident for parents. Data were analyzed from surveys and interviews conducted with 82 parents who had been the targets of parental alienation, and we will

present findings that highlight the contributing factors associated with evidence of depressive symptoms. Discussion will focus on how parenting plans, when not enforced by courts, can have dramatic effects on the divorced family system. References Hilton, J.M, & Kopera-Frye, K. (2006). Loss and depression in cohabitating and non- cohabitating custodial single parents. Family Journal, 14(1), 28-40. doi:10.1177/1066480705282053 Wolchik, S. A, Braver, S.L, & Sandler, I.N. (1985). Maternal versus joint custody: Children's post-separation experiences and adjustment. Journal of Clinical Child Psychology, 14(1), 5-10.

50 Do native and introduced plants invest differently in their young and old leaves?

Kelly Davis

Major: Biological Science

Faculty Advisor/Mentor: Stacy Endriss

An important question in ecology is: can plants adapt in the face of rapid environmental change? One area that has been especially neglected is understanding how plants allocate resources to their leaves, and whether this allocation remains static over the course of the growing season. Whether plants can change investment to young vs. old leaves can provide information about insect-plant interactions and the population adaptation to continuously changing environments. We used Verbascum Thapsus as a model system and conducted a common garden experiment containing plants from thirteen populations from both the native and introduced range. We grew three sets of plants, each of which was destructively harvested for its leaves either during the early, middle, and late part of the growing season. In order to test the differences in leaf shape/area, we used ImageJ to analyze the area and circularity of the harvested leaves. I found that leaves experience logistic growth, indicating more energy is invested in young versus old leaf growth. Additionally, young leaves are more circular than old leaves, indicating that younger leaves are protected more than old due to tissue value. Furthermore, native species were found to have similar circularity compared to introduced species in both old and young leaves. This analysis provides information valuable to the improvement in insecticide development and conservation through understanding of ecological interactions and population adaptation.

56 Using Resonant Ultrasound Spectroscopy (RUS) to Investigate Spin Lattice-Couplings in Quantum Magnetic Materials

Tyler Dodge

Major: Physics

Faculty Advisor/Mentor: Kathryn Ross

All materials have fundamental frequencies at which they naturally vibrate. Resonant ultrasound spectroscopy (RUS) is a measurement technique in which a solid is vibrated at a range of frequencies in search for resonance within the material. A RUS measurement is intended to discover the elastic properties of the material, which are described by an elastic tensor consisting of up to 21 unique elastic constants. These elastic constants are the description of the material's feedback to enforced stress, and they originate from the effective "stiffness" of the crystal lattice due to bonding and atomic interactions. The sample's elastic properties change depending on physical properties of the specimen such as crystallinity, symmetries, temperature, and magnetic state (e.g. ferromagnet vs. paramagnet). In my research, I prepare precise sample shapes using a low-speed diamond saw, followed by polishing the faces on an optically flat surface to form a rectangular parallelepiped. Once the preparation is over, samples are placed in the RUS probe for frequency measurements. The resonant peaks are input to an algorithm, along with sample properties, to ultimately determine the elastic constants. The final goal of my research this semester is to modify an pre-existing RUS probe and Labview code to enable RUS measurements on the Central Instrument Facility's (CIF's) Physical Property Measurement System (PPMS) at low temperatures and high magnetic fields. The probe will primarily be used to measure the effect of a material's magnetic properties on its elastic constants, to better understand spin-lattice coupling in quantum magnetic materials.

61 Effects of Blood Flow on Klf2a Expression in Zebrafish (Danio rerio) Cardiac Development

Samantha Eckert

Major: Biological Science

Faculty Advisor/Mentor: Deborah Garrity and Neha Ahuja

Biomechanical forces attributed to blood flow are necessary for proper cardiac development, but their precise role in development is poorly understood. These forces include shear stress (stress exerted by the blood cells on the endocardial wall) and reverse flow (the fraction of blood that returns from the ventricle to the atrium each cycle). The atrioventricular junction is exposed to high levels of sheer stress and reverse flow and has been shown to have high expression levels of the transcription factor klf2a, otherwise known as Kruppel-like factor 2a. Klf2a is necessary for proper valve formation in the heart and is thought to be regulated by blood flow. To determine the expression patterns of klf2a when sheer stress and reverse flow were altered, in situ hybridization was performed from ages 24 to 56 hours post fertilization (hpf). This experiment involved the knock down of the hematopoietic transcription factor, gata2, to decrease sheer stress and the knock down of a cardiac muscle gene, flncb, to increase reverse flow. Real time PCR was also performed in the same conditions to determine if klf2a expression changed in the endocardial cells of the heart. Both experiments concluded that when the heart experiences high reverse flow, the expression of klf2a increase, whereas conditions of low sheer stress decreased the expression of klf2a. These results will help to further understand

the genetic and epigenetic factors involved in heart valve formation.

62 Investigation of transcription-coupled DNA repair in Thermococcus kodakarensis

OGHENE-OKUKO EFAGENE
MAJOR: BIOCHEMISTRY
FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO AND ALEXANDRA GEHRING

DNA lesions are known to halt transcription in bacteria and eukaryotes. Blocking the progression of the transcription complex can be detrimental to cells, primarily by leading to double stranded breaks, and is known to cause a variety of diseases in humans. In Bacteria and Eukaryotes, a DNA repair pathway termed transcription-coupled DNA repair (TCR) exists. The TCR pathway proteins are responsible for removing the stalled RNA polymerase (RNAP) and triggering repair of the DNA damage. RNAP in both archaea and eukarya share homology when considering structure and transcription factors. This serves as an advantage, as we can use information gathered from the simplified archaeal system and apply it to eukaryotic RNAP. Here we investigate the presence or absence of TCR in the anaerobic, hyperthermophilic archaeal organism, Thermococcus kodakarensis. Results include primer extension assays on genomic DNA from cells exposed to DNA damaging agents. Cells exposed to DNA damaging agents are likely to contain RNAP stalled at sites of DNA damage and the rate of repair of these lesions can be used to investigate TCR. The results of on-going experimentation to determine if TCR exists in T. kodakarensis will be presented.

66 Effects of PDE5-inhibiting zaprinast and recombinant MIH in Carcinus maenus on ecdysteroidgenesis in the Y-organ

CRISTIANA FALVO
MAJOR: ZOOLOGY
FACULTY ADVISOR/MENTOR: DONALD MYKLES AND NADA RIFAI

Molting in crustaceans is a hormone-regulated process essential to growth and survival. Molt-inhibiting hormone (MIH) prevents molting by inhibiting the synthesis of molting hormones (ecdsyteroids) by the Y-organ (YO). MIH acts by increasing cGMP level in the YO. PDE5 is a gene that degrades cGMP, thus preventing activation of cGMP-dependent protein kinase (PKG). We hypothesize that PDE5 activity contributes to the sensitivity of the YO to MIH. This study examines the PDE5 gene in the green crab, Carcinus maenus. We will determine the effects of zaprinast, a PDE5 specific inhibitor, and recombinant MIH on YO ecdysteroid secretion in vitro. One YO receives zaprinast, while the other receives zaprinast and rMIH. We are also quantifying PDE5 expression using PCR and qPCR. We predict that ecdysteroidgenesis will decrease in the presence of zaprinast and rMIH. It has been shown in previous studies that there is an increase in PDE5 activity during mid and late premolt, indicating that the PDE5 gene might play a role in desensitizing the YO to MIH in this committed state. Supported by NSF (IOS-1257732).

68 Meet Rwanda

KAYLA FERTMAN
MAJOR: PSYCHOLOGY

I decided to study abroad in Rwanda on a whim looking for something to change my life. What I found there was nothing that I could have imagined. When I was imagining my trip to Rwanda, I imagined that my crazy adventure would start by a rickety plane flight that landed on dirt and that I would be picked up in a safari car. I imagined myself getting dropped off on a dirt road in the middle of a village with huts, and staying in a dark lit room with a mattress and a bathroom that had a lot of insects. I imagined myself walking along a dirt road to get to school, and having school in a dim classroom without electricity. I imagined mostly being scared for my safety and not feeling comfortable to walk alone at night or even during the day. I imagined that I might be offered very strange types of food that I would constantly want to reject, and that nobody would be able to speak English. This image is the one that media, the voices of other people, and my imagination had created. This image is 95% false. However, this is the image that the majority of Americans have in their head about "Africa". After spending time in Rwanda I really wanted to create something that would help people understand more about Africa and help relieve some of the images that we have engrained in our heads. I wanted to do this because we often limit ourselves to the places that we travel or the people that we become friends with because of these false images and there are beautiful places and people out there that deserve to be known, recognized, and explored. Rwanda is a country of extremely rich culture with an emphasis on community, integrity, family, unity, selflessness, and loving one another. The country recently went through a Genocide 20 years ago but often people only have heard about the Genocide and know nothing about the incredible ways in which the country has restored itself in the past 20 years. Rwanda has a booming economy but nobody would ever know that. I met more people that knew how to create websites and mobile apps in Rwanda then I know here in the United States, not to mention that almost every Rwandan that I met could speak three languages - fluently. So why are we belittling countries like this? My answer is because our minds limit us to believing and acting on our assumptions. Although my example is in regards to Rwanda, our assumptions limit us every single day. Another great example of how our assumptions control us is in regards to how we treat other people. Often minorities, people with disabilities, people who have a certain socio-economic status or sexual preferences or just people who don't fit the "status quo" are pushed to the outskirts of society because people are always making assumptions about them based on the images that have formed in our heads about certain people. I want to end with saying that if we work towards letting go of our assumptions about people and places,

our world will exponentially expand. There is an entire world that we don't know about simply because we choose not to experience it because of our assumptions about it. So I propose that we start trying to let go of our engrained assumptions and begin freely experiencing the world around us without fear but rather with optimistic eyes that we will find something that we could not have imagined.

73 Our bugs within: the intense power of the body's microbiome

NATALEE FRANZ

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: GERALD CALLAHAN

Beginning at birth, every individual develops a diverse microbial community in the gut, the microbiome. This microbiome changes throughout our lives, based on factors like stress, physical activity, drugs, and most importantly diet. Recent studies are revealing that our unique bacterial community, which outnumbers our own cells, has more power over our bodies than once thought. When in balance, our microflora is capable of producing some of our body's most vital neurotransmitters and micronutrients. The bacteria in our gut have the ability to communicate directly with our body's central nervous system via the vagus nerve. Our microbiomes have the ability to regulate our mood and clarity of thought, causing some scientists to call our microflora the "second brain." Equipped with its own immune system, the microbiome also acts as a key regulator of inflammation, the pre-cursor to numerous diseases. A dysbiotic microbiome increases one's risk for developing diseases such as Parkinson's, Alzheimer's, attention deficit hyperactivity disorder, depression, obesity, diabetes, autism and multiple sclerosis. With the Western diet evolving into one high in processed foods, refined sugar, and fat, the prevalence of these diseases are skyrocketing. Based on the resilient nature of the microbiome, every individual has the power to change and nourish their microbiome via proper dietary choices. Through a comprehensible book, I seek to explain the vast power the bacteria within our bodies hold, and educate younger generations on how to properly nourish the tribes within our guts to promote health and prevent life-threatening diseases.

76 Phosphorylation as a Molecular Switch within the Dengue NS5 Capping Enzyme

BENJAMIN FULLER

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: BRIAN J. GEISS, PHD

Over 2 billion people are at risk of contracting Dengue Virus annually, and the closely related Zika Virus is spreading explosively throughout the Western Hemisphere. There are currently no antivirals or approved vaccines available to combat this family of viruses. Flaviviruses are single-stranded positive sense RNA viruses whose genomes are replicated by several virus-encoded proteins. In particular, non-structural protein 5 (NS5) plays a critical role in capping the progeny RNA that are produced within the host cell. If the progeny RNA are not capped then the viral RNA will be degraded and the viral lifecycle will be aborted. Previous research has shown that the N-terminus of the NS5 protein (also known as the "capping enzyme") has two specific functions during the viral RNA capping process, a methyltransferase function that adds methyl groups to the viral RNA, and a guanylyltransferase function that adds the cap to the 5' end of the viral RNA. The NS5 methyltransferase function has been shown to be, in part, reduced by phosphorylation of specific serine residues via a cellular kinase, but there is no information about how these phosphorylation events affect the guanylyltransferase function. We used a combination of molecular dynamics simulations and targeted mutations (including phosphomimetic mutations) to demonstrate that phosphorylation of capping enzyme serines 56/59 increases guanylyltransferase function. This is in contrast to phosphorylation reducing methyltransferase activity, and suggests that phosphorylation of the NS5 capping enzyme may act as a molecular switch between methyltransferase and guanylyltransferase functions within the NS5 protein.

78 Expression of ecdysteroid responsive genes in blackback land crab limb regenerates

BRIGITTE GAUDREAULT

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FACULTY ADVISOR/MENTOR: DONALD MYKLES AND SUNETRA DAS

Regeneration of tissue or body parts is a phenomenon found in many groups of animals, from hydra to mammals. Arthropods, which include insects and crustaceans, can regenerate limbs. We study the molecular basis of limb regeneration in the blackback land crab, Gecarcinus lateralis. Leg regeneration is initiated when a crab reflexively loses its limb by autotomy. Regrowth of new limbs is regulated by circulating steroid hormones called ecdysteroids. Growth of the limb regenerates occurs in two phases that correspond to circulating ecdysteroid titers: basal growth, when titers are low, and proecdysial growth, when titers rise. Ecdysteroids regulate limb regeneration via a transcription factor cascade initiated via ecdysteroid receptor complex, EcR/RXR. We hypothesize that expression levels of EcR, RXR, and two ecdysteroid responsive genes, E75 and HR3, in limb regenerates correlate with circulating ecdysteroid concentrations. To test this hypothesis, we have collected limb regenerates and hemolymph samples at different time points during basal growth and proecdysial growth phases. Our results indicated that transcript levels of these four genes significantly increased during the progression of basal growth despite low ecdysteroid titers. Regenerates from later time points are currently being analyzed. We predict that expression levels of these genes during proecdysial phase will significantly increase in comparison to their expression levels during basal growth phase. Supported by NSF (IOS-1257732).

79 Genetic Rescue Following Gene Flow from Divergent Immigrants in Populations of Trinidadian Guppies

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FACULTY ADVISOR/MENTOR: JOHN A. KRONENBERGER, SARAH AND W. FITZPATRICK, W. CHRIS FUNK

When populations become fragmented, gene flow is often reduced resulting in low levels of genetic diversity and higher susceptibility to environmental change. Supplementing declining populations with individuals from other areas is a tool used by conservationists to increase genetic diversity, known as genetic rescue. However, there is a concern that introducing immigrants that are genetically and adaptively divergent could cause outbreeding depression. Here, we use Trinidadian guppies to investigate the effects of gene flow from genetically and adaptively divergent populations on population fitness. Guppies reside in a multitude of streams in northern Trinidad and are adapted to high predation (HP) and low predation (LP) environments. We used two LP populations with differing genetic diversity to stock mesocosm tanks in the lab. Immigrants of varying degrees of divergence are introduced over multiple generations during a capture-mark-recapture experiment. The immigrants consist of identical, similar, and genetically divergent guppies from LP environments and adaptively divergent guppies from an HP environment. Preliminary evidence suggests genetic rescue did not occur in genetically diverse populations. In populations with low genetic diversity however, there is evidence for genetic rescue from divergent immigrants. These results suggest an increase in population fitness can be attained from the introduction of adaptively and genetically divergent immigrants.

80 Development of a plasmid isolation technology from environmental DNA sources

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Shuttle vectors - plasmids that can autonomously replicate in two species - are extremely useful for genetic and biochemical research, particularly of emerging organisms. Although there is an increased reliance on shuttle vectors to open new organisms to genetic manipulation, there does not yet exist a reliable methodology to construct and obtain these vectors that exploits the natural abundance of plasmids in environmental samples. We are establishing a transposon-based technology to rapidly develop new shuttle vectors from environmental sources. The overarching goal is to capture essential plasmid-sequences that are can direct autonomous replication in the organism of interest as well as E. coli. Here we focus on the development of new shuttle vectors for the archaeal organism Thermococcus kodakarensis using the transposon technology.

81 Preparation and Characterization of a Potential Antidiabetic Catecholate-Schiff Base-Vanadium Complex

CALEB GLOVER
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We are synthesizing and characterizing a series of vanadium catecholate compounds with the objective of investigating their anti-diabetic properties. Vanadium compounds have been found to increase sensitivity to blood-glucose in muscle and other tissues, aiding in the hypoglycemic effects caused by diabetes mellitus. As a result, a number of vanadium compounds have been explored as anti-diabetic agents. In the following work we describe the synthesis of vanadium compounds with a series of different catecholate derivatives complexed to a vanadium Schiff base. The Schiff base was formed by the condensation of a salicylaldehyde and a diamine to form the intermediate N-(salicylidene aminato)-N'-(2-hydroxyethyl) ethylene-diamine (VO2(HENSAL)). It is our hypothesis that changes in the catechol structure improve the properties of the resulting vanadium complexes with regard to solubility. Several catechol complexes were prepared to select a vanadium complex with the best solubility. In the following we described the synthesis and large scale preparation for testing of the biological properties of one catechol-vanadium complex. We use multinuclear NMR spectroscopy, IR spectroscopy, elemental analysis and UV-Vis absorption spectroscopy to characterize the complex. It is anticipated that the future biological testing of one of these catechol compounds will lead a new compound with the ability to decrease elevated blood glucose levels in an animal model system.

84 The Discovery of (CH3NH3)2SnI6 : A hybrid double perovskite for photovoltaics

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FACULTY ADVISOR/MENTOR: JAMES NEILSON, ANNALISE MAUGHAN

Hybrid perovskite materials (of the family ABX3) have recently kindled monumental research interest due to their unprecedented power conversion efficiencies and ease of fabrication in photovoltaic applications. In particular, hybrid materials based on lead- and tin-halide inorganic frameworks and the methylammonium cation (CH3NH3+), such as CH3NH3SnI3 and CH3NH3PbI3, exhibit favorable electrical conductivities and effective charge separation. However, these materials' significant sensitivities to moisture, air, temperature, and light, coupled with toxicity of lead, ultimately inhibit these materials from achieving widespread implementation

and industrial efficiency. The ability to fully structurally characterize hybrid perovskite materials and their analogues is therefore invaluable. Key structural features such as lattice type, space groups, distortions, voids, and phase transitions can provide valuable insight into how and why these materials operate, and therefore how their operation in the field can be maximized. Here, we report the discovery of a new vacancy-ordered hybrid double perovskite, with the nominal formula (CH3NH3)2SnI6. Laboratory powder X-ray diffraction, high-resolution synchrotron X-ray diffraction, and time-of-flight neutron diffraction data are employed in an effort to fully solve this compound's crystal structure. In doing so, we discovered structural anomalies that present an approach to improve perovskite materials, their synthesis, and their function.

85 Benzoic Acid Effect on Model Membranes in Relation to Tuberculosis

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Despite being a curable disease, tuberculosis is still one of the world's most common diseases. With a treatment time of 6 months or more, it is necessary to reevaluate our current treatment regimen. The first line drug, pyrazinamide, is thought to diffuse across the Mycobacterium tuberculosis membrane where it is then hydrolyzed to the active form of the drug, pyrazinoic acid. Pyrazinoic acid has then been shown to reduce proton motive force in a pH dependent manner. Benzoic acid has also been shown to have an antituberculosis effect in a pH dependent manner similarly to pyrazinoic acid. To explore this pH dependent effect, the interactions of benzoic acid with reverse micelles and Dipalmitoylphosphatidylcholine (DPPC) Langmuir monolayers were studied at different pH values. Through this research, it was shown that there is a pH dependent penetration of benzoic acid through model membrane interfaces. This is the first direct evidence showing a pH dependent interaction of benzoic acid at a water/surfactant/oil interface.

88 The Experiences of Minority Groups that Decide to Remain in STEM at CSU

SHARON GUZMAN

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Minority students continue to be underrepresented in Science, Technology, Engineering, and Mathematics (STEM) majors. According to CSU's Institutional Research, only 13.9% of minority students are undergraduate STEM majors, 43% are white females. Despite having programs to better support these students, there has not been a significant increase of minority students and women in STEM. With this study, I hope to understand what qualities are present in minority students who persist in a STEM major, with the goal of informing the development of programs to support minority STEM students who persist. I will interview minority students of various grade levels at CSU that are currently STEM majors. Through their responses I will look for common themes as to what has worked for these students and how it has helped them to continue in their STEM majors. In addition, I will administer a survey to both minority and white students about their experiences as a student. I anticipate that participants will most likely have encountered some stereotypes and that some may have had support from family, peers, and teachers before college, but may not experience the same support in college. I anticipate that most of the participants will have unique and personal stories as to how they chose a STEM major, which have encouraged them to remain strong in their pursuit of their chosen career. Results from this interviews and surveys will be discussed.

93 From Donation to Dissection: The Importance of Cadaveric Medical School Learning

LAURA HARPER

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: TOD CLAPP

This project argues that hands-on, cadaveric learning is more beneficial than computer-based anatomy programs alone and evaluates the multi-dimensional benefits of cadaver labs in the medical school curriculum. When evaluating literature, it was found that students who learned anatomy through dissection outperformed students who learned with computer-based programs on exams and in clinical settings after graduation. Original research was also performed appraising graduate student attitudes regarding the dissection experience. Student attitudes towards learning anatomy were significantly more positive in both enjoyment ($p=2.71x10-21$) and understanding ($p=4.99x10-60$), when asked to compare their dissection experience to using computer-based models. The data show there are clear educational, practical, and clinical benefits to learning anatomy through dissection, but there are also emotional, professional, and social benefits. These qualities are often overlooked when evaluating a physician, but they are just as important as intelligence or anatomical knowledge. A doctor should be intelligent, but they also need to be empathetic, hard-working, and well-adjusted in order to effectively connect with their patients. Cadaver labs expose medical students to the concept of mortality, require long hours of stressful work, and emphasize teamwork and problem-solving skills. This promotes the development of a compassionate physician who competently manages both time and stress while working collaboratively in a team; all things that a successful physician must be able to do. Overall, dissection is more effective in teaching anatomy than computer-based technologies and is an emotional and psychological experience that every medical professional should have.

94 The Relation Between Mindfulness and Impulsivity

COLIN HARRIS

MAJOR: PSYCHOLOGY

FACULTY ADVISOR/MENTOR: JAMIE PARNES AND BRAD CONNOR

Mindfulness, conceptualized as a tool, is a method of centering one's attention to awareness and focus on the present moment. Conversely, impulsivity is as an individual's tendency to act without premeditation and perseverance in immediate reaction to a stimuli (Peters, Erisman, Upton, Baer, & Roemer, 2011). This suggests that mindfulness, intended to cultivate present moment focus, may be effective in mitigating impulsive behaviors. Previous research demonstrated mindfulness significantly decreased maladaptive impulsive behaviors in the presence of stressful stimuli when controlling for negative affect (Peters et. al, 2011). Additional research revealed mindfulness to be an effective intervention for reducing impulsivity in alcoholics (Murphy & MacKillop, 2012). Impulsivity can be a detriment to well-functioning individuals as well as those with severe psychopathology. Therefore, investigating the relation of impulsivity and mindfulness across the general population may contribute to understanding the use of mindfulness to attenuate impulsivity. Previous studies largely focused on specific populations implicated with adverse impulsive behavior. The current study examines the overall relation between trait mindfulness and impulsivity. Based on previous studies, it was hypothesized individuals exhibiting higher trait mindfulness will express less impulsive behaviors. This study included 641 participants, of which 72% were female, with an average age of 19.57 years old (SD = 2.98). Participants completed an online survey including the Mindfulness Attention and Awareness scale (MAAS) and the UPPS-P impulsive behavior scale. The UPPS-P measures negative urgency, lack of premeditation, lack of perseverance, sensation seeking, and positive urgency. Correlations were run between MAAS scores and impulsivity facets. A significant negative relation was found between mindfulness and negative urgency ($r = -0.43$, $R2 = .18$), mindfulness and positive urgency ($r = -0.37$, $R2 = 0.14$), mindfulness and lack of perseverance ($r = -0.30$, $R2 = 0.09$), and mindfulness and lack of premeditation, ($r = -0.09$, $R2 = 0.01$, $p < .05$). All p-values were

97 Harnessing the Genetic Diversity of Aegilops tauschii to Improve Yield Components in Wheat

MEGHAN HENDERSON

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FACULTY ADVISOR/MENTOR: PATRICK BYRNE, ANGELA C. MOORE, AND SCOTT REID

More crop land area is dedicated to wheat (Triticum aestivum L.) production than to any other crop in the world. Yield increases will be needed to meet the needs of a growing population in the face of diminishing land and water availability. Domestication and selection have limited the genetic diversity available to address the need for increased productivity and yield potential in modern wheat cultivars. Resynthesizing the hexaploid genome using the wild relative Aegilops tauschii has provided breeders with novel variation that may be used to overcome this genetic bottleneck. We backcrossed the locally adapted wheat cultivar "Hatcher" to six different synthetic-derived lines. This research is focused on a variety of yield components among these diverse sets of synthetic-derived backcross lines (Syn-BL) compared to locally adapted cultivars under multiple environments. Ten heads were harvested and evaluated for yield components including: average seed weight, seeds per square meter, spikes per square meter, seeds per spike, and harvest index. All data collected was spatially adjusted and principal component analysis (PCA) was used to compare the traits. Seeds per square meter is both a highly heritable and a highly influential determinant of yield in both the wheat and the Syn-BL under fully irrigated and water-limited environments. Yield heritability is low due to environmental influences, and selection for seeds per meter squared as a secondary trait could improve yield gains in both wheat and Syn-BL under irrigated and water-limited conditions.

