



2019 South Dakota Undergraduate Research Symposium & Faculty Meetings

Ramkota Hotel - Sioux Falls, SD

July 29-30, 2019

2019 Undergraduate Research Symposium
Ramkota Hotel, Sioux Falls, SD

Monday, July 29

- 2:30 PM Tours (POET, Raven, Sanford, Avera, SAB Biotherapeutics, EROS)
- 2:30 PM – 4:30 PM Faculty/research meetings
- PULSE (Partnership for Undergraduate Life Science Education) workshop (Session Chair: Dr. Steve Matzner) - **Amphitheater II**
 - What is PULSE? Building a Regional Network (Dr. Steven Matzner)
 - Flipped Classrooms (Dr. Jennifer Gubbels)
 - Department assessment/curriculum alignment (Dr. Mark Larson)
 - Science Identity and Service Learning (Dr. Season Vitiello)
 - Panel Discussion: REU Sites: Sharing Research Themes and Lessons Learned (Session Chair: Dr. Michael West) - **Conference Room 2**
- 5:00 PM-6:30 PM Networking Mixer (**Sanford House**)
- 6:30 PM Dinner on own

Tuesday, July 30

- 8:00 AM-8:30 AM Breakfast with a Scientist/Registration – **Washington Room**
- 8:30 AM-9:00 AM NSF National Research Training Student Panel
- 9:00 AM-9:30 AM Setup Morning Posters - **Roosevelt, Lincoln, Jefferson Rooms**
- 9:30 AM-11:30 AM Morning Poster Session (Poster Feedback)

Morning Breakout Sessions

- 9:00 AM-10:00 AM Preparing for Graduate School (Dr. Barb Goodman) - **Amphitheater I**
- Nicole Lounsbery, Interim Dean for Graduate School - SDSU
 - Sanf Pasquale Manzerra, PhD – Assistant Dean, Medical Student Affairs and Admissions
 - Raegan Nelson – USD Graduate Student

- John Slunecka – USD MD/PhD Student

10:00 AM-10:30 AM Review Posters

10:30 AM-11:30 AM South Dakota Opportunities in Science (Denise Guzzetta – Sioux Falls Development Foundation & Joni Johnson – SD Biotech Association) - ***Amphitheater II***

11:30 AM-12:00 PM Take Down Posters

12:00 PM-1:00 PM Lunch (Panel on Scientific Careers) - ***Washington Room***

- Sanford Research (Kristi Eglund)
- SAB Biotherapeutics (Christoph Bausch)
- Poet (Steve Lewis)
- Guidepoint Global LLC (Kara McCormick)

1:00 PM-1:30 PM Setup Afternoon Posters - ***Roosevelt, Lincoln, Jefferson Rooms***

1:30 PM-3:30 PM Afternoon Poster Session

Afternoon Breakout Sessions

1:00 PM-2:00 PM Preparing for Graduate School (Dr. Barb Goodman) - ***Amphitheater I***

- Nicole Lounsbery, Interim Dean for Graduate School - SDSU
- Sanf Pasquale Manzerra, PhD – Assistant Dean, Medical Student Affairs and Admissions
- Raegan Nelson – USD Graduate Student
- John Slunecka – USD MD/PhD Student

2:00 PM-2:30 PM Review Posters

2:30 PM-3:30 PM South Dakota Opportunities in Science (Denise Guzzetta – Sioux Falls Development Foundation & Joni Johnson – SD Biotech Association) - ***Amphitheater II***

3:30 PM Closing Session

BRIN undergraduate evaluations and focus group (Sharon Chontos) **At the conclusion of the closing session.*

Event Partners:

Sioux Falls Development Foundation

For over 60 years, it's been our business to help better your business.



Since 1954, the Sioux Falls Development Foundation (SFDF) has been leading the way in creating one of the most vibrant, secure, and growing economies in the nation. Founded by a group of far-sighted business leaders, the SFDF is a non-profit economic development corporation with the mission of improving the economy of the Sioux Falls region. We connect businesses with the tools and resources they need to be successful.

What we do:

- Help you build partnerships for workforce success
- Assist in all phases of site selection
- Develop high-quality business parks
- Guide you in developing a local network of business allies

We have also collaborated with a number of organizations throughout the years. Visit siouxfallsdevelopment.com for more information.

South Dakota Biotech Association

South Dakota Biotech is the state affiliate of the Biotechnology Innovation Organization (BIO). This non-profit organization is dedicated to developing biotechnology through expanding research, advocacy, funding, education, infrastructure development and promotion.



Formed in 2006, South Dakota Biotech serves a membership which includes business, universities, service providers and state-wide economic development entities to expand the bioscience industry. The primary goals of the association are to:

- Connect leaders and experts.
- Collaborate to shape the future.
- Drive innovation to feed, fuel, and heal the world.

Visit sdbio.org for more information.

South Dakota Biomedical Research Infrastructure Network (SD BRIN)

SD BRIN is funded by the National Institutes of Health (NIH) Institutional Development Award (IDeA) program known as INBRE (IDeA Networks of Biomedical Research Excellence) through the National Institute of General Medical Science (NIGMS) Center for Research Capacity Building.



SD BRIN received 3 years of funding from NIH from the original BRIN program in 2002 and has received three five year grants since then from the INBRE program continuing until 2020. Visit brin.usd.edu for more information.

South Dakota Established Program to Stimulate Competitive Research (SD EPSCoR)

The National Science Foundation created the Established (formerly Experimental) Program to Stimulate Competitive Research (EPSCoR) in 1979 because Congress recognized the uneven distribution of federal research and development grants. After World War II, federally funded academic research grew dramatically, but national science policy at the time tended to funnel resources to a small number of centers of excellence.



This status quo ignored the dramatic growth in regional educational and research institutions. In every state, talented young people aspired to careers in science, technology, engineering and mathematics, but the nation wasn't profiting fully from the wealth of ingenuity and skill embedded across the country. EPSCoR provided a solution and is now a federal-wide initiative spanning five agencies including NASA, DOE, DoD, NIH and NSF. Current goals of South Dakota EPSCoR include:

- Increase South Dakota's Science and Technology Research Capacity
- Provide educational opportunities for k-12, undergraduate, and graduate students
- Promote Science Based Economic Development for South Dakota

Visit sdepescor.org for more information.

19p Anderson, Marie
30p Baker, Aaron
10a Beagle, Taylor
25a Beck, Jonathon
15a Bedwell, Sierra
36p Bertsch, J. Michael
21p Botsford, Rachael
23p Boyens, Anna
8a Brett, Joseph
53p Brown, Samuel
69a Brucker, Kari
31a Burch, Kyle
74a Callahan, Dakota
65a Cardona, Nathan
75p Carlson, Michelle
61p Cates, Carina
24p Christiansen, Kylie
50a Chu, Alina
68p Clobes, Mason
31p Cole, Matthew
76a Cork, Dawson
38a Cosgrove, Jameson
64p Crawford, Samuel
58a Culley, Alexis
48p Daniell, Mollie
26a Dao, Carol
16p Dash, Kyle
21a Deck, Eric
2p Do, Robin
70p Fanta, Betty
1p Fasching, Shelby
57a Fiala, Megan
47p Fick, Evan
75a Fields, James
45p FitzPatrick, Sophie
30a Frazee, Jennifer
43a Getz, Forrest
17p Glenn, Katherine
72a Goeden, Brock
23a Goerger, Krista
41p Grabenstein, Susan
61a Gucwa, Melanie
35a Hallak, Destiny
48a Hare, Ethan
18a Hartman, Timothy
51p Hasse, Jason
39a Haugen, Anna
10p Hayes, Tyler
46a Heinzl, Lilian
49a Hillard, Joshua
59p Hirst, Cora
59a Hogan, Zachary
8p Iverson, Jacob
62a Iwamoto, Naoki
11p Johansen-Sallee, Anthony
28p Jurkoic, Michael
33a Kasuske, Kyla
72p Kavunga, Divine
13a Kee, Vanessa
71a Kirkvold, Clara
27a Kjerstad, Elliot
29a Knoblich, Cole
66p Koble, MaKenna
11a Koupal, Aaron
66a Kovarik, Dennis
53a Kray, Alec
2a Kress, Lauren
47a Krump, Ryan
22p Kuca, Ali
29p Kuiken, Jennifer
20p Lamoreux, Alec
57p Lawrence, Jack
49p Legore, Tavine
60p Lewandowski, Luke
65p Lewis DaeYung Kim, Marshall
56a Li, Shuhang
14a Lindner, Tiegen
35p Logue, Morgan
18p Lonneman, Mitchell
28a Lungren, Ethan
37a Maldonado, Hugo
46p Marshall, Cody
56p McCarthy, Kathryn
38p McGehrin, Ann
7p Menzel, Elizabeth
15p Merrill, Lucas
1a Messler, Kathryn
4p Michelson, Darla
5p Monahan, Jessilyn
58p Morgan, Connor
60a Morris, Kahlen
41a Mulder, Kaitlyn
32a Muldrow, Destiny
32p Nelson, Dillon
4a Neumiller, Hannah
34p Nielson, Katherine
44p O'Laughlin, Courtney
14p Okosun, Blessing
40p Pauls, Alana
20a Pekas, Nathaniel
42p Perez, E. Celeste
52p Petriti, Vanisa
44a Pompa, Elizabeth
69p Poor Bear, LaShell
6p Porter, Neal
27p Priesel, Austin
67a Rama, Alejandro
5a Rehmeier, Kyle
39p Rider, Sierra
67p Ridgway, Jacob
52a Rivera, Amber
12p Roskam, Adam
9p Rothschadl, Morgan
34a Rust, Haley
62p Samuelson, Brady
37p Schnetzer, Erin
40a Schottler, Karen
74p Schroder, Stormi
63a Schwartz, Charles
25p Shiffler, Janelle
51a Silva, Nicholas
3p Smith, Olivia
6a Smith, Logan
43p Sobczak, Calvin
36a Stacey, Logan
54p Stein, Tara
63p Subedi, Subrat
68a Sullivan, Jessie
50p Tassew, Diana
54a Ternes, Claire
45a Tesselendorf, Cole
55p Tilahun, Liya
64a Townsend, Tiana
33p Trowbridge, Andrew
73p Tulowitzke, Eric
70a Uhl, Lillian
17a Urroz, Jonathan
16a Valen, Grace
22a Vanden Berge, Kalista
3a Vanetti, Dillon
73a Vasek, Patrisse
24a Vaughn, Magan
26p Vettrus, Noah
42a Voss, Tiffany
71p White Bird, Bradley
19a Williquett, Brady
12a Wixon, Christopher
7a Wood, Kelsey
13p Yellowhawk, Gabriel
55a Yuan, Yifan

1a - Variation in Selenium and Other Elements Evaluated by ICPMS and Flame-AA for Western South Dakota Prairie Soils

Kathryn Messler (1)*, Shelby Fasching (2), Anthony Checchi (1), Yi Ren (1), Tara Ramsey (1), Justin Ramsey (1)**,
kathryn.messler@yellowjackets.bhsu.edu

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

Abstract: Selenium is a trace element found in almost all soil but at high concentrations it can be toxic. It also is an essential micronutrient to animals, but there is no known function in plants. This research investigates if there are differences in Selenium levels, other elemental levels, and plant species based on geographic location throughout western South Dakota using the analysis of Flame-AA and ICPMS.

BRIN - Black Hills State University

2a - Gene Expression Changes in *Trichophyton interdigitale* in Response to N-methyl-fluoxetine

Lauren Kress (1)*, Cynthia Anderson (1)**, lmkress17@ole.augie.edu

(1) Black Hills State University

Abstract: With the overuse of antifungal medications, drug resistant strains of pathogenic fungi have become increasingly common, and researchers are seeking new treatments to target resistance pathways. SSRI drugs have shown promising antifungal properties, especially the new fluoxetine derivative N-methyl-fluoxetine (NMF). Our lab recently obtained transcriptomic data to assess changes in gene expression of *Trichophyton interdigitale* when exposed to NMF. The purpose of this experiment was to validate the transcriptomic data by qPCR for eleven genes of interest. Primers for each locus were designed and amplification efficiencies were tested. Analysis revealed that our qPCR validation data largely supported the results of the RNAseq experiment. Additionally, we used qPCR to compare the expression levels of eleven *T. interdigitale* genes in cultures treated with 50 µg/mL of NMF for 12 hours (MIC 90) and cultures treated with 25 µg/mL of NMF for 12 hours (MIC 50).

BRIN - Black Hills State University

3a - Testing and Synthesis of Prozac For Anti-Malaria Drug Activity

Dillon Vanetti (1)*, John Dixson (1)**, dillon.vanetti@yellowjackets.bhsu.edu

(1) Black Hills State University

Abstract: The World Health Organization estimated in the year 2017, there were 219 million cases of malaria in 90 countries across the world. 99.7% of these cases were caused from the species *Plasmodium Falciparum*. Nearly half a million deaths occurred in 2017 from the malaria parasite across the world. The current treatment involves a combination therapy of an artemisinin derivative and a second medication such as chloroquine. Resistance is being noted across the species from heavy medication prescription and the need for developing a new method of treatment is becoming ever more critical. In our laboratory we have discovered N-Methylfluoxetine (Prozac) to have activity against the parasite *Plasmodium Falciparum*. Expanding on this discovery, our laboratory group has synthesized a small set of N-Methylfluoxetine derivatives with substitution of the trifluoro methyl group. These derivatives were tested against *Plasmodium Falciparum* using a SYBER Green Assay.

