

2017 Undergraduate Research Symposium



In partnership with

SOUTH DAKOTA



SCHOOL OF MINES
& TECHNOLOGY

Ramkota Hotel - Pierre, SD

August 2-3, 2017

**South Dakota Undergraduate Research Symposium
Ramkota RiverCentre Conference Center
Pierre, SD
August 2-3, 2017**

*All times are listed as Central Daylight Time

Wednesday, August 2

Faculty Workshop

1:00-4:30 pm

Next Generation Sequencing Workshop (Gallery D)

Student Sessions

1:00-2:30 pm

First Breakout Session

• ***Ins and Outs of Medical/Health Professional Schools (Gallery E)***

Moderator: Dr. Mark Larson, Augustana University

Panel: Dr. Paul Egland, Augustana Chief Health Professions Advisor; Dr. Charles Lamb, BHSU
Chief Health Professions Advisor

• ***Applying for Graduate School (Gallery B, C)***

Moderator: Dr. Brian Logue (SDSU)

Panel: Dr. Mike West (SDSMT), Dr. Grant Crawford (SDSMT), Dr. Jon Kellar (SDSMT),
Dr. Stan May (USD)

2:30-3:00 pm

Break

3:00-4:30 pm

Second Breakout Session

• ***STEM Career Opportunities in South Dakota (Gallery B,C)***

Moderator: Dr. Melvin Ustad (SD GOED)

Panel: Mark Anderson, SD Department of Labor; Kenna Hagan, Black Hills Energy; Pam Hilber,
Avera Health; Heather Perry, Director of Policy and Special Projects, SD Bureau of
Human Resources; Penny Sattgast, President, PCS Biotech Services;
Matt Smart, Smart Software Solutions

4:00-5:30 pm

Faculty Scientific Sessions - BRIN Faculty (Lake Francis Case)

4:30-5:30 pm

Site Visit Grad Poster Set Up (Discovery Center)

5:30—7:00 pm

Dinner

Keynote Presentation - Dr. Giselle Muller-Parker (NSF) (Gallery A,F,G)

7:00-8:00 pm

Site Visit Poster Presentations and Review (Discovery Center)

7:30-9:00 pm

Collaborative Networking Groups - BRIN (Gallery A,F,G)

Thursday, August 3

7:30-8:30 am	Breakfast With a Scientist (Gallery A,F,G)
8:30-9:00 am	First session poster presenters set up posters
9:00-11:00 am	Poster Session #1 (Gallery B,C,D,E) Graduate Student Recruiting Fair
11:00-11:30 am	Poster takedown
11:30am-12:30 pm (Second session poster set up starting at 12:30 pm)	Lunch
1:00-3:00 pm	Poster Session #2 (Gallery B,C,D,E) Graduate Student Recruiting Fair
3:00-3:30 pm	Picture of the conference attendees, Poster takedown, judging time
3:30-3:45 pm	Award announcements/Meeting Adjourns
3:45-5:00 pm	BRIN Student Program Assessment
3:45-5:00 pm	BRIN faculty Meeting Time

Panel Session Descriptions

• *Ins and Outs of Medical/Health Professional Schools*

Moderator: Dr. Mark Larson, Augustana University

Panel: Dr. Paul Eglund, Augustana Chief Health Professions Advisor; Dr. Charles Lamb, BHSU
Chief Health Professions Advisor

Many students doing research in South Dakota have an interest in Medical School or other health professions. However, what does the process of getting into Medical School look like? And how can you leverage your experiences in research as you assemble your application materials and prepare for this vocation? This workshop will walk you through the basics of Medical School admission, matriculation, and the training beyond the MD degree. It will also show you how to make use of your research skills along the way, and help you start honing your ability to convey your understanding of the field and how you fit into it.

• *Applying for Graduate School*

Moderator: Dr. Brian Logue (SDSU)

Panel: Dr. Mike West (SDSMT), Dr. Grant Crawford (SDSMT), Dr. Jon Kellar (SDSMT), Dr. Stan May (USD)

A panel of faculty who are members of their university graduate admission committees will provide an overview of the characteristics of an outstanding CV and personal statement that are required parts of a graduate school application. The workshop requires some homework. Participants need to send a copy of their CV and a personal statement (which is much like the personal statement you prepared as a part of your REU application) to Dr. Brian Logue (Brian.Logue@sdsu.edu). The panel's faculty members will critically review each student's materials as if we were looking at them as part of an application packet for their universities. The remainder of the session after the panel will be small breakout groups where faculty will return the CV/personal statements that they have evaluated and discuss them with the students to help them improve it prior to its inclusion as a part of an actual graduate school application. Please note, participants should be willing to have their CVs and personal statements (good, bad, or ugly) shared with the other REU participants.

• *STEM Career Opportunities in South Dakota*

Moderator: Mel Ustad (SD GOED)

Panel: Mark Anderson, SD Department of Labor; Kenna Hagan, Black Hills Energy; Pam Hilber, Avera Health; Heather Perry, Director of Policy and Special Projects, SD Bureau of Human Resources; Penny Sattgast, President, PCS Biotech Services; Matt Smart, Smart Software Solutions

South Dakota has a vibrant growing economy with businesses that need employees with STEM skills. It has a relatively low unemployment rate so the industries in this sector are always actively recruiting and hiring students with hands-on STEM experience; in effect, students who've done undergraduate research or had an internship experience (like you now have!). This workshop will help you understand South Dakota's STEM career opportunities, raise awareness of what skills employers are seeking, and learn how to find these job opportunities.

Keynote Presenter



Dr. Giselle Muller Parker joined NSF as Program Director for the Graduate Research Fellowship Program in October 2008. From 2004-2006 she served as Associate Program Director at NSF in GEO, Division of Ocean Sciences, Ocean Education Program, as a rotator from Western Washington University. She was Professor of Biology at Western Washington University from 1990-2010, where she taught courses in marine biology, symbiosis, and botany and served as the Assistant Director of Shannon Point Marine Center. She received degrees from SUNY at Stony Brook (BS in Biology), the University of Delaware (MS in Marine Studies), and UCLA (PhD in Biology). She has served on the editorial boards of the Biological Bulletin, Coral Reefs, and the Journal of Phycology. Her research on algal symbiosis in sea anemones and corals has engaged many undergraduate and graduate students.

Ins/Outs of Medical/Health Professional Schools

Moderator:



Dr. Mark Larson is an Associate Professor and the Chair of the Biology Dept. at Augustana University. He received a BA in Biology and Chemistry from Concordia College (Moorhead, MN), and a PhD in Pharmacology from the University of North Carolina at Chapel Hill. He did further postdoctoral training at the Centre for Cardiovascular Sciences and the University of Birmingham, United Kingdom. He has been teaching at Augustana since 2006, and has taught numerous students on their way to Medical School.

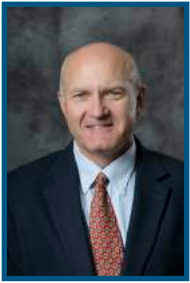
Panel Members:



Dr. Paul Egland is an Associate Professor of Biology and Chair of the Natural Science Division at Augustana University. Egland earned his Ph.D. in microbiology from the University of Iowa, and completed a postdoctoral fellowship in the National Institute for Dental and Craniofacial Research at the National Institutes of Health prior to joining the faculty at Augustana in 2004. He teaches general and introductory microbiology classes, and his research interests lie in the area of bacterial communities. Egland has served as the Chief Health Professions Advisor at Augustana since 2006 and is a member of the National Association of Advisor for the Health Professions.

STEM Career Opportunities in South Dakota

Moderator:



Dr. Melvin Ustad, Director of Commercialization at the Governor's Office of Economic Development, has extensive experience leading collaborative interdisciplinary public private research and economic development projects. He has served or currently serves on the Board of Directors of numerous national and state technology entrepreneurship organizations. Dr. Ustad has been an active researcher serving as principal investigator on numerous research and outreach projects supported by various federal agencies and private foundations.

Panel Members:



Mark Anderson has been with the SD Dept. of Labor and Regulation serving in various roles for over 26 years, most recently as the Manager for the Pierre and Winner offices. Mark graduated from Sisseton H.S. and received BS degrees at USD for Organizational Psychology and Speech Communication.

Mark also serves on local boards (Chairman- Pierre Economic Development Corp., Pierre and The Right Turn Inc.) and served on the following groups: the Governors SD WINS Subcommittee, River City Transit Board, as well as the recently dissolved Local Workforce Council. Mark has also volunteered in the past as a hockey coach and football coach.



Heather Perry is the Director of Policy and Special Projects for the State of South Dakota's Bureau of Human Resources. In this role, she oversees communications for the South Dakota State Employee Health Plan, which covers more than 26,000 employees; manages the bureau's strategic plan; and implements new initiatives. The Pierre resident served on the Governor's team to review Paid Time Off policies in 2016 and will be a member of the Governor's Leadership Development Program class this fall.



Penny Sattgast is President of PCS Biotech Services, LLC, which she founded in March of 2017. Prior to that, Penny worked for Elanco Animal Health and served as a Clinical Trial Study Director and Scientist. While working full time for Novartis Animal Health, Penny attended South Dakota State University in Brookings, SD where she earned a Master's degree in Biology in 2013. Penny has 14 years of diverse clinical trial management and laboratory experience in the biologics industry. Penny is a Harrisburg, SD native and now resides in Pierre along with her husband Rich, and 3 children: Claire, Chase, and Joshua.

Poster Presenter Locator

23a	Agnew Jr., Dennis	64a	Hedman, Jonathan	52p	Olvera, Selena
70p	Anderson, Lucas	83p	Heilman, Kevin	28p	Ostergren, Gwen
11a	Arens, Joshua	55a	Helmuth, Ralph	30a	Owens, Hannah
40a	Arnold, Adrienne	17p	Henning, Tanner	62a	Paulson, Delayna
48a	Austin, Shaylyn	5a	Hight, Marissa	6a	Peterson, Alexandra
14a	Benjamin, Haley	7a	Hollinsworth, Troy	57p	Pfaff, Branden
34p	Bieber, Andre	3a	Hora, Kirby	27p	Pickthorn, Taylor
71p	Black Feather, Tennille	62p	Hummel, Faith	61p	Picotte, Tristan
58p	Bogart, Chandler	84a	Husher, Sara	30p	Prouty, Mikayla
85a	Bortnem, Gage	7p	Iverson, Alissa	67p	Przelomski, Hannah Przelomski
22a	Bowen, Gregory	21a	Jenkins, Savannah	31p	Rauscher, Keyvin
64p	Brave Heart, Jessica	13a	Jenks, Olivia	17a	Red Eagle, Larissa
76p	Brett, Joseph	54a	Jennings, Ethan	8a	Reman, Bethany
63a	Brewer, Matthew	66p	Jennings, Ethan	79p	Rice, Logan
74a	Brunmaier, Laura	15a	Johnson, Hannah	72a	Riel, Megan
45p	Buchholz, Hannah	38p	Kane, Bailey	20a	Roetman, Jessica
29p	Byron, Jacob	23p	Kardelis, Gwyneth	68p	Roireau, Jack
51a	Carinder, Abigail	20p	Karki, Chandra	58a	Ruiz, Sebastian
39a	Carter, Cassandra	36p	Kesterson, Roy	34a	Runia, Alissa
56p	Carter, John	6p	Kittelson, Ashley	86p	Running Horse, Darian
32p	Casey, Chandler	50p	Kosola, Shelley	25p	Santore, Robert
49a	Catrillo, Danielle	41p	Krasky, Rebecca	65a	Savinov, Theodore
40p	Checchi, Anthony	65p	Kreutzmann, Sydney	69a	Schad, Sydney
19a	Cheek, Tesla	26a	Kujawa, Cody	16p	Schmidt, Emma
45a	Cheskie, Drew	22p	Kulas, Benjamin	78p	Schmidt, Emme
80p	Chov, Ashleigh	59p	LaBelle, Aleisa	59a	Seidel, Tyler
73a	Christensen, Colette	12a	Lang, Carl	82p	Selberg, Avery
46a	Citterman, Morgan	21p	Larson, Caitlyn	72p	Seongwan, Jo
31a	Closs, Evan	39p	Lauko, Anna	54p	Shouldis, Carmelita
14p	Curley, Sabrina	10p	Lawrence, Jack	78a	Shriver, Jackson
9p	Curry, Samantha	24p	Leavitt, Bailey	82a	Simon, William
71a	Damrauskas, Jonathan	32a	Levey, Jessica	29a	Smithee, Isaac
74p	Daniels, Sydnie	73p	Li, Shuai	24a	Snyder, Sarah
67a	Decker, Donald	52a	Lillig, Alexandra	44p	Sorensen, Collin
48p	Dekle, Ryan	27a	Lim, Megan	3p	Springer, Jesse
33a	Dolezal, Alexandra	35a	Liu, Taylor	81a	Stadem, Nathan
44a	Doss, David	60p	Lober, Katie	26p	Stevens, Katelyn
2a	Dowling, Courtney	66a	Lowrey, Olivia	37a	Stillman, Bailey
9a	Dyer, Jacqueline	53a	Lynn, Kriston	13p	Tarango, Estebanne
47p	Earle, Dakota	38a	Malik, Naveen	61a	Tobacco, Dylan
11p	Fanta, Claire	43a	Mammo, Joseph	83a	Travis, Meghan
37p	Farooq, Linta	8p	Marotz, Matthew	18a	VanLaecken, Allison
68a	Fisher, Trevor	16a	Masching, Hayley	57a	Vaverka, Samantha
53p	Flitner, Anna	63p	Massey, KaeLee	51p	Vazquez, Bethany
4p	Fortuna, Tyler	84p	Mech, Saryvoudh	60a	Venkatachalam, Ananth
4a	Fritsch, Luke	87a	Meek, Moses	28a	Weigel, Morgan
47a	Gallegos, Arthur	81p	Menard, Aryn	50a	Weldeselasie, Melat
55p	Garcia, Carolina	2p	Mikkelson, Mikenzie	15p	Wiley, Alex
79a	Garnette, Shawn	77p	Miller, Matthew	56a	Williams, Shaun
77a	Gettinger, Adam	76a	Minette, Carrie	33p	Williamson, Austin
49p	Giorgio, Katherine	10a	Moen, Erika	80a	Wilson, Patrick
19p	Graber, Katelyn	41a	Moore, Madigan	46p	Wixon, Nicholas
35p	Guillen, Manuel	85p	Moore, Karen	25a	Yonan, Leon
86a	Gunhammer, Shaunae	1p	Mriden, Paige	5p	Yoshida, Jacee
69p	Hamilton, Rick	75a	Muro, Jose	12p	Ziemer, Bethany
75p	Hanan, Desmond	42p	Nelson, Blaine	43p	Zvarick, Allison
18p	Hansen, Matt	70a	Newbrough, K'dyn		

2a - Nordic exercise testing protocol and hamstring injury prevention training program

Cortney Dowling (1)*, Shane Scholten (1)**, cadowling16@ole.augie.edu
(1) Augustana University, (2) Black Hills State University

Abstract: Introduction: Athletes involved in rigorous movements are highly susceptible to hamstring injury which may be prevented by elongating and strengthening the muscle. Purpose: To develop a testing protocol for the Nordic exercise and implement a training protocol with the intent to reduce hamstring injury. Methods: Hamstring specific strengthening and ROM exercises were implemented into a summer lifting program of 29 high school male athletes. Exercises were assessed via videography. Results: Pearson Correlation Coefficient revealed strong inter-tester correlations for the Nordic exercise ($r = 0.82$). Comments from the athletes and coaches were favorable regarding the addition of exercises. Conclusion: While subjectivity limits the measurement of the Nordic exercise, it is feasible to assess eccentric hamstring strength and implement a strengthening and ROM training protocol by making minor adjustments to a pre-existing program.

BRIN - Augustana University, BRIN - Black Hills State University, BRIN - University of Sioux Falls

3a - Ovarian cancer cell exosome isolation with quantitative and biochemical analysis for interactions with platelets

Kirby Hora (1)*, Tania Rodezno (1), Katelyn Graber (1), Sarah Stein (1), Mark Larson (1)**, kahora14@ole.augie.edu
(1) Augustana University

Abstract: Ovarian cancer (OvCa) is the deadliest gynecologic cancer and the 7th leading cause of cancer deaths in women. OvCa can metastasize without the aid of the circulatory or lymphatic system by traveling through the peritoneal fluid (ascites), adhering to the mesothelial lining, and spreading to neighboring organs. Furthermore, OvCa tumors have the ability to hijack platelets as a means to evade immune responses and medicinal therapies. Recently, a novel tumor cell surface protein, SUSD2, was correlated with increased OvCa survival rates, as well as lowered platelet adhesion. Given the relatively minimal levels of platelets in the ascites, we hypothesized that OvCa cells interact with platelets distally by releasing exosomes into the ascites and that exosome-platelet interaction can be inhibited by abundant SUSD2 presence on the tumor cells. Our initial results suggest a mechanistic role of SUSD2 in exosome production, and possible exosome-platelet communication.

BRIN - Augustana University

4a - A Comparison of Exercise versus Estradiol for Preventing Type 2 Diabetes

Luke Fritsch (1)*, Brittany Gorres-Martens (1), Brittany Gorres-Martens (1)**, ljfritsch16@ole.augie.edu
(1) Augustana University

Abstract: Post-menopausal women are at a greater risk for type 2 diabetes (T2D) compared to pre-menopausal, and hormone replacement therapy can ameliorate this risk. Exercise is a known treatment for decreasing one's risk for type 2 diabetes, but the extent to which exercise versus estradiol can prevent T2D remains unknown. Female Wistar rats were ovariectomized and consumed a high-fat diet (60% kcal fat; HFD) for 10 weeks. The control group received no treatment, while the other rats were subjected to a treatment of exercise (Ex), estradiol (E2), or Ex+E2. At the end of the study, the rats were subjected to a glucose tolerance test (GTT) and blood was also collected to measure serum insulin levels during the GTT. The amount of abdominal adipose tissue was also measured. The following data will be presented: body weight, adipose tissue weight, food consumption, blood glucose levels, and serum insulin levels.

SD EPSCoR/BioSNTR

5a - Antifungal Properties of Fluoxetine (Prozac) Derivatives Against Trichophyton mentagrophytes

Marissa Hight (1)*, Dr. Cynthia Anderson (1)**, mnhight15@ole.augie.edu
(1) Black Hills State University

Abstract: Dermatophytes, such as Trichophyton mentagrophytes, are commonly found fungi that can attack keratinized tissue such as skin, nails, and hair leading to various tinea infections including athlete's foot and ringworm. With resistance forming against commonly used Azoles, and other treatments being too toxic, there is a great need for safe alternatives. Fluoxetine, available under the brand name Prozac, is an anti-depressant that has been shown in literature to have anti-fungal properties with no cytotoxicity or mutagenic effects on mammalian cells. Eleven derivatives of this compound, along with fluoxetine, were tested on two T. mentagrophytes strains. Through assessment of the Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) two Fluoxetine derivatives, N-Methyl-Fluoxetine HCL salt and N-Methyl-Fluoxetine, were found to be most effective. An experiment with N-Methyl-Fluoxetine against fungal tissue was done for downstream gene expression analysis.

