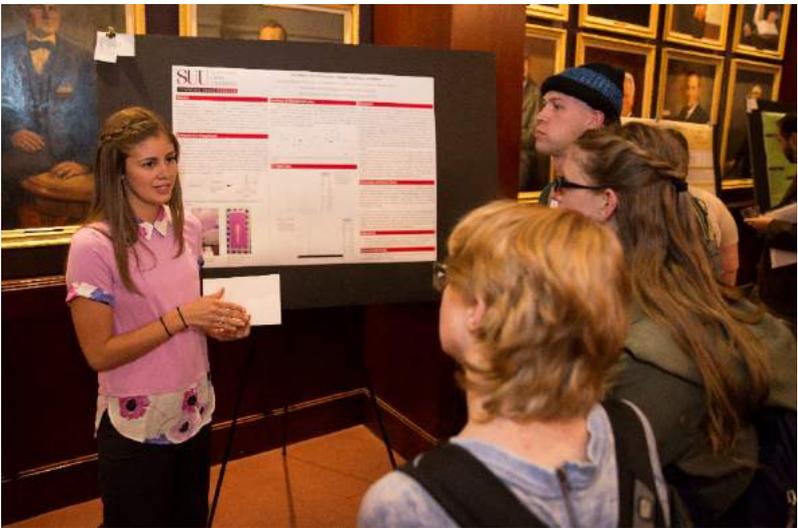


**Walter Maxwell Gibson
College of Science & Engineering
Ninth Annual
Undergraduate Research Symposium**



**Monday, November 13, 2017
Southern Utah University**

5:00 p.m. Keynote Speaker

John F. Hurdle, *Ph.D.*

Professor of Biomedical Informatics at University of Utah

“Nutritional Informatics: measuring household grocery quality for clinical and public health applications”

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

Room WR.....Whiting Room, 2nd Floor

Location of Poster

Abstract #

- Gr Hall 1 042
Acceptability and Knowledge of Hemp Seed as a Dietary Source of ALA
Author's Name(s): *Artis Grady*
- Gr Hall 2 032
Range Management: Public Perception of a Fuel Load
Author's Name(s): *Whittni Ananin, Julian Mesick, Randall D. Violett, Ph.D.*
- Gr Hall 3 073
Incorporating Applied Research with Student Organization Funding
Author's Name(s): *Randall D. Violett, Ph.D.*
- Gr Hall 4 029
Identifying Factors Contributing to Spatial Patterns of Mule Deer-Vehicle Collisions
Author's Name(s): *Darby Adams, Natalie Barlow, Michael Christiansen, Arsene Mugisha, Karl Jarvis, Ph.D.*
- Gr Hall 5..... 052
Brian Head Fires: Affects of Fire on Aquatic Ecosystems
Author's Name(s): *Lauren Nickell, Nayla Rhein, Fredric Govedich, Ph.D., Carrie Jo Bucklin, Ph.D., and Bonnie Bain, Ph.D.*
- Gr Hall 6..... 060
Effect of Salinity on Hatching of *Branchinecta lindahli*, Packard 1883
Author's Name(s): *Nayla Rhein, Fredric Govedich, Ph.D.*

Location of Poster

Abstract #

Gr Hall 7 055

A new gigantic sea spider in the genus *Colossendeis*

Author's Name(s): *Jordan Parker, Fredric Govedich, Ph.D.*
and Bonnie Bain, Ph.D.

Gr Hall 8 075

**Collection and Identification of Macroinvertebrates
in and around Montezuma Well**

Author's Name(s): *Samuel Wells, Fredric Govedich, Ph.D.,*
William Heyborne, Ph.D.

Gr Hall 9 008

**TCR-Medicated Signaling Proteins and their association
with Nuclear GRB2**

Author's Name(s): *Josh Matt, John Houtman, Ph.D.*

Gr Hall 10 072

Wolbachia Infection Rates in Southern Utah Ants

Author's Name(s): *Logan Tuttle, Laurie Mauger, Ph.D.,*
Carrie Jo Bucklin, Ph.D. Samuel Wells

Gr Hall 11..... 062

**Prevalence of Malaria in the New World: Supporting
Benjamin Rush's Hypothesis**

Author's Name(s): *Agueda Rodriguez, Samuel Wells*

Gr Hall 12 046

Synaptotagmin Localization in Zebrafish Embryos

Author's Name(s): *Emily James, Lindsey Roper, Ph.D.*

Gr Hall 13..... 076

The Role of Multiple Simuli in Short-term Memory Retention

Author's Name(s): *Trevor Zollinger, Mary Jo Tufte, Helen Boswell, Ph.D.*

Gr Hall 14 031

Dendrimer Synthesis

Author's Name(s): *Aleksei Ananin, Mackay Steffensen, Ph.D.*

Gr Hall 15 049

Developing a methodology for determining the redox potential of cells

Author's Name(s): *Jacob Lambertsen, Kim Weaver, Ph.D., and Mackay Steffensen, Ph.D.*

Gr Hall 16 037

Accretion Disk Morphology and Tidal Disruption Radius in Massive Black Hole Growth

Author's Name(s): *Kyle Christiansen, Payton Christensen, Brandon Wiggins, Ph.D. and J Smidt*

Gr Hall 17..... 069

The Cosmological Origins of Water

Author's Name(s): *Morgan Taylor, A Gagliano, Brandon Wiggins, Ph.D. and J Smidt*

Gr Hall 18 071

Orthorectification of Thermal Imagery for Live Fires

Author's Name(s): *Michaela Truman, Benjamin Smith, David Maxwell and Jeff Obering*

Gr Hall 19 044

Using GIS to Create Hazard Maps and Assess Evacuation Routes Around "The Gate to Hell"; Masaya Volcano, Nicaragua

Author's Name(s): *Rebecca Hedges, Stevie Mcdermain, Jason Kaiser, Ph.D. and David Maxwell*

Gr Hall 20 077

Assessing Geothermal Energy Potential in Southern Utah Using the Trace Element Chemistry of Granitic Intrusions

Author's Name(s): *Chesley Gale, Jason Kaiser, Ph.D.*

- Gr Hall 21 051
Palladium-Catalyzed Suzuki-Miyaura Cross-Coupling Reactions of (E)-Styrylboronic Acid Pinacol Ester with Aromatic Bromides
Author's Name(s): *Marcus C. Mifflin, Hailee Rau, and Nathan Werner, Ph.D.*
- Gr Hall 22 054
Synthesis of Alcohols from Epoxides Using Visible Light
Author's Name(s): *Christopher Ozeretny, Nathan Werner, Ph.D.*
- Gr Hall 23 065
Synthesis of Alkyl-Substituted trans-Alkenes by Palladium-Catalyzed Cross-Coupling Reaction
Author's Name(s): *Mason Smith and Nathan Werner, Ph.D.*
- Gr Hall 24 056
Developing a cheap and efficient DNA purification method
Author's Name(s): *Bryan Pearson and Elizabeth Pierce, Ph.D.*
- Gr Hall 25 057
Homologous molybdoenzymes from different environments
Author's Name(s): *Alex Peterson and Elizabeth Pierce, Ph.D.*
- Gr Hall 26 061
Exploring the Fundamental Light-Harvesting Properties of Nature's Pigments
Author's Name(s): *Kelsey Rico, Clayton Staheli, Emily Huffman, Jacob Dean, Ph.D.*
- Gr Hall 27 038
Measuring oxygen Levels in Low Oxygen Environments Using a Microfluidic Device
Author's Name(s): *Mariah Clayson, Brian Anderson, Esther Harkness, et al and Christopher Monson, Ph.D.*

Gr Hall 28 047

The Separation of Organic Material Using a Microfluidic Device

Author's Name(s): *Megan Jensen and Christopher Monson, Ph.D.*

Gr Hall 29 053

Stripping Supported Lipid Bilayers

Author's Name(s): *Michael Ornstead and Christopher Monson, Ph.D.*

Gr Hall 30 039

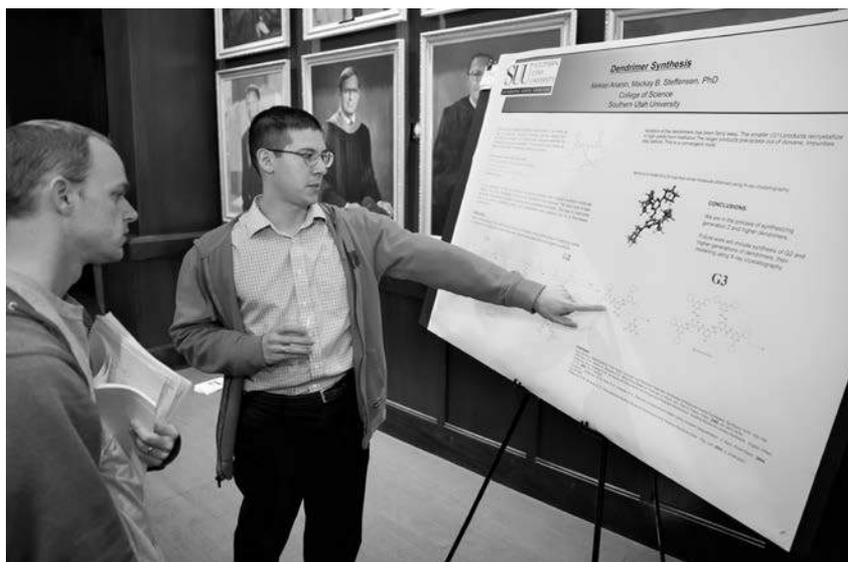
Unexpected Copper Nanoparticle Synthesis from Bulk Copper Metal

Author's Name(s): *Mikaila Cook, Mitchell Johnson and Christopher Monson, Ph.D.*

Gr Hall 31022

Measuring Regrowth and Animal Movement After a Fire Disturbance

Author's Name(s): *Diana Villicana, Kaitlin Veylupek, and Carrie Jo Bucklin, Ph.D.*



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

<i>Location of Poster</i>	<i>Abstract #</i>
CH 1	035
Super Bowl Outcomes	
<i>Author's Name(s): Travis Bettridge, Dallin Langford, Leilani Begaye and Cecilia Weingartner</i>	
CH 2	045
Touchdown! Is Football Worth Your Time?	
<i>Author's Name(s): Madison Howlett, Kylie Willingham, Jeremiah Kolb, et al and Cecilia Weingartner</i>	
CH 3	033
Concussions in College Football	
<i>Author's Name(s): Ashley Anderson, Brookelynn Carlson, Riley Cunningham, et al and Cecilia Weingartner</i>	
CH 4.....	043
How athletes prepare for season?	
<i>Author's Name(s): Frank Harris, Kobe Toa and Cecilia Weingartner</i>	
CH 5	070
The Luxurious life? Featuring Students and Athletes	
<i>Author's Name(s): Robert Torgerson, Josh McMillin, MaKade Maloy and Cecilia Weingartner</i>	
CH 6	036
Hiking: A Joy or A Stuggle	
<i>Author's Name(s): Shiyong Cai, Wesley Terry, Trina Peel, et al and Cecilia Weingartner</i>	
CH 7	066
The Life Behind the Blonde	
<i>Author's Name(s): Kyndra Sorenson, Britany Blakely, Kylee Wharton and Cecilia Weingartner</i>	

CH 8 068

So You think You're a Southpaw?