BRIN - Black Hills State University

4a - Quantum Dot Solar Cells: Beginning to End

Hannah Neumiller (1)*, Dan Asunskis (1)**, hannah.neumiller@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: The increasing demand for solar energy gives rise to the need for development of better techniques to harness it. Currently, mass-produced silicon solar cells are costly and time consuming to manufacture while nanoparticles are a growing field of research due to their tunable bandgaps and simpler fabrication. This study followed procedures to synthesize CdTe and CdSe nanoparticles and to then fabricate solar cells. The optical analysis for the quantum dot synthesis and the IV measurements of the fabricated solar cells are presented.

BRIN - Black Hills State University

5a - Photoredox Catalysts

Kyle Rehmeier (1)*, Katrina Jensen (1)**, kyle.rehmeier@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: This research involves the use of photocatalysts and chiral catalysts to synthesize small chiral molecules via oxidation-reduction reactions. Most commonly, these molecules made are enantiomers, or non-superimposable mirror images of one another. The purpose of this research project is to successfully couple aldehydes with alkyl bromides using a copper(I) catalyst. The choice of this catalyst is due to the abundance of copper as well as the affordability of the element compared to Ruthenium, another efficient photoredox catalyst. The final product is purified using column chromatography and analyzed with thin layer chromatography. Using Nuclear Magnetic Resonance (NMR) spectroscopy, the product is characterized to determine if it was produced in addition to determining if additional purification is necessary. High Performance Liquid Chromatography (HPLC) is used to separate the enantiomers in order to determine the ratio of those produced. Through these methods, we have been able to receive up to 79% product yield.

SD EPSCoR/BioSNTR

6a - Characterization of Natural Waters at the Sanford Underground Research Facility

Logan Smith (1)*, Katrina Jensen (1)**, logan.smith626@jacks.sdstate.edu
(1) Black Hills State University

Abstract: Several water samples taken from different levels and locations of the Sanford Underground Research Facility, formerly the Homestake Gold Mine, in Lead, SD, were analyzed. Analysis includes temperature, pH, and solute data.

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

7a - Identifying LD50 and Validation of the Transcriptomic Response of Thymoquinone on *Candida glabrata*

Kelsey Wood (1)*, Cynthia Anderson (1)** , kelsey.d.wood@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: *C. glabrata* is an emerging pathogen that has demonstrated increased levels of tolerance or resistance to several commonly used antifungal agents. Thymoquinone is an organic compound isolated from *Nigella sativa* identified as having antifungal activity. An earlier study in our lab established the minimum inhibitory concentration (MIC50) of thymoquinone against *C. glabrata*, and examined its transcriptomic response when exposed to thymoquinone at the MIC50 level. The purpose of this project is two-fold; first to identify the lethal dose (LD50) of thymoquinone against *C. glabrata*, and second to validate the transcriptome data obtained by our lab in an earlier experiment.

BRIN - Black Hills State University

8a - Total Internal Reflection Fluorescence Structured Illumination Microscopy (TIRF-SIM): Pushing the Boundaries of Bio-Imaging

Joseph Brett (1)*, Steve Smith (1), Steve Smith (1)** , joseph.brett@mines.sdsmt.edu
(1) South Dakota School of Mines & Technology

Abstract: Structured illumination microscopy is a super-resolution microscopy method which can typically achieve twice the resolution possible with conventional widefield microscopy by using patterned illumination of the sample.

Combining SIM with total internal reflection fluorescence (TIRF) microscopy enables high-speed image application with low background noise. Multiple raw images are computationally combined to form one isotropic super-resolution image. A spatial light modulator (SLM) is used to create the illumination patterns. The SLM must be synchronized with the camera and supporting hardware components to ensure optimal image quality; this is achieved using a combination of Labview VIs and digital I/O devices. Images are acquired using a high-speed EMCCD camera. This TIRF-SIM system enables high-speed super-resolution imaging of live cells, creating the potential for exciting new discoveries.

SD EPSCoR/BioSNTR

11a - The Role of the Human Circadian System on Decision Making and Motor Performance in a Single Outcome Gambling Task

Aaron Koupal (1)*, Dr. Lee Baugh (2), Dr. Kelene Fercho (2), Carly Cooper (2), Rachel Okine (3), Lee Baugh (2)**,
aarkou66@mtmc.edu

(1) Mount Marty College, (2) University of South Dakota, (3) 0

Abstract: Humans follow a standard 24-hour sleep cycle which is called their circadian rhythm. Some people have cycles that naturally start in the early morning, some in the late evening, and some fall in neither of these categories. This can lead to differences in personality and impulsiveness. The research of this lab looks to provide insight into how the body-mind relationship of sleep cycles can affect impulsiveness in people when they are in and out of their preferred cycle.

BRIN - Mt. Marty College

12a - M2e Protein Expression in BL21 using the PET32a Plasmid Expression System

Christopher Wixon (1)*, Victor Huber (1)**, chrwix28@mtmc.edu

(1) University of South Dakota

Abstract: Three major surface proteins are found on Influenza Viruses: hemagglutinin, neuraminidase, and the matrix ion channel (M2e). M2e is a universal vaccine target because it is a conserved protein. The antibodies that are directed against this protein are infection permissive. The goal of this project was to create a bacterial strain that produces the M2e protein so that it may be used for diagnostic and vaccine purposes. To do this, the gene for M2e was isolated from three different influenza A viruses: CA09, PR8, and HK68. These genes were cloned and placed into a protein expression vector (PET32a). However, only the CA09 strand was successfully isolated. A dot blot was used to confirm M2e expression, which allows this bacterial stock to be used in the future to make more M2e. Future work with M2e will include evaluation of anti-M2e vaccine-induced immunity.

BRIN - University of South Dakota

13a - Correlated Atomic Force and Fluorescence Microscopy of Captured Exosomes in Micro-carbon Beads for Hemoperfusion Applications

Vanessa Kee (1)*, Steve Smith (1), Wang Congzhou (1), Steve Smith (1)** , vanessakee0515@gmail.com

(1) South Dakota School of Mines & Technology

Abstract: This project aims to specifically capture and deplete cancer-related exosomes from circulation using nanopores micro-carbon beads, which could reverse immune dysfunction and improve responses to standard cancer treatments. Exosomes are small vesicles ranging from 30 – 100 nm in size that can be found in nearly all eukaryotic fluids, and facilitate a range of important cellular functions. Cancer exosomes are surrounded by varieties of different size and shape protein chaperones. The AFM was used to scan the surface and cross-section of micro-carbon beads, and to analyze the difference between several polymer modifications of the micro-carbon beads. Combining AFM with fluorescence microscopy allows to uniquely identify the exosomes in the micro-carbon beads by using their fluorescence signature. Fluorescence imaging localized the exosomes, and AFM reveals high resolution topographic features of the carbon micro-beads. The data show the carbon beads absorb the exosomes and may be a potential therapeutic for cancer treatment.

SD EPSCoR/BioSNTR

14a - The Acute Effects of Ischemic Preconditioning on Physical Performance

Tiegen Lindner (1)*, Shane Scholten (1)***, tdindner16@ole.augie.edu

(1) Augustana University

Abstract: PURPOSE: To determine the acute effects of IPC on power and sprint performance. METHODS: Twelve highly trained athletes received IPC and SHAM treatments with either a 20 min or 0 min rest. A Delfi Personal Tourniquet System with a doppler radar was used to properly occlude the blood flow. Performance testing included a vertical jump, G-flight power jump measuring reactive strength index (RSI), broad jump, flying 10m dash, and pro-agility. Each of the twelve subjects received all four protocols. RESULTS: No statistical significance was found between the type of treatment and the various performance tests. Additionally, no statistical significance was found between the order of treatments and the various performance tests. CONCLUSIONS: The present study examined IPC's acute effect on power and sprint activities. The present study's findings demonstrate that there is no association between IPC treatment and improvements in power and sprint performance in highly trained athletes.

BRIN - Augustana University, BRIN - University of Sioux Falls

15a - Microbial Fuel Cells: Powering the Future with Methane

Sierra Bedwell (1)*, Jawahar Kalimuthu (1), Bhuvan Vemuri (1), Venkata Gadhamshetty (1)***,

sierra.bedwell@yahoo.com

(1) South Dakota School of Mines & Technology

Abstract: Microbial Fuel Cells (MFCs) are biological batteries which use microorganisms known as exoelectrogens to generate energy captured using an electrical circuit. Biofilms of exoelectrogens grow on an anode and oxidize carbon substrates, transfer their electrons to a cathode and produce electricity. The goal was to utilize exoelectrogens to directly convert methane into energy, as well as to use novel graphene electrodes to enhance growth. Work focused on optimizing fuel cells using two types of anodes and three types of microorganisms. Electrical tests on fuel cells were performed, including polarization studies, electrochemical impedance spectroscopy, and temporal current profiles. In addition, SEM analysis was performed to verify biofilm existence. When grown on a carbon felt anode, *M. capsulatus* str. Bath produced more power than *M. trichosporium* str. OB3b, but further experimentation is needed to determine whether a carbon felt anode or a nickel coated graphene anode produces more power.

REU: BuG ReMeDEE SURE, SD EPSCoR/BioSNTR

16a - Analysis of Platelet Response to Different Agonists in the Native American Population

Grace Valen (1)*, Mark Larson (1)***, gevalen17@ole.augie.edu

(1) Augustana University

Abstract: Thrombosis results from obstructive vascular blood clots. Due to the role of platelets in clotting, individuals whose platelets react more robustly to vascular damage are at higher risk of thrombosis. Native Americans have higher rates of cardiovascular disease, and previous research suggests African Americans have higher platelet reactivity correlating to their higher risk for cardiovascular disease. Therefore, we set out to measure platelet reactivity in Native Americans and identify potential genetic alleles that are responsible for their elevated reactivity. Five platelet agonists were utilized to simulate vascular damage followed by measurements of subsequent platelet activation. Preliminary results showed that Native American platelets more rapidly aggregate in response to several agonists when compared with Caucasians, whereas other measures of platelet function are largely similar between the groups. The next phase of research will analyze genomic DNA sequences of the highest responders to see if specific genetic alleles correlate to platelet responses.

BRIN - Augustana University

17a - Wicozani Waste: Good Health, Wellness, and Life- A Quality Assurance Evaluation for Native Youth Cultural and Physical Programs

Jonathan Urroz (1)*, Katherine J Glenn (1), Diane L Smith (1), Diane Smith (1)**, jonurr82@mtmc.edu
(1) Mount Marty College

Abstract: Obesity and diabetes are critical health issues amongst Native American tribes. During the summer of 2019, BRIN researchers investigated and utilized a Quality Improvement and Quality Assurance approach to provide a statistical and descriptive analysis of the Santee Health & Wellness Center cultural and physical activities with the youth ages 3 to 18 with a focus on obesity and diabetes. The findings included the following: Santee Health & Wellness Center created and enhanced community partnerships; further Community Based Participatory Research is needed to identify obesity and DMII among the youth through physical and laboratory assessments and then commit to a well-communicated program with culturally accepted interventions; also research is recommended to investigate age appropriate physical activity effectiveness; and finally continued development of an evaluation tool is needed to give a complete picture of the process and what is required to implement the program intervention in the rural Native American community.

BRIN - Mt. Marty College

18a - BASIN - A Bioimage Analysis Web Application Using R

Timothy Hartman (1)*, Evgeni I Radichev (1), Carrie J Minette (1), Etienne Z Gnimpieba (1), Etienne Gnimpieba (1)**,
tim.hartman@coyotes.usd.edu
(1) University of South Dakota

Abstract: Despite available high-quality imaging technologies, many still rely on visual observation to compare images. Image comparison is used for protein expression, therapy testing, and drug response assessment. The image data repository Open-i stores over ten million image comparison experiments from peer-reviewed publications. The Bioinformatic Analysis, Statistic, and Image Comparison (BASIN) toolkit, an extension of our Ontology-Driven BioImage Dataset Discovery System (OntoBIDS), aims to enhance image comparison using a non-biased, computational method. BASIN would allow users to extract, analyze, and view a wide range of image data to improve research conclusions and statistical strength. This data currently includes object positions, size, area, and fluorescence intensities. Researchers could then run tests on data of interest and publish these results in a reproducible fashion. The toolkit's power lies in being interactive yet able to process multiple images semi-automatically—combining data acquisition and statistics technologies into one easy-to-use application.

SD EPSCoR/BioSNTR

19a - Analysis of Platelet Response to Different Agonists in the Native American Population

Brady Williquett (1)*, Grace Valen (1), Krista Goerger (1), Mark Larson (1)**, bcwilliquett17@ole.augie.edu
(1) Augustana University

Abstract: Thrombosis results from obstructive vascular blood clots. Due to the role of platelets in clotting, individuals whose platelets react more robustly to vascular damage are at higher risk of thrombosis. Native Americans have higher rates of cardiovascular disease, and previous research suggests African Americans have higher platelet reactivity correlating to their higher risk for cardiovascular disease. Therefore, we set out to measure platelet reactivity in Native Americans and identify potential genetic alleles that are responsible for their elevated responsivity. Five platelet agonists were utilized to simulate vascular damage followed by measurements of subsequent platelet activation. Preliminary results showed that Native American platelets more rapidly aggregate in response to several agonists when compared with Caucasians, whereas other measures of platelet function are largely similar between the groups. The next phase of research will analyze genomic DNA sequences of the highest responders to see if specific genetic alleles correlate to platelet responses.