BRIN - Black Hills State University

6a - Flux Control in the Indolic Glucosinolate Pathway of Arabidopsis thaliana

Alexandra Peterson (1)*, Alexandra Peterson (1), Erica Bien (1), Carrie Olson-Manning (1)**,
ampeterson14@ole.augie.edu
(1) Augustana University

Abstract: As stationary organisms, plants are particularly vulnerable to predator attack. For protection many plants have developed complex defense mechanisms. One of these mechanisms is the indolic glucosinolate pathway of Arabidopsis thaliana which is responsible for the production of toxic compounds called glucosinolates that deter herbivory. Previous work on other pathways has shown that enzymatic control over pathway output (flux control) can be unevenly distributed and enzymes with high flux control should be the preferred target of natural selection due to their disproportionate effect on phenotype. Using high-performance liquid chromatography (HPLC), we analyzed glucosinolate concentrations for wild type, heterozygote, and knockout plants in order to determine which enzymes have higher flux control.

BRIN - Augustana University, SD EPSCoR/BioSNTR

7a - SBAP-Linked Bioconjugation of Oligonucleotides to Quantum Dots

Troy Hollinsworth (1)*, Austin E. Kroeger (1), Barrett Eichler (1)**, tdhollinsworth15@ole.augie.edu
(1) Augustana University

Abstract: Malignant prostate cancer cells can be detected by targeting surface proteins using bioconjugated quantum dots (QDs). Previous attempts to conjugate QDs with oligonucleotides were unsuccessful, so a project was initiated to create a reliable protocol for conjugating oligonucleotides to quantum dots. Succinimidyl-3-(bromoacetamido)propionate (SBAP) was selected as a heterobifunctional crosslinker between the thiolated oligonucleotide and amine-coated QD for its amine- and thiol-reactive properties. Studies were conducted to investigate optimal conjugation incubation time, oligonucleotide quantum dot ratio, and fluorescent/electrostatic effects of base length; results of these studies will be presented.

BRIN - Augustana University, SD EPSCoR/BioSNTR

8a - Eukaryotic diversity of deep underground biofilms

Bethany Reman (1)*, Shane Sarver (1)**, bethany.reman@gmail.com
(1) Black Hills State University

Abstract: The sub-surface environment at Sanford Underground Research Facility at the former Homestake gold mine in Lead, South Dakota is a unique habitat for biological research. Temperatures reach 30oC and humidity is 100%. These conditions combined with the absence of cosmic radiation provide an uncommon environment in which to peruse life. Cave biofilms were harvested from the 4850 foot level at SURF. DNA analysis and microscopy are being used to determine the eukaryotic diversity.

SD EPSCoR/BioSNTR

9a - Ligand Controlled Morphology Evolution of Gold Nanostars

Jacqueline Dyer (1)*, Xianghua Meng (1), Chaoyang Jiang (1), Chaoyang Jiang (1)**, jdyer618@gwmail.gwu.edu
(1) University of South Dakota

Abstract: Gold nanostars show great promise for use as a surface-enhanced Raman scattering (SERS) substrate due to their capacity to amplify the local electromagnetic field by surface plasmon resonance (SPR). The combination of unique SPR and SERS spectra make these plasmonic gold nanostars perfect candidates for use in anti-counterfeiting tags. However, the SPR characteristics of plasmonic nanoparticles are inherently dependent on their sizes and morphologies. Thus, it is critical to control their morphology. Here, we explore a new approach to control the morphology of gold nanostars for distinct plasmonic characteristics. Specifically, we investigated 4-hydroxybenzoic acid and 4-mercaptophenol as potential freezing ligands for stabilizing the gold nanostars. Our results indicated that 4-hydroxybenzoic acid does not successfully freeze morphology. Conversely, 4-mercaptophenol can effectively freeze the morphology. Furthermore, our preliminary results indicated that these gold nanostars can result in strong SERS signals and could be excellent candidates for anti-counterfeiting tags.

REU: Security Printing and Anti-Counterfeiting Technology - (USD)

10a - Electropolymerization of perfluoroalkylated thiophene- and aniline-based aromatic compounds for high-performance batteries

Erika Moen (1)*, Jack Lawrence (1), Haoran Sun (1)**, erika.l.moen@usd.edu
(1) University of South Dakota

Abstract: Lithium-ion batteries have been widely used in consumer electronics, but they present safety concerns, and their performance is limited by issues with the cathodic materials. Previous studies of fluoroalkyl coating on cathodic materials have shown that the hydrophobic fluoruous coating can significantly improve battery capacity retention by increasing the cathode's resistance against hydrofluoric acid attack. Inspired by the improved capacity retention and the conductive properties of conjugated conductive polymers, we performed the electropolymerization of perfluoroalkylated thiophene- and aniline-based aromatic compounds and investigated their electrochemical performance via cyclic voltammetry experiments. Initial electrochemical results show that these materials can serve as potential high-performance cathodic materials for primary batteries. Future studies focusing on the rechargability of these perfluoroalkylated conductive polymers are necessary to determine their applicability in secondary batteries.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

11a - Design and Synthesis of Perfluoroalkylated Organic Semiconductor Materials

Joshua Arens (1)*, Joshua Arens (1), Haoran Sun (1)**, joshua.arens@coyotes.usd.edu
(1) University of South Dakota

Abstract: Using the toolbox of organic synthesis, chemists can design and synthesize molecules that, in the solid state, have properties well-suited for specific applications including all-optical switches, field-effect transistors, light-emitting diodes, and solar cells. Several methods within the realm of organic synthesis—namely, conjugation extension, heteroatom replacement, electron withdrawing groups addition, and side chain addition—can be used to tune the properties of organic semiconductor materials while improving efficiency and stability. The present poster reports the design and synthesis of perfluoroalkylated N-containing aromatics using these methods. With a previously reported synthetic route, novel compounds are synthesized and added to the growing library of perfluoroalkylated N-containing aromatics. Because of the perfluoroalkyl substituents and nitrogen heteroatoms, these compounds are expected to demonstrate long-lasting air-stability, a lamellar crystal-packing motif, and a transition from p- to n-type semiconductor behavior of the material, making them promising candidates for next generation electronic and optoelectronic devices.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

12a - Generation of Benzyl Isothiocyanate via Photolysis of an ortho-Nitrobenzyl-Protected Analogue

Carl Lang (1)*, Ellen M Voigt (1), Ethan H Pauley (1), Jared R Mays (1), Jared Mays (1)**, cwstring14@ole.augie.edu
(1) Augustana University

Abstract: Naturally-occurring isothiocyanates have well-described chemopreventive properties and result from the enzymatic hydrolysis of glucosinolate precursors found in cruciferous vegetables. This current study explores the capacity to generate isothiocyanates from a predicted non-glucosinolate precursor containing a photoactive ortho-nitrobenzyl group, which has been previously prepared. Preliminary data suggest that photolysis of this photosubstrate generates the expected isothiocyanate in moderate yield. Future studies will continue to optimize photolysis conditions and analytically evaluate the product(s) of photolysis.

BRIN - Augustana University

13a - Studies of the Reactions of 3-Chloromethylphthalimides with Amines

Olivia Jenks (1)*, Kenaniah Swenson (2), David Hawkinson (2)**, olivia.jenks@usd.edu
(1) Manchester University, (2) University of South Dakota

Abstract: Phthalimides possess a wide range of physiological properties, including anti-inflammatory and immunomodulatory activities, and have been found to be useful in the preparation of specialized polymers and macrocycles. While a vast number of N-substituted phthalimides have been reported, the number of phenyl-substituted compounds is fairly limited. We have recently developed a convenient method for the synthesis of 3-hydroxymethylphthalimides, which have the potential for conversion into a number of other phenyl-substituted compounds. In this paper, we describe the transformation of the hydroxymethyl group to the corresponding chloride and the reactions of the benzylic halides with a variety of amines as nucleophiles. With alkyl amines, nucleophilic acyl substitution at the imide ring competes with the desired alkyl substitution to yield diamides. Studies with substituted anilines show the rate of substitution varies markedly with the basicity of the nucleophile.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

14a - Variation in Egg Size in *Drosophila melanogaster* Resulting from Differing Modes of Selection

Haley Benjamin (1)*, Tristan Roy (1), Cecilia Miles (1)**, hkbenjamin15@ole.augie.edu
(1) Augustana University

Abstract: The intricate relationship between genotype and phenotype is complex, and not well understood, even in well-characterized model organisms like *Drosophila melanogaster*. Examining the tradeoffs among life history traits in *Drosophila* will help in comprehending this relationship. This summer four correlated traits that are closely related to fitness were measured: egg size, body size, development time, and fecundity. Then, the results were contrasted in various inbred lines that were derived via direct and indirect selection for large egg size. Future research will use next-generation sequencing to identify the genetic variants associated with specific tradeoffs. The long term goal is to identify and examine the genetic networks underlying the trait of egg size, and to ask if the same pathways are called upon in the two modes of selection.

BRIN - Augustana University, SD EPSCoR/BioSNTR

15a - Synthesis and Evaluation of N-Methylfluoxetine derivatives on plasmodium falciparum

Hannah Johnson (1)*, John Dixon (1)**, hannah.johnson@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: As of 2015, the WHO has estimated 212 million cases of malaria with 429,000 resulting in death. The current treatment involves a combination therapy of an artemisinin derivative and a second medication such as mefloquine. Malaria is developing resistance against these current treatments, thus a new treatment is becoming critically important. We have discovered that N-Methylfluoxetine has shown activity against plasmodium falciparum. Expanding on this discovery, we have synthesized a small set of N-Methylfluoxetine derivatives where we have replaced the trifluoro methyl group with different substituents. In addition, we have also synthesized a set of derivatives where we have altered the dimethyl amino side chain. These derivatives were tested against plasmodium falciparum using the SYBER Green Assay.

BRIN - Black Hills State University

16a - Synthesis and Characterization of a DFDPP-CPDT Polymer With Ethynyl Spacers by Means of Sonogashira Coupling

Hayley Masching (1)*, Colter Benson (1), Jetty Duffy-Matzner (1)**, hmasching16@ole.augie.edu
(1) Augustana University

Abstract: This research explores the synthesis of a polymer based on cyclopentadithiophene (CPDT) and difurodiketopyrrolopyrrole (DFDPP) comonomers. This work differs from previously published compounds due to an ethynyl spacer between the comonomers, which will provide less steric interactions between the alkyl chains. The DPP comonomer will be synthesized via published methods and then brominated with NBS. The dibromodihexylcyclopentadithiophene comonomer will be treated with trimethylsilylacetylene under Sonogashira conditions to yield the ethynyl comonomer. The final polymer will be produced via another Sonogashira reaction of the deprotected CPDT ethynyl and dibromoDPP comonomers. This polymer will be characterized via FTIR, ¹HNMR, and GPC. The optical band gap will be determined from solid UV-Vis absorbance. This organic polymer will be employed in the construction of bulk heterojunction hybrid solar cells with a colleague at South Dakota State University.

BRIN - Augustana University

17a - Characterization and Identification of Kaempferol and Asarone in Acorus Calamus from South Dakota, USA

Larissa Red Eagle (1)*, Deig N. Sandoval (1), John Dixon (2), Deig Sandoval (1)**, Ired23492@olc.edu
(1) Oglala Lakota College, (2) Black Hills State University

Abstract: The rhizome of acorus calamus(sweet flag) was obtained from the local store and ground to powder form, extracted with a water alcohol solution, freeze dried, and the crude extract was passed through a He-flash chromatography system. The fractions were separated through a Shimadzu HPLC LC-20AP. Fractions from HPLC were analyzed through a GCMS variant saturn 2000 and the peaks of Asarone and Kaempferol were identified.

BRIN - Oglala Lakota College

18a - Characterization of Dentin Slices and Monitoring Their Remineralization by AFM-IR and Nano-Indentation

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(1) University of South Dakota

Abstract: The project aims at the exploration of dentin remineralization by the gel diffusion technique and two toothpastes. Better understanding of remineralization at the micro- and nanoscale will help in the prevention of tooth decay and its restoration. The teeth were cut into 0.3 mm thick slices by a diamond blade and characterized for quality by SEM. Remineralization of the polished samples were monitored by AFM-IR, nano-indentation, and SEM. Before remineralization, the dentin slices were partially demineralized at pH=4. After partial demineralization, the slices were remineralized by the MI toothpaste, Colgate toothpaste ground with hydroxyapatite, and by diffusion of calcium and phosphate ions through the chitosan-phosphate gel. Remineralization of the tooth collagen matrix prepared from dentin slices was performed by the gel diffusion and monitored by SEM. The gel remineralization starts on the wrinkles and bumps of the dentin surface. Occlusion of the tubules by the toothpastes were also observed.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

19a - Molecularly Imprinted Polymers for Dopamine

Tesla Cheek (1)*, George Mwangi (1)**, tesla.cheek@usioxfalls.edu
(1) University of Sioux Falls

Abstract: MIPs are polymers that have specific recognition capabilities and for our purposes we are trying to quantify dopamine in the physiological system. This research is currently on finding the optimal reagents and its ratios to give the optimal MIP.

BRIN - University of Sioux Falls

22a - A study on Parallel Simulation for ACOPF (Alternating Current Optimal Power Flow) using the PETSc DMNetwork Object

Gregory Bowen (1)*, Dennis Agnew Jr. (2), Nicholas Stegmeier (3), Fernando Bereta Dos Reis (3), Timothy Hansen (3), Jung-Han Kimn (3)**, gregory.bowen@sdstate.edu

(1) Southwest Minnesota State University, (2) Jackson State University, (3) South Dakota State University

Abstract: Simulating Alternating Current Optimal Power Flow (ACOPF) is essential for reducing the cost of electricity. We will report our current framework for the large scale ACOPF models over unstructured geometry based in High Performance Computing (HPC) using multiprocessor cluster machine. The key parts of this framework are: 1) Parallel graph data structure based on DMNetwork of PETSc (Portable, Extensible Toolkit for Scientific Computation), and 2) Parallel Optimization Toolkits such as TAO (Toolkit for Advanced Optimization). As an initial step, we modeled a linear Direct Current Optimal Power Flow (DCOPF) problem in PETSc for parallel computing. By implementing the abstract data structure DMNetwork and TAO we preserved the structure of the network and its physics in a flexible, expandable, representative format while still maintaining access to the data within the network. The resulting simulation may be adapted for ACOPF in future research by adding additional physics and modifying the chosen solver.

REU: High Performance Computing in STEM disciplines (SDSU)

23a - A Study on Parallel Performance of Power Flow Simulations using PETSc

Dennis Agnew Jr. (1)*, Gregory Bowen (2), Nicholas Stegmeier (3), Fernando Dos Reis (3), Jung-Han Kimn (3), Tim Hansen (3), Dr. Jung-Han Kimn (3)**, dennis.agnew@sdstate.edu

(1) Jackson State University, (2) Southwest Minnesota State University, (3) South Dakota State University

Abstract: We present our results from our study on large scale parallel simulations of power flow in models of electric power systems. Our main aims of this study are: 1) The improvement of PETSc (Portable, Extensible Toolkit for Scientific Computation) DMNetwork structure, 2) To execute scalability tests for parallel simulation protocols based on PETSc example codes using large scale graph structures generated by Excel's random number generator, and 3) Testing various simulation solvers including SNES (Scalable Nonlinear Equations Solvers). The improvement of DMNetwork was a joint effort with the PETSc team of the Argonne National Laboratory. With the help of PETSc Team of Argonne National Laboratory, we implemented new DMNetwork changes to further improve the master branch of PETSc. Through our research, we hope to further to advance DMNetwork and continue studies in the parallel functionality of power flow codes.

REU: High Performance Computing in STEM disciplines (SDSU)

24a - Radon Mitigation System

Sarah Snyder (1)*, Richard Schnee (1)**, ssnyder@udel.edu

(1) South Dakota School of Mines & Technology

Abstract: Radon decay products can mimic dark matter signals and produce important backgrounds for experiments focused on dark matter detection. Therefore, a low-radon environment is critical for commissioning dark matter detectors. Reducing the radon concentration in living spaces has important health applications. My research involves a vacuum-swing-adsorption (VSA) radon mitigation system at SD Mines. I've used a simulation of this system to examine the effect of combinations of system settings on the radon reduction. The findings from these studies can be used to optimize the current VSA radon mitigation system as well as future systems.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

25a - Study on Implementation of Parallel Simulation of a Biofilm Model using PETSc

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(1) University of Illinois at Urbana-Champaign, (2) South Dakota State University

Abstract: This study was conducted so that we may make a parallel simulation framework of a biofilm model based on the Cahn-Hilliard equation. The framework targets an efficient simulation of extracellular polymeric substances (EPS) within a biofilm. To design a parallel simulation, we utilize PETSc (Portable Extensible Toolkit for Scientific computing) parallel data structures and libraries. The major part of current work is to convert already built but sequential C++ code to parallel code with PETSc routines. The essential parts of this work are 1) to transform the original C++ routines into PETSc compatible routines, 2) to build PETSc data structure including matrices, and 3) to connect PETSc linear solvers. This framework can be extended to other problems which demands a parallel implementation for large scale problems.

REU: High Performance Computing in STEM disciplines (SDSU)

26a - Analysis of Trace Gases Using Cavity-Enhanced Laser Spectroscopy

Cody Kujawa (1)*, Skyy V Pineda (1), Dr. Andrew Klose (1), Andrew Klose (1)**, cykujawa15@ole.augie.edu
(1) Augustana University

BRIN - Augustana University

27a - Determining a Chemical Fingerprint for Aspirin by ICECLES-GC-MS

Megan Lim (1)*, Brian Logue (1)**, lim199@purdue.edu
(1) South Dakota State University

Abstract: A \$200 billion industry, counterfeit medication affects persons from different age groups and is unrestricted by geographical boundaries. Current fraudulent medication detection methods, such as High Performance Liquid Chromatography, are a mix of being costly, inefficient, and time-consuming. Through the combination of Stir Bar Sorptive Extraction (SBSE), which provides selectivity, and Freeze Concentration, which provides a more concentrated sample, ICE Linked with Extractive Stirrers (ICECLES) allows for the detailed examination of chemical compounds. This project details the use of ICECLES – GC/MS to identify unique chemical fingerprints by comparing pill excipients. 2 different aspirin brands, Bayer and Walgreens, were evaluated using the ICECLES method and Principal Component Analysis (PCA) statistical procedure. Ultimately, the 2 brands were differentiated and unique compounds specific to a certain brand were identified. The effectiveness of ICECLES was then compared to SBSE, a standard method for sample analysis.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSU)

28a - Discovering Biodiversity in Deep Sub-Terrestrial Ecosystems

Morgan Weigel (1)*, Bethany Reman (1), Cynthia Anderson (1)**, mrweigel14@wells.edu
(1) Black Hills State University

Abstract: Deep in the Sanford Underground Research Facility, formally the Homestake gold mine, life thrives. In this unique habitat where temperatures are constantly high, humidity is 100% and in the complete absence of sunlight and cosmic radiation a whole ecosystem of microscopic organisms made a home. We are using gene sequencing and microscopy to try and discover the biodiversity of this amazing ecosystem.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU), SD
EPSCoR/BioSNTR

29a - CFD Modeling of Heterogeneous Blood Flows

Isaac Smithee (1)*, Stephen Gent (1)**, isaac.smithee@jacks.sdstate.edu
(1) South Dakota State University

Abstract: As the medical field continues to increase its scope, computational fluid dynamics (CFD) has become essential to understanding blood flow in the cardiovascular system. Blood is traditionally represented in simulations as a homogeneous fluid. However, blood is actually a heterogeneous fluid, or a fluid made up of multiple components. These components are liquid plasma and solid particles of red blood cells, white blood cells, and platelets. The objective of this research is to create a simulation of blood as a multi-component fluid and compare the results to simulations and real-life experiments of blood as a single fluid. These simulations were done using a commercially available CFD solver. Using the fluid properties of plasma and the solid properties of the particles within blood gained from previous research, particle behavior of cells suspended in plasma was investigated in both Newtonian and non-Newtonian flows. The resulting data is tabulated and compared.