Author's Name(s): *David Tapia, Gavin Stapley, Shantel Galindo and Cecilia Weingartner*

CH 9 074

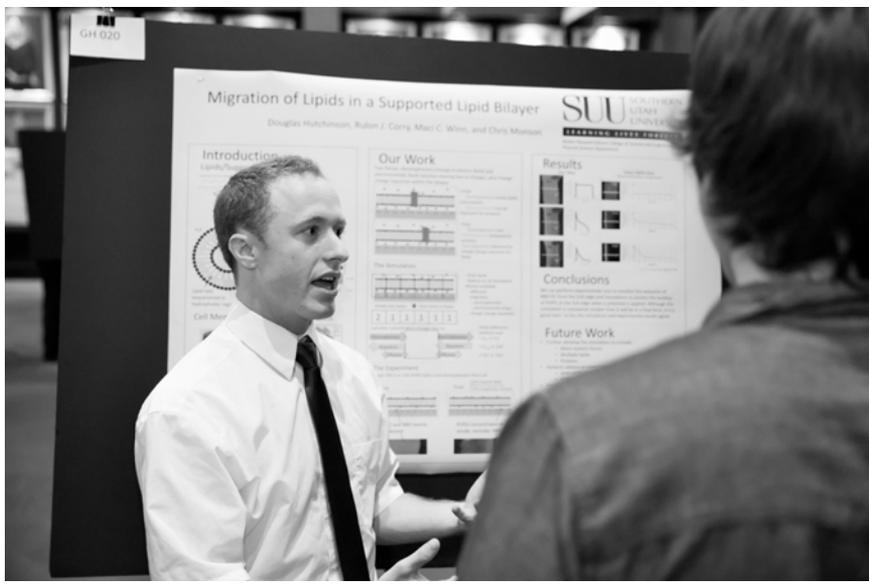
Shut up and Drive

Author's Name(s): *Camron Webster, Colten Warren, Jake Taylor, A J Diaz and Cecilia Weingartner*

CH 10..... 041

What's in your glass?

Author's Name(s): *Caleb Crump, Jade Dulaney, et al and Cecilia Weingartner*



*'WR' posters are located on second floor
in the Whiting Room*

<i>Location of Poster</i>	<i>Abstract #</i>
WR 1	034
The Test Does Not Define You	
<i>Author's Name(s): Kiersten Atwood, Sara Pearson, James Caron, and Cecilia Weingartner</i>	
WR 2	040
Living as a target: The importance of modern journalism, and the reasons why journalists are being targeted and killed while covering newsworthy stories	
<i>Author's Name(s): Tiago Costa and Cecilia Weingartner</i>	
WR 3	048
Don't Stress the Small Things	
<i>Author's Name(s): Sydnee Johnson, Kaisey Margetts, Tyson Olsen, Angel Cruz and Cecilia Weingartner</i>	
WR 4.....	058
Caffeination effects on Sleep	
<i>Author's Name(s): Kaitlyn Peterson, Jasmine Webb, Raegan Urguidez, Andy Flody and Cecilia Weingartner</i>	
WR 5	059
Is Social Media Killing Us?	
<i>Author's Name(s): Jordan Porcaro, Matt Boucher, Tyler Priest, Conner Thornton and Cecilia Weingartner</i>	
WR 6	063
Post-College Survival Guide	
<i>Author's Name(s): Cedric Rupa, Jakob Furhiam, Ally Carlisle And Cecilia Weingartner</i>	

WR 7 067

Welcome to SUU!

Author's Name(s): *Josalyn Stacey, Sarah Tullis, and Cecilia Weingartner*

WR 8 030

Smoke-Free Campus

Author's Name(s): *Hassan Alkaber, Ali Albatee, Hamad Almoridi, Ahmed Almohaidly and Cecilia Weingartner*

WR 9 050

What does your budget make you?

Author's Name(s): *Mikela Marvin, Skyler Yarbrough, Sierra Chamberlin, Nikkita Blain and Cecilia Weingartner*

WR 10..... 064

Phone Epidemic

Author's Name(s): *Alexis Sargent, Ethan Smith, Stacy Soto, Xiyang Ding and Cecilia Weingartner*



**Oral Presentations
Located in Shooting Star**

Abstract #

6:45 PM 016
Cretaceous Dinosaur Stomping Grounds in the Greenhouse Arctic
Author's Name(s): *Grant Shimer, Ph.D.*

7:00 PM 019
**Recent Research in Large-Scale Flank Collapse of Volcanic
Fields: Implications for Southern Utah Geology**
Author's Name(s): *Zachary D. Smith and John S. Maclean, Ph.D.*

7:15 PM 013
**The effect of Terpinen-4-ol on Blood Vessel Diameter
in Frogs**
Author's Name(s): *Brock Orme, Mark Albrecht, Matthew
Weeg, Ph.D. and Mary Jo Tufte*

7:30 PM006
**Using CRISPR/Cas-9 to genetically modify *C. elegans*
nematodes**
Author's Name(s): *Jon Karpel, Ph.D.*

7:45 PM.....010
Population genetics of black bears in New Hampshire
Author's Name(s): *Mauger, Laurie, Ph.D. Kaetlyn Revels,
Benjamin Kilham and Andrew Timmins*

8:00 PM 009
**Sequence Variation of the CytB Gene in American
crocodile, *Crocodylus acutus*, Populations in Pacific
Costa Rica**
Author's Name(s): *Laurie Mauger, Ph.D. Kyle Javenes, Jonathan
Karpel, Ph.D. and James Spotilla*

**Oral Presentations
Located in Yankee Meadow**

Abstract #

- 6:45 PM 020
Dendrimers- What, Why and How
Author's Name(s): *Mackay Steffensen, Ph.D.*
- 7:00 PM 024
Palladium-Catalyzed Suzuki-Miyaura Cross-Coupling Reactions of (E)-Styrylboronic Acid Pinacol Ester with Aromatic Bromides
Author's Name(s): *Hailee Rau, Marcus C. Mifflin and Nathan Werner, Ph.D.*
- 7:15 PM 012
Microfluidic Research at SUU
Author's Name(s): *Christopher Monson, Ph.D.*
- 7:30 PM 014
Nanoparticle Synthesis with Microfluidic Devices
Author's Name(s): *Kyler Radmall, Rachel Radmall and Christopher Monson, Ph.D.*
- 7:45 PM 017
A Microfluidic Device for Oxygen Quantitation in anoxic Environments
Author's Name(s): *Maverik Shumway, Braxton Williams, Mariah Clayson, B. Anderson and Christopher Monson, Ph.D.*
- 8:00 PM 018
Analysis of Vesicles Resulting from Bilayer Stripping
Author's Name(s): *Stephen Smith, Christopher Monson, Ph.D. and Matthew Rowley, Ph.D.*
- 8:15 PM 007
Utilizing phosphatidylserine containing supported lipid bilayers as a method to separate copper binding proteins from non-copper binding proteins
Author's Name(s): *Dylan Keiser and Christopher Monson, Ph.D.*

**Oral Presentation
Located in Vermillion Cliffs**

Abstract #

- 6:45 PM 011
Counting Schur Rings over Cyclic Groups
Author's Name(s): *Andrew Misseldine, Ph.D.*
- 7:00 PM 004
Cyclic Decompositions of λ Kn into LWO Graphs
Author's Name(s): *Derek Hein, Ph.D.*
- 7:15 PM 003
Aspects of Growth in Baumslag-Solitar Groups
Author's Name(s): *Eric M. Freden, Ph.D.*
- 7:30 PM 028
Astronomy Research For Any Discipline
Author's Name(s): *Rhett Zollinger, Ph.D.*
- 7:45 PM..... 026
**Using Exoplanet Transits to Calibrate the Great Basin
Observatory**
Author's Name(s): *Katherine Wilcox and Rhett Zollinger, Ph.D.*
- 8:00 PM 025
Simulations of Protoplanetary Collisions
Author's Name(s): *Brandon Wiggins, Ph.D.*
- 8:15 PM 021
Astrochemistry: The Formation of Water in the Early Universe
Author's Name(s): *Morgan Taylor and Brandon Wiggins, Ph.D.*

**Oral Presentations
Located in Sage Valley**

Abstract #

- 6:45 PM 001
Incorporating current events and real-life application into introductory statistics classes
Author's Name(s): *Sarah Duffin, Ph.D.*
- 7:00 PM 023
Applications of Calculus: The most economical shape of a can
Author's Name(s): *Leon Weingartner and Jianlong Han, Ph.D.*
- 7:15 PM 002
The Effects of Algebra on Critical Thinking
Author's Name(s): *Edgar Judd and Andreas Weingartner, Ph.D.*
- 7:30 PM 015
Cyber Skills Acceleration through Academic/Industry partnerships and stack-able credentials
Author's Name(s): *Rob Robertson, Ph.D. and Matt Heffelfinger*
- 7:45 PM 027
Using Galvanic Skin Response to Measure Stress Levels in Programming Students
Author's Name(s): *Matthew Wilde and Cecily Heiner, Ph.D.*
- 8:00 PM 005
A Robotics Experience for All the Students in an Elementary School
Author's Name(s): *Cecily Heiner, Ph.D.*

ABSTRACTS

Title:

Incorporating current events and real-life applications into introductory statistics classes

Author's Name(s): *Sarah Duffin, Ph.D.*

Department: *Mathematics, Southern Utah University*

Mentor(s):

Abstract

When students clearly see the relevance of topics being taught, they work harder and enjoy learning more. With that in mind, I created supplemental assignments for my introductory statistics classes. Students have created graphs from actual sports data, analyzed presidential election results, studied consumer reviews on Amazon.com, read books from the New York Times Best Sellers list that use statistics, and more. I would like to share with conference goers the content of these real-life based assignments. I will demonstrate how to find applications of statistics that are not found in textbooks.

Title:**The Effects of Algebra on Critical Thinking****Author's Name(s):***Edgar Judd***Department:** *Mathematics, Southern Utah University***Mentor(s):***Andreas Weingartner, Ph.D.***Abstract**

This research experiment was designed to determine whether or not college-level algebra has an effect on the critical thinking skills and abilities of students. This was done through a series of surveys given to SUU students throughout the fall and spring semesters of the 2016-2017 school year. Students were also given the option to participate in one-on-one interviews to discuss their thoughts on critical thinking and how/if mathematics helped them develop the skill. The results of the research showed a decrease in the average survey scores. This would suggest a decrease in the critical thinking skills of students. I concluded that determining a direct relationship between decreased critical thinking skills and the classes was difficult because there were many uncontrollable variables responsible for errors in calculation and the research as a whole.

Title:**Aspects of Growth in Baumslag-Solitar Groups****Author's Name(s):** *Courtney, Cleveland and Eric Freden, Ph.D.***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

We show that the asymptotic growth rate of $BS(2,4)$ is the same as that of its Bass-Serre tree and that this fact generalizes to $BS(m,km)$ for $k,m>1$ only when $k=2$.