SD EPSCoR/BioSNTR

20a - Modification of Ultrafiltration Membranes with Fractionated Natural Organic Matter

Nathaniel Pekas (1)*, Cyndey Johnson-Edler (1)**, nrpekas18@ole.augie.edu
(1) Augustana University

Abstract: Polyethersulfone (PES) ultrafiltration membranes are widely used throughout the chemical, environmental, biological and biomedical sciences to provide selective separation of nanoparticulates and create cleaner water supplies. This project aimed to modify existing PES ultrafiltration membranes using natural organic matter extracted from carbon-rich soil samples. Ultraviolet grafting was used to attempt to covalently bond extracted fractionated soil components to the surface of the PES membrane. The original and modified membranes were then analyzed using ATR/FTIR spectroscopy and contact angle measurements of the surface.

BRIN - Augustana University

21a - Construction of a Cavity Ring-Down Spectroscopy System for Rare Event Searches

Eric Deck (1)*, Eric Deck (1), Andrew Johnson (1), Brianna Mount (1)**, ericdeck@berkeley.edu
(1) Black Hills State University

Abstract: Rare event search experiments -- notably liquid noble time projection chambers -- require extreme purity measurements and controls. In order to aid these types of experiments by measuring sub-parts per billion level impurities, we have constructed a Cavity Ring-Down Spectroscopy (CRDS) system.

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

22a - Detection of PSMA in Prostate Cancer Gel and Tissue Microarrays with Quantum Dot-Aptamer Bioconjugates

Kalista Vanden Berge (1)*, Morgan Rothschadl (1), Elizabeth Menzel (1), Barrett Eichler (1)**,
kmvandenberge18@ole.augie.edu
(1) Augustana University

Abstract: Prostate cancer (PCa) is one of the deadliest cancers for men, but is difficult to detect due to the size and location of the prostate. Greater than 90% of PCa patients have cells that overexpress the protein PSMA. Protocols to label aptamers with fluorescent quantum dots (QD) and then bind the aptamers selectively to PSMA + PCa cells were previously developed in our lab. This summer, the same cells will be used to create gel matrices that mimic human tissue samples in order to test the binding ability and fluorescence of the QD-aptamer bioconjugate in an environment that is similar to tissues. If successful, the bioconjugate will be used on human tissue microarrays, where the binding ability will be tested and the fluorescence might be quantified for different stages of PCa.

BRIN - Augustana University

23a - Analysis of Platelet Response to Different Agonists in the Native American Population

Krista Goerger (1)*, Mark Larson (1)**, krista.goerger@siouxfalls.edu

(1) Augustana University

Abstract: Thrombosis results from obstructive vascular blood clots. Due to the role of platelets in clotting, individuals whose platelets react more robustly to vascular damage are at higher risk of thrombosis. Native Americans have higher rates of cardiovascular disease, and previous research suggests African Americans have higher platelet reactivity correlating to their higher risk for cardiovascular disease. Therefore, we set out to measure platelet reactivity in Native Americans and identify potential genetic alleles that are responsible for their elevated reactivity. Five platelet agonists were utilized to simulate vascular damage followed by measurements of subsequent platelet activation. Preliminary results showed that Native American platelets more rapidly aggregate in response to several agonists when compared with Caucasians, whereas other measures of platelet function are largely similar between the groups. The next phase of research will analyze genomic DNA sequences of the highest responders to see if specific genetic alleles correlate to platelet responses.

BRIN - Augustana University, BRIN - University of Sioux Falls

24a - Adaptive enrichment of thermophilic bacterium bacterial "Geobacillus sp. strain WSUCF1" for enhanced Laccase enzyme activity

Magan Vaughn (1)*, Rajesh Sani (2)**, magan.vaughn@mines.sdsmt.edu

(1) South Dakota State University, (2) South Dakota School of Mines & Technology

Abstract: Efficient enzymatic hydrolysis of lignocellulose to fermentable sugars requires a complete repertoire of biomass deconstruction enzymes. *Geobacillus* sp. strain WSUCF1 can produce thermostable enzymes when grown on various inexpensive untreated and pretreated lignocellulosic biomasses such as prairie cord grass and corn stover. Lignocellulosic agricultural and forestry waste materials are the key components for producing biomaterials, for example Polyhydroxyalkanoate (PHA). Therefore, increasing the activity of these enzymes could be very beneficial. In this research work, the evolutionary adaptation was performed to increase the PHA producing capability of WSUCF1, by inducing its laccase enzyme activity. During evolutionary adaptation, first WSUCF1 was grown with corn stover in the presence of kraft lignin to encourage the production of enzymes. Next, the induced laccase was characterized to find the optimum temperature and pH. Finally, the gene responsible for producing laccase was isolated and inserted in DH5 α *E. Coli* using pET vector.

REU: BuG ReMeDEE SURE, SD EPSCoR/BioSNTR

25a - Perfluoroalkyl Functionalization of Multi-Walled Carbon Nanotubes

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(1) University of South Dakota

Abstract: Carbon nanotubes are graphitic materials that show great promise for use in composite materials, microelectronics, and biotechnology; however, their utility is limited by their lack of solubility. Reactions that alter the surface of carbon nanotubes could lead to changes in solubility and electronic structure. We investigated a novel method of functionalizing multi-wall carbon nanotubes (MWCNTs) with perfluoroalkyls. Perfluorooctanoic acid (PFOA) undergoes a decarboxylation reaction to generate perfluoroalkyl radicals, which covalently attach to the sidewalls of MWCNTs. Functionalized materials were characterized with infrared spectroscopy, scanning electron microscopy, and nuclear magnetic resonance spectroscopy. The effects of temperature, solvent, and catalysts were investigated.

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

26a - Analyzing ciliary beat frequency and phenotype in double mutant mice with primary ciliary dyskinesia

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Abstract: Primary ciliary dyskinesia (PCD) is characterized by sinusitis, hydrocephalus, and infertility and results from defects in motile cilia and flagella. Motile cilia are complex, hair-like organelles that beat rhythmically to clear fluid in the respiratory system, brain, and oviduct. The structure of the ciliary axoneme is 9+2 with nine outer doublet microtubules and a central microtubule pair. Mouse lines with mutations in CFAP221, SPEF2, or CFAP54 have PCD due to loss of central pair apparatus (CPA) proteins. These mutations result in decreased ciliary beat frequency (CBF) and sometimes a structural defect in the CPA. In this study, the three mouse lines have been crossed to each other to analyze double mutants for genetic interactions. PCD pathogenesis was analyzed by histology, immunohistochemistry, and high-speed video microscopy to measure CBF. Double heterozygotes have no phenotype, but preliminary data shows that double homozygous mutants have dramatically reduced or nearly immotile CBF.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

27a - A Dynamic Security Testing Infrastructure for Internet of Things

Elliot Kjerstad (1)*, Bailey Belisario (1), Yong Wang (1)***, elliot.kjerstad@trojans.dsu.edu
(1) Dakota State University

Abstract: IoT devices such as Google Home and Amazon Echo provide convenience to our lives. These devices collect data including Personal Identifiable Information (PII) such as names, phone numbers, and addresses and thus IoT security is essential. However, conducting security analysis on IoT devices is also challenging due to their variety and volume, and the special skills required for hardware and software analysis. In this project, we create an isolated dynamic testing infrastructure to capture network traffic from IoT devices for security analysis. For this analysis, we mirrored network traffic as well as developed programs for data analysis. Using the dynamic testing infrastructure, we conducted an extensive security analysis on Google Home and Amazon Echo. Our testing results indicate that both Google and Amazon devices provide the desired security level to protect user data in general while our analysis also indicates that Google Home enforces tighter security controls than Amazon Echo.

REU: IoT Security (DSU)

28a - Surface Modification of Upconversion Nanoparticles with Cucurbituril Ligand

Ethan Lungren (1)*, Aravind Baride (1), Stanley May (1), Aravind Baride (1)***, ethan.lungren@usd.edu
(1) University of South Dakota

Abstract: Upconversion nanoparticles (UCNPs) are useful for numerous applications, including security printing. However, UCNPs are insoluble in polar solvents, due to their oleic acid (OA) capping ligand, making them unsuitable for incorporation into polar inks bases. In this work CB capped UCNPs (CB-UCNPs) were prepared by two processes and both methods were compared for processability and scalability. In the first method, OA-UCNPs were modified with 3 pH HCl and then functionalized with CB. In the second method, OA-UCNPs were modified with NOBF₄ and then functionalized with CB. Either processes led to successful CB-capping of the UCNPs and formed stable dispersion in N,N-dimethylformamide. Scanning Electron Micrographs (SEM) and Zeta-potential measurements were performed to confirm the functionalization of CB-UCNPs. The NOBF₄ intermediate process yielded much more concentrated dispersions of CB-UCNPs in addition to being the quicker option, but the HCl intermediate process is the much safer process to scale-up for the applications.

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

29a - Synthesis of Phenyl-Substituted Phthalimides and Phthaldehydes

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(1) University of South Dakota

Abstract: Phthalimide-based compounds have a wide range of applications. These span from pharmaceutical uses, photochemical cyclization, polymer synthesis, to unique electrical properties. Most of the work done with phthalimides has explored the substitution of different groups onto the imide nitrogen. Current work includes the synthesis of phthalimides with groups substituted onto the phenyl ring, which can be easily modified in hopes to increase the applications of phthalimide-based compounds.

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

30a - Methanotrophic Bacteria: A Deeper Understanding

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(1) University of Nevada, Las Vegas, (2) South Dakota School of Mines & Technology

Abstract: Methane gas is an essential part of the atmosphere; however, methane levels have steadily been increasing secondary to fossil fuel production and use, landfill decomposition, livestock farming, and rice agriculture. Methane absorbs infrared radiation before releasing that stored energy as heat. The release of that radiant energy contributes to global warming. Methanotrophic bacteria consume methane and release byproducts that can be used as renewable fuels. This research uses in-silico studies to assess the role Cytochrome C plays in methane oxidation. In addition, it paves the way for future studies regarding identifying transition state intermediates in methane oxidation by analyzing the Laccase gene, which has similar oxidative functioning.

REU: BuG ReMeDEE SURE, SD EPSCoR/BioSNTR

31a - The Development of an Automated and Self-Contained instrument for Ice Concentration Linked Extractive Stirrer (ICECLES)

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(1) South Dakota State University

Abstract: The Ice Concentration Linked Extractive Stirrer (ICECLES) is a novel technique that combines both freeze concentration and stir bar sorptive extraction (SBSE) for extracting compounds from aqueous matrices at ultra trace levels. The current ICECLES instrumentation includes a chiller, jacketed beaker and stir plate. This current design limits the sample size to 10 mL or less, control of parameters affecting the extraction efficiency, automation, and the ability to extract multiple samples simultaneously. A novel ICECLES prototype was produced using electromagnetic stirring (EMS) of the SBSE stir bar, thermoelectric cooling (TEC), and computer control. The EMSTEC prototype allows for detailed temperature and stir speed control, larger sample sizes (up to 40 mL) and is fully automated. Direct comparison of the previous instrumentation and the EMSTEC for 5 mL and 10 mL samples produced equivalent results with regards to time, accuracy, precision, and extraction efficiency.

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

32a - IoT Digital Forensics: A Use Case of Amazon Echo Devices

Destiny Muldrow (1)*, Soukaina Assou (1), Ashley Podhradsky (1)**, damuldrow@coastal.edu
(1) Dakota State University

Abstract: Our poster focuses on the gathering, analyzing and interpreting of data on Amazon Echo Devices

REU: IoT Security (DSU)

33a - Comparison of Water-Related Traits Between *Asclepias speciosa* and *Asclepias syriaca*

Kyla Kasuske (1)*, Haley Eversman (1), Steven Matzner (1)**, kmkasuske17@ole.augie.edu
(1) Augustana University

Abstract: Common milkweed (*Asclepias syriaca*) and showy milkweed (*Asclepias speciosa*) are widely distributed in the United States with common milkweed found in the east (including Eastern South Dakota) and showy found in the west (including Western South Dakota). South Dakota experiences a strong moisture gradient, which correlates with the milkweed species' distribution and the two species hybridize in the center of the state. We aimed to determine if water-related traits are linked to the distribution of the species and hybrids by growing them under various water levels ranging from high moisture to drought conditions. Preliminary data indicates that the two species differ in stomatal density (*A. syriaca* has greater density) and stomatal length (*A. speciosa* has greater length). Additional work this summer will determine if the two species differ in overall growth, transpiration, and other measures of plant drought tolerance in response to varying moisture levels.

BRIN - Augustana University

34a - Suzuki Coupling Catalyzed by (8-(dimesitylboryl)quinoline)palladium(0) Species: A Theoretical Analysis

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(1) University of South Dakota

Abstract: The Suzuki reaction is a palladium catalyzed cross coupling reaction which is of utmost importance in the formation of carbon-carbon bonds in modern organic synthesis. Recently a new catalyst including an 8-(dimesitylboryl)quinoline for the coupling of aryl halides with phenylboronic acids was synthesized.[1] The experimental results are promising; however, it is challenging to characterize the species involved in this catalytic reaction or the extent and nature of the interaction between the 8-(dimesitylboryl)quinoline ligand and palladium center. We performed a DFT study and identified a favorable pathway to form the catalytically active palladium species and the reaction mechanism for the Suzuki coupling. Mayer bond analysis and electron localization function maps showed a bond between the boron center in the ligand and the palladium center, but electron density, gradient and Laplacian maps showed no interaction. Thus, an elaborate EDA-NOCV theory was performed to further characterize this interaction.