102 Exploring the interactions between the anti tuberculosis agent, pyrazinoic acid, and lipid model membrane systems

JOHN PETER HOUGH

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FACULTY ADVISOR/MENTOR: DEBBIE CRANS AND BENJAMIN PETERS

Pyrazinamide (PZA) is a tuberculosis drug listed on the World Health Organization's list of essential medicines, used around the world, and its modes of action are not fully understood. Current research suggests a few mechanisms, including: ribosomal rescue, collapse of membrane potential, and inhibition of fatty acid synthesis. It is known that PZA is hydrolyzed to its active form, pyrazonoic acid (POA), upon entry into the bacteria where there is an extracellular pH dependent effect. To explore this pH dependence, compression isotherms were run on a Langmuir trough to characterize the interaction between POA and lipid monolayers prepared from 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC) and 1,2-dipalmitoyl-sn-glycero-3-phosphoethanolamine (DPPE). The isotherms were run with a 10 mM POA sub phase at a range of pH values then compared to isotherms with no POA at the same pH. Although the isotherms for DPPC and DPPE were different, they both suggest a similar interaction. The results show that POA interacts with the membrane interface in a pH dependent manner. This is consistent with a greater effect on tuberculosis inside the acidic environment within the macrophage.

107 Perceptions of work-family conflict by married women in science/engineering doctoral programs

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MAJOR: PSYCHOLOGY
FACULTY ADVISOR/MENTOR: SILVIA CANETTO

U.S. women are underrepresented in science and engineering (SE) doctoral programs and in SE careers, particularly within academia. U.S. SE female faculty are also less likely than male faculty to be married or have children. Might women's lower interest in SE academic careers be influenced by their perceptions of an incompatibility between a SE academic career and having a family? Also might perceptions of work/family (W/F) conflict by SE women vary depending on their husband's field of work? 17 married women in SE doctoral programs were interviewed about their perceptions of professional and family goals. The findings suggest that SE women with husbands in STEM fields tend to have a more negative view of work-family conflict. SE women with STEM husbands had more negative views of their ability to manage family and work than women with non-STEM husbands. They also had more negative views of their own work-family conflicts. These results provide preliminary evidence that SE women with husbands in STEM fields might be least likely to pursue an SE career due to the additional challenges to work-family balance.

110 High Temperature FMR

SIDNEY KATZ
MAJOR: PHYSICS
FACULTY ADVISOR/MENTOR: MINGZHONG WU AND DANIALE RICHARDSON

My poster is on the experiment of High Temperature ferromagnetic resonance (FMR). The system had a particular set up to get the data. The first concern is we had to heat up the sample without melting the rest of the system. Another concern was the sample had to be in vacuum when taking data. For these matters we had a vacuum chamber and diamond rod for heating the sample. The purpose of the experiment is to test quality of the FMR system as well as the Bloch equations. At high temperature magnetization goes down in ferromagnetic materials. The Bloch equations govern magnetization dynamics at high temperatures. There are six different modern Bloch-like models, and we are testing to see which one is most accurate. During the experiment two different samples are being used, the samples are ferromagnetic thin films. The first sample used in the experiment is YIG. YIG has a very low damping constant and thus is easier to excite, which is why it was used to verify the system. While testing the system, we left the temperature at room temperature. After testing the system we raised the temperature YIG by increments of 40°C. In the future we would like to use Iron Platinum to test the Bloch equations. With Iron Platinum the only parameter change in the experiment was temperature.

112 Elaboration Through the Use of Examples and its Effects on Memory

BETHENY KING, HEATHER ACKART, JONATHAN BRINKS , TARYN FLACK , AND LISA BAKER
MAJOR: PSYCHOLOGY
FACULTY ADVISOR/MENTOR: ED DELOSH AND LAUREN BATES

Elaboration Through the Use Examples and its Effect on Memory Rote memorization can be a common technique used when attempting to commit material to memory, however previous research demonstrated an increase of memory for information when processed on a deeper level (Craik & Lockhart, 1972; Craik & Tulving, 1975). Deep processing involves deducing meaning from information; elaboration, the process of connecting material to previous knowledge and supplemental examples associated with information, is how deep processing takes place. The use of examples is one way elaboration can be examined, research indicated an increase for information memory with the increase of related examples (Palmere, Benton, Glover & Ronning, 1983) but the topic implores further investigation. We examined the relationship between elaboration by means of examples and the effect it has on memory, utilizing both free recall and recognition. Experiment 1 used a within subjects design, presented 46 participants with a set of facts shown for six seconds each, concluded with a free recall test of original facts. Experiment 1 was replicated to form Experiment 2 but used a recognition multiple choice test. Our results suggested elaboration by means of examples leads to better memory of given material when compared with restudying, lacking variability between testing type. The use of elaboration through examples can be applied within the classroom with encouragement from educators, as well as individual student use, to better remember and understand material presented to them in and out of school setting.

116 Music Preference and Test Anxiety: An Analysis of Working Memory and Performance

CASSIDY KOOLMEES
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Music can reduce test anxiety, with this effect believed to occur through changes in working memory function. However, the current research overlooks one important dimension to understanding the impact of music on an individual's performance - that is music preference. Previous studies assigned music to participants, but tastes and preferences in music vary widely. It has been shown that personal preference in music when compared with randomly chosen music reduced average stress levels more effectively where personal preference is defined as favoring one type over another. The current experiment then applies this concept of personal preference to the finding that music can reduce test anxiety. Music that matched the individual's personal preference was played prior to or during

a mathematical task. Performance with music was compared to baseline condition with no music, and control "positive thoughts" condition. There were several hypotheses being examined in the current experiment. The first hypothesis is that preferred music has a larger effect than positive thoughts alone and is more than just a means that produces positive thoughts itself. Therefore the music conditions should lead to lower anxiety and higher performance than the positive thoughts condition. The second hypothesis is that continued exposure to preferred music during the test will have a greater impact on performance and anxiety than music listened to prior to the test. Results of the study will be discussed.

120 Mountain Sagebrush

YUNYI LIN, BRANDON VENN, QITING LIN, CHRIS MILLS, AND KENT GANVIK

MAJOR: PSYCHOLOGY

FACULTY ADVISOR/MENTOR: PHILIP TURK AND ZHEYUAN WANG

Mountain big sagebrush has a slow decomposition rate which makes the nitrogen it uses return slowly into the soil from its litter it produces, but it uses little nitrogen itself. Often the foliage around some of the mountain big sagebrush has a quick decomposition rate, and uses a lot of nitrogen causing a fast nitrogen cycle. There are five plots with mountain big sagebrush that have a lot of foliage around them, and there are plots of mountain big sagebrush that have only a little bit of foliage around them. Six soil samples were tested from each plot. The soil was being tested for quality, and amount of litter that is in the sample as well. From this data it will determine if the mean mass of litter, mean quality of litter, and variance of mass and quality is different between each plot.

121 Market Segmentation of a new beer based on support vector machine

XIAOYU LIU AND XINHUI WANG

MAJOR: MATHEMATICS

FACULTY ADVISOR/MENTOR: HENRY ADAMS

Our project aims to use machine learning algorithms like support vector machine to make a market segmentation for a local beer factory. They prepare to put a new kind of beer into the market but they have no idea what is the ratio among flavors to achieve the maximal profit. Using support vector machine, we successfully classify the local beer market and compare our new beer with the existing ones so that we can make prediction about the sales for each flavor. In the end, we employ some statistical methods like linear programming to obtain the maximal profit.

122 Nanobody Supercharging as a Means to Endowing Cell Penetration

MONICA LOPEZ-ISLAS

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: BRIAN MCNAUGHTON AND VIRGINIA BRUCE

Proteins have the capability to selectively bind to disease-relevant macromolecules due to their size, structure, and functional group diversity. The inability of proteins to cross the lipid bilayer membrane of mammalian cells has limited the potential of proteins as therapeutics. Previous research has shown that mutating solvent-exposed residues to a positively charged arginine or lysine, known as supercharging, allows proteins to penetrate mammalian cells. We have found that nanobodies, small and stable proteins, are amenable to supercharging, which endows potent cell penetration. We have shown that this mutagenesis does not significantly alter the nanobodies' expression, structure, or function, and that the supercharged nanobodies are able to penetrate mammalian cells more effectively than the wild-type nanobodies. Our results suggest that supercharged nanobodies are well suited as a protein scaffold that can be evolved to target specific intracellular disease-relevant receptors.

124 Characterization of an archaeal transcription termination factor

OLIVIA LUYTIES

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO AND JULIE WALKER

Characterization of an archaeal transcription termination factor Olivia Luyties, Julie E. Walker, Thomas J. Santangelo Department of Biochemistry & Molecular Biology, Colorado State University Archaeal chromosomes are typically very gene dense, with very little intergenic DNA separting coding region. Such a chromosomal structure is highly efficient due to its gene density; however, this benefit simultaneously threatens the organism's viability when transcription of genes occurs. When a genome is as dense as that of the archaeal model organism Thermococcus kodakarensis, termination of RNA polymerase (RNAP) must be precise or risk continued transcription into neighboring genes. Such aberrant transcription is inherently wasteful and is often detrimental to viability. To prevent aberrant transcription of downstream genes, archaeal genomes encode intrinsic transcription termination sequences downstream of ~50% of genes. It can be inferred that the remaining half of archaeal transcription termination activities are factor-dependent, yet no archaeal transcription termination factors have been described. We have preliminary evidence that gene number TK0566 in T. kodakarensis encodes a transcription termination factor. The protein product of TK0566 is annotated as an RNA helicase and is highly conserved across archaeal species, making it a likely factor responsible

for factor-dependent transcriptiontermination in archaea. Progress in describing, in molecular detail, the activities of the archaeal transcription factor, both in vivo and in vitro will be discussed.

125 Establishing the link that couples transcription and translation in Archaea

ERIN LYNCH

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO AND JULIE WALKER

The lack of a nuclear membrane in Archaea and Bacteria permits direct coupling of the transcription and translation apparatuses. Ribosomes access the nascent transcript and start translation while RNA polymerase (RNAP) is still transcribing the DNA. The coupling of transcription and translation is mediated by the conserved transcription factor NusG in Bacteria. NusG, termed Spt5 in archaea, contains two domains: a NusG N-terminal domain (NGN) that binds to RNAP and a C-terminal KOW domain that binds to the S10 subunit of the ribosome. The binding interface of RNAP and Spt5 in Archaea is established, however, the potential binding of Spt5 to the translation machinery remains to be determined. Based on the demonstrated coupling of transcription and translation in bacteria and archaea as well as the homology of the conserved transcription elongation factor Spt5/NusG it is hypothesized that the archaeal Spt5 KOW domain also binds to the ribosome. The goal of this project is to determine if there is a direct interaction between Spt5 and S10. Understanding specific interactions of the conserved transcription factor Spt5 will shed light on the mechanistic details involved in transcription elongation, translation, and transcription termination. To investigate the coupling of transcription and translation, the model archaeal organism, Thermococcus kodakarensis, will be used as a platform. We have preliminary data supporting that Spt5 and the S10 ribosomal subunit interact in vivo and we now will further characterize the binding interface between Spt5 and the S10 ribosomal subunit in vitro. We will investigate the Spt5:S10 interaction by recombinant expression and purification of both archaeal Spt5 and S10 for use during co-immunoprecipitation assays (Co-IP). Presented are supportive experimental results for the Spt5:S10 interaction as well as methods that will be employed in the future to further characterize the binding interface of Spt5:S10.

128 Fabrication of Cobalt Phthalocyanine modified PMMA/Graphite based Microfluidic Devices for the Selective Detection of Dithiothreitol.

DAVID MAST

MAJOR: CHEMISTRY

FACULTY ADVISOR/MENTOR: CHUCK HENRY AND KEVIN KUNDER

Microfluidic devices can be used to study air quality and aerosol oxidative activity through the detection of Dithiothreitol (DTT) in aerosol samples. This research involves the fabrication of poly(methyl methacrylate) (PMMA) based continuous flow micro-fluidic devices for the electrochemical detection of DTT. Each device contains a working, reference and auxiliary electrode, each composed of graphite suspended in PMMA. Selective detection of DTT is achieved by incorporating cobalt phthalocyanine (CoPc), a catalyst for the oxidation of DTT, into the graphite electrodes. We aim to create devices that are more affordable and have greater sensitivity than the current commercially available products.

131 The Effect of Oxygen Levels on Tumor Xenografts and Migratory Embryonic Neurons

COLLEEN MCCOLLUM

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: STUART TOBET AND STACY WILLETT

To understand the function of live animals, including humans (in vivo), we often need to create models that allow us to work with live cells ex vivo. Such studies have been carried out for over 100 years. To mimic the environment within the body, in vitro (or ex vivo) experiments control carbon dioxide levels, pH, temperature, nutrient concentrations, and surfaces upon which cells grow. One variable that is commonly ignored is oxygen (O2). Perhaps counter intuitively, the oxygen levels we breathe (19-20% -144 to 152 mmHg) are significantly higher than the levels that reach our internals cells and in the brain are only about 1-5% (7.6 to 38 mmHg) (Erecinska and Silver, 2001). Yet ex vivo culture experiments are usually performed at atmospheric or ambient O2 levels. Similarly, cultures on human breast cancer cells and tissue have been traditionally done at ambient O2. However, aggressive tumor strains have been shown to have greater malignancy at low O2 levels of 1% (Brugnoli, et al., 2016). O2 control should be considered in many more in vitro studies. In the current experiments, human breast cancer xenograft tumors were maintained ex vivo as tissue slices from either MCF7 (nonaggressive) or MB-231 (aggressive) cell lines. Proliferating cells (incorporation of 5-ethynyl-2-deoxyuridine (EdU)) and dying cells (fluorescent ethidium homodimer (EthHD)) were measured, at 1.5% O2 versus ambient. In slices from MCF7 xenografts, there was less incorporation of EdU at 1.5% O2, suggesting less DNA synthesis and cell division. EthHD was more prevalent in slices from xenografts kept at ambient O2, but was more prevalent at the edge of slices in cells kept at 1.5% O2. In slices from MB-231 xenografts, incorporation of EdU was greater at the edge of slices. EdU incorporation sharply dropped with distance from the edge in slices maintained at 1.5% O2, but more gradually in slices maintained in ambient O2. EthHD was more prevalent in slices kept at 1.5% O2 than ambient. To further determine the relevance of different O2 levels for cell movements, normal migratory cells will be examined in a developing head/brain slice model to track the movement of gonadotropin-releasing hormone neurons. References Brugnoli, F, S Grassilli, Y Al-Qassab, S Capitani, and V Bertagnolo. (2016)

Molecular Carcinogenesis. PLC-γ2 is modulated by low oxygen availability in breast tumor cells and plays a phenotype dependent role in their hypoxia-related malignant potential. [Epub ahead of print]. Doi: 10.1002/mc.22462 Erecinska, M and IA Silver. (2001). Respiration Physiology. Tissue oxygen tension and brain sensitivity to hypoxia. 128: 263-276.

134 The effects of immigration on mating behavior in Trinidadian guppies

Emily Mensch

Major: Biological Science

Faculty Advisor/Mentor: John Kronenberger, Dale Broder, and Lisa Angeloni

Immigration into small populations can rapidly spread novel alleles if immigrants have a mating advantage over residents. Additionally, the environment from which the immigrant originates may affect mating behavior and potentially mating success. The Trinidadian guppy system allows us to study variation in mating behavior between immigrants and residents from populations that are locally adapted to different levels of predation pressure, which selects for different mating strategies. For example, compared to guppies from populations with low levels of predation (LP), guppies from populations with high levels of predation (HP) may invest more in mating, including aggressive mating tactics, because of a faster life history. We compared male mating behavior between residents and immigrants and also manipulated the type of immigrant: from the same LP population, from a different LP population, and from an HP population. Because female guppies are attracted to novel males, we expected immigrant males to differ from resident males in overall mating effort as well as mating tactics. We also expected HP immigrants to invest more in mating than LP immigrants, with HP males emphasizing aggressive mating tactics, instead of more conspicuous courtship displays. We found support for both of our predictions in preliminary analyses.

135 Animal Socialization: Testing the Effectiveness of Non-Food Items as Reinforcement in Teaching Shelter Cats Via Operant Conditioning Techniques

Emily Merrell

Major: Biologic Science

Faculty Advisor/Mentor: Katrina Dushaj

Animal socialization is the process of training animals to become more acclimated to human contact and interaction. It is used in order to enrich the lives of those who live in shelters and/or are used for research purposes. Socialization can also prepare the animals who are on non-terminal studies for adoption in the future. This practice includes introducing general contact with the animal, and teaching it using operant conditioning. This method of teaching entails the test subject making an association with either a positive or negative reinforcer. The most common type of positive reinforcer used in animal socialization is food. In our study, the cats we were socializing were already part of a medical study. This study required the close monitoring of the subject's diet. For this reason, we were unable to use food as a reinforcer in socialization. Instead, we decided to use scents and toys. The aim of this paper is to describe how effective non-food items such as scents and various toys are in training cats by operant conditioning techniques.

137 Effects of H2O and Ar/O2 Plasma Surface Modification on the Gas Sensing Capabilities of SnO2 Nanomaterials

Christopher Miller

Major: Chemistry

Faculty Advisor/Mentor: Ellen Fisher and Erin Stuckert

As energy production has increased, emission of toxic gasses, such as NOx, benzene, and formaldehyde, have also increased. Unfortunately, current gas sensors are unable to sense at or below the toxicity levels for many of these gasses. Tin(IV) oxide (SnO2) nanomaterials may help address these limitations, as they are inexpensive, have high surface area, and have the capacity for dual valency (Sn2+ and Sn4+), all properties which lead to enhanced gas-surface interactions that drive the sensing mechanism. One way to further increase gas-surface interactions is via increasing adsorbed oxygen on the surface of SnO2, which ultimately leads to resistivity changes associated with sensor sensitivity and selectivity. H2O(g) and Ar/O2 plasma were used to etch SnO2 nanomaterial surfaces, creating greater surface oxygen adsorption. XPS analysis shows the extent of surface modification caused by the plasmas, while PXRD shows crystallinity changes of nanomaterials after plasma treatment. In addition, SEM reveals any changes in the morphology of the nanomaterials with plasma treatment. The extent of surface chemistry and morphology changes are dependent on applied RF power,treatment time, and precursor gas. All nanomaterials were then fabricated into gas sensors which were analyzed for their gas detection performance. By observing resistance when materials were exposed to air versus CO (Ra/Rg) we learned which plasma treatment is more effective at increasing sensitivity and selectivity.

145 Exploring the complexation of citrate with selenium

Sumaiyah Mujtaba, Noah Barkley, and Mary Fisher

Major: Biochemistry

Faculty Advisor/Mentor: Debbie C. Crans , Sandra Bonetti and James Carsella

Selenium is known to have beneficial anticancer effects but has toxic effects in high doses. It is an essential element, but at high levels can cause birth defects, and neural degenerative problems. Because different forms of selenium can have different effects it is important to separate out the different forms of the selenium compounds. We are using liquid chromatography mass spectrometry to determine speciation of selenium in an ongoing environmental study, and as part of this process use citrate to separate out the different oxidation states of the selenium. In this work NMR spectroscopy is used to characterize the complexes that form with selenium. We use both 1H and 13C NMR spectroscopy to characterize the complexes that form and investigate complex formation as a function of pH. The results show that complex formation is pH dependent. These speciation studies will allow us to characterize the selenium-citrate system, and will assist in defining the conditions used for the column separation. In addition, because citrate is a prevalent anion these studies will provide information on the selenium-citrate complexes and allow us to determine whether these could be important in biological systems. James Carsella, Sandra Bonetti and Debbie C. Crans Manuscript under preparation

148 Comprehensive Genomic Archaeal Strain Library

Melisa Nguyen, Robin Blackwood, Sasha Boyarskya, Nicholas Furlong, Kristy Heiss, Geraldy Liman, Kathryn Veazey, Sarah Wetzel, and Rebecca Zimmerle

Major: Biochemistry

Faculty Advisor/Mentor: Thomas J. Santangelo and Hallie P. Febvre

Our aim is to construct the first comprehensive genomic strain libraries of a model archaeal species. Such libraries are used by communities of researchers to establish metabolic pathways, dissect biochemical processes, and determine functions encoded in every gene in a genome. A model organism is an easily genetically manipulated species used to represent, probe, and understand the basic physiological mechanics of a specific domain. The three domains of extant life are Eukarya, Bacteria, and Archaea. Model species are available for Bacteria and Eukarya, but until recently, no single species served as a model for the archaeal domain. Our research focuses on the marine archaeal species Thermococcus kodakarensis. T. kodakarensis is a planktonic, anaerobic, hyperthermophilic archaea that is easily cultivated under laboratory conditions, grows rapidly, and can be genetically manipulated with extreme precision. We are generating ~4,300 strains of T. kodakarensis, in two libraries: one wherein each gene is individually deleted, and a second library wherein each gene is extended by sequences encoding affinity and epitope tags on the encoded protein product. The methodology employed, examples of constructed strains, and an overview of progress towards completion of these libraries will be presented.

150 Solid Alkane Reverse Micelles (SARMs) - Confining Water in the Solid State

Kaylen Obray

Major: Chemistry

Faculty Advisor/Mentor: Joseph DiVerdi

Water is virtually insoluble in pure alkanes (~ 500 uM) yet, as was demonstrated several decades ago, the addition of small quantities of certain surfactants creates a ternary system where a significant amount of water can be taken up by the solution. These clear, macroscopically homogeneous solutions were shown to contain reverse micelles (RMs) - nanometer-sized pools of confined water, each surrounded by a monolayer of amphiphilic surfactant molecules immersed in a large volume of non-polar alkane. These RMs, made from an alkane that is liquid at room temperature, i-octane (C8H18), have been shown to possess unusual and interesting physical properties. Dynamical measurements intended to reveal details of internal structures, however, can be confounded by the overall micellar motions in solution. Solid state RMs have been prepared previously by others and in our laboratory from liquid styrene that was then polymerized into solid polystyrene. The solution dynamics are supposedly quenched yet fundamental questions arise as to the chemical environment in the aqueous pool during and after polymerization. The work presented here adopts a new, uniquely different yet related course - by utilizing various alkanes with greater molecular weight, for example icosane (C20H42), and with melting point higher than room temperature. Solid Alkane Reverse Micelles (SARMs) can be created with chemically similar environment to liquid RMs by comparison to i-octane RMs and without the confounding solution dynamics presented by the polymerized RMs. Preliminary data on physical measurements and various spectroscopies will be presented (NMR, FT-IR, UV-Vis, DLS, SAXS).

163 Development of a Paper Sensor for Detecting Zinc

Katrina Puck

Major: Chemistry

Faculty Advisor/Mentor: Dr. Charles Henry and Nathan Meredith

For either humans or animals, ingesting high levels of zinc can lead to sickness and can cause deficiencies of other metals in the body such as copper. Pulmonary distress and gastroenteritis are two symptoms of acute zinc exposure through industrial fumes (WHO). The ability to quickly, easily, and cost-effectively determine the concentration of zinc in food, water, and air is crucial to understanding the risk of exposure and how it will affect the body. Microfluidic paper-based analytical devices (mPADs) are simple sensors made from ordinary filter paper and wax. They are attractive for applications that require fast screening and low operational costs. While many of these devices have been developed previously, none have been used for zinc detection in environmental samples. Our focus is

developing a novel instrument-free zinc detection system using mPADs by relating the distance of a color change in a channel to the concentration of zinc present. Initial development focused on solution-based colorimetry to optimize reaction chemistry before transferring to the mPAD. On the mPAD, the use of the colorimetric reagent Zincon and a polyelectrolyte were optimized to maximize color development. Reagents are printed onto the paper using an inkjet printer, and samples are added using a pipette. Masking agents to provide selectivity against other metals are currently being investigated, and analytical figures of merit, like detection limit, are being generated. Ultimately, welding fume samples will be tested, and the method will be verified against traditional analytical techniques.

164 Chemotherapeutic Responses in Canine Lymphoma Models After Treatment with the CHOP Protocol

Dominique Ramirez

Major: Biochemistry

Faculty Advisor/Mentor: Luke A. Wittenburg

In both human and veterinary oncology, multi-drug resistance is a phenomenon where a cancer gains a cyto-protective effect against chemotherapeutics. Resistance is often witnessed when remitted cancers relapse and become untreatable. As an example, canine lymphomas are notorious for relapsing after treatment with the multi-drug CHOP protocol. While canonical drug efflux transporters have been implicated with the chemo-resistance phenotype, there are other transporters which might also contribute. Recent research has demonstrated that exposure to chemotherapeutics results in epigenetic changes to transporter gene expression; this could be a possible route for acquiring the resistance phenotype. What is still unknown, however, is a mechanistic understanding of the chemotherapy-transporter expression relationship. To address this void, we are focusing our research on three questions: 1) What are the temporal fluctuations in transporter expression following exposure to multi-drug regimens? 2) What patterns of epigenetic markers on transporter genes promote altered expression? 3) How does transporter expression correlate to protein levels in chemo-resistant lymphomas? We will address each of these questions using a panel of four chemo-sensitive canine lymphomas as our models, and the CHOP protocol as our drug regimen. We will expose the lymphomas to combinations of the CHOP protocol to mimic short- and long-term treatments, and monitor transporter expression via QT-PCR, and epigenetic changes via ChIP-assays. Additionally, protein levels will be monitored with LC-MS/MS methods to correlate expression with translation. We hypothesize that changes in transporter expression exhibit temporal and drug-dependent patterns.

165 Synaptotagmin interactions with the SNARE complex are required for synaptic transmission in vivo

Katherine Redd

Major: Biological Science

Faculty Advisor/Mentor: Noreen Reist and Mallory Shields

For communication between nerve cells, the synaptic vesicle protein, synaptotagmin, is the calcium sensor required for triggering vesicle fusion during synaptic transmission, although the mechanism of action remains in question. Biochemical experiments have shown that synaptotagmin interacts with the SNARE complex, which in turn is essential for mediating vesicle fusion at the nerve terminal. Therefore, calcium-dependent interactions between synaptotagmin and the SNARE proteins have been hypothesized to couple the rise in calcium concentrations within a nerve cell with vesicle fusion. However, the importance of these interactions for synchronous neurotransmitter release in vivo has yet to be determined. Biochemistry has shown that four, highly conserved basic residues in the two calcium-binding domains of synaptotagmin interact with corresponding acidic residues on the SNARE protein SNAP-25. To test whether these residues are important for synaptic transmission at an intact synapse, we mutated all four to alanines and expressed the mutant synaptotagmin from a transgene in Drosophila. We found that mutation of these basic residues causes a marked decrease in synchronous neurotransmitter release when compared to the transgenic wild type control. These results provide evidence that the calcium-dependent SNARE binding mediated by these residues is essential for synchronous release of neurotransmitter in vivo.