Title:**Cyclic Decompositions of λK_n into LWO Graphs****Author's Name(s):***Derek W. Hein, Ph.D.***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

In this talk, we identify LWO graphs, find the minimum λ for decomposition of λK_n into these graphs, and show that for all viable values of λ , the necessary conditions are sufficient for LWO--decompositions using cyclic decompositions from base graphs. Presentation of these research results at a professional conference at the University of West Georgia last month was supported by a grant from the WMG COSE FSSF.

Title:

A Robotics Experience for All the Students in an Elementary School

Author's Name(s):

Cecily Heiner, Ph.D.

Department: *Computer Science and Information Systems, Southern Utah University*

Mentor(s):**Abstract**

Robotics can be a meaningful and motivating application of computer science that helps make abstract concepts concrete and visible, but most elementary school robotics thus far has focused on design and after school extra-curricular activities with small groups of select students rather than in-school, school-wide robotics for all the students within a school. This paper describes our experience designing, implementing, and trying to evaluate a robotics curriculum and program for all the students within an elementary school; the primary focus of this paper is scale. We describe challenges and opportunities we experienced as part of this project and reflect on the degree to which they are unique to our relatively small, isolated rural town and the timing of our project. We present data points suggesting that robotics can be effectively and economically implemented in the elementary school curriculum.

Title:

Using CRISPR/Cas-9 to genetically modify *C. elegans* nematodes

Author's Name(s):

Jonathan Karpel, Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s):**Abstract**

CRISPR/Cas-9 has been in the news lately as a novel gene-editing technology that can be used to introduce genetic variations into a variety of species. This ability to change an organism's DNA in a very specific way opens many doors for research, but also introduces some ethical concerns as well. Several approaches to gene editing have been developed and the efficiency of the techniques are improving every day. To demonstrate the system in nematodes, we decided to add a large genetic element into the *C. elegans* genome to create a fusion with our protein of interest, the *ddx-15* gene, which is a protein that is thought to be part of the spliceosome. The *ddx-15* gene was fused to the GFP marker using CRISPR/Cas9 and successfully used in a co-immunoprecipitation experiment to examine proteins interacting with the *ddx-15* protein. Details of the CRISPR experiment along with future research will be detailed in the presentation.

Title:

Utilizing phosphatidylserine containing supported lipid bilayers as a method to separate copper binding proteins from non-copper binding proteins

Author's Name(s):

Dylan Keiser

Department: *Physical Science, Southern Utah University*

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

Abstract

The goal of this experiment is to develop a new way to separate copper binding proteins from non-copper binding proteins. We create a supported lipid bilayer inside a microfluidic device by flowing a solution of lipid vesicles into the device. Once the vesicles come into contact with clean/annealed glass, they burst and adhere to the surface of the glass. A solution of copper is then flowed through the device. The copper ions bind strongly to the phosphatidylserine contained in the bilayer. We are then able to flow a solution of proteins through the device. The proteins that bind copper will stick to the bilayer, while the proteins that do not bind copper will pass freely through the device. As the pH becomes acidic, the serine group on the phosphatidylserine becomes protonated, and it lets go of copper. This releases the copper binding proteins from the bilayer. If the pH is made acidic at a slow rate, then the proteins will be released from the bilayer at different rates according to their relative binding affinities for copper allowing the copper binding proteins to be separated from each other. The protein solutions are tagged with fluorophores along with the lipids. Used in conjunction with a fluorescence microscope, we can visualize the presence of proteins and lipids in the channel of the device.

Title:**TCR-Mediated Signaling Proteins and their association with Nuclear GRB2****Author's Name(s):***Josh Matt***Department:** *Department of Microbiology and Immunology,
University of Iowa***Mentor(s):***Aline Sandouk, Jon Houtman, Ph.D.***Abstract**

Growth factor Receptor-Bound protein 2 (GRB2) is an adaptor protein that is found in all human cells. Traditionally, it has been viewed as a strictly cytoplasmic protein playing a role in signal transduction and cell communication. Recently though, GRB2 has been found in the nucleus of cells. In CD4-T helper cells, past research has shown that GRB2 increases in the nucleus after cell activation and appears to interact with transcription at the promoters of a subset of genes. Thus, we hypothesize that GRB2 and associated proteins translocate from the cytoplasm into the nucleus where they influence gene transcription through an unknown mechanism. For this study, we began to probe for proteins that are known to be associated with cytoplasmic GRB2 within the nuclei of unstimulated Jurkat (E6.1) cells and activated primary human T cells. To do this cytoplasmic and nuclear fractions were separated by selective disruption of plasma and nuclear membranes using high and low salt buffer solutions. Fractions were analyzed for protein levels by immunoprecipitation followed by Western Blot. Our results revealed baseline levels of three known cytoplasmic GRB2 associated proteins: SOS-1, Lck and GADS. Our data currently suggests that the proteins Lck and GADS are not found in and do not translocate into the nucleus of Jurkat cells and primary human T cells. However, SOS-1 has shown small but appreciable abundance in the nucleus of activated primary human T cells. Although our findings require further investigation, this data suggest a selective translocation of individual GRB2-associated proteins into the nucleus of T cells.

Title:

Sequence Variation of the CytB Gene in American crocodile, *Crocodylus acutus*, Populations in Pacific Costa Rica

Author's Name(s): *Laurie Mauger, Ph.D., Jonathan E. Karpel, Ph.D., Kyle Javenes, and James Spotila, Drexel University*

Department: *Biology, Southern Utah University*

Mentor(s):

Abstract

Sequences of mitochondrial genes are useful in studying phylogeography and genetic differentiation in populations of threatened and endangered species. We determined the genetic structure of American Crocodile (*Crocodylus acutus*) populations in Pacific Costa Rica for the CytB mitochondrial gene using the primer pair L14849, and H15453. Crocodile samples were collected from 11 localities (Las Baulas National Park, Santa Rosa National Park, Palo Verde National Park, and several rivers and lagoons on the Osa Peninsula). Sequences were edited on BioEdit 7.0.9.0 and aligned with ClustalW on Mega 7.0.18. We sequenced 547 base pairs for 119 individuals. Gene sequences were collapsed into 5 haplotypes on FaBox 1.41. Haplotype CytB2 was unique to crocodiles in Las Baulas National Park. We constructed maximum likelihood (ML) trees for the mitochondrial region and estimated the mitochondrial divergence and substitution model across geographical locations for crocodiles in Pacific Costa Rica. Preliminary data support minimal divergence and independent evolution in the sampled populations.

Title:**Population genetics of black bears in New Hampshire**

Presenting Author's Name(s): *Laurie Mauger, Ph.D., Kaetlyn Revels (Biology), Benjamin Kilham (Independent Wildlife Biologist, New Hampshire), Andrew Timmins (New Hampshire Fish and Game Department)*

Department: *Biology, Southern Utah University*

Mentor(s):**Abstract**

Large mammalian species face many challenging including habitat fragmentation and destruction, human population growth, and loss of genetic variability. It is important to describe the genetic structure and mating systems of these species to ensure their survival. American black bears, *Ursus americanus*, range widely throughout Canada and the United States. There is a relatively large bear population in southwestern New Hampshire, however little is published about the genetic structure in this area. Extensive research has been conducted on the black bear population in Lyme, New Hampshire by wildlife biologist Ben Kilham, Ph.D. Preliminary kinship analysis confirmed known mother-offspring relationships and suggested that multiple paternity exists. However, relatedness amongst the males and effective population size in the study area is not known. A more comprehensive study is needed to further elucidate the genetic relationships of the bears residing in the study area. The main objectives of our study are to (1) estimate the rate of multiple paternity in black bear litters in southwestern New Hampshire, (2) estimated the relatedness of the male population in the study area, and (3) describe the population genetic structure of the black bear population in the study area.

Title:**Counting Schur Rings over Cyclic Groups****Author's Name(s):***Andrew Misseldine ,Ph.D.***Department:** *Mathematics, Southern Utah University***Mentor(s):****Abstract**

Any Schur ring, an algebraic structure closely related to association schemes, is uniquely determined by a partition of the elements of the group. An open question in the study of Schur rings is determining which partitions of the group induce a Schur ring. Although a structure theorem is available for Schur rings over cyclic groups, it is still a difficult problem to count all the partitions. For example, Kovacs, Liskovets, and Poschel determine formulas to count the number of wreath-indecomposable Schur rings. In this talk we solve the problem of counting the number of all Schur rings over cyclic groups of prime power order and draw some parallels with Higman's PORC conjecture.

Title:**Microfluidic Research at SUU****Author's Name(s):***Chris Monson, Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):****Abstract**

Microfluidic devices are increasing important measurement devices. I will discuss research that students are doing with me to develop microfluidic devices that will enable measurements to be done more quickly, cheaply, and accurately. Research topics include new titration techniques, new purification techniques for large biologically-relevant molecules, new nanoparticle fabrication techniques, and improved analysis techniques.

Title:**The Effect of Terpinen-4-ol on Blood Vessel Diameter in Frogs.****Author's Name(s):***Brock Orme, Mark Albrecht***Department:** *Biology, Southern Utah University***Mentor(s):** *Matthew Weeg, Ph.D., Mary Jo Tufte***Abstract**

Plants produce a series of compounds known as secondary metabolites which 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, previous research has shown that vasoconstriction occurs when the essential oil from *Umbellularia californica* is applied to small cutaneous blood vessels in leopard frogs (*Rana pipiens*). This essential oil is composed of several terpenoids, including terpinen-4-ol. To explore the possible cause of the observed vasoconstriction, we focused on this terpenoid in an isolated study. We applied the compound directly to cutaneous microvasculature in resected portions of frog skin and recorded changes in blood vessel diameter. Terpinen-4-ol caused a sustained reversible vasoconstriction of blood vessels in a concentration dependent manner. Our results suggest that Terpinen-4-ol may be partially responsible for the observed vasoconstriction caused by *U. californica* essential oil.

Title:**Nanoparticle Synthesis with Microfluidic Devices****Author's Name(s):***Kyler Radmall, Rachel Radmall***Department:** *Physical Science, Southern Utah University***Mentor(s):***Christopher F. 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. After several trials, it was concluded that the first device did not induce proper mixing of the reagents. A brand new device was made to improve reproducibility. 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. We will also use a UV-Vis spectrometer and spectrofluorimeter to analyze the stages of nanoparticle synthesis.

Title:

Cyber Skills Acceleration through Academic/Industry partnerships and stack-able credentials

Author's Name(s):

Rob Robertson, Ph.D., Matt Heffelfinger

Department: *Computer Science and Information Systems, Southern Utah University*

Mentor(s):**Abstract**

In today's Cyber Security world, the consensus is that there is a great shortage and workforce gap between skilled professionals and the jobs needing to be filled. This gap cannot be filled without the combined efforts of industry and academia. This presentation outlines efforts being made to provide synergistic logistical plans to help diminish the study-to-work time gap and produce more skilled cyber security professionals. Southern Utah University partners with other academic institutions as well as industry to help solve this workforce gap, and improve the security capabilities of our nation's cyber security workers. As part of these partnerships stack-able credentials play an important role in laying a foundation of skills that can quickly build an educated/skilled workforce.