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

35a - Utilizing Ice Concentration Linked with Extractive Stirrer (ICECLES) to Identify the Source of Aspirin

Destiny Hallak (1)*, Megan B. Guetzloff (1), Brian A. Logue (1), Brian Logue (1)**, hallakd@chc.edu
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Abstract: According to the World Health Organization, 1 in 10 medications in poor countries are falsified. Approximately 35,000 online pharmacies have appeared in the last decade that sell counterfeit drugs. Thin-Layer Chromatography (TLC) is the main technique used to identify counterfeit pharmaceuticals, but it only separates the main components of a potential counterfeit, producing limited information as to the authenticity of a drug product. A novel sample preparation technique called Ice Concentration Linked with Extractive Stirrer (ICECLES) has been shown to work well for comprehensive analysis of substances. Therefore, ICECLES was used to prepare aspirin samples from multiple manufacturers with analysis via gas chromatography-mass spectrometry (GC-MS). Multiple compounds were tentatively identified in the aspirin pills (N=8). Standards were used to attempt to definitively identify these compounds based on retention time and mass spectrometry including comparison to the NIST online database. Currently, three of the eight chemical compounds have been definitively identified.

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

36a - The Nature of Antibacterial Active Molecules in Animal Placentas

Logan Stacey (1)*, Meghan Kuntz (1), Alek Keegan (1), Paul Egland (1)**, Idstacey18@ole.augie.edu
(1) Augustana University

Abstract: The placenta is a fetomaternal organ composed of structures from both the mother and fetus. This temporary organ allows for exchange of nutrients and oxygen as well as removal of fetal waste. The placenta is a barrier that helps prevent infection by containing antimicrobial peptides and proteins and genes involved in immune modulation. *Bos taurus* (cow), *Ovis aries* (sheep), and *Sus scrofa domesticus* (pig) maternal and fetal membrane placenta extracts were studied for their antimicrobial effect on inhibiting the growth of *Staphylococcus aureus*. Boiled placenta extracts are more effective at depleting the bacteria membrane potential than untreated placenta extracts. The antimicrobial factor in the cow cotyledon extracts is protease-resistant. The depletion of the bacterial membrane potential did not kill the bacteria permanently, suggesting the antimicrobial activity in the placenta is a bacteriostatic factor. Research is continuing to identify the active antimicrobial factor in the placenta and its chemical nature.

BRIN - Augustana University

37a - Upconversion Nanoparticles in an Artistic and Creative Realm

Hugo Maldonado (1)*, William Cross (1)**, revelc23@yahoo.com
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Abstract: UCNPs are nanoscale particles that exhibit photon upconversion. Upconversion is a process in which the sequential absorption of two or more photons leads to the emission of light at shorter wavelengths than the excitation wavelength. Questions to be answered by this research include: how do you apply UCNPs to an art piece? How do the UCNPs interact with acrylic paint? In the experimentation process several experiments were performed to determine what media mix well with the UCNPs, how well the UCNPs disperse, and analyzed for UCNPs visibility and brightness. Upon excitation with a near infrared (NIR) laser or an LED light, an image treated with UCNPs would give off light in the near infrared or visible area, while the background remains invisible. The goal is to determine the right strategy for UCNPs application and use them to create a hidden image within the original paintings.

REU: Back to the Future III (SDSMT)

38a - Investigating the Cerebellum in the BTBR Mouse Model of Autism

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Abstract: The cerebellum, a brain region associated with sensorimotor function, is commonly affected in autism spectrum disorder (ASD) patients, but its role in the neurodevelopmental disorder remains unknown. The BTBR mouse, a model of autism that displays behavioral deficits analogous to human ASD, has increased cerebellar volume and differences in cerebellar autism susceptibility gene expression but requires further characterization as a model for studying cerebellar function. Following up on last year's finding of cerebellum-dependent behavioral deficits, we employed various staining procedures and microscopy to characterize the anatomy and cell morphology in the cerebellum in BTBR and C57BL6/J mice. We hypothesized that the BTBR mice would display differences in cerebellar-cortical thickness and Purkinje cell density and morphology in a lobule-specific manner. Investigating such differences would help validate the BTBR mouse as a model for studying the role of the cerebellum in ASD.

BRIN - Augustana University, SD EPSCoR/BioSNTR

39a - Quantification of Actin Motion in Chondrocytes Using Lattice Light-Sheet Microscopy

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Abstract: In chondrocytes, the F-actin cytoskeleton plays a large role in the mechanotransduction of both internal and external forces. As a result, changes in the movement of this cytoskeleton could impact chondrocyte homeostasis quite significantly. To investigate, lattice light-sheet microscopy (LLSM) was used to image the motion of actin in chondrocytes in the presence of various cytoskeletal inhibitors. This imaging technique was chosen as it provides rapid image acquisition times, 3-D images for analysis, and less photobleaching of the sample. The raw data was processed using Super Resolution Radial Fluctuations (SRRF), both for image visualization and quantification preparation purposes. Different quantification approaches were employed, including isosurface with motion vector rendering in ChimeraX and Pearson's colocalization in ImageJ. It was determined that the Pearson's analysis provided quantifiable results that matched the initial qualitative interpretation of the data.

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

40a - Dry Adhesion Separation Process Based on the Surface Energy Between Solids

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Abstract: Copious amounts of water are currently used by the mining industry to separate/concentrate mineral particles. This research seeks to investigate dry processing methods based upon adhesive properties. On each solid's surface, the components of surface tension (van der Waals' London dispersion, Debye, and Keesom forces interact with the electron accepting/donating behavior between Lewis acid/base pairs) work together to attract and repel material. Adhesion is a function of the surface energy characteristic to each solid's surface, and if the surface energy of a substrate is high, other high-surface-energy solids will adhere. If the surface energy is too low solids will not adhere. The focus of this research is to compare the solid surface energies of glass and other common minerals in their natural states and when surface treated with hydrophobic and hydrophilic compounds to predict thermodynamic adhesion for those materials.

REU: Back to the Future III (SDSMT)

41a - Building Your Own Scientific Instrument with a 3D Printer and Arduino

Kaitlyn Mulder (1)*, Kaitlyn Mulder (1), Charles Weiss (1), Andrew Klose (1), Charles Weiss (1)**,
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(1) Augustana University

Abstract: A colorimeter device was created using a 3D printed cuvette holder, an Arduino Uno microcontroller, and an LCD screen. An LED and phototransistor were used for light generation and detection. The Arduino was used to power the LED and read out the signal from the phototransistor. The system was validated by comparing the performance of the newly designed system to commercial colorimeters and spectrometers. The present system is robust for absorption values ranging from 0 to 1 and has an absorption resolution of 0.02. Static absorption measurements of colored samples as well as dynamic measurements of chemical kinetics were demonstrated, and the results will be presented. Students will use these 3D printed devices and microcontrollers and be able to assemble their own cost-effective instrumentation which will aid in the challenges schools face in teaching students the inner workings of scientific instrumentation.

BRIN - Augustana University

42a - Cyclosporine-A Decreases Stress-Induced Expression of CRF and IL-2 in the Central Nucleus of the Amygdala

Tiffany Voss (1)*, Tej I. Mehta (2), Thomas P. Beresford (3), Patrick J. Ronan (2), Patrick Ronan (4)**,
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(1) University of Sioux Falls, (2) University of South Dakota, (3) University of Colorado School of Medicine, (4) Sioux Falls veterans affairs health care system

Abstract: We have shown that immunosuppressants reduce alcohol intake in rodents through inhibition of calcineurin. Calcineurin is an abundant phosphatase in the brain that plays a key role in the transcription of both cytokines and signaling molecules related to addiction. Ethanol withdrawal is known to activate corticotropin releasing factor (CRF) signaling in the central nucleus of the amygdala (CeA). We sought to determine whether the inhibition of calcineurin could prevent stress-induced transcription of CRF and cytokines in the CeA. Rats were given cyclosporine-A (CsA) or vehicle and either subjected to restraint stress or remained in their home cage. Cyclosporine administration led to a significant decrease in both IL-2 and CRF mRNA levels in the CeA. The significant anti-drinking effects of CsA may be due to calcineurin's role in multiple pathways involved in brain stress, reward, and neuroimmune responses. Deciphering these mechanisms holds promise for the development of effective treatments.

BRIN - University of Sioux Falls

43a - Investigation on the Effect of Sample Size on the Tensile Properties of 6061-T6 Aluminum

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Abstract: Tension tests are useful to measure the strength and ductility of an alloy which are useful measurements to evaluate, compare, or develop alloys. A miniature specimen may be needed for certain applications to understand the localized mechanical properties of the materials. However, it is not clear how the tensile properties of miniature size specimens compare with the standard size specimens. So, the main objective of this work is to investigate and understand the effect of sample size on the resultant tensile properties of aluminum alloys. Al 6061 tensile coupons with cross-sectional areas of 2, 4, 24, and 36 mm² were prepared and subjected to uniaxial tensile loading. Strain measurements were measured using digital image correlation (DIC) and compared with the grip displacement. The mechanical properties of Al 6061 alloy as a function of sample size were measured and variability in the tensile properties were analyzed and reported.

REU: Back to the Future III (SDSMT)

44a - Consequences of hybridization of two native milkweed species (*Asclepias*) in their natural hybrid zone

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Abstract: Hybridization is an important and common phenomenon in plants, but the extent that hybridization affects adaptation or speciation is unknown. We are using morphological and biochemical markers to try to understand the extent of the hybrid zone between two milkweed species, *A. speciosa* and *A. syriaca*. We identified the correlates of species ranges and the hybrid zone by measuring floral morphology on images collected by citizen scientists on iNaturalist. We found that the species ranges are correlated to precipitation and vapor pressure. We also analyzed cardenolides across two hybrid zone transects with HPLC and found that the parental species had different cardenolide concentrations while the individuals collected in the region of sympatry are still unknown. We found that the most extreme phenotypes are in the region of sympatry, suggesting that there is extensive hybridization and backcrossing.

BRIN - Augustana University

45a - Role of CXCR2 and CCLR2 on Neutrophil Migration During Labor Onset

Cole Tessendorf (1)*, Cole D. Tessendorf (1), Tania Rodezno (1), Jennifer Gubbels (1)**,
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Abstract: Labor, both term and preterm, begins when maternal neutrophils migrate into the lower uterus, causing a sterile inflammatory reaction. The cytokine signalling that causes this migration and the receptor expression changes on neutrophils as labor approaches is yet unknown. Using plasma and cells from women in different stages of pregnancy, we investigated both the migratory nature of neutrophils in different stages of pregnancy as well as the expression of a major chemokine receptor, CXCR2 and its regulator protein, CCLR2.

BRIN - Augustana University

46a - Neonicotinoid Contamination in Northern Leopard Frog Brains

Lilian Heinzl (1)*, Lilian Heinzl (1), Kaitlyn Campbell (1), Jacob L. Kerby (1), Jacob Kerby (1)**,
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Abstract: The widely practiced agricultural system tile drainage may harm non-target organisms like Northern Leopard Frogs (*Lithobates pipiens*) in the Prairie Pothole Region of South Dakota. Other possible non-target organisms are humans, domestic animals, and bees. Farm crops are sprayed with an insecticide called neonicotinoids that dissolve well in water. One neonicotinoid is imidacloprid. Imidacloprid has been found in fish brains (Iturburu et al., 2017). Amphibians have skin extremely absorbent skin (Lancot et al., 2017). That could make leopard frogs an indicator of how much imidacloprid is in wetlands. Our study exposes fifty *L. pipiens* collected from Wetland Production Areas in Eastern South Dakota to 0, 0.1, 5.0, and 10.0 µg/L of imidacloprid over a twenty-one-day testing period. After the testing period, we will collect the frogs' brains and send them to the University of North Dakota for analyzing.

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

47a - Identifying the Prevalence of Primary Cilia on Lymphatic Endothelial Cells in Homeostasis

Ryan Krump (1)*, Mackenzie Latterell (1), Darci M Fink (1), Darci Fink (1)**, ryan.krump@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Primary cilia are single, non-motile organelles present on most vertebrate cells which participate in signaling pathways between cells in homeostasis, and organismal development. Intraflagellar transport proteins, IFT, traffic proteins for the development of cell organelles. IFT20 is the specific protein involved in the development of primary cilia. Using SVLEC (immortalized mouse lymphatic endothelial cells) and hLEC (human lymphatic endothelial cells) cell lines grown on coverslips, primary cilia have been shown on lymphatic endothelial cells in homeostasis and serum starved conditions by using IFT20 and Arl13b immunofluorescent stains and epifluorescent microscopy. Primary cilia are less prevalent in cells in homeostasis due to the greater proliferation of cells. Primary cilia were also shown on lymphatic cells in adult mouse ear tissue using two-photon microscopy. This identification of primary cilia on lymphatic endothelial cells suggests that primary cilium-dependent signaling may be important in lymphatic vessel development, adult homeostasis, and remodeling in disease.

SD EPSCoR/BioSNTR

48a - Neural Network Potentials for Uranyl-Peroxide Species

Ethan Hare (1)*, Pere Miro (1)**, ethan.hare@coyotes.usd.edu
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Abstract: Uranyl-peroxide nanocapsules are a unique family of self-assembled actinide species. Uranyl ions rapidly self-assemble in basic peroxidic media through a myriad of reactions to coalesce into a single nanocapsule that includes both peroxide and hydroxide bridging groups between the uranyl moieties. However, many of the uranyl-peroxide nanocapsules are too large to study using quantum mechanics methods such as density functional theory. We mapped the potential energy surface by scanning the molecular normal modes and created a large database containing uranyl monomers ($[(UO_2)_3]^{4-}$ and $[(UO_2)_2(OH)]^{3-}$) and dimers ($[(UO_2)_2(O_2)_4(O_2)]^{6-}$ and $[(UO_2)_2(O_2)_4(OH)_2]^{6-}$). We then used the atomistic machine learning package to train a Neural Network Potential in order to create a cheap structure-energy connection and predict quantum mechanics energetics of larger uranyl-peroxide systems for a fraction of the computational cost.

