

Walter Maxwell Gibson
College of Science & Engineering
Eight Annual
Undergraduate Research Symposium



Monday, November 7, 2016
Southern Utah University

5:00 p.m. Keynote Speaker

Jennifer M. Heemstra, *Ph.D.*

*Associate Professor, Department of Chemistry
Deputy Director, Center for Cell and Genome Science
University of Utah*

“Building with nature’s LEGO bricks: Harnessing DNA molecular recognition and self-assembly to improve drug synthesis”

6:00 p.m. Reception

Light dinner will be served

Thanks to the Undergraduate Research Symposium Committee

Chad Gasser, Department of Agriculture and Nutrition Science

Matt Ogburn, Department of Biology

Cecily Heiner, Department of Computer Science & Information Systems

L. Scott Hansen, Department of Engineering & Technology

Sarah Duffin, Department of Mathematics

Johnny MacLean, Department of Physical Science

Robert Eves, Dean, WMG College of Science & Engineering

**This Symposium is sponsored in part
by the generosity of:**

Dr. Jacob and Melissa Corry

Poster Presentations

6:15 – 7:45 PM

Locations:

All posters presentations will be in the Hunter Conference Center

Room Gr Hall.....Great Hall, 2nd Floor

Room CH.....Charles Hunter, 1st Floor

<i>Location of Poster</i>	<i>Abstract #</i>
Gr Hall 1	052
Dendrimer Synthesis	
Author's Name(s): <i>Aleksei V. Ananin, Mackay B. Steffensen Ph.D.</i>	
Gr Hall 2	041
Diffusion-limited Titration Using Microfluidics	
Author's Name(s): <i>Jaxon Barney</i>	
Gr Hall 3	050
Synthesis of a Potential Malate Synthase Inhibitor	
Author's Name(s): <i>Samantha Bengtzen, Bruce R. Howard Ph.D., J. Ty Redd Ph.D., Nathan S. Werner Ph.D.</i>	
Gr Hall 4	042
To Use or Not to Use a Virtual Lab	
Author's Name(s): <i>Carrie Bucklin, Kristy Daniel</i>	
Gr Hall 5.....	046
Caffeine Derived Carbene Ligands in Nickel Catalyzed Cross-Coupling Reactions	
Author's Name(s): <i>Christopher Christiansen, Nathan S. Werner Ph.D.</i>	
Gr Hall 6.....	049
Stereoselectivity of the Palladium-Catalyzed Heck Reaction	
Author's Name(s): <i>Kyle Clark, Nathan S. Werner, Ph.D.</i>	

Gr Hall 7 053
Physical and cultural causes of unrelenting Malarial infections in the Accra metropolis. The power of GIS to identify and discern sources and causes of tropical epidemiology.
 Author's Name(s): *Peter T. Combs, David J. Maxwell*

Gr Hall 8 027
Immunity in the Community
 Author's Name(s): *Dakota Denver, Amanda Eggleston, Emma Jones, Anthony Sattiewhite, Jessica Stone*

Gr Hall 9 051
Synthesis of Chalcones Under Microwave Irradiation and with an Environmentally Friendly Catalyst
 Author's Name(s): *Adam F. Eddington, Nathan S. Werner Ph.D.*

Gr Hall 10 059
The geological effects of extrusions in the Rocky Range on molybdenum soil concentrations.
 Author's Name(s): *Darian Elliot, Rhiannon Garrard, Kim Weaver, Ph.D., Jason Kaiser, Ph.D.*

Gr Hall 11..... 056
Engineering a laboratory host for production of terpenoids from local soils
 Author's Name(s): *Thomas Ellis, Elizabeth Pierce, Ph.D.*

Gr Hall 12 038
College jobs and recreation
 Author's Name(s): *Brooklyn Whitney, Kristian Evenson, Justin Lewis, Tayler Park*

Gr Hall 13..... 062
Two new Antarctic Colossendeis species (Pycnogonida, Colossendeidae)
 Author's Name(s): *Coral E. Gardner, Fredric R. Govedich, Ph.D. and Bonnie A. Bain, Ph.D.*

Gr Hall 14 029
Swipe Right or Swipe Wrong: The Truth About Tinder
Author's Name(s): Brenna Garrett, Macy Call, Roger Young, Allora Heaton, Collin Moore

Gr Hall 15 058
Comparing Exam Options for Assessment of Student Learning
Author's Name(s): Chad L. Gasser, Ph.D.

Gr Hall 16 039
Freshwater Leeches of North America
Author's Name(s): Fredric R. Govedich, Ph.D.

Gr Hall 17..... 040
Use of green infrastructure to increase invertebrate biodiversity in the built environment
Author's Name(s): Jaqualine Grant, Ph.D., Mathew Weeg, Ph.D., Hailey Wallace, Andrew Carlson, Youcan Feng, Steven Burian

Gr Hall 18 054
Active Galaxy Feedback on Neighboring Galaxies: A Pilot Study
Author's Name(s): Taylor Hammack, Kasen Lisonbee, Bryan May, Jordan Memmott, Kallin Raymond, Morgan Taylor, and Cameron Pace, Ph.D

Gr Hall 19 055
Sources of Stress and Coping Mechanisms in SUU Students
Author's Name(s): Phillip Hilton, Mathew Vaughn

Gr Hall 20 045
Migration of Lipids in a Supported Lipid Bilayer
Author's Name(s): Doug Hutchinson

Gr Hall 21 035
How buzzed are college students?
Author's Name(s): Madison Keith, Sabrinah Cava, Hailey Sorensen, Caitlin Bess

Gr Hall 22 063

Benzoin Condensation using Caffeine as a Catalyst

Author's Name(s): *Peter Kemp and Nathan S. Werner Ph.D.*

Gr Hall 23 060

A Microfluidic Device for Oxygen Quantitation in Anoxic Environments

Author's Name(s): *Aubriel Koehler, Ester Harkness, Maverik Shumway*

Gr Hall 24 043

Expression of immunogens and activation of the immune system in *C. elegans*

Author's Name(s): *Chase Leavitt*

Gr Hall 25 032

All Aboard the Thunder Train

Author's Name(s): *Audrie Lindsay, Brayden Ross, Kristin Lynn, Kaitlyn Moore, and Madelyn Pendleton*

Gr Hall 26 057

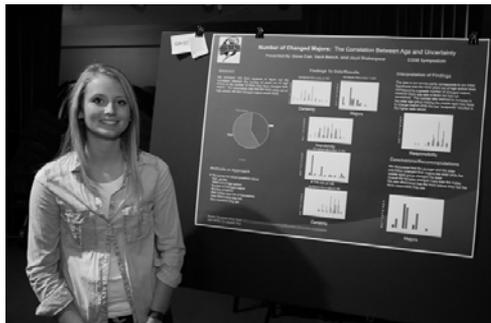
Evaluating the usability of readily available GIS vector feature classes to assist in natural hazard mitigation at the county level.

Author's Name(s): *Nathan Osborne, Nathan Wilberg*

Gr Hall 27 031

Stressed Out

Author's Name(s): *Brittany Palmer, Austin Orton, Peter Seegrst, Bobi Dotson*



*'CH' posters are located on first floor
in the Charles Hunter Room*

<i>Location of Poster</i>	<i>Abstract #</i>
CH 1	044
Can I Afford a Relationship and Still Get an "A"?	
<i>Author's Name(s): Trevor Perida, Peter Kim, Paige Dolan, Caleb Smith</i>	
CH 2	036
Nanoparticle Synthesis with Microfluidic Devices	
<i>Author's Name(s): Kyler Radmall, Rachel Radmall</i>	
CH 3	047
Preparation of trans-Stilbene Derivatives by Palladium-Catalyzed Cross-Coupling Reaction	
<i>Author's Name(s): Hailee Rau, Nathan S. Werner Ph.D.</i>	
CH 4.....	034
Biology of Arid Landscape Wetlands	
<i>Author's Name(s): Nayla Rhein, Bonnie A. Bain, Ph.D. and Fred Govedich, Ph.D.</i>	
CH 5	048
Synthesis of Alkenyl Pinacolboranes by Hydroboration Reaction	
<i>Author's Name(s): Haley R. Shumway, Nathan S. Werner Ph.D.</i>	
CH 6	028
Dietary Analysis of Invasive <i>Apalone spinifera</i> in the Muddy River and Virgin River, Utah: An Ecological Impact Investigation.	
<i>Author's Name(s): Josh Sigg, William H. Heyborne, Ph.D.</i>	
CH 7	061
Geospatial and Petrographic Analysis of Leucogranite in Beaver Dam Mountains, Southwest Utah	
<i>Author's Name(s): Zachary Smith, Jason Kaiser, Ph.D., David Maxwell, Ph.D.</i>	

CH 8 033

Let's get Outdoorsy

Author's Name(s): *Mark Solomon, Marci Peterson, Kaylee Peatross, Ali Alnasser*

CH 9 037

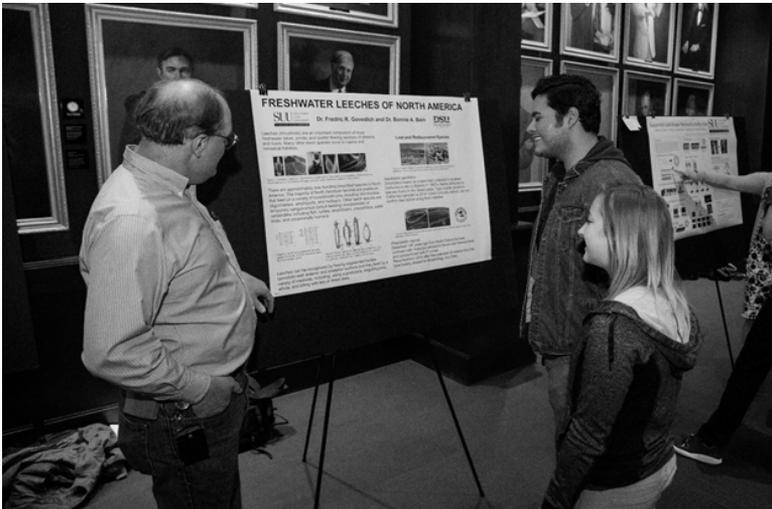
Development of a Low-cost PDMS Modular Microfluidic Device for Sample-in, Answer-out STR Analysis of Genomic DNA