Title:**Cretaceous Dinosaur Stomping Grounds in the Greenhouse Arctic****Author's Name(s):***Grant Shimer, Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):****Abstract**

Sedimentological, paleontological, and geochemical evidence indicate that the mid Cretaceous was a time of peak greenhouse conditions in recent Earth history. The period serves as a reference point for changes that may occur during modern warm periods, especially at high latitudes. In August 2017 I participated in the third field season of a project aimed at describing the ancient environments preserved within the Albian-Cenomanian Nanushuk Formation, and with cataloging evidence of dinosaurs from those paleo-environments. The Nanushuk Formation comprises fluvial, deltaic, and shallow marine sedimentary deposits found across Alaska's North Slope, with equivalently aged deposits in Siberia. Previous studies described the vibrant paleo-flora of the formation and associated Russian deposits, including abundant cycad, conifer, and fern fossils, as well as rarer examples of early angiosperms. This project examined the formation along a transect parallel to the Kukpowruk River, in northwest Alaska. This summer we described a range of rock types typical of meandering river floodplains, tidal flats, and deltas. The floodplain and tidal flat environments were especially rich in dinosaur trackways, and in total the paleontologists cataloged 70 new vertebrate track sites over three summers, including birds. The association of herbivorous dinosaur tracks with 50-60 cm-thick standing fossilized tree trunks paints a picture of a verdant ecosystem that sustained herds of large animals. This corroborates evidence from elsewhere in Alaska and Russia, depicts a dramatically different environment than currently exists on the North Slope, and provides some positive implications for an increase in atmospheric CO₂ over a geologic time scale.

Title:

A Microfluidic Device for Oxygen Quantitation in Anoxic Environments

Author's Name(s):

Maverik Shumway, Braxton Williams, Mariah Clayson, Brian Anderson, Chris Monson, Ph.D.

Department: *Physical Science, Southern Utah University*

Mentor(s):

Christopher Monson, Ph.D.

Abstract

Anoxic waters, or water containing very low levels of oxygen (<1% of oxygen saturation), are important and relatively common. Low oxygen levels occur both naturally (such as ocean basins and deep waters in lakes such as the Great Salt Lake) and in managed waters (such as waste lagoons). We are attempting to create a microfluidic device to measure low oxygen levels that will be less expensive and more sensitive than current STOX techniques.

Measuring the amount of oxygen present in anoxic water is both challenging and important. Actual oxygen levels can be important in determining what types of chemical processes can occur. Currently, the method for measuring low oxygen concentration is to use an STOX electrode, which is expensive and relies on a diffusion-limited current to measure dissolved oxygen. We are attempting to create a microfluidic-based STOX-like device employing active (magnetohydrodynamic) transport. This should be much less expensive than an STOX electrode and it should produce a greater current for a given oxygen level, giving our device an overall better oxygen detection limit.

Title:**Analysis of Vesicles Resulting from Bilayer Stripping****Author's Name(s):***Stephen Smith***Department:** *Physical Science, Southern Utah University***Mentor(s):***Christopher Monson, Ph.D., Matthew Rowley, Ph.D.***Abstract**

Lipids are an important part of cell membranes. When in water, these lipids form a model cell shape called a vesicle. When lipid vesicles come in contact with smooth glass they form Supported Lipid Bilayers (SLB) which are unrolled, flattened, lipid vesicles on glass. These bilayers are important for the purification, separation, and study of cell membrane substituents. As a fast-moving buffer flows over these bilayers, it disrupts the bilayer and strips portions of it from the glass and reforms into vesicles. We are building a particle analyzer to determine the number and size of the particles that are produced from stripping the bilayer. In our device, a laser shines on the solution from the stripping experiment and the reflected light is analyzed thus making a light scattering particle sizer.

Title:**Recent Research in Large-Scale Flank Collapse of Volcanic Fields: Implications for Southern Utah Geology****Author's Name(s):***Zachary D. Smith***Department:** *Physical Science, Southern Utah University***Mentor(s):** *John S. MacLean, Ph.D.***Abstract**

Flank collapse of volcanoes and laccoliths has been well documented in many locations around the world. However, the collapse of volcanic fields due to gravitational spreading is rare and still poorly understood. In September 2017, researchers from across the world converged on southern Utah for a week long Geological Society of America Thompson Field Forum-Catastrophic Mega-Scale Landslide Failure of Large Volcanic Fields-to study and present the latest scientific knowledge on gravity slides. The group focused on the Markagunt gravity slide (5,200 km²) and the Sevier gravity slide (1,500 km²) and the mechanisms that led to their development. Deformational features that distinguish large fast moving landslides versus slow moving low-angle normal faults are still not clear. Pseudotachylite, an obsidian like glass that forms from frictional heating of rock, has been located in many places across the Markagunt Plateau and is believed to be one of the distinguishing characteristics of catastrophically emplaced mega-landslides. Other distinguishing but controversial features of large landslides are large scale injectites and widespread low-angle basal slip surfaces. The field forum established collaboration between many different fields in geology and served as a jump-start to a new generation of geologic research on gravity slides in southern Utah.

Title:**Dendrimers-What, Why, and How****Author's Name(s):***Mackay B. Steffensen, Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):****Abstract**

Dendrimers are a class of synthetic polymers identifiable by their perfect branching architecture. The 1,3,5-triazine core has been utilized in the syntheses of a variety of structurally diverse macromolecules. We aim to expand the diversity of macromolecules utilizing 1,3,5-triazine as the fundamental building scaffold. Our contribution focuses on the use of a short atomic linker as the other key building component. We have had success in constructing small dendrons and dendrimers using a hydrazine linker. Our motivation is three-fold: to develop methods and determine the limitations in constructing these novel macromolecules, to characterize the material produced with a focus on identification of unique physical properties, and to provide a true research experience for undergraduates, where their efforts will result in the production of molecules that have never before existed.

Title:**Astrochemistry: The Formation of Water in the Early Universe****Author's Name(s):***Morgan Taylor and Brandon Wiggins, Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Brandon Wiggins, Ph.D.***Abstract**

Water is required for the rise of life as we know it throughout the universe, but its origin and the circumstances of its first appearance remain a mystery. The abundance of deuterated water in solar system bodies cannot be explained if all the water in the solar system were created in the protoplanetary disk (Cleeves et al. 2014), suggesting that as much as half of Earth's water predates the Sun. Water has been observed as early as one sixth the current universe's age in MG J0414+0534 (Imprellizzeri et al. 2008). It was recently shown that water could, in principle, appear in hot halos barely enriched with heavy elements such as oxygen and carbon (Bialy et al. 2015). So far, no self-consistent calculation of cosmology physics carried out in line with a large chemical reaction network has been carried out to study the first sites of water formation in the universe. We present initial results of cosmological calculations post-processed with a 26 species low-metallicity molecular chemical reaction network with Enzo (Bryan et al. 2014) to understand the role of hydrodynamics and radiative feedback on molecule formation in the early universe and to shed light on the cosmological history of this life-giving substance.

Title:

Measuring Regrowth and Animal Movement After a Fire Disturbance

Author's Name(s):

Diana Villicana, Kaitlin Veylupek, and Carrie Jo Bucklin

Department: *Biology, Southern Utah University*

Mentor(s): *Carrie Jo Bucklin*

Abstract

We are using GigaPan Units and game camera/trail camera traps to identify the return of different plant types (i.e. grasses, shrubs, trees), the rate of regrowth (how quickly the different plant types return), and animal movement patterns. There are three locations: A) Control Site - near the burn, but not directly affected by the fire; B) High Intensity Site – north of Brian Head; C) Moderate-Low Intensity Site– east of Brian Head. At sites B and C we are taking two photos with the GigaPan to really capture the green sprouting in the midst of the black burn. We are anticipating that by using the image J and descriptive statistics we will be able to see a moderate growth rate change and return of species into the area that was burned. The pictures at our control site will help contrast our findings at the other sites.

Title:

Applications of Calculus: The most economical shape of a can.

Author's Name(s):

Leon Weingartner

Department: *Mathematics, Southern Utah University*

Mentor(s):

Jianlong Han, Ph.D.

Abstract

We study the dimensions of a can that minimize the total cost to make it, where the total cost includes the cost of the metal and the cost of joining sides. Using Calculus, we find an equation which describes the relation between the ratio of height and radius, and the volume of the can.

Title:

Palladium-Catalyzed Suzuki-Miyaura Cross-Coupling Reactions of (*E*)-Styrylboronic Acid Pinacol Ester with Aromatic Bromides

Author's Name(s):

Hailee Rau, Marcus C. Mifflin and Nathan S. Werner Ph.D.

Department: *Physical Science, Southern Utah University*

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

Abstract

The alkene functional group is commonly found in many important organic molecules. The restriction to rotation of a carbon-carbon double bond leads to isomeric molecules that can have similar physical properties and can be difficult to separate by conventional techniques. Therefore, it is important that synthetic reactions produce one alkene isomer in excess to avoid a potentially difficult separation. Here we present our study of the stereospecific palladium-catalyzed Suzuki-Miyaura cross-coupling reaction of (*E*)-styrylboronic acid pinacol ester with aromatic bromides.

Title:**Simulations of Protoplanetary Collisions****Author's Name(s):**

Brandon Wiggins, Ph.D. and Morgan Taylor

Department: *Physical Science, Southern Utah University*

Mentor(s):**Abstract**

A key prerequisite for the rise of life on Earth is carbon abundance in Earth's crust. However, it is expected that carbon and other volatile elements would either have boiled out of early Earth's atmosphere or else have been trapped within its iron core. Some have suggested that Earth's volatile elements including carbon were replenished through geologic history by comets and asteroids, but silver, copper, and carbon isotopic abundances on Earth disagree with the composition of these solar system bodies. Other theories suggest that most of Earth's carbon was delivered earlier on. It has been proposed that a collision with a Mercury-like planetesimal in the early solar system may have delivered much of the carbon in Earth's mantle and crust. This theory suggests that if sufficient sulfur was delivered to Earth's core in this merger, carbon sequestration into the core would be stymied, better allowing carbon to be convected to Earth's crust. In this paper, we simulate collisions taking place between a proto-Earth and a Mercury-like object with different speeds and impact parameters to explore the conditions where such an impact would mix the impactor's and proto-Earth's cores. Our smoothed particle hydrodynamic simulations offer a computational fluid dynamics perspective on the proposed scenario.

Title:

Using Exoplanet Transits to Calibrate the Great Basin Observatory

Author's Name(s):

Katherine Wilcox

Department: *Physical Science, Southern Utah University*

Mentor(s):

Rhett Zollinger, Ph.D.

Abstract

Southern Utah University is one of four university partners who manage and operate the new Great Basin Observatory (GBO). As partners, SUU students have priority access to the remotely operated telescope for astronomical research. Since the GBO telescope is new, its capabilities are still unknown. In order to determine the telescope's limits, we have started taking photometric measurements of exoplanet transit systems. We then verify that the photometric data is consistent with accepted values. So far we have successfully processed several transits. We plan to continue detecting exoplanet transit systems with lower signal to noise ratios until the transit dimming is too faint for our telescope to detect. Once our work is finished, we will have a better understanding of the GBO limits which will benefit future SUU students and other GBO university partners.

Title:

Using Galvanic Skin Response to Measure Stress Levels in Programming Students

Author's Name(s):

Matthew Wilde

Department: *Computer Science and Information Systems, Southern Utah University*

Mentor(s):

Cecily Heiner, Ph.D.