166 Quantum Ground States of Co1-xMgxNb2O6

Stephanie Oatman

Timothy Reeder

Major: Physics

Faculty Advisor/Mentor: Kate Ross, Jake Walker, and Harikrishnan Nair

Our current goal is to determine the quantum ground states of magnetic solids with the chemical formula Co1-xMgxNb2O6 for x = 0, 0.2, 0.4, 0.6. The first value, x = 0, gives the parent compound, CoNb2O6, which is a ferromagnet with an ordered magnetic ground state. This parent compound happens to be a realization of the simplest theoretical model displaying quantum criticality, the Transverse Field Ising Model. Quantum critical behavior involves a phase transition between two quantum ground states driven by zero-point fluctuations; i.e., quantum fluctuations. In the new series of crystals, we replace a fraction, x, of Co2+ atoms with Mg2+ atoms. Mg2+ has a net zero magnetic moment, while Co2+ has a finite moment. By exchanging these atoms, we introduce disorder which can result in two things of interest. The first is different collective responses to quantum fluctuations. The second is disordered magnetic ground states that can freeze into what is known as a "spin

glass". To check if the ground state of the Mg2+ diluted material is a spin glass we apply a small, constant magnetic field, and follow two different cooling protocols while measuring the magnetization as a function of temperature. The magnetization of a spin glass exhibits a predictable, and measurable curve that is different than other ground states. The slow spin relaxation in the identified spin glass phases will help us to understand quantum criticality in disordered and non-equilibrium phases.

168 Construction of archaeal shuttle vectors for Thermococcus kodakarensis

ANTHONY RIBARICH AND ALEXANDRA GEHRING

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: TOM SANTANGELO

Archaeal genomes encode a wide range of chemistries with promising roles in the biotechnology marketplace. The thermostable enzymes derived from hyperthermophilic archaea are of particular interest and the identification, characterization, and manipulation of the genes encoding such enzymes has received a great deal of attention. As more work is performed directly in archaeal organisms, more advanced techniques are necessary for genetic manipulations appropriate for the organisms under study. Thermococcus kodakarensis readily incorporates foreign DNA into its genome and has emerged as a model system for archaeal research. T. kodakarensis has also received attention as a tractable expression platform for hyperthermophilic enzymes that are poorly expressed in bacterial hosts or for which incorporation of appropriate metal co-factors is essential for activity. T. kodakarensis has no naturally occurring replicative vectors. Currently, one vector has been designed and made available for shuttling between T. kodakarensis and Escherichia coli. To allow for more advanced techniques, construction of additional shuttle vectors with independent selectable markers are needed. Here we present results on the construction of a suite of additional vectors with replicative sequences derived from environmentally isolated plasmids.

172 Rewarding Without Food: Testing the Effectiveness of Non-Food Stimuli for Positive Reinforcement Training in Domestic Cats

MAKAYLA RISCH AND EMILY MERRELL

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: KATRINA DUSHAJ

Animal socialization is used in order to enrich the lives of animals who live in humane societies as well as those used for research purposes. Socialization can benefit laboratory animals by improving their quality of life as well as preparing participants on non-terminal studies for adoption once the study is complete . Socialization can be achieved through both classical and operant conditioning which is dependent on the animal's less of stress and fear. Typically positive reinforcement training is employed with the use of a high valued item such as food. However, the participants utilized in our study were apart of non-terminal diet studies and food outside of their experiments could not be used for training or other socialization purposes. The purpose of our study was to examine whether or not other stimuli such as scents could be used as a reward in replace of food for positive reinforcement training. In our study we exposed cats to three different scents: lavender, peppermint and a synthetic feline pheromone. We measured the distance the cats were in approximation to each scent, the time spent near the scent and any behavior exhibited during the exposure. Our research looks to investigate if the cats behaved differently to any of the scents and whether or not one scent was preferred over the others. We plan to compare time, distance as well as if the personality of each individual cat also played a role in the reactions to the scents.

173 Effect of Nitric Oxide on the Initial Events on the Coagulation Cascade

ALEXANDRA ROACH

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: MELISSA REYNOLDS AND KRISTIN ARABEA

Medical technology has advanced over the years and continues to save lives. However, with each new innovation in medical technology, new risks and complications need to be overcome. One example of this is thrombus formation in extracorporeal circuits, which circulate blood out of and into the body, and which can result in device failure and complications to the patient. This is caused by the activation of blood plasma proteins and platelets forming a clot in response to contact with a foreign surface. In order to combat problems with this activation, the steps of the coagulation cascade must be understood, starting with the adsorption of blood proteins to a surface material and their responses to modified surfaces, such as those that elute anti-thrombotics. One area that shows potential is nitric-oxide (NO) releasing surfaces. NO is a naturally occurring anti-thrombotic that has been proven to have an effect on the initial events of the coagulation cascade, including platelet activation. However, little it known about how NO affects the adsorption of blood plasma proteins in the initial events of the coagulation cascade. Our experiments test how NO affects the adsorption of blood plasma proteins, albumin and fibrinogen, and how these change the initial events of the coagulation cascade. This will increase out understanding of how to fabricate future biocompatible materials.

174 External Cavity Diode Laser Two Color Frequency Lock

COLIN ROBERTS
MAJOR: PHYSICS
FACULTY ADVISOR/MENTOR: JACOB ROBERTS

For a planned future experiment measuring radiation transport in an ultracold gas, it is necessary to drive a resonant two photon transition with two different laser colors. In order to do so it requires locking the frequency of both lasers. We are developing a spectroscopy system that will enable such locking. This system is described in this poster.

179 The Influence of Rad51 in Rates and Mechanism Preference During Spontaneous Homologous Recombination Events in Saccharomyces cerevisiae

JOSHUA ROMERO
MAJOR: BIOCHEMISTRY
FACULTY ADVISOR/MENTOR: DR. JAC NICKOLOFF AND DR. CHRIS ALLEN

DNA repair is crucial to maintaining the integrity of the genome in cells, and Saccharomyces cerevisiae serves as the model eukaryote for investigating DNA repair mechanisms. Error-prone DNA repair can lead to carcinogenic mutations that provide a selective advantage for the cell to become cancerous, ultimately leading death of a multicellular organism. Single strand annealing (SSA), gene conversion (GC), and unequal sister chromatid exchange (UESCE) are homologous recombination pathways that cells employ to repair double strand breaks. SSA is error-prone and is Rad52 dependent, whereas GC and UESCE are relatively error-free and Rad51 dependent. Rad51 is involved in the search for homology during GC and USCE. This project investigated 2 strains of Saccharomyces cerevisiae to-date, 3084 and 3657. 3084 has a fully functional Rad51 whereas 3657 has a mutation in the RAD51 locus, decreasing the function of the ATPase domain of Rad51. Through an engineered genetic sequence consisting of LEU2 flanked by 2 nonfunctional ura3- (ura3--LEU2-ura3-), we were able to analyze the rates of spontaneous homologous recombination (SHR) in 3084 and 3657. We found that 3657 had an overall rate of SHR fourfold higher than 3084. We also found that 3657 had a ratio of SSA:GC+UESCE fourfold larger than 3084. This is significant because it suggests that the ATPase domain mutation in 3657 not only results in the cells undergoing increased rates of SHR, but it also forces the cells to undergo higher rates of the error-prone SSA pathway.

180 Composting with Residence Halls

SARAH ROSS
MAJOR: BIOLOGICAL SCIENCE
FACULTY ADVISOR/MENTOR: TIM BRODERICK

In a two-year process, I collected data on the climate of CSU when it came to composting, designed a composting pilot around the collected data and opinions, and then orchestrated a one semester pilot of composting within the residence halls. The pilot consisted of one test floor in Pinon hall, where residents were informed of the pilot and asked to sign an agreement form. Both roommates had to agree both verbally and by signing an agreement form that detailed the pilot, the benefits, and the risks before being issued a collection bin. Each room got one of two collection bins: one bin had a carbon filter in the lid, which would mitigate smells from the compost, and one bin was a simple bin with a regular lid. The students were also issued a scrub brush, so that they can clean their bins if needed. We then placed a composting collection bin in the common area by the trash and recycling and let the residents sort on their own. With the help of the RA on the floor and the PAL coordinator for the area, we weighed the bin every morning to try and quantify how much the bin was being used. We also sorted the bin once a week to get a sample of the contamination rate of the bin. We found that the bins were overall a success, with a very low contamination rate and a steady amount of waste being collected with minimal setback to students.

183 Effect of Prebiotics and Probiotics on Microbiota and Obesity

TAYLOR RUNION
MAJOR: BIOLOGICAL SCIENCE
FACULTY ADVISOR/MENTOR: TIFFANY WEIR

Historically, the ability to maximize food intake has been an advantage, but with today's high calorie diets it has become a detriment to public health. While the way to lose weight is typically seen as using more calories than consumed, this does not always hold true. It has been well proven that other factors also impact weight loss and weight gain. One factor is a correlation between the ratio of two phyla of bacteria and obesity or leanness. High Bacteriodetes and low Firmicutes tend to correlate with a lean phenotype, and the opposite is true as well. The focus of this will explore how prebiotics and probiotics impact how nutrients are digested in the human digestive tract. Factors impacted by prebiotics and probiotics include: short chain fatty acids (SCFA), gut permeability, fasting-induced adipose factor (fiaf), peptide YY (PYY), and glucagon-like peptide (GLP-1). Overall, major factors that contribute to weight loss are calories consumed compared to calories used, diet, higher consumption of indigestible carbohydrates, and prebiotic and probiotic administration.

184 Expression of the TGF-beta Signaling Pathway during limb regeneration and growth in the Blackback Land Crab, Gecarcinus lateralis

MEAGHAN RUPPRECHT

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: DONALD MYKLES, SUNETRA DAS, AND JILIN HE

Molting is the way arthropods shed old exoskeletons in order to grow or regenerate lost limbs. The molt cycle of crustaceans takes place in four stages: intermolt, premolt, ecdysis, and postmolt. The limbs of decapod crustaceans that are lost due to injury or predation can be regenerated completely during a single molt cycle (Hopkins 2001). In the blackback land crab (Gecarcinus lateralis), there are two methods that can be used to induce molting. Multiple leg autotomy (MLA) is the process of removing all of the walking legs by pressuring the animal to reflexively release them. Limb buds are grown in two stages in which the limb bud differentiates and then rapidly grows (Hopkins 2001). Previous experiments have determined that SB1431542 injections, which inhibit TGF-β components, decrease the hemolymph hormones present in premolt animals. These results suggest that the TGF-β signaling pathway is involved in committing the animal to molt. My experiment will be focused on characterizing and quantifying components of the TGF-β pathway (Activin Receptors/SMAD/Myostatin) found in the limb buds of the blackback land crab and determine if limb bud autotomy (LBA), which suspends premolt, affects TGF-β signaling gene expression. I hypothesize that there will be an upregulation of the components present in the TGF-β signaling pathway during premolt, followed by a sharp decline in expression in the fully functional leg in postmolt. The effects of molting on gene expression would be reversed by LBA. Supported by NSF (IOS-1257732).

186 A Mental-Task Brain-Computer Interface for Controlling a Game

IGOR RYZHKOV

MAJOR: COMPUTER SCIENCE

FACULTY ADVISOR/MENTOR: ELLIOTT FORNEY , CHARLES ANDERSON, AND PATRICIA DAVIES

Brain-Computer Interfaces (BCI) are technologies that enable a user to communicate with a computerized device using only voluntary changes in mental state. An important application for BCI is the development of assistive technologies for people with motor impairments. For these people, restoring the ability to perform day-to-day functions can be extremely beneficial. Current BCI systems are typically designed to perform relatively simple tasks, such as typing a message or moving a mouse cursor. We believe, however, that a long-term goal for BCI should be to control more sophisticated devices that restore high-level functions, such as electric wheelchairs, prosthetic limbs or, perhaps, robotic exoskeletons. As a first-step toward these goals, we have begun developing new modules for The Colorado Electroencephalography and BCI Laboratory (CEBL) that allow users to interact with various devices using BCI technologies. These modules monitor the user's brain activity while he or she performs a mental task (e.g. singing a song, counting, imagining moving hands and/or legs). Different mental tasks produce different brain-activity patterns, which hopefully can be used to control a device. Currently we are developing a game, similar to pong, which uses mental tasks as its main controller. The game provides user with incentive to adapt his or her mental tasks to perform better in the game. We hope that after some time, the user can learn to use his or her mental tasks reliably, and use them to do other activities, such as controlling robots, typing, etc.

187 Activity of transcription-coupled DNA repair factors in Archaea

TRAVIS SANDERS

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO

Accurate and timely DNA repair is required to maintain the genome for high fidelity replication and transcription. Deficiencies in DNA repair pathways result in life-altering syndromes, including Cockayne Syndrome and Xeroderma pigmentosum (XP). Both conditions result from the loss of function of a specialized DNA repair pathway termed Transcription Coupled DNA Repair (TCR). Several enzymes are necessary for TCR but the individual activities and associations of each factor have not been established. The complexity and potential redundancy of the many TCR related protein complexes encoded by Eukarya hinders progress in dissecting individual enzyme function. Recently, homologues of a suspected minimal set of TCR-factors were discovered to be encoded by archaeal genomes, thus offering an attractive model system that may be easily manipulated to dissect the mechanistic basis of TCR. Studies from our group have demonstrated that the archaeal RNA polymerase stalls at and identifies damaged bases during transcription, and we now aim to describe the enzymes and factors involved in removing RNA polymerase from the site of DNA damage and initiating rapid repair of the DNA. The minimal archaeal TCR system is predicted to involve only three proteins (XPF, XPD, and XPB), each with a clearly defined eukaryotic homologue known to be critical for TCR loss of activity of any results in Xeroderma pigmentosum. This presentation will discuss the genetic techniques, methodologies, and future work to establish the role(s) of each archaeal TCR-associated.

191 Reverse transcription -quantitative polymerase chain reaction (RT-qPCR) as a robust method for measuring differences between in vivo elongation rates in Saccharomyces cerevisiae

COLIN SEMPECK

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: ALISON THURSTON AND DR. LAURIE STARGELL

A major factor in cancer research is the genomic stability of the cell, which can be affected by histone chaperones that aid in the association of DNA and histones. These chaperones can sequester histones or aid in the assembly or disassembly of nucleosomes; the DNA and histone complex. Nucleosomes cause obstacles for polymerases and also need to be reassembled after passage of a polymerase. We predict mutations and deletions of these chaperones may lead to changes in the elongation rates of RNA polymerases. Measuring these changes would allow us to better characterize these chaperones. My project has two aims; to develop a method of measuring RNA polymerase II (Pol II) elongation that is accessible to the technical skills of an undergraduate student, and to use this method to assess how histone chaperones aid in Pol II elongation. Reverse Transcription -Quantitative Polymerase Chain Reaction (RT-qPCR) is a method that can be used to measure the concentrations of messenger RNA (mRNA) in vivo. When used with primer sets associated with different positions in the open reading frame (ORF), elongation rates can be developed by using an induction time course. RT-qPCR is a relatively simple and robust assay that can be implemented by a team of undergraduate students for high throughput. There are other methods for measuring elongation rates, such as Chromatin Immuno-Precipitation (ChIP) and S1 Nuclease Mapping assays, however these methods require more experience and technical expertise than an undergraduate student may possess.

194 SIMPSON - Spectrum Simulation Software for Advanced NMR

IAN SITARIK

MAJOR: CHEMISTRY

FACULTY ADVISOR/MENTOR: DR. JOSEPH DIVERDI

SIMPSON is open-source software designed to offer spectroscopists with a convenient, practical and extensive means of simulating Nuclear Magnetic Resonance (NMR) spectra of many types on multiple platforms. Nuclei with non-quadrupolar and quadrupolar spin numbers, in isolation and coupled to others are easily simulated. Single spin interactions like (anisotropic) chemical shift and quadrupole plus multi-spin interactions, for example homo- and hetero-nuclear dipolar interaction can be introduced freely. Experimentally selected and designed methods including Magic Angle Spinning (MAS), arbitrarily complex radio frequency (RF), and field gradient pulse sequences are also readily constructed. All user generated instructions are written in a relatively simple, flexible, and well-known Tcl (pronounced "tickle") language using plain text editing. The resulting simulated time and frequency domain data can be processed in many common and popular visualization programs. Examples of key NMR systems will be presented to demonstrate the various software features and power.

196 Modeling Human Organs: A Further Exploration of the Structures of the Human Kidney and Interactive Map of the Human Heart

CASEY SMITH

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: TOD CLAPP AND KENNY IVIE

The goal of this project is to build excitement for STEM disciplines among k-12 students. The department of Biomedical Sciences currently has an extensive outreach program that engages kids in science and health through hands-on anatomy activities. We have set out to create interactive anatomical demonstrations to supplement the current outreach. The project has two parts: the heart map and a kidney models. The 12' x 15' map of the heart allows participants to physically walk through the chambers of the human heart following the path that a typical red blood cell would take. This map provides participants with a method of interaction and builds excitement about the relevant anatomy. Kids are encouraged to explain the anatomy they know and ask questions as they physically walk through the heart map. In addition, we created two kidney models using 3D printing, which allows kids to independently investigate the internal anatomy of the kidneys. The first model demonstrates a bisected kidney on a life-size scale; however, many important structures of the kidney are too small to see without the use of microscopes. Because of this, the second model was created which enlarged the very small structures to a size that microstructure can be observed by the naked eye. These models will accompany the verbally presented information with a visual stimulus while additionally, promoting kinesthetic learning. Overall, these items will be used to supplement the k-12 outreach currently done by the Department of Biomedical Sciences to increase knowledge about the human body.

199 Investigation and Manipulation of an Archaeal Fluoride Responsive Riboswitch

CLAYTON SPEED

MAJOR: BIOCHEMISTRY

FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO

Archaeal species, particularly Thermococcus kodakarensis, are increasingly employed as production hosts for valuable thermostable enzymes and biorenewables. The current suite of genetic techniques available for manipulation of T. kodakarensis permits a wide-range

of expression choices, however, one seemingly ubiquitous molecular technique that is lacking in our anaerobic hyperthermophilic archaeal model is a rapid, dose-dependent induction system, analogous to the bacterial Lac system. Several repressor-operator pairs have been tested with minimal success, and here we describe an alternative method for regulatory control based on riboswitches. Riboswitches are small noncoding RNA sequences in the 5' untranslated regions of mRNA that regulate expression. Though previously undescribed in the domain Archaea, bioinformatics and functional biochemistry dictate that T. kodakarensis utilizes a fluoride responsive riboswitch to regulate a fluoride export pathway. It is hypothesized that manipulation of the T. kodakarensis riboswitch may allow for rapid, nontoxic transient expression of any gene of interest in this hyperthermophilic model organism. Experiments to establish the natural regulon controlled by fluoride, the mechanistic basis of this regulation, and the capacity to adapt this regulation to genes of interest will be presented.

205 Does Grit Predict Job Performance? When and How Well?

Qiuyu Su

Major: Psychology

Faculty Advisor/Mentor: Dr. Alyssa Gibbons

Organizations often use measures of personality traits, such as conscientiousness, to predict job performance. Increasingly, organizations are interested in measuring grit, often defined as "a positive, non-cognitive personality trait based on an individual's passion for a particular long-term goal or end state, combined with a powerful motivation to achieve their respective objective" (Duckworth, Peterson, Matthews, & Kelly, 2007). Grit appears to be a highly desirable trait in employees, but there are several obstacles to using grit as a predictor of job performance. First, grit is defined in terms of an individual's personal objectives, which may or may not be aligned with their employer's objectives. Further, the established measure of grit treats it as a general trait, but research suggests that workplace-specific measures of traits are better predictors of job performance than are general measures. Finally, because grit is a motivational trait, it may be more effective at predicting discretionary or organizational citizenship behavior (willingness to go above and beyond what is required) than at predicting required task performance. We predict that grit will be positively related to self-ratings of job performance behavior. However, the relationship between grit and job performance will be strongest when: (a) grit is measured using workplace-specific items rather than general items; (b) the job performance behaviors are discretionary rather than required; and (c) the employee is in a job related to his or her long-term career goals rather than in a job that does not align with those goals.

213 Conditional Targeting of SMYD2 in Hematopoiesis

Lisbel Torres and Chiara A. Flores

Major: Biological Science

Faculty Advisor/Mentor: Melissa A. Edwards, Lisbel Torres, Chiara A. Flores, Haley Tucker, and Mark A. Brown

SMYD2 is a member of the SET and MYND (SMYD) domain-containing family of lysine methyltransferases (KMT) with specificity for both histone and non-histone targets. Targets include: histone H3K4; histone H3K36; tumor suppressor p53; and tumor suppressor RB. The SMYD family regulates a broad range of processes including cell differentiation, cell proliferation, and tissue-specific morphogenesis. In addition, aberrant expression of SMYD proteins drives tumorigenesis and cell proliferation in a wide range of cancers. SMYD2 is overexpressed in Pre B-cell Acute Lymphoblastic Leukemia (ALL) as well as in Chronic Myeloid Leukemia (CML) and its overexpression is correlated with low overall survival in ALL and CML patients. ALL and CML are characterized by an excess of immature lymphoblasts and abnormal myeloid cells, respectively, that rapidly develop in the bone marrow and out-compete other healthy hematopoietic stem cell (HSC) derived cells. Due to the relatively high expression of SMYD2 throughout the HSC pathway and its overexpression in ALL and CML, we investigated the role of SMYD2 in HSC development and function using a SMYD2 conditional targeting vector. Flow cytometry data suggests that loss of Smyd2 function leads to a severe depletion of small pre B cells, a key site associated with the B-ALL transformation however, downstream populations of more mature B cells resulted in an unexpected expansion of transitional B cells, follicular and marginal zone B cell populations. Going forward I will assess the function of mature B cells and plasma cells by immunizing control and Smyd2 cKO mice and analyzing the antibody repertoire to investigate the degree of overall immunity and the possibility for autoimmunity.

216 Absorption of Omega-3 Fatty Acids in Ruminants

Miranda Wade

Major: Biological Science

Faculty Advisor/Mentor: Terry Engle and Shawn Archibeque

Faculty Advisor(s)/Mentor(s): Shawn Archibeque, Terry Engle

The purpose of this experiment was to determine if different omega-3 supplements could bypass biohydrogenation by rumen microorganisms to potentially be absorbed by the animal. It was hypothesized that both DHA Gold™ and the fish oil treatments would yield DHA after fermentation. Determining which supplement yielded the highest omega-3 concentration was also of interest. A basic fermentation experiment followed by Folch analysis and B-3

fame methylation of the samples were used to determine fat content and then fatty acid composition. It was found that the DHA Gold™ supplement and fish oil treatments both yielded significantly higher percentages of DHA omega-3 fatty acids compared to the control. DHA Gold™ had the highest DHA concentration, with and average concentration of 20.77%.

217 Testing episomal constructs for gene knock down in the marine diatom Phaeodactylum tricornutum

Troy Waneka

Major: Biological Science

Faculty Advisor/Mentor: Graham Peers and Denis Jallet

Diatoms are photoautotrophic eukaryotes that often dominate phytoplankton communities. Gene silencing with interference RNA (RNAi) facilitates the characterization of genes and enzymes in the unique genome of Phaeodactylum tricornutum, a model pennate diatom. The current RNAi strategy inPhaeodactylumrelies on the random integration of an antisense sequence into the nuclear genome, which could potentially interrupt functional regions and lead to erroneous conclusions about gene function. We have developed an RNAi approach for Phaeodactylum that avoids integration into the nuclear genome by utilizing a recently developed episome system. These Phaeodactylumcompatible episomes replicate independently of the chromosome and can be delivered toPhaeodactylum through bacterial conjugation. We have created a custom episome (pJW3) that uses the constitutive histone H4 promoter fromPhaeodactylumto drive antisense RNA production. The episome also contains an antibiotic resistance gene (ShBle) for resistance against zeocin.Conjugations with pJW3 have yielded zeocin resistantPhaeodactylumstrains with conjugation efficiencies between 5.6 x 10-7and 5.8 x 10-7diatom cells. An antisense construct for urease expression knockdown was cloned into pJW3, yielding the pJW3u1as episome, which was delivered to Phaeodactylum through bacterial conjugation. RNA extractions and RT-qPCRs showed that the antisense construct is expressed in pJW3u1as lines. However, urease gene expression in pJW3u1as lines is not reduced compared to control lines carrying pJW3. We hypothesize that the histone H4 promoter is not sufficiently strong to change urease RNA accumulation. Current efforts are focused on constructing alternative episomes with stronger promoters for increased expression of antisense constructs.

227 Multinuclear NMR studies of aqueous vanadium-HEDTA complexes

Xiao Wu

Major: Chemistry

Faculty Advisor/Mentor: Debbie Crans and Ben Peters

Multinuclear NMR studies of aqueous vanadium-HEDTA complexes

Xiao Wu, Benjamin J. Peters, Christopher D. Rithner, Debbie C. Crans Department of Chemistry N-(2-hydroxyethyl)ethylenediamine-N,N',N'-triacetic acid (HEDTA) is an alternative chelator similar to ethylenediaminetetraacetic acid (EDTA) which is commonly used for metal-ion removal; however, the details of the metal complexes have not been characterized. Because of the introduced asymmetry in the HEDTA ligand, more than one coordination complex can form, and each isomer can be characterized by spectroscopy. The interaction between HEDTA and vanadate has been studied by 1D and 2D, 51V, 13C, and 1H NMR spectroscopies at ambient temperature to determine the complexes formed in solution and to explore the pH dependence on complex formation. Two main complexes form in the reaction between vanadate and HEDTA at a one to one ratio in the pH range between 3 and 11. The first complex, V-HEDTA1, begins to form at pH 6 and decreases as pH increases to pH 10. The second complex, V-HEDTA2, forms above pH 3 and increases with pH until pH 9 where the complex no longer forms. Structurally, V-HEDTA2 is similar to the complex that forms between vanadate and EDTA, whereas the data is consistent with the alkoxy arm of the V-HEDTA2 complex being weakly coordinated. The other complex formed, V-HEDTA1, is structurally different from the vanadate EDTA complex. The formation constants of the V-HEDTA complexes and the values were calculated for the future use of these constants to predict formation of complexes under biological and environmental studies.