Author's Name(s): *Sharla Winn*

CH 10..... 030

Lithological and Structural Analyses of Clastic Dikes within the Indian Peak-Caliente Caldera Complex

Author's Name(s): *Sarah Zdanowski*



**Oral Presentations
Located in Shooting Star**

Abstract #

6:45 PM 005

Simple Experiment to Evaluate Beam Deflection

Author's Name(s): *Jacob Carter*

7:00 PM 013

Overview of Eating Disorders

Author's Name(s): *Artis Grady*

7:15 PM.....011

**Demographic Differences in How Riders Perceive Themselves Based
On Video Analysis**

Author's Name(s): *Lee G. Wood, Ph.D.*

7:30 PM 019

**Massively Parallel Simulations of Black Hole Formation and
Supernovae**

Author's Name(s): *Brandon Wiggins Ph.D.*

7:45 PM014

**Dark Skies and Bright Minds... Astronomical Research Opportunities
with the GBO**

Author's Name(s): *Rhett Zollinger, Ph.D. and Cameron Pace, Ph.D.*

8:00 PM.....015

Mathematics of Mario Party 10

Author's Name(s): *Andrew Misseldine, Ph.D.*

8:15 PM 001

**Obtaining a 2-character of a finite group as a character of a
generalized centralizer ring**

Author's Name(s): *Emma Schafer, Ph.D.*

**Oral Presentations
Located in Yankee Meadow**

Abstract #

- 6:45 PM 025
Copper Nanoparticle Synthesis from Bulk Copper Metal
Author's Name(s): *Emily Pehrson, Ashlie Pender*
- 7:00 PM 008
Microfluidic DNA Analysis: making CSI a reality
Author's Name(s): *Allison Hadley*
- 7:15 PM 020
Stripping Supported Lipid Bilayers
Author's Name(s): *Mike Ornstead, Stephen Smith, Joshua Reid*
- 7:30 PM 018
Phosphatidylserine-containing Supported Lipid Bilayer as a Separation Medium and Novel Chromatography Column for Copper Binding Compounds
Author's Name(s): *Christopher Reynolds, Dylan Keiser*
- 7:45 PM 003
Supported Lipid Bilayer Research at SUU
Author's Name(s): *Christopher Monson, Ph.D.*
- 8:00 PM 022
Aspen (*Populus tremuloides*) restoration utilizing nursery-propagated seedlings
Author's Name(s): *Randall Violett, Ph.D.*
- 8:15 PM 064
Markov Chains and Shut the Box
Author's Name(s): *Skyler Simmons*

**Oral Presentation
Located in Vermillion Cliffs**

Abstract #

- 6:45 PM 002
The effects of airport noise on birdsong across a rural to urban gradient
Author's Name(s): *Denton C Shepherd, Paola A. Garrison-Tovar, Jazmine N. James*
- 7:00 PM 016
The Effect of Eucalyptol on Blood Vessel Diameter in Frogs
Author's Name(s): *Skyler Buck, Mark Albrecht*
- 7:15 PM 023
Adaptive Trajectories of an Environmental Microbe to become Host-Associated in a Zebrafish
Author's Name(s): *Josh Matt*
- 7:30 PM 009
Comparison of arthropod populations in upland Iron County streams with and without Rotenone treatment
Author's Name(s): *Jeremy Evans, Kiersten Williams, Samuel Wells Ph.D., Fred Govedich Ph.D.*
- 7:45 PM..... 006
A Promising New Herbicide for Control of Cheatgrass (*Bromus tectorum*) on Rangelands
Author's Name(s): *Dean L. Winward, Chad R. Reid*
- 8:00 PM 010
A Bayesian method on landmark momentum data for abnormality detection
Author's Name(s): *Dongyang Kuang*
- 8:15 PM 017
Differential Equations versus Fractional Differential Equations.
Author's Name(s): *Bhuvaneswari Sambandham, Ph.D.*

**Oral Presentations
Located in Red Hills**

Abstract #

6:45 PM 012

Cooperative Ion Pi Network for Protein Stability

Author's Name(s): *Mohammad Samha*

7:00 PM 024

Pyridyl- and Phenyl- Substituted Benzenes- A Modular Synthesis

Author's Name(s): *Andy Larsen, Daniel Taylor, and Adam Penrose*

7:15 PM 004

Ideas and Strategies for Student Success and Retention

Author's Name(s): *Scott Munro, Ph.D.*

7:30 PM 026

SUU's Semester in the Parks Initiative

Author's Name(s): *Johnny MacLean, Ph.D.*

7:45 PM 021

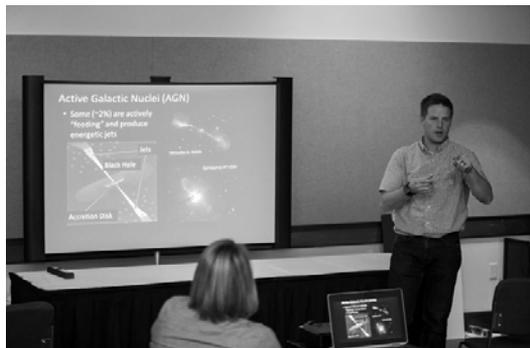
Update on Utah Rocks! A Layman's Guide to Some of the State's Spectacular Geology

Author's Name(s): *Robert L. Eves, Ph.D. and Larry E. Davis, Ph.D.*

8:00 PM 007

An Interdisciplinary Approach to Undergraduate Research and Pedagogy in Geology Courses

Author's Name(s): *Jason Kaiser Ph.D., Johnny MacLean Ph.D., Grant Shimer Ph.D.*



ABSTRACTS

Title:

Obtaining a 2-character of a finite group as a character of a generalized centralizer ring

Author's Name(s):

Emma Schafer, Ph.D.

Department: *Mathematics, Southern Utah University*

Mentor(s):**Abstract**

Let G be a finite group. If elements of G are represented by matrices, the vector space that those matrices act on is called a G -module, and the function X that maps each matrix to its trace is called a character of G . For each character X of G , there is a related function $X^{(2)}$, called a 2-character, defined as $X^{(2)}(g, h) = X(g)X(h) - X(gh)$. The 2-classes of a finite group G are a partition of $G \times G$ which satisfies certain symmetry and conjugacy conditions. The 2-S-ring of G is a subring of the group algebra of $G \times G$ which has as its basis the class sums of the 2-classes of G . We show that if a vector space V is a G -module with character X , the antisymmetric vector space $A(V \otimes V)$ is a module of the 2-S-ring of G with character $\frac{1}{2}X^{(2)}$.

Title:

The effects of airport noise on birdsong across a rural to urban gradient

Author's Name(s):

Denton C Shepherd, Paola A. Garrison-Tovar, Jazmine N. James

Department: *Biology, Southern Utah University*

Mentor(s): *Rachel Bolus, Ph.D.*

Abstract

As humans continue to encroach on natural habitat, many species are forced to deal with the negative consequences of urbanization, including noise. For example, airports generate a constant barrage of machinery noise, which can significantly impact the biodiversity of bird species in local habitats. Birds that choose to stay in noisy habitats could acclimate by changing the timing, amplitude, frequency, or modulation of their songs, but these changes could negatively affect their reproductive success, as song characteristics have evolved to attract mates. We will compare the relative timing of natural and anthropogenic sounds at five airports across an increasingly rural to urban gradient: Bar 10 Ranch airstrip, Panguitch Airport, Saint George Airport, Cedar City Airport, and Salt Lake Airport. In addition, we will analyze and contrast songs of the sage thrasher and sagebrush sparrow to determine if the noise from the airport affects timing, amplitude, frequency, and modulation of their songs by comparing to them to individuals at sites away from airports. To record songs, we will use passive audio recorders placed within a mile of airports and at a location at least 10 miles away in the same sagebrush habitat. We will analyze songs using the bioacoustics software Raven and a custom program written in Python. Our goals of this project are to explore at what level airport noise affects populations and to educate the public about these effects through outreach.

Title**Supported Lipid Bilayer Research at SUU****Author's Name(s):**

Christopher Monson, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s):**Abstract**

Lipids are a class of biomolecule with both hydrophilic (water loving) and hydrophobic (water hating) regions. When exposed to water, lipids form lipid bilayers, organized sheets of lipids that maximize favorable interactions. Lipid bilayers are essential elements of cells, and supported lipid bilayers have developed as both a good model lipid bilayer system (and thus good cell membrane models) and valuable scientific tools. I will discuss research that students have done with me using supported lipid bilayers, focusing on progress that has been made in using supported lipid bilayers as a protein filter and in stripping supported lipid bilayers.

Title:**Ideas and Strategies for Student Success and Retention****Author's Name(s):***Scott Munro, Ph.D.***Department:** *Engineering and Technology, Southern Utah University***Mentor(s):****Abstract**

The First Year Engineering Experience (FYEE) is a conference dedicated to improving the experience for first year engineering students. Obviously, there are several aspects to the first year experience for engineering students, but of primary interest are the academic success and the retention of students. The conference has topic areas related to helping students transition from high school as well as learning what it means to be a successful engineering student. Also, the conference has sessions devoted to addressing specific issues such as math preparedness and generating student interest in engineering in the first year (since many engineering programs do not have students interfacing with engineering faculty until the 2nd year). This presentation will present highlights and ideas and methods presented at the conference that SUU could implement to increase student success and retention. While the conference is dedicated to the engineering major, many of the ideas and programs could easily be applied to a broader range of majors.