Abstract

Stress in introductory computing courses is a nationwide problem as evidenced by high drop/fail/withdraw rates and student complaints. We will measure stress levels in students taking CSIS 1400 Fundamentals of Programming, an introductory CSIS course at SUU. We will measure the stress that students experience in these courses using the Microsoft Band 2 Galvanic Skin Response (GSR) technology to measure spikes in stress levels. Students will wear this band while they program or work on homework. We will map these stress levels to errors and other feedback in their assignments including writing Java code. In CSIS 1400, students develop software in the BlueJ Development Environment which also sometimes produces inaccurate feedback. We will build software to gather, plot, and visualize stress levels and feedback events. Based on our findings, we will validate this data source as a real-time feedback mechanism to help instructors make decisions and help students manage stress and succeed in these difficult courses.

Title:**Astronomy Research For Any Discipline****Author's Name(s):***Rhett Zollinger***Department:** *Physical Science, Southern Utah University***Mentor(s):****Abstract**

Southern Utah University has recently joined a small partnership of undergraduate institutions to manage the operation of the new Great Basin Observatory (GBO). The GBO houses the first research grade robotic telescope located inside a national park. SUU does not currently have a physics or astronomy major, so we lack a dedicated group of potential students to engage in astronomy projects. Fortunately, the intrigue of astronomy research is not limited to these majors. Our access to the GBO can be a valuable resource to students from all disciplines. I will present on SUU's utilization of the GBO and discuss current and future research projects with the telescope.

Title:**Identifying Factors Contributing to Spatial Patterns of Mule Deer-Vehicle Collisions****Author's Name(s):**

Darby Adams, Natalie Barlow, Michael Christiansen, Arsene Mugisha

Department: *Biology, Southern Utah University*

Mentor(s): *Karl J. Jarvis, Ph.D.*

Abstract

Wildlife-vehicle collisions (WVCs) cause millions of dollars in damage in Utah annually, and Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) is the major species involved in these deadly WVCs. Density of mule deer WVCs varies greatly, depending on migration and environmental factors, but no studies have focused on the effect of proximity of pinyon-juniper cover on WVCs in this region. We examined environmental factors contributing to WVCs on State Route 56 by analyzing the relationship between WVC density, roadside vegetation characteristics, and LANDFIRE vegetation cover data. Our hypotheses were that proximity of forest and grassland cover to roads increases WVC rates due to higher occupancy while mule deer are accessing those resources. We found that grass, shrub, and soil cover 15-20 m from the road were stronger predictors of WVC density than density of general forest, shrub, and herb cover in the 800 m surrounding the road. These results will help land managers optimize natural resource management activities and road mitigation measures to reduce WVCs, and plan locations for wildlife crossings and other measures to maximize mule deer connectivity.

Title:**Smoke-Free Campus****Author's Name(s):***Hassan Alkaberi, Ali Albatee, Hamad Almoridi, Ahmed Almohaidly***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Many national institutions of higher education have taken considerable steps towards implementations of smoke-free and healthy campus policies. On SUU campus, smoking issues have been raised by many students and officials who advocate for the rights of non-smokers on campus regarding breathing fresh and healthy air. On the other hand, smokers claim that such ban on smoking infringes with their individual and personal right.

The ban advocates emphasis on raising awareness of the increasing harm caused by smokers in public communities. On the contrary, smokers point at preserving their right at least by constructing smoking rooms or designated areas. To develop a coherent argument and consistent policy, this survey examines the variety of opinions of SUU students as well as staff in order to come up with an agreed solution.

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

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

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:**Range Management: Public Perception of a Fuel Load****Author's Name(s):***Whittni Ananin, Julian Mesick***Department:** *Agriculture & Nutrition Science, Southern Utah University***Mentor(s):***Randall Violet, Ph.D.***Abstract**

The gap between public perception of a fuel load and applicable range management is wide. Land managers wish to properly manage invasive species encroachment, but are commonly faced with opposition. Without a proper understanding of a fuel load, rangeland reaches deplorable conditions allowing for unnaturally hot fires to burn. The public currently perceives management techniques such as bull hogging and clear cutting as negative. Similar techniques may be prescribed to restore the ecosystem to a seral stage. In areas such as southern Utah, forests have been permitted to grow older than ever before, leaving these forests incredibly vulnerable to fire. Such devastation has called for swift changes in management practices. Negative connotations predominantly arise from special interest groups without backgrounds in forest management. Our research looks at strategies to bridge the gap between negative perception of forest fires and effective rangeland management. A campus wide poll was conducted to further investigate and educate the gaps within the local community.

Title:**Concussions in College Football****Author's Name(s):***Ashley Anderson, Brookelynn Carlson, Riley Cunningham, Lina Gonzalez and Makenna Reid***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecelia Weingartner***Abstract**

In football, players are bound to get injured on or off the field. In cases that are severe, it can lead to death or the end of a career. A concussion occurs when the player is hit on their head leading to symptoms that interfere with their memory and coordination. We looked at concussions for College Football players based off of what position and how much time they play.

Title:**The Test Does Not Define You****Author's Name(s):***Kiersten Atwood, Sara Pearson, James Caron***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

Our research focuses on finding the correlation of various topics to test anxiety. After finding correlations, we plan to identify the causes and different ways to lessen them. Our research and data was collected by surveying random students and faculty at Southern Utah University using Google Survey. By drawing information from random students, we can represent the general population of Southern Utah University based on random sampling.

Title:**Super Bowl Outcomes****Author's Name(s):***Travis Bettridge, Dallin Langford, Leilani Begaye***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

For this research study we are analyzing the data of the NFL rushing yards, passing yards, and turnovers to help determine what makes a team win. We have gathered stats from past super bowls and records throughout the season to compare and contrast with each other.

According to the data when teams have fewer turnovers despite the difference in passing and rushing yards the team with less turnovers in a game win. Except when the team has a much greater number of yards passing or rushing.

During the regular season the importance of limiting turnovers (rushing, and passing yards) are important but not as important as it is in the playoffs. Basically it doesn't determine the super bowl winner.

Title:**Hiking: A Joy or A Struggle****Author's Name(s):***Zhiying Cai, Wesley Terry, Trina Peel, Mayra Rios, Chaunee Olsen, Kaimi Denny***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

For this project, we conducted a survey to get an understanding of the reasons behind hiking for students at Southern Utah University. SUU is known as the "Most Outdoorsy School" in the nation and we wanted to go in deeper to figure out what gets us outside. We chose to create a survey focused solely on hiking because there are so many national parks right outside of our door. Just asking why students like hiking was not good enough for us. There are endless reasons why people like to be outside and we wanted to know more. We chose to ask a few qualitative questions but mostly focused on quantitative ones. SUU puts a lot of focus on hiking because of the many benefits people can gain from the activity. When someone is feeling overwhelmed or stressed with school, work, and/or family life, hiking is a great way to help deal with it. Hiking helps clear one's head and it helps them focus on the there and then. While hiking, you can choose your own pace. There is no need to hurry. Nature is a beautiful thing, and hiking helps you see that. Hiking can lead to a healthy and happy life.

Title:

Accretion Disk Morphology and Tidal Disruption Radius in Massive Black Hole Growth

Author's Name(s):

Payton Christensen and Kyle Christiansen

Department: *Physical Science, Southern Utah University*

Mentor(s): *Brandon Wiggins, Ph.D.*

Abstract

We have a supermassive black hole in the center of our galaxy (Sagittarius A). A stellar (or average-sized) black hole is created when, in essence, a star collapses in on itself. While stellar black holes may be 10's of solar masses in size, supermassive black holes tend to weigh millions or tens of billions of suns. The process of how a supermassive black hole is created or how they grow through time is not well-understood. It is widely believed that properties of a black hole's accretion disk (the disk of material that feeds a black hole) affect how fast the black hole eats. The purpose of our experiment is to find massive black hole growth rates of different disk morphologies in the scenario of episodic accretion as we also consider the tidal disruption radius of black holes by testing several specific scenarios involving the course of a star in the vicinity of a black hole. We use smoothed particle hydrodynamics to distinguish which disk shapes result in highest black hole growth. We discuss implications of our results for how massive black holes may have grown through cosmic time.

Title:

Measuring Oxygen Levels in Low Oxygen Environments Using a Microfluidic Device

Author's Name(s):

Mariah Clayson, Brian Anderson, Esther Harkness, Maverick Shumway, Braxton Williams, Lohra Miller, Chris Monson

Department: *Physical Science, Southern Utah University*

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

Abstract

Oxygen levels in water environments affect many aspects of the world around us. Fish require diffused oxygen to live, our pipes will corrode more easily if oxygen levels are too high, etc. For this reason, we have focused our research on fabricating a microfluidic device that is sensitive enough to measure small amounts of oxygen, is durable enough to be reused, and is cost effective. Our device can measure oxygen in anoxic environments (water that contains very low levels of oxygen) and is made out of PDMS, which is an extremely durable substance. We have based our design off of the STOX electrode which uses a double membrane set-up to measure oxygen levels. The STOX electrode is very expensive to make and is extremely fragile. We have successfully made a device and performed field tests.

Title:**Unexpected Copper Nanoparticle Synthesis from Bulk Copper Metal****Authors:***Mikaila Cook and Mitchell Johnson***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher F. 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 hydrochloric acid dissolves 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:

Living as a target: The importance of modern journalism, and the reasons why journalists are being targeted and killed while covering newsworthy stories.

Author's Name(s):

Tiago Costa

Department: *Mathematics, Southern Utah University*

Mentor(s): *Cecilia Weingartner*

Abstract

Every year, a relevant number of journalists die while covering the most diverse stories to inform the masses. This was always real during the history of journalism, mostly because it's a characteristic of the journalist to put himself in difficult situations. However, while three decades ago the majority of journalists who died would be killed in crossfire, while covering conflicts; today, they are mostly deliberative murdered. They are today, most of the times, the target #1. I question: are these journalists being recognized by their bravery? What's the public opinion in relation to that? This study has three goals: understand the number of journalists killed between 1997 and 2017; study the reasons behind that shootings and combine with the public opinion about modern journalist; also, analyze how is the public opinion seeing this emergent issue and the journalism as a life risk-job.

Title:**What's in your glass?****Author's Name(s):***Caleb Crump, Jade Dulany, Sebastian, Lee, Addi, Hannan***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

What's in your glass? How do students view the world? Do they see changes that need to be made? What will students do when they see another's need, will they step in to help or look away? Our purpose of our study is to see what type of people volunteer, what characteristics do these people have? We will use a survey to find student's preferences with volunteer work. We will also survey student's views on the world to see what be behind their motivation to serve others.

Title:**Acceptability and Knowledge of Hemp Seed as a Dietary Source of ALA**

Author's Name(s): *Paige Milar, Aferdit Sadrija, Kourtney Smith, Danielle Erickson, Artis Grady, Matt Schmidt Ph.D.*

Department: *Agricultural and Nutritional Sciences, Southern Utah University*

Mentor(s):

Artis Grady, Matt Schmidt Ph.D.