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

49a - Implementing an Inverse Solution for Parameter Calibration of the Cahn-Hilliard Equations

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Abstract: The efforts conducted are part of an NSF funded project for developing a method of mineral separation that uses little to no water to extract a desired mineral. By exploiting the adhesion between particles and tailored (functionalized) substrates, minerals can be separated without resorting to using exuberant amounts of water. These efforts involve the development of a predictive, computational tool, based on the Cahn-Hilliard equation, for the proposed mineral separation process. The contribution of this undergraduate research project consists of the development of a calibration framework for the assessment of the proper physical parameters in the Cahn-Hilliard equation. To do so, a computational parameter study has been conducted of the Cahn-Hilliard equation through FEA and subsequently an inverse computational method has been implemented to solve for the parameters from experimental data.

REU: Back to the Future III (SDSMT)

50a - Fingerprint Image Analysis for Identification

Alina Chu (1)*, Kc Santosh (1)**, alina.chu@coyotes.usd.edu

(1) University of South Dakota

Abstract: Automated fingerprint identification system (AFIS) is a beneficial biometric tool for crime investigators and anti-counterfeiting software. While conventional AFISs use minutiae-based algorithm, this research uses a different approach based on image analysis and pattern recognition. The method employs Scale-Invariant Feature Transform (SIFT) algorithm and Fast Library for Approximate Nearest Neighbors (FLANN) based matching (with the use of the OpenCV library). The SIFT detects and computes distinctive key points on a fingerprint image that will be used by the FLANN based matcher to create matches between two fingerprint images. The matcher was tested on a database that contains the original and altered fingerprint images. The results illustrate that our method can precisely identify the genuine fingerprint. The complete tool was implemented in Python (including OpenCV library) and can be provided for research purpose.

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

51a - A Network Flow Model of Non-Cash Value Transfer in Illicit Transactions

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Abstract: The problem of research investigation will be a specific type of illicit value exchange system wherein articles of value such as cultural artifacts are traded for equivalent quantity of illicit substances as a way to circumvent cash payments. The proposed study details a network flow model that formulates a mathematical representation of a transaction involving exchange of quantities of illicit fentanyl for similarly valued cultural artifacts. The nodes characterize changes in value artifacts experience from price variation existing in underground markets. In addition, nodes are connected to each other by arcs having flows representing currency values. The expected outcome of the proposed research is to provide law enforcement agencies with insight into functioning of trade-based illicit financial flows. Based on five test cases conducted, the proposed model showed an illicit drug trafficking organization could stand to profit in the billions of dollars by engaging in these types of transactions.

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

52a - The Impact of Microbial Induced Calcite Precipitation (MICP) Solutions on Rapid Creek Water Parameters

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Abstract: Microbial induced calcite precipitation (MICP) is a process whereby calcite (CaCO_3) precipitates due to the enzymatic activity of urease that is produced by a ureolytic microorganism, such as *Sporosarcina pasteurii*. Numerous MICP studies have been conducted as a means to enhance soil engineering properties, which includes utilization to reduce negative impacts from liquefaction, contaminate transport, and fugitive dust. The application of MICP treatment solutions and its effect on a variety of water quality parameters has yet to be observed. As a mini environmental study, the observed role/effect that MICP plays on a number of physical and chemical water properties is investigated. This preliminary experiment has been conducted in a controlled laboratory environment. The study showed that MICP solution could have a profound effect on salinity and turbidity, a moderate impact on pH and a minimal effect on temperature and dissolved oxygen.

REU: BuG ReMeDEE SURE

53a - Interferometric Characterization and Mode-Locking of an Erbium-Doped Fiber Laser System

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Abstract: Multiple erbium-doped mode-locked fiber lasers were constructed and optimized. The fiber laser was designed in a ring configuration and contained erbium-doped and passive single-mode fibers. Nonlinear polarization evolution of the light through the laser cavity resulted in pulsed operation of the laser. Differing configurations fiber components in the ring cavity were investigated and will be discussed. A Michelson Interferometer was constructed to determine the group velocity dispersion (GVD) value for the erbium-doped fiber using interference data from white and IR light sources. Dispersion data for the erbium-doped fiber, currently difficult for vendors to specify to a high precision, will help for future laser designs. An Arduino microcontroller was interfaced with a stepper motor which controlled the movable stage of the interferometer. A data acquisition system was written and the resolution and characteristics of the interferometer were investigated and will be presented.

BRIN - Augustana University

54a - 3D Printed Biomimetic Material Structures

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Abstract: Nature has developed complex material structures to optimize the mechanical properties of materials such as bone, nacre, and honeycomb. Researchers are interested in mimicking the structures of natural composites with synthetic materials to learn how to design metamaterials with the same desirable mechanical properties. Using additive manufacturing to fabricate biomimetic materials, this project investigates honeycomb structures with varying cell size and others with varying wall thickness. Compression testing gives the elastic modulus of the samples 3D printed in thermoplastic polyurethane (TPU). Biomimicry has the potential to provide lightweight structural materials to support innovations in transportation, architecture, energy, and other fields because of the combination of stiffness, strength, and toughness at low density that is found in many natural structures such as honeycomb.

REU: Back to the Future III (SDSMT)

55a - Quality Assurance & Verification of SiPMs for the sPHENIX Detector

Yifan Yuan (1)*, Nathan Grau (1)**, yyuan18@ole.augie.edu
(1) Augustana University

Abstract: The poster describes the silicon photomultipliers (SiPMs) used in the sPHENIX Detector as the sensor readout for the electromagnetic and hadronic calorimeters, which detect particles produced from collisions. About 110,000 Hamamatsu SiPMs have been purchased and must be tested to insure they meet sPHENIX specifications as ordered. The poster includes an introduction of the sPHENIX Detector, SiPMs, and our test stand. Results for the SiPM testing will be shown.

REU: Simulation and Analysis (SDSU)

56a - Measurement of Dijet Azimuthal Correlations in $\sqrt{s_{NN}}$

Shuhang Li (1)*, Nathan Grau (1)**, sli17@ole.augie.edu
(1) Augustana University

Abstract: Using the 2016 PHENIX collaboration d+Au collision data producing the base line to study the density of gluon, which is the carrier of the strong force that bind proton and neutron together in the nuclear.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

57a - Development of a Digital Podiatric Examination Method

Megan Fiala (1)*, Evan Fick (1), J. Michael Bertsch (1), Stephen Gent (1)**, megan.fiala724@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Digital diagnostics refers to digital technologies used to assess a patient. Some examples include heart-rate monitors, software that analyzes eye movement to track Alzheimer's progression, and computer programs that can interpret medical images. Despite these advancements, most digital technologies focus on internal measurements with little advancement to the detection of external pain. Many people experience significant pain in their feet, which can lead to more health concerns in the future. This project centers around creating a digital diagnostics tool to measure dynamic forces of the feet. Data collected from sensors embedded within a shoe sole is transmitted via Bluetooth to Microsoft Excel, creating relevant graphs and charts for medical professionals. This allows podiatrists to track forces throughout a patient's stride and accurately assess areas of concern. The effectiveness of this project can be measured using three criteria: accuracy of data collected, speed of data interpretation, and patient comfort.

REU: High Performance Computing in STEM disciplines (SDSU)

58a - Influence of Fish Size in Stage-Structured Feeding

Alexis Culley (1)*, Jeff Wesner (1)**, culley20@sbc.edu
(1) University of South Dakota

Abstract: Stage-structured feeding can better predict predator-prey interactions within a food web by accounting for the variability in predation across life stages. For example, aquatic insects such as chironomid midges feed on the bottom of rivers and lakes as larvae, move through the water column as pupae, and emerge as flying terrestrial adults. However, while it is known that fish target specific life stages of these prey, it is not known whether this is related to fish size. Therefore, in this study we examined the relationship between fish size and proportion of non-larval insects. Preliminary analysis indicates a positive relationship between size and proportion of non-larval insects in Bluegill, Spottfin Shiner, and Johnny Darter, but not other common fish species. Overall, these data support the hypothesis that fish size and proportion of non-larval insects is related, but it is variable among species.

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

59a - Engineering *Geobacillus thermodenitrificans* (LC-41) For Resistance Towards Catabolite Repression

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(1) South Dakota School of Mines & Technology

Abstract: *Geobacillus* sp. (LC-41) can utilize carbohydrates in the production of polyhydroxyalkanoates (PHA), a biodegradable plastic. LC-41 has the potential to be used in large scale bioreactors for the mass production of bioplastic. The resulting industrialized product could possibly be a suitable replacement of nondegradable polymers. This research seeks to maximize the yield of PHA by LC-41 in the presence of corn stover—an economically feasible biomass. It is not fully understood how LC-41 would behave in the presence of corn stover. PHA production can be assessed by experimenting with glucose and/or xylose media. In these conditions, LC-41 might tend to exhibit catabolite repression behavior. Which means LC-41 will respond to environmental stresses by systematically utilizing available carbon sources. Perhaps, these factors will adversely affect the production of PHA. Therefore, the PHA yield is limited by the natural behaviors of the bacteria. Ideally, engineering LC-41 will allow simultaneous carbohydrate utilization.

REU: BuG ReMeDEE SURE

60a - A New Imaging Agent Used to Visualize Lymphatic Remodeling: Hyaluronic Acid-Conjugated Fluorescent Dye

Kahlen Morris (1)*, Chase Petersen (1), Aaron Mohs (2), Denis Svechkarev (2), Darci Fink (1), Darci Fink (1)**,
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Abstract: A new class of hyaluronic acid (HA)-conjugated fluorescent-organic-nanoparticle (FONP) was developed. These molecules are specifically designed to target lymphatic endothelial cells (LECs). LECs undergo extensive remodeling and plays a significant role in the metastasis of cancerous cells. The long-term goal of this project is to develop new tools for pre-clinical and clinical imaging of pathological lymphatic vessel remodeling signatures indicative for early malignancy. The primary objective of this experiment is to show that the HA-conjugated FONP will specifically identify LECs in co-culture and intact tissue with >95% of LECs detected by traditional immunofluorescence through two aims. Aim one is to confirm specificity for LECs in vitro using a co-culture model. Aim two is to define the penetrance and specificity for LECs in vivo using a corneal explant model. Inverted epifluorescence and spinning disk confocal microscopy was utilized to confirm results.

SD EPSCoR/BioSNTR

61a - Potential Roles of Nup155 Protein Subdomain in Cardiac Electrophysiological Development

Melanie Gucwa (1)*, Randolph Faustino (1)**, melanie.gucwa@gmail.com

(1)

Abstract: Cardiovascular Disease (CVD) accounts for 31% of global deaths (CDC 2015). Arrhythmias are a form of CVD characterized by abnormal cardiac electrical activity that causes irregular beating. Atrial Fibrillation (AF) is a specific class of arrhythmia that can lead to other heart complications including increased mortality. Recent studies have illustrated a connection between AF and proteins called nucleoporins (nups). Nups make up the nucleocytoplasmic transport-mediating nuclear pore complexes (NPCs). Mutations in one of the nups, NUP155, have been clinically associated with AF. We previously identified an R672G point mutation in the alpha-solenoid region of human NUP155 predicted to have high pathogenicity. In the current project, we performed the CRISPR/Cas9 method of genome editing to introduce the NUP155 R672G mutation in human-induced pluripotent stem cells (hiPSCs). We then utilized the hiPSC model of cardiogenesis to study the effects of the NUP155 R672G mutation on developing cardiomyocytes.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

62a - Strong-Field Control of H₃⁺ Formation Pathways in Methanol and Ethanol

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(1) Augustana University

Abstract: Using CD₃OH isotopologue of methanol and CH₃CD₂OD isotopologue of ethanol, the ratio of D₂H⁺ to D₃⁺ formation is manipulated by changing the characteristics of the intense laser pulse. For methanol, detection of D₂H⁺ indicates a formation process involving two hydrogen atoms from the methyl side of the target and a proton from the hydroxyl side, while detection of D₃⁺ indicates direct formation involving only the methyl group. For ethanol, the dissociation mechanisms are more complicated. An adaptive control strategy that employs image-based feedback to guide the learning algorithm results in an enhancement of the D₂H⁺/D₃⁺ ratio by a factor of approximately two for methanol dissociation, but only a 20% enhancement in ethanol dissociation. Systematic changes to the dispersion terms of the laser pulse are compared to the optimization results. Consistent temporal features are observed in pulses optimizing D₂H⁺/D₃⁺ ratio from methanol dissociation.

SD EPSCoR/BioSNTR

63a - Exploring the 4f Optical Setup in Pump-Probe Ultrafast Laser Experiments

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(1) Augustana University, (2) 3

Abstract: The 4f geometry is commonly applied to broadband pulse shaping applications where the shaping device is placed in the Fourier plane, thereby accessing the pulse spectrum directly. Here we report on the construction and characterization of a 4f setup for pulse shaping that uses a linear, folded geometry that minimizes spatial chirp and conical diffraction. The complicated alignment of the device is made easier by the construction of a TRI-color Dispersive Environment Tool (TRIDENT) that combines three spatial-mode filtered, narrow-band diode lasers in the far-field. The 4f output is characterized using SHG-FROG, which indicates that there are some higher-order dispersion components that need further correction. When completed, a spatial light modulator in the center of the 4f setup will shape ultrafast laser pulses that will form part of a multiple-pulse approach to probing and controlling molecular systems.