228 Exploration of the Stability of the Schiff Base Functionality During Drug Formulation

Wenjie Yan, and LaRee Henry

Major: Chemistry

Faculty Advisor/Mentor: Debbie Crans and Mary J. Fisher

The objective is to obtain information on the effects of membrane model interfaces on the Schiff base ligands and their hydrolysis. Schiff base ligands are very popular ligands for coordination chemistry and are used in many technical applications. However, this ligand system suffers from one major limitation: its hydrolytic stability. The present research is to explore the stability of the imine linkage toward hydrolysis. We use the sodium bis(2-ethylhexyl)sulfosuccinate (abbreviated AOT) reverse micellar system as a membrane model system to analyze the stability of two Schiff bases prepared by condensation of 3-trifluoromethylamin (3TF) and 5-chlorosalicyl aldehyde (Cl), which is abbreviated 3-TF-Cl. The effects of changing membrane interactions were investigated using 1H and 19F NMR spectroscopy and dynamic light scattering (DLS). Using the chemical shift changes and monitoring the changes in the DLS, we conclude that the compound is situated at the interface of the reverse micelle and that the hydrolysis of the ligand increases as the reverse micelle size increases.

231 Reduction of UDP-glucose diphosphorylase (UGP2) gene expression does not reduce accumulation of the diatom storage sugar chrysolaminarin in Phaeodactylum tricornutum

YUN ZHANG

MAJOR: BIOLOGICAL SCIENCE

FACULTY ADVISOR/MENTOR: GRAHAM PEERS AND MICHAEL CABALLERO

Diatoms are ecologically significant microalgae, responsible for 40% of the ocean's primary productivity. Diatoms distribute fixed carbon into metabolic pools such as carbohydrate, lipid, and protein. We are interested in exploring the unusual storage carbohydrate of diatoms, chrysolaminarin, which has the same composition and function as starch from plants, but a different structure ('-1,3 and '-1,4 linked glucans, respectively). Decreasing carbon partitioning into chrysolaminarin may increase diatom lipid productivity for biofuels. The synthesis and degradation pathways for chrysolaminarin are unknown. Biochemical evidence suggests that making UDP glucose is the first step of chrysolaminarin synthesis. The sequenced genome of the model diatom Phaeodactylum tricornutum encodes two predicted gene products that may make UDP glucose (UGP1, UGP2). We investigated the contribution of UGP2 to diatom carbohydrate accumulation using an RNAi approach by constructing two independent antisense knockdown vectors with unique, non-overlapping amplicons from UGP2. We identified four UGP2 knockdown strains with reduced gene expression levels by a qRT-PCR screen. These mutants did not have different growth rates or chrysolaminarin per cell compared to wild-type controls. These data suggest that UGP2 does not significantly contribute to chrysolaminarin metabolism. However, partial gene knockdowns may be adequate to reduce chrysolaminarin synthesis. Therefore, UGP2 CRISPR/Cas9 knockouts are in development to study the role of UGP2 in chrysolaminarin biology. These studies improve our understanding of diatom central carbon metabolism, which may inform bioengineering strategies to produce biofuels.

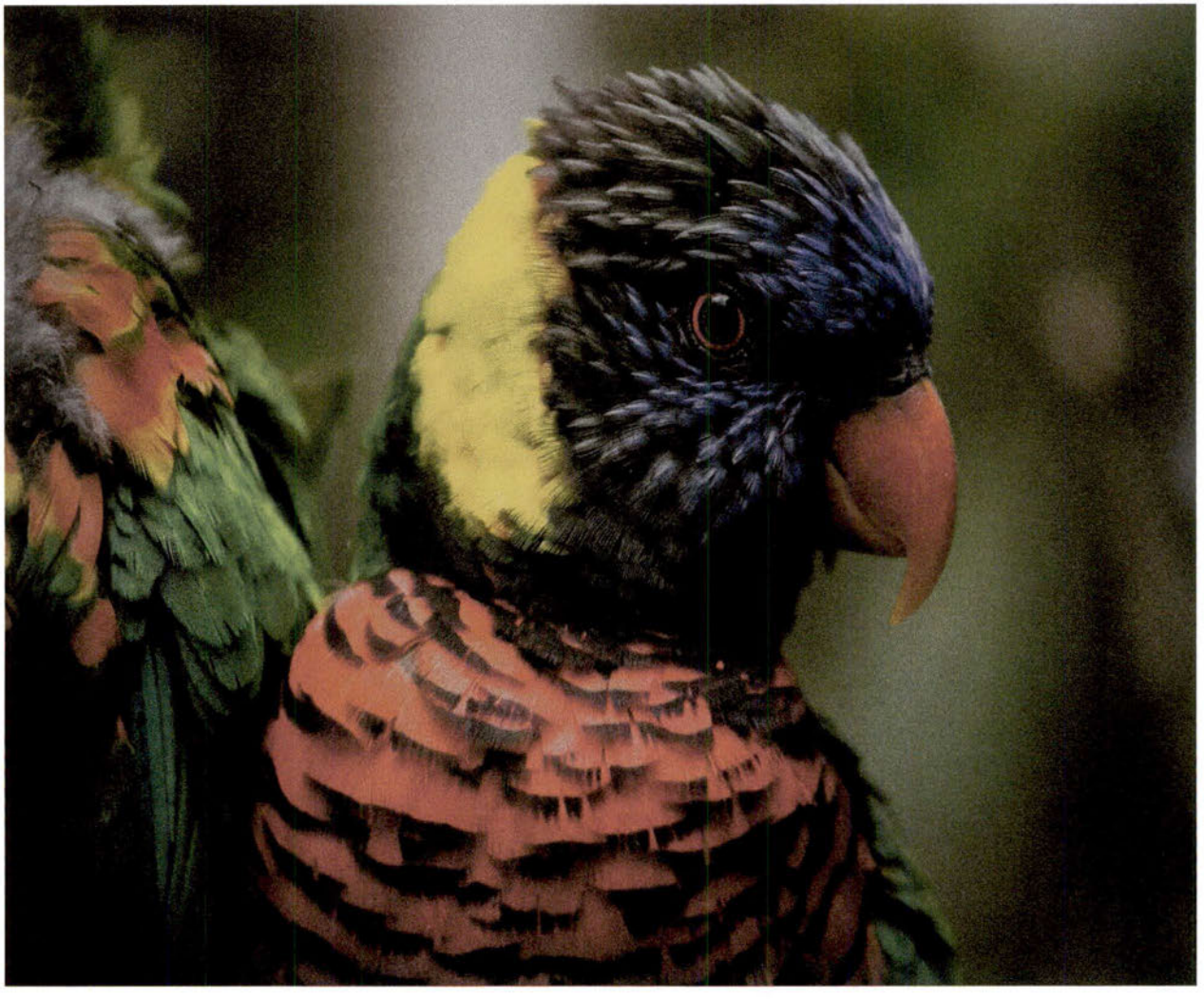
232 Perceptions of Health Challenges in the Workplace

BING ZHU

MAJOR: PSYCHOLOGY

FACULTY ADVISOR/MENTOR: ALYSSA GIBBONS

Recovering from a major health challenge, such as a cancer diagnosis or a stroke, is difficult in itself, but survivors may face additional obstacles in returning to work beyond their physical health. A recent study by Martinez, White, Shapiro, & Hebl (2015) found that cancer survivors are perceived as warmer, but less competent, than normal employees in the workplace, and that job applicants who disclosed a history of cancer were treated less well and were less likely to be called back for an interview. This high-warmth/low-competence stereotype profile is often associated with paternalistic prejudice (Fiske, Cuddy, Glick, and Xu, 2002). We replicated and extended Martinez and colleagues' study by comparing perceptions of cancer survivors and stroke survivors. We conducted an anonymous online survey in which participants rated how they think others would perceive stroke survivors in the workplace. This approach has been used successfully in the past to identify shared stereotypes while avoiding social desirability effects. We expected that stroke survivors would be perceived as warmer than other widely stereotyped social groups (Fiske et al.), but as even less competent than cancer survivors.



College of Veterinary Medicine and Biomedical Sciences

1 X-Chromosome Inactivation Patterns as an Assessment for Canine and Feline Cell Clonality

COURTNEY ABBOTT

MAJOR: BIOLOGICAL SCIENCES

FACULTY ADVISOR/MENTOR: ROBERT BURNETT, ANNE AVERY

Analysis of X-clonality inactivation patterns (XCIP) represents a promising tool for the assessment of cell clonality in suspected canine and feline neoplasms. In the present study, we adapted the human androgen receptor assay (HUMARA) for use in both dog and cats. The PCR-based assay targets polymorphism in tri-nucleotide tandem repeats within the AR gene. Initial experiments focused on assay validation relying on clinical samples from suspected feline lymphoid neoplasms. Clonality in these samples had previously been assessed by PCR for antigen receptor rearrangements (PARR) analysis. Current focus is being shifted toward clinical application of the XCIP assay for non-lymphoid disease. If data implies biased X-chromosome usage, this knowledge will be significant in facilitating development of treatment technologies and techniques.

2 Rapid Detection of Prion Protein in Deer Tissues with a New Assay

SARAH ACCARDI

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: CLARE HOOVER, EDWARD HOOVER

Prions are proteinaceous infectious particles that cause transmissible spongiform encephalopathies (TSE's), a group of neurodegenerative conditions such as chronic wasting disease (CWD) in deer, and bovine spongiform encephalopathy (BSE) in cows. Prions are unique pathogens because they do not contain nucleic material but instead are abnormal misfolded conformations of a normal cellular prion protein, called PrPC. PrPC is transformed into misfolded disease form (PrPCWD) when it encounters existing PrPCWD. PrPCWD then aggregates into amyloid fibrils, which are detected by a new assay, called quaking induced conversion (QuIC). Our research has been directed toward understanding how CWD is transmitted, spreads throughout, and excreted from an infected deer's body. My specific area of study has been finding what tissues of white-tailed deer are infected with prions at four months post-prion exposure by using the new QuIC amyloid seeding method. Using QuIC, we have detected PrPCWD amyloid seeding activity to be concentrated in lymphoid tissues (lymph nodes and spleen). By contrast, CWD prions were not found in several other tissues we examined, suggesting lymphoid tissues are the first organs to be infected by CWD prions. In our next experiments we will use QuIC to determine whether or not prions have infected the nervous tissues at the same 4 month time point. These findings will help us better understand how CWD prions spread within a deer's body and also demonstrate how QuIC can be used to detect infection in live deer at an earlier stage than has been possible.

11 mRNA validation of cellular factors important in prion susceptibility

REGINA ARGO

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: GLENN TELLING, JULIE MORENO, AND DEANDRA WALKER

Transmissible spongiform encephalopathies (TSE) are infectious neurodegenerative diseases caused by the misfolding of normal prion protein (PrPC) to (PrPSc). Some examples of TSEs include: Chronic Wasting Disease (CWD), variant Creutzfeldt Jakob disease, and bovine spongiform encephalopathy (mad cow disease). The only known cellular factor essential for prion propagation is PrPC, however it is known that some cells, even with expression of PrPC, are resistant to prion disease. Therefore, additional unidentified cellular factors may regulate disease susceptibility and pathogenesis. To address this we compared the transcriptomes using RNA sequencing (RNAseq) of cells that are either susceptible (S) or resistant (R) to prion infection and identified 136 differentially expressed genes. We hypothesize that these 136 genes are important in prion susceptibility but these results will first be validated using semi-quantitative real time PCR. To perform real-time PCR we first designed primers for each mRNA transcript and checked its specificity using PCR and gel electrophoresis. If the correct size product was formed DNA was isolated and sent for sequencing. Once sequencing was found to be correct primers were used to perform Sybr-Green real-time PCR on a number of S and R cells lines. A number of genes have been tested and are found to be significantly changed similar to the RNAseq data, however, many more will be validated. Once genes are confirmed to be significantly changed we will then access how the genes allow susceptibility or resistance to prion propagation in our cells.

17 Characterizing telomere length differences between interphase and metaphase PBMCs from astronauts and age-matched controls

JACOB BERG

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: SUSAN BAILEY, MILES MCKENNA

The ends of human chromosomes are capped by telomeres; terminal features composed of tandem DNA repeats and associated proteins that protect chromosomal ends from degradation and prevent inappropriate DNA damage responses. As normal somatic cells undergo successive cellular divisions, telomere length progressively shortens. A variety of lifestyle factors can also negatively influence telomere length, including physiological stress, smoking, poor nutrition, and radiation exposure. Therefore, the rate at which telomeres shorten serves as an informative biomarker for aging and age-related pathologies (e.g., cancer). Although the overall goal of this study is to assess risks associated with telomere dynamics due to long-term spaceflight, we also sought to validate that any observed variability is indeed indicative of actual telomere length changes,

and not an artifact of assay design. Telomere length was measured in peripheral blood mononuclear cells (PBMCs) using telomere fluorescence in situ hybridization (Telo-FISH) on interphase nuclei and metaphase chromosomes. Interestingly, interphase Telo-FISH detected many fewer foci than expected across all mononuclear cells (specific type unknown), potentially masking changes due to spaceflight. Conversely, chromosomal Telo-FISH pinpointed nearly all telomeres in a single cell type (T-cells). Thus, we hypothesize that metaphase chromosomes are more informative of telomere dynamics. Characterizing telomere length differences determined in interphase vs. metaphase will address possible confounding factors regarding cell cycle and cell type, as well as support conclusions of relative telomere length changes in astronauts vs. their age-matched controls.

18 Comparison of three diagnostic tests for the detection of Cryptosporidium in dairy calves

MORGAN BERNER

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: DR. ASHLEY MCGREW, DR. LORA BALLWEBER

Cryptosporidium parvum is a zoonotic protozoan of the small intestines of many ruminant species, especially dairy calves. It is an important parasite of clinical significance, and is often screened for in veterinary diagnostic laboratories. The purpose of this study was to compare the performance and ease-of-use of three diagnostic approaches for detecting Cryptosporidium using an immunofluorescence assay (IFA), acid fast (AF) stain, and lateral flow (LF) test. A total of 29 fecals were collected from potentially infected dairy calves. From these 29, 16 samples were selected to be included in the comparative study. The AF failed to detect oocysts in all samples, whereas the IFA detected oocysts in 8 samples and the LF detected oocysts in 9 samples. Test comparisons were evaluated using kappa statistics, and a k value of 0.1766 was obtained, suggesting a poor agreement due to the AF lack of detecting any positives. Lack of detection by the AF may be due to minimal sample amount used. Discrepancies in IFA and LF results may be related to the high specificity of the IFA as a Gold Standard test, or by a false positive LF result. After comparing tests, it was evident that the IFA is optimal in both test performance and ease-of-use. Due to challenges in interpretation of the LF results, the LF test was not found to be an optimal test. In the diagnostic laboratory, a test that is accurate, precise, easy to read, and provides consistent results amongst different personnel is key for appropriate test selection.

20 Response Inhibition Represented by the N200 in Adults in a Go-NoGo Task

ALEXANDRA BICKET

MAJOR: NEUROSCIENCE

FACULTY ADVISOR/MENTOR: PATRICIA DAVIES, BRITTANY TAYLOR, AND WILLIAM GAVIN

Researchers are developing biomarkers for human functioning using measures derived from electroencephalography (EEG) such as event related potentials (ERPs). For example, the inhibitory N2 ERP component is elicited following "NoGo" stimuli of a Go-NoGo task and is believed to represent one's inhibitory abilities. Despite abundant research on the inhibitory N2, to date, no studies have examined the test-retest reliability of the component. Additionally, a variety of stimuli in Go-NoGo tasks have been used to elicit the inhibitory N2 across studies (letters, pictures, sounds), yet no research has determined whether different stimuli elicit the same neural response (i.e., validity of the Go-NoGo paradigm). Establishing the psychometric properties of ERPs and paradigms is essential for the development of robust biomarkers. The purpose of this study is to establish the psychometrics of the inhibitory N200 in a Go-NoGo task. Thirty young adults aged 18-25 will be recruited from the community to complete two sessions of EEG data collection. During each session, participants will complete two versions of a Go-NoGo task. Test re-test reliability of the inhibitory N2 will be established using correlations. I predict reliability will be high. To establish validity of the paradigm, differences in N2 amplitudes will be measured using a repeated measures ANOVA. I expect to see differences in amplitude due to emotional valence associated with different stimuli in the two versions of the Go-NoGo task. This study could inform scientists and professionals in the medical field about the development of N200 as a biomarkers of inhibitory control.

23 Does Placental Lactogen Affect Glucose Transport Across the Placenta?

ALEXANDER BOYARKO

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: RUSSELL V. ANTHONY, KIMBERLY M. JECKEL

Intrauterine growth restriction (IUGR) is a significant cause of infant mortality and morbidity, affecting upwards to 8% of all pregnancies. Although its function has not been well defined, both human and sheep placental lactogen (oPL) are hypothesized to modify maternal and fetal metabolism to promote fetal growth and development. We recently generated oPL deficient pregnancies using lentiviral mediated shRNA, and allowed the resulting pregnancies to go to 135 days of gestation (dGA) along with a control group. Placental and fetal weights were reduced (P</=0.01) 52% and 32%, respectively, and were associated (P</=0.01) with a 50% reduction in oPL mRNA and a 38% reduction in placental oPL concentration. We recently harvested control and oPL deficient pregnancies at 50 dGA to examine the effects of oPL during early pregnancy. Uterine vein oPL concentrations were reduced (P</=0.05) 41%, and fetal weights were reduced (P</=0.01) 20% in oPL deficient pregnancies. We have examined the expression of the facilitated glucose transporters SLC2A1 and SLC2A3 responsible for glucose uptake and transfer by the sheep placenta. SLC2A1 mRNA concentrations were reduced (P?0.05) in the cotyledons by 43% and 55%, at 50 and 135 dGA, respectively. SLC2A3 mRNA concentration was not significantly

reduced (P</=0.10) at 50 dGA (24%) but was at 135 dGA (49%; P?0.05) in oPL deficient pregnancies. Overall, these data suggest that the failure of glucose transfer by SLC2A1 may be a driving force behind early IUGR, and both transporters may play a role in the severe IUGR observed during late gestation in oPL deficient pregnancies.

24 Analysis of mechanisms of copy number variation in yeast

JADA BOYD

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: VICTORIA HARCY, LUCAS ARGUESO

When DNA double strand break repair pathways are misused, they can produce non-reciprocal chromosomal translocations associated with gene amplifications and deletions. This type of gene copy number variation (CNV) is often observed in cancer cells. Two distinct mechanisms, Canonical Homologous Recombination (CHR) and Break Induced Replication (BIR), can each result in similarly translocated chromosomes. Removal of the POL32 gene, which is required for BIR in model yeast cells, inhibits this specific pathway, thus providing a way to indirectly assign a mechanism to non-reciprocal translocations detected through a selection system. We hypothesize that without an active BIR pathway, CHR will produce 100% of the non-reciprocal chromosomal translocations. Materials and Methods: The experiment was based on a diploid strain containing one allele of the LYS2 gene missing its 5' end on chromosome 10 and a second allele of LYS2 missing its 3' end on chromosome 4. Neither truncated allele encodes a functional version of LYS2, but if recombination between their shared regions occurs it generates a translocation resulting in a functional full-length gene that restores lysine prototrophy. The rate of Lys+ recombination in wild type cells was recorded using fluctuation assays. In addition, we characterized the LYS2 translocations in the wild type strain through Pulse Field Gel Electrophoresis (PFGE) analysis. An isogeneic pol32?::Nat homozygous diploid strain was constructed using PCR-mediated gene knockout in haploid cells and yeast tetrad analysis. Results: PFGE revealed that the wild type-derived Lys+ clones had approximately a 1:1 ratio of non-reciprocal to reciprocal translocations, suggesting that CHR was the primary mechanism involved. If BIR had contributed to the Lys+ translocations, that ratio should have been greater than 1:1. I am currently conducting the same experiment with the pol32'::Nat strain I built to examine whether the recombination rate and/or ratio of non-reciprocal to reciprocal translocations are altered. In addition, we are moving the LYS recombination substrate on chromosome 4 to a position closer to the telomere to facilitate the formation of BIR-mediated non-reciprocal translocations.

26 Characterization of Antibiotic Tolerance and Biofilm Formation in Clinical Isolates of Pseudomonas aeruginosa

MARIA BROCK

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Pseudomonas aeruginosa is a Gram-negative, rod-shaped bacterium that is found in a variety of environments and produces biofilms. Biofilms occur when planktonic bacteria attach to a surface, congregate in a group, and secrete a polysaccharide matrix. Biofilms reduce the bacteria's susceptibility to antibiotic treatments. An initial group of 38 paired P. aeruginosa clinical isolates were obtained from the Colorado State University Veterinary Teaching Hospital Diagnostic Laboratory. Bacterial isolates from various animal sources (canine, feline, equine, and bovine) submitted for antibiotic susceptibility testing were characterized. Isolates were evaluated for EPS production, biofilm production, motility, and cyclic di-GMP production. Two pairs of isolates were shown to be genetically related but isolates within the pair showed different phenotypes. For one of these paired isolates, we identified mutations in genes gyrA and parC that confer antibiotic resistance. These studies suggest that initial antibiotic treatment regiments targeting a single isolate may not be effective against all of the possible phenotypic variants that arise during an infection.

28 Investigating the Role of Autophagy in Canine Osteosarcoma through Combination Treatments

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Autophagy is a homeostatic mechanism utilized by cells in order to clear and recycle damaged proteins and organelles. It is an important pathway in metabolic regulation and intracellular recycling in order to maintain protein and organelle quality. Autophagy is also a stress response, allowing cells to use recycled organelles as an alternative energy source to survive starvation. Autophagy allows cells to survive when conditions are not optimal. Some tumor cells can activate autophagy in response to stress, as a protective barrier. This allows tumors to avoid apoptosis and continue to proliferate even when there is cell damage and lacking nutrients. While autophagy was initially thought to be a mechanism by which normal cells could repair damage and as such be a tumor suppression mechanism, it is now clear that it can also enable tumor cell survival in adverse conditions including those associated with treatment such as chemotherapy and radiation. The role of autophagy inhibition on tumor cell proliferation was determined using hydroxychloroquine (HCQ). HCQ is an FDA approved drug for treating a number of diseases including arthritis, lupus and malaria, but is also effective at inhibiting autophagy and safe for dogs, as shown by previous studies

in the Gustafson laboratory. Combination treatments were done using HCQ and doxorubicin (DOX), a common chemotherapeutic drug, in order to expand understanding of autophagy suppression effect on tumor development. The combination was found to be largely additive across cell lines.

34 Identification of Cryptosporidium species in Colorado animals

MEAGAN CHRISWELL

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: DR. VALERIA SCORZA, DR MICHAEL LAPPIN, AND DR. LORA BALLWEBER

Introduction: Cryptosporidium is an important parasitic pathogen for humans and animals. Humans can become infected with Cryptosporidium directly from other humans, from the environment, from contaminated water sources, from animals via zoonotic transmission (Xiao, 2010), or through raw milk consumption (Rosenthal et al, 2014). There are known differences in zoonotic potential between Cryptosporidium species, with greater than 90% of human cryptosporidiosis caused by Cryptosporidium parvum and C. hominis (Xiao, 2010). Objectives: This study's aim is to identify the species and subtypes of Cryptosporidium commonly found in Colorado animals. This study could help to determine the zoonotic transmission potential in Colorado. Materials and Methods: 58 fecal DNA samples were retrieved from a bank of samples from naturally infected animals. A nested Polymerase Chain Reaction (PCR) was performed on each sample. The target for the PCR assay was a highly conserved 18S ribosomal DNA gene (Ryan el al., 2003). The C. parvum positive samples were subtyped using another nested PCR assay that targeted the surface protein gene that determines Cryptosporidium subtype (Chalmers et al., 2011). Results: Out of the samples run, there were 32 positives out of 58 (55%). 24 (75%) of these were C. parvum positives. 21 out of the 24 (88%) C. parvum positive samples amplified on the subtyping assay. All 21 samples were in the subtype class IIaA, a class that has been implicated in zoonotic Cryptosporidium transmission (Chalmers and Giles, 2010). Conclusion/Discussion: The high prevalence of C. parvum could signal a higher risk for zoonotic transmission of Cryptosporidium in Colorado. This finding is compounded by the fact that all C. parvum samples were found to be in the subtype IIaA, which has been implicated in zoonotic transmission.

37 Household air pollution from cookstoves and metabolomics in dried blood spots among Honduran women

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MAJOR: ENVIRONMENTAL HEALTH

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Introduction: Household air pollution (HAP) from the use of biomass-burning cookstoves is the third leading risk factor for global morbidity and mortality. However, direct evidence linking HAP and cardiovascular disease (CVD) endpoints is limited largely due to the difficulties associated with collecting clinical disease measures in developing countries. The use of dried blood spots (DBS) in metabolomics is a newer and more convenient method for field studies, and has the potential to provide metabolomics data in hard-to-reach populations. Evaluating metabolites such as MG18:2, a monoglyceride previously identified as an independent risk factor for incident coronary heart disease, may provide insight into the relationship between HAP and CVD. Methods: A cross-sectional study was completed with 107 female cooks between the ages of 22-55 years, in rural Honduras. Personal and kitchen fine particulate matter (PM2.5) was collected for 24 hours with the use of gravimetric sampling. Health assessments were conducted via survey and point-of-care devices. DBS were collected using a finger prick and analyzed by LC-MS. We assessed the relationship between several known risk factors for CVD (e.g., triglycerides, BMI, total diet diversity score, age, and socioeconomic status) and MG18:2, as measured in DBS. Results: In preliminary results, we observed positive correlations between the relative abundance of MG18:2 and triglycerides and diet diversity score ($r=0.48$ and 0.27, respectively) Conclusion: Observed correlations between MG18:2 and independent risk factors for CVD promote confidence in the use of DBS for metabolomics investigations. Further analysis will describe the relationship between levels of HAP and MG18:2.