Abstract

Most Americans have suboptimal intakes of dietary omega-3 fatty acids (FAs). Omega-3 FAs have been shown to reduce the risk of many diseases, including inflammation, elevated triglycerides, and sudden death from heart attacks and arrhythmias. Alpha-linolenic Acid (ALA) is a form of omega-3 FAs found in some plants, including shelled hemp seed hearts. The purpose of this study was to determine the acceptability of shelled hemp seed in food products and to examine the awareness of shelled hemp seed as a source of omega-3 FAs. One hundred fifteen volunteers, 64 males and 51 females, sampled four baked products (muffins and cookies)—two with and two without shelled hemp seed. After sampling each of the products, a questionnaire was given that evaluated the participant's acceptance of the four products and knowledge about omega-3 FAs. The products without shelled hemp seed were preferred over those with the added ingredient. However 79.7% of participants liked or strongly liked muffins containing the hemp seed and 60.9% reported similar acceptance of the cookies. The questionnaire revealed that 77% of participants had heard of omega-3 FAs, yet only 27.8% could correctly identify plant sources and a mere 7% knew of hemp seed as a source. This study showed that shelled hemp seed is not a commonly known ingredient, but it can produce an acceptable product that could increase the amount of omega-3 FAs in the diet.

Title:**How athletes Prepare for season?****Author's Name(s):***Frank D. Harris, Kobe Toa***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Athletes and dieting essential for humans' life. People consume on a daily basis to be at the top of their game. To be at the top best performance it is not just working out it has a lot to do with how you eat as well. My prediction is that every athlete has different diets to keep up with they're body. Every sport is different and requires different type of bodies which means different type of exercising. I believe through doing this project I will have a better understanding of their everyday life. I'm trying to find out how many calories they consume, how much sleep they get, and more. It is important to monitor how much food and calories a person intakes for various reasons. It could be for losing weight, gaining weight, or even just to stay healthy. Sleep is an important part of everyday life. Sleep helps the body in many ways as far as eating goes.

Title:

Using GIS to Create Hazard Maps and Assess Evacuation Routes Around “The Gate to Hell”; Masaya Volcano, Nicaragua

Author’s Name(s):

Rebecca Hedges, and Stevie Mcdermaid

Department: *Physical Science, Southern Utah University*

Mentor(s): *Jason F. Kaiser, Ph.D. and David Maxwell*

Abstract

The volcano Masaya located near Managua, Nicaragua is part of a newer volcanic arc system derived from the Cocos plate subducting beneath the Caribbean plate. Masaya exhibits a mafic composition. The recent cycle of volcanism began 7000 years ago with lava flows and degassing events leading up to climactic Vulcanian eruptions. These eruptions produce lava and ash flows, as well as ash falls that affect the underdeveloped communities around Masaya. These communities are in need of simple maps and action plan to use during an eruption. While evacuation routes are in place, there are no known secondary options. Through the EDGE Program, we visited the study area, gathered data using GPS Coordinates to create an evacuation route and hazard map for the surrounding communities using GIS software. With this information we confirmed possible routes and hazardous areas. Thematic maps were compiled with three options. A, the preferred route. B, the secondary route with contained sections of caution, and C that is not recommended. Our preliminary research of prior eruptions also gave us sufficient data to create hazard zones. With confirming research at the study site and our preliminary data, our map contains three zones of hazards in gradients of red, orange, and grey. These maps give the communities surrounding Masaya more insight as to the behavior of the eruptions and knowledge about their environment. It is our hope that this work will make the hazards of Masaya more recognizable to the local communities.

Title:**Touchdown! Is Football Worth Your Time?****Author's Name(s):***Madison Howlett, Kylie Willingham, Jeremiah Kolb, Alec Tatton,
Tyler Marwitz***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

What makes you go to football games? Is it the free food or do you just love the overall atmosphere of cheering on your team? This is what we as a group are trying to figure out. We will do this by creating a survey that students can take to see what really motivates students to go to a game. We are also trying to figure out why students don't go to games. Once we figure this out we can now find a way to incorporate an atmosphere for all students. We want to incorporate different groups at football games such as music, dance, and other clubs so that the population will increase. Our overall objective is to increase SUU's school pride when it comes to cheering on our football team.

Title:**Synaptotagmin Localization in Zebrafish Embryos****Author's Name(s):***Emily James***Department:** *Biology, Southern Utah University***Mentor(s):** *Lindsey K. Roper, Ph.D.***Abstract**

Synaptotagmins (syts) are a group of proteins that play an important role in exocytosis from neuro and neuroendocrine cells. While some isoforms are essential for neurotransmitter release at mature synapses, very little research has been published regarding the localization of these proteins during embryonic development. Therefore, we plan to systematically identify which syt isoforms are expressed in the neural tube during earlier stages of development and their location. We will harvest embryos from the zebrafish population residing in the animal lab, humanely euthanize them prior to hatching, and then determine the locations of the seventeen syt isoforms at various stages of development in the embryonic tissue. To determine which isoforms are expressed in the early neural tube we will isolate mRNA from the embryos and then perform RT-PCR. Once we have determined the specific stages of development during which the isoforms appear, we will perform in situ hybridization on the harvested tissues to find the location of synaptotagmin expression in the embryos.

Title:**The Separation of Organic Material Using a Microfluidic Device****Author's Name(s):***Megan Jensen***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Christopher F. Monson, Ph.D.***Abstract**

This presentation is about separating organic material using a microfluidic device. A microfluidic device is used to prevent the mixing of liquids running through a tube. We are attempting to separate the organic material by using electric currents on either side of the device, negative on one side, positive on the other. Negatively charged material will be separated out to one side, positively charged material will be separated to the other side. The purpose of this research is to find a cheap, and efficient way to separate DNA, which is negatively charged, from organic material. However, there are several other possible uses as well. Our research is currently still in the developmental stage. We are still working out how to maintain a constant liquid flow while applying a powerful electric charge, which creates a large amount of bubbles.

Title:**Don't Stress the Small Things****Author's Name(s):***Sydnee Johnson, Kaisey Margetts, Tyson Olsen, Angel Cruz***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

We explored how stressors such as sleep, exercise, and social obligations affect students at Southern Utah University's academic success. We also want to understand how the majority of students feel about balancing school, work, and social events. Using this information, we hope to understand how daily stress is affecting students both in and outside of the classroom.

Title:

Developing a methodology for determining the redox potential of cells

Author's Name(s):

Jacob Lambertsen

Department: *Physical Science, Southern Utah University*

Mentor(s): *Kim H. Weaver, Ph.D. and Mackay Steffensen, Ph.D.*

Abstract

The cytosol of cell is a reducing environment, but the exact reduction potential is unclear. This experiment will attempt to determine the redox potential of erythrocytes, which, in doing so, will develop a methodology for determining the redox potential of other cells. This will be accomplished by utilizing a readily oxidized and water soluble fluorothiol that, when the thiol is reduced, will have a significant shift in the electronic environment of the fluorine. This shift can be measured via ^{19}F NMR. Up to this point, we have been unable to find a molecule that meets these parameters. Currently, 3-Mercapto-4,4,4-trifluorobutyric acid – a molecule similar to a fluorinated cysteine – is being synthesized in an attempt to find a molecule that meets the parameters. Once a molecule has been obtained, I will apply the oxidized fluorothiol to lysed red blood cells and use ^{19}F NMR to determine the reduction of the fluorothiol. I will then make a solution of fluorothiol and whole erythrocytes to attempt to get the fluorothiol to cross the cellular membrane and be reduced within the erythrocyte. I will quantify this reduction using ^{19}F NMR analysis. If this is successful, this methodology can be used to determine the redox potential of other cell types.

Title:

What does your budget make you?

Author's Name(s):

Mikela Marvin, Skyler Yarbrough, Sierra Chamberlin, Nikkita Blain

Department: *Mathematics, Southern Utah University*

Mentor(s): *Cecilia Weingartner*

Abstract

Purpose: We want to see what kind of student's budget, and the personalities and situations that attribute to those who budget.

Method: We will be conducting an online survey asking a series of questions dealing with personality types, life situations, and what is in a person's budget. **Population:** SUU Students.

We expect to see that college students who tend to be more analytical are more likely to budget. Also we are looking at different personality traits and expect to see that those who are more introverted, organized, are financially independent to be those who prioritize budgeting in their life. We also are comparing those students who don't budget and their stress levels.

Title:

Palladium-Catalyzed Suzuki-Miyaura Cross-Coupling Reactions of (*E*)-Styrylboronic Acid Pinacol Ester with Aromatic Bromides

Author's Name(s):

Marcus C. Mifflin, Hailee Rau and Nathan S. Werner, Ph.D.

Department: *Physical Science, Southern Utah University*

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

Abstract

The alkene functional group is commonly found in many important organic molecules. The restriction to rotation of a carbon-carbon double bond leads to isomeric molecules that can have similar physical properties and can be difficult to separate by conventional techniques. Therefore, it is important that synthetic reactions produce one alkene isomer in excess to avoid a potentially difficult separation. Here we present our study of the stereospecific palladium-catalyzed Suzuki-Miyaura cross-coupling reaction of (*E*)-styrylboronic acid pinacol ester with aromatic bromides.

Title:**Brian Head Fire: Affects of Fire on Aquatic Ecosystems.****Author's Name(s):***Lauren Nickell, Nayla Rhein***Department:** *Biology, Southern Utah University***Mentor(s):** *Fredric R. Govedich, Ph.D., Carrie-Jo Bucklin, Ph.D., Bonnie Bain***Abstract**

The Brian Head fire, which began due to human action in June 2017, quickly wrecked havoc in the western corner of the Dixie National forest. It covered roughly 72,000 acres of land¹. The full impact of the fire have yet to be discovered, but there is an urgent necessity to evaluate the drastic changes to the ecosystem. In this study, we aim to look into variations in water chemistry of two streams crossing the Brian Head burn scar. We will conduct weekly monitoring of the pH, dissolved oxygen, water velocity, temperature, and turbidity. Our two sites are located on along the Second Left Hand Road, in Middle Creek and Parowan Creek. Our goal is to evaluate how the fire affects these streams not only through ash deposits but flooding and erosion as well. Water velocity and turbidity will be more reflective of punctual episodes of flash flooding that have occurred on multiple occasions in the Parowan area since the fire. We can see that the road and the stream banks have already been significantly altered, our study will allow us to have a deeper understanding of how the fire affected the area and its ecosystem. Future studies will include and biological assessment through the invertebrate community of the streams.

1 (2017, June 18). Brian Head Fire. InciWeb. Retrieved from www.inciweb.nwcg.gov

Title:**Stripping Supported Lipid Bilayers****Author's Name(s):***Michael Ornstead***Department:** *Physical Science, Southern Utah University***Mentor(s):***Chris Monson, Ph.D.***Abstract**

Lipid membranes are a necessary component of living things. In addition to keeping the contents of a cell separate from the environment, they play a major role in intracellular signaling, drug action, nutrient absorption, and metabolic pathways. A problem facing scientists researching biological lipid membranes is that some of the components are sensitive to changes in conditions and can lose their functionality when purified. One proposed method around this problem is to separate the components in a supported lipid bilayer, an environment that is very similar to a cell membrane, before carrying out analyses. This presentation is focused on a method for repackaging supported lipid bilayers into lipid vesicles, which may have an application for use with supported lipid bilayers after a separation has occurred. The method used is flowing buffer at a high rate over a supported lipid bilayer, causing stripping of the bilayer to occur.