REU: High Performance Computing in STEM disciplines (SDSU)

30a - Evaluating Scope of Enantioselective Copper Photoredox Catalysis

Hannah Owens (1)*, Michael R. Hurst (1), Thomas G. Trimble (1), Cassidy L. Kotelman (1), Katrina H. Jensen (1), Katrina Jensen (1)**, hannah.owens@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Ruthenium and iridium complexes are often used as catalysts in reactions that utilize light, referred to as photoredox reactions. The catalyst assists when one of its electrons enters an excited state as it absorbs a photon; this can start an electron-transfer process which ultimately allows for the formation of new bonds. We have evaluated copper(I) catalysts in photoredox reactions to find an alternative to the expensive and toxic metals, ruthenium and iridium. Copper would be a cheaper, more earth abundant alternative. We have found Cu(dap)₂ successfully catalyzes the combination of aldehydes with alkylbromides. A chiral catalyst was also introduced to control facial selectivity in this reaction. We evaluated enantioselectivity through high performance liquid chromatography (HPLC) analysis of the product using a chiral column. Varying alkylbromides were paired with an aldehyde to evaluate the scope of this coupling, and the percent yield and enantiomeric excess were determined.

BRIN - Black Hills State University

31a - Investigating the Effects of Wave Propagation in Arteries

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(1) South Dakota State University

Abstract: Pressure and flow waves are initially generated in arteries during the cardiac cycle when the heart injects blood into the ascending aorta. These waves, however, may also form due to changes in vessel radius or stiffness. These reflecting sites act as an impediment to an incident wave, reflecting a portion of the wave back toward the source. Thus, the propagation of pressure and flow waves through arteries may have significant effect on blood flow and hemodynamics. A model for wave reflection and transmission is in development using data collected from a commercially available Computational-Fluid-Dynamics (CFD) solver. The end goal of this project is to investigate how pulsatile flow induces a wave to propagate as it travels through the vessel.

REU: High Performance Computing in STEM disciplines (SDSU)

32a - Using Cu(dap)2 as a Photoredox Catalyst in Enantioselective Reactions

Jessica Levey (1)*, Michael Hurst (1), Thomas Trimble (1), Cheyloh Bluemel (1), Katrina Jensen (1), Katrina Jensen (1)**, jessica.levey@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Complex chiral molecules have many uses in chemistry including in pharmaceuticals. One sustainable and environmentally friendly way to synthesize these molecules is to use light as an energy source through photocatalysis. Using a metal complex catalyst to absorb a photon allows the catalyst to then transfer an excited electron to another reactant, this lowers the activation energy and allows the reaction to proceed at a faster rate. Previous work on this has been completed using the metals ruthenium and iridium. While efficient, ruthenium and iridium are both rare and expensive. Also both metals are toxic. In response to these issues we are trying to creating a photocatalyst for use in these complex chiral reactions that utilizes copper instead. Copper is more abundant, cheaper and less toxic. I tested the copper catalyst, Cu(dap)2Cl, by coupling various aldehydes and bromides, determining percent yields as well as enantioselectivity.

BRIN - Black Hills State University REU: Environmental/Green Chemistry (BHSU, NSU, SDSU), SD EPSCoR/BioSNTR

33a - Analyzing the Relationship between Socioeconomic Effects Relating to Drug Overdose in the United States

Alexandra Dolezal (1)*, Lisa McFadden (1)**, alex.dolezal@coyotes.usd.edu
(1) University of South Dakota

Abstract: According to the Center for Disease Control, an increase in the drug overdose rate has been seen across the United States. The purpose of this study was to determine what socioeconomic factors influence the overdose rate on a state-by-state basis. Results revealed the drug overdose mortality rate significantly increased from 2013 to 2015. In 2014, the following six variables were positively and significantly associated with the drug overdose mortality rate: Gallup poll percentage of Obama disapproval, Gallup poll percentage of workers perceiving a reduction in employment in the workplace, prevalence of any mental illness in the past year, prevalence of cocaine use in the past year, percentage of population living in an urban setting, and high school education as highest degree earned. By improving these associated factors, such as mental health, education, and economic stability, the consequences may lead to reductions in drug overdose mortality.

BRIN - University of South Dakota

34a - Quantitative Analysis of CdSe/ZnS Quantum Dots by X-ray Fluorescence

Alissa Runia (1)*, Alex Tietz (1), Hope Maunders (1), Duane Weisshaar (1)**, ajrunia14@ole.augie.edu
(1) Augustana University

Abstract: X-ray fluorescence (XRF) is a non-destructive method for elemental analysis requiring standards and samples with similar compositions. The CdSe/ZnS quantum dots (QDs), a high organic-content paste, were previously analyzed by AA Spectroscopy. Calibration curves for eight standards were fairly linear, with some curvature for zinc and selenium. These curves produced QD compositions significantly different from AA results (percent errors >100%). Standards tested for internal consistency generally had percent errors <10% (2nd order fit for Zn and Se) with scatter due to variations in sample preparation and peak counts. Testing for a matrix mismatch, one QD sample was diluted 1:1 (mass) with stearic acid; it exhibited no improvement in accuracy. Future work will include purification of the QDs, identification of a better matrix for the standards, and improvement of internal consistency by improving standard preparation and using longer XRF analysis times.

SD EPSCoR/BioSNTR

35a - Investigating Bacterial Communities on the 4850 Level of SURF

Taylor Liu (1)*, David Bergmann (1), David Bergmann (1)**, tayliu@berkeley.edu
(1) Black Hills State University

Abstract: Using culture-based and non culture-based methods, along with DNA sequencing to discover what types of bacteria inhabit a warm, alkaline pool of water in the "17 Ledge", 4850 feet underneath the Black Hills of South Dakota in the Sanford Underground Research Facility (Lead, SD).

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU)

37a - Application Development and Process Automation for Fast Isotope Ratio Mass Spectrometry (FIRMS)

Bailey Stillman (1)*, Paul Hinker (1)**, bstillman1@catamount.wcu.edu
(1) South Dakota School of Mines & Technology

Abstract: FIRMS is a new method for determining the IRs of known molecules using a mass spectrometer. It is comparable to Isotope Ratio Mass Spectrometry (IRMS) which is considered the industry standard. In order to increase precision, and decrease the amount of time it takes to implement the FIRMS process, an application has been developed.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT)

38a - Efficacy of Thymoquinone against four strains of Candida

Naveen Malik (1)*, Cynthia Anderson (1)**, naveen.malik@yellowjackets.bhsu.edu
(1) Black Hills State University

BRIN - Black Hills State University, SD EPSCoR/BioSNTR

41a - Genetic Origin of a Rare Mitochondrial Disorder

Madigan Moore (1)*, Madigan Moore (1), Matthew Moe (1), Seasson Vitiello (1), Seasson Vitiello (1)**,
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(1) Augustana University

Abstract: A pediatric patient with hypotonia, cerebellar atrophy, psychomotor delay, and increased blood lactate levels was seen at Sanford Health. Whole exome sequencing shows the patient harbors two novel variants of the TARS2 gene, which encodes the mitochondrial threonyl-tRNA synthetase (mtThrRS). The aminoacylation catalyzed by mtThrRS is necessary for the translation of proteins encoded by mitochondrial DNA. One variant in the patient contains a putative splice-site mutation, while the other variant contains a missense mutation. Both mutations are predicted to cause loss of mtThrRS function, suggesting that these novel variants of the TARS2 gene cause mitochondrial dysfunction and are therefore causal for the disorder. We aim to assess the effects of these variants on mitochondria and energy production, and to determine the molecular effects of the TARS2 splice-site mutation. This work contributes to the understanding of the connections between mitochondrial function and health.

BRIN - Augustana University

43a - OTU2ROC: An Online Computational Tool for Microbial Metagenomics Data Analysis

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(1) University of South Dakota

Abstract: Many open-source analytical tools for microbial metagenomics have emerged in recent years. These tools can automatically process raw metagenomics data to produce an OTU (Operational Taxonomic Units) table, and then step through a basic analytical pipeline. However, this is just a starting point for determining how these billions of bacteria are interacting and the implications for the functional and ecological roles. Therefore, we developed an online computational framework, OTU2ROC, and made it available through an interactive web interface. The framework takes in an OTU table in a plain-text format, selects and ranks the attributes using multiple feature selection methods and evaluates the selected feature set using a variety of classifiers. It generates a series of ROC (Receiver Operating Characteristic) curves and reports the area under the ROC curve to demonstrate the usefulness of the feature set. We published OTU2ROC on our BioComs Lab website and can be accessed at <http://biocoms.org/OTU2ROC/>.

SD EPSCoR/BioSNTR

44a - Transcriptomic Differential Expression Analysis of Osteogenic Sarcoma Among Mus musculus Models

David Doss (1)*, Kirby Rickel (2), Fang Fang (2), Jianning Tao (2), Erliang Zeng (1), Erliang Zeng (1)**,
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(1) University of South Dakota, (2) Sanford Health

Abstract: Osteogenic sarcoma is a form of bone cancer most common in youth. In this project, we performed transcriptomic differential expression analysis of mice with osteosarcoma. By comparing gene expression profile between mice in healthy and diseased conditions, we identified genes likely linked to the prevalence of osteosarcoma. Through the use of multiple commonly used R packages, we are able to not only measure the relative robustness and stringency of each tool but also identify core genes of interest by ensembling significant genes identified by each of the tools. Identification of these core genes of interest can eventually lead to a comprehensive understanding of osteogenic sarcoma, which will assist in revealing therapeutic targets that can be used to develop pathway inhibitors for a non-invasive treatment of osteosarcoma.

BRIN - University of South Dakota

45a - Antimicrobial Assay of Fish Epidermal Mucus Membranes

Drew Cheskie (1)*, Kathleen Gibson (1)**, dreche954@mtmc.edu
(1) Mount Marty College

Abstract: Fish are covered in a slimy substance known as the epidermal mucus membrane which serves to protect them against infection. Four species of fish, *Oncorhynchus mykiss* (rainbow trout), *Scaphirhynchus albus* (pallid sturgeon), *Perca flavescens* (yellow perch), and *Polyodon spathula* (paddlefish), were obtained from the Gavin's Point National Fish Hatchery in Yankton, SD. The fish mucus was collected, centrifuged, filter sterilized, and lyophilized. The mucus was reconstituted to a protein concentration of 1 mg/mL and screened using both the Minimum Inhibitory Concentration and Kirby Bauer disk-diffusion assays against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus cereus*, and *Pseudomonas aeruginosa*. No bacterial inhibition was observed for any screened species. These results could be due to either the extraction method or the controlled environment the fish were maintained in.

BRIN - Mt. Marty College

46a - The Impact of Music on Cardiovascular and Respiratory Function

Morgan Citterman (1)*, Kenneth Tice (1)**, morgan.citterman@mtmc.edu
(1) Mount Marty College

Abstract: This study expands on previous work done by The American Heart Association in 2009, with the purpose of testing a larger age demographic. A Biopac Bioharness was used to observe and record 49 participants' cardiovascular and respiratory rates while they listened to a randomized playlist of five pieces of classical music, as well as one track of silence. Participants were given a Perceived Stress Scale (PSS) from Sheldon Cohen and were asked about previous musical experience. The data was then evaluated for obvious patterns in results from the participants which correlated with rises or falls in the music. When comparing the data from musicians and non-musicians, although there were no significant differences between the two groups, both groups were affected by the music. The results of this study could encourage greater use of music throughout the medical field as a means to improve the cardio-respiratory rates of patients.

BRIN - Mt. Marty College

47a - Beta Cyclodextrin Inactivated Zika Virus Utilized as a Vaccine or the Development of Therapeutic Antibodies

Arthur Gallegos (1)*, Nicholas Wixon (2), Scott Killian (3), Corey Hewitt (1), Victor Huber (3)**, artgal373@mtmc.edu
(1) Sanford Health, (2) Mount Marty College, (3) University of South Dakota

Abstract: Zika (ZIKV) is a flavivirus that can cause Guillian-Bar syndrome and birth defects such as microencephaly. There is currently no vaccine or therapy available for ZIKV infection. Our approach was to inactivate ZIKV in a manner that would leave the natural antigenic proteins unmodified allowing for the inactivated ZIKV product to be used as a vaccine or for the development of therapeutic antibodies. This lead us to evaluate the use of beta cyclodextrin (BCD) for inactivation because it acts to remove cholesterol from the virus membrane without disrupting viral proteins. To test the inactivation, we utilized reverse transcriptase real time polymerase reaction (qRT-PCR). We evaluated the BCD-treated cell culture in vivo. BALB/c Mice were monitored daily and 3 of 3 mice showed no signs of infection. In conclusion, the results indicate that ZIKV was successfully inactivated with BCD and has proven safe from further pre-clinical trials.

BRIN - Mt. Marty College, BRIN - University of South Dakota

48a - Effect of a glyphosate-based herbicide on the microbiome of false map turtles from southeastern South Dakota

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Abstract: Roundup® is a commonly used herbicide worldwide. Frequently applied to corn and soybeans, the active ingredient, glyphosate, has been widely detected in Midwestern aquatic habitats. This experiment examined the effect of short-term glyphosate exposure on the cloacal microbiome of false map turtles (*Graptemys pseudogeographica*), a South Dakota state-threatened species. Ten turtles were collected from the main stem of the Missouri River in southeastern South Dakota and kept individually in tanks for 72 hours. Five of the tanks were randomly selected and dosed with 10 µg/ L of glyphosate, with the other five as a control. It is predicted that glyphosate will alter the microbial community composition of the exposed turtles, as studies have shown the ability for glyphosate to obstruct bacterial biochemical pathways. Understanding how environmental contaminants disrupt the microbiome and effectively influence disease susceptibility, individual fitness, and population size is important for informing management decisions.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

49a - Construction and Implementation of Sex Education Curriculum for American Indian Youth

Danielle Catrillo (1)*, Char Green-Maximo (1), Alyson Becker (1), PJ Beaudry (2), DenYelle B. Kenyon (1), DenYelle Kenyon (1)**, danielle.catrillo@sanfordhealth.org

(1) Sanford Health, (2) Great Plains Tribal Chairmen's Health Board

Abstract: Although the American Indian (AI) population is the second smallest population in the country, the rates for STIs and teen pregnancy outrank almost all other groups. AIs have the second highest rate of chlamydia and gonorrhea¹ along with high teen pregnancy rates and early sexual debut. To curb these rates, tribes are implementing different types of sex education in their communities. For higher success rates, researchers and tribes work together to incorporate tribal need and culture into the curriculum's layout. From these collaborations, several programs have been successful in incorporating culture and need into the curriculum. This review discusses both the overarching need to tailor sex education for this population as well as concrete steps to take in the construction of future programming. Although successful AI sex education programs are available, there is still work to be done in order to cater to the needs of various tribal nations.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

50a - The Emancipation of Postcolonial Slaves Along the "Midwest Pipeline"

Melat Weldeselasia (1)*, DenYelle Kenyon (1)**, welde012@umn.edu

(1) Sanford Health

Abstract: Native women comprise 40-50% of sex trafficking victims in the state of South Dakota. With 56% of the statewide homeless population identifying as American Indian and 23% of the Sioux Falls, SD citywide homeless population identifying as victims of domestic violence; this project identifies the critical role that programs like Street Outreach can play in identifying sex trafficking and domestic violence victims with a focus on the at-risk Native homeless youth population in Sioux Falls. Qualitative content analysis of Street Outreach contact data identifies the presence of warning signs such as tattoos indicative of ownership along with reports of physical, emotional, and mental abuse. Based on this finding, specified training for Street Outreach and similar programming staff on trauma-informed approaches to victim identification in the Native homeless youth population alongside the integration of age-specific, culturally-appropriate resources into an existing South Dakota continuum of care system is suggested.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

51a - Differential gene expression related to drought tolerance in invasive hybrids of Tamarix spp.

Abigail Carinder (1)*, Padmapriya Swaminathan (1), Michelle Ohrtman (1), Anne Fennell (1), Anne Fennell (1)**, carinderal5821@marybaldwin.edu

(1) South Dakota State University

Abstract: Tamarix, salt cedar, was used in shelterbelts in the 1930s. It is currently classified as an invasive species for its ability to deposit salt, hybridize, absorb large amounts of water, and exist after typical eradication attempts (fire, drought, chemical) while monopolizing the landscape. To gain an understanding of how Tamarix survives, T. chinensis and T. ramosissima were well-watered or exposed to drought conditions. Leaf tissue RNA was sequenced and High Performance Computing was used to develop a de novo transcriptome and analyze gene expression. Differential gene expression was determined between well-watered and drought tissues. The genes were annotated using BLAT and the Arabidopsis thaliana and Beta vulgaris genomes. Gene expression differences between species and response to drought will be explored to aid in determining Tamarix control methods.

REU: High Performance Computing in STEM disciplines (SDSU)

52a - Correlation of Bond Area and Shape to Ultrasonic Spot Welding Parameters

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Abstract: Recent advances in the development of high-strength thermoplastic polymers are increasing their use as composite matrix material. As the use of these thermoplastic matrix composites (TPMCs) increases, a need for joining techniques for TPMCs is prevalent. The method of joining TPMCs investigated in this work was ultrasonic spot welding (USSW), a method which joins material by using high frequency, low amplitude vibrations to locally melt and re-solidify the material. Previous work showed bond area is directly correlated to the strength of the bond, but little is known about the effect of specific welding parameters. In this work, bond area was measured through a variety of non-destructive optical and destructive techniques and lap shear samples were produced and tested for measurement of bond strength. The correlation of USSW parameters and bond area and strength from this work will be used to guide the production of high strength bonds in TPMCs.

REU: Back to the Future III (SDSMT), SD EPSCoR/BioSNTR

53a - Understanding Competing Value Claims of the Missouri River

Kriston Lynn (1)*, Silvana Rosenfeld (1)**, kriston.lynn@usd.edu
(1) University of South Dakota

Abstract: How people understand and assign value to natural systems affects their interactions with those systems. These value claims display differences between what people consider economically valuable as opposed to their broader values.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

54a - Mapping Land Use Change in Watersheds through ArcGIS

Ethan Jennings (1)*, Brennan Jordan (1)**, ethan@jenningshome.com
(1) University of South Dakota

Abstract: Mapping land use change in watersheds has historically relied on labor intensive fieldwork. This study determines the viability of using ESRI's ArcGIS software to map out land use changes in a watershed using Digital Elevation Maps (DEMs) and photos from the National Agriculture Imagery Program (NAIP). Using the Little Vermillion creek watershed as a test bed, we calculated the watershed area and lines of flow for the watershed using the DEMs for the area, through ArcGIS Hydrology tools. We then clipped the NAIP photographs from both bookend years (2006, 2016) to the watershed area, and compared the two with a grid pattern search to detect differences. The areas that show a change (e.g. trees lost, wetlands plowed) are digitized as polygons and intersected with the streamlines to determine what percentage of the streams in the watershed have experienced land use change in the ten year interval.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

55a - PRI-724 inhibits the growth and migration of human osteosarcoma cells.