38 The Role of Cytokinin in the Growth-Defense Tradeoff

KATHRYN CLEARY

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FACULTY ADVISOR/MENTOR: CRIS ARGUESO

Defense responses in Arabidopsis thaliana are accompanied by a decrease in growth rate. This is known as the growth-defense tradeoff. The molecular pathway responsible for the growth-defense tradeoff is not well understood. We designed an experiment to determine whether the plant hormone cytokinin, associated with other aspects of defense, plays a role in the tradeoff. Wild type Arabidopsis thaliana (Columbia) and a mutant type (ahk2,3) which lacks two of three receptors for cytokinin were grown on soil and plants of each genotype sprayed with either 100nM FLG22 or water. FLG22 is an epitope of flagellin, the protein filament that makes up bacterial flagella, and is commonly used by plant pathologists to stimulate a defense response. The experiment was also done on seedlings grown on solid media with 100nM FLG22. If cytokinin did in fact affect the growth-defense tradeoff, we expect to see that those plants that were treated with FLG22 but were unable to perceive cytokinin (ahk2,3) will not differ in size to their untreated counterparts. ImageJ software to measure the area of plants, we calculated percent reduction and saw with some statistical significance that cytokinin plays a role in the growth-defense tradeoff.

39 Use of ddPCR to quantify virulence gene expression in Mycobacterium tuberculosis

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In 2014 alone 9.6 million people fell ill with Tuberculosis and 1.5 million died from the disease. Tuberculosis is caused by the bacteria, Mycobacterium tuberculosis. Preliminary data suggests that the protein CtpH, a cation transport protein, when knocked out in M. tuberculosis shows an increased virulence during the infection of macrophages and animal model. The proteins ESAT6 and Cfp10 are highly correlated with virulence of this pathogen. ESAT6 is a potent T cell antigen secreted by the cell and Cfp10 is also secreted by the cell and the two proteins form a complex which is secreted into the host infected macrophage during infection. Droplet Digital PCR (ddPCR) is a recently developed molecular biology tool that allows for absolute quantification of gene expression. By use of ddPCR, the expression of all three of these proteins can be evaluated. We hypothesize that CtpH regulates the expression of the ESAT-6/Cfp10 complex via an unknown cation. To confirm this, we will use ddPCR to quantify transcripts in Mtb strain with wild-type and deletions of the ctpH gene.

42 Inflammatory activation of glial cells mediates neuronal injury from exposure to manganese

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FACULTY ADVISOR/MENTOR: RONALD TJALKENS, KATRIANA POPICHAK

Manganese (Mn) is an essential element for cellular homeostasis, but exposure to increased levels causes neuroinflammation and neurotoxicity in the cortex and basal ganglia, resulting in a parkinsonian-like disorder called manganism. NF-κB-mediated activation of inflammatory genes in astrocytes and microglia cause neuronal injury, but it is not known which factors are most highly regulated by Mn. We examined the response of neurons to glia-conditioned media (GCM) from astrocytes and microglia exposed to varying levels of Mn in order to identify factors critical to neuronal injury. We hypothesized that mixed cultures of astrocytes and microglia exposed to Mn (0-100M) would enhance neuronal death compared to Mn alone. To determine the optimal Mn concentration to induce glial inflammation and neuronal death from GCM, primary cultures of mixed glia, pure astrocytes and pure microglia were treated with concentrations of 0, 10, 30 or 100 M Mn for 24 hours. The GCM was transferred to primary neurons for 24 hours and then assessed for viability via a Presto-Blue Viability Assay and apoptotic marker staining (Annexin V, Caspase-3). An ELISA Array was used to measure cytokine release in the GCM for each glial cell type. Inflammatory gene expression in all cell types was assessed using reverse transcriptase-Real-Time PCR. Once the ideal Mn concentration for inflammation and neuronal death is determined, future experimentation will include glia isolated from astrocyte-specific IKK knock-out mice. The results from this project could help understand mechanisms of injury in Mn neurotoxicity.

51 Transitional Needs of Seniors Entering the Workforce

KELLYN DAVIS
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This paper provides a comprehensive analysis of existing literature and independently gathered qualitative data in an attempt to provide insights into the transitional needs of seniors entering the workforce. Existing research in the field of student affairs and higher education is used as a framework to provide background on what research indicates students need to both learn and experience as undergraduates in order to be effective employees when first entering the workforce. In addition to currently existing research and models, additional data from surveys and interviews of both senior students and 1st year members of the workforce is included. This data includes information on the lived experiences and outcomes of students that will be and have entered the workforce, and their beliefs about programs that could have or did contribute to developing them as effective members of the workforce. This research also outlines general skills and qualities believed by participants to be important for new working members of society. The collected data on what students indicate as their transitional needs will be compared with what existing literature recommends. The paper concludes with general recommendations for transitional programming for seniors at the collegiate level.

54 Lipid Differentiation of Burkholderia pseudomallei Following In Vitro Infection

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This experiment was conducted in order to assess the lipid makeup of Burkholderia pseudomallei following an in vitro infection. B. pseudomallei is a bacterium associated with the human disease melioidosis. It is observed to be similar to Mycobacterium avium subspecies paratuberculosis (MAP), which causes Johne's disease in ruminants. My work aims to further existing research that associates species similar to MAP with receptor-mediated lipid transformation. Such research has been limited in the past due to the highly infective quality of subject bacteria. The method I used began with the infection of live macrophages with a culture of B. pseudomallei δpurM (Bp82), an adenine and thiamine auxotrophic form of B. pseudomallei . After infection, the macrophages were lysed in order to expel the bacteria. Lipid was extracted from the bacteria post-infection by a process of lyophilization and Folsch washing. Bp82

from broth that did not undergo infection was submitted to the same lipid extraction protocol. The lipid produced from both samples was run through a series of thin layer chromatography systems of varying polarity and also submitted for LC/TOF-MS, using the Sartain Method in both positive and negative modes. My analysis has suggested that infection increases the abundance and intensity of lipids possessing greater polarity. These results may be used to improve knowledge of the composition of B. pseudomallei for use in vaccination and treatment.

55 Modulating T cell Autoimmunity in Type 1 Diabetes through PKCϴ

James Dilisio

Major: Microbiology

Faculty Advisor/Mentor: Brendan Podell

T lymphocytes mediate the autoimmune disorder Type 1 diabetes (T1D) that targets and destroys the insulin-producing beta cells in the pancreas, resulting in an inability to control high blood glucose levels (hyperglycemia). Current therapies of insulin replacement only target the symptom hyperglycemia; preventative methods aimed at reducing autoimmune T cell activation currently lack. New approaches to alleviate autoimmune reactivity could preserve long-term insulin production and therefore blood glucose regulation. This led to the hypothesis that negative regulation of a key protein (protein C kinase , PKCθ) in autoimmune T cell activation and proliferation could reduce beta cell death while promoting an anti-inflammatory, regulatory T cell(Treg) population. To test this hypothesis we determined the efficacy of inhibiting PKCθ in vitro and in a T1D mouse model(NOD), either before or after autoimmune infiltration. In vitro, T cell stimulation led to a significant decrease in exogenous IL-2, a marker of T cell activation, after PKCθ inhibition when compared to control cells. Likewise, preventative treatment of NOD mice caused a significant decrease in the development of diabetes. The cells of treated mice exhibited a greater anti-inflammatory capacity compared to the saline-treated controls. However, the inhibitor displayed little efficacy after the onset of disease (concurrent treatment). These findings align with previous studies showing that inhibition of PKCθ after antigen-specific proliferation has little effect on reducing autoimmune T cell destruction. In summary, beta cell destruction is abrogated by inhibiting PKCθ before autoimmune T cell proliferation, therefore preventing T1D.

57 Mosquitocidal Properties of IgG Targeting the Voltage Gated Sodium Channel in Malaria Vector Anopheles gambiae

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Faculty Advisor/Mentor: Brian Foy, Jacob Meyers

Insecticides are the most powerful system of controlling the transmission of malaria. Voltage gated chloride channels (VGSC) are large transmembrane proteins that are responsible for conducting sodium ions across axons and generating action potential and are also highly selective insecticide targets of the pyrethroids class of insecticides and DDT. Due to the increase of insecticide resistance, we have targeted VGSC with purified immunoglobulin G (IgG) and measured its mortality effects on Anopheles gambiae mosquitoes. VGSC has 4 different domains, each with six alpha subunits and 4 extracellular loops. We targeted unique sites on a single extracellular loop of domains 1, 2 and 4. We immunohistochemically stained adult An. gambiae and determined that targets on domains 1, 2 and 4 (VGSC 1, 2, and 3 respectively) are located in the tissues of the head and thoracic ganglia, suggesting this protein is conserved in these regions. VGSC 1 and 3 are also located in the tissues of the Malpighian tubules and ovaries, while VGSC 2 and 3 also have locations in the flight muscle tissues. To determine if targeting the channel would result in mortality, we injected 958ng/mL anti-VGSC 1, 2 and 3 IgG in the thorax of female mosquitoes and measured their mortality. Targeting VGSC has shown to reduce survivorship, which suggests that when VGSC 1, 2 and 3 are digested via blood meal, the antibodies should cause dose dependent mortality effect. This implies that when introduced in a vaccine, the antibodies should cause mosquitocidal effects.

58 Feline Soluble CD14: Expression, purification, and ELISA development

Luke Draper

Major: Microbiology

Faculty Advisor/Mentor: Gregg Dean, Alora LaVoy

Objective: Develop an ELISA to measure soluble CD14 in cat plasma. Background: The intestine is a primary target organ of human immunodeficiency virus (HIV) and feline immunodeficiency virus (FIV), a natural pathogen of domestic cats. Infection leads to impaired barrier function of the intestine which results in bacterial translocation from the lumen of the gut into the blood. Circulating bacterial products then drive chronic inflammation that is associated with accelerated disease and a poor prognosis. Soluble CD14 (sCD14) is released by activated monocytes in response to the circulating bacterial products. Detection of increased concentrations of feline sCD14 could be used as a biomarker for bacterial translocation and chronic inflammation in cats. Assays to measure sCD14 in human plasma are established, but assays are not available for feline plasma. Methods: Rabbit polyclonal antibodies were generated against three feline sCD14 peptides. An expression plasmid containing the gene for feline sCD14 (pND14-fCD14mpHis) was generated and stably transfected into the 293T/17 mammalian cell line. Expression of feline sCD14 was confirmed by Western Blot and ELISA. sCD14 purified from the medium using affinity or ion-exchange chromatography was evaluated by SDS-PAGE, WB, and ELISA. Results: Two of the antibodies were suitable for use in the ELISA. sCD14 was secreted by 293T/17 cells stably transfected with the expression plasmid. The purification process was optimized for high purity. Purified feline sCD14 was validated as a standard for use in a quantitative ELISA. Future studies will validate this sCD14 ELISA as a prognostic tool in FIV infected cats.

59 Developing a photoacid system to investigate the kinetics of amyloid- Cu2+ ion complexes using absorption spectroscopy

DAVID DUMMER

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FACULTY ADVISOR/MENTOR: DEBBIE CRANS, ESTELA MAGALLENES

Absorbance spectroscopy will be used to characterize Cu2+-complexes and a photoacid system will be developed for measuring the kinetics of Cu2+-complex formation relevant to Alzheimer's disease. Misfolding of the amyloid β protein is known to ultimately lead to Alzheimer's and other neutrodegenerative diseases. Metal ions, particularly copper ions have been implicated in enhancing the onset of these diseases. It is therefore important to understand the types of metal ion complexes that form and their properties. However, the kinetics of Cu2+ complex formation is difficult to measure because these reactions are often diffusion limited and not readily measureable. We hypothesize that one can use photoacids to measure the kinetics of Cu2+-peptide complexes formation or hydrolysis. We are characterizing these complexes using absorbance spectroscopy and are working toward using a photoacid to measure the kinetics of peptide complex formation and/or hydrolysis. To this end we have investigated to pH profiles of Cu2+ the presence of 8-Hydroxypyrene-1,3,6-Trisulfonic Acid, Trisodium Salt, HPTS, a photoacid. Specifically we have determined the effects of Cu2+ on the HPTS at a range of concentrations. These studies are critical for us to be able to develop this system to measure the peptide kinetics.

64 Heterozygote deletion of FADS2 attenuates glucose intolerance and modifies effects of n-3 PUFA in mice fed a high-fat diet

AMANDA EVANS, CALEB WORKER

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FADS2 haplotypes associated with hyperactivity of its gene product, delta-6 desaturase (D6D), are associated with obesity and type-2 diabetes in humans. D6D regulates long-chain polyunsaturated fatty acid (PUFA) biosynthesis and is upregulated in several rodent models of obesity/insulin resistance, but its direct influence on the development of diabetes is unclear. D6D activity might favor pathogenic effects of linoleic acid (LA) in the modern diet by enhancing production of its desaturation/elongation product arachidonic acid (AA). Conversely, D6D may promote protective effects of dietary α-linolenic acid (ALA) by enhancing its conversion to long-chain omega-3 PUFAs that displace AA in cell membranes. The present study determined if suppression of FADS2 expression would attenuate glucose intolerance in mice fed a high-fat diet, and perhaps modify the effects of dietary ALA enrichment in this context. Adult male mice with wild type (WT) expression or heterozygote ablation of FADS2 (HET) were fed high-fat diets (45% w/w) containing 8% PUFA supplied by an equal mix of LA and ALA, or ~4:1 ALA:LA for 3 months. Body weight increased significantly in all groups, but was attenuated by ALA enrichment, with no significant effects of FADS2 suppression. Glucose intolerance developed in WT mice fed both diets, but was markedly attenuated in HETs fed the mixed diet. Interestingly, ALA enrichment negated the protection against glucose intolerance in HETs, but had no effect in WT mice. In conclusion, FADS2 expression potently modulates metabolic responses to high-fat feeding, supporting further study of its potential involvement in the pathogenesis of type-2 diabetes.

67 Resolving the argument: what is the role of ribonucleotide excision repair in the stimulation of mitotic recombination?

JESSICA FERRAREZI

MAJOR: UNDECIDED

FACULTY ADVISOR/MENTOR: JUAN LUCAS ARGUESO, HAILEY NICOLE CONOVER

Two recent studies (O'Connell et al. 2015 and Conover et al. 2015) showed that mutant yeast cells lacking the genes encoding H-class ribonucleases display increased rates of mitotic recombination leading to loss-of-heterozygosity (LOH). The role of these enzymes is to remove two types of RNA:DNA associations: stable mRNA-DNA hybrids (R-loops) formed during transcription, and ribonucleotide monophosphates (rNMPs) incorporated into DNA during replication. RNases H1 and H2 can degrade the RNA component of R-loops, but only H2 can remove rNMPs from DNA. Both O'Connell et al. and Conover et al. observed high LOH rates in rhn201? mutant strains, completely lacking the catalytic subunit of RNase H2. Despite reporting similar data, the two studies reached contrasting conclusions. O'Connell et al. concluded that unprocessed R-loops were the main cause of elevated recombination when RNase H2 was not present, whereas Conover et al. concluded the unprocessed ribonucleotides were the main cause. To resolve this argument, our research group measured LOH rates in strains carrying a mutant version of RNase H2 (rnh201-red) that is unable to remove ribonucleotides, but remains functional for R-Loop processing. Our results indicate that both R-loops and misincorporated ribonucleotides are each partly responsible for elevated mitotic recombination.

69 Skull size but not shape predicts ear loss in bufonid toads

TYLER FIERO

MAJOR :MICROBIOLOGY

FACULTY ADVISOR/MENTOR: KIM HOKE, MOLLY WOMACK

Most terrestrial vertebrates have outer and middle ear structures to transmit airborne sound from the environment to their inner ear sensory cells. Yet, all over the world numerous anuran species have independently evolved "earlessness", the lack of middle and outer

ear structures, despite the importance of acoustic communication in most anuran mating systems. Our work aims to determine whether shifts in the skull drive middle and outer ear loss within the bufonid (true toad) family by comparing microCT data of eared and earless toad species across independent ear loss events. Our data shows that skulls of earless species do not share any particular shifts in skull shape, do not lack other skull bones more frequently, nor are they less ossified than skulls of eared species. We conclude that shifts in skull shape are not driving the evolutionary lability of ear structures.

71 Novel Diindolylmethane Analogs Suppress Neuroinflammation in Parkinsonian Model of Glia

LUKAS FOSTER

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Parkinson's Disease (PD) is the second-most prevalent neurodegenerative disease in the United States and is characterized by progressive loss of dopaminergic neurons within the substantia nigra pars compacta. The NF-kB signaling pathway plays a significant role in the progression of PD by upregulating expression of several neuroinflammatory genes and eventually inducing neuronal apoptosis. Members of the NR4A nuclear orphan receptor family, including Nurr1, Nur77, and NOR1, have shown the ability to modulate NFkB - mediated neuroinflammatory gene expression in glia. Despite Nurr1, Nur77, and NOR1 not having any known physiological ligands, past studies have uncovered this nuclear receptor family's affinity for novel diindolylmethane analogs such as DIM-C-pPhOCH3 (C-DIM5) and DIM-C-pPhCl (C-DIM12). Diindolylmethane is a naturally occurring compound currently used to treat colorectal and ovarian cancers due to its studied abilities to combat oxidative stress. To examine how these novel diindolylmethane analogs affect neuroinflammatory gene expression in an in-vitro Parkinsonian model, microglia and astrocytes were treated with either C-DIM5 or C-DIM12 in conjunction with the neurotoxin precursor, MPTP. Q-PCR data showed microglia and astrocytes treated with either C-DIM5 or C-DIM12 and MPTP had significantly lower levels of neuroinflammatory gene expression than cells treated with MPTP alone. Subsequent knockout studies showed C-DIM12 and C-DIM5's efficacy in modulating neuroinflammation was significantly exacerbated upon Nurr1 and Nur77 knockout, respectively, using gene-specific siRNAs. These data suggest C-DIM5 and C-DIM12 are interacting with Nur77 and Nurr1, respectively, and enhancing these nuclear receptors' abilities to enervate the NFkB signaling pathway and thusly decrease neuroinflammatory gene expression within glia.

75 The Identification, Characterization, and Quantification of Cytochrome 18a1 in the Blackback Land Crab Gecarcinus lateralis

GENNA FRAPPAOLO

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For arthropods the molting cycle is essential for growth and development. Ecdysteroids are steroid hormones that regulate and coordinate the molting process. In the molting cycle animals spend a majority of time in intermolt and transition to premolt as molting hormones levels increase, hormone levels decrease right before the animal sheds the old exoskeleton and remain low in postmolt to preventing precocious molting. Ecdysteroids are synthesized and expressed in the Y-organ, an endocrine gland, located within cephalothorax in the black land crab (Gecarcinus lateralis). Halloween genes encode enzymes that catalyze the synthesis of ecdysteroids. Once ecdysteroids are no longer needed in premolt, they are degraded. In related species, Cytochrome 18a1 catalyzes the 26-hydroxylation of the molting hormone 20-hydroxyecdone, which is necessary to decrease in the levels of active ecdysteroid hormones. We hypothesize that the same phenomenon occurs in the land crab, G. lateralis. We used arthropod sequences to extract and characterize the land crab orthologs CYP18a1. RNA-seq data from G. lateralis Y-organ show mRNA levels were highest in intermolt and lowest in postmolt. Future work will include qPCR to quantify mRNA expression of CYP18a1 in the Y-organ at different stages of the molt cycle. Supported by NSF (IOS-1257732).

82 Basic Word Processing and Recognition in Bilingual and Monolingual Individuals

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Previous behavioral literature suggests that multilingual individuals use multiple processing systems that engage in simple word recognition; thus, delaying response time in picture-naming and word-recognition tasks presented. This study addresses the difference in word processing in monolingual and bilingual individuals, specifically, the delayed response time showed by bilingual individuals compared to monolingual individuals regarding basic word recognition. The study's main objective is to identify differences in neural processing that occur in basic word recognition, as well to examine those differences. To do so, two different tasks will be used, both tasks will be picture-naming related tasks, one will be an immediate response, while the other one will be a delayed response. The delayed response task will allow us to see if the delay is due to more complex word processing

or simply due to individual delay. We believe that the delay observed in bilingual individuals is due to more complex neural processing in word recognition. That being said, will bilingual individuals actually be slower to respond than monolingual individuals' And will that delay/difference disappear in the "delayed response" task' The results will expand the understanding of language processing, as well as compare basic word-recognition processing in bilingual and monolingual individuals.

91 Detection of Guinea Pig Immune Proteins

PAIGE HANDGEN

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: NICOLE KRUH-GARCIA, CAROLINA MEHAFFY

There is a lack of Guinea pig reagents, which are vital to track the prognosis of tuberculosis infection. The only way we can track the prognosis currently is by RTPCR, which can only be done by killing the guinea pig. We can monitor live animals and track the disease by using the immune proteins exhibited throughout infection.

92 Understanding the mechanism behind spontaneous disease in female gene targeted elk and deer PrP mice

MADISON HARMAN

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: GLENN C. TELLING , JIFENG BIAN, AND JULIE A. MORENO

Chronic Wasting Diseases (CWD) is a prion disease that affects cervids, specifically elk, deer, and moose. Prion diseases are fatal neurodegenerative diseases also known as transmissible spongiform encephalopathies (TSEs). The infectious agent of prion diseases is formed by the misfolding of the normal prion protein PrPC to PrPSc. In order to study CWD our lab created gene targeted (Gt) mice that express elk or deer PrP in place of mouse PrP. While conducting studies using these mice we observed an anomaly, the Gt female mice were spontaneously dying at a significantly higher rate, 30% for Gt elk and 60% for Gt deer, compared to the wild-type FVB mice at a rate of 15%. The Gt mice experience seizures and die around 200 days post inoculation, no matter the prion they were inoculated with or the route of exposure. We then asked: why are Gt female mice more prone to spontaneous death than their wild-type counterparts? What mechanism would cause specifically Gt deer mice to express these clinical symptoms at such high rates? The glutamate 5 receptor (mGluR5) is known to be associated with PrP and is involved with seizures, therefore we hypothesize that this receptor is a key player in this spontaneous disease. To test this hypothesis we are using Western blots and immunofluorescence to determine the levels of mGluR5 found in the brains from the spontaneously sick mice. Further analysis of the mGluR5 pathway will be performed on both Gt elk and Gt deer mice.

98 Neuropathological features of chronic wasting disease in gene targeted elk and deer PrP mice

PEYTON HENDERSON, JAMES DILISIO

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: GLENN TELLING, JULIE MORENO

Chronic wasting disease (CWD) is a form of transmissible spongiform encephalopathy (TSE) specific to cervids such as deer, moose, and elk. TSEs, otherwise known as prion diseases occur when the normal cellular prion protein, PrPC, is misfolded to PrPSc. These diseases affect the nervous system producing an array of clinically observable symptoms and neuropathalogical changes such as spongiosis,neuronalloss, andamyloidplaque formation. Although deer and elk only differ by one amino acid residue at 226, transgenic mice expressing Elk- or Deer-PrP differ in neuropathology and strain transmission during disease. To increase biological relevance we are using gene targeted (Gt) mouse models expressing deer or elk PrP as these express endogenous levels of PrP in all tissues unlike the transgenic mcie. These mice will be used to determine if neuropathology differs between elk and deer PrP expression. Mice were inoculated with a number of different CWD prions by various routes of inoculation including, intracerebral (i.c.), intraperitoneal (i.p.) and orally. We hypothesize that there will be a difference in brain morphology between Gt-Deer and Elk mice independent of the route of exposure. To study this we will assess neuronal morphology, degree of spongiosis and loss of neurons. We have stained brain sections with Hematoxylin and Eosin, making pathological features more distinguishable. We will compare different CWD prions and routes of inoculation in both Gt-Elk and Gt-Deer mice. Our findings will be combined with biochemical analysis to fully understand disease pathogenesis in these mice.

99 Toward Increasing the Efficiency of Sorghum Transformation using Agrobacterium and Microparticle Bombardment

CHAUNCY HINSHAW

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: CHRISTIE PEEBLES

Sorghum is currently one of the most important cereal crops worldwide and is used as a primary food source in places such as Africa and Asia. Sorghum is a naturally drought tolerant crop and can be utilized as food, feed, or fuel. Genetic engineering of sorghum could increase drought tolerance and plant yield, leading to more food and resources for the global population. In genetics, transformation is defined as the alteration of a cell through the incorporation of exogenous DNA from its surroundings. Due to lack of experimentation, average transformation rates of sorghum are relatively low compared to other crops. The goal of this project is to increase average transformation efficiencies through optimizing microparticle bombardment protocols using a gene gun and creating

optimized vectors for Agrobacterium-mediated transformation. Transformation events will then be performed and efficiency will be defined as the number of successful transgenic events divided by the number of transformations performed. Creating more efficient methods of transformation will allow for easier transformation of sorghum plants, ultimately allowing for the production of more efficient sorghum varieties.