Title:**Simple Experiment to Evaluate Beam Deflection****Author's Name(s):***Jacob W. Carter***Department:** *Engineering and Technology, Southern Utah University***Mentor(s):** *Ali Siapush***Abstract:**

In engineering applications, when different components such as beams, columns or foundations have been used, normally they are designed within the certain limits. Limits are placed on the amount of elastic beam deflection when it is subjected to a load. The design of such beams can be complex but is essentially intended to ensure that the beam can safely carry the required load. The purpose of this paper is to discuss the fundamentals of beam deflection and a simple and cost effective method (integration method) to evaluate the amount of deflection and slope at the free end of beams based on the load. To test these fundamentals, a device was designed and constructed to evaluate the elastic deflection of a beam. Upon successful completion of this exercise, participants will understand the concept of elastic beam deflection and will be able to evaluate the deflection of a beam under different vertical loads. Through this exercise, we demonstrated that the experimental values and theoretical values match within 95%.

Title:

A Promising New Herbicide for Control of Cheatgrass (*Bromus tectorum*) on Rangelands

Author's Name(s):

Dean L. Winward, Chad R. Reid

Department: *Agriculture & Nutrition Science, Southern Utah University and Utah State University Extension*

Mentor(s):**Abstract:**

Cheatgrass has become one of the most notorious and invasive species of rangelands in the Western United States. Estimates indicate in the west, cheatgrass infests more than 22 million ha and is increasing at a rate of 14% each year. Cheatgrass, or downy brome as it is sometimes referred to, is competitive enough to displace native plants and drastically alter the structure and function of existing ecosystems. Several methods have been tried to manage cheatgrass with highly variable results. A new herbicide, Indaziflam (trade name – Esplanade from Bayer Crop Science), a cellulose biosynthesis inhibitor (CBI) herbicide has shown good results in controlling downy brome when applied as a pre-emergent. In this study, Indaziflam is being compared to other recommended herbicides for control of cheatgrass and for damage to non-target species.

Title:**An Interdisciplinary Approach to Undergraduate Research and Pedagogy in Geology Courses****Author's Name(s):**

Jason Kaiser Ph.D., Johnny MacLean Ph.D., Grant Shimer Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s):**Abstract**

Integrating undergraduate research with pedagogical practices is a staple in the Geology Program at SUU. Combining writing-intensive projects with collaborative assignments fits SUU's pursuit of experiential education and follows the practices of The Liberal Education and America's Promise (LEAP) and the Association of American Colleges & Universities (AAC&U). These high impact learning practices have been incorporated into two upper level Geology classes as a joint research project focusing on the tectonic and geochemical evolution of the Indian Peak-Caliente Caldera Complex (IPCCC) of southern Utah and Nevada. Based on the success of the IPCCC project, we have expanded the collaborative assignments to include four upper level classes for the 2016-2017 school year. Students from each class have been introduced to the Parowan Gap field area, North of Cedar City. This field area presents multiple geologic problems/questions that can be resolved through each of the geology sub-disciplines taught this year. Students are developing research plans regarding the age, chemistry, and deformation history of the rocks present in the field area. In addition to the AAC&U's LEAP practices, this year-long project also addresses several SUU Essential Learning Outcomes. The project serves as a model of integrating undergraduate research with pedagogy, which is well aligned with SUU's mission of engaging students in a "personalized and rigorous experiential education.

Title:**Microfluidic DNA Analysis: making CSI a reality****Author's Name(s):***Allison Hadley***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher Monson, Ph.D.***Abstract**

DNA quantification and sequencing are crucial activities in many disciplines, including biology, medicine, and forensics. In many of these applications, and particularly in forensics, DNA analysis is limited by the amount of material available, thus making microfluidic technology (which requires very little material) inherently valuable. We are attempting to develop a microfluidic device that will take a small sample of material, separate any DNA from the rest of the material, and sequence the DNA. I am in the process of creating a device and will present the progress I have made in device design, fabrication, and testing. I hope that our microfluidic device will be able to analyze DNA quickly, cheaply, and easily, potentially allowing analysis to be done on-site.

Title:

Comparison of arthropod populations in upland Iron County streams with and without Rotenone treatment

Author's Name(s):

Jeremy Evans, Kiersten Williams, Samuel Wells Ph.D., Fred Govedich Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s): *Samuel Wells Ph.D., Fred Govedich Ph.D.*

Abstract

Rotenone is a plant derived toxin that is known to be an effective piscicide with alternative effects on arthropods and other various groups of animals. We evaluated post-treatment arthropod populations on two streams and compared their diversity with a non-treated equivalent stream from the upper reaches of Mammoth Creek in Iron County, Utah. Castle Creek was treated with rotenone on September 9th, 2015 and again on August 23rd, 2016. Lower Creek was treated with rotenone on September 22nd, 2015 and again on July 12th, 2016. These treatments were performed by the Utah Division of Wildlife Resources and the Dixie National Forest fisheries crews. Upper reaches of Mammoth Creek, upstream from State Highway 143, remained untreated and has presence of Brook Trout (*Salvelinus fontinalis*). We were able to observe arthropod populations that were under the effects of fish predation and those where fish predation has been absent for over a year, resulting from rotenone treatments. We found a greater abundance of individuals from a variety of orders among the two treated streams. Fish predation has a significant impact on aquatic invertebrate populations. Ephemeroptera, or may flies, were also found to be in greater numbers among the treated streams than the untreated stream, showing a potential advantage or an effective recolonization behavior. Rotenone was used as an effective piscicide for fish removal and left arthropod communities intact. Upon reintroduction of fish into these upland Iron County streams, there should be a sufficient population of arthropods to avoid trophic cascades.

Title:

A Bayesian method on landmark momentum data for abnormality detection

Author's Name(s):

Dongyang Kuang

Department: *Mathematics, Southern Utah University*

Mentor(s):**Abstract**

Making inferences from data are not usually easy. One can use relatively complex approaches on original raw data for investigation. Or these data can be alternatively preprocessed to have certain feature extracted before analysis. "Good" data with nice properties can certainly simplify the design of statistical methods used. In this presentation, momentum representation for each landmark template of a small brain image database is first calculated based on our previous work as a feature extraction. A Bayesian approach generating predictive distribution for these extracted momentum data plays a key role in following abnormality detection of brain structure caused by schizophrenia.

Title:**Demographic Differences In How Riders Perceive Themselves Based On Video Analysis****Author's Name(s):**

Lee G. Wood, Ph.D.

Department: *Agriculture and Nutrition Science, Southern Utah University*

Mentor(s):**Abstract**

Students are videoed while riding and evaluated by the class as a part of the SUU equitation program. Demographic data has been collected as a part of a survey and analyzed using SPSS. Independent *t*-test were used to evaluate differences in mean scores for each demographic. Over 95% agreed that "seeing myself ride was beneficial", however, there was a significant difference ($P<0.03$) in mean scores between males and females. Students were sorted into four age groups, 18-20, 21-24, 25-29, and 30-52. In response to the question "Watching and evaluating other riders in the class benefits me" every student agreed in the oldest group ($P<0.001$). Though most students agreed that watching increased awareness of control, the oldest group showed more awareness ($P<0.025$). Freshmen showed more interest in watching and discussing the video ($P<0.019$). Advanced riders placed more value on improvement ($P<0.011$). Beginning riders had less desire to watch the video multiple times than intermediate or experienced riders ($P<0.020$). Analyzing the demographics of SUU equestrian students has revealed significant information about using video analysis as a teaching technique. The data suggest that older and more experienced riders value improving equitation and horse control, and find it useful to view and evaluate other riders. Younger riders find more value in watching themselves and discussing the experience. Interestingly, female riders appear to dislike viewing themselves ride more than male students. This information can help provide direction to the future of SUU's and other equine programs.

Title:**Cooperative Ion Pi Network for Protein Stability****Author's Name(s):***Mohammad Samha***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Mason Smith, Wendy Billings, Josh Price Ph.D.***Abstract**

Cooperative Ion Pi network is the usage of a cation and an anion in a pi network to help increase stability of a Protein. These interactions occur due to the aromatic quadrupole that allows the electron density to be on the top and bottom of an aromatic ring. On the outer edges of the ring is a lack of electron density and this is the positive force that interacts with our anion in a network. The electronics diagram (shown below) shows the electron density of the aromatic rings of benzene, phenol and a part of a Tryptophan. We will also be looking at cation-pi and anion-pi interactions and the data of delta G values for these interactions. As well as the preliminary data of mutation interactions, binary interactions and cation-pi-anion interactions.

Title:**Overview of Eating Disorders****Author's Name(s):***Artis Grady***Department:** *Agriculture and Nutrition Science, Southern Utah University***Mentor(s):****Abstract**

Eating disorders (ED) occur in individuals of all ages, genders, ethnicities, cultures, and socioeconomic classes. ED may take the form of anorexia nervosa, bulimia nervosa, binge-eating disorder, and many other manifestations. The postulated causes are varied: societal influences, epigenetics, post-traumatic stress, psychological factors, environmental abnormalities, dieting gone awry, and body dissatisfaction, to name just a few. It should be recognized that the damage caused by ED to both bodies and minds is great and that eating disorders do not just go away. Medical and nutritional intervention may be needed along with psychotherapy and psychological counseling. This session is not original research, but provides a glimpse at information from a recent National Eating Disorders Conference.

Title:

Dark Skies and Bright Minds... Astronomical Research Opportunities with the GBO

Author's Name(s):

Rhett Zollinger, Ph.D. and Cameron Pace, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s):**Abstract**

Great Basin National Park has some of the darkest and clearest night skies in the contiguous United States. SUU is one of four partner institutions in a collaboration that just finished construction on the first research-grade observatory in any national park, known as the Great Basin Observatory (GBO). The GBO can enable SUU students to explore fundamental questions about our universe. The telescope is remotely operated, allowing research to be conducted from just about anywhere. Exciting new research opportunities include detection of extrasolar planets, monitoring active galactic nuclei, stellar classification, solar system observation, and much more. In addition to research, we'll be generating amazing images of astronomical wonders, offering unique outreach opportunities for K-12 educators and local schools, and providing innovative learning projects for astronomy students at SUU.