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(1) Dakota Wesleyan University, (2) Sanford Health

Abstract: The survival rate for osteosarcoma, the most common type of primary bone malignant neoplasms, has not improved substantially over the past four decades. Enhanced Wnt signaling has been implicated in both human osteosarcoma and genetic mouse osteosarcoma models, which provides a vulnerability in osteosarcoma treatment. PRI-724, a CBP/ β -catenin inhibitor, has been investigated in clinical trials for colon cancer, leukemia, and pancreatic cancer. Herein, we hypothesize that PRI-724 may inhibit human osteosarcoma cell growth and metastasis. We found sustained high Wnt signaling in 143B, a human osteosarcoma cell line through immunoblotting. We also revealed that PRI-724 (25 μ M) was sufficient to inhibit 143B cell proliferation. Suppressed Wnt signaling was confirmed by decreased protein levels of active β -catenin and CyclinD1, the Wnt target. Moreover, PRI-724 inhibited 143B cell migration in both scratch and transwell assays. Taken together, these data suggest that PRI-724 has significant therapeutic potential for the treatment of human osteosarcoma.

BRIN - Dakota Wesleyan University

57a - Characterization of Biofilm Formation by Acid-resistant *Salmonella enterica*

Samantha Vaverka (1)*, Hannah R Higgins (1), Paul G Egland (1), Paul Egland (1)**, sbvaverka15@ole.augie.edu
(1) Augustana University

Abstract: *Salmonella enterica* is notorious for causing salmonellosis, a common food-borne disease. Previously, strains of *S. enterica* were isolated based on their acid resistance, and their genomes were sequenced so that genes responsible for acid-resistance could be identified. One phenotype of interest for bacterial pathogens is the ability to grow as biofilms. *S. enterica* is able to grow both planktonically in suspension as well as attached to a surface in a biofilm. Acid-resistant strains were compared to a well-characterized strain, ATCC 14028. Biofilms were grown in flow cells and imaged using confocal microscopy. Microtiter plate biofilm assays were also used to measure biofilm growth. While the planktonic growth was similar under neutral and acidic conditions, biofilm comparisons between ATCC 14028 and a representative acid-resistant strain showed that thicker biofilms were formed by the acid-resistant strain in flow cells with a low pH medium.

BRIN - Augustana University

58a - Invasive Trees and their Effects on Nesting success of Songbirds

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Abstract: Riparian forests along the Missouri have been dramatically altered by the damming of the river. *Elaeagnus angustifolia* are now a major component of many floodplain forests. Decades of flood management practices have allowed native upland species including *Juniperus virginiana* to colonize areas which were once regularly inundated by seasonal high flows. This study seeks to determine whether these alterations impact the ability of songbirds to successfully nest in these important breeding habitats. Preliminary results indicate that many birds choose to nest in *Elaeagnus angustifolia* and *Juniperus virginiana*. However, they may face higher rates of nest failure than those who build in native trees. This could suggest that conservation efforts in riparian forests should seek to decrease the prevalence of invasive trees in these habitats, but that this management work should be conducted in late fall or winter to minimize unintended disruption of active nesting activity.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

59a - Effects of fishes on aquatic insect consumption in linked aquatic-terrestrial food webs

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(1) University of South Dakota

Abstract: The consumption of aquatic insects by native and introduced fishes may reduce the energy available to terrestrial food webs. Our research predicted that fishes would alter local food webs and affect ecosystem productivity by 1) reducing available benthic insect biomass, 2) consuming pupal insects in the water column, 3) reducing emergent aquatic insect biomass, and 4) reducing density of terrestrial insectivorous spiders. Emergence traps were used to collect emerged aquatic insects from treatments with and without fish using exclosure cages, and to determine the reduction of emergent biomass by fishes. Furthermore, in situ fish diets were sampled, spider densities were recorded, and fish and benthic assemblages were recorded. Research occurred at Bow Creek Recreation Area in Cedar County, Nebraska. Preliminary data suggests that traps without exclusion cages yielded 80-94% reductions in emergent aquatic insect biomass, and that the terrestrial spider densities were higher above cages without fish than with fish.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

60a - Degradation of Methylene Blue Dye Using Nanomaterials: A Photocatalytic Study of ZnO-SBA-15

Ananth Venkatachalam (1)*, Balaranjan Selvaratnam (1), Ranjit Koodali (1)**, ananth.venkatachalam@gmail.com
(1) University of South Dakota

Abstract: The World Bank estimates that twenty percent of aqueous pollution is caused by indiscriminate discharge of dyes to aquatic sources. Several methods to eliminate dyes have been proposed that include adsorption, biodegradation, coagulation/ precipitation and Advanced Oxidation Processes (AOPs). Among the various AOP methods, photocatalysis has attracted the significant attention. The goal of this project is to evaluate whether ZnO supported on a mesoporous silica material, SBA-15 is effective for removal of a model dye pollutant, methylene blue. Towards realizing this goal, a series of ZnO containing SBA-15 material were prepared and characterized. Photocatalytic studies indicate effective removal of methylene blue and the photocatalytic activity is maximum at an ideal loading of ZnO.

61a - Forensic Analysis of Native American Artifacts - Strike of Light - Wampam Bracelet

Dylan Tobacco (1)*, Grant Crawford (1)**, dylandtobacco@gmail.com
(1) South Dakota School of Mines & Technology

Abstract: The poster will have the processes used for the forensic analysis of Native American artifacts and provide history background for historical significance.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT)

62a - A TARGETED APPROACH TO ANALYZING LARGE LIPIDOMIC DATA SETS

Delayna Paulson (1)*, Paula A. Mazzer (1), Paula Mazzer (1)**, delayna.paulson@jacks.sdstate.edu
(1) Dakota Wesleyan University

Abstract: Lipidomic technology provides several advantages over other “-omic” technologies in holistically investigating the effect of toxic insult on cells and tissues. Using lipidomics, a smaller sample size is required in a shorter time frame, and gene and protein expression can be observed as they are amplified in metabolism changes. We isolated lipids of rat lung macrophages that have undergone staurosporine induced apoptosis and collected mass spectrum data. By connecting our mass spectrum data with the pathways producing these lipids, we can gain a better understanding of the changing lipids. Using MATLAB, we built a lipid library with masses and their corresponding names that we expected to find in these macrophage cells. We also built an analysis program, which will search the library for matches in our data. This program allows us to use a targeted approach for better analysis of large lipidomic data sets and understand pathways producing these lipids.

SD EPSCoR/BioSNTR

63a - Direct Amide Coupling Using Microwave Techniques

Matthew Brewer (1)*, George Nora (1)**, matthew.moran-brewer@wolves.northern.edu
(1) Northern State University

Abstract: The objective of our research was to try and directly couple an amine to a carboxylic acid group without a coupling agent such as EDC. Since these reactions typically take between eighteen and twenty-four hours the second objective of our research was to speed up the reactions using microwave synthesis. Being able to complete both of these objectives would mean greener chemical reactions since less chemicals would be used and the reactions could be completed faster. This research could be helpful to pharmaceutical companies since it would make it cheaper and faster to add amines on to carboxylic acid groups of certain drugs which could improve their effectiveness.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU), SD EPSCoR/BioSNTR

64a - The Study of Parallelization of PETSc Code for Physics Simulations

Jonathan Hedman (1)*, Jung-Han Kimn (1)**, jonathan.hedman@sdstate.edu
(1) South Dakota State University

Abstract: We will present our current progress on the parallel implementation of the time decomposition preconditioners for physics simulations based on the Semi-Linear Wave equation. The parallelization required the following updates: 1) global and local index sets for data communication through processors, 2) parallel global data structures, and 3) local data structures for the time decomposition preconditioner. This parallelization process was implemented using PETSc (The Portable, Extensible Toolkit for Scientific Computation) from Argonne National Laboratory. PETSc is a programming library that allows for the manipulation of mathematical matrices and vectors for use in built in PETSc solvers. This tool enables configured simulations to scale more effectively when adding more processors to work on the problem. Adapting the current simulation to parallel is an arduous task, but is essential to construct an efficient simulation for large scale problems.

SD EPSCoR/BioSNTR

65a -

Cavity Ring-Down Spectroscopy for Ultra-trace Determination of Chemical Impurities in Noble Gases

Theodore Savinov (1)*, Brianna Mount (1)**, savin032@umn.edu
(1) Black Hills State University

Abstract: Many searches for rare event physics located in deep underground laboratories rely on time projection chambers filled with liquid noble gases. These detectors require extremely low levels of chemical impurities in these liquids. After being moved between labs at Black Hills State University, a Cavity Ring-Down Spectroscopy (CRDS) system was set up and aligned for the detection of chemical impurities in liquid noble gas samples.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU)

66a - A Qualitative Analysis Using the Stages of Change within the OST CHOICES Program

Olivia Lowrey (1)*, Olivia Lowrey (1), Kaitlyn Ciampaglio (1), Jamie Messerli (1), Jessica Hanson (1), Jessica Hanson (1)**, olivia.lowrey@sanfordhealth.org
(1) Sanford Health

Abstract: Background: Project CHOICES has demonstrated success in its preconceptional approach to decreasing risk of alcohol-exposed pregnancies when adapted to fit the needs of an American Indian community: the Oglala Sioux Tribe (OST). Objectives: This poster aims to establish an understanding of the experiences of American Indian women as they endeavor to decrease their alcohol consumption and increase birth control use. Methods: A framework analysis of written responses from participants was conducted using the transtheoretical model as a conceptual framework. Steps consistent with the Stages of Change emerged. Results: For both decreasing alcohol consumption and increasing birth control use, participants' responses suggested they were concentrated in beginning stages, while later responses suggested a progression towards later stages by the end of the program. Conclusion: The written responses uncover common themes among experiences and can help inform future programs on more effective ways to address the needs of American Indian communities.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

67a - Cytotoxicity Of Silver Nanoparticles

Donald Decker (1)*, Daniel Asunskis (1)**, donald.decker@yellowjackets.bhsu.edu

(1) Black Hills State University

Abstract: Cytotoxicity of various Silver Nanoparticles

SD EPSCoR/BioSNTR

68a - Effect of Electronic Properties on Water Splitting Over a Pt-TiO₂ Co-Catalyst

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(1) South Dakota School of Mines & Technology

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

69a - Adapting an Infant Safe Sleeping Curriculum

Sydney Schad (1)*, Amy Willman (1), Brooke Schmidt (1), Deborah Tobacco (1), Amy Elliot (1), Amy Willman (1)**,

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(1) Sanford Health

Abstract: The purpose of my research was to look at a curriculum that is currently being developed and to look at how it could be implemented in other Native American tribes. The ongoing study is to help educate expecting mothers on safe sleeping practices. A major find in my research was that the traditional use of cradleboards is just now being acknowledged as a safe sleeping method. Native American tribes have been using cradleboards as a safe sleeping measure for as long as people can remember. It is now directed that babies sleep alone, on their backs, and in a crib. This curriculum has the potential to be very helpful to expecting mothers and couples who are planning to have children. The main goal is to increase the number of safe sleeping environments and lower SIDS rates.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

70a - "Alcohol Use during Pregnancy: Who Were the Mothers that continued drinking?"

K'dyn Newbrough (1)*, Amy Elliott (1), Amy Willman (1), Amy Willman (1)**, kdynnew23@hotmail.com
(1) Sanford Health

Abstract: The Safe Passage Study, conducted by the Prenatal Alcohol in Sudden Infant Death Syndrome (SIDS) and Stillbirth (PASS) Network, was designed to investigate the role of prenatal drinking on peri- and postnatal outcomes, particularly SIDS and stillbirth, in populations at high risk for drinking during pregnancy (Dukes et al., 2014). I looked at some of the data from the Safe Passage Study and narrowed it down to the Rapid City, SD, site only. I looked at demographics of the mothers who continued drinking vs. those mothers who quit drinking throughout pregnancy.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

72a - Ligand Docking Inhibition of Alcohol Dehydrogenase from *T. mathranii*

Megan Riel (1)*, Rajesh Sani (1)**, megan.riel@mines.sdsmt.edu
(1) South Dakota School of Mines & Technology

Abstract: Inhibition of alcohol dehydrogenase (ADH) by selected phenolic compounds was analyzed as to optimize ethanol production. Crystal structures of ADH from thermophilic *T. mathranii* str. A3, were constructed from known structures of *T. ethanolicus* encoded by the genes: *adhA*, *adhB*, and *adhE* using homology modeling. The enzymes were then docked with the phenolic ligands and substrates, respectively: Ferulic acid, Gallic acid, and Vanillic, then ethanol and methanol. It was determined that the ligands bound allosterically. To determine how the ligands altered the conformation of the active sites, simulations were run using molecular dynamics. To prepare the ADH for simulation, the enzymes were hydrolyzed and protonated, and counter-ions were added to reproduce a neutral environment. CHARMM forcefields were then generated in PuTTY and loaded into LAMMPS. The program's objective is to simulate the enzyme conformation changes but requires a significant amount of time and will be completed in future analysis.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

73a - Development of Biomimetic Nano-fibrous Gelatin Scaffolds for Bone Tissue Engineering

Colette Christensen (1)*, Yangxi Liu (1), Hongli Sun (1)**, colette.christensen@coyotes.usd.edu
(1) University of South Dakota

Abstract: Biomimetic Nano-fibrous Gelatin Scaffolds were fabricated by a thermally induced phase separation combined with a porogen leaching technique. The pore size, porosity, and mechanical properties of the scaffolds were tailored and characterized. C2C12 cell growth and osteogenic differentiation on the differing property scaffolds were also studied.

SD EPSCoR/BioSNTR

74a - Development and Use of a Myosin II Tension Sensor Module Sensitive to Forster Resonance Energy Transfer Capable of Detecting Intracellular Forces

Laura Brunmaier (1)*, Laura Brunmaier (1), Steve Smith (1)**, laura.berkeley@mines.sdsmt.edu
(1) South Dakota School of Mines & Technology

Abstract: During different cellular processes the cytoskeleton exhibits a variation of tension or stress induced forces. In cases of cell motility, the cytoskeleton can depolymerize and re-polymerize actin filaments to migrate. Non-muscle myosin ii (MII) is an actin binding motor protein that initiates these physiological progressions. The intracellular forces that MII generates have yet to be quantified. We have developed a non-muscle myosin ii biosensor able to measure these forces via Forster Resonance Energy Transfer (FRET). We use the recently developed tension sensor module (TSMoD) which employs flagelliform between two fluorophores, mTFP1 and venusA206K. These fluorophores undergo FRET during laser excitation, noting the changes in fluorescent lifetimes due to varying levels of tension exerted by the motor protein. We present lifetime images of live cells expressing MII TSMoD and analyze these to visualize and quantify the nano mechanical forces exerted on the cytoskeleton.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University), SD EPSCoR/BioSNTR

75a - Influenza A Virus Non-Structural Protein NS1 associations and interactions with Type 1 Interferons

Jose Muro (1)*, Victor Huber (2)**, jose.muro@nwciova.edu
(1) Northwestern College, (2) University of South Dakota

Abstract: Type 1 interferons (IFNs) α and β serve as the first host defense against viral infections. To bypass this defense, the influenza A viruses (IAV) encode the non-structural 1 protein (NS1), which suppresses type 1 IFNs. The expression of type 1 IFNs during different stages of IAV play a role in bacterial super infection (BSI) susceptibility, and are involved in the host response against IAV. In previous studies, we observed that truncating the NS1 expressed by an IAV can influence severity of a BSI through modulation of type 1 IFN expression. To translate these findings from mice into humans, we are now evaluating influenza viruses in human epithelial and fibroblast cells to define Type 1 IFN responses. Since NS1 protein is known to interact with IFN induced responses, our interests were in deciphering the interaction between NS1 protein and IFN, which mediate outcomes from BSI.

SD EPSCoR/BioSNTR

76a - cellTreeGenerator R package

Carrie Minette (1)*, Mark J. Block (1), Etienne Gnimpieba (1)**, carrie.minette@coyotes.usd.edu
(1) University of South Dakota

Abstract: cellTreeGenerator is an integrated cell tree prediction framework developed in R Bioconductor environment that facilitates the production of cell relationship graphs with hierarchy visualizations, and produces standardized output for further downstream analysis, such as tumor cell of origin prediction.

SD EPSCoR/BioSNTR

77a - Assessing Infrastructure and Systems Risk to Climate Change for South Dakota

Adam Gettinger (1)*, William Capehart (1)**, adamgettinger@gmail.com
(1) South Dakota School of Mines & Technology

Abstract: Shifting climate in the Northern Great Plains is expected to have significant impact on regional infrastructure as seen recent extreme weather events. Recent attention on global levee failures from flooding in times of drought has shown the urgency of assessing civil infrastructure fragility that was designed for a different climate than will be in place at the end of the infrastructure design life. Extreme heat and cold events cost US highway departments billions of dollars each year in pavement maintenance and rehabilitation. Here, we'll explore the projected impacts of 21st century climate change on the Northern Great Plains region using both regional and global climate model ensembles to illustrate the possible spread of climate outcomes. This study hopes to show the hazards to civil infrastructure and agriculture fragility. Emphasis will be given to potential changes in extreme event frequency and changing distributions of temperature, precipitation and storm frequency.

SD EPSCoR/BioSNTR

78a - Nanoparticle Uptake Assay to Demonstrate the Role of Fc Receptor-Mediated Phagocytosis in Influenza Immune Response

Jackson Shriver (1)*, Adam Bleeker (1), Victor Huber (1)**, jackson.shriver@coyotes.usd.edu
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Abstract: Influenza vaccination can minimize the severity of influenza infection, but vaccines are not always 100% effective. The target of vaccine induced immunity hemagglutinin (HA) and antibodies can neutralize the virus or increase clearance through opsonophagocytosis. Previous work in the Huber lab has shown Fc receptors contribute to clearance of influenza viruses, but the mechanism remains undefined. To test which Fc receptor genes have the most significant impact on opsonophagocytosis, we designed an uptake assay using nanoparticles to simulate opsonophagocytosis in macrophage cells. Pseudo virions were synthesized from silica nanoparticles and dyed with a fluorescent label. Hemagglutinin was attached to the nanoparticles and then using antibodies, uptake was monitored using fluorescent microscopy. Future direction involves further optimization the assay, utilization of different variants of hemagglutinin to test for the presence of different antibodies and using cells that have had Fc receptor genes inhibited to determine genes of interest regarding opsonophagocytosis.

SD EPSCoR/BioSNTR

79a - A Comprehensive Study of Background Radiation Along the White Clay Fault in Southwest South Dakota

Shawn Garnette (1)*, Hannan E LaGarry (1), Hannan LaGarry (1)**, sgarn2455@gmail.com
(1) Oglala Lakota College

Abstract: Research conducted over the 2015 and 2016 field seasons identified potential sources of elevated background radiation concentrated along the White Clay Fault on the Pine Ridge Reservation. During the 2017 season 80 sites were tested along the White Clay Fault. Ionizing radiation was measured using a Geiger-Muller counter held at one meter above strata. Three measurements of three minutes each were taken and results were averaged. Radiation intensities were plotted as points using GIS software. Radiation intensity for the study region was interpolated through Gaussian process regression (kriging) and nonparametric descriptive statistics of the sample data were compiled. Radiation intensity near the White Clay fault averaged 34.0 uRem/hr, the 95th-percentile of measured radiation intensities across the PRR. We interpret the annual background radiation dose for the study area of 200 to 300 mRem/yr to be an aggregate measurement of ionizing radiation from cosmic sources, naturally-occurring uranium and breakdown products.

SD EPSCoR/BioSNTR

81a - The Cytotoxicity of Urban Dust and Diesel Particulate on Murine Microglial Cells

Nathan Stadem (1)*, Paula Mazzer (1)**, nate.stadem.14@dwu.edu
(1) Dakota Wesleyan University

Abstract: This research is into the effects of Urban Dust and Diesel Particulate on murine Microglial cells. Microglial cells act as a defense system for the brain, similar to the function of macrophage cells. Past research has suggested that microglial cells can activate and cause the death of neurons in the presence of airborne particulate matter, but no correlation between particulate chemistry and microglial response has been studied. We were able to study their activation by treating microglial cell cultures at different dose levels of both particulate types and tested for cell death via caspase activation and trypan blue exclusion. So far the research has shown caspase activation for cells tested with diesel particulate. In the future we will test for caspase activation with urban dust and use ELISA assays to determine the level of microglial activation and superoxide production in treated cells.