100 Toll-like receptor (TLR)2 and TLR4 knockout mice display reduced osteoarthritis secondary to joint injury compared to wild type mice

GEORGE HOLLING

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: KELLY SANTANGELO

Osteoarthritis (OA) secondary to joint injury is a debilitating, degenerative condition characterized by clinical symptoms such as pain, swelling, and stiffness, all of which decrease the quality of life of affected individuals. Toll-like receptors (TLRs) play an important role in the innate immune response and may be key contributors in OA pathogenesis. Damage to the extracellular matrix of cartilage and other joint tissue causes the release of molecules, known collectively as Damage Associated Molecular Patterns (DAMPs), which have been shown to stimulate pro-inflammatory pathways through TLR activation. Specifically, TLR2 and TLR4 are found on macrophages, dendritic cells, and the surface of joint tissue. As many studies have shown that DAMPs are widespread in synovial fluid of patients with end-stage OA, we postulated that TLR activation by DAMPs is a critical aspect of the negative biological response of joint tissue to traumatic injury. Thus, following joint damage, receptors on resident tissue and inflammatory cells are stimulated by DAMPs and incite pro-inflammatory pathways that lead to detrimental and irreversible joint destruction. To explore this theory, we injured mouse strains systemically lacking either TLR2 or TLR4 to determine whether these knockout mice would develop secondary OA following traumatic joint injury to the same degree as wild type mice. Gross joint pathology and quantitative gait analysis did, indeed, demonstrate that both knockout strains developed less significant OA at 14 and 28 days post-injury, supporting our hypothesis. Thus, interruption of the TLR-DAMP interaction post-injury may be a viable therapeutic option for secondary OA.

101 Age and Sustained Attention in Children and Adults During a Visual Go-Nogo Task

HANNAH L. HOOGS

MAJOR: NEUROSCIENCE

FACULTY ADVISOR/MENTOR: PATRICIA L. DAVIES, BRITTANY K. TAYLOR , AND WILLIAM J. GAVIN

The contingent negative variation (CNV) includes a component called the E-wave. This component is attributed to attentional anticipation formulated in the prefrontal cortex. Previous studies show an increase in E-wave amplitudes with age, and such changes in amplitudes following practice on a task are assumed to indicate shifts in cognitive strategies. We found that across two sessions set one-to-two weeks apart, adults' amplitudes became smaller and childrens amplitudes became larger. In the present study, our goal is to determine the shift in cognitive strategies. Electroencephalography (EEG) data were collected from 32 adults and 51 children who performed a visual Go-NoGo task during two sessions. Following one of the sessions, the participants performed a behavioral assessment, the Test of Everyday Attention for Children (TEA-Ch) that measures selective, sustained, and switching attention abilities. Statistical analyses through multilevel modeling revealed no consistent changes in amplitudes across trials, though there was significant within-person variability. As a result, we examined the role of attention in explaining variability in the E-wave amplitude within each session. Hierarchical regressions indicated that in session 1, age was the only significant predictor of E-wave variability. In contrast, sustained attention was the only significant predictor in session 2. While only results for children in session 1 and adults in session 2 are statistically significant, the other results are approaching significance and exhibit a telling pattern. Many factors affect the amplitude of the CNV that are still unexplained, and the patterns we found are a starting point for future investigations.

103 Genetic and pharmacologic inhibition of NF-kB in glial cells is neuroprotective in a mouse model of Parkinson's disease.

LINDSAY HUNT

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: RONALD TJALKENS, SEAN HAMMOND

Parkinson's disease (PD) is the second most common neurodegenerative disease in the US and is characterized by neurological symptoms including bradykinesia, rigidity, postural instability, and resting tremors. PD specifically targets dopamine producing (DA) neurons in the basal ganglia. Motor symptoms present only after a significant portion of DA neurons are lost; therefore, diagnosis is significantly tardy relative to initial onset. The progression of neuronal cell death in PD is aggravated by activation of the inflammatory pathway NF-kB in glial cells . The neurotoxin, 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) activates NF-kB and progressively degrades DA neurons in the basal ganglia. We postulated that cell-specific knockout of the NF-kB pathway in astrocytes would therefore protect dopamine neurons against inflammatory injury in the MPTP model of PD. Using novel transgenic mice lacking the inhibitory kappa kinase beta (IKK1/IKK2) gene in astrocytes, we found that neurotoxicity from MPTP was greatly diminished. Western blotting indicated that levels of the Tyrosine Hydroxylase (TH) were preserved in the striatum, as well as the Dopamine Transporter (DAT). Determination of dopamine neurons in the substantia nigra by 3D design-based stereology indicated that 1,1-bis(3'-indolyl)-1-(p-chlorophenyl)methane (C-DIM12), a small molecule ligand of the nuclear receptor NR4A2

and a repressor of NF-kB, protected against loss of DA neurons in the SN. We conclude that inflammatory activation of NF-kB in glial cells is critical to neuronal injury in the MPTP model of PD and that selective inhibitors of this pathway may be promising therapeutics for slowing disease progression.

114 Identifying some areas of general chemistry as important stepping stones for the learning of organic chemistry

Olivia Kinney

Major: Biomedical Sciences

Faculty Advisor/Mentor: Debbie C. Crans

The course "Introduction to Organic Chemistry" has been designated as one of the more challenging courses in many science-based majors or programs for undergraduate students. The transition between the learning of general chemistry and organic chemistry is often viewed as very difficult. We hypothesize that the problems arise when students do not see the material covered in general chemistry as being consistent with what is expected in organic chemistry. We carried out a survey 3 weeks to one month into the organic chemistry class where we asked to identify topics that were particularly difficult for them to learn. Because some of the topics covered in organic chemistry are directly relevant and others not, we anticipate that the conclusion will be topic dependent. Topics that are briefly touched on in General Chemistry include basic structures, hybridization, resonance, acid base, thermodynamics and kinetics. Topics including organic reactions overlap less because the equivalent is much less obvious in general chemistry. In the survey we asked students to identify topics that were particularly difficult for them to learn. They were also asked to identify topics that they felt their background was very solid for their learning in organic chemistry. The results were tabulated and are presented on this poster. We find that the same topic "Acids and Bases" are both the topic that student wish more information on and they feel they have a firm background in. We feel that this result reflect the fundamentally quantitative approach to Freshman Chemistry compared to the conceptual and spacial considerations in Organic Chemistry. This analysis can provide the General Chemistry Instructors more information on what students felt was important for their learning of Organic Chemistry.

127 Evaluation of Interbody Cages in an Ovine 2-Level Lumbar Interbody Fusion: A Radiographic, Biomechanical, Micro-CT and Histologic Analysis

Jacob Machmer

Major: Biomedical Sciences

Faculty Advisor/Mentor: Kirk McGilvray

Numerous materials have been used for the interbody cages used in spinal fusion procedures. Two of the most popular materials, titanium and polyetheretherketone (PEEK), have demonstrated successful biocompatibility, but have limitations due to their elastic modulus or bone bonding abilities. The limitations with current materials has driven the innovation of new surface technologies to increase the rate of fusion and create stronger fusion constructs. One such development combines a PEEK core with a porous titanium endplate to allow bone to grow into the implant and optimize fusion. The present study examines the efficacy of this PEEK/titanium hybrid design to cause lumbar intervertebral body fusion in an ovine model. Animals (N=34) were surgically treated at two non-adjacent fusion levels, L2-L3 and L4-L5. A total of 8 animals were sacrificed at each of the following time points, 8 weeks, 12 weeks and 18 weeks after surgery. Following dissection, high resolution digital radiographs were taken. Each sample underwent or is in the process of non-destructive biomechanical testing (N=64), micro-computed tomography (CT) analysis (N=48), and histological processing with histomorphometry (N=48). The aforementioned methods are currently underway, thus, complete results have not been obtained or analyzed. It is hypothesized that the proprietary PEEK Titanium Composite (PTC) design of spacers leads to bony ingrowth and construct stability that is no worse than the spinal construct using a PEEK interbody cage.

133 How preventing consistent motor responses during a category learning task changes patterns of brain activity: an fMRI study

Hannah Mechtenberg

Major: Neuroscience

Faculty Advisor/Mentor: Dr. Carol Seger, Kade Jentink

The current experiment investigated whether consistent versus inconsistent motor responses in an information integration category learning task would result in differences in patterns of brain activity. In category learning tasks, it is common practice to have only the right finger map onto an "A" category response, and the left finger map onto the "B" category response; we refer to this as a consistent mapping. When learning using a consistent mapping, participants can perform successfully by learning the category names, the motor response, or both. In order to force subjects to learn the category names we developed an inconsistent mapping task in which the mapping of the category names to response fingers changed each trial. This fMRI study tested whether preventing consistent left/right motor responses to particular category labels using inconsistent mappings would result in changes in brain activity when compared with participants who learned with consistent mappings. Gabor patches were used as the stimuli to be categorized, and a total of 30 participants were randomly assigned to the "consistent" or "inconsistent" group. Each subject had two scans; one scan while learning the task and one engaging in the categorization task after learning was completed. During the second scan participants performed both consistent and inconsistent mapping conditions. The results after applying the general linear model revealed different patterns of brain activity during categorization using consistent and inconsistent mappings, indicating that motor responses can play an

important role in learning.

139 Interrogating the Impact of ACOT-1 on Dengue Virus 2 Replication

Stephanie Mills

Major: Biomedical Sciences

Faculty Advisor/Mentor: Rushika Perera, Rebekah C. Gullberg

Over one third of the world's population lives in areas at risk of contracting dengue fever. A suboptimal vaccine has been used in limited settings while other therapeutic options are currently unavailable. Dengue viruses (DENV) infect over 400 million people per year, so understanding the life cycle of this virus is critical. DENV alters intracellular membranes to support their replication in host cells. Acyl-CoA thioesterases (ACOT) are enzymes that maintain specific ratios of activated fatty acids, free fatty acids and coenzyme A within the cell. These key enzymes target long fatty acyl-CoAs throughout the cell for hydrolysis to free fatty acids and coenzyme A. Acyl-CoA thioesterase-1 (ACOT-1), an ACOT enzyme located in the cytosol, has been shown in preliminary loss of function studies to significantly increase DENV replication. Upon DENV infection, levels of ACOT-1 are also decreased. We hypothesize that ACOT-1 decreases DENV replication by increasing the levels of fatty acids within the cytosol. Interestingly, a bacteria currently being used to infect mosquitoes and prevent transmission of DENV increases ACOT-1 expression in the mosquito supporting the hypothesis that high levels of ACOT-1 may be detrimental to DENV. Since DENV RNA replication requires many specialized membranes in the cell, we anticipate the function of ACOT-1 impacts the amount of fatty acids in the cell membranes and thus influences the assembly and function of viral RNA replication complexes in host cells. Therefore, ACOT-1 plays a key role in regulating the DENV life cycle and can be used to identify novel therapeutics.

154 Operationalizing a Mobile Clinic in the Zumbo District of Mozambique from 2010-2015

Avery Olson

Major: Biomedical Sciences

Faculty Advisor/Mentor: Dr. Gene Kelly

Care for Zumbo is a mobile clinic in the Tete Province of Mozambique that offers medical services to villages outlying Zumbo, Mozambique. There was little to no care in this area before the project started in 2010. By joining forces with the local government hospital in Zumbo, we are able to serve the communities sustainably with diagnostic and prevention centered care. Care for Zumbo provides immunizations, maternal and gynecological care, HIV counseling and testing, and general medicine services within the 100km radius project concession. The holistic outreach plan of Care for Zumbo includes healthcare, food for the elderly and disabled, home construction projects, health education, and AIDS orphan care. This review compiles all current health data in the Care for Zumbo project concession and looks critically at Care for Zumbo's impact on the community from 2010-2015. It then evaluates the current mobile clinic model identifying complications and concluding with possible improvements.

158 Quantitative Assays for ATP-dependent Chromatin Remodeling by yeast CHD1

Graham Opie

Major: Biomedical Sciences

Faculty Advisor/Mentor: Tingting Yao, Benjamin Schmitt

Integral to the process of condensing DNA in a cell are histone proteins, which form an octameric core that 147 base pairs of DNA wraps around to form the nucleosome. Nucleosomes are the basic unit of chromatin and many cellular types of machinery are dedicated to modulate the nucleosome to control DNA accessibility at specific genomic loci. Among these are ATP-dependent chromatin remodelers that use the energy of ATP hydrolysis to change positions of histone octamer on DNA, a process referred to as "sliding". This project examines how post-translational modifications (PTMs) of histones regulate the efficiency of sliding by the yeast Chd1 remodeler. We set out to establish assays to quantitatively measure sliding efficiency. First, using fluorescently-labeled DNA to assemble recombinant nucleosomes with or without the PTM of interest, we compared the rate of sliding by native Polyacrylamide Gel Electrophoresis (PAGE). Nucleosomes with different positions on a 216mer DNA migrate differently by native PAGE and can be quantified on a Typhoon imager. Second, to monitor sliding in real time, we utilized a Fluorescence Resonance Energy Transfer (FRET)-based assay by introducing a second fluorophore on the C-terminal of histone H2A. Efficient FRET occurs when the initial distance between the two fluorophores is small. As sliding occurs, we observe a decrease of FRET, indicating the end of DNA moving away from the histones. Using these quantitative assays, we have examined how monoubiquitination of histone H2B affects sliding by Chd1. Large varieties of histone PTMs exist in cells and are responsible for regulating a wide array of cellular functions. These experiments provided biochemical tools to examine the interplay between PTMs and chromatin remodelers and paved way to understand the underlying mechanisms in future studies.

159 Purification of Archaea Transcription Factor TK0566p for Invitro Studies and Characterization

Blessed Otabil

Major: Biomedical Sciences

Faculty Advisor/Mentor: Tom Santangelo, Julie Walker

Among the three domains of extant life, Archaea has arguably received the least experimental attention. Understanding the activities and regulation of central information processing machinery (DNA

-> RNA -> protein) is essential to ultimately rationally-altering archaeal physiologies for biotechnological applications. In contrast to eukaryotes and bacteria, the transcription processes (DNA -> RNA) and transcription machinery of Achaea are understudied. As regulation of transcription serves as the primary point of regulation for many genes, a full understanding of the archaeal transcription cycle is necessary. Transcription is typical demarcated into three stages: initiation, elongation, and termination. This work focuses on the final stage of transcription - transcription termination using the genetically tractable system of Thermococcus kodakarensis. Thermococcus kodakarensis has emerged as an outstanding system for studying archaeal biochemistry due to the advanced genetic techniques available for this organism2,3. We have preliminary evidence that gene number TK0566 encodes a transcription termination factor. In order to further characterize this potential termination factor it is necessary to purify the encoded protein product (TK0566p) for use during in vitro studies. We used the genetic systems available to generate a strain (TK-0566NT) wherein the TK0566 locus was extended to encode an N-terminal tag (His6) to faciltate rapid purification of TK0566p. Purifications, to date, yield a mixture of profiles, suggesting that TK0566p is engaged in protein-protein interactions that influence affinity and elution from various columns. Western blots using a primary antibody specific for TK0566p have been employed to identify fractions that contain the partially purified protein, TK0566p. A combination of nickel purification and cibacron blue affinity chromatography have yielded TK0566p that appears ~90% pure. However, TK0566p co-purifies with RNA polymerase (RNAP) and separation of TK0566p and RNAP remains problematic. It is essential to eliminate RNAP from purifications of TK0566 to eliminate introduction of additional RNAP to our in vitro studies. We will provide supportive experimental results for the identification and purification of a termination factor conserved in all archaea.

160 The Skeletal Reconstruction of an Immature Black Bear

Jordan Paulus

Major: Biomedical Sciences

Faculty Advisor/Mentor: Tod Clapp

In order to improve skeletal anatomy knowledge and to provide a learning tool for various biology classes we began the process of reconstructing a complete bear skeleton. The process began with the donation of a nuisance bear. Preparation included the removal of all superficial fascia, muscles and organs, as well as the disarticulation of the limbs from the axial skeleton. Further preparation allowed us to remove all soft tissue and resulted in clean bones. Our first, and perhaps, largest challenge, was the discovery that the animal had been a young adult, meaning that the bones were not fully formed. This presented us with many challenges with the physical reconstruction. There were still considerable amounts of spongy bone that had not fully calcified and would not support wiring techniques commonly used during osteological preparations. Our first step was to determine the overall position that we wanted the bear to assume at the completion of the reconstruction as this determined the final angle of all articulations. The lack of calcification required a great deal of structural support and a great deal of ingenuity when designing the support. We incorporated a host of materials including: metal rods, wood, Styrofoam, silicon, and various glues to distribute the weight of the bones in the final structure. The resultant product is a female black bear in a bipedal position which will be a resource for students for years to come. This project challenged us to find new ways around problems when the original ten ideas failed.

161 Synaptotagmin's Role in Asynchronous Neurotransmitter Release

Lara Perinet

Major: Microbiology

Faculty Advisor/Mentor: Noreen Reist, Mallory Shields

Synaptic communication is essential for nerve cells, and occurs by the release of neurotransmitter. Synaptic vesicles store neurotransmitter which is released by the coordinated effort of many synaptic proteins. This process begins with the depolarization of the cell upon arrival of an action potential, allowing Ca2+ influx through voltage-gated channels. There are two phases of neurotransmitter release: a rapid, synchronous release and later, a prolonged asynchronous release. One synaptic protein, synaptotagmin, is the calcium sensor for synchronous release. It has two calcium-binding domains, C2A and C2B, which bind calcium and trigger a rapid response culminating in the fusion of the neurotransmitter-filled vesicle with the presynaptic membrane. Synaptotagmin's role in asynchronous release, however, is less well understood. It is currently hypothesized that the C2A domain of synaptotagmin is actively inhibiting an unknown asynchronous sensor, and that calcium binding is needed for this role. However, new evidence from the Reist lab questions this working hypothesis. Using both novel and previously constructed specific mutations, we are able to directly test the interaction between synaptotagmin and the asynchronous calcium sensor.

169 Evaluation Of Bp82 LPS As Vaccine Adjuvant Against Burkholderia Pseudomallei in Goats

Lauren Rice

Major: Biomedical Sciences

Faculty Advisor/Mentor: Torsten Eckstein, Darcy Fletcher

Burkholderia pseudomallei is a select agent, gram-negative bacterium that is responsible for causing melioidosis in a multitude of hosts. An auxotroph strain of this bacteria known as Burkholderia pseudomallei δpurM mutant 82 (Bp82) was developed as a select-agent list exception and is currently being investigated for its potential as a vaccine candidate. This study examined the characteristics of the lipopolysaccharide profile of Bp82 and its potential as an adjuvant in vaccine therapy in the goat model. In a proof of concept study, two

goats ? goats 35 and 36 ? were vaccinated with Bp82. Two other goats ? goats 0 and 3 ? were left unvaccinated as a control. Two weeks later, all four goats were challenged with the virulent strain of Burkholderia pseudomallei. Serum samples were collected weekly, and the experiment was terminated two weeks after the challenge. LPS was isolated from Bp82 culture, and used in an ELISA test to evaluate the reactivity of the goat serum to the molecule. After controlling for media readings, unvaccinated goats 0 and 3 had low amounts of immunoreactivity to the LPS. Goat 35 had a significant serum response to the LPS antigen, and its ELISA reactivity was greatest one week after challenge. Goat 36 had a smaller response and its ELISA reactivity was greatest two weeks after challenge. Additionally, LPS extracted from Bp82 culture was characterized by linearizing the sugars through an alditol acetate protocol. The resulting sample was analyzed through gas chromatography ? mass spectroscopy. The study implicates that the lipopolysaccharide of Bp82 may have potential as a vaccine adjuvant, though further studies are needed. Future studies may include evaluating the effectiveness of live Bp82 vaccination in causing immune responses against virulent strain LPS in BSL-3 settings, and increasing the sample size.

170 A novel diindolylmethane analog, DIM-C-(p-chlorophenyl), slows MPTP-induced dopaminergic neurodegeneration by suppressing glial cell activation in a Parkinson's disease mouse model

Evan Richman

Major: Biomedical Sciences

Faculty Advisor/Mentor: Dr. Ron Tjalkens, Sean Hammond

Approximately 1.5 million people suffer from Parkinson's Disease (PD) in the United States. PD is characterized by the degeneration of dopamine neurons due to chronic neuroinflammation, regulated by cell-crosstalk between astrocytes and microglial in the basal ganglia. Currently there are no drugs available that can effectively slow the progression of PD. However, in previous studies we have demonstrated 1,1-bis(3'indolyl)-1-(p-chlorophenyl) methane (C-DIM12) compound protects against dopaminergic neuronal loss from a 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) post-lesion mouse model of PD. C-DIM12 protects dopaminergic neurons by activating nuclear receptor related protein 1 (Nurr1), a transcription factor responsible for limiting neuroinflammation and positively regulating dopaminergic genes in neurons. In the current study, we investigated the capabilities of C-DIM12 to protect against MPTP induced neurotoxicity in a concurrent PD model at half the dosage of C-DIM12 (25mg/kg) that previously demonstrated therapeutic effect. To examine this we treated mice with either C-DIM12 or vehicle (Corn oil) via oral gavage every day while concurrently treating with MPTP four individual days for 2-weeks. Brain tissue samples were fixed in paraformaldehyde and analyzed via immunohistochemistry. Immunostaining and stereology for tyrosine hydroxylase (TH), the rate limiting precursor of dopamine, showed more TH-positive neurons in C-DIM12 when compared MPTP treatment alone. Furthermore, microglia and astrocyte activation were found to be less in C-DIM12 treated mice. Immunostaining of Nurr1 also showed an increase of Nurr1 expression within TH-positive neurons in mice treated with C-DIM12. Thus, our immunohistochemistry results suggest that C-DIM12 can slow the progression of PD in a mouse model.

171 A Comparison of the Effects of High Intensity Interval Training on Balance in Young and Older Adults

Erika Rigel

Major: Biomedical Sciences

Faculty Advisor/Mentor: Raoul F. Reiser, Christopher Bell, and Timothy Brodsky

Exercise has been shown to reduce the risk of falling in the elderly. Although, most studies have concentrated on endurance training, high intensity interval training (HIIT) has become an acceptable alternative to traditional endurance exercise and might evoke similar adaptations without the same time commitment. Weight bearing asymmetries have a negative effect on postural stability, and can be used as a diagnostic tool for age-related decline in balance. A parallel, repeated measures experimental design was used to obtain preliminary data to investigate the impact HIIT has on standing weight bearing asymmetries in older and younger adults prior to and following seven sessions of HIIT. This preliminary study population will consist of 6 older (aged 65-80 years) subjects and 4 younger (18-30 years) subjects. The instantaneous center of pressure (COP) location was calculated under each foot as well as the net during double-limb quiet standing trials performed pre and post HIIT training at the beginning and end of the intervention. From the COP (individual and/or net) both anterior-posterior and medial-lateral sway, path length, and standard deviation were calculated along with weight distribution. It is hypothesized that 1) older adults will have greater weight bearing asymmetries than young adults prior to intervention; 2) A single bout of HIIT will acutely effect single leg and net COP contributions in older adults more than in their younger counterparts; 3) HIIT will chronically improve-pre exertion postural symmetries and 3) attenuate the magnitude by which a single bout of exercise affects asymmetries and postural stability.

175 The Effect of Fungiform Papillae Density on the Ability to Discriminate Electrical Stimulation on the Tongue

Collin Roberts, Josiah Racchini, and Kristina Dahlgren

Major: Biomedical Sciences

Faculty Advisor/Mentor: Leslie M. Stone-Roy, and Joel Moritz

Over 30 million Americans are affected by hearing loss or impairment. While hearing aids and cochlear implants are the most common assistive devices, they are not ideal for all patients. Specifically, they do not help people with profound hearing loss due to damage central to the cochlea. Additionally, cochlear implants require invasive surgery and may cost

up to 100,000 dollars. Our research is focused on developing a sensory substitution device that includes proprietary software and a custom built mouthpiece that delivers electrical stimulation to somatosensory nerves in the tongue to replace lost auditory information with specific stimulation patterns. There is a great deal of variability in electrotactile sensitivity and 2 point discrimination between individuals and in different regions of the tongue. The current study investigates whether the density of fungiform papillae is related to these differences in electrotactile perception. To do this we examined the relationship between the density of fungiform papillae and the perceived intensity of the electrical stimulus. Additionally, the relationship between papillae count and accuracy was investigated by analyzing the effect of papillae density on the number of correctly recognized stimulations and the average minimum discrimination distance.

176 Detection of Prion Protein Specific Camelid Nanobodies: Implications for Prion Disease Therapeutic Options

SAVANNAH ROCHA

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: MARK ZABEL , SARAH KANE

B-lymphocytes produce highly specific heterotetrameric antibodies when challenged with antigen. Most species produce antibodies composed of four polypeptides, which consist of two heavy chain domains and two light chain domains. Each light chain domain contains a variable region and a hyper-variable region, which allow for specific contact interaction with the antigen by means of differing amino acid sequencing. However, Camelid sera contains both heterotetrameric antibodies as well as functional homodimeric antibodies that are devoid of variable regions and derived from the heavy-chain variable (VHH) domains on Immunoglobulin (Ig) molecules. These smaller antibodies, termed nanobodies, are smaller than the heterotetrameric antibodies found in other species. They are the cloned portion of the Complimentarity Determining Region of the single chain variable fragment, and have implications for treatments due to the reduced size and antigen specificity. After seven immunizations utilizing white tailed deer recombinant PrP as the antigen, specific antibodies have been detected using Enzyme Linked Immunosorbent Assays. Post immunization bleeds four, five, six, and seven show a statistically significant increase in optical density (O.D.) when contrasted to numerous negative controls. A threshold was determined by taking the average O.D. of the negative controls plus three standard deviations above the mean. Positive sample sera contained an antibody titer between 2,000 and 4,000, indicating that the antibody that is being identified within this assay is specific for the antigen of white tailed deer PrP. This project focuses on the production, the specificity, and the future implications of Camelid nanobodies within prion disease.