Title:**Synthesis of Alcohols from Epoxides Using Visible Light****Author's Name(s):***Christopher Ozeretny and Nathan S. Werner Ph.D.***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Nathan S. Werner Ph.D.***Abstract**

An alcohol is any compound that contains a hydroxyl functional group (–OH) attached to a carbon atom. Alcohols are widely found in nature, and can be prepared from epoxides. Typically, highly acidic or basic conditions are used when alcohols are synthesized from epoxides by a ring-opening reaction. However, these harsh conditions can destroy other sensitive functional groups contained in complex molecules. Here we present our work on the synthesis of alcohols from epoxides with visible light.

Title:**A new gigantic sea spider in the genus Colossendeis****Author's Name(s):***Jordan Parker, Fredric R. Govedich, Ph.D. and Bonnie Bain***Department:** *Biology, Southern Utah University***Mentor(s):** *Fredric R. Govedich, Ph.D.***Abstract**

Pycnogonids or sea spiders are a small group of marine chelicerate arthropods (90 genera, 2,000 species). The genus *Colossendeis* contains the largest pycnogonids (leg spans up to 70 cm) which are found in very deep water and also near shore in shallower water in the polar regions. We have a number of specimen lots of *Colossendeis* sp. borrowed from the Smithsonian Institution, National Museum of Natural History and are in the process of determining whether or not any of them are new species. All are labeled as *C. colossea*, but after an examination of the type specimens for this species, it is apparent that many of these specimens could be new species. Currently, we are examining USNM 69522, a specimen lot which contains two adults and a number of juveniles of different sizes. The project includes examining the specimens under a microscope, photographing them and documenting their morphology, measuring the trunk and appendages with the program, ImageJ, and then comparing the results with the type species. Morphological structures to be examined include proboscis and mouth, eyes and eye tubercle, pedipalps, ovigerous legs and ovigerous leg spines on segments 7-10, and the walking legs.

Title:**Developing a cheap and efficient DNA purification method****Author's Name(s):***Bryan Pearson***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Elizabeth Pierce, Ph.D.***Abstract**

Microorganisms incorporate molybdenum into cofactors in enzymes that are used in basic reactions in sulfur, carbon, and nitrogen metabolism. We are interested in studying two molybdoenzymes that should be common in soil microbes, sulfite oxidase and aldehyde oxidoreductase. Specifically, we would like to compare different versions of these enzymes from microbes that grow in different environments. To make these enzymes in the lab, we will use polymerase chain reaction to copy genes from the microbes' genomic DNA, and we will insert the gene copies into small circular DNA molecules called plasmids. The plasmids will be propagated and our proteins will be produced in a strain of bacteria that is easily grown in the lab.

For this project, we need to be able to purify genomic DNA from environmental samples and plasmid DNA from our laboratory host. DNA purification techniques typically used in biochemical labs involve expensive kits. These kits use proprietary technology, but are mostly based on the binding of DNA to silica membranes. Older purification methods are cheaper but require hazardous chemicals. We are optimizing a silica gel purification procedure that uses minimally hazardous reagents that can be purchased cheaply. This method makes use of high salt concentrations that favor DNA binding to silica so that contaminants like proteins and solubilized agarose can be removed.

Title:**Homologous molybdoenzymes from different environments****Author's Name(s):***Alex Peterson***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Elizabeth Pierce, Ph.D.***Abstract**

Organisms have evolved in order to survive in a variety of environments. Specifically, their proteins have changed over time to become more stable in their specific environment. In this project we will be comparing two proteins, sulfite dehydrogenase and aldehyde oxidoreductase, that are found in bacteria that grow in various environments, including thermophilic, acidophilic and halophilic bacteria. Our goal is to identify the changes in these protein sequences that allow for these organisms to survive in different environments.

Title:**Caffeination effects on Sleep****Author's Name(s):***Kaitlyn Peterson, Jasmine Webb, Raegan Urquidez, Andy FLody***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Together as a group we had the question of whether or not caffeine has a direct correlation to one's sleep pattern. To test our hypotheses we created a survey with multiply questions related to caffeine (how much one drink, how often, why one drinks it) and multiple questions on sleep and activity (how much sleep one gets, how many naps one takes, if one stays up late or goes to bed early). We will then analyze our data to create charts and graphs to accurately represent our data and further explain our research. Through our experiment we will be able to conclude on our data and create multiple hypothesis and have multiple ways to explain our data to make an efficient project we can all learn from.

Title:**Is Social Media Killing us?****Author's Name(s):***Jordan Porcaro, Matt Boucher, Tyler Priest, Conner Thornton***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

Our research question involves social media and how excessive use may affect health in a negative way. We chose this path because we would like to see how social media affects college student's physical health. We believe that college students that use social media to an excessive amount will experienced a lower self-image, joint pain, and other negative health effects. We will reach as many students as we can through email and other online forms of communication throughout Utah.

Title:

Effect of Salinity on Hatching of *Branchinecta lindahli*, Packard 1883.

Author's Name(s):

Nayla Rhein and Fredric R. Govedich, Ph.D.

Department: *Biology, Southern Utah University*

Mentor(s): *Fredric R. Govedich, Ph.D.*

Abstract

The effect of salinity on hatching rates of *Branchinecta lindahli*, Packard 1883, was examined using five salt (NaCl) concentrations ranging from 0 g/L to 4 g/L (N = 18). A significant negative relationship ($p=7.03 \times 10^{-3}$, $R^2 = 0.522$) was found between salt concentration and the number of fairy shrimp hatched. This supports other studies looking at hatching cues as a survival mechanism of fairy shrimp in ephemeral habitats. The avoidance of abortive hatching suggests that fairy shrimp do use a bet-hedging strategy that allows them to survive and persist in temporary wetlands. Salinity is most likely a hatching trigger used in that strategy.

Title:

Exploring the Fundamental Light-Harvesting Properties of Nature's Pigments

Author's Name(s):

Kelsey Rico, Clayton Staheli, Emily Huffman, and Jacob C. Dean

Department: *Physical Science, Southern Utah University*

Mentor(s): *Jacob C. Dean*

Abstract

The pigments responsible for capturing and transporting solar energy in natural photosynthesis are ubiquitous in Nature. In fact, the green color we see in plants and most algae across the planet is due to Nature's use of only a few types of molecules which serve as light-harvesters in photosynthesis. Namely, the tetrapyrrole class of molecules, such as chlorophyll and bilins, are found as primary pigments for almost all photosynthetic organisms and across highly diverse ecological contexts. In order to address the highly conserved use of these molecules as Nature's favorite sunlight harvesters, we propose to investigate the fundamental light-harvesting properties of tetrapyrroles from the bottom-up. To do this, we will perform UV-vis absorption, fluorescence, and IR spectroscopy on several series of individual pyrrole subunits, and di-pyrrole units which make up natural pigments. These experiments in conjunction with high-level molecular calculations will yield insights into those chemical properties that enable the high efficiencies of sunlight capture by natural pigments.

Title:

Prevalence of Malaria in the New World: Supporting Benjamin Rush's Hypothesis

Author's Name(s):

Agueda M. Rodriguez and Samuel A. Wells, Ph.D.

Department: *Biology, Southern Utah University*

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

Abstract

Malaria, literally meaning “bad air” associated with brackish and otherwise foul-smelling water, was until relatively modern times a disease of both tropical and temperate climes. In 1785 New England physician, Benjamin Rush wrote a short essay on the causes of the disease in the American colonies. The essay, “An inquiry into the causes of the increase of bilious and intermitting fevers in Pennsylvania”, is less than 2,000 words long and presents an ecological argument for mitigating the spread of a disease that wasn't clearly understood at the time. Rush believed the disease arose from “mill-ponds”-reservoirs of water that power mills of various kinds. Most of his contemporaries, however, following the traditions of the Old World, where intermittent fevers were associated with brackish water, ignored his important observation. Because mosquitoes were not known to vector the disease until the end of the 19th Century, the ecological differences between the Old World and the New World species went un-noticed, along with Rush's insights. Our focus is the demographic ecology of malaria in the American Colonies. Through literature review including the identification of counties with high levels of mill ponds, maps of malaria by county, and anecdotal documented cases, we were able to construct a clearer image of the association between malaria and mill ponds, thus supporting Rush's Hypothesis.

Title:**Post-College Survival Guide****Author's Name(s):***Cedric Rupa, Jakob Furhiam, Ally Carlisle***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

This research study will focus on the differences between student athletes and non-athletes at Southern Utah University. The information gathered will aim to highlight the differences between athlete and non-athletes regarding the essential life skills of time management, social skills, stress management and budgeting. A survey was conducted to try and find whether student athletes are more prepared for post-college life because of their time management skills having to cope with the demands of athletics and academics and because they work in a team environment more often. Questions were also asked about job experience, stress levels and life structure to see whether the life of an athlete can be adjusted to 'real life' after college and to see whether a normal student might have an advantage because they had time to have a job and are not always told what to do. Questions were also asked about budgeting which the authors discerned as an important life skill.

Title:**Phone Epidemic****Author's Name(s):***Alexis Sargent, Ethan Smith, Stacy Soto, Xiyan Ding***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Nowadays, many people discuss and argue about what type of cell phone is better. We want to find out why this is so important. Different phones contain different functions such as iphones have good color processing which is useful in the aspect of design while Samsung phones don't break as easily as other phones. We believe that different majors might prefer different brands of phones, design majors probably like to use iphones due to the better color processing while engineering majors might use Android because of the longer battery life.

Cell phones have become a significant part of the culture of our generation. Social media apps play a large role in our social lives by making it our main form of communication. People our age constantly use their phones as a source of entertainment and other importance. Today, our generation depends on everything to be instant. Instant news, information, and communication (including instant messaging).

We are investigating what kind of phones college students are using, what benefits their phone contains, and how satisfied they are with their phone. We are also seeking to know what specific functions they like, and how they use their phones.

Title:

Synthesis of Alkyl-Substituted *trans*-Alkenes by Palladium-Catalyzed Cross-Coupling Reaction

Author's Name(s):

Mason Smith and Nathan S. Werner, Ph.D.

Department: *Physical Science, Southern Utah University*

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

Abstract

The alkene (C=C) is an important functional group that is found in many interesting and useful organic molecules. The palladium-catalyzed Suzuki cross-coupling reaction is a general, mild, and high yielding method to produce *trans*-alkenes of defined geometry. Here we present our work on the Suzuki-Miyaura cross-coupling reaction of alkyl-substituted alkenyl boranes with aromatic bromides. The goal of this project is the development of a general method for the synthesis of alkyl substituted *trans*-alkenes in high yield and isomeric purity.

Title:**The Life Behind the Blonde****Author's Name(s):***Kyndra Sorenson, Brittany Blakely, Kylee Wharton***Department:** *Mathematics, Southern Utah University***Mentor(s):***Cecilia Weingartner***Abstract**

Does hair color affect personality, or have an effect on how a person is treated? How does natural hair color influence a person's behavior? Does hair color have any influence on how well a person does in school or how easily they make friends? To find answers to these questions, over 100 SUU students were surveyed. The survey focused on questions related to hair color, personality, school work, and popularity. The researchers expect to find little to no influence of hair color on any other aspect of life.