BRIN - Dakota Wesleyan University

82a - Using Optimization Algorithms to Determine Isotope Ratios from Tandem Mass Spectrometry

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(1) Princeton, (2) Princeton University, (3) South Dakota State University

Abstract: Fast Isotope Ratio Mass Spectrometry (FIRMS) is new method under development to determine isotope ratios (IRs) in a sample of a given compound from tandem mass spectrometry data. FIRMS calculates IRs through optimization software that minimizes the sum of absolute percent differences between experimentally observed and theoretically predicted mass spectra. But the algorithm best suited to FIRMS and optimal method for setting bounds on the IR solution space are unknown. This study seeks to determine an optimization algorithm most likely to accurately calculate IRs when employed by FIRMS and proposes a new method for setting bounds on the IR solution space.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSU)

83a - Shotgun Lipidomic analysis of murine astrocyte cells exposed to airborne particulate matter

Meghan Travis (1)*, Delayna Paulson (1), Shayne Quinn (1), Paula Mazzer (1), Paula Mazzer (1)**,

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(1) Dakota Wesleyan University

Abstract: Millions of people around the world that are affected by neurodegenerative disease. A potential correlation has been found between neurodegenerative disease and particulate pollution. Several studies have shown oxidative stress in the brain and induction of neuroinflammation due to airborne particulate matter. Our lab has shown that urban dust induces apoptosis, and diesel exhaust particulate matter induces necrosis. I studied the lipid profile of murine astrocyte cells exposed to urban dust and diesel exhaust. Lipid profiling is a rapid approach to determining cellular response, provided the changes in lipid expression are understood. I used shotgun lipidomics to identify all the lipid chemical species present in the cell samples. The samples were run through the 12T Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (COSMIC). Results were processed two ways, with an approach developed by COSMIC, and using a targeted approach developed in our lab by D. Paulson and S. Quinn.

BRIN - Dakota Wesleyan University, SD EPSCoR/BioSNTR

84a - Time Resolved Study of Staurosporine Induced Apoptosis in Murine Astrocyte Cells

Sara Husher (1)*, Kayla N. Weber (1), Paula Mazzer (1)**, sara.husher.13@dwu.edu

(1) Dakota Wesleyan University

Abstract: Metabolomics shows substantial potential in understanding the biochemical functioning of cells. A division of metabolomics, lipidomics, is particularly interesting as lipids are simple to analyze and respond quickly to toxic insult. One impediment of current lipidomics is the limited knowledge of which synthetic pathways are being activated following toxic insult. Therefore, we began exploring the time resolved change in lipid expression after induced apoptosis in murine astrocyte cells. Lipids were extracted at definite time-points prior to staurosporine insult using a modified Bligh and Dyer technique. Lipid classes were separated with Two-Dimensional High-Performance Thin-Layer Chromatography. Once segregated, the lipids were derivatized to fatty acid methyl esters for GCMS analysis. Time-dependent changes in fatty acid expression in the murine astrocyte cells were observed. Once our results are optimized, the goal is to present ¹³C-labeled glucose before staurosporine addition to investigate de novo fatty acid synthesis by Isotope Ratio Mass Spectroscopy (IRMS) analysis.

BRIN - Dakota Wesleyan University, SD EPSCoR/BioSNTR

85a - Direct Amination of a Carboxylic Acid without Coupling Agents

Gage Bortnem (1)*, George Nora (1)**, gage.bortnem@wolves.northern.edu
(1) Northern State University

Abstract: Coupling agents can be expensive to procure/make and dispose of. By performing the reaction directly, without coupling agents, the cost of disposing of chemicals will be reduced due to there being less to dispose of, and the amount of materials required and steps to completion will also be reduced, making the reaction more efficient. This poster will focus on showing a carboxylic acid (such as 4-tert-butylbenzoic acid) that is directly attacked by an amine (benzylamine) in the presence of a boron catalyst (3,4,5-trifluorophenylboronic acid, etc.). The process can take anywhere between 10 hours to 2 days and when microwave techniques are applied the time required to complete the reaction is reduced significantly.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU), SD EPSCoR/BioSNTR

1p - Defining tissue and cellular-specific defects of Wnt/beta-catenin signaling in cholesterol synthesis disorders

Paige Mriden (1)*, Kevin Francis (2)**, paige.mriden@siouxfalls.edu
(1) Sanford Health, (2) Sanford Research

Abstract: Smith-Lemli-Opitz Syndrome is a cholesterol synthesis disorder caused by a mutation in the DHCR7 gene that catalyzes the reduction of 7-dehydrocholesterol to cholesterol in the last step of the cholesterol synthesis pathway. Cholesterol is important for proper neuronal growth and development as well as signal transduction and synaptic activity. Patients with SLOS exhibit facial, cognitive, and behavioral abnormalities. While the main biological defect explaining SLOS is well known, the physiopathology to explain physical and cognitive impairments is unknown. Our lab recently demonstrated the Wnt/beta-catenin pathway that promotes cell proliferation and controls embryonic development is dysregulated in SLOS. By examining this pathway in Dhcr7 deficient mouse brain tissue via immunohistochemistry and Western blotting, we can determine if this defect is specific and restricted to certain tissues or broadly affects various cell types. These studies will further define a role for Wnt signaling in the pathogenesis of SLOS.

BRIN - University of Sioux Falls

2p - Effect of Vitamin D Repletion on Anaerobic Performance in Physically Active Adults

Mikenzie Mikkelsen (1)*, Cortney Dowling (2), Jesse Springer (3), Shane Scholten (2)**,
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(1) Black Hills State University, (2) Augustana University, (3) University of Sioux Falls

Abstract: Introduction: Vitamin D insufficiency is associated with impaired physical performance in physically active adults. Vitamin D repletion could have a positive effect on neuromuscular function, which could increase physical performance. Purpose: This study assessed the role of vitamin D repletion on markers of anaerobic performance in physically active adults. Methods: 16 physically active participants (5 participants <75 nmol/L, 11 participants >75nmol/L) were recruited to assess anaerobic fitness (vertical jump, hand grip strength, 10 and 40 meter sprints, push up test, isokinetic knee flexion/extension strength, and a Wingate bike test). Results: Vitamin D repletion was not found to be significant in any of the anaerobic performance tests ($p>.05$). Conclusion: This investigation demonstrated a lack of effectiveness for vitamin D repletion on markers of anaerobic performance in physically active adults.

BRIN - Augustana University, BRIN - Black Hills State University, BRIN - University of Sioux Falls

3p - Validity of Accelerometers for Velocity Based Weight Training

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(1) Sioux Falls, (2) Black Hills State University, (3) Augustana University

Abstract: Velocity based training (VBT) can be a useful tool to enhance exercise prescription by providing instantaneous feedback that can act as motivation, aid in countering daily muscular performance fluctuation, and help an athlete optimize resistance load to train a desired trait (strength, power, speed). Recent development of accelerometers for barbell use have amplified interest in VBT. This study assessed the validity of the Bar Sensei against kinematic data. Barbell velocity and kinematic data from high-speed video (120 Hz) were obtained from 2 volunteers performing 1 repetition each of a barbell hang clean. The results showed that the accelerometer measures were highly correlated with derived acceleration data from video ($r = 0.99$). Based upon the results, the Bar Sensei can be utilized as a valuable tool to provide instantaneous barbell velocity to coaches and athletes.

BRIN - Augustana University, BRIN - University of Sioux Falls

4p - A Comparison of Cytotoxicity of Two Types of Airborne Particulate Matter in Murine Astrocyte Cells

Tyler Fortuna (1)*, Paula Mazzer (1)**, tyler.fortuna.14@dwu.edu

(1) Dakota Wesleyan University

Abstract: We studied the ability of urban dust and diesel exhaust particulate matter to induce cytotoxicity and oxidative stress in murine astrocyte cells. Diesel exhaust particulate matter and urban dust have very different organic components, with UD containing a higher concentration of oxidized aromatic compounds. Therefore we hypothesized that these two airborne particulate types would produce different toxicological effects in our astrocyte cells. LC50 determinations showed DEP to be more toxic with an LC50 of 35 μ g/mL versus the LC50 of UD at 52 μ g/mL. A caspase 3 activity assay showed that the enzyme was activated by DEP but not by UD. These data suggest that DEP is inducing apoptotic cell death while UD is inducing necrotic cell death. The difference in cell death suggests that UD could potentially be more harmful in vivo due to the release of intracellular components caused by the rupture of the cell membrane.

BRIN - Dakota Wesleyan University, SD EPSCoR/BioSNTR

5p - The Efficacy of Fluoxetine Derivatives Against Candida Species

Jacee Yoshida (1)*, Jacee M. Yoshida (1), Cynthia Anderson (1)**, jacee.yoshida@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Many types of fungi are harmless and live ubiquitously as saprophytes; however, some fungi are pathogenic like the *Candida* species *albicans*, *glabrata*, and *krusei*. Fungal infections are becoming more prevalent worldwide, with the more invasive fungal infections being nosocomial in origin. Similar to bacteria, fungi are demonstrating increased resistance to current medications. This results in a need for new antifungals. A collaborative effort with the BHSU chemistry department provided 11 novel derivatives of fluoxetine to be tested against the three selected *Candida* species. Here we present the efficacy of those derivatives.

BRIN - Black Hills State University

6p - Measuring Levoglucosan Using Novel ICECLES Method

Ashley Kittelson (1)*, Brian Logue (2)**, akittelson@css.edu
(1) The College of St. Scholastica, (2) South Dakota State University

Abstract: The ICE Concentration Linked with Extractive Stirrer (ICECLES) method uses a combination of stir-bar sorptive extraction (SBSE) and freeze concentration to concentrate organic analytes. This results in lower levels of detection using a gas chromatogram/mass spectrometer. This research attempts to use the ICECLES method to analyze levoglucosan, a sugar produced when cellulose is burned at temperatures greater than 300°C. Levoglucosan concentrations in ice cores provide a historical record of biomass burning.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

7p - Evaluating Clonal Structure and Genetic Diversity of Invasive Ivy through Molecular Markers

Alissa Iverson (1)*, Anna Hafele (1), Tara Ramsey (1), Justin Ramsey (1), Justin Ramsey (1)**,
alissa.iverson@yellowjackets.bhsu.edu
(1) Black Hills State University

BRIN - Black Hills State University, SD EPSCoR/BioSNTR

8p - Analysis of NDEA in Tap Water with ICECLES-GC-MS

Matthew Marotz (1)*, Brian Logue (1)**, matthew.marotz@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Analyzing n-nitrosodiethylamine, a potential carcinogen and disinfection byproduct of water chlorination, commonly found in small concentrations in the water supply. ICE-Concentration Linked with Extractive Stirrer (ICECLES) is used to prepare samples, which are analyzed using GC-MS.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

9p - Fabrication of Closely Packed Gold Nanoparticle Monolayers by Adjusting Surface Charge

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(1) University of South Dakota

Abstract: Raman spectroscopy has the potential to be a useful tool in molecular identification. However, the signal intensity that is observed using this technique is very low. As a result, surface enhanced Raman scattering (SERS) has emerged as a major technique in the field of chemical sensing. Gold nanoparticle monolayers could be an effective approach to achieve SERS active substrates. When the nanoparticles are closely packed, the electromagnetic field is enhanced, which leads to increased signal intensity of the Raman scattering. In this work, we are investigating the effect of surface charge on the packing properties of the nanoparticles using sodium chloride in the fabrication of the gold nanoparticle monolayers. We observed a color change upon adding the sodium chloride, which indicates the successful adjustment of the surface charge on nanoparticles. Finally, we found more gold nanoparticles can be packed in the monolayer at the water-oil interface.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

11p - Synthesis and Evaluation of Substituted-Biaryl Isothiocyanates

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Abstract: A diet high in Brassica vegetables has been linked to a decreased risk of cancer. Enzymatic hydrolysis of glucosinolates, a natural product in Brassica vegetables, forms the bioactive component, organic isothiocyanates (ITCs). Previous studies have shown that non-natural ITCs amplify the anticancer effects of naturally-occurring ITCs. In this study, a panel of substituted-biaryl ITCs were prepared. The antiproliferative properties of these biaryl ITCs against human MCF-7 breast cancer cells were evaluated and structure-activity relationships were identified.

BRIN - Augustana University, SD EPSCoR/BioSNTR

12p - Developing fluorinated organic materials for biomedical and energy storage applications

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Abstract: The unique chemical and physical properties of fluorinated materials can be useful in both biomedical and electronic applications, including drug delivery, consumer electronics (laptops, phones, etc.), and energy storage. This poster will report the design and synthesis of a new monomer that possesses both fluorophilic and hydrophilic centers. An efficient synthetic route was optimized for the monomer synthesis. In addition, perfluoroalkylated aniline-containing compounds were synthesized and characterized. Upon electrochemical oxidation, these substituents polymerize at the electrode surface, offering new, high performance carbon-fluorine materials for primary batteries. Future research will focus on utilizing fluorinated micelles for ¹⁹F MRI imaging and drug delivery. In addition, we will also diversify the cathode materials by working towards pyrrole derivatives and modifying the aromatic core structure.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

13p - Engineered Alloy Structures by Friction Stir Reaction Processing

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Abstract: In this investigation, the use of friction stir processing has been adjusted to include a process that involves chemical reactions between the substrate and materials introduced into the stirred zone. This process is known as friction stir reaction processing (FSRP). This project involves creating intermetallic coatings prepared in-situ by encapsulating pure metal powders such as nickel and titanium onto aluminum substrates, followed by friction stir processing. Al-Ni 15 wt% and Al-Ti 15 wt% powders were encapsulated in Al 1100 substrates and friction stir processed with the objective of creating Ni₃Al and Ti₃Al intermetallic compounds on the surface. The formation of these compounds are expected to improve the tribological and corrosion properties of the materials. The reaction products were analyzed using scanning electron microscopy and X-ray diffraction techniques. The experimental details along with the detailed characterization of the reaction products are presented.

REU: Back to the Future III (SDSMT)

14p - Influence of Titanium Substrate Surface Preparation on the Growth of Titanium oxide Nanotubes for Biomedical Application

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Abstract: Titanium dioxide nanotubes are of considerable interest with their unique structure being investigated as a surface treatment for biomedical titanium implants. Anodic oxidation forms nanotubes on the titanium substrate, with the structure's final geometry dependent on multiple processing variables (voltage, electrolyte composition, and anodization time). Though these parameters are well understood, little is known regarding the metal substrate surface. This study investigates the influence of metallographic preparation on nanotube quality. Internal stress accumulates on the surface depending on the polishing method used. Typical mechanical polishing builds higher stress in titanium, work hardening the sample as it progresses from 320 to 1200, then a final colloidal silica polish. A minimized mechanical process allows for little residual stress using 600, 9 μ m, and colloidal silica. Alternatively, electrolytic polishing produces low stress samples using a perchloric based electrolyte. Samples from each method experienced identical anodization conditions to grow nanotubes, the structures then characterized and analyzed.

REU: Back to the Future III (SDSMT)

15p - Synthesis and Evaluation of Lipid A Inhibitors: A New Class of Antibiotics to Fight Bacterial Resistance

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Abstract: Antibiotic resistance is an ever-growing problem in the health industry. The CDC has reported in 2017 that there are 2 million people in the United States that are infected with bacteria resistance to antibiotics and at least 23,000 people die each year as a direct result of these infections. A new antibiotic is sorely needed. We have synthesized three ether derivatives of 3-hydroxybenzoic acid to begin this study. We then converted the acid into a hydroxamic acid. We have tested these compounds on a 96-well micro-titer plate format. Growth and inhibition levels are evaluated by measuring the optical density at 600 nanometers. We hope to establish sufficient IC₅₀ values and stabilize the compound to in vivo metabolism.

BRIN - Black Hills State University

16p - Protection of the Skeletal Muscle Insulin Signaling Pathway in Females with Type 2 Diabetes

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Abstract: Background: Activation of the insulin signaling pathway is decreased during obesity and results in type 2 diabetes. Changes in the insulin signaling pathway in the presence and absence of estrogens and exercise remain unknown. Methods: Female Wistar rats were fed either a standard diet (SD) or a high-fat diet (HFD) for 10 weeks, were ovariectomized (OVX) or had intact (In) ovaries, and a subset of animals exercised. Results: Exercise decreased weight gain, adipose tissue weight, and blood glucose and plasma insulin levels. However, consumption of the HFD did not decrease activation of the insulin signaling pathway (pAkt, TBC1D4, and PAS-160) in the soleus muscle. Conclusion: These data show that while the combination of the HFD/OVX resulted in whole body changes (increased body weight, adipose tissue weight, blood glucose and plasma insulin), but the insulin signaling pathway in the soleus is not affected in female rats.

BRIN - Augustana University

17p - Synthesis and Characterization of a Luminescent Anthraquinone-containing Ruthenium Polypyridyl Metal Sensor

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Abstract: We are interested in using anthraquinone macrocycles to detect heavy metal ions in solution using fluorescence spectroscopy. Although these macrocycles observe good selectivity for different metal cations, they often suffer from low quantum yield (poor sensitivity). We have incorporated a second lumophore to test if fluorescence resonance energy transfer (FRET) can occur and increase sensitivity. A polypyridyl ruthenium complex that contains a coordinated anthraquinone-bipyridyl macrocycle has been synthesized via two different pathways by changing the order of addition of the different reagents. We have compared the synthetic yield of these pathways and investigated the fluorescence efficiency of this complex in the presence and absence of a wide variety of different metal cations of environmental and biological concern. In addition, we will present the single-crystal X-ray diffraction data for the structures of these and related ruthenium complexes.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

18p - Making metal (Pd) - metalloid (Te) alloy from organometallic precursors at ambient conditions

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Abstract: One-pot synthesis of palladium-tellurium containing alloy nanomaterial synthesized by mixing allylpalladium(II)chloride dimer and dppm analogue of Te. Pd_xTe_y nanomaterials are characterized by PXRD and TEM imaging. PXRD data suggests that it is Pd₂₀Te₇, and also it is single phase. A redox reaction is responsible for the formation of Pd₂₀Te₇. Other organic pieces in the redox reaction were isolated and characterized by NMR and X-Ray crystallography. Pd₂₀Te₇ may act as a heterogeneous catalyst for a C-C coupling between an aryl halide and an alkene, known as the Heck reaction. Mixing tetrakis(triphenylphosphine) palladium(0) with dppm analogue of Te also yields a Pd-Te alloy, but it is Pd₁₀Te₃.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

19p - Mapping platelet responses in Native American populations

Katelyn Graber (1)*, Kirby Hora (1), Tania Rodezno (1), Sarah Stein (1), Mark Larson (1)**,
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Abstract: Platelets, key cellular components in normal hemostasis, can contribute to cardiovascular disease progression and are altered by certain drug therapies. These effects occur via a wide array of protein receptors that can respond to various in vivo signals and pharmaceutical products. The degree of platelet reactivity to either signals or drugs may vary among individuals based upon the presence of receptor allele polymorphisms enriched within certain ethnicities. For example, African American populations have a variant in the thrombin receptor PAR-4 that results in greater degrees of platelet activation and refractivity towards anti-platelet medications compared to Caucasian populations. Based upon this finding, we mapped Native American population platelet responses to five agonists that target distinct platelet receptors and compared the degree of platelet activation to Caucasians. Preliminary data provides insight into possible platelet receptor variants between Native Americans and Caucasians that warrants further investigation.