Title:**Mathematics of Mario Party 10****Author's Name(s):***Andrew Misseldine, Ph.D.***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

The Mario Party video game franchise by Nintendo has offered a fun, wholesome party game experience for millions of happy gamers since 1998. The newest installment of the series, Mario Party 10 for the Wii U, continues in this tradition. These video games play like a board game but with regular mini-games where players battle for coins and hearts. While players can best these mini-games by strategy, skill, timing, and massive button-mashing, victory in these mini-games and the overall board game often comes down to luck. From dice rolls to card drawing and other games of chance in between, this talk will analyze effective Mario Party 10 strategies based upon the mathematics of probability.

Title:**The Effect of Eucalyptol on Blood Vessel Diameter in Frogs****Author's Name(s):**

Skyler Buck, Mark Albrecht

Department: *Biology, Southern Utah University*

Mentor(s): *Mary Jo Tufte and Matthew Weeg, Ph.D.*

Abstract

Plants produce a series of compounds known as secondary metabolites that are not essential for primary growth or development, but do provide advantages such as chemical protection from herbivores or coloration to attract pollinators. Terpenoids are the largest category of plant-produced secondary metabolites. Terpenoids have been found to cause vasodilation in rat aortae and mesenteric arteries. However, we have previous evidence that shows vasoconstriction occurring when the essential oil from *Umbellularia californica* is applied to small cutaneous blood vessels in leopard frogs (*Rana pipiens*). While this essential oil is composed of several terpenoids, eucalyptol, umbellulone and terpinen-4-ol are present in the greatest concentrations. Therefore, we have decided to focus on these three terpenoids in isolated studies. To begin exploring the possible cause of the observed vasoconstriction we applied eucalyptol directly to the cutaneous microvasculature in resected portions of frog skin. Eucalyptol caused a sustained reversible vasoconstriction of these blood vessels in a concentration dependent manner. The vasoconstriction of *U. californica* essential oil is therefore partially attributed to the presence of eucalyptol. In the future we hope to test remaining terpenoids found in *U. californica* essential oil and determine any possible synergistic effects on frog blood vessels.

Title:**Differential Equations *versus* Fractional Differential Equations.****Author's Name(s):***Bhuvanewari Sambandham, Ph.D.***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

In the past three decades, dynamic systems with fractional derivatives have gained importance due to their advantage in applications. The advantage of fractional derivative versus integer derivative and their behavior will be discussed in this presentation.

Title:

Phosphatidylserine-containing Supported Lipid Bilayer as a Separation Medium and Novel Chromatography Column for Copper Binding Compounds

Author's Name(s):

Christopher Reynolds, Dylan Keiser

Department: *Physical Science, Southern Utah University*

Mentor(s): *Christopher Monson, Ph.D.*

Abstract

Many different biological compounds bind copper to varying degrees. These compounds are important in copper trafficking, enzymatic reactions, and cell signaling. We are developing a device that will bind and purify copper binding compounds. To accomplish this, we have fabricated a microfluidic device made from glass and PDMS. The device consists of two annealed glass coverslips and a PDMS spacer. The glass supports a lipid bilayer that contains phosphatidylserine, a phospholipid that binds to copper extremely strongly under basic conditions, and under acidic conditions is protonated and releases the copper ions. The supported lipid bilayer is initially saturated with copper ions in a basic solution, then solution containing copper binding compounds and non-copper binding impurities is introduced. The copper binding compounds bind to the copper ions bound to the bilayer, while the non-copper binding compounds are rinsed away. Acidic solution is then introduced into the device and the bilayer releases the copper and copper binding compounds. This technique can also potentially be applied to chromatographic separations, in which compounds with different copper binding constants are eluted at different times based on their binding constant.

Title:**Massively Parallel Simulations of Black Hole Formation and Supernovae****Author's Name(s):***Brandon Wiggins Ph.D.***Department:***Physical Science, Southern Utah University***Mentor(s):****Abstract**

Exploding stars (supernovae) and accreting black holes are the brightest events in the universe. By making detailed predictions about the magnitude and character of their brightness, we can probe the high-energy/high-density processes giving rise to their impressive luminosities. These studies require use massively parallel calculations which model compressible fluid dynamics, radiative transfer, self-gravity and other relevant physics. In this talk, I present some results of such calculations of massive black hole formation in the early universe, compact object mergers and supernovae carried out with collaborators on supercomputers at Los Alamos National Laboratory (LANL). I will highlight some research opportunities for students and colleagues with these resources and present future projects being undertaken by myself and collaborators at LANL.

Title:**Stripping Supported Lipid Bilayers****Author's Name(s):**

Mike OrNSTEAD, Stephen Smith, Joshua Reid

Department: *Physical Science, Southern Utah University*

Mentor(s): *Christopher Monson, Ph.D.*

Abstract

Lipid bilayers are necessary components of living organisms. In addition to keeping the contents of a cell separate from the environment, they play a major role in intercellular signaling, drug recognition, nutrient absorption, and metabolic pathways. A problem facing scientists researching biological lipid vesicles is that membrane proteins are sensitive to changes in conditions and can lose their functionality when purified. One proposed way around this problem is to separate membrane proteins in a supported lipid bilayer, an environment that is very similar to a cell membrane, before carrying out analyses. Our work focuses on the retrieval of separated membrane proteins by stripping them from a supported lipid bilayer and repackaging them as vesicles. This stripping and repackaging is achieved by a high buffer flow above a supported lipid bilayer, which dimples the bilayer and then rolls it into vesicles. We will present the results of our research as well as some future directions for study.

Title:

Update on Utah Rocks! A Layman's Guide to Some of the State's Spectacular Geology

Author's Name(s):

Robert L. Eves, Ph.D. and Larry E. Davis, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s):**Abstract**

My co-author and I continue to work on the Utah installment of Mountain Press' state by state Geology Rocks! series. During the summer of 2015, we visited sites in the northwest, northeast, southwest, and southeast portions of the state. During the summer of 2016, we visited numerous localities in western and southwestern Utah. This presentation will highlight four of the sites investigated this year, chosen for their general interest: spectacular Grosvenor Arch in Garfield County; a hidden geological gem at Mt. Carmel Junction, Kane County; the Wheeler Amphitheater, a world class fossil locality west of Delta, Millard County; and, an easily accessed slot canyon near Bryce Canyon, Garfield County.

Title:

Aspen (*Populus tremuloides*) restoration utilizing nursery-propagated seedlings

Author's Name(s):

Randall Violett, Ph.D.

Department: *Agriculture and Nutrition Sciences, Southern Utah University*

Mentor(s):**Abstract**

Quaking aspen (*Populus tremuloides*) is a foundation species in the western US, where it supports high levels of biodiversity, provides important wildlife and domestic forage, and is prized for its aesthetic qualities. Recently, aspen has experienced widespread declines linked to a variety of factors including drought, pathogens, succession, and herbivory. With the range of aspen predicted to contract in the western US over the coming century, active management approaches such as assisted migration may be required. Traditional silvicultural practices to regenerate aspen focus on inducing asexual suckering through coppicing or burning, but these methods reduce genetic diversity over time and are limited to existing stands. Planting of nursery-grown aspen seedlings could address these limitations and has proven effective in mined land reclamation in Alberta, Canada, but protocols have yet to be developed for the western US. To assess the viability of a seedling-based approach to aspen restoration, seed was collected from stands in Alberta, Utah, and New Mexico and nursery-propagated following protocols developed in Alberta. In the fall of 2015, over 7,000 seedlings were planted in southwestern Utah in 15 wildlife exclosures.

Title:

Adaptive Trajectories of an Environmental Microbe to become Host-Associated in a Zebrafish

Author's Name(s):

Josh Matt

Department: *Biology, Southern Utah University and University of Oregon's Institute of Ecology and Evolution*

Mentor(s):

Jarrett Lebov and Brendan Bohannon, Ph.D.

Abstract

All animals throughout the history of earth have lived in the presence of microbes. Consequently, many microbes have evolved to inhabit animal host environments. However, little is known about how these microbes develop such host-associations. In order to understand this, an experimental evolution method was previously taken to produce six replicate, but independent, lines of *Shewanella oneidensis* that were passaged through the digestive tract of zebrafish. In order to expand upon the seen fitness increase the lines had, my mentor and I began to investigate what trajectories *S. oneidensis* had taken in its evolutionary progress towards host-association and also looking into how variable those trajectories are. In this study, in order to identify the fitness variability, several isolates from evolved *S. oneidensis* lines were competed against an ancestral population by introducing them together to the digestive tract of a zebrafish and allowing for colonization to occur over 72-hours. The fish were then dissected and the microbes plated onto agar where colonies could then be counted. Growth dynamics of *S. oneidensis* were also tracked, growth rate and stationary phase dynamics, by comparing the lines to the ancestor's growth dynamics. By exploring the growth dynamic factors, we found little to no influence upon the microbe and its increase in fitness compared to the ancestor. However, the competition assays revealed that fitness variability may stem from physiological differences between fish rather than from genetic diversity within evolving lines. Those assays also revealed interesting fitness increases within the flasks the fish were kept in.

Title:**Pyridyl- and Phenyl- Substituted Benzenes- A Modular Synthesis****Author's Name(s):**

Andy Larsen, Daniel Taylor, and Adam Penrose

Department: *Physical Science, Southern Utah University*

Mentor(s): *Mackay Steffensen, Ph.D.*

Abstract

Molecule based magnets (MBMs) are compounds that display magnetic properties, but are not rare earth or transition metal based magnets. They typically utilize communication between layers of ligands and metals to exhibit magnetism, are cheaper and easier to make than other types of magnets, and could be a better option for technological application, i.e. NMRs, MRIs, and cell phones. The ligands used in MBMs must allow for electronic communication between coordinated layers of metals, and so a highly conjugated bidentate ligand is preferred.

The purpose of this project is to design and conduct a modular synthetic route for the production of these bidentate ligands. Specifically, we aim to construct every possible combination of pyridyl/phenyl-substituted benzenes. The planned synthetic route promises to provide a library of structurally related compounds that ultimately could serve as a toolbox for physical chemists investigating electron-coordinating materials.