SD EPSCoR/BioSNTR

64a - Exploring H₃⁺ formation from ethane using shaped ultrafast laser pulses

Tiana Townsend (1)*, Charles J. Schwartz (1), Naoki Iwamoto (1), J.L. Napierala (1), S.N. Tegegn (1), A. Solomon (1), S. Zhao (1), Bethany Jochim (2), Kanaka Raju P. (2), Travis Severt (2), Peyman Feizollah (2), K.D. Carnes (2), Ben-Itzhak (3), Eric Wells (1)**, ttownsend18@ole.augie.edu

(1) Augustana University, (2) Kansas State University, (3) 2

Abstract: Dissociation of ethane following double ionization by ultrafast laser pulses is examined using COLd Target Recoil Ion Momentum Spectroscopy (COLTRIMS), a imaging technique that can measure the momentum vector of all the charged products emerging from the dissociation. This information is used to explore the complicated formation of D₃⁺ from a C₂D₃²⁺ parent ion. Dissociation into D₃⁺ + C₂D₃⁺ with a kinetic energy release of approximately 5 eV is the dominant channel for tri-hydrogen ion formation. This formation is thought to occur via roaming of a neutral D₂ around the C₂D₄²⁺ dication until a third deuteron is captured, forming D₃⁺. Using the Ethane-1,1,1-d₃ isotopologue to distinguish tri-hydrogen ion formation involving hydrogen from a single methyl group (D₃⁺) or both methyl groups (D₂H⁺), we show that shaped ultrafast laser pulses can change the D₂H⁺/D₃⁺ ratio by a factor of about two.

SD EPSCoR/BioSNTR

65a - Suspended sediment contributions of Nebraska tributaries along the 59-mile reach of the Missouri National Recreational River

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(1) University of South Dakota

Abstract: Suspended sediment loads in the 59-mile reach of the Missouri National Recreational River (MNRR) are derived by tributaries and by bank erosion within the main channel. The Gavin's Point Dam withholds suspended sediment, preventing it from traveling into the 59-mile reach. Previous studies have documented sediment loads from, the Big Sioux, Vermillion and James Rivers. While these rivers are the source of the majority of the sediment (~76%) entering the 59-mile reach of the MNRR, the tributaries on the Nebraska side also contribute a significant amount.

Suspended sediment samples were taken using depth-integrated sampling techniques on the Bow, Turkey, Lime and Aowa Creeks. Discharge at the time of sampling was used to estimate yearly suspended sediment loads. It was determined that 14% of the suspended sediment present in the MNRR at Sioux City, Iowa is sourced from the Nebraska tributaries.

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

66a - Automatic Sweat Pore Extraction Using Convolutional Neural Networks on Local Ridge Minima

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Abstract: A critical step in automatic fingerprint recognition systems is feature extraction. Most systems use level 2 features (called minutiae) for the matching step, but the poor image quality of latent fingerprint makes it difficult to extract enough high-quality features to accurately match fingerprints. Therefore, level 3 features, such as sweat pore configurations, are examined to improve current methods. With fingerprint images where the ridges are light and the background is dark in color, this report proposes a method for extracting sweat pores by finding local minimum grayscale pixel values along the ridges followed by the sweat pore classification of the identified local minima using convolutional neural networks. Using this method, the majority of the confirmed sweat pores were successfully extracted automatically on test images of latent fingerprint. The performance is expected to improve with a larger, more accurate dataset to train the neural network.

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

67a -

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(1) South Dakota School of Mines & Technology, (2) South Dakota State University, (3) Oglala Lakota College

Abstract: The Heritage Center at Red Cloud Indian School (located on the Pine Ridge Reservation) was gifted an 1863 Sharps Rifle. This rifle allegedly belonged to Chief Red Cloud who was a well-known and respected Chief of the Oglala Lakota people. The gift came with little provenance but did include a letter that attributed the rifle as a gift from Red Cloud to General Nelson. This research involved scientific and cultural analysis to ascertain the authenticity of the rifle. X-ray fluorescence was conducted to understand the chemical background of the steel components. Examination of powder from the barrel of the rifle was conducted using energy dispersive x-ray spectroscopy to determine if the rifle was fired. A literature review was conducted on General Miles and Chief Red Cloud to determine the nature of their interaction. Interviews with Lakota Elders and cultural experts was used to augment the scientific analysis of the rifle.

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

68a - Chemical Functionalization of Metal-Organic Supercontainers (MOSCs) for Biomedical Applications

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Abstract: Metal-organic supercontainers (MOSCs) represent a new class of container molecules featuring multiple binding domains (endo- and exo-cavities). They are constructed of cup-shaped container precursor p-tert-butylsulfonylecalix[4]arene, metal ions, and carboxylate linkers of various shapes. The nature of the assembly provides structure tunability, allowing for many diverse structures. The MOSCs had previously been studied for gas adsorption, chemical sensing, and catalysis. However, most of the prototypal MOSCs lacked desired biocompatible characteristics, such as water-solubility and lipophilicity, making them less suitable for biomedical applications. This study focuses on the synthesis of functionalized MOSCs that are biocompatible and can be readily employed for biomedical applications, such as neurotransmitter regulation. By functionalizing the MOSCs with sulfo (SO₃⁻) groups through modification of carboxylate linkers, the results showed improved water solubility when compared to their non-functionalized counterparts. To impart additional lipophilicity, fluorine was incorporated into the linkers to generate new MOSCs with unique chemical properties.

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

69a - Associations Between Breast Cancer Screening, Incidence, and Mortality in South Dakota

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Abstract: Breast cancer is the second leading cause of cancer deaths among women in South Dakota. The purpose of screening is to detect tumors earlier, leading to a reduction of death from the disease. The relationship between breast cancer preventative screening, incidence, and mortality should be straightforward, but some studies have shown otherwise. This research looks at these relationships in five clusters of counties with similar socioeconomic characteristics and screening participation. The analysis focuses on women aged 40-64 years. Maps displayed cluster average of incidence and mortality. The associations between screening, incidence, and mortality with full and reduced data is explored using linear regression models. Overall, there was a negative association between screening and mortality in SD. However, clusters behaved differently with one group of counties presenting a strong case for overdiagnosis and the largest group of rural counties having abnormally high incidence and mortality and low screening rates per county.

SD EPSCoR/BioSNTR

70a - Electronic Structure and Speciation of Actinide Molecular Metal Oxides

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Abstract: The understanding and control of the speciation and self-assembly of aqueous molecular metal oxides is fundamental since our ability to manipulate the evolution of transient species in solution lies at the core of nanotechnology. In this aspect, actinide molecular metal oxides are highly relevant in an advanced nuclear energy cycle including fuel reprocessing and long-term waste storage. The speciation of transuranic molecular metal oxides is very complex and relatively little is known regarding their composition, structure, and properties in solution. In this study, we explored the electronic structure of [An(H₂O)₉]⁴⁺, [An₂(OH)₂(H₂O)₁₂(Cl)]⁴⁺, and [An₆(OH)₄(O)₄(R-CO₂)₁₂] using density functional theory (DFT) and second order perturbation theory complete SCF (CASPT2) methods.

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

71a - Molecular Geometries of Fe (II) Spin-Crossover Complexes

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Abstract: Spin-crossover occurs when the spin state of a complex changes due to external stimuli, such as temperature, pressure, or light. Spin-crossover complexes show promise for use in future sensors, catalysts, and in molecular electronics. Development of these technologies relies on our ability to understand, predict and control spin behavior. Specifically, d6 Fe(II) octahedral complexes frequently exhibit this behavior and the change in spin-state between the low spin-singlet and high spin-quintet is accompanied by a change in molecular-geometry. We present geometry optimizations of small complexes with density functional theory (DFT) and second-order complete active space methods (XMS-CASPT2). While the geometries for these systems are well known to be sensitive to the choice of functional, we explore the performance of XMS-CASPT2 with small active spaces and reasonable sized basis sets. The difference in the energy splitting between high spin and low spin states at the DFT and CASPT2 geometry is investigated.

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

72a - Synthesis and Electrochemical Characterization of High-Capacity Organic Cathodic Materials for Use in Lithium-Ion Batteries

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Abstract: The low energy density of traditional LiCoO₂, cathodic material (272 mAh/g) has limited potential to meet new demands in portable electronic applications. To solve this problem, we are investigating a new type of Schiff Base polymeric material with a conductive backbone as a possible replacement for the cathodic materials in Li-ion batteries. We designed a new polymer that can be utilized as secondary battery material and would have a theoretical capacity of 581 mAh/g. 1H NMR results show that we have successfully prepared the Schiff Base monomers with thiophene functional groups. Electrochemical study indicates multiple electron transfer occurs during the reduction at about 2.5 V vs. Li/Li⁺. Future work would focus on the optimization of polymerization of the Schiff Base and to begin preliminary battery discharge testing. This project explores the field of light-weight organic cathodic materials and has the potential to greatly increase the energy density for lithium batteries.

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

73a - ICP-MS Analysis of Heavy Metals through Soil, Strata, and Plant Uptake

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Abstract: The potential for environmental contamination from in-situ leach uranium mining operations is of serious concern to the Oglala Sioux Tribe (OST) and public. Many of whom rely on local drinking water sources, local food and medicinal plants. Exposure and ingestion of heavy metals, to heavy metals are associated with adverse risks to human health. Samples were collected at seven sites along Whitehead Creek from rock outcrop and regolith, soils, and (medicinal/edible) plants. Bioavailability and leachability of these samples was analyzed for elements (As, Se, U, and Th) using an Inductively Coupled Plasma Mass Spectrometer. Concentrations of Selenium and Arsenic in samples were higher than expected within all samples. While regolith and strata samples contained higher concentrations of Uranium and Thorium than majority of the soil samples. Then, analysis of phyto-accumulation has confirmed the hypothesis of hyper-accumulation of U, As, and, Se.

SD EPSCoR/BioSNTR

74a - The effects of a pan-HDAC inhibitor, SAHA, on a novel murine osteosarcoma cell line.

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Abstract: Osteosarcoma (OS) is the most common primary malignancy of the bone in adolescents and children. The five-year survival rate of localized osteosarcoma is about 70%, while patients that have metastatic disease can be less than 30%. However, the outcome for these groups has not changed in the last four decades. OS cells have a higher expression level of Notch signaling indicating the pathologic gain-of-function of Notch may contribute to tumorigenesis of bone cells. The Notch pathway is an evolutionary conserved mechanism that governs various cell activities like promoting the self-renewal of mesenchymal stem cells, and the proliferation of preosteoblasts and immature osteoblasts. T29 is a murine OS cell line derived from a Notch1-induced OS model. Herein, we will study the effect of a pan-HDAC inhibitor, suberoylanilide hydroxamic acid (SAHA; commonly known as vorinostat or Zolinza™) in T29 with the hopes of providing a genetic gateway for OS treatment.

BRIN - University of Sioux Falls

75a - Antibiotic Resistance in Rapid Creek

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Abstract: Antibiotic resistance is one of the most pressing and increasingly important issues humanity currently faces. When microorganisms become resistant to medication, usually harmless infections can become deadly. To find out about the prevalence of antibiotic resistance in Rapid Creek, several water samples were taken along the stream at specifically chosen locations based on recorded EPA environmental data. These samples were then plated onto Petri dishes with the antibiotics Kanamycin and Spectinomycin. All plates were incubated and observed for growth, and conclusions about antibiotic resistance were drawn based on the level of growth per dish. Results forthcoming.

REU: BuG ReMeDEE SURE

76a - Selective Fluorescence Sensing of Metal Cations with Imine Based Macrocycles

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Abstract: Previously, an anthraquinone-18-crown-5 macrocycle reacted with aromatic amines in the presence of TiCl₄ yields imine molecules substituted at the external carbonyl. However, fluorescence studies revealed that external imine derivatives; although they form complexes with metal cations, do not exhibit strong fluorescence or UV-Vis changes, indicating they are relatively poor sensors for metal ions in solution. Based on these findings, it is hypothesized that selectivity would increase if imines could be substituted at the internal carbonyl group instead. The internal imine derivatives CEN-Methyl and CEN-Ethyl have been subsequently synthesized in our laboratory and characterized by proton NMR, LC-MS and elemental analyses. CEN-Methyl showed large shifts in UV-Vis/Fluorescence spectra with Mg(II) and Zn(II), and CEN-Ethyl demonstrated large shifts with Mg(II), Zn(II), and Mn(II). While both internal derivatives are more sensitive than the external imines, they are not selective for any cation.

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

1p - Elemental Analysis of South Dakota Prairies with Se-Indicator Plants Using ICP-MS and Flame-AA

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(1) Black Hills State University

Abstract: Selenium is an essential micro-nutrient in human and mammal diets, but is not necessary for plants. Some plants have adapted to grow on soils with high selenium and can accumulate it in their tissues. Selenium-rich soils from across South Dakota were collected and sampled via ICP-MS and Flame-AA to determine elemental composition. The results were then used to determine if there was any correlation between study sites.