BRIN - Augustana University

20p - Synthesis, characterization, and catalytic activity of hollow Mn₃O₄ nanoparticles for cyclohexene oxidation

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Abstract: Catalytic oxidation of alkenes into value-added oxygenated derivatives is a fundamental reaction in organic chemistry with many industrial applications. The use of oxygen or H₂O₂ as oxidants in the catalytic oxidation reactions are considered as green procedure since no toxic by-products are produced in these reactions. In this project, hollow Mn₃O₄ nanoparticles exhibiting uniform shape and size were prepared by oxidation of MnO nanocrystals that leads to a Kirkendall effect. The material was characterized with powder X-ray diffraction, electron microscopy, and UV-visible spectroscopy. The catalytic activity of hollow Mn₃O₄ nanoparticles towards the oxidation of cyclohexene (10 hours at 80°C in air) was investigated. Using FTIR, GC-MS, and NMR data, it was found that cyclohexene was oxidized to 2-cyclohexen-1-one and 1-cyclohexen-1-ol as main products and cyclohexene oxide (7-oxabicyclo [4.1.0] heptane) as the side product.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

21p - Water Quality in the Homestake Mine Near the Sanford Underground Research Facility

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Abstract: Water was collected and analyzed from four levels of the Homestake Mine in Lead, SD near the Sanford Underground Research Facility (SURF). Samples were analyzed for the following ions: ammonia, bicarbonate, carbonate, calcium, chloride, magnesium, nitrate, potassium, sodium, and sulfate. The samples were also tested for the following properties: temperature, dissolved oxygen, total alkalinity, total hardness, and conductivity. Fifteen additional elements were determined using ICP-MS (Inductively Coupled Plasma Mass Spectrometer). On the 4850 level, this work was done in collaboration with biologists, correlating microorganisms with their aqueous environments. Last year, differences were found between the 4100 and 4850 levels; this year it was found that differences can even exist between water on two sides of the same tunnel, less than 25 feet apart.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU)

22p - Computer Modeling of High-Purity Germanium Detectors in MAJORANA

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(1) Black Hills State University

Abstract: The MAJORANA project seeks to observe neutrinoless double beta decay, a hypothesized variant of double beta decay in which the two emitted neutrinos annihilate each other. The detection of neutrinoless double beta decay would confirm that neutrinos are Majorana particles, i.e. that neutrinos and antineutrinos are the same particle. There is currently an array of high-purity germanium (HPGe) detectors, the MAJORANA DEMONSTRATOR, searching for neutrinoless double beta decay at the Sanford Underground Research Facility. It uses HPGe crystals composed of approximately 87% Ge-76, encased in radiologically pure lead and copper. Using the high-energy physics software library Geant4, I created a C++ "detector construction" file specifying the exact HPGe mixture used in the DEMONSTRATOR. Combined with an implementation of double beta decay in Geant4, this detector construction specification could be used to simulate the DEMONSTRATOR.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU), SD EPSCoR/BioSNTR

23p - Anti-Icing Surfaces

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(1) South Dakota School of Mines & Technology

Abstract: Anti-Icing Surfaces

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

25p - Adhesion Testing of Silanized Silica

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Abstract: Mineral processing often generates the need for vast amounts of water, especially in separation processes, such as froth flotation. Water is consumed via evaporation, or rendered unfit for other uses through the addition of chemical reagents. This research is the first step towards designing and developing a method of particle separation that uses little to no water in its mechanism. Specifically, this report focuses on the strength of adhesion between silica microparticles and a glass disc. Both substrates have been treated with trichlorooctadecylsilane (TCOD) or trimethoxysilyl propyldiethylenetriamine (TMPA) to form self-assembled monolayers (SAM), which change the physical properties of the substrate's surface. The silanes used form either hydrophobic (TCOD) or hydrophilic (TMPA) SAM's. Adhesion strength is tested via a "drop test" which provides an early model on how hydrophobic/ hydrophilic surface properties effect adhesion of particles.

REU: Back to the Future III (SDSMT)

26p - Novel Isoxazoline Synthesis and Investigation as Potential Antimicrobial Agents

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(1) Augustana University

Abstract: Isoxazoles, isoxazolines, and their derivatives have been found to have a vast array of applications such as being antimicrobial, anti-inflammatory, and antifungal agents. It has been found to be useful in halting malignant cell lines from growing and is also found in animal pharmaceuticals in treatment of endoparasitic infestations. This work strives to synthesize a novel isoxazoline which will be tested against agricultural fungi, gram negative, and gram positive bacterium to find it's effectiveness as an antifungal agent. A Grignard reaction of an aldehyde and ethynyl magnesium bromide will produce a secondary alcohol that will be treated in a Michael Addition with nitrostyrene to synthesize a nitroether. The nitroether will then produce the furo-isoxazoline by an Intramolecular Silyl Nitronate Cycloaddition (ISNC). The cyclic ether will then be opened up by a Lewis acid to create the final isoxazoline product.

BRIN - Augustana University

27p - Methane to Methanol Transformation Catalyzed by Tricopper Complexes

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(1) University of South Dakota

Abstract: Our nation is heavily dependent on petroleum, a finite resource. In addition to renewable and nuclear energy, an important target in efforts to reduce the use of petroleum is to catalytically transform methane to methanol. By researching the mechanism and electronic properties of transition metal catalysts, we aim to understand and improve the efficiency of this transformation. Methane to methanol oxidation has been studied and a copper catalyst is reported. Density functional theory calculations were employed using the def2-TZVP and the wB97XD functional to study structure and experimentally proposed catalytic mechanism. A model system in which the ligand was removed was studied initially to provide insight into the reaction pathway while reducing the computational cost. Two reaction pathways were considered where the C-H activation occurred at different oxygen sites. We studied both triplet and quintet spin states for all species. Calculations for the experimentally characterized catalyst are ongoing.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

28p - Uncertainty Quantification of Pulsatile Blood Flow through a Contraction using Computational Fluid Dynamics

Gwen Ostergren (1)*, Stephen Gent (1)**, gwen.ostergren@sdstate.edu

(1) South Dakota State University

Abstract: As medical technology advances, so does the need evaluate the safety and performance of novel medical devices. One methodology that is increasingly being used for this purpose is computational fluid dynamics (CFD) modeling. This project used CFD to assess the performance of endovascular stent grafts by modeling blood flow through the stent graft. However, the accuracy of these numerical models needs to be well understood, so it is necessary to justify simulations results with experimental data and uncertainty quantification. This project aimed to create a methodology for numerically quantifying the uncertainty of parameters in a contraction model. This objective was achieved by varying four parameters in two closely related models, and using the method of Non-Intrusive Polynomial Chaos to propagate uncertainty throughout the model. Preliminary results indicate that the two of the uncertainties have a negligible on the model, and two have a notable impact on the model.

REU: High Performance Computing in STEM disciplines (SDSU)

29p - Computational Fluid Dynamics Analysis of Heat Transfer Coefficients and Crossflow in Non-Uniform Impinging Jets

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Abstract: With electronic devices getting smaller and more energy-dense, there is an urgent need to find more efficient cooling methods. Impinging jets are a proven heat transfer technique that could be applied to electronics cooling applications. However, when larger jet arrays are used, crossflow from the inner jets begins to negatively affect the performance of the outside jets. Experiments were previously performed on non-uniform circular jet arrays to determine if crossflow effects could be reduced with different jet arrangements to obtain higher heat transfer coefficients. Using a commercial CFD solver, the different jet arrays were modeled and results were compared to experimental data. The simulation data were used to analyze how cross flow affects the heat transfer coefficients at different points on the target surface. The performance of newly designed jet arrays can also be simulated on a commercial CFD solver to determine if they are viable to test experimentally.

REU: High Performance Computing in STEM disciplines (SDSU)

30p - Analyzing Enantioselective Copper Photoredox Catalysts through Aldehyde and Alkyl Bromide Coupling

Mikayla Prouty (1)*, Michael R. Hurst (2), Thomas G. Trimble (2), Cheyloh A. Bluemel (2), Katrina H. Jensen (2), Katrina Jensen (2)**, mikpro908@mtmc.edu

(1) Mount Marty College, (2) Black Hills State University

Abstract: Photoredox catalysts have proven efficient for synthesizing new molecules. By absorbing light, photoredox catalysts excite electrons in lower molecular orbitals to higher orbitals and facilitate the transfer of electrons ultimately leading to the formation of new bonds. Previously studied photoredox catalysts include ruthenium and iridium complexes which are rare, expensive and toxic metals. Our research is aimed at analyzing copper, a more abundant, less toxic, and environmentally safer metal, as a photocatalyst in the coupling reaction of aldehydes and alkyl bromides. The reaction yields a chiral molecule by forming a new carbon-carbon bond, thus we used a chiral catalyst to synthesize enantiomerically-enriched products. It is known that enantiomers can vary in biological effects. Through the use of a chiral catalyst, we can facially select for one enantiomer over the other. Measurements of enantioselectivity were obtained through High Performance Liquid Chromatography (HPLC), and reaction effectiveness was measured by percent yield.

31p - Development and processing of oxide dispersion strengthen steels by friction additive manufacturing processes

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(1) South Dakota School of Mines & Technology

Abstract: This poster outlines an effort for researching the development of an alternative, low cost, and near-net shaped fabrication technique for producing Oxide Dispersion Strengthened (ODS) alloys. 316 stainless steel ODS powders were fabricated by mixing yttrium oxide nano particles (.35wt%) using a ball milling approach. Particle size analysis of the ODS powder suggest that the particle size decreased with increase in milling time. Scanning electron microscopy and X-ray diffraction analysis was performed to understand the distribution of yttrium oxide dispersion in the powder. Preliminary friction additive manufacturing experiments were performed using Al 6061 alloy. The experimental details along with the microstructural details of the ODS powder were analyzed and presented.

REU: Back to the Future III (SDSMT)

32p - Development of a Mechano-Responsive Ink for Security Printing

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(1) South Dakota School of Mines & Technology

Abstract: The field of security printing is concerned with developing anti-counterfeiting, print-based solutions to circumvent the illicit production of high value documents and products. A mechano-responsive ink could provide a new covert component for printed security features to help prevent counterfeiting. This research investigated the use of spiropyran, a well-known color-changing, fluorescent, and reversible mechanophore, covalently linked into a polydimethylsiloxane (PDMS) matrix as a potential security ink. Initial work focused on printing PDMS (no spiropyran) with toluene using an automated pneumatic dispensing system - a Nordson EFD (Engineered Fluid Dispenser). Next a solution of spiropyran dissolved in toluene and mixed with PDMS was used to print a quick response QR code, demonstrating proof-of-concept for this system as a security end product. Finally, the relationship between the mechanical force applied to the printed film and the chemical activation of spiropyran was investigated by a combined full field fluorescence and mechanical testing technique.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSU)

33p - Analysis of the Substitution of Common Photoredox Complexes for Copper (I)

Austin Williamson (1)*, Austin D. Williamson (1), Michael R. Hurst (1), Thomas G. Trimble (1), Cheyloh A. Bluemel (1), Katrina H. Jensen (1), Katrina Jensen (1)**, austin.williamson@yellowjackets.bhsu.edu

(1) Black Hills State University

Abstract: Photoredox catalysis has been demonstrated to be a useful strategy in chemical synthesis. Reactions that use photoredox catalysis require visible light absorption to promote the catalyst to an excited state, lowering the activation energy needed for a reaction to occur between two molecules. Ruthenium and iridium are common metals used for these complexes, which are expensive, rare, and toxic. Copper is more earth abundant, less expensive, and less toxic than ruthenium and iridium; and certain copper (I) complexes have similar properties to common photoredox catalyst. For these reasons, we are analyzing the effect of copper (I) complexes with various ligands attached. Through our research, we have found that copper complexes of phenanthroline ligands are effective photoredox catalysts, and the most efficient is Cu(dap)2Cl. We have also investigated the use of copper (I) complexes of bipyridine based ligands as photoredox catalysts.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

34p - Combustion Analysis: Using Finite Difference Methods to Model Grenade Delay Housings

Andre Bieber (1)*, Lori Groven (1)**, andre.bieber@mines.sdsmt.edu
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Abstract: The use of Finite Difference Methods are an effective way to provide a numerical solution to partial differential equations (PDE) when an analytical solution is not possible or practical. Using boundary conditions and a PDE, software like FlexPDE, can run thousands of calculations and provide a model from those calculations. The model that was developed during the research will allow the combustion of the delay composition W/MnO₂ to be analyzed while in zinc and aluminum housing channel materials. The W/MnO₂ was run at a theoretical maximum density (TMD) of 50%, 60%, and 70%. The models shows the effect thermal conductivity of the housing channel preheating the delay material, which speeds up the reaction near the channel of the housing. The effect becomes more pronounced as the TMD percentage is increased for the delay material.

SD EPSCoR/BioSNTR

35p - Exploring Enzyme-like Catalysis of Metal-Organic Supercontainers (MOSCs)

Manuel Guillen (1)*, Alexis Redowl (1), Parvathi Jampani (1), Yupu Qiao (1), Z. Rick Wang (1), Z. Rick Wang (1)**,
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Abstract: A new class of nanostructured molecules known as metal-organic supercontainers (MOSCs) were examined for their ability to mimic enzymatic catalysis. The concept of “small-molecule regulators” was adopted in particular to modulate the catalytic activity of MOSCs in two important reaction types, namely, Michael addition and Friedel-Crafts alkylation. Designing new catalytic activities in MOSCs will have numerous synthetic applications in areas as diverse as chemical synthesis, drug development, and nanotechnology.

REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

36p - Effect of Overcoating Printed Silver on Conductivity

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Abstract: Printed electronics are becoming more common, and because of this advancement they are moving to different applications, such as aerospace. This project is a preliminary stage in a larger project for printed spacecraft. Printed spacecraft have three basic components, a substrate, printed conductive material for the electronics, and a printed superstrate. The substrate used in this project was Kapton, the conductive material a colloidal silver paste, and the superstrate a liquid Kapton. The silver paste will be printed using an Engineered Fluid Dispensing printer, and the Kapton superstrate will be printed using a Sono-Tek aerosol-jet printer. The goal of this project is to test if conductivity is negatively affected by the overcoating process. This will be done by printing silver traces, testing the resistance, overcoating with liquid Kapton, and testing the resistance again. Finally, the resistances will then be used to calculate the conductivity of the material.

REU: Back to the Future III (SDSMT)

37p - Loading of Functional Optical Material in PWHGMs for Security Printing Systems

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Abstract: The purpose of the research is to develop porous- wall, hollow glass microsphere (PWHGM) based security features for anti-counterfeiting or anti-tampering applications. The project aims to develop anti-tamper or anti-counter security features by using a functional material with unique optical characteristics and loading it inside PWHGMs.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT), SD EPSCoR/BioSNTR

38p - Ultratrace determination of U and Th in acrylic by ICP-MS

Bailey Kane (1)*, Brianna J. Mount (2), Daniel J. Asunskis (2), Marcelo B. B. Guerra (2), Marcelo Guerra (2)**,
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(1) Casper College, (2) Black Hills State University

Abstract: The aim of this work was the optimization of a sample preparation method based on dry-ashing for the ultratrace determination of U and Th in acrylic by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). This initiative is part of the efforts towards the search of candidate materials to be used in low background physics experiments. An acrylic sample was cut into small pieces (ca. 0.3 g), cleaned to remove superficial contaminants, and submitted to dry-ashing for matrix decomposition followed by acid dissolution and ICP-MS measurements. In order to attain very low detection limits, several measures were adopted: i) rigorous cleaning of quartz crucibles with aqua regia; ii) cleaning of glassware with HNO₃ 10 % v/v; iii) use of a class 1,000 clean room, as well as sub-boiling distilled HNO₃, and ultra-pure water. Detection limits in the sub-ppt range were achieved for U and Th, which are appropriate for this radiopurity screening.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU)

39p - Evaluating the reaction scope and enantioselectivity of photoredox catalysis with copper photoredox catalysts

Anna Lauko (1)*, Michael R. Hurst (2), Madison R. Jilek (2), Cheyloh A. Bluemel (2), Katrina H. Jensen (2), Katrina Jensen (2)**, laukoa@carleton.edu
(1) , (2) Black Hills State University

Abstract: Photoredox catalysis, which utilizes visible light to form new bonds between organic molecules, has emerged as a powerful new tool for synthesizing complex molecules, especially ones with biological activity. Commonly used photoredox catalysts are made from iridium and ruthenium, which are both extremely rare and expensive. Comparatively, copper is less toxic, significantly more abundant, and cheaper, and could make photoredox catalysis viable in larger scale organic synthesis. We investigated the reaction scope of copper photoredox catalysts by using them to couple various aldehyde and bromide combinations and determining yields. The reaction also calls for a second catalyst, which can be tuned to select for one enantiomer of chiral products. We evaluated the selectivity of this chiral catalyst by determining the enantiomeric excess in each reaction.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

41p - Mapping Human Impacts on South Dakota's Historical Landscapes

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Abstract: South Dakota's landscapes have been shaped by humans throughout history, with the past three hundred years as perhaps the most significant period of anthropological modifications to the environment. This project aims to visually represent these changes through a series of maps, constructed in conjunction with research into rural geography and agricultural landscapes. We found that South Dakota's landscape evolution can be categorized by several events: the arrival of Europeans and their infectious diseases, the shifting power relations between different tribal nations, the forced relocation of South Dakota's indigenous peoples to reservations, the opening of South Dakota's land to settlers via the Homestead Act, the conversion of short- and tall-grass prairie to agriculture and ranching, and the damming of the Missouri River. This map series demonstrates the evolution of South Dakota's landscapes, and shows that anthropological modifications of the environment are not just a recent occurrence.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

42p - Functional Genomics of Medulloblastoma among Mus musculus Models: An Integrative Analysis of Transcriptome and Targetome Data

Blaine Nelson (1)*, Blaine A. Nelson (1), Hasitha Premathilake (1), Alex Heglin (1), Katie B. Grausam (2), Haotian Zhao (2), Erliang Zeng (1), Erliang Zeng (1)**, blaine.nelson@coyotes.usd.edu
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Abstract: Medulloblastoma (MB) is the most common malignant brain tumor found among pediatric patients, constituting about 20% of all childhood brain tumors. This cancer, which is composed of four molecular subgroups including: WNT, Sonic Hedgehog (SHH), Group 3, and Group 4, stems from the cerebellum and tends to metastasize through the cerebrospinal fluid (CSF) to the meninges and subarachnoid space covering the brain and spinal cord. Primary aggressive treatments such as surgery, craniospinal radiation therapy, and chemotherapy are performed to resect or destroy the cancerous tumor; however, the possibility of recurrence may occur. It is important to explore the molecular and cellular events involved in the ATOH1-driven cascade of metastatic MB so that potential therapeutics may be safer and more effective. This project applied functional genomic statistical analyses of RNA-Seq and ChIP-Seq to uncover differentially expressed genes. The results were compared, and pathways were detected and analyzed using Ingenuity Pathway Analysis.

BRIN - University of South Dakota

43p - Single Nucleotide Mutations in Soybeans and Nodule Development

Allison Zvarick (1)*, Sen Subramanian (1)**, allison.zvarick@sdstate.edu
(1) South Dakota State University

Abstract: My project details the analysis of over 100 different soybean lines and the mutations in genes thought to be expressed during hormone regulation for the purpose of nodule development in soybeans.