Title:**Copper Nanoparticle Synthesis from Bulk Copper Metal****Author's Name(s):***Emily Pehrson, Ashlie Pender***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher Monson, Ph.D.***Abstract**

Copper nanoparticles have applications in many fields including antibiotics and engineering nanofluids. The difficulty with producing copper nanoparticles, compared to synthesizing gold or silver nanoparticles, is that copper nanoparticles oxidize when exposed to oxygen. Oxidation causes nanoparticles to dissolve. We have discovered that high concentrations of hydrochloric acid dissolve copper metal when sonicated. This is a result not expected thermodynamically. Likewise, at low hydrochloric acid concentrations copper nanoparticles form when the solution is sonicated. Neither of these results are expected and neither have been used to explore methods for copper nanoparticle synthesis. Using these findings, we developed a new method to synthesize copper nanoparticles from bulk copper metal. We are testing how controlling the level of oxygen effects the nanoparticles produced. We are working to find optimal oxygen concentration as well as hydrochloric acid concentration to consistently synthesize nanoparticles. We will report on our results up to this point.

Title:**SUU's Semester in the Parks Initiative****Author's Name(s):***Johnny MacLean, Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):****Abstract**

Southern Utah University is partnering with Bryce Canyon National Park and Ruby's Inn Resort to celebrate the National Park Service's Centennial during the fall 2016 semester. The partnership has resulted in the SUU Semester in the Parks initiative. A cohort of undergraduate students from a variety of majors live and work at Ruby's Inn Resort throughout the fall semester while they are enrolled in six courses that include 16 credits. Faculty members teaching the six courses commute 1.5 hours to Bryce Canyon each week to teach the courses in the field and in the High Plateaus Institute, which is the original visitor center that has been converted to an educational classroom approximately 100 meters from the rim of Bryce Canyon. Additionally, students take educational field trips to several other southwestern national parks and monuments. The hypothesis is that teaching these courses in the national park environment will enhance student learning and faculty development. To assess the efficacy of the Semester in the Parks initiative, two strategies are employed. The first will assess student progress toward mastery of SUU's Outdoor Engagement Center learning objectives. A pre- and post-experience assessment tool will be used. The second will assess faculty development of specific teaching strategies. A post-experience survey will ask participating faculty what high-impact teaching strategies they used during the Semester in the Parks initiative, and which of those strategies they will then implement in their typical classroom teaching.

Title:**Immunity in the Community****Author's Name(s):***Dakota Denver, Amanda Eggleston, Emma Jones, Anthony Sattiewhite, Jessica Stone***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

The research focuses on the Immune Health of individuals who are attending a tertiary institution. The goal is to understand what variables effect the health of students. The survey will ask questions about all aspects of life. Questions like how many class credits do you have; how often do you exercise a week. These types of questions will allow the research to view a broader spectrum of activities that induce stress. There is a large focus on exercise. Former studies show exercise in moderate amounts helps strengthen the immune system of an individual and the study observes how exercise could affect overall health.

Title:

Dietary Analysis of Invasive *Apalone spinifera* in the Muddy River and Virgin River, Utah: An Ecological Impact Investigation.

Author's Name(s):

Josh Sigg, William H. Heyborne, Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s): *William H. Heyborne, Ph.D.*

Abstract

Apalone spinifera (Spiny Softshell Turtle) is a species native to the Midwest and Southeast United States. It is hypothesized that these turtles were introduced into the Gila-Colorado River System around 1900 and from there traveled north and west into tributaries of the Colorado River into Nevada and southwestern Utah (Collins et al., 2010). Initial observations suggest that the Muddy and Virgin Rivers support thousands of individual animals, yet no study has been conducted to investigate their impacts on the system – including their diet. We determined to explore the diet of *Apalone spinifera*, collected from these rivers, in order to find out how this species impacts the native wildlife. We hypothesize these turtles are feeding primarily on fish, notably threatened and endangered species, and pose a threat to the sustainability of many of these native endemic species. Stomach content analyses are currently being conducted, on sacrificed turtles, in order to identify which animal species are being utilized as prey. Here we report on those initial findings as well as future plans for this research.

Title:**Swipe Right or Swipe Wrong: The Truth About Tinder****Author's Name(s):***Brenna Garrett, Macy Call, Roger Young, Allora Heaton, Collin Moore***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

We chose to do Tinder because online dating is currently a trending topic, and thought that it would be interesting to see how many SUU students use Tinder. Discussing that Tinder was known for its bad reputation we thought we would check it out for ourselves, and see what caused Tinder to have such a terrible reputation. We wanted to know what people's concerns were with the dating application. As a team we asked questions that showed the levels of usage for Tinder and what the amount of usage depended on. We surveyed randomly around campus using Google Survey. We found many people base their decisions regarding Tinder on their level of security. Those who feel brave enough to download it often only used it to "window shop", some even found themselves in questionable situations. Many of those who had installed Tinder only kept it for a short time before uninstalling it.

Title:**Lithological and Structural Analyses of Clastic Dikes within the Indian Peak-Caliente Caldera Complex****Author's Name(s):***Sarah Zdanowski***Department:** *Geology, Southern Utah University***Mentor(s):** *John MacLean, Ph.D.***Abstract**

In Enterprise, Utah, there are clastic dikes cross cutting ignimbrites and volcanoclastics from the 36-18 Ma Indian Peak-Caliente Caldera Complex that have not been documented or studied. The purpose of this research is to answer the following three questions; what are the compositions of the clastic dikes, what was the order of events that led to the emplacement of the clastic dikes, and how do their orientations relate to the regional tectonic setting? To do this, I mapped the locations and orientations of the prominent dikes, described their lithologies in hand sample, created thin sections to analyze at the microscopic scale, and completed a paleostress analysis using stereonet.

The clastic dikes strike in two different orientations which crosscut each other. The first generation is oriented about N54E 8NW, and the second generation is oriented about N52W 87NE. Generation one contains pumice particles of various sizes within a pink, ash-sized matrix. These dikes also have a thin mud coating along the outer edges. Generation two seems to be mostly mud. Many of the larger dikes are layered from a very fine grained to a fine grained mud. A few of these dikes also have volcanoclastic material within them. Although this is a work in progress, I expect to have a finished project by the end of the year. Future research plans are creating a thin section for generation one, researching styles of emplacement, and finding the local extent of this feature.

Title:**Stressed Out****Author's Name(s):**

Brittany Palmer, Austin Orton, Peter Seegrist, Bobi Dotson

Department: *Mathematics, Southern Utah University*

Mentor(s): *Cecilia Weingartner*

Abstract

We hypothesized that factors such as sleep, exercise, and caffeine consumption would have an effect of stress levels of the college students. Sleep deprivation, lack of exercise, and increased levels of caffeine consumption can increase the stress of students. We began with the survey that we constructed on google forms online and included multiple questions of each factor. We sent the survey randomly to contacts and people that are students here at SUU. We also posted on Facebook and sent it via email to people in the area attending SUU and recorded their responses. After we questioned the participants for each factor we found that most students at SUU have good habits, 53% of students receive sufficient sleep, 40% seldom drink caffeine, and 60% of students get more than an hour of physical exercise. You could also conduct future experiments to determine other factors that increase stress that we did not test for such as relationships, occupations, and family. Although the data didn't support our hypothesis, by testing a larger population we still predict you would find lack of sleep, exercise, and increased caffeine would increase stress levels.

Title:**All Aboard the Thunder Train****Author's Name(s):***Audrie Lindsay, Brayden Ross, Kristin Lynn, Kaitlyn Moore, and Madelyn Pendleton***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

As a group, we were all curious as to why people chose to attend college at SUU. We know that it is a great school, but people have come from all over the world to attend a small college in southern Utah, and we want to know why. We have created a survey to help answer this question. We want to know if scholarships, friends, family, majors, or surrounding national parks contributed to their decision about SUU.

Title:**Let's get Outdoorsy****Author's Name(s):***Mark Solomon, Marci Peterson, Kaylee Peatross, Ali Alnasser***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Success can be measured in countless ways: money, power, happiness, career choice, etc. So what really makes someone successful? We defined it for SUU students as participating in various activities such as clubs or sports, maintaining a high GPA, making and keeping positive relationships with others, having self-confidence and just being happy in general. As a group, we wanted to find out the correlation between a student's success and what types of recreational activities they are participating in here in Cedar City.

For our research, we decided to conduct a survey with questions ranging from how many times they exercise a week to how often they are meeting and making new friends on campus. We wanted to see how each part of a successful student's life was affected by any recreational activities they participated in. To do so, we split the questions up into different categories: social, physical, emotional, financial and educational success. This way, it is much easier to see the relationships between each category.

Title:**Biology of Arid Landscape Wetlands****Author's Name(s):**

Nayla Rhein, Bonnie A. Bain, Ph.D. and Fred Govedich, Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s): *Bonnie A. Bain, Ph.D. and Fred Govedich, Ph.D.*

Abstract

Many wetlands in the arid southwest are temporary/ephemeral in nature. Climate change and increasing human populations have potential to impact these systems before their importance is fully appreciated. Utah is located in an arid desert environment, with many small isolated ephemeral or seasonal wetlands. These systems provide viable habitat for bacteria, algae, crustaceans, and insects and act as important water sources for many vertebrates, including reptiles, mammals, and birds. Climate change has the potential to greatly influence both the quantity and form of precipitation with more intense rainfall rather than snow, changing runoff and evapotranspiration rates. We have begun a multi-year study of a series of temporary rock pools of various sizes in southeastern Utah. These pools fill with rain or snow and then slowly evaporate until the next storm when they fill up. Preliminary work consists of assessing both biodiversity and physical and chemical aspects of these pools. Future work will include monitoring selected pools over an extended period of time to examine the effects of fluctuating water level, temperature, and other variables on the pond inhabitants over time.

Title:**How buzzed are college students?****Author's Name(s):***Madison Keith, Sabrinah Cava, Hailey Sorensen, Caitlin Bess***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

As a group, we were curious to see if there was any relation between students at Southern Utah University and coffee. It was interesting to see that there was a small amount of students at local coffee shops compared to other students in different states and colleges. To find out how coffee relates to college students and their studies, we surveyed randomly selected people. We hypothesized that the majority of SUU students don't drink coffee due to religious purposes, but instead use alternative methods to stay awake like energy drinks and soda.