178 Effects of rhBMP-2 on canine adipose derived mesenchymal stem cells and canine and human osteosarcoma cells

CALLIE ROGERS

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: DR. NICOLE EHRHAR , DR. ROSS PALMER

The role of bone morphogenetic proteins (BMPs) in association with tumor tissue is relatively unknown with many conflicting opinions on the subject. Recently, recombinant human bone morphogenetic protein two (rhBMP-2) has been found to have suppressive effects on canine osteosarcoma cells and as a result, could have therapeutic potential. Additionally, the use of rhBMP-2 in conjunction with fetal mesenchymal stem cells has been observed to increase programmed cell death (apoptosis) in osteosarcoma cells and has been shown to have similar inhibitory effects in other types of cancer. This project explored the proliferative and suppressive effects of rhBMP-2 at various concentrations on malignant canine, non-malignant canine, and human osteosarcoma cells as well as on canine derived adipose mesenchymal stem cells (AdMSCs), this type of stem cell is often used in osteosarcoma therapies. The protein was added at increasing concentrations to cultures of each cell line in a 96 well plate (1x103cells/well). Proliferation and inhibition were observed and measured via Incucyte (Essen BioScience) device over the course of 120 hours. The rhBMP-2 had a suppressive effect on all of the osteosarcoma cell lines and promoted proliferation in the AdMSCs when compared to untreated control groups. In addition, doses in the lower-middle concentration range were observed to be most inhibitory for the osteosarcoma cell lines and most proliferative for the AdMSCs. These results suggest that at certain concentrations rhBMP-2 could have potential therapeutic use in suppressing osteosarcoma.

182 Chronic Wasting Disease and its Transmission in Semen

RICHARD RUDER

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: CANDACE MATHIASON

Transmissible spongiform encephalopathies (TSEs), also known as prion diseases, are neurodegenerative diseases that ultimately lead to death. Chronic Wasting Disease (CWD) is a TSE that is found in cervid species including deer, elk and moose. While some modes of transmission have been determined, only a small amount of research has been conducted to look at the role of male reproductive tissues or fluids in the transfer of prion diseases. This study will provide knowledge into the role male reproductive functions play in the transmission of CWD prions. Not only is this important to understand for CWD animals, but has implications in all TSEs including those affecting humans.

188 The replicon hypothesis in the archaeal organism Thermococcus kodakarensis

KYLE SCALZO
MAJOR: BIOMEDICAL SCIENCE
FACULTY ADVISOR/MENTOR: THOMAS SANTANGELO, ALEXANDRA GEHRING

The replicon hypothesis states that all organisms are reliant on an initiator protein and an origin or origins of replication to initiate bi-directional replication of the genome. An initiator protein will bind to the origin recognition box (ORB) to recruit additional replication machinery to the origin of replication. Through bioinformatics, it was found that the hyperthermophile Thermococcus kodakarensis has a single predicted origin of replication. In the T. kodakarensis genome the gene TK1901 encodes for the presumptive initiator protein, Cdc6. It was previously thought that the gene encoding for Cdc6 cannot be deleted from any genome. Presently, our lab has deleted the gene encoding for Cdc6 and demonstrated that no cellular phenotype results from this deletion. This experiment aims to delete both the hypothesized origin of replication and the gene encoding for Cdc6 in the same strain. We will then look for cellular phenotypes and use marker frequency analysis to map the origin of replication. If we are able to delete the origin of replication and the gene encoding for Cdc6 and determine that T. kodakarensis replicated in an origin independent manner, this will be the first time an organism that disobeys the replicon hypothesis will have been identified. Future work will look at archaeal organisms that naturally lack a Cdc6 homolog and determine their origin of replication.

192 Validation of a novel microcomputed tomography grading scheme to characterize disease progression in the Hartley guinea pig model of primary osteoarthritis

JOHN SHANNON
MAJOR: BIOMEDICAL SCIENCES
FACULTY ADVISOR/MENTOR: KELLY SANTANGELO

Osteoarthritis (OA), an irreversible joint disease associated with pain and inflammation, is one of the most common causes of disability in the elderly. Animal models, such as the Hartley guinea pig, are utilized to determine the mechanical and molecular contributions to disease pathology. This strain " the only outbred model of naturally-occurring OA in a laboratory species" develops age-related, spontaneous OA of the knee and other joints, with disease progression identical to human OA. Microcomputed tomography (microCT) is an imaging technique utilized to detect and characterize alterations in subchondral bone, a key degenerative feature in this model of OA. Interestingly, data from these images are rarely evaluated in a manner similar to that used in clinical settings. We sought to develop an innovative approach to score OA severity using a novel grading scale in comparison to more traditional microCT analyses. To accomplish this, microCT images of Hartley guinea pig knees were collected at 3, 5, 9, and 15 months of age. Reconstructed images were evaluated by a veterinary radiologist using a numeric scheme considering clinical features of OA: presence and location of osteophytes, subchondral bone sclerosis and cystic changes, articular bone lysis, and intra-articular soft tissue mineralization. Traditional analyses of total volume (TV), bone volume (BV) and TV/BV ratio were conducted on the medial weight-bearing region. Our grading scheme confirmed increasing OA severity and score with age, which correlated with traditional microCT data. Thus, this grading scheme may provide a clinically relevant evaluation of OA progression in this animal model.

193 Investigating Antigen-Specific T Cell Responses to Influenza Infection

JOHN SHANNON
MAJOR: BIOMEDICAL SCIENCES
FACULTY ADVISOR/MENTOR: PAUL G. THOMAS, PHD

Influenza viruses are respiratory pathogens that cause seasonal infections and periodic unpredictable pandemics. Human infection by influenza virus initiates in the respiratory tract, causing a wide range of disease symptoms including sudden onset of fever, myalgia, sore throat, and rhinitis. Each year seasonal influenza viruses infect 5-20% of the population. Highly contagious influenza is responsible for widespread morbidity and mortality, with an estimated 5 million cases annually. After each infection, individuals develop innate and adaptive immune responses directed towards clearing the infection. Innate immunity occurs at the onset of infection and provides a rapid response to the pathogen. Adaptive immunity requires several days for differentiation of lymphocytes specific for influenza infection. Together they limit the infection and establish a memory response to reinfection by homologous strains. Despite the prevalence of influenza little is known about the precise role of T cells in influenza immunity. We sought to examine antigen-specific T cell responses in a cohort of naturally influenza-infected individuals utilizing flow cytometry. We found a boost in memory CD4+, but not CD8+, T cells at day 28 compared to day 0. We also observed a correlation between viral load and abundance of CD8+ T cells. Looking at clinical symptoms from patients at the time of sample collection, we detected a correlation between severity of influenza infection and CD8+, but not CD4+ T cells. These data are suggestive of a CD8+ response dependent on virus magnitude, while CD4+ responses appear to be boosted in most individuals. Data obtained throughout this study provides insight into the mechanisms of T cells immunity and information that may aid in the design of novel broad-spectrum influenza vaccines.

198 The effects of rice bran prebiotics on growth and heterologous protein expression of Lactobacillus acidophilus HIV vaccine strains

McKenzie Smith

Major: Microbiology

Faculty Advisor/Mentor: Gregg Dean, Jonathan LeCureux

Lactobacillus acidophilus (LA) is a probiotic bacterium commonly used in dairy products such as yogurt. There is interest in exploiting LA as a vaccine platform because it is inexpensive to produce, can be delivered orally and may be particularly useful to prevent mucosally-transmitted pathogens such as human immunodeficiency virus (HIV). Our lab has engineered LA to express MPER (LA-MPER), an HIV envelope protein. Prebiotics are food supplements that stimulate the growth of probiotics. We hypothesize that feeding a prebiotic, such as rice bran, will increase antibody induction by LA-MPER. The goal of these studies is to validate the prebiotic effect of rice bran extract (RBE) on our LA-MPER vaccine constructs. To that end we compared growth rate and recombinant protein expression of four LA vaccine constructs under four media conditions: MRS broth containing glucose, MRS broth without glucose, MRS broth containing RBE, and MRS broth containing glucose and RBE. We found that RBE supported the growth of LA and the expression of recombinant proteins at levels similar to optimized MRS medium with glucose. MRS without glucose or RBE failed to support the growth of LA. No additive effects were observed when both glucose and RBE were included. These results support the idea that rice bran may be an effective dietary prebiotic to enhance the growth of a recombinant probiotic vaccine. Future in vivo studies will determine whether antibody expression is increased in animals consuming rice bran as a dietary supplement.

204 The conserved histone chaperone Spn1 functions in mRNA processing and export

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Faculty Advisor/Mentor: Laurie Stargell, Catherine Radebaugh

Spn1 is a highly conserved histone chaperone with essential functions in the yeast, Saccharomyces cerevisiae. It has been shown to play a role in transcription initiation and elongation, and genomic stability in yeast cells. Spn1 is comprised of a conserved, structured central domain that is flanked by poorly conserved, unstructured N- and C-termini. The purpose of the study presented here, was to determine if yeast Spn1 interacts genetically with components of the mRNA processing and export complexes: THO/TREX and TREX2. This was done by introducing Spn1 mutants into strains bearing deletions of individual subunits of the THO/TREX and TREX2 complexes and then assessing growth of the resulting double mutant strains under various growth conditions and on growth mediums. We found that Spn1 interacts genetically with subunits in all three of the assessed complexes, indicating that in yeast Spn1 functions in mRNA processing and export. This investigation shows implications with regards to links between transcription/mRNA processing and genomic stability.

208 P200 Sensory Gating in Children with Autism

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Major: Neuroscience

Faculty Advisor/Mentor: Jewel Crasta, Patricia L. Davies, and William J. Gavin

Sensory gating is the neurological process that filters out irrelevant stimuli to prevent sensory overload of higher brain functions. Gating is commonly studied using electroencephalography (EEG) via a paired click paradigm. Most studies examine gating at the P50 ERP (event-related potential) component, which is a positive deflection occurring around 50 ms after stimulus onset and relates to pre-attentional inhibitory mechanisms. In neurotypical individuals, there is an attenuation of second click amplitude compared to first click amplitude, indicating sensory gating. Impaired gating has been documented in children with autism spectrum disorders (ASD) at the P50 component. However, sensory gating has not been studied at the P200 component, which is a positive deflection that occurs around 200 ms post-stimulus onset and relates to the registration of stimuli. The purpose of this study was to analyze gating in the P200 component in children with ASD. Based on previous studies, we hypothesized that there will be impaired sensory gating at the P200 component in children with ASD. A cross-sectional quantitative study was employed to compare two groups when performing the paired click paradigm. To date, EEG data has been recorded from 20 children with ASD and 20 neurotypical controls. Data will be analyzed using statistical procedures to compare the two groups with regards to the processing of click stimuli and sensory gating for the P200 component. These results can help practitioners understand aspects of sensory processing that appear difficult for children with ASD and may suggest more effective treatment strategies for children with ASD.

211 Running wild type mice on declined treadmill surfaces prolongs detectable gait differences following knee injury

Ariel Timkovich

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Faculty Advisor/Mentor: Kelly Santangelo

Osteoarthritis (OA) secondary to traumatic injury is a debilitating condition for which there is no cure. Rodent models of injury-induced knee OA are important prototypes to further our understanding of disease pathology and identify pathways for therapeutic intervention. Utilizing videographic gait analysis, we have demonstrated that injured wild type mice running on a flat treadmill surface return to pre-surgery baseline gait status by day 8, which is not reflective of the gross and histologic changes that continue to occur in their knee

joints over time. Our hypothesis was that, compared to flat surfaces, challenging injured mice to inclined and declined treadmill conditions would accentuate, exacerbate, and/or prolong detectable gait differences post-surgery. Specifically, we anticipated that using both 5 and 10 inclined and declined surfaces on our treadmill gait analysis system would result in longer periods of time with which the injured limb would remain suspended off of the surface (% swing time) and, hence, lead to longer stride lengths. This study used 12 wild type mice to compare gait parameters after surgery under flat, inclined, and declined conditions. Compared to flat surfaces, no differences in gait parameters were elucidated at either the 5 or 10 incline, or 5 decline, conditions. At 10 decline, only, differences in both % swing time and stride length were present, which persisted until day 13 post-surgery. Moving forward, analyzing our injured mice at a 10 decline will enable us to evaluate the efficacy of symptom-modifying treatment options for a longer period of time post-surgery.

215 Detection of Methicillin-Resistant Staphylococcus Species in Canine Patients

LUKE VOGT

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: CLAUDIA GENTRY-WEEKS

Methicillin-resistant Staphylococcus pseudintermedius (MRSP; formerly designated S. intermedius) is a major threat for practitioners treating surgical and dermatological infections in dogs, since this bacterium is often resistant to a multitude of antibiotics in addition to beta-lactams (1). MRSP contains the mecA gene on a mobile genetic element (transposon) and thus produces an altered penicillin binding protein (PBP2) that does not bind beta-lactam antibiotics (2). MRSP is considered a rapidly emerging zoonotic agent since it has been increasingly reported in human disease and it has been found in the nasal passages of pet owners and veterinary practitioners that have handled dogs colonized with MRSP (3-6). It has been suggested that MRSP colonization of dogs will lead to greater transmission of methicillin resistance since the mecA gene is located on a transposon rather than being plasmid-mediated (as occurs with its relative, methicillin resistant Staphylococcus aureus MRSA)(2).

218 Development of a Reliable Alamar Blue Viability Test in Brucella Species

JACKSON WATKINS

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FACULTY ADVISOR/MENTOR: PHILLIP KNABENBAUER, ANNE SIMPSON, AND KAREN DOBOS

Gamma irradiation of select agent cell cultures can allow for product which is non-viable, while allowing the cells to remain mostly intact for various experimental procedures. In select agents, this becomes useful for allowing work with BSL-3 organisms under BSL-1/BSL-2 conditions. BSL-1/2 work is cheaper and more realistic if widespread research on select agents is to be accomplished. Currently, the most common test for viability in irradiated cell culture is common plating technique. While accurate, this method can introduce unnecessary hazards, especially in select agents like Brucella melitensis and Brucella abortus, which grow quickly, and require very little inoculum for infection. To improve safety in viability testing on select agents B. melitensis and B. abortus, an Alamar Blue assay has been designed using near neighbor Brucella ovis. The Alamar Blue assay gives results on cell viability without the risk of growing large cultures of select agent, but previous work with the assay in select agents is limited and needs to be developed before being used as a common test for select agent viability. Doubling time in colonies of B. ovis have been accurately measured using light spectroscopy via OD600 readings. This step has been taken to create a reliable positive control, since measuring viability of sample culture is dependent on the growth curve measured in the positive control, and accurate time points in the growth curve are crucial for measurement. Using B. ovis as a positive control, an Alamar Blue assay will be run with previously irradiated B. melitensis and B. abortus cell stocks. Success in this procedure could lead to an accurate and safer method for testing cell viability.

220 Ex vivo gut slice model for study of immune, nervous, and microbial networks

TORI WEINGARTEN

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: STUART TOBET, LUKE SCHWERDTFEGER

The gastrointestinal wall contains three major integrated networks- the neural, immune, and microbial networks. Increasing evidence suggests that proper gut function depends on signaling among these networks. An ex vivo slice model of the gut was created to study neural, immune, and bacterial interactions under controlled conditions. This new organotypic slice model can maintain structures in a physiologically relevant environment for subsequent immunohistochemistry and Gram stain labeling. Intestinal slices are well maintained for up to 6 days ex vivo, while maintaining immune components such as Peyer's patches that house lymphocytes and dendritic cells, and at the same time keeping enteric neurons and glia alive. Commensal (aerobic) microbiota are found in abundance. With these structures intact, fluorescent microscopy and immunohistochemistry was used to image cell types of interest. Evidence suggests that the immune system communicates between the microbiome and the enteric nervous system via chemical signaling. Post hoc visualization of enteric neurons was performed using an antibody to recognize the enzyme neuronal nitric oxide synthase, which helps produce nitric oxide important for gut function. Components of the immune system were visualized using anti-CD3 and anti-CD79a antibodies, which bind to T and B cell surface receptors. Finally, the microbiome was visualized using a fluorescent Gram stain that shows differentiated Gram positive and negative bacteria. Examining the three major systems in the gastrointestinal tract using this model has implication for future research focusing on cell signaling between the immune,

neural, and microbiota networks and how these interactions might affect physiological function.

226 Exploring the role of Tda2 in Saccharomyces cerevisiae clathrin-mediated endocytosis

COLETTE WORCESTER

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: SANTIAGO DI PIETRO, KRISTEN FARRELL

Clathrin-mediated endocytosis is an essential cellular process of vesicle internalization. Endocytosis is involved in many functions including nutrient uptake, neurotransmitter reuptake, and membrane receptor downregulation. Saccharomyces cerevisiae is a model organism for studying endocytosis and identifying key proteins involved. A green fluorescent protein (GFP) library has been previously created for the S. cerevisiae genome, tagging each gene with GFP to view under fluorescence microscopy. During previous work with this GFP-library, several uncharacterized proteins were found to localize to endocytic sites. This study explores the properties of one of these proteins, Tda2, during endocytosis. To study this protein, patch lifetimes of seven known endocytic GFP-tagged proteins (Ede1, Las17, Abp1, Aim21, Cap1, Myo5, and RVS167) were quantified in both wild type strains and Tda2 knock-out strains. Additional experiments utilized fluorescence microscopy and knock-out strains to further understand whether endocytosis was hindered with a Tda2 gene deletion. It was noted that Aim21 had significantly longer endocytic patches in Tda2 knock-out yeast, suggesting that Tda2 may be associated to endocytic proteins such as Aim21. Additional experiments are needed to explore this association and importance in endocytosis more thoroughly.

229 Adaptation of mouse prions in gene targeted mice

MICHAEL YOUNG

MAJOR: MICROBIOLOGY

FACULTY ADVISOR/MENTOR: GLENN C. TELLING, JULIE A. MORENO, JEFFREY R., CHRISTIANSEN

Chronic Wasting Disease (CWD) is a transmissible spongiform encephalopathy (TSE) of deer, elk, and moose. As with other TSEs, the infectious agent is the pathogenic misfolded isoform (PrPSc) of the normal host cellular prion protein (PrPC). CWD is of particular concern as it is the only known prion-based disorder affecting animals both in captivity and in the wild. The primary structure of the prion protein is known to be important in CWD disease transmission. Deer and elk prion proteins differ by a single amino acid and this difference appears to play a role in both CWD neuropathology and strain transmission. We have generated gene-targeted (Gt) models, in which the deer or elk PrPC coding sequence replace the mouse PrP coding sequence. We used these mice to ask: Does the prion pathogenesis differ when Gt mice expressing cervid PrPC are exposed to either mouse or cervid-adapted mouse prions? We hypothesize that Gt mice infected with cervid-passaged RML will display pathology consistent with cervid inocula. To test this, we infected two groups of Gt mice with either a murine prion strain or a murine strain that had been passaged through transgenic mice expressing cervid PrPC. We observed clinical signs, and generated Kaplan-Meier survival curves based on the time at which disease occurred. We used antibodies to discriminate between cervid and mouse prions using Western blotting and immunohistochemistry.We found that cervid-adapted RML in Gt mice produces a pathology more consistent with cervid models of prion disease than with mouse models.

230 Iron, Hepcidin, and Hepatocellular Carcinoma

MADISON ZENK

MAJOR: BIOMEDICAL SCIENCES

FACULTY ADVISOR/MENTOR: CHRISTINE OLVER

In a retrospective study, we identified 14% of dogs with hepatocellular carcinoma as having erythrocyte microcytosis, indicating either true or functional iron deficiency. Because there was no other clinical condition that would lead to true ID, we suspected a functional ID secondary to the hepatocellular carcinoma. We quantified RNA expression of two important iron regulatory genes, hepcidin and interleukin-6. Our hypothesis is that these molecules are overexpressed in either tumor or non-tumor tissue, particularly those associated with microcytosis. RNA was isolated from hepatocellular carcinoma tissue and adjacent non-tumor tissue and NanoString technologies nCounter platform was used to quantify expression of hepcidin and interleukin-6 from formalin-fixed paraffin-embedded archived tissues. Samples were divided further into microcytic and normocytic subsets. Although interleukin-6 expression did not vary between groups, hepcidin expression varied significantly. Hepcidin was markedly downregulated in all tumor tissue compared to non-tumor tissue and normal liver. Specifically, microcytic tumor cells showed a 28-fold decrease ($p=0.0017$) in hepcidin expression and normocytic tumor cells showed an 8-fold decrease (non-significant). To determine whether the disorder of iron has any physiological relevance, the slides were stained with Prussian blue and a scoring system was used to quantify iron both within the hepatocytes and in the surrounding connective tissue. We found excessive iron deposits in the adjacent non-tumor tissue and virtually no iron in the HCC or in the normal control. Therefore, we propose iron loading in the adjacent non-tumor tissue is a precursor to hepatocellular carcinoma, which then utilizes the over-load of iron to rapidly proliferate.

Warner College of Natural Resources

10 Seismic Refraction Survey of the Arikaree River, Colorado

FISHER ANKNEY, CAROLINE TOWNSEND, AND ALEX JACOB
MAJOR: GEOLOGY
FACULTY ADVISOR/MENTOR: DENNIS HARRY AND BRAD SPARKS

As apart of an interdisciplinary study of Fox Ranch in the northwestern corner of Colorado, four undergraduate geophysics students have set out to better understand the fluvial system through a geophysical surveying technique known as seismic refraction.

40 Participatory Processes and the Contribution of Local Knowledge for Restoration in a Rubber Dominated Landscape

FRANCIS COMMERCON
MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY
FACULTY ADVISOR/MENTOR: RHETT HARRISON

Xishuangbanna, in Yunnan, China, contains the country's highest concentration of biodiversity. However, rubber plantations have replaced most of the prefecture's seasonal lowland tropical rainforests, leading to wildlife habitat loss and degradation of ecosystem services. To determine the best solutions for improving ecosystem services in rubber-dominated areas, the World Agroforestry Center's project, Green Rubber, engages smallholders directly in establishing and maintaining scientifically rigorous intercropping experiments in their villages. Using Mane village and Green Rubber as a case study, I asked to what degree and through what means can local knowledge improve environmentally friendly rubber initiatives. To discover what local knowledge exists that may be of use in designing intercropping options, I surveyed residents (n=52), conducted guided interviews with several key informants, toured the local nature reserve with local guides, and visited rubber farms. To learn how scientists may use such knowledge, I critically observed how the scientists established an initial dialogue with villagers. The villagers had significant knowledge that could be used in designing restoration options adapted to the local economy and local resource consumption patterns. However, this knowledge lies scattered in disparate aspects of community life; finding it requires looking carefully and learning holistically about the community. Furthermore, researchers must first develop close communication with the villagers before they can establish a practical platform from which to engage locals in their project. These results can inform initial planning in other initiatives that aim to encourage adoption of sustainable land management practices in rural communities.

47 The Impact of Body Condition On Avian Influenza Infection Dynamics in Mallards After a Secondary Exposure

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FACULTY ADVISOR/MENTOR: SUSAN SHRINER, COLLEEN WEBB

In regards to the global spread of influenza A viruses (IAVs), mallards (Anas platyrhynchos) are often viewed as a vehicle for transmission and a particularly important reservoir host. IAV infection in waterfowl hits peak prevalence during the pre-migratory staging in autumn, and then declines as the birds arrive at their wintering grounds. Given the physical demands of migration, loss of body condition may potentially suppress immune function and affect the course of an infection. Our study evaluated the impact of body condition on immune function and viral shedding dynamics in mallards primarily exposed to a H9 IAV, and then secondarily exposed to a H4N6 low pathogenic avian influenza (LPAI) virus. Mallards (n=30) were divided into three treatment groups of 10 birds per group, with each bird's body condition manipulated as a function of body weight by restricting food availability to achieve either a -10%, -20%, or control weight class. We found that mallards gain heterosubtypic immunity against an H4N6 LPAI infection from an H9 IAV, and that body condition did not have an impact on shedding dynamics in response to a secondary exposure. Furthermore, body condition also did not affect aspects of the innate and adaptive immune system. Contrary to the recently proposed condition-dependent hypothesis, our results do not support a relationship in mallards between body condition and host competence following a second exposure to low pathogenic avian influenza. Consequently, the maintenance and spread of low pathogenic avian influenza viruses by migrating waterfowl is likely not exacerbated by migration.

65 Pit Width Predicts Length of the Antlion

KYLE EVANS
MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY
FACULTY ADVISOR/MENTOR: KATE HUYVAERT, LARISSA BAILEY, AND BRITTANY MOSHER

I studied an insect known as an antlion. It is the larval stage of a flying insect known as an antlion lacewing. These small invertebrates dig holes in soft soil, lay in wait at the bottom of the pit, and capture small arthropods when they fall into the hole. These holes vary in size. I wanted to see what determined the size of the antlion pit. I looked at substrate, location, and the size of the antlion in each pit. I measured the width, depth, slope, and location of each pit before digging up the antlion that made it. My analysis showed that the width of the pit is strongly correlated with the size of the antlion inside the pit. Larger pits often contain larger antlions.

74 Predicting Potential Distribution of Citrus Mealybug (Planococcus citri) in the Continental United States

LEO FRANZONE
MAJOR: ECOSYSTEM SCIENCE AND SUSTAINABILITY
FACULTY ADVISOR/MENTOR: SUNIL KUMAR

Citrus mealybugs are a significant pest that negatively affects citrus and other crop production across the globe. Citrus mealybugs are of particular concern in the United States because of the economic costs they cause farmers, retailers, and consumers to incur. We used ecological niche models (ENM) and species distribution models (SDM) to generate habitat suitability maps in order to predict the likelihood of this species' distribution throughout the United States. We identified environmental variables that influence the current distribution of the citrus mealybug. We used presence data of P.citri, as well as temperature and humidity records as environmental variables.

86 Behavior and Heterogeneity affect the Abundance of Dogs in Todos Santos, Mexico

TABITHA GULLEY
MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY
FACULTY ADVISOR/MENTOR: KATE HUYVAERT

We became interested in the dogs in Todos Santos from a study conducted by veterinarian Dr. Cody Minor on tick-borne diseases. Our initial interest was the disease interaction between dogs and wildlife. To begin this process, we conducted a study in the downtown area of Todos Santos, Mexico to determine the abundance of dogs and their detection and recapture probability. We performed a photo mark-recapture study over two path transects to estimate abundance, probability of detection, and probability of recapture of dogs in town. Our hypotheses were that our estimates would be affected by the transect path, heterogeneity, behavior, and fencing. We found that our best supported model accounted for behavior and heterogeneity. In total, we estimated that there are 283 dogs in downtown Todos Santos. Some biological explanations for why heterogeneity with behavior is the best model are the type of dog-owner relationship, health of the dog, and the degree of movement of the dog. Some of the dogs in our study were also in Dr. Cody Minor's study, which offered some interesting implications but not enough data to perform any correlative studies. Our study of estimating probability of detection, recapture, and abundance of dogs in downtown Todos Santos can help in the future to conduct studies that correlate wildlife with domestic dog disease transmission.