REU: High Performance Computing in STEM disciplines (SDSU)

44p - Herbal Inhibition of Gram Positive and Gram Negative Bacteria

Collin Sorensen (1)*, Kathleen Gibson (1)**, colsor556@mtmc.edu
(1) Mount Marty College

Abstract: Bacteria have become resistant to commonly used antibiotics due to overuse of antibiotics. In recent years, people have claimed that herbs have antimicrobial properties that can inhibit bacterial growth. For this study, eleven species of plants were selected: Cinnamon Basil, Bee Balm, Pineapple Sage, Lemongrass, Lavender, Oregano, Spearmint, Curled Parsley, Rosemary, Dill, and Flat Parsley. Plants were collected, extracted and screened against four species of bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Bacillus cereus*) using the Kirby Bauer disk assay. The most effective plants were Pineapple Sage, Lavender, Oregano, Spearmint, and Rosemary, Curled Parsley, and Flat Parsley. Of these, Lavender, Spearmint, and Oregano inhibited both Gram positive and Gram negative bacteria. The remaining plants showed zero inhibition against all bacteria screened. Ethanol extractions were more effective than distilled water extractions, indicating nonpolar molecules are more of the focus.

BRIN - Mt. Marty College

45p - Interactions Between Musical Rhythms and Cardiorespiratory Rates in Humans

Hannah Buchholz (1)*, Kenneth Tice (1)**, hannah.buchholz@mtmc.edu
(1) Mount Marty College

Abstract: This study expands on previous work done by Luciano Bernardi, Cesare Porta, Gaia Casucci, Rossella Balsamo, Nicolò F. Bernardi, Roberto Fogari, and Peter Sleight, with the hope of recreating their results using a larger participant age range. A Biopac Bioharness was used to monitor and log forty-nine participants' cardiovascular and respiratory rates while listening to a randomized playlist of five pieces of classical music, and silence. Participants took a perceived stress scale and asked about previous musical experience. The data was evaluated for any significant patterns in participants' results that aligned with rises or falls in the music. In comparing data from those with musical experience and those without, both groups were affected by the music, and no significant difference was found between two groups. The results of this study could lead to more widespread use of music in the medical field as a means to improve patients' cardiorespiratory rates.

BRIN - Mt. Marty College

46p - Quantification of Required Antibody Titer to Inhibit Influenza's Neuraminidase Enzyme Activity Via the Enzyme-Linked Lectin Assay

Nicholas Wixon (1)*, Arthur Gallegos (2), Victor Huber (3)**, nicholas.wixon@mtmc.edu
(1) Mount Marty College, (2) Sanford Health, (3) University of South Dakota

Abstract: Neuraminidase (NA) is an envelope glycoprotein of influenza viruses capable of sialidase activity. Sialidase activity is important at multiple points in the viral replication process such as countering the sialic acid receptor binding activity of the other major envelope glycoprotein hemagglutinin (HA) by cleaving sialic acid. Antibodies that inhibit NA can be used therapeutically to help slow down the viral replication process, while also limiting the secondary infection risks that NA poses. Recently, new neuraminidase inhibition measuring assays have been developed that are more efficient and have less chemical waste produced. Our utilized method of quantification for the inhibition of NA function is the enzyme-linked lectin assay (ELLA), which is performed in 96-well plates and analyzed on a spectrophotometric plate reader. The ELLA assay was utilized to measure the lowest antibody concentration that still effectively inhibits the NA activity of each virus.

BRIN - Mt. Marty College, BRIN - University of South Dakota

47p - Anti-Counterfeiting with Digital Forensics

Dakota Earle (1)*, Ashley Podhradsky (2), Jon Kellar (1), Ashley Podhradsky (2)**, dearle@albany.edu
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Abstract: Today the counterfeit world exceeds \$100,000,000 and criminals are able to keep their identities and activities almost completely anonymous through the use of the TOR browser. TOR is an open source browser that uses relays to keep a users identity and activity anonymous. The goal for the project is to determine the efficacy and value of combined cyber and physical analyses to better understand the counterfeit world. Digital Forensic tools will be used to help analyze a digital image of a hard drive that is known to have purchased items off suspicious sites. A comparison of the digital and physical analysis results will be created to help achieve the research goal.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT)

48p - Toward the development of the CellWell 3D cell culture platform - a novel micropatterned substrate for high-throughput fluorescent imaging of single adherent cells

Ryan Dekle (1)*, Scott Wood (1)**, ryan.dekle@student.nmt.edu
(1) South Dakota School of Mines & Technology

Abstract: Osteoarthritis is a crippling chronic condition in which articular cartilage is destroyed. The goal of this summer's work is to develop a proof-of-principle prototype of an electrospun, hydrogel-embedded, micropatterned substrate to overcome imaging and physiological restraints of current culture methods for mechanotransduction studies. An electrospinning apparatus was used to create woven mats for laser ablation. Once viable polyvinylpyrrolidone (PVP) mats were made, attempts were made to embed the mat with an agarose gel solution for laser ablation of micrometer-sized holes in each sample. Results from SEM imaging indicated photothermal ablation of electrospun samples. Ablation position inconsistencies were observed when utilizing multiple laser pulses at a single location. It was also found that electrospun PVP mats required crosslinking prior to embedding in agarose to prevent solubilization of fibers in the aqueous environment of the hydrogel. In all, micropatterned ablation of hydrogel-embedded electrospun mats appears to be feasible with further optimization.

REU: Back to the Future III (SDSMT)

49p - Recruitment strategies to increase engagement in the PASS-ECHO cohort

Katherine Giorgio (1)*, Christa Friedrich (1), Morgan Nelson (1), Peter Gilbertson (1), Tracy Thomes (1), Amy Elliott (1), Christa Friedrich (1)**, katherine.giorgio@sanfordhealth.org
(1) Sanford Health

Abstract: The Environmental influences on Child Health Outcomes (ECHO) study will utilize mother-child pairs from the Prenatal Alcohol, SIDS, and Stillbirth (PASS) cohort who are located in the Sioux Falls and Rapid City sites to build a new cohort. Establishing a large cohort is essential to the success of the study. The first group of PASS participants (n = 338) were contacted on May 18th, 2017. Of this group, demographic characteristics, the number of contact attempts from research staff, and the amount of time passed since the most previous contact were examined in order to aid the staff in future ECHO participant recruitment.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

50p - Does Seeded Species Phenology Affect Establishment of Non-Seeded Species in Tallgrass Prairies?

Shelley Kosola (1)*, Shelley Kosola (2), Meghann Jarchow (1)**, hightreeranch@gmail.com
(1) University of South Dakota, (2) Nebraska Indian Community College

Abstract: Tallgrass prairies are complicated and diverse ecosystems and are endangered. In this project we will evaluate how the growth form and phenology of functional groups affects establishment of non-seeded species in a field experiment near Vermillion South Dakota. We hypothesize that more non-seeded species will become established in treatments where there is an open ecological niche (i.e. differing growth form and phenology of the seeded species). Plant diversity data from 2015-2016 will be used to show effects of seeded functional groups (i.e. early and late-flowering grasses and forbs) on non-seeded functional group abundance. This data was obtained through quadrant samples where all harvested species were dried and weighed. Better understanding of the complex niche behaviors will allow for better management recommendations for tallgrass prairies.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

51p - Impact of Drought on Suspended Load: The Vermillion, Big Sioux, and James Tributaries

Bethany Vazquez (1)*, Mark Sweeney (1), Mark Sweeney (1)**, bethani.vazquez@gmail.com
(1) University of South Dakota

Abstract: The Missouri River basin moves suspended sediment loads which are an important part in river hydrology. Due to the installation of Gavins Point Dam sediment loads have been greatly reduced downstream in the Missouri National Recreational River, while at the same time, trapping sediment upstream of the dam. This research measured the suspended load of three major tributaries below the Gavins Point Dam and looked at their overall contribution to the Missouri River load. Using a 26lb depth integrated sampler we collected suspended sediment from the water column at two locations in each river every other week during a two month period in summer 2017. We observed a positive correlation between suspended load and attributes such as total dissolved solids and conductivity. The Vermillion was significantly different to the other tributaries after loss on ignition, with the suspended load decreasing as the discharge decreased.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

52p - A Historical Analysis of the Usage of and Interaction with Mníšoše by American Indian Tribes

Selena Olvera (1)*, David Posthumus (1), David Posthumus (1)***, selena.olvera@coyotes.usd.edu
(1) University of South Dakota

Abstract: Before recorded history, American Indian tribes have inhabited the Upper Missouri River Basin and utilized the Missouri River's natural resources. They have fought for centuries to keep a strong relationship with their original homelands and source of life. The objective of this research is to analyze traditional relationships between tribes and the river. To pursue this information, the researcher employed two primary methods. First, data was gathered from historical and contemporary texts that cover a large range of activity on the river from fur trading to ethnic botany. Second, interviews were conducted with members of two tribes within the Basin to obtain more personal data. These ongoing studies will reveal how the river was traditionally used and will help to understand the importance in sustaining the Missouri River. Communities surrounding the river can use historical information to understand the cultural, economic, and ecological importance of the Missouri River.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

53p - Informing Strengths Based Programming: Uncovering Cultural Protective Factors for Peer Victimization Among Rural and Native American Youth

Anna Flitner (1)*, Emily Griesse (1)***, anna.flitner@sanfordhealth.org
(1) Sanford Health

Abstract: Native American and rural youth are at a higher risk of experiencing peer victimization in comparison to the rest of the nation's youth. In addition, Native American youth have the highest rates of suicide in the US, and peer victimization can exacerbate negative psychological effects. Among this specific population, limited research has been done regarding intervention programs. Qualitative data from key informant interviews (N=3) revealed three themes: a high prevalence of bullying, community resilience, and the prominence of culture. Interviewees suggested that bullying interventions be focused on principal characteristics of Native American culture. Programs should focus on developing identity while enabling youth to understand and accept backgrounds and beliefs different from their own. By using the seven Lakota virtues as protective factors and the medicine wheel as a teaching tool, life-long positive changes in youth behavior may be achieved.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

54p - American Indian representation in community health needs assessments conducted by South Dakota nonprofit hospitals

Carmelita Shouldis (1)*, Chelsea Wesner (1)***, carmelita.shouldis@coyotes.usd.edu
(1) University of South Dakota

Abstract: The Affordable Care Act requires tax-exempt hospitals conduct a community health needs assessment (CHNA) and address priority needs. The CHNA must be publicly available and completed every three years. The purpose of this study was to determine the representation of American Indian populations in CHNAs conducted by nonprofit hospitals in South Dakota. Through a web-based search of nonprofit hospitals (n=50), we collected CHNAs completed for the 2016 tax year. From each CHNA, we extracted and analyzed CHNA methods, public health involvement, and, if reported, primary data from CHNA surveys (e.g., race/ethnicity, education, health insurance status, income). Preliminary results indicate American Indians are underrepresented in SD CHNAs, as well as other medically underserved, minority, and low-income populations. Recommendations will be shared to help nonprofit hospitals improve collaboration with rural and American Indian communities and increase representation in future CHNAs. This study aims to advance health equity and improve population health.

BRIN - University of South Dakota

55p - A Conspectus of Data Sovereignty and Data Governance in Indigenous Communities

Carolina Garcia (1)*, Victoria Grey Owl (1)**, carolina.garcia@sanfordhealth.org
(1) Sanford Health

Abstract: Positive growth within Indian country requires an increasing demand for data. With this increasing demand requires culturally specific data management that encompasses data sovereignty and data governance. To begin the process of developing strategic data management plans with five tribal nations, a literature review was conducted to gain an understanding of the barriers indigenous communities face when working with researchers. Background, barriers, and resources found during the literature review were presented to five tribal nation leaders at a workshop. The presentation included a pre-post-test to measure the learning objectives. Evaluation data was collected from all five tribal nation leaders and will be utilized in the preparation of a presentation to a broader audience on the Collaborative Research Center for American Indian Health website. We expect our presentation to encourage a stronger collaborative relationship between researchers and Native American communities.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

56p - Corrosion in Seawater

John Carter (1)*, William Cross (1)**, cartj321@coyote.csusb.edu
(1) South Dakota School of Mines & Technology

Abstract: The corrosion of steel occurs in many environments. In seawater, the process is heavily affected by the growth of marine organism on the exposed surface. This growth is called the biofouling layer. A method of analysis has been developed that need only look at certain characteristics of the biofouling layer to determine the rate at which corrosion is occurring. These characteristics include density, thickness, and concentration of iron. This project seeks to use that method and test its validity through comparison with other studies.

REU: Back to the Future III (SDSMT)

57p - Developing Use of Local Microbes for Commercial Brewing

Branden Pfaff (1)*, Paul Egland (1)**, bdpfaff14@ole.augie.edu
(1) Augustana University

Abstract: Fernson Brewing Company wishes to develop a locally-sourced South Dakota beer. The present study identified three local yeast strains based on DNA sequence analysis, revealing that two of the strains were of the genus *Hanseniaspora*. The third was identified as *Saccharomyces cerevisiae*, which grew faster and was able to consistently reach sufficient cell counts for a 1-gallon of wort. Pilsner wort was inoculated with all three strains, and was incubated at 20C. After two weeks of fermentation, specific gravity and sensory analysis were performed on each sample. *Hanseniaspora* samples did not fully ferment and had unpleasant flavor profiles. Results suggested that *Hanseniaspora* would be a difficult yeast to utilize in brewing because of its unpalatable secondary metabolites. The *S. cerevisiae* fermentation reached a specific gravity of 1.2 and gave a crisp, dry product with pleasant flavors of biscuits; suggesting that it is a candidate for Fernson Brewing Company.

BRIN - Augustana University

58p - Visible to Infrared Converting Cuprorivaite Based Security Ink

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Abstract: Infrared emitting inks are being developed in an effort to combat counterfeiting technologies using ultraviolet fluorescent inks. Cuprorivaite, historically Egyptian Blue, is a silicate which demonstrates strong near infrared emission when exposed to visible light. The aim of this research is to produce a cuprorivaite based security ink. A solid state synthesis is conducted using cupric oxide, calcium carbonate, and silicon oxide. This synthesis yields microscale particles. The particles are then wet milled to reduce the particle size and enable surface modification of the particles. Finally, ink production is done based on Hansen solubility parameters (HSPs). The HSPs were determined for the sample which demonstrated the smallest median particle size by running a dispersion test involving eleven different organic solvents. The ink was then demonstrated as printable using an Optomec M3D aerosol jet printing system.

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT), REU: Back to the Future III (SDSMT)

59p - Effects of functional group pairings on overyielding and underyielding in tallgrass prairie

Aleisa LaBelle (1)*, Alison Bower (1), Meghann Jarchow (1)**, aleisa.labelle13@gmail.com
(1) University of South Dakota

Abstract: Native tallgrass prairie species are being considered as feedstock for cellulosic bioenergy production. Some studies have shown that increasing biodiversity in prairies can allow the community to produce more aboveground biomass, which is referred to as overyielding. The objective of this research was to measure whether cool-season grasses, warm-season grasses, early-flowering forbs, and late-flowering forbs overyielded when grown in pairwise combinations. Using 2015-2016 data from a field experiment near Vermillion, SD, we calculated overyielding and underyielding of each functional group when grown in pairs compared to grown as a single-functional group. The hypothesis is that paired functional groups will tend to overyield when compared to single functional groups. We found that the cool-season grasses generally overyielded, warm-season grasses generally underyielded when grown with cool-season grasses but overyielded when grown with forbs, and both forb treatments neither overyielded nor underyielded.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

60p - Measuring and Modeling Fructosyltransferase Activity

Katie Lober (1)*, Timothy Shenk (1)**, kathryn.lober@wsu.edu
(1) South Dakota School of Mines & Technology

Abstract: Pectinex Ultra SP-L is an enzyme produced by *Aspergillus aculeatus*. Physical experiments will be used in conjunction with mathematical models created with Stat-Ease to determine the enzyme activity of fructosyltransferase under different conditions. High Performance Liquid Chromatography (HPLC) will be used to analyze experimental samples and determine the enzyme's fructosyltransferase activity. By creating a mathematical model of Pectinex Ultra SP-L, researchers will be able to better understand how the enzyme responds to different conditions. The physical experiments will target changes in solubility of sucrose and stachyose when treated the enzyme. The model will target the activity levels of Pectinex Ultra SP-L as it interacts with pure sucrose, pure stachyose, and multiple ratios of the two sugars. These results offer information that will be used in creating high value products from low value organic waste.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

61p - Forensic Analysis of Native American Artifacts - Wampum Bracelet

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(1) South Dakota School of Mines & Technology

REU: Security Printing and Anti-Counterfeiting Technology - (SDSMT)

62p - Brain Analysis of the Protective Effects of Estrogens on Type 2 Diabetes

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(1) Black Hills State University, (2) Sioux Falls Veterans Affairs Medical Center, (3) Augustana University

Abstract: Previous studies demonstrate that abdominal obesity is associated with type 2 diabetes (T2D). Additional studies suggest that females are somewhat protected from T2D; however, the tissue specific beneficial effects of estrogens remain unknown. The objective of this study is to determine the cellular changes in the brain that occur in female rats fed a high-fat diet with and without estrogens and exercise. Throughout the 10-week study, body weight and food consumption were measured. At the end of the study, the abdominal adipose tissue was weighed, and the brains were frozen and sliced on a cryostat for microdissection of discrete brain regions. Future analysis will use qRT-PCR to determine the expression of genes that play a role in satiety and feeding behaviors and in the brain reward system. The brain regions and genes will include: ghrelin (NTS), leptin (NA), and tyrosine hydroxylase and the dopamine receptors (VTA and NA).

BRIN - Black Hills State University

63p - Comparative Farm-gate Life Cycle Assessment

KaeLee Massey (1)*, Devin Moeller (1)**, kaeleemassey@gmail.com

(1) South Dakota School of Mines & Technology

Abstract: As domestic and global biofuel production is expected to increase, it is increasingly important that feedstock selection and farm management practices are maximized to leverage the greatest environmental and energetic benefit from bioresources. Second generation biofuel feedstocks such as carinata and camelina offer unique advantages over traditional bioenergy alternatives, such as canola or soybean. As the global demand for food and livestock feed continues to grow, the utility of canola and soybeans as a bioenergy resource is uncertain. This work focused on two second generation oilseed alternatives for use as biofuel feedstocks across the semi-arid region of the Northern Great Plains. This analysis compared the geographic distribution of current yields, assessed the environmental impacts, and evaluated the energetic benefit of oilseed production at aggregated crop management zone (CMZ) levels through a life-cycle assessment (LCA) methodology.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

64p - Exercise Response to Powwow Dancing in Healthy Adults

Jessica Brave Heart (1)*, Jessica R. Brave Heart (1), Brandon Ness (1)**, jessica.braveheart@coyotes.usd.edu
(1) University of South Dakota

Abstract: Research Question: What is the exercise response to different types of powwow dances in healthy adults? **Methods:** Healthy adults performed three different powwow dances (traditional, jingle, and crow hop) in a laboratory setting. Each dance lasted 3 minutes duration, separated by a 5-minute rest period. Participants were familiarized with each dance prior to testing. Rating of perceived exertion (RPE), average heart rate (HRavg), and maximal heart rate (HRmax) were recorded after each dance. **Results:** Eight participants completed testing procedures. RPE varied according to dance type (mean \pm SD; traditional: 2.4 ± 0.9 , jingle: 4.0 ± 1.4 , crow hop: 5.3 ± 1.8), while no significant differences were observed between dance types for HRavg or HRmax. **Conclusions:** In healthy adults, powwow dancing produced a favorable exercise response in terms of reaching HR training zone thresholds and may have the potential to promote cardiovascular health.