BRIN - Mt. Marty College

2p - Development of "Cave Silver" Biofilms on Artificial Rock Surfaces in the Sanford Underground Research Facility

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(1) Black Hills State University

Abstract: The Sanford Underground Research Facility (SURF) is a former gold mine that contains extensive "cave silver" biofilms in one area of the 1470 m level. Sterile rock slabs were left in this area and were collected in time intervals of fifteen, forty, and sixty days to study biofilm development over time. Samples were plated from these rock slabs on low nutrient media and then sampled for microbial DNA. Libraries of 16S rRNA genes were made from the extracted DNA and sequenced. Although bacteria colonized the rocks within fifteen days, the number of cultivable bacteria did not increase from fifteen to sixty days. The major groups of bacteria for the fifteen-day samples were Proteobacteria (mainly Pseudomonas), Actinobacteria, Bacteroidetes, as well as Firmicutes (Bacillus). Chloroflexi and Acidobacteria increased going from the fifteen-day samples to sixty days, while Firmicutes decreased.

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

3p - Characterization of Microbial Life Sanford Underground Research Facility Water

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(1) Black Hills State University

Abstract: The Sanford Underground Research Facility (SURF) is located in a former mine system that collects water originating from both the surface and from deep underground aquifers. This generates a variety of microbial ecosystems, each with different water chemistry and inhabitants. Sequencing of the V4 region of the 16S and 18S rRNA genes allowed us to identify the members of aquatic communities at three different depths below the surface: 510 m, 1400 m, and 1500 m. Despite similarities among these ecosystems, there were major differences between prokaryotic and eukaryotic organisms present. Alpha diversity of these communities decreases with depth with the greatest being at the 510 m level in a natural pool next to the Ellison Fan and the lowest at the 1500 m level sump. These communities can be classified by the types of microbial metabolism. The 1400 m level contained a number of iron-oxidizing bacteria, while the 1500 m sump contained many sulfur and thiosulfate oxidizers.

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

4p - Exploring Gene Expression of Buffalo Rat Alveolar Macrophages Exposed to Cadmium Telluride

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(1) Black Hills State University

Abstract: Cadmium Telluride (CdTe) nanoparticles are being utilized to increase efficiency of solar cell technology. Previous research has explored the toxicity of these nanoparticles and the potential for adverse human health effects, however less is known about how that toxicity may alter gene expression. Buffalo rat alveolar macrophages are cultured and exposed to a lethal dose of CdTe (LD20-50) via serial dilution over 24-, 48- and 72-hour time periods. LD50 was achieved in the 72-hour time period with a mid level concentration ranging from 6-12ppm. Macrophages were re-cultured, plated, and exposed for RNA extraction, then proceeded to library preparation, quantification, quality check, and sequencing. Future work will include a continuation of evaluating data and targeting altered gene expression.

BRIN - Black Hills State University

5p - Reseraching the Lasting Effects of Selenium in Soil in the Western South Dakota Region Using ICP-MS

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(1) Black Hills State University

Abstract: High concentrations of the element Selenium (Se) is known to be extremely toxic to the environment and the wildlife around it. It's known that high concentrations of Selenium in soil are referred to as Seleniferous soils. Too much selenium can cause horses and cattle hair loss and hoof change. In extreme cases, cattle can become lame from consuming high levels of Selenium. Our research team was able to take many different soil samples from around the western South Dakotan area and then digest the soil with a nitric acid and hydrogen peroxide mixture. Once processed, the elemental analysis were analyzed by inductively coupled plasma mass spectrometry, ICP-MS. The results for the selenium and other elemental quantification will be presented.

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

6p - Evaluating Copper(I) Bisphenanthroline as a Photoredox Catalyst in Enantioselective Reactions

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Abstract: This research involves the use of photocatalysts and chiral catalysts to synthesize small chiral molecules via oxidation-reduction reactions. Most commonly, these molecules made are enantiomers, or non-superimposable mirror images of one another. The purpose of this research project is to successfully couple aldehydes with alkyl bromides using a copper(I) catalyst. The choice of this catalyst is due to the abundance of copper as well as the affordability of the element compared to Ruthenium, another efficient photoredox catalyst. The final product is purified using column chromatography and analyzed with thin layer chromatography. Using Nuclear Magnetic Resonance (NMR) spectroscopy, the product is characterized to determine if it was produced in addition to determining if additional purification is necessary. High Performance Liquid Chromatography (HPLC) is used to separate the enantiomers in order to determine the ratio of those produced. Through these methods, we have been able to receive up to 79% product yield.

BRIN - Black Hills State University

7p - Detection of PSMA in Prostate Cancer Tissue Microarrays with Quantum Dot-Aptamer Bioconjugates

Elizabeth Menzel (1)*, Morgan Rothschadl (1), Kalista Vanden Berge (1), Barrett Eichler (1)**,
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Abstract: Prostate cancer (PCa) is one of the deadliest cancers for men, but it is difficult to detect due to the size and location of the prostate. Greater than 90% of PCa patients have cells that overexpress the protein PSMA. Protocols to tag RNA aptamers with fluorescent quantum dots (QD) to make a bioconjugate probe, and bind the probe selectively to PSMA + PCa cells were previously developed in our lab. This summer, PSMA + PCa cells were mounted on coverslips, stained with the probe, and visualized under a confocal microscope to normalize settings and quantify fluorescence. Human tissue microarrays were then stained with the probe to test the binding ability and to quantify the fluorescence for different stages of PCa.

BRIN - Augustana University, SD EPSCoR/BioSNTR

8p - The Effects of an 8-Week Stabilization Exercise Program on Lumbar Multifidus and Transversus Abdominis Using an Augmented Musculoskeletal Feedback System Compared to Traditional Core Stabilization Exercises: A Randomized Control Trial

Jacob Iverson (1)*, Craig Triplett (1), Jacob Iverson (1), Cortez Standing Bear (1), Abbie Fredrick (1), Vicki Burshia (1), Craig Triplett (1)**, jacob.iverson@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: A prevailing health problem in the United States is low back pain (LBP). It is estimated that approximately 80% of the adult population has or will experience LBP. Studies have demonstrated that one of the most effective strategies to treat LBP is the activation and strengthening of key core stabilization muscles. 32 healthy university students filled out a Physical Activity Enjoyment Scale (PACES) questionnaire regarding their feelings toward exercise. They performed maximal strength testing of core muscles. Participants were split into two groups. The control group performed traditional core exercises while the experimental group used an augmented biofeedback system. Participants performed the exercises 3 times a week for 20 minutes for 8 weeks. The results demonstrate that the more the subjects performed the exercises, the higher they reported on the PACES. Neither group demonstrated a significant improvement in strength. More subjects will be participating in the fall of 2019.

BRIN - Black Hills State University

9p - Quantum dot-aptamer bioconjugates for prostate cancer detection

Morgan Rothschadl (1)*, Elizabeth Menzel (1), Kalista Vanden Berge (1), Barrett Eichler (1)**,
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(1) Augustana University

Abstract: Our poster is about looking for a method of staging prostate cancer using quantum dot-aptamer bioconjugates.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

10p - Identification of Polymorphisms in Candidate Genes involving Egg Size in *Drosophila melanogaster*

Tyler Hayes (1)*, Taylor A Beagle (1), Dr. Cecelia Miles (1), Cecilia Miles (1)**, tjhayes17@ole.augie.edu
(1) Augustana University

Abstract: Whole-genome sequencing (WGS) provides a way to understand complex polygenic traits. Egg size is known to be closely associated with fitness, and a highly polygenic trait. A base population of wild *Drosophila melanogaster* was used to derive three treatment groups to genetically shift egg size: cold (16.5C) indirectly selected for large eggs, warm (25C) directly selected for large eggs, and warm (25C) directly selected for small eggs. Our current aims are 1) to screen all inbred lines derived from the replicate cages and identify two lines derived from each cage with healthy mothers producing the phenotype of interest after inbreeding 2) to measure both egg size and body size using image analysis in these lines and 3) to extract DNA from females in each of these inbred lines to submit for sequencing. Illumina WGS will be used to identify consistent sequence changes in previously identified candidate genes between inbred lines.

BRIN - Augustana University

11p - PALEOPROTEOMICS ANALYSIS OF CERAMIC POTS RESIDUES FROM PRE-COLUMBIAN WARI CULTURE: A STRATEGY TO IDENTIFY POTENTIAL ANIMAL AND VEGETABLE SPECIES USED AS SOURCES OF FOOD.

Anthony Johansen-Sallee (1)*, Eduardo Callegari (1)**, a.johansensallee.17@dwu.edu
(1) University of South Dakota

Abstract: Paleoproteomics is the study of ancient proteins through the use of different proteomics, bioinformatics, and archeological techniques. The Wari civilization flourished in the central Andes (Peru) between c. 650 and c. 1000 CE. They expanded and became the first ancient empire of South America. The paleoproteomic analysis of archeological residues from ceramic pots is an important strategy to understand how this society organized their cuisine. Our main goal was to identify proteins from animals and vegetables from ceramic residues to understand which species were cooked on it. A protocol for protein extraction was developed, followed by a shotgun proteomics analysis using LC-MS/MS, combined with bioinformatics tools to identify the potential proteins and its corresponding species present in the ceramics. Examples of species identified are: guinea pig, llama, sweet potato, corn, etc. The proteins identified provide an approximation of what kind of animals and plants were used as a source of food.

BRIN - University of South Dakota

12p - The Effects of Exercise, Estrogens and Diet on Hepatic Protein Expression in Type 2 Diabetes

Adam Roskam (1)*, Alexandria Jacobs (2), Skylar McCaulley (3), Brittany Gorres-Martens (4)**, adaros66@mtmc.edu
(1) Mount Marty College, (2) Dakota Wesleyan University, (3) 0, (4) Augustana University

Abstract: Type 2 Diabetes (T2D) is a widespread epidemic associated with abdominal obesity. Exercise can ameliorate T2D symptoms, and studies show estrogens may prevent the onset of T2D. Thus, postmenopausal women may be at a greater risk for T2D. While the effects of exercise, estrogens, and diet on whole body risk factors for T2D are well established, little is known about the cellular molecular mechanisms accounting for these whole body beneficial effects. Therefore, we used female Wistar rats to examine the effects of exercise, estrogens, and diet on hepatic protein expression. Consuming a high-fat diet increased the expression of lipoprotein lipase (LPL), a protein that stimulates fat storage, and decreased the expression of acetyl CoA carboxylase (ACC) and fatty acid synthase (FAS), two proteins involved in de novo lipid synthesis. Notably, estradiol replacement had the opposite effect by decreasing LPL expression and increasing ACC and FAS expression.

BRIN - Augustana University, BRIN - Mt. Marty College

13p -

Gabriel Yellowhawk (1)*, To Be Added Later (3), Alessandra Higa (1)**, gyellowhawk@gmail.com
(1) Oglala Lakota College, (2) To Be Added

Later, (3) 0 Abstract: to be added later

SD EPSCoR/BioSNTR

14p - Characterization of human lung adenocarcinoma cell line Calu3 underair-liquid interface culture

Blessing Okosun (1)*, Jordan A. Hoops (1), Timothy Brenza (1)**, blessing.okosun@dickinsonstate.edu
(1) South Dakota School of Mines & Technology

Abstract: Advanced in vitro cell models provide more predictive alternatives for evaluating particulate-lung epithelial interactions. An example is Calu-3. Calu-3 a human adenocarcinoma alveolar type 1-like cell line with physiological characteristics similar to that of the conducting airways. These features include tight junction formation, mucus production and expression of cilia proteins. However, Calu-3 culture protocols vary between research groups, resulting in inconsistencies between studies. There are currently two main ways to culture the cell line: air-liquid interface (ALI), which involves exposing the cells on the apical side to air, or liquid-covered protocol, where cells are submerged in media. We aim to standardize the protocol for culturing Calu-3 by comparing expressed characteristics of cells cultured in liquid covered culture and ALI methods. Response parameters include tight junction integrity measured by transepithelial electrical resistance and cell growth kinetics quantified by MTT viability assay and cell counts.

REU: BuG ReMeDEE SURE

15p - Analyzing Murine Microglial Response to Different Types of Particulate Matter

Lucas Merrill (1)*, Kelsey R. Buchmann (1), Nathan M. Stadem (1), Mikayla E. Street (1), Paula A. Mazzer (1), Paula Mazzer (1)**, luke.merrill.16@dwu.edu
(1) Dakota Wesleyan University

Abstract: Alzheimer's and other neurodegenerative diseases affect nearly 24.3 million individuals globally [1]. In a recent survey, a panel of experts discussed existing data and concluded that there are higher rates of dementia in developed regions than in developing regions. Microglia, a macrophage-like cell located in the central nervous system, can produce a respiratory burst in response to a pathogen [5]. Reactive oxygen species (ROS) contrived from a respiratory burst can have unintended consequences resulting in oxidative stress to neurons. We are looking at the ability of two different types of particulate matter, diesel exhaust and urban dust, to activate microglial cells and determine if there is an increase in ROS when microglial cells are exposed to these conditions. We measured TNF-alpha and hydrogen peroxide produced from the remnants of ROS. Thus far, we have been able to conclude microglia have a difference in response to the various types of particulate matter.

BRIN - Dakota Wesleyan University

16p - Tree Presence and Species Identity in relation to American Beaver Activity on the Missouri River

Kyle Dash (1)*, Ashley Williams (1), Kyle Dash (1), Dr. Meghann E. Jarchow (1), Meghann Jarchow (1)**,
kyle.dash@usd.edu

(1) University of South Dakota

Abstract: The American Beaver (*Castor canadensis*) can be viewed as an ecosystem engineer due to the affects it has on its environment through dam construction, tree cutting and removal, and eventual abandonment of sites. We hypothesized that plots with beaver activity would have greater cottonwood (*Populus* spp.) and willow (*Salix* spp.) abundance. We measured tree species identity, number, size, and cover at sites with and without beaver activity at three locations along the Missouri River near Vermillion, SD in June-July 2019. Our preliminary data suggests that there is a positive correlation between average canopy cover (tree density) and beaver activity. We also found greater (*Populus* spp.) and willow (*Salix* spp.) abundance where beavers were present. It is essential to understand habitat requirements for *C. canadensis* in order to develop sound management and conservation plans for the species.