Title:**Nanoparticle Synthesis with Microfluidic Devices****Author's Name(s):**

Kyler Radmall, Rachel Radmall

Department: *Physical science, Southern Utah University*

Mentor(s): *Christopher Monson, Ph.D.*

Abstract

Our research focuses on the synthesis of silver nanoparticles using microfluidic devices. These devices are of particular interest to us because of the controlled environment that they provide for reactions to take place. As the name suggests, the “micro” scale of this device gives us a high surface area to volume ratio while the “fluidic” aspect allows a controlled flow rate and pattern. This provides reproducible products with accuracy and precision. Our microfluidic device is created by using Polydimethylsiloxane (PDMS), a polymer that is similar to glass. Using a magnesium wire we can shape our microfluidic device to fit the needs of our experiment and then suspend it in PDMS. The magnesium wire can be dissolved once the PDMS solidifies, forming a hollow chamber in which we can perform our reaction and synthesize our silver nanoparticles. Silver nanoparticles have a wide range of applications but the focus of our research will be to learn more about what causes inconsistency in the size of the particles. Since one of the major challenges of nanoparticle synthesis is creating a product that is uniform in size, learning how to control the synthesis process to create highly uniform nanoparticles would be beneficial. To accomplish this, we plan to gather more information about the nanoparticles using Raman spectroscopy. We will also use a UV-Vis spectrometer and spectrofluorimeter to analyze the stages of nanoparticles synthesis.

Title:

Development of a Low-cost PDMS Modular Microfluidic Device for Sample-in, Answer-out STR Analysis of Genomic DNA

Author's Name(s):

Sharla Winn

Department: *Physical Science, Southern Utah University*

Mentor(s): *Christopher Monson, Ph.D. and Jaqualine Grant Ph.D.*

Abstract

Microfluidic devices, or micro total analysis systems (μ TAS), achieve the same results as conventional assays in a fraction of the time and at considerably reduced cost. We are developing a low-cost, simple to operate and portable μ TAS for short tandem repeat profiling that would be a step toward timely and efficient processing of forensic evidence. Our device is made from PDMS, an inexpensive silicone elastomer, using a sacrificial magnesium wire to form the reaction chambers and flow channels, thus eliminating the need for expensive materials and fabrication equipment. Our design takes advantage of PDMS chemistry and the adsorption of DNA to its surface components. We will control roughness and surface chemistry of the reaction chamber by scratching the magnesium wire before fabrication and altering the polymer base to curing agent ratio. For initial experiments, plain, scratched (cross-hatched) and sanded magnesium wires were used to form reaction chambers in PDMS. Protein adsorption to chambers with varying surface roughness is currently being investigated by measuring retained fluorescence after incubation of Texas red-labeled bovine serum albumin. Future work will involve Pico green-labeled dog genomic DNA to monitor and optimize DNA adsorption, and PCR amplification using dog-specific primers and reagents on a PCR thermal cycling block. On-chip thermal cycling, sample addition, and cell lysis will be developed at a later stage of the project.

Title:**College jobs and recreation****Author's Name(s):***Brooklyn Whitney, Kristian Evenson, Justin Lewis, Tayler Park***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

The purpose of this project was to investigate the topic of jobs and the affect they have on a person currently enrolled in a college or university. Our goal for this project was to determine the amount of time any given person has for recreational activities while attending university while not working, working part time or working a full time job. We hypothesized that on average a person who works during the semester will have less opportunity for recreational activates due to a busier schedule. We were also intrigued to know how people felt recreation affected their stress levels. We formulated a survey to answer these questions and to find out more detailed information that could lead us to further conclusions. The result was a survey aimed at finding out all about how jobs and recreation affect a student's stress level.

Title:**Freshwater Leeches of North America****Author's Name(s):***Fredric R. Govedich, Ph.D.***Department:** *Biology, Southern Utah University***Mentor(s):****Abstract**

Leeches (Hirudinida) are an important component of most freshwater lakes, ponds, and quieter flowing sections of streams and rivers with other species occurring in marine and terrestrial habitats. There are approximately one hundred described species in North America. The majority of North American leeches are predators that feed on a variety of invertebrate prey including chironomids, oligochaetes, amphipods, and molluscs. Other leech species are temporary sanguivorous (blood-feeding) ectoparasites of vertebrates including fish, turtles, amphibians, crocodilians, water birds, and occasionally humans. Leeches can be recognized by having segmented bodies (annelids) with anterior and posterior suckers and feed by a variety of methods, including: using a proboscis, engulfing and two or three jaws.

Title:

Use of green infrastructure to increase invertebrate biodiversity in the built environment

Author's Name(s):

Jaqualine Grant, Ph.D., Mathew Weeg, Ph.D., Hailey Wallace, Andrew Carlson, Youcan Feng, Steven Burian

Department: *Biology, Engineering and Technology, Southern Utah University*

Mentor(s): *Jacqueline Grant, Ph.D.*

Abstract

Land use change driven by climate change, urbanization, and population growth challenges the conservation of biodiversity. One approach to reconcile biodiversity conservation with land use change is the integration of green infrastructure, specifically green roofs, into the built environment. Because green roofs integrate plants with buildings, they have a great potential for enhancing urban invertebrate biodiversity. We examined invertebrate biodiversity because of the important roles (pollination, food web interactions) held by invertebrates in terrestrial ecosystems. We tested the ability of green roofs to contribute to urban invertebrate diversity by comparing diversity of invertebrates at three sites: asphalt roof, green roof, and ground level sites. We collected over 5,539 invertebrates during two three-month periods over a two-year interval (2014-2015). Ground level sites generally were more diverse than green roof sites, which in turn were more diverse than asphalt roof sites. However, one taxon, the arachnids, was more diverse at green roof sites than ground level sites, which were more arachnid-diverse than asphalt roof sites. We conclude that green infrastructure can contribute to urban invertebrate biodiversity, and that green roofs may be particularly important for the conservation of arachnid biodiversity

Title:**Diffusion-limited Titration Using Microfluidics****Author's Name(s):***Jaxon Barney***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher Monson, Ph.D.***Abstract**

Using microfluidic technology it will be possible to conduct and simultaneously analyze an acid base titration that relies solely on the diffusional properties of ions. With a specialized microfluidic device we have created an environment in which an acid and a base injected with a pH sensitive fluorescent dye can be titrated together and observed as the conditions become acidic enough to trigger the pH indicator. This will be tested will various strong and weak acids and with bigger such as proteins with much slower diffusion rates. After the titration has occurred in our microfluidic channel we will inject known concentrations of known acids into the main channel as a built in calibration curve that will require no additional calculations these acids will flow side by side with our new solution and will not have enough time to diffuse. At this point the fluids together in the device will be photographed with a fluorescent microscope. It is our hope to be able to titrate an unknown acid into a fluorescent dye-infused NaOH solution and using our device and calibrations curves be able to determine the concentration of the unknown acid. We have hypothesized that this will allow us achieve our main goal and practical application of taking complex water samples such as pond water, that may contain acidic molecules and be able to analyze and approximately quantify the concentrations of strong and weak acids, and even larger protein particles.

Title:**To Use or Not to Use a Virtual Lab****Author's Name(s):**

Carrie Bucklin, Kristy Daniel

Department: *Biology, Southern Utah University; Biology, Texas State University*

Mentor(s): *Carrie Bucklin*

Abstract

Evolutionary relatedness, like many other phenomena in science, is a difficult topic to understand, let alone teach. This topic's difficulty is compounded by the complexity of phylogenetics and phylogenetic trees (evolutionary trees). A person's ability to read and use phylogenetic trees is influenced by their ability to use representations in general and their understanding of the scientific language used when describing these trees. There are a variety of projects or classroom activities available to help students learn to read and build phylogenetic trees, including technology-based representations. I conducted a mixed-methods study to investigate the changes in students' tree-reading and levels of tree-reading representational competence after varied forms of instruction: A) No Instruction, B) Lecture only, C) Virtual Lab only, and D) Lecture & Virtual Lab. Participants included students enrolled a two-course introductory biology series: Principles of Biological Science I and II (n=128). I found that repeated, explicit instruction, that incorporated multiple types of representations, resulted in a larger increase in mean scores on a tree-thinking assessment and a larger increase in level of tree-reading representational competence. My findings suggest that technology-based representations alone are not as beneficial to student learning as when they are used in conjunction with lectures.

Title:

Expression of immunogens and activation of the immune system in *C. elegans*

Author's Name(s):

Chase Leavitt

Department: *Biology, Southern Utah University*

Mentor(s): *Jonathan Karpel, Ph.D.*

Abstract

Caenorhabditis elegans is a broadly studied nematode species, utilized heavily by biologists. Their small size, the fact that they are eukaryotic like higher organisms and their similar life cycle to higher organisms makes them an ideal research organism. While much research has been done in regards to *C. elegans* growth and development, little has been done in regards to their immune systems, specifically in how they fight off viral infection. *C. elegans* are known to fight infection primarily through genetic means, and studies have indicated a crossover between the genes that are used to fight bacteria and the genes used to fend off viral infection; however, the crossover was not studied further after its discovery. In this research we attempt to investigate this overlap of mechanisms by feeding a potential immunogen to nematodes. This research will include details on developing the methods to activate the nematode immune system and our plan to monitor the activity of the system.

Title:**Can I Afford a Relationship and Still Get an “A”?****Author’s Name(s):***Trevor Perida, Peter Kim, Paige Dolan, Caleb Smith***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Have you ever wondered whether your relationship status is making an impact on your study habits? This study is to determine the impact or effect of an individual’s relationship status on study habits and whether that status affects your study in a negative or positive way. Our sample is taken from randomly selected individuals as well as volunteers who are currently attending a university. Through this study we hope to find out the study habits of students and where each student’s priorities lie pertaining to college study habits vs their relationship status. We also hope to find out the correlation of relationship status on study time compared to the relationship status of the average college student.