BRIN - University of South Dakota

65p - Evolution of corticosteroid production

Sydney Kreutzmann (1)*, Carrie Olson-manning (1)**, snkreutzmann14@ole.augie.edu
(1) Augustana University

Abstract: Biochemical pathways can be regulated at a variety of levels, from transcriptional to protein localization. Here we study the corticosteroid synthesis pathway to try to understand how the regulation of biochemical pathways can change through evolutionary time. Most mammals have a single enzyme, CYP11B, which produces the corticosteroid hormone aldosterone in the exterior layer of the adrenal cortex and the hormone cortisol in the interior layer. In single-CYP11B species, the specific production of aldosterone and cortisol in different tissues is thought to be accomplished by allosteric regulation by another enzyme, CYP11A. Here we used Forster Resonance Energy Transfer (FRET) and High Performance Liquid Chromatography (HPLC) to determine whether CYP11B and CYP11A physically interact and whether that interaction contributes to allosteric regulation of this pathway.

SD EPSCoR/BioSNTR

66p - Determining feeding behaviour in Tyrannosaurus Rex

Ethan Jennings (1)*, Timothy Heaton (1)**, ethan.jennings@coyotes.usd.edu
(1) University of South Dakota

Abstract: The Tyrannosauridae is a highly charismatic family of carnivorous theropod dinosaurs containing one of the most famous and recognizable dinosaurs: Tyrannosaurus Rex. However, despite some bitter disagreements, a comprehensive study considering physiology, environment, and prey habits to determine what kind of hunter Tyrannosaurus Rex was, or if it hunted at all, has yet to be written. This study will synthesize research from various fields of paleontology to determine what hunting strategies could have worked for T. Rex by considering the type of environment it lived in, the capabilities and abundance of its prey, specializations in T. Rex anatomy, exceptionally insightful fossil discoveries, and by comparing T. Rex and other theropods with modern carnivorous mammals. This paper intends not only to establish feeding behaviour for T. Rex but to determine a general, standardized framework for evaluating predation strategies for extinct carnivores.

REU: Sustainable RIVER (Remediating InVasives to Encourage Resilience) (USD)

67p - Examination of Atmospheric Perchlorate Response During Large Volcanic Eruptions using an Antarctic Ice Core

Hannah Przelomski Przelomski (1)*, Jihong Cole-Dai (1), Thomas Cox (1), Joshua Kennedy (1), Jihong Cole-Dai (1)**, hprzelom13@catawba.edu
(1) South Dakota State University

Abstract: Perchlorate (ClO_4^-) in the environment is of significant interest because of potential threat to human health. Recent research suggests that perchlorate is naturally formed in the atmosphere and atmospheric formation constitutes a significantly large portion of perchlorate in the current environment. Yet, the environmental factors that influence atmospheric production remain uncertain. Preliminary data from ice cores suggest large volcanic eruptions influence perchlorate production. However, the largest volcanic eruptions (Tambora, 1809 event, and Kuwae) over the last millennia and their respective perchlorate responses have not been examined. Volcanic-sulfate and perchlorate were measured in samples taken from a South Pole ice core. Perchlorate concentrations increased three-fold during volcanic events from the non-volcanic background. This data suggests that perchlorate is formed in the stratosphere and that ultra-plinian eruptions promote perchlorate production.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

68p - Physiochemical Characterization of Deep Eutectic Solvents

Jack Roireau (1)*, Douglas Raynie (1)**, jroireau@iwu.edu
(1) South Dakota State University

Abstract: Deep eutectic solvents (DESs) are mixtures of two substances of which the product of mixing will have a depressed melting point as compared to each of the individual components. In addition to low melting points, DESs share many similar traits with ionic liquids such as high viscosities and low vapor pressure. However, an additional advantage of the DES is ease of synthesis and low cost. While traditional ionic liquids are expensive, the DESs presented are mixtures of choline chloride and propylene glycol, both of which are cheap and environmentally friendly compounds. Various ratios of choline chloride (ChCl) and propylene glycol (PG) were mixed, and their physical properties were tested. Preliminary data suggests that the ChCl:PG system at a 1:5 ratio shows promising results for electrochemical systems operating at temperatures as low as -20°C . These results will be compared with the same ratios of ChCl and ethylene glycol (EG).

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU)

69p - Synthesizing Polimides of Various Compositions for Study of Thermal Expansion Properties

Rick Hamilton (1)*, Jon Kellar (1)**, richard.hamilton@k12.sd.us
(1) South Dakota School of Mines & Technology

Abstract: The research presented here is just one part of a larger goal of developing direct-write materials for NASA printable spacecraft. The primary objective of this research is to find a polymer substrate that can be synthesized in such a way to have comparable thermal expansion properties of silver ink. A secondary objective is to be able to incorporate methods and content learned through this process into a STEM centered classroom. The polymers chosen were 4, 4' – Oxydianiline (ODA), Pyromellitic dianhydride (PMDA), and 3, 3', 4, 4' – Benzophenonetetracarboxylic dianhydride (BTDA), with varying compositions. The polymers were synthesized and printed onto glass slides using an electronic fluid dispenser. The polymers, once cured, were cut into thin film strips and tested using Thermomechanical Analysis for the coefficients of thermal expansion (CTE). CTE values were compared among the various compositions. Several topics have been chosen to integrate into a STEM classroom.

SD EPSCoR/BioSNTR

71p - Education and Mental Health

Tennille Black Feather (1)*, Simone Bordeaux (2)**, tennille.blackfeathe@coyotes.usd.edu

(1) University of South Dakota, (2) Rosebud Sioux Tribe Health Administration

Abstract: This poster will present information on the state of mental health on reservations and the importance of education.

REU: Social-Behavioral Research Training in American Indian Community-Based Projects (Sanford/USD)

72p - Investigation on adaptive immune response of Macrophage

Jo Seongwan (1)*, Adam Hoppe (1)**, seongwan.jo@jacks.sdstate.edu

(1) South Dakota State University

Abstract: Macrophages are an important cell of the immune system. They are capable of eliminating foreign materials by a cellular engulfment process called phagocytosis. Targeting of material for phagocytosis can be mediated by innate immune response signals or by antibodies produced by the adaptive immune response. Antibodies provide a promising therapeutic platform for directing macrophage function, however the additional knowledge of the fundamental cell biology is needed. Here, we developed a liposome system to study how antibodies and additional innate signals that modulate receptor activation on macrophages and ultimately govern internalization of particles by macrophages. This research focused on the quantification of internalization small particles, mimicking viruses (e.g. liposomes <100nm), with differently positioned IgG2a antibodies.

SD EPSCoR/BioSNTR

73p - Development of a integrative pipeline for quantitative and functional metagenome and metatranscriptome data analysis in microbes

Shuai Li (1)*, Qin Ma (1)**, shuai.li@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Nowadays, it is common for people to utilize medicines to protect themselves from numerous diseases. Over time, the underlying microbes that cause many of these diseases become resistant to the medicines, leading to the drugs being less effective. Metagenomic and metatranscriptomic data analysis allow for species-level profiling and can help understand the hidden genetic mechanisms behind this resistance. In this research, I will use bioinformatic tools to perform quantitative and functional metagenomic and metatranscriptomic data analysis to interpret and analyze the microbiota with respect to important diseases and ecological changes related to increased drug resistance.

SD EPSCoR/BioSNTR

74p - Imaging Auxin and Cytokinin Outputs in Prairie Turnip: A Native Legume with Atypical Root Nodules

Sydney Daniels (1)*, Paul Gaillard (1), R. Neil Reese (1), Senthil Subramanian (1), Senthil Subramanian (1)**,
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Abstract: Prairie turnip (*Pediomelum esculentum*) is a perennial legume that has served as a nutritious staple in Native American diets. Previous research suggested that *P. esculentum* forms a unique symbiosis and atypical nodules with a central nodule vasculature and infected cells extending inwards to the main root vasculature. This atypical nodule structure prompted us to evaluate hormonal and developmental aspects of these nodules. We developed hairy root transformation methods for this plant species using *Agrobacterium rhizogenes* and generated transgenic roots expressing marker genes that can localize outputs for the key plant hormones auxin and cytokinin. Results from microscopy imaging of these markers will be presented.

SD EPSCoR/BioSNTR

75p - CRISPR/Cas9 Knockout of CD36 and Atg5 for Studying Lipid Droplets Metabolism in Macrophages

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Abstract: Modified low density lipoprotein (LDL) is taken up by macrophages in vivo, forming lipid droplets and creating foam cells. Foam cell formation is a key event in the development of atherosclerosis; however, mechanisms of lipid droplet biogenesis and degradation are understudied and not well understood. To develop positive controls for a CRISPR/Cas9 screen for lipid droplet related genes, we used Alt-R CRISPR/Cas9 genetic editing techniques to knockout CD36 and ATG5 genes in macrophages. CD36 is a scavenger receptor and a primary uptake mechanism for modified LDL-cholesterols and ATG5 is an autophagy related protein that has been shown to be necessary for cells to metabolize lipid droplets. Knockouts for CD36 and ATG5 should decrease and increase, respectively, the amount of lipid droplets in cells providing controls for functional differences in the lipid droplet screen. This poster describes the results of experiments developing these controls.

SD EPSCoR/BioSNTR

76p - Application of Mechanical Force to Chondrocytes via Magnetic Gradients

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Abstract: Chondrocytes, cells responsible for the maintenance and breakdown of articular cartilage, are of interest due to their role in osteoarthritis. They are normally subjected to complex mechanical forces inside joints, which are difficult to replicate in laboratory settings. The primary goal was to use magnetic gradients, provided by Neodymium magnets, to apply various cyclic loads to chondrocyte integrins. The magnetic gradients are converted to mechanical forces via magnetic beads bound to specific integrins. To vary the force cyclically a dual-cam machine, providing 12.7 mm of vertical translation of magnets, was made for use during incubation and imaging of cells. Determination of experimental parameters was achieved using finite element modeling and empirical estimates of the magnetic force; ultimately small disc magnets at distances 20-40 mm from cells were utilized. The variable forces made possible by this machine will be used to elicit and observe integrin-mediated mechanotransduction pathway events in chondrocytes.

SD EPSCoR/BioSNTR

77p - Treading Water: Life in the Day County Flood Era

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Abstract: Mammoth snows and floods in the 1990s, repeated in 2011, have caused Day County's greatest flooding in recorded history. A natural disaster that has lasted twenty years has altered the land and the people left behind, causing widespread economic, ecologic, and social change. Tensions brewing over decades have now come to a breaking point in the form of a landmark case, *Duerre v. Hepler*, whose consequences have affected the entire state, introducing the term "non-meandered water" into our vocabulary, and prompting the SD Legislature to once again attempt to strike a balance between land, water, and people.

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78p - Test of Key Pathways in Protective Bacteria Against a Deadly Fungal Pathogen using Blanchard's Cricket Frogs

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Abstract: The fungal pathogen *Batrachochytrium dendrobatidis* (Bd) has been threatening amphibian populations across the globe. Recent work has discovered that bacteria isolated from certain populations of amphibians are able to protect hosts from this pathogen. This project focuses on the anti-fungal mechanisms of *Serratia marcescens*, a species of bacteria our laboratory has isolated from a Costa Rican frog that has proven to dramatically inhibit Bd in culture. Wild-type and recombinant *S. marcescens* will be introduced to the microbiomes of a live amphibian host, *Acris blanchardi* (Blanchard's Cricket Frog) and then challenged with Bd to examine the protective effects of this bacteria. The experiment includes recombinant *S. marcescens* with key genetic pathways removed to allow us to determine which genetic mechanisms are utilized in its defense against Bd. This experiment is still underway. These efforts will aid in the future conservation of amphibian species worldwide.

SD EPSCoR/BioSNTR

79p - 2D Hydraulic Modeling of Physical Habitat for Fisheries Management

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Abstract: Water needed for domestic use and irrigation in Rapid City is released from Pactola Reservoir directly into Rapid Creek via the Rapid Creek Basin. The water is released at variable rates, and when releases (discharge) are at or exceed bank full flows, bank erosion has been observed. Thus, the challenge is designing physical habitat constructions that remain stable under changing flow regimes. Eroding the creek embankments takes away much of the necessary “pool” (deep and slow-moving) water that brown trout feed and rest in, and literature states that 50 to 70 percent pool water habitat is recommended for healthy brown trout fisheries. This poster outlines the steps to analyze whether or not constructed physical habitat (boulders, fallen trees, seeded burlap lifts) to Rapid Creek in Rapid Creek Basin (just below Pactola Dam) resulted in increased habitat for the local brown trout population above what existed prior to construction.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT)

80p - Optimization of NIR-to-NIR Upconversion Nanocrystals for Latent Fingerprint Development

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Abstract: The purpose of this research is to explore methods to enhance the NIR-to-NIR upconversion efficiency of NaYF₄: Yb, Tm upconversion nanocrystals (UCNCs) for the application of latent fingerprint development. Two strategies are pursued: optimization of lanthanide doping composition and an addition of an inert shell to minimize surface quenching. UCNCs with three different doping concentrations of Yb were synthesized and a standard procedure was developed to compare the brightness of the synthesized UCNCs. The procedure compares NIR emission intensity at 800 nm of different samples as a function of 980 nm excitation power densities. The effect of the doping composition and heating rate on the morphology and size of the UCNCs was also evaluated. The size and morphology of the UCNCs was characterized using electron microscopy. The NIR-NIR UCNCs produced in this research will be tested for use in latent fingerprint development.

REU: Security Printing and Anti-Counterfeiting Technology - (USD)

82p - Identification of Water Related Genes in Tomatoes: A Bioinformatics Approach

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Abstract: Since resistance to drought is a complex trait, previous studies trying to identify genes that increase drought resistance have discovered hundreds of changes in gene expression. To narrow down the number of candidate genes that control drought associated traits, we grew *Solanum lycopersicum*, the common tomato under four different treatments—drought, porous soil, low light, stem flexing. Previous Matzner lab work has indicated that drought related traits including cavitation, vessel size, wood density, and water use efficiency change in predictable ways, therefore allowing us to detect coordinated expression changes. We used Illumina sequencing to identify changes in gene expression and used Gene Set Enrichment Analysis (GSEA), to compare differentially expressed genes to known pathways to identify drought trait related genes.

BRIN - Augustana University

83p - Divergent Molecular Structures of Natural Organic Matter.

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Abstract: Determination of the chemical structure and properties of natural organic matter within different soil samples can help chemists in figuring out the sorption/desorption characteristics of hydrophobic organic compounds. Leonardite soil, Pahokee peat, and Elliot silt loam from different regions of the country were selected for this experiment to distinguish the variations in the chemical structures and properties of NOM. Spectroscopic techniques were used in a number of different ways to compare the NOM. UV-vis were used to measure absorbances of the humic acid fraction of NOM and make an E4/E6 comparison. FTIR was complementarily used with UV-vis. DP/CP-MAS ¹³C-NMR gave the assignment of NOM functional groups based on different chemical shift ranges. The differences and similarities of NOM were identified and quantified. Therefore, the configuration and/or change of the NOM and its fractions within the soil was greatly affected by its origins and environments.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU), SD EPSCoR/BioSNTR

84p - Biodiesel Synthesis from Brown Grease Using Titanium Niobate Acid Catalyst

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(1) South Dakota State University

Abstract: Biodiesel is an environmentally-friendly, yet economically uncompetitive, alternative to the diesel we use today. The materials used to synthesize it are expensive; producers use vegetable oil, making up most of the production cost. The fast reactions that base catalysts bring are favored by industry, but the extra washings required to purify its products increases costs. Titanium niobate (KTiNbO₅) is an acid catalyst that has been proven to be able to create biodiesel. If the titanium oxide in KTiNbO₅ can be replaced by SiO₂ gravel, it could replace base catalysts. After experimentation, it was concluded that this is not possible because of the temperature instability of K and Nb reactants. To address economic concerns, brown waste grease is a candidate for biodiesel production; it is common and reduces costs by 3 quarters. Use of 3 different solvents yielded 3.0g of solid product. Transesterification/biodiesel synthesis from brown grease will be presented.

REU: Environmental/Green Chemistry (BHSU, NSU, SDSU), SD EPSCoR/BioSNTR

85p - A Brief Look at Pesticide Use: Organic vs Non-Organic Oranges

Karen Moore (1)*, Dana Gehring (1)**, karenmmmoore16@gmail.com

(1) Sinte Gleska University

Abstract: Pesticides are defined as a substance that can kill anything considered a pest. Organic foods have made their way into our grocery stores, claiming to be pesticide free or containing a small amount of necessary pesticides. But how do you know if the foods you buy are really what they claim to be? The purpose of this project was to identify imazalil and thiabendazole in a non-organic and an organic orange. To identify pesticides in each orange, steam distillation was used to extract oil from the different peels. Those samples were then analyzed using the gas chromatography-mass spectrometry (GCMS) method. Finally, the pesticides from each sample were identified using two different online databases. There was a total of eight pesticides identified, including the four that both oranges shared. For better results, a recommendation is to run the GCMS analysis for a longer period of time.

REU: Multidisciplinary Underground Science at the Sanford Underground Research Facility (BHSU)

86p - Acid Content of Rain Water and Soil in Todd County

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(1) Sinte Gleska University

Abstract: With the growing pollution in the world today, have you ever wondered if acid rain exists or affects the state of South Dakota, and is this a concern for the crop production? The objective of this project is to analyze the pH content of rain water and soil within rural Todd County, SD. Rain water samples were taken in various locations throughout the county and soil samples were taken from cropland and grasslands within the county. With the short amount of time to complete this project, it was found that there were no major difference in change from within a month. Also, another factor that had a significant effect was the amount of precipitation in South Dakota during this summer resulting in drought conditions. Recommendations for future work should include more time to collect analyze and record data along with more precipitation and soil samples.

SD EPSCoR/BioSNTR

86a - INVESTIGATING CHANGE IN PRAIRIE DOG POPULATION OVER 10 YEARS

Shaunae Gunhammer (1)*, Dana Gehring (2)**, shaunae.gunhammer@gmail.com

(1) Sisseton Wahpeton College, (2) Sinte Gleska University

Abstract: Prairie Dogs (*Cynomys ludovicianus*) are a keystone species of the short to medium grass prairies. These rodents are important to Lakota Culture (Lakota: "pispiza"), although are considered a nuisance species. The objective of this lesson plan is to digitize the prairie dog population on SGU's campus to create a difference map over a 10 year period using ArcGIS. Prairie dog mounds over a 10 year period (2014 and 2004) were digitized and buffered on NAIP imagery. A difference map of these mounds was created to show a potential population change over time. It was found that there was an increase in mound number over the 10 year period, which may be due to significant increase in protection of the prairie dog population on the SGU campus. Recommendations for future work include to study the impact of infrastructure, elevation, soil type, vegetation, water availability, and humans on the prairie dog populations

SD EPSCoR/BioSNTR

87a - Water Conditions of Antelope Lake and Mission Lake on the Rosebud Indian Reservation

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(1) Sinte Gleska University

Abstract: In all forms of water, there are several types of bacteria, there is one type that was focused in this study that is E-coli and its presence in the bodies of water that are near Mission SD. The objective of this project was to determine if the concentration of E-coli is harmful to people located near Mission and Antelope Lake. The water was tested for E-coli concentration, nitrate concentration, pH, turbidity, and depth of water during each day of collection. It was found over the 5 week period, a decrease in E-coli concentration. The pH remained constant over the time period and turbidity showed a significant fluctuation. Nitrate levels showed change over the study period. In conclusion, it is beneficial to the people of Mission to continue to monitor these two bodies of water for any other change and activity.

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