Title:**Welcome to SUU!****Author's Name(s):***Josalyn Stacey and Sarah Tullis***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

In this project, our group decided to survey students on the effectiveness of Welcome Week events that occurred at Southern Utah University and how the events affected how they adjusted. We are also surveyed how well attended these Welcome Week events were. The research was conducted through an online survey. This research is important because it will help Southern Utah University know how to better help their students adjust. In conclusion, this research will impact both the students and faculty at SUU as well as Welcome Week.

Title:**So You Think You're a Southpaw?****Author's Name(s):***David Tapia, Gavin Stapley, Shantel Galindo, Nick Petersen, Rylan Anderson***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

According to studies, it is proven that brain asymmetry is associated with functions such as left-brain specializations and right brain specializations. Although we use all four major sections of our brain, some functions are stronger than others, thus making us right or left brained dominated. Dominant hands may correlate with what side of the brain is dominant. So if you are left handed it may correlate with the right side of the brain, making a person more artistic; if you are right handed, it may correlate with the left side of your brain making a person more logical. Handedness is partially genetically controlled, but cognitive and emotional feelings can override gene responsibility and cause them to have no correlation. Our group is testing to see if dominant hands really reflect the dominant side of the brain and its functions.

For our experiment we will survey people who are left handed or right handed. Our questions will test what side of the brain is more dominant and if it correlates with what hand they are most dominant with. The correlations may affect what type of personality they have. After the experiment we will analyze our results and see if there is any correlation.

Title:**The Cosmological Origins of Water****Author's Name(s):***Morgan Taylor and Alex Gagliano***Department:** *Physical Science, Southern Utah University***Mentor(s):** *Joseph Smidt, Brandon K. Wiggins, Ph.D.***Abstract**

Evidence suggests that water in the solar system originated prior to the formation of the sun's protoplanetary disk. It is now believed that the early universe may have had the conditions necessary to form water. The detection of water masers in star-forming regions has suggested that water is present throughout the universe (Lo et al., 1975), but its origins have not been computationally studied. In this project, cosmological simulations were run on a 64 *Mpc* box of space from $z = 200$ to $z = 2$. (The z values represent redshift, which is a way to measure time. Larger values correspond to earlier periods in the universe's history, where smaller values correspond to later periods.) Regions with conditions conducive to water formation are isolated, and a 26-species reaction network is run on a single galaxy in the simulation. The results show significant water formation ($[n_{H_2O}/n_H] > 10^{-8}$) at the shock fronts in the spiral arms, as well as regions conducive to H_2O at a cosmological scale. Further analysis needs to be done in order to couple the reaction network with the full simulation to verify and quantify water formation in these regions.

Title:**The Luxurious Life? Featuring Students and Athletes****Author's Name(s):***Robert Torgerson, Josh McMillin, and MaKade Maloy***Department:** *Mathematics, Southern Utah University***Mentor(s):** *Cecilia Weingartner***Abstract**

Subject: College Lifestyle Differences between student-athletes and regular students.

Population: Southern Utah University students

Summary: We are excited to be able to study the academic successes and challenges for students and student-athletes. For our project we would like to compare the lifestyles of the typical student and student-athletes at Southern Utah University. Through previous years, many individuals have thought that student-athletes have been given unfair academic advantages and that they primarily attend school so they can continue their career in sports. Also, many believe the compensation of scholarships is not fair as well. With our research we hope to be able to answer some of these topics. To achieve this we will conduct a survey that will include various questions tailored to how much time is spent at school, how much social time you typically have, and so forth. The survey will be administered on campus and all answers will be recorded.

Title:**Orthorectification of Thermal Imagery for Live Fires****Author's Name(s):***Michaela Truman, Benjamin Smith and David Maxwell***Department:** *Physical Science, Southern Utah University***Mentor(s):** *David Maxwell, Jeff Obering***Abstract**

A process to provide thermal imagery data to the National Forest Service to better understand the behavior of wildfires in order to improve firefighting techniques and forest health. In this process, an active fire call is received issuing X, Y coordinates for the area of a fire. A flight plan is devised for the Pilot and Flight Sensor Technician (FST) based on the given coordinates. The Image Technician initializes the camera and programs while in flight and, after reaching the fire site, begins to collect imagery and data of the wildfire.

While the plane is in route to the fire the fire processing office and the Geographic Information System Image Technician (GISIT) collects associated Digital Elevation Images. Mosaics are then imaged together for later use in the process. After the imagery and data are collected and while the plane is landing, the FST sends the collected data to the GISIT for processing. The images are extracted, processed, rectified, and mosaicked to produce a finalized image to show active fire areas, hot spots, and the burn scar. This information is then passed on to a Research Ecologist and an Information Technology Specialist for further analysis.

Title:***Wolbachia* Infection Rates in Southern Utah Ants****Author's Name(s):***Logan Tuttle, Laurie Mauger Ph.D., Carrie Jo Bucklin Ph.D., Sam Wells Ph.D.***Department:** *Biology, Southern Utah University***Mentor(s):***Laurie Mauger, Ph.D.***Abstract**

The study of endosymbionts has become an important field of study because it allows us to better understand the effects bacteria have on their eukaryotic hosts. Once such endosymbiont, bacteria from the genus *Wolbachia*, has piqued the interest of scientists when it comes to the role they play in arthropod populations. *Wolbachia* are a group of maternally inherited, intracellular bacteria that infect many species of arthropods and some other invertebrates. They are exclusively found in the reproductive tissues and can cause reproductive alterations in infected hosts. Understanding the function of *Wolbachia* provides important knowledge about reproductive trends, population structure, and genetic diversity. Various studies have been performed around the world to determine infections rates but little is published about the presence of *Wolbachia* in Southern Utah and the surrounding region. Therefore, this research is designed to determine *Wolbachia* infection rates in ant species in Southern Utah and to determine if infection rates are similar to other locations which have been studied. Individuals across multiple ant genera will be isolated and diagnostic PCR will be used to verify the presence of *Wolbachia* in extracted DNA. Infection rates will then be determined and compared between ant genera and location.

Title:

Incorporating Applied Research with Student Organization Funding

Author's Name(s):

Randall D. Violet, Ph.D.

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

Mentor(s):**Abstract**

Fund raising is a constant challenge for University Student Organizations (SO) especially in communities where resources are limited and the population is less than 30,000 people. An innovative remedy to this funding challenge is to incorporate the SO into research proposals. The purpose of this poster is to illustrate and share a research project that lent its self to a large labor requirement. To resolve organizing and hiring all the labor the PI hired the Natural Resource/Range Management Club of Southern Utah University. The members of the club then developed a bid and performed the work for the agreed upon bid. This project fostered an educational experience into a fund raiser for the club. Many of the members that participated in the project have developed an interest in conducting undergraduate and graduate research. The club has used the funding from this project to help defray expenses to attend professional society meeting. This has been a win, win project and the club now has a reputation of doing quality work and has been approached to complete some other projects.

Title:

Shut up and drive.

Author's Name(s):

Camron Webster, Colten Warren, Jake Taylor, AJ Diaz.

Department: *Mathematics, Southern Utah University*

Mentor(s): *Cecilia Weingartner*

Abstract

What we really wanted to see from this study is to see people's stereotypes of certain drivers and their ethnic and age driven background to see who people thought were the best and worst drivers out there. We also asked for personal opinions about how people react to distractions and stop signs.

Title:**Collection and Identification of Macroinvertebrates in and around Montezuma Well****Author's Name(s):**

Rebecca Beresic-Perrins (NAU), James Boothroyd (NAU), Chris Wirth (NAU), Kim Whitely (NAU), Tina Greenawalt (NPS Montezuma Castle NM), Bonnie Bain (SUU), Fredric R. Govedich, Ph.D., Samuel A. Wells, Ph.D., William H. Heyborne, Ph.D., and Stephen Shuster (NAU)

Department: *Biology, Southern Utah University*

Mentor(s): *Fredric R. Govedich, Ph.D., Samuel A. Wells, Ph.D., William H. Heyborne, Ph.D.*

Abstract

We conducted a Bioblitz at Montezuma Well May 20th and 21st 2016, in collaboration with the Montezuma Castle National Monument for their Centennial celebration. Montezuma Well's unique water chemistry has made it an area of intense study in the Southwest, but only its plant and vertebrate life have been fully cataloged. This event provided an opportunity for our group to fully survey the invertebrates living in this national park. We collected and identified on-the-spot or in the laboratory, terrestrial and aquatic macroinvertebrates from the cave (N=9), meadow (N=65), irrigation ditch (N=53), outlet (N=198), Beaver Creek (N=104), and picnic area (N=15). Our collecting methods included the use of beating sheets, light traps, aspirators, nets, and hand collection. We preserved specimens in 70% or 95% ethanol and took pictures of them in the field and in the laboratory. We collected over 620 samples which have been identified to some 24 orders in 4 phyla; three Annelida, one in Platyhelminthes, 18 in Arthropoda, and two in Mollusca.

Title:**The role of Multiple Stimuli in Short-term Memory Retention****Author's Name(s):***Trevor Zollinger***Department:** *Biology, Southern Utah University***Mentor(s):** *Helen C. Boswell, Ph.D. and Mary Jo Tufte***Abstract**

Short-term memory retention in individuals may be either positively or negatively influenced by the amount of stimuli available for processing. When asked to memorize text information in a particular sequence, introducing two forms of stimuli may result in an increase in the recollection of the sequence of random text patterns. In this proposed study, I will provide participants with varying colored slides in a random sequence and have them recall what order the slides are in after presenting the entire sequence. I will measure the accuracy of the sequence that participants can recall across three randomized lists. I hypothesize that the use of more than one simultaneous sensory input (color and text) will increase the ability of participants to recall short-term patterns. The goal of this experiment is to determine the magnitude of the role that multiple sensory inputs have in short-term memory retention.

Title:

Assessing Geothermal Energy Potential in Southern Utah Using the Trace Element Chemistry of Granitic Intrusions

Author's Name(s):

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Abstract

Enhanced Geothermal Systems (EGS) have been recognized by geothermal energy experts as a very large potential alternative energy source to help meet growing energy demands. The benefits of EGS are vast, not solely limited to energy production alone, that can be exploited for industrial and residential purposes. This project aims to advance the development of geothermal systems by analyzing the major and trace element geochemistry of the Mineral Mountains in Utah to determine the cause of the elevated geothermal gradient and consequent favorable geothermal setting of the region. The Roosevelt Geothermal Area is a designated geothermal resource area surrounding the Mineral Mountains. Additionally, a deep EGS experiment laboratory, the Frontier Observatory for Research in Geothermal Energy (FORGE), has been proposed for placement within the geothermal area. Samples were taken across competent outcrops of the major granitic units in the Mineral Mountains and analyzed by XRF. Radiogenic heat generation produced by decay of the unstable isotopes ^{238}U , ^{232}Th , and ^{40}K in Tertiary granites has been calculated from XRF and the results are favorable in certain units. Average radiogenic heat production at the surface is 2.86 microwatts/m³ with several units approaching or slightly exceeding 4 microwatts/m³. The strongly speculated presence of an active magma chamber in the region combined with favorable amounts of radioactive heat decay in granitic plutons are very likely the sources of heat in the Mineral Mountains.