Title:**Migration of Lipids in a Supported Lipid Bilayer****Author's Name(s):***Doug Hutchinson***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher Monson, Ph.D.***Abstract**

Membranes and membrane proteins have a profound influence on life. These influences are important to consider in scientific fields such as biology and medicinal chemistry. However, these can be hard to study unless we can successfully isolate each of the membrane components. In our research, we are simulating lipid and membrane protein motion under a technique called electrophoretic/electroosmotic focusing (EEF) by use of a computer program in attempt to improve the technique.

EEF has been shown to separate lipids and proteins, but the behavior of these lipids and proteins is not well understood in all phases of the separation. Our computer simulation will allow us to model the behavior of neutral and charged lipids and proteins in all stages of the separation. Our simulation calculates the movement of charged lipids. We are currently able to simulate the motion of two different species of charged protein and lipids. By optimizing our simulation using experimental data, we hope to reduce lipid migration to a 1-dimensional simulation that will be time and cost effective. This will help to increase understanding of protein/lipid interactions and functions for many important purposes in the science fields.

Title:

Caffeine Derived Carbene Ligands in Nickel Catalyzed Cross-Coupling Reactions

Author's Name(s):

Christopher Christiansen, Nathan S. Werner Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Nathan S. Werner Ph.D.*

Abstract

Organic ligands are known to have a profound effect on a variety of chemical and biological transition metal catalyzed processes. The structure of each ligand has a direct influence on the reactivity and functionality of the coordination complex. The focus of this research is the synthesis of a caffeine derived carbene ligand and the study of its application to nickel catalyzed cross-coupling reactions. The potential impact of this work is more stable, selective, and efficient catalysts for the production of fine chemicals and medicines.

Title:

Preparation of trans-Stilbene Derivatives by Palladium-Catalyzed Cross-Coupling Reaction

Author's Name(s):

Hailee Rau, Nathan S. Werner Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Nathan S. Werner Ph.D.*

Abstract

Stilbene is a hydrocarbon consisting of a carbon-carbon double bond flanked by two phenyl groups. Stilbene exists as two geometrical isomers: trans-stilbene ((E)-stilbene) and cis-stilbene ((Z)-stilbene). A review of the literature provides no general solution to the synthesis of geometrically pure trans-stilbene derivatives. Two synthetic methods for the synthesis of trans-stilbene by palladium-catalyzed cross-coupling were evaluated and their costs compared: synthesis and cross-coupling of trans-2-phenylvinylboronic acid pinacol ester, and the Heck reaction of styrene.

Title**Synthesis of Alkenyl Pinacolboranes by Hydroboration Reaction****Author's Name(s):**

Haley R. Shumway, Nathan S. Werner Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Nathan S. Werner Ph.D.*

Abstract

Organoboranes are extensively used in organic synthesis. Two noteworthy examples of organoborane chemistry include the Hydroboration-Oxidation reaction commonly covered in sophomore organic chemistry courses and the Nobel Prize winning Suzuki Cross-Coupling reaction. Classically, catecholborane is prepared and then used as the boron source in the hydroboration reaction. As such, it has been thoroughly utilized as an intermediate in the synthesis of pinacolboranes and boronic acids. However, the use of catecholborane is not ideal. For example, catechol is oxidatively sensitive and the catecholborane product decomposes upon exposure to air or moisture. Pinacol boranes are a more stable and potentially more useful alternative. But, their stability also negatively affects their reactivity in hydroboration reactions. The goal of this project is to circumvent the use of the intermediate catecholborane to directly prepare the pinacolborane.

Title:**Stereoselectivity of the Palladium-Catalyzed Heck Reaction****Author's Name(s):**

Kyle Clark, Nathan S. Werner, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Nathan S. Werner, Ph.D.*

Abstract

The alkene functional group (C–C double bond) is commonly found in natural products like unsaturated fats and vitamins. The restriction of rotation about the internuclear axis provided by the double bond can cause molecules of the same elemental make up to have different geometrical orientation. Therefore, these molecules have similar physical properties and are difficult to separate by conventional techniques. It is important that synthetic reactions produce one isomer in excess to avoid this difficult separation. The Heck reaction, which was awarded the 2010 Nobel prize in chemistry, is a method of alkene synthesis. It is an efficient way to substitute a vinyl proton with a new carbon group. This research will examine the stereoselectivity (*cis* or *trans*) of the Heck reaction, and reaction variables which contribute to alkene stereoselectivity.

Title:**Synthesis of a Potential Malate Synthase Inhibitor****Author's Name(s):**

Samantha Bengtzen, Bruce R. Howard Ph.D., J. Ty Redd Ph.D., Nathan S. Werner Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Nathan S. Werner Ph.D.*

Abstract

Tuberculosis (TB) has been identified as one of the deadliest infectious diseases worldwide. A potential novel class of therapeutics to treat TB is small molecule inhibitors of Malate Synthase (MS). A candidate molecule with potentially-improved binding affinity has been proposed based on the analysis of the TB Malate Synthase x-ray crystal structure. The goal of this project is the synthesis of this phosphorus containing MS inhibitor. The proposed synthesis contains 5 reactions including an acetal protection reaction, two SN2 alkylation reactions, an acetal deprotection reaction, and a base catalyzed hydrolysis of an ester to form the target MS inhibitor.

Title:**Synthesis of Chalcones Under Microwave Irradiation and with an Environmentally Friendly Catalyst****Author's Name(s):***Adam F. Eddington, Nathan S. Werner Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Nathan S. Werner Ph.D.***Abstract**

Chalcones are a class of organic compounds characterized by an α,β -unsaturated ketone flanked by a phenyl group on either side. They exhibit a wide range of interesting properties and biological activities that include: anti-AIDS, anti-viral, anti-malarial, anti-tumor, anti-cancer, anti-inflammatory, and anti-oxidant. Traditionally, the syntheses of chalcones has depended upon harsh conditions or various catalysts to bring about an aldol condensation of an aromatic ketone with an aromatic aldehyde. We hypothesize that that we can address the problems associated with the current methods for chalcone synthesis by development of an environmentally friendly and mild technique using microwave irradiation.

Title:**Dendrimer Synthesis****Author's Name(s):**

Aleksei V. Ananin, Mackay B. Steffensen Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Mackay B. Steffensen, Ph.D.*

Abstract

Dendrimers constitute a family of branching polymers. Every consecutive addition of a monomer creates a new generation of dendrimers. Unlike linear polymers, synthesis of dendrimers faces obstacles like steric hindrance as we move towards larger-sized generations. Our goal is to create molecules with unique structures and the largest possible size. This project utilizes cyanuric chloride as the branching unit, hydrazine as the linking unit and piperidine as the surface groups. Such chemical polymers are unique and have never been synthesized before. Work will involve X-Ray crystallography to confirm the three-dimensional structure.

Title

Physical and cultural causes of unrelenting Malarial infections in the Accra metropolis. The power of GIS to identify and discern sources and causes of tropical epidemiology.

Author's Name(s):

Peter T. Combs, David J. Maxwell

Department: *Physical Science, Southern Utah University*

Mentor(s): *David J. Maxwell*

Abstract

An *in situ* initial investigation of the location and causes of Malaria in the Greater Accra Region of Ghana, West Africa was conducted during June 2016. An initial 30m X 30M digital elevation model of the region revealed extremely low relief on the coastal plain of one of Africa's largest and fastest growing metropolises. It was hypothesized that proximity to stagnant water would predict rate and percentage of Malarial infection. But a thorough literature review, interviews, collection of fresh data and mapping of the results revealed a combination of dysfunctional open sewers, drainage channels choked by trees, uncollected plastic garbage, and ethnic land ownership disputes—combined—result in an 18-month population infection rate of 20-50% by administrative districts. It was also learned the *Anopheles* mosquitoes fly 2-3 miles at dusk to feed on their human hosts, peaking at midnight, and return to the trees in the choked drains and lagoons at dawn to breed. This effectively puts the entire region at risk as influenced by a prevailing southwesterly sea breeze. Accordingly, while the initial hypothesis proved true, it did not explain the large disparity between adjacent districts. The ongoing study is now mapping ethnic land ownership to determine the correlation between feuding neighbors and district infection disparities.

Title:**Active Galaxy Feedback on Neighboring Galaxies: A Pilot Study****Author's Name(s):***Taylor Hammack, Kasen Lisonbee, Bryan May, Jordan Memmott, Kallin Raymond, Morgan Taylor, and Cameron Pace, Ph.D***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Cameron Pace, Ph.D.***Abstract**

All normal galaxies host massive black holes in their centers. A small portion (<2%) of these black holes are actively growing and produce energetic jets that may extend for millions of light-years beyond the host galaxy. For their size, galaxies are relatively close together and thus nearby galaxies may be in range of jets from neighboring galaxies. This research project examines the effects of a sample of ~23 energetic jets on nearby galaxies within range of the jets. We limit this study to neighbors whose photometric redshift is within 0.1 of the spectroscopic redshift of the active galaxy, which produces a sample of ~750 neighbor galaxies. The relation of neighboring galaxies to the jets is checked by visual inspection such that two samples are produced: neighbors inside the path of the jet and those outside. We compare the colors and thus the star formation rates of neighbors within the jets to those outside the jets. We also explore the star formation of neighbors within the (projected) path of the jets as a function of distance from the host.

Title:**Sources of Stress and Coping Mechanisms in SUU Students****Author's Name(s):**

Phillip Hilton, Mathew Vaughn

Department: *Biology, Southern Utah University*

Mentor(s): *Helen Boswell, Ph.D.*

Abstract

Worldwide, university students show an alarming incidence of prescription drug abuse along with other damaging behaviors due to high levels of stress. The purpose of this study was to identify the (1) levels and sources of stress that SUU students experience and (2) positive vs. negative behaviors that students use to cope with stress. We distributed an initial survey to pre-health students during the third- and second-to-last weeks prior to final exams. Over 70% of students reported moderate to high levels of stress, primarily due to required coursework, during this time of the semester. Over half of students additionally reported at some time exhibiting self-harm behaviors; most notable was the high (47%) of respondents reporting that they have seriously contemplated suicide. We found a relatively low (15%) incidence of self-reported prescription drug abuse, where students received drugs from a peer or family member in an attempt to cope with school-related stress. Over half of student respondents did not demonstrate an understanding of either the danger of misusing or the highly addictive nature of these prescription drugs. We are currently extending this survey to a larger sample of students at SUU in order to cross-analyze stress levels and coping mechanisms among students in different colleges. Long-term goals include providing peers with information on how to positively cope with academic and other sources of stress, including education about resources available on- and off-campus.