89 Surface Soil Water Content Across Homogeneous Terrain

RACHEL HABERMEHL
MAJOR: WATERSHED SCIENCE
FACULTY ADVISOR/MENTOR: STEVEN FASSNACHT AND ANNA PFOHL

Soil moisture impacts a range of major hydrologic and geographic processes including evaporation, weather and climate, flooding, erosion, and solute transport. Soil moisture is highly variable in space and time, and recognizing the characteristics involved with moisture variability is important for understanding and predicting these hydrological processes. Soil water content can vary greatly across a seemingly homogenous environment and it is important to acknowledge and interpret this variation to better understand how it relates to climate and environmental processes such as water flow. Relative soil water content of the near surface was measured using Time Domain Reflectometry (TDR) probes across several small-scale study sites with homogenous terrain; specifically open fields with little human traffic and no canopy. Data were collected at a 1-m resolution or finer across three 50-meter transects per site. Standard statistics were used to characterize the soil water content at each site, and variogram analysis was used to define the scale of variability as well as the fractal nature of soil moisture.

95 Characteristics and predictors of organic matter content in floodplain soils of the Front Range

JOHN HARRIS
MAJOR: GEOLOGY
FACULTY ADVISOR/MENTOR: DR. NICHOLAS SUTFIN AND DR. ELLEN WOHL

Rivers and floodplains have recently been estimated to store a significant portion of terrestrial carbon, an important component of the global carbon cycle and riverine ecosystems. To better understand the characteristics and controls of carbon storage in fluvial systems, I analyzed organic matter content in 67 soil samples collected from floodplains along 7 streams in the Colorado Rocky Mountains. Study sites represented variability in valley and channel morphology to investigate the role of channel confinement of singlethread channels, the presence of subparallel channels of flow across the valley bottom, and the influence of beaver populations. Resulting channel categories include 4 confined single channels, 12 partly confined single channels, 11 unconfined single channels, 21 beaver influenced channels, and 18 multithread channels. I tested 2 hypotheses: (1) Percentage of organic matter in floodplain soil samples is significantly correlated with bulk density, and (2) Unconfined singlethread channels have the highest organic matter content among the channel types. Analysis of 19 floodplain soil samples indicate that bulk density is negatively correlated with percent organic matter ($r2 = 0.65$). Bulk density of soil samples is notoriously difficult to measure accurately, so using organic matter ratios in place of bulk density could lead to more

efficient research. Results indicate that percent organic matter in floodplain soils is highest along single thread unconfined channels and decreases in the following order: multithreaded reaches, confined channels, reaches with beaver meadows, and partly confined channels respectively.

108 Understanding the role of nitrogen in low nutrient lake productivity over time

Jessica Johnstone

Major: Ecosystem Science and Sustainability

Faculty Advisor/Mentor: Bella Oleksy

Nearly all freshwaters of the US are degraded from inputs of excess reactive nitrogen, sources of which are mostly anthropogenic. Although not directly impacted by land-use change and runoff pollution, there is abundant evidence that the biologically and chemistry of remote alpine and arctic lakes have been affected by atmospheric nitrogen deposition in the last century. This deposition and climate warming may be together driving new ecological states in alpine lakes, manifested by changing patterns of primary producer structure and function. Empirical observations and experimental studies indicate that plant, algal and soil microbial species compositions have already changed in response to N deposition, with nitrophilic species like algae, increasing in abundance. This research serves to gain a better understanding of how the effects of nitrogen deposition have changed primary productivity in low nutrient lakes over time and under different climatic regimes. Our hypothesis is that relatively new ecological states in alpine lakes are manifested by changing patterns of primary producer structure and function. This analysis takes place in a single lake, the Loch, situated in an area of Rocky Mountain National Park. In this study, we analyze sediment sample stoichiometry from the Loch in order to track changes over recent geological time. In our analysis, we compare C:N ratios of samples from the deepest part of the lake and from the littoral zones, to examine the changes in productivity through time as well as by location.

109 The Echo - Educational Wildlife Film Series

Matthew Juneau, Mike Davis

Major: Natural Resources Management

We are Natural Resource students at Colorado State University. From our experience in the College of Natural Resources, we have gained considerable interest in making an impact on the public's perception on human-wildlife interactions. Our project is designed around researching the ways humans and animals interact in modern society. More specifically, our aim is to educate people on the current status and importance of certain animals, as well as their impacts on ecosystems shared by humans. Our ambition aligns with the fact that people have a genuine interest in the wildlife around them, and we believe that we can further educate the public on this topic. Our method involves video production, with YouTube "episodes" centered on interviews of people and companies that work with the animals of interest. We want to share both the process of making an idea a reality. How as a two person team we have seen success in a semester, and how we plan to continue the success in the future.

118 Using MODIS Imagery for Pest Risk Assessment: A Case Study of Wheat Stem Sawfly (Cephus cintus) in Colorado, USA

Jordan Lestina

Major: Forestry

Faculty Advisor/Mentor: Dr. Sunil Kumar

Wheat stem sawfly (Cephus cinctus Norton) has long been a significant insect pest on spring, and more recently, winter wheat in the northern Great Plains. Wheat stem sawfly was first observed infesting winter wheat in Colorado in 2010 and, subsequently, has spread rapidly throughout wheat production regions of the state. Here, we used maximum entropy modeling (MaxEnt) to generate habitat suitability maps in order to predict the risk of crop damage as this species spreads throughout the winter wheat growing regions of Colorado. We identified environmental variables that influence the current distribution of wheat stem sawfly in the state and evaluated whether remotely sensed variables improved model performance. We used presence localities of C. cinctus and climatic, topographic, soils, and NDVI/EVI data derived from MODIS imagery as environmental variables. All models had high performance in that they were successful in predicting suitable habitat for C. cinctus in its current distribution in eastern Colorado. The enhanced vegetation index (EVI) for the month of April improved model performance and was identified as a top contributor to MaxEnt model. Soil clay percent at 0-5 cm, temperature seasonality, and precipitation seasonality were also associated with C. cinctus distribution in Colorado. The improved model performance resulting from integrating vegetation indices in our study demonstrates the ability of remote sensing technologies to enhance species distribution modeling. These risk maps generated can assist managers in planning control measures for current infestations and assess the future risk of C. cinctus establishment in currently uninfested regions.

119 Effective Leadership in Conservation

Effective Leadership in Conservation

Nakayla Lestina

Major: Rangeland Ecology

Faculty Advisor/Mentor: Zachary Mercurio

Awareness of leadership and its importance is expanding within the career world. Higher education provides opportunities for individuals to learn about themselves as well as leadership itself. However, leadership within conservation is minimal and what is available is not relevant. Through this project, the role of leadership within conservation organizations will be examined to see if there are certain leadership approaches that can help improve the effectiveness

of a conservation organization. By doing this, individuals within organizations will be given tools and ideas at how they may be able to improve their effectiveness within their organization to increase the success. Individuals within conservation organizations may include farmers, non-profit organization members, educational staff, local, state, and federal employees. Leadership is important in conservation because professionals, public entities, and private landowners collaborate together to meet specified goals. Through collaboration, communication is essential; however, some inefficiencies with communication have been observed impacting the overall workings of the organization. From the issue at hand and the possibility to make positive change, three research questions arose: 1) What leadership approaches are most prevalent in conservation organizations? 2) What are the perceptions for effective leadership in conservation organizations? and 3) How do these perceptions vary among the organization's structure? These questions will be addressed through a literature review and interviewing individuals from various conservation organizations. By asking these questions, the roll leadership has in conservation can be better understood to make recommendations on how to help improve communication within the organization's structure.r the subject manner and the outdoors in general increased.

144 An Analysis of Items Carried in the Mouths of Carnivores

REBECCA MUCH

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: KEVIN CROOKS, JESSE LEWIS, AND ASHLEY GRAMZA

Eighty percent of the global human population now resides in or around urbanized areas. As a result, mammalian carnivore species in these areas have altered foraging patterns in response to residential development and the subsequent availability of anthropogenic resources. This paper describes and discusses the diverse array of items carried in the mouths of carnivores along a gradient of human influence. Camera trap captures of six carnivore species (Puma concolor, Canis latrans, Vulpes vulpes, Lynx rufus, Urocyon cinereoargenteus, Felis catus) carrying objects in mouth across five study areas thatinclude a spectrum of wildlands, rural, and wildland-urban interface sites are analyzed to identify objects as natural food items, natural nonfood items, and anthropogenic items. Natural food items are identified to the most detailed level of taxonomic classification possible. Nonfood items are described generally as objects with little to no energy consumption value. Anthropogenic items are described as both subsidized food items and nonfood items to the greatest probable detail. Items captured in the mouths of each of the six carnivore species are discussed in relation to 1) proximity and degree of human influence surrounding each study grid, 2) the rate of items carried in mouth in comparison to body size, foraging patterns and human development sensitivity of the carnivore species, and 3) possible applications for urban carnivore conservation education.

153 Does Water Use Efficiency Explain Vegetation Production Responses to Climate Change on the Tibetan Plateau?

GARY OLDS

MAJOR: ECOSYSTEM SCIENCE AND SUSTAINABILITY

FACULTY ADVISOR/MENTOR: KELLY A. HOPPING AND JULIA A. KLEIN

Climate change is increasing temperatures and the intensity and frequency of extreme weather events across the globe. Tundra regions, which are particularly sensitive to warming, are experiencing an increase in temperatures that is greater than the global average. The Tibetan Plateau, an alpine ecosystem, is projected to experience a temperature increase of up to 4.9C by the end of the 21st century, as well as increases in snowfall outside of the summer monsoon season. Our research group set up an experiment in Tibet to examine the effects of warming and snow addition treatments on an alpine meadow ecosystem for four years. We estimated biomass of the dominant species, Kobresia pygmaea, from off-plot regressions. In the lab, we analyzed for carbon isotopes using a Carlo-Erba elemental analyzer. We hypothesize that (1) warmer temperatures will decrease soil moisture, which will in turn decrease K. pygmaea biomass, (2) that snow additions will increase soil moisture and thereby increase biomass. We also hypothesize that water use efficiency (WUE) of K. pygmaea will have an inverse relationship to soil moisture trends, leading to higher WUE with warming and lower WUE with snow additions. Here we present out results on changes in vegetation caused by climate change manipulations on the Tibetan Plateau.

155 Should We Care About Frost? The Relevance of Sublimation onto the Snowpack

JACOB OLSON, AND CONNOR MITTS

MAJOR: WATERSHED SCIENCE

FACULTY ADVISOR/MENTOR: STEVEN FASSNACHT

Across the mountain west, snow is the dominant storage of water. Sublimation of snow from the surface or from snow intercepted by trees can be a relevant loss of stored water and this loss of water is a concern to water resources managers. Estimating the related sensible and latent heat fluxes usually requires expensive field sensors, such as three-dimensional sonic anemometers. However, during the night and early morning, winds are often low and little turbulence is present; it is possible that fluxes only occur from/to the surface and the air immediately about it. As such, the fluxes may not be sampled by the lowest sensor that is usually 1.5 m above the surface. To evaluate the relevance of the downward latent heat fluxes, we measured the daily occurrence and quantity of sublimation onto the surface during the winter of 2016. We correlated the occurrence and rate of downward sublimation to 10-minute temperature and vapor pressure deficit data collected nearby. Photographs were also taken to qualify the degree of downward sublimation or frost.

197 Spatial and temporal analysis of prior Winter Olympic venue selections by use of empirically modeled snowpack depth and SWE

KELLER SMITH

MAJOR: WATERSHED SCIENCE

FACULTY ADVISOR/MENTOR: STEVEN FASSNACHT

The first Winter Olympic Games were hosted in Chamonix France in 1924, and initiated what has become an international venue for all nations to join and compete in hosted winter Olympic games (olympic.org). The winter Olympics have continued to be held every four years at varying international host venues throughout the world as determined by the International Olympic Committee (IOC) (olympic.org). Throughout this history the IOC has determined that the games are to occur in mid February for the venue of selection to which occurs seven years prior in a totaling ten year selection process. In 1964, Innsbruck Austria held the winter Olympics games in which the lowest recorded mean snowpack depth occurred during the hosted winter games time frame, and posed the question as to if the Winter Olympic games occurred at the most ideal time and place. Peak snowpack depth, and Snow Water Equivalent (SWE) commonly indicate suitable winter recreation, and provide scientific insight into seasonal climatic effects and snowpack properties (nrcs.usda.gov). Moreover, these properties are highly variable both spatially and temporally and can display an even large degree of variability between maritime and continental based winter snowpack's (Trujillo and Molotch, 2014). This study evaluates the relationship between this variability and the IOC decision to select the host venue seven years prior at a static time frame in February for the Winter Olympics to be scheduled.

201 Retrograde Flow Regulates Gene Expression During Cardiac Valve Formation in Zebrafish

HALEY STAPLETON

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: DEBORAH GARRITY, NEHA AHUJA, AND MOLLY ZELLER

Zebrafish research has become essential to providing innovative insights into human cardiovascular disease because zebrafish experience similar heart development patterns as and possess an orthologous genome to humans. Our research with zebrafish stems from the previous knowledge that reversing blood flow is a notably strong stimulus to valve formation in the heart. Our research concentrates on the structural protein, filaminC (flnc). Flnc helps anchor the sacromeres to the cell surface in the heart, which is important in maintaining cardiac muscle integrity. Zebrafish with knocked down flnc exhibit decreased contractility and increased retrograde flow. Retrograde flow is the flow of blood backwards from the ventricle to the atrium. Thus, we are analyzing flncb and its homolog, flnca, and how these phenotypes in morphants cause altered flow and altered contraction. Since we know that heart valve development is flow responsive, we use the flow-response transcription factors klf2a, klf2b, klf4, and notch1 to help detect if gene expression changes in response to increased retrograde flow due to the knockdown of flnc. To achieve this, mRNA extractions and cDNA syntheses are performed in mopholino-injected embryos aged 48 hours post fertilization for flnca, flncb, and non-injected morphants. We then evaluate gene expression in response to retrograde flow through in-situ hybridization and digital droplet PCR. These results strongly suggest that retrograde flow is necessary for proper valve formation.

203 Root Nodulation in trees Elaegnus and Alnus, in the presence of Frankia sp. bacteria with varying PAR and Nitrogen levels

TATIANA STOECKER, AND JORY COATES

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: GRAHAM TUTTLE

The purpose of this experiment is to study the formation of root nodulation on several tree species in the presence or absence of Frankia sp. bacteria in the soil, and under different PAR and soil nitrogen levels. The formation of root nodulation indicates the presence of Frankia on the plant and fixating nitrogen to assist with plant growth. Species Elaeagnus angustifolia, Elaeagnus unbellata, Elaeagnus commutata, Alnus rubra, Alnus incana, and Cercocarpus montanus were studied in particular due to their ability to form nodules with Frankia. Several other variables were changed, such as sunlight (shade or full sun) and soil nitrogen concentration (low, medium, high) to see if growth and nodulation would also change under these conditions. Data collected from this experiment will supply a better understanding to how certain species may thrive in certain environments compared to others. Russian Olive (Elaeagnus angustifolia) is known to be a shade-tolerant invasive species, so it is expected to thrive and form lots of root nodules in environments that are shady and supplied with low nitrogen. Since all the species in study are either closely related to E. angustifolia or from the same habitat, it is expected that they will have similar growth rates in the absence of Frankia and low PAR and soil nitrogen concentrations.

206 Maslow's Hierarchy of Needs Applied Between Two Cultures

CAT SUNSTONE

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: DR. RAY BLACK

Many Westerners have the opinion all of Africa is terribly poverty stricken. They look at the world through the lens of our privilege and view all those who lack such amenities as living in deprivation. However, after a recent study abroad trip in Ghana I find myself now asking many questions about my own conceptions of poverty. As an adult, I lived in extreme poverty for 10 years of my life, right here in America; even now I continue to live in what our society considers to

be poverty. With this insight into American poverty, I applied myself to answering questions such as: What is poverty? Who defines poverty? Is poverty strictly an economic concept from the American perspective or do we also take into account other common needs? By applying Maslow's Hierarchy of Needs to these questions, I will illustrate that fundamentally we all have the same needs across cultures, regardless of socioeconomic standing. In removing the economic component when evaluating these questions, I hope to help bridge the culture gap between our societies and the way Americans view those from developing countries as being "less than" us, but instead to see that people are similar even when our cultural lifestyle is very different from each others.

209 Species Richness of Birds as it Relates to Slope Aspect of Desert Scrubland Habitat in Todos Santos

BRANDI THOMAS, KENSIE MURRAY

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: KATE HUYVAERT, LARISSA BAILEY, AND BRITTANY MOSHER

We explored the relationship between slope aspect and bird species richness in Todos Santos, Mexico. We predicted that north and south facing slopes received different level of sunlight throughout the day, and that this difference may influence habitat preference for resident bird species. We chose a north facing slope and a south facing slope just off the trails behind the center to conduct point counts on at different times of day. There were 16 species found on the south facing slope compared to only 10 species found on the north facing slope at any time of the day. The south facing slope had greater estimated species richness, as well as a greater average number of species detected at any time of day. Every species on the north facing slope was found on the south facing slope, suggesting that birds were not excluded from either environment but there appeared to be a preference for the south facing slope. Due to limited resources and time constraints, the data and results are only conclusive to these slopes analyzed. Additional research may be done to expand the study area and allow for more variables, such as distance from public areas and slope gradient.

210 The Spatial Distribution of Fine Resolution Snow Surface Roughness

ERIC THOMAS

MAJOR: WATERSHED SCIENCE

FACULTY ADVISOR/MENTOR: STEVEN FASSNACHT

Variability in snow surface roughness is rarely incorporated into climate or hy-drological models, yet it has the potential to have a large impact on both latent and sensible heat for a snow dominated system. We looked at the spatial varia-bility of snow surface roughness using the data collected by the NASA Cold Land Processes Experiment (CLPX) during the winters of 2002 and 2003 for nine 1 km2 study sites across northern Colorado. Black boards where placed perpendicularly into the snow to create a contrast so that pictures could be taken of the surface. The surfaces digitally extracted and the surfaces were detrended to remove random data acquisition biases. The datasets for each board within a study site where then assigned a value based on variability in the surface, standard deviation and categorized based on location. These roughness metrics were then analyzed geospatially to understand their spatial variability and the driving processes

219 Patterns of Snowmelt Rates across the Southern Rocky Mountains, U.S.A.

AMANDA WEBER

MAJOR: WATERSHED SCIENCE

FACULTY ADVISOR/MENTOR: STEVEN FASSNACHT

About 20% of the world's population relies on melting snow for their main water supply. Many of these areas are mountainous and there is limited in situ monitoring of snow accumulation and melt due to few stations and the lack of representativeness of these stations in this complex terrain. Most of the existing stations only collect precipitation and temperature data, thus modeling of snowmelt often uses temperature as an index of the full energy balance needed to physically model melt. Across the Western United States (U.S.), there are currently about 700 snow telemetry (SNOTEL) stations that monitor precipitation and temperature, as well as snow water equivalent (SWE) and snow depth. Across the Southern Rocky Mountains in the central-western U.S., 90 SNOTEL stations have been operating since the late 1970s or mid-1980s. These stations were used to estimate the daily snowmelt rate as a function of the daily average air temperature over month periods to consider the seasonality of incoming solar radiation. The various melt rates, in millimeters of snow per day per degrees Celsius were then evaluated based on the location, topography, and canopy characteristics of each station. It is anticipated that the spatio-temporal variability in the melt rates can be applied to other continental regions.

225 Black-tailed Praire Dog (Cynomys-ludovicianus) altered alarm call function in presence of pups

GRETE WILSON-HENJUM

MAJOR: FISH, WILDLIFE AND CONSERVATION BIOLOGY

FACULTY ADVISOR/MENTOR: GEORGE WITTEMYER, JACOB JOB

Vocal communication is critical to the fitness of many species. With increasing encroachment of anthropogenic disturbances into wildlife habitat, understanding the effects of anthropogenic noise on vocal communication is important for conservation and management action. The black-tailed prairie dog (Cynomys ludovicianus) is native to the Front Range of Colorado and is heavily dependent on vocalized anti-predator alarm calls for survival. Furthermore this species invests a large amount of energy in juvenile care relative to their body size. This study investigates how the presence of pups in

conjunction with varying levels of anthropogenic noise effects the black-tailed prairie dog's alarm call. It was found that the alarm call recordings taken in the presence of pups across both the site with elevated anthropogenic noise and the control site were adjusted to have a lower minimum frequency, measured as the 95th percentile frequency, and a lower peak frequency, compared to calls made by adults not in the presence of pups. This suggests a difference in the functionality of the alarm calls in the presence of pups that remains consistent across different background acoustic conditions.

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POSTER SESSION:
Monday, April 18, 2016 from 10:30am to 1:30pm
Lory Student Center Ballrooms A, B, C, and D

ORAL PRESENTATION SCHEDULE:
Electorates, Influenza, and Snowmelt Patterns: Science in the Lab and in the Field
Monday, April 18, 2016 from 9:30am to 10:55am
Lory Student Center Room 310

From Fort Collins to Xishuangbanna: Research and Community Outreach
Monday, April 18, 2016 from 10:00am to 11:45am
Lory Student Center Room 308

DOCUMENTARY FILM SCHEDULE:
Monday, April 18, 2016 from 1:00pm to 3:00pm
Lory Student Center Room 308

AWARDS CEREMONY:
Monday, April 25, 2016 at 5:00pm to 7:00pm
Lory Student Center Ballrooms C and D

Keynote Address by Dr. Doug Ming
Chief Scientist, Astromaterials Research and Exploration Science Division
NASA Johnson Space Center
Curiosity on Mars: Trailblazing the Path for Humans

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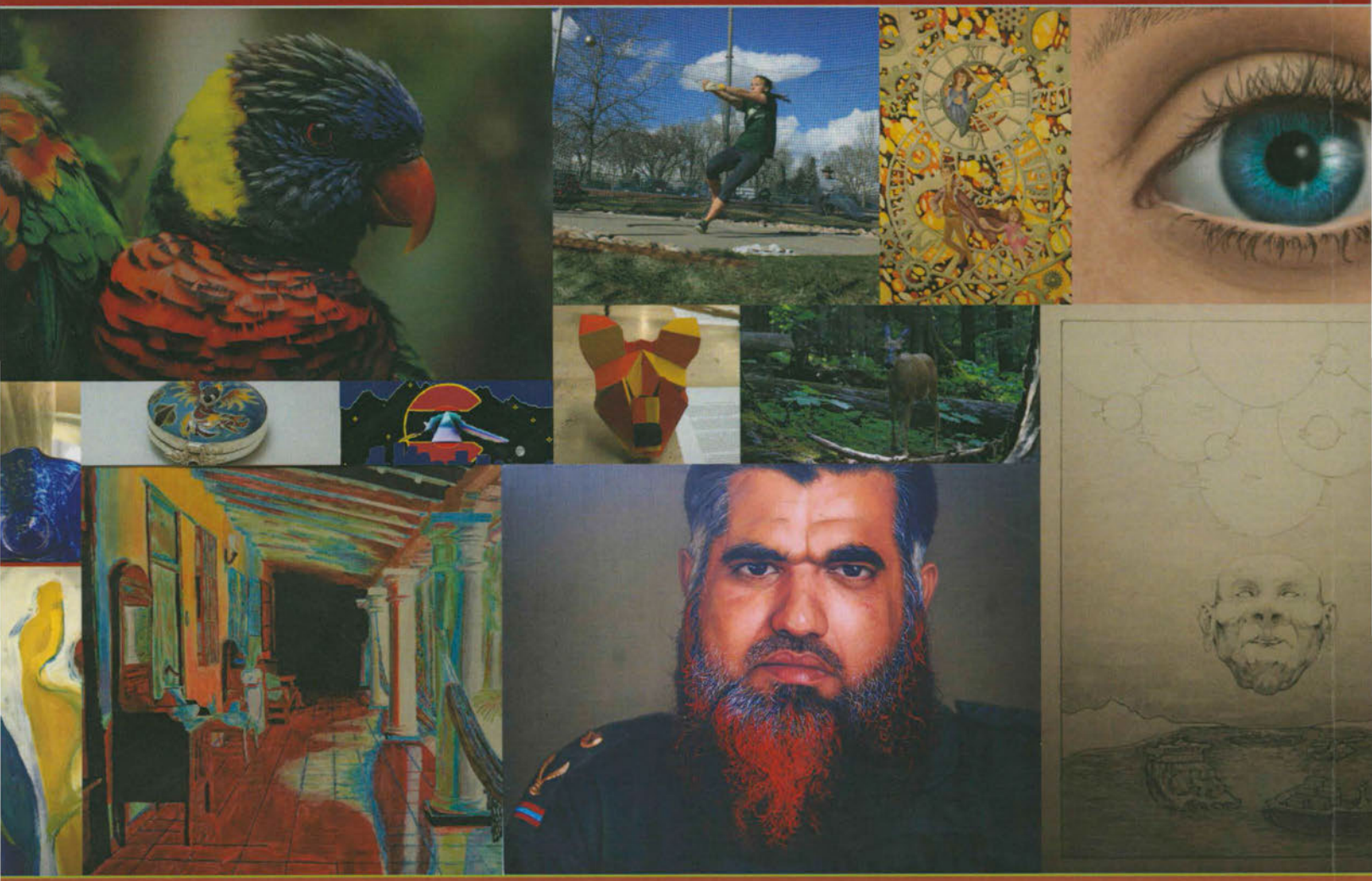

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