Title:

Engineering a laboratory host for production of terpenoids from local soils

Author's Name(s):

Thomas Ellis, Elizabeth Pierce, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Elizabeth Pierce, Ph.D.*

Abstract

Terpenoids are a large and diverse class of biologically produced chemical compounds found in nearly all organisms. In nature these molecules have many functions including pigments, defense, pheromones and antimicrobial agents. The diversity of terpenoid compounds has been exploited by many industries such as, but not limited to, the cosmetic, food, agricultural and medical industries. For example, the terpenoid molecule artemisinin has been developed as an antimalarial drug. Recently, desert soil bacteria have received wide interest as a source of new terpenoids. This project aims to optimize a soil bacterium for use as a host for laboratory biosynthesis of terpenoids from local soils. Our approach is to increase terpenoid production by making a plasmid to overexpress 1-deoxyxylulose-5-phosphate synthase (DXS) in *Streptomyces griseus*. DXS has been found to be the rate-limiting step in the biosynthetic pathway that produces the terpenoid precursor molecules isopentenyl diphosphate (IPP) and its isomer dimethylallyl diphosphate (DMAPP), so we hypothesize that increasing concentrations of DXS in *S. griseus* will increase terpenoid production.

Title:

Evaluating the usability of readily available GIS vector feature classes to assist in natural hazard mitigation at the county level.

Author's Name(s):

Nathan Osborne, Nathan Wilberg

Department: *Physical Science, Southern Utah University*

Mentor(s): *David Maxwell*

Abstract

Can a viable hazard mitigation predictive model be created with readily available vector feature classes at the county level? Natural hazards such as landslides or floods can occur almost at any time and sometimes without much warning. Can Geographic information system (GIS) data be used to create models and reports that can help identify specific problem areas with high potential for loss? The natural hazards included in this project were Problem Soils, Landslides, Faults, Floods and Wildfire. Natural Hazard GIS layers from readily available sources were used in this project as well as tax databases from five Southern Utah counties to include Iron, Washington, Beaver, Garfield and Kane. While this process seems simple enough there are many issues with the analysis process that must be overcome, so that the level of accuracy, is within acceptable parameters.

Title:**Comparing Exam Options for Assessment of Student Learning****Author's Name(s):***Chad L. Gasser, Ph.D.***Department:** *Agriculture and Nutrition Sciences, Southern Utah University***Mentor(s):****Abstract**

Various aspects of student learning can be assessed through different exam formats and conditions. The objective of this study was to compare student performance on initial exams to performance on follow-up exams with different conditions. Two animal science courses taught by the same instructor in 2015 were used for this study, Animal Reproduction (AR) and Horse Science and Industry (HS). The AR course included five short exams, and the HS course included three 50-minute exams. All initial exams were completed individually without notes. Follow-up exams contained the exact same questions as corresponding initial exams. One AR and all three HS follow-up exams were completed individually without notes during the class session following the initial exam, allowing for additional review. The remaining four AR follow-up exams were each given with different conditions during the same class sessions as the initial exams. These conditions included review of notes between exams, open classmate discussion without notes, open notes without classmate discussion, and open notes with open classmate discussion. Overall average scores improved from initial to follow-up exams, increasing from 66.2% to 85.5% in the AR course and from 68.1% to 70.4% in the HS course. Comparing individual scores on follow-up exams to initial exams across both courses, 70.5% were greater, 16.8% were equal, and 12.6% were lower. Most students demonstrated improved performance on follow-up exams when provided with additional review time or resources. The results also allowed the instructor to gain a better assessment of different aspects of student learning.

Title:

The geological effects of extrusions in the Rocky Range on molybdenum soil concentrations.

Author's Name(s):

Darian Elliot, Rhiannon Garrard, Kim Weaver, Ph.D., Jason Kaiser, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Kim Weaver Ph.D., Jason Kaiser Ph.D.*

Abstract

This work is a seeks to determine the effect of volcanic extrusions on the surrounding soil of Rocky Range near the town of Milford Utah. An extrusion occurs when magma pushes its way into the crust and cools. When this geological formation cools, many parts of the magma crystalize into minerals. These minerals are often sought after in mining operations, so mines are often found near such extrusions. Molybdenum is one of the minerals found in these extrusions. Molybdenum is a mineral that occurs naturally and is necessary for life in that molybdenum forms enzymes in many bacteria and eukaryotic systems, aiding in nitrogen fixation in the organism. Its abundance is thought to affect the nitrogen cycle. Previous Molybdenum studies however, have been conducted largely in moist, humid areas. Very little research has been done in drier, more aired climates. Initial initial work consisted in collecting samples along 3 transect lines and analyzing each sample for Molybdenum. This work showed correlation between molybdenum concentration in the soil and contour maps. Because the previous study was preliminary in nature there is an obvious need to sample between the three contact lines. We have expanded upon these interesting in order to validate the initial stud. We have obtained soil samples in a grid like pattern near the Enterprise Mine and determined Molybdenum concentrations in the soil. The results of our study will be presented at this time.

Title:**A Microfluidic Device for Oxygen Quantitation in Anoxic Environments****Author's Name(s):***Aubriel Koehler, Ester Harkness, Maverik Shumway***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher Monson, Ph.D.***Abstract**

Many bodies of water have low oxygen concentrations. These areas of water are referred to as anoxic environments. Determining these low levels of oxygen can play an important role in environmental chemistry and pose a unique challenge in analytical chemistry. Currently, the use of the STOX electrode is the only method that is available to test these areas of water to the needed precision. The STOX electrode uses gold electrodes to measure the oxygen that diffuses across two membranes with a resting period to get a baseline oxygen concentration. This baseline can then be compared to the signal and used to determine the oxygen concentration. The STOX electrode is both expensive and very fragile with a short lifetime. Our research is focused on building a microfluidic that will address the issue of cost and durability of the device as well as removing the need for diffusion by active solution mixing using magnetohydrodynamic (MHD) transport, which adds continuous flow into the microfluidic channel for better circulation. Overall, our device should produce a greater response and sensitivity providing a lower limit of detection for oxygen in aqueous solutions.

Title:

Geospatial and Petrographic Analysis of Leucogranite in Beaver Dam Mountains, Southwest Utah

Author's Name(s):

Zachary Smith, Jason Kaiser, Ph.D., David Maxwell, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s): *Jason Kaiser, Ph.D.*

Abstract

The presence of leucogranite outcrops in the Western United States suggest possible locations of suture zones for Precambrian terranes accreted to Laurentia. While large scale maps exist, little has been done to extend the suture zones at a fine scale, between Proterozoic terranes such as the Mojave and Yavapai Provinces. Outcrops of Proterozoic leucogranite in the Beaver Dam Mountains of Southwest Utah and the Virgin Mountains of Northwest Arizona indicate possible locations of these suture zones. Using GIS and GPS equipment the locations of leucogranite outcrops following a North-South trend, up to one kilometer in length have been identified near the Utah/Arizona/Nevada border. After field verification these rocks have been correlated to Precambrian basement rocks such as the Grand Canyon Metamorphic Suite to the southeast.

Petrographic analysis confirms the presence of high amounts of leucocratic minerals such as orthoclase and quartz as well as garnet indicate a high pressure origin and possible partial melting. Garnet located near the contact with the gneiss and schist host is evidence that minerals from the parent rock may have been consumed and incorporated into the leucogranite by peritectic reactions.

Title:

Two new Antarctic *Colossendeis* species (Pycnogonida, Colossendeidae)

Author's Name(s):

Coral E. Gardner, Fredric R. Govedich, Ph.D. and Bonnie A. Bain, Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s): *Fredric R. Govedich, Ph.D. and Bonnie A. Bain, Ph.D.*

Abstract

During the course of a revision of *Colossendeis colossea* Wilson, 1881, two new Antarctic species of *Colossendeis* were discovered. Both of these Antarctic colossendeids are similar in some respects to *C. colossea*, but differ from the holotype for this species in several characters including shape of eye tubercle, shape and arrangement of the basal elements [lateral processes] of the pedipalp and ovigerous leg, pedipalp and walking leg spination, ovigerous leg spines and terminal claw, and relative proportions of the terminal segments of both the pedipalp and walking leg. In addition, the two new species share a new characteristic, ventral lateral process spines on the walking legs, making them quite different from the type specimen for *C. colossea* which has no spines present on the ventral surfaces of the walking leg lateral processes.

Title:**Benzoin Condensation using Caffeine as a Catalyst****Author's Name(s):***Peter Kemp and Nathan S. Werner Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Nathan S. Werner, Ph.D.***Abstract**

The benzoin condensation is a reaction which couples two aldehydes; most commonly, two benzaldehydes to form the product benzoin. Benzoin has applications in both allopathic and traditional medicines and in perfumes and beauty products. Benzoin condensation, because of its high activation energy, requires the use of a catalyst. Cyanide ion is the most used catalyst for this reaction. Instead of using the dangerous cyanide catalyst, we propose to use caffeine derivatives. The structure of caffeine should allow it to catalyze the necessary steps of the benzoin reaction. The potential applications of this research would be to create a safer environment to create benzoin, and possibly invent a more efficient method as well.

Title:**Markov Chains and Shut the Box****Author's Name(s):***Skyler Simmons***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

I propose to do a research project involving the game Shut the Box. This is a simple mathematical game involving a pair of dice and nine markers. Our goal will be to determine the optimal strategy for both the first and the second players in a two-player game. My presentation will give a simple outline of the game as well as a description of the methods we will use as part of the project.