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

17p - Wicozani Waste: Good Health, Wellness, and Life- A Quality Assurance Evaluation for Native Youth Cultural and Physical Programs

Katherine Glenn (1)*, Jonathan J Urroz (1), Diane L Smith (1), Diane Smith (1)**, katgle59@mtmc.edu

(1) Mount Marty College

Abstract: Obesity and diabetes are critical health issues amongst Native American tribes. During the summer of 2019, BRIN researchers investigated and utilized a Quality Improvement and Quality Assurance approach to provide a statistical and descriptive analysis of the Santee Health & Wellness Center cultural and physical activities with the youth ages 3 to 18 with a focus on obesity and diabetes. The findings included the following: Santee Health & Wellness Center created and enhanced community partnerships; further Community Based Participatory Research is needed to identify obesity and DMII among the youth through physical and laboratory assessments and then commit to a well-communicated program with culturally accepted interventions; also research is recommended to investigate age appropriate physical activity effectiveness; and finally continued development of an evaluation tool is needed to give a complete picture of the process and what is required to implement the program intervention in the rural Native American community.

BRIN - Mt. Marty College

18p - Molecular and Cellular Investigation of MRSA Acetate Kinase Inhibitor AK072019 as a Narrow-Spectrum Antibiotic Candidate against Staphylococcus aureus Infection

Mitchell Lonneman (1)*, Chun Wu (1)**, mlonneman@iw.net

(1) Mount Marty College

Abstract: The therapeutic challenge caused by the emergence of Methicillin-resistant *Staphylococcus aureus* (MRSA) has driven the demand for novel antibiotics. Our previous study identified MRSA acetate kinase (ACK) as one of the promising drug targets due to its involvement in central metabolism. We have cloned, expressed, purified and characterized MRSA ACK. High throughput screening of 10,500 compounds against MRSA ACK has identified 38 hits with IC₅₀ values less than 50 μ M and AK072019 has a value of 3.542 μ M. Comparative analysis of antibacterial activity of inhibitor AK072019 against 17 species of representative Gram positive and Gram negative bacteria was conducted by Kirby-Bauer disk diffusion method. The results showed that inhibitor AK072019 selectively inhibit the growth of Gram-positive bacteria *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Bacillus cereus* without inhibiting the rest of Gram-positive and Gram-negative bacteria tested. Its selectivity sheds light on the potential of developing inhibitor AK072019 into a narrow spectrum antibiotics.

BRIN - Mt. Marty College

19p – Synthesis of Glucosinolates via the Nitronate Pathway

Marie Anderson (1)*, Madalyn R. Heiling (1), Kali E. Ryan (1), Jared Mays (1)**, maanderson16@ole.augie.edu
(1) Augustana University

Abstract: Diets rich in Brassica vegetables provide a variety of anticancer benefits, largely due to the presence of glucosinolates, β -thioglucoside-N-hydroxysulfates, which are abundant in the plants. The action of the enzyme myrosinase on glucosinolates evolves biologically-active isothiocyanates (ITCs), cellular electrophiles which are believed to be partially responsible for the anti-cancer properties of these vegetables. The non-natural ITCs

4-(methylsulfinyl)benzyl ITC and 3-pyridylmethyl ITC have been shown to be potent inducers of antioxidant response element (ARE) promoted genes. Since myrosinase is known to be tolerant of non-natural glucosinolate substrates, this study describes efforts to utilize the nitronate synthetic pathway toward the preparation of four non-natural glucosinolate precursors related to these target ITCs: 4-(methylthio)benzyl glucosinolate, 4-(methylsulfinyl)benzyl glucosinolate, 4-(methylsulfonyl)benzyl glucosinolate, and 3-pyridylmethyl glucosinolate.

SD EPSCoR/BioSNTR

20p - Molecularly Imprinted Polymers to Dopamine

Alec Lamoreux (1)*, Cade Cody (2), George Mwangi (3)**, alec.lamoreux@coyotes.usd.edu
(1) University of South Dakota, (2) Dakota Wesleyan University, (3) University of Sioux Falls

Abstract: Molecularly imprinted polymers have many theoretical applications: from medicinal field to the environmental field for qualification and quantification of molecules in the systems. Our research this summer focuses on being able to synthesize a biosensor that has the ability to quantify dopamine in a physiological system. Molecularly imprinted polymers possess the ability to quantify target molecules due to the synergistic relationship between the crosslinker, which is what gives the polymer its structure, and the functional monomer of which gives the ability to bind to a target molecule (dopamine). This summer we are investigating changing the ratios of cross-linker to find the optimal range that gives the best release and re-binding of dopamine in our polymer matrices. In addition to studying cross-linking, we are also looking into the optimal way of removing dopamine from the polymer with the perfect ratio of solvent to allow for later quantification in a system.

BRIN - University of Sioux Falls

22p - Inconsistency in Testing Measures in Resistance Training Studies in Older Adults: A Systematic Review

Ali Kuca (1)*, Daniel Flahie (1)**, alikuc921@mtmc.edu
(1) Mount Marty College

Abstract: Studies regarding resistance training in older adults are not consistent or repetitive. Studies randomly pick exercises to measure the participant's results making it difficult to fully understand what exercise methods should be done and what training program best benefit older adults, reverse the signs of aging, and improve quality of life. The goal is to create a structured set of assessment measurements that can be considered the gold standard performed when assessing the results of the resistance training program. The standard must pertain to a person's quality of life that display the true effectiveness of the resistance training program. A systematic review was conducted based off 19 articles that met the inclusion criteria. According to the results BMI, chair stands, gait speed, 8 ft. up and go timed, balance, and hand grip tests should be the norm assessments that are executed to show the effectiveness of a resistance training program.

BRIN - Mt. Marty College

23p - The epigenetics of Friedreich's ataxia

Anna Boyens (1)*, Seassion Vitiello (1)**, aeboyens17@ole.augie.edu
(1) Augustana University

Abstract: Friedreich's ataxia (FRDA) is an autosomal recessive disorder characterized by trinucleotide GAA repeat expansion of intron 1 in the FXN gene. Decreased cellular levels of Frataxin cause patients to experience decreased muscle coordination, with the majority of the patients succumbing to heart failure. One possible explanation for the decreased FXN expression is hypermethylation of the FXN locus. We aim to map the location of methylation along the FXN locus in FRDA and control fibroblast cell lines. We will then test the functionality of the methylation by removing it using CRISPR-dCas9. We predict removal of the methylation will result in increased expression of the FXN gene in FRDA cell lines and restoration of mitochondrial function.

BRIN - Augustana University

24p - The Perfluoroalkylation of Multi-Walled Carbon Nanotubes via Decarboxylation of Perfluorooctanoic Acid

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(1) University of South Dakota

Abstract: This project is focused on the perfluoroalkylation of multiwall carbon nanotubes (MWCNTs). In prior work, decarboxylation of perfluorooctanoic acid was shown to occur at 80°C and produce perfluoroalkyl radical. We perform the decarboxylation step in the presence of MWCNTs, and hypothesize that perfluoroalkyl radical may attack the sidewall of the carbon nanotube and form a covalent bond. Functionalized MWCNT samples were characterized with transmission Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and ¹⁹F nuclear magnetic resonance (NMR) spectroscopy.

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

25p - Differential Effect of Exercise, Estradiol, and Specific Estrogen Receptor Activation on Type 2 Diabetes Risk Factors

Janelle Shiffler (1)*, Janelle Shiffler (1), Brittany Gorres-Martens (1), Brittany Gorres-Martens (1)**,
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(1) Augustana University

Abstract: In 2017, the United States counted over 109 million obese citizens making it the most obese country in the world. Obesity is a top indicator for type 2 diabetes mellitus (T2D), and T2D is the seventh leading cause of death in the United States. Insulin resistance is among the main characteristics of T2D. Insulin resistance occurs when the insulin signaling pathway fails to activate and blood glucose levels remain high. Previous studies suggest that estrogens combat T2D, and specifically, activating estrogen receptor alpha may offer the greatest defense. In this study, high-fat-fed/ovariectomized rats were treated with exercise, estradiol, or specific estrogen receptor agonists. The control received low doses of receptor-specific agonists, while other groups received endogenous levels. This study measured body weight, food consumption, spontaneous cage activity, % body fat, and blood glucose. These data will provide novel insights about the non-reproductive molecular mechanisms of estrogens affecting T2D.

BRIN - Augustana University

26p - Ceramide Signal Analysis Via Lipid Extraction

Noah Vettrus (1)*, Paula Mazzer (1)**, noah.vettrus.16@dwu.edu
(1) Dakota Wesleyan University

Abstract: to be added later

BRIN - Dakota Wesleyan University

27p - IoT Is Everywhere, Is Your Privacy Theirs?

Austin Priesel (1)*, Malique Barksdale (2), Yong Wang (1)**, prieselap15@gmail.com
(1) Dakota State University, (2) Capital Technology University

Abstract: This project aims to study the data collected from IoT devices and how the data affects user privacy. Without any knowledge of the data collected from IoT devices or security controls being used by these devices, user privacy is a huge concern. In this project, we select 14 IoT devices and conduct literature review to discover the data collected from these devices. We further analyze and evaluate the data based on PII and non-PII information. Our analysis shows that IoT devices have huge impact to user privacy thus users must use caution when adopting IoT devices. A user case on the Fitbit Charge 3 is further conducted in the project to validate our analysis.

REU: IoT Security (DSU)

28p - A Better Offer: A Comparative Security Analysis of Alternative Smart Home Solutions

Michael Jurkoic (1)*, Tegan Chin (1), Sulabh Bhattarai (1)***, mjjurkoic@gmail.com
(1) Dakota State University

Abstract: Internet of Things smart home systems most often use a cloud-based management model, due to the resource constraints of physical IoT devices. A notable example of this model is Samsung's SmartThings ecosystem. The company Hubitat, Inc., however, offers an alternative model that eschews cloud computing in favor of local storage and automation processing, claiming greater user privacy as a benefit. We conducted a comparative security analysis of both systems based on the ten most common IoT vulnerabilities identified by OWASP to determine whether this claim is true. Our research indicates that, currently, Samsung's SmartThings is more secure, but the Hubitat model holds promise due to its smaller exposure surface and fewer points of failure. We conclude by offering mitigation strategies that will help users take advantage of these benefits, and make the next generation of locally-based smart home systems more secure.

REU: IoT Security (DSU)

29p - Analyzing Protein Trafficking in Live Mouse Cilia

Jennifer Kuiken (1)*, Casey McKenzie (1), Indra Chandrasekar (1), Lance Lee (1), Lance Lee (1)***, jenniferl.kuiken@gmail.com
(1) Sanford Health

Abstract: Primary Ciliary Dyskinesia (PCD) is a syndrome that results from improper function of motile cilia, organelles responsible for circulating fluids in the respiratory system, oviduct, and brain. Protein dynamics associated with motile cilia have not been well investigated in mammalian systems. In this study, we demonstrate a novel technique to visualize protein dynamics in cultured multi-ciliated cells taken from wild-type mice and mice with PCD. Tracheal epithelial cells are harvested, transduced with a lentivirus to express a GFP-tagged ciliary protein, and cultured at an air-liquid interface to enable differentiation into ciliated cells. High-resolution, live confocal imaging of the cells was used to observe trafficking of GFP-tagged intraflagellar transport protein IFT52. Visualization of IFT52 dynamics was observed in wild-type cells and cells from mice lacking the CFAP54 protein that is associated with the ciliary central pair apparatus. Quantification of protein movement will identify differences between wild-type and mutant cilia.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

30p - Cryptojacking Malware Analysis for Internet of Things

Aaron Baker (1)*, Jonathan Schmitz (1), Josh Stroschein (1)***, crosby.baker2010@gmail.com
(1) Dakota State University

Abstract: IoT devices such as IP cameras, smart devices and smart appliances are a prime target for attackers due to hardware and software vulnerabilities when accessing these devices. Cryptojacking malware is one of emerging threats to IoT and can create an endless source of revenue for the attackers. This project investigates aspects of malware, the process of crypto mining, and a potential way of detecting the use of cryptojacking malware on IoT devices. Our research and testing results indicate that the cryptojacking malware can be detected using system performance monitoring matrix such as CPU usage and incoming and outgoing network packets. We further analyze the cryptojacking malware using the NIST Cybersecurity Framework in the processes of identify, protect, detect, respond, and recover.

REU: IoT Security (DSU)

33p - Competitive Absorption of Organic Ligands on Plasmonic Gold Nanostars

Andrew Trowbridge (1)*, Andrew Trowbridge (2), Yifeng Huo (1), Chaoyang Jiang (1)**, atrowbr1@cord.edu
(1) University of South Dakota, (2) Concordia College

Abstract: To combat counterfeiting, more complex anti-counterfeit measures must be developed. One such development is using different combinations and concentrations of organic ligands in solution with plasmonic gold nanostars as anti-counterfeiting SERS tags, which can be then analyzed through principle component analysis (PCA). The purpose of this project is to further understand how the surface-enhanced Raman scattering (SERS) signals from different organic ligands impact each other in order to synthesize more complex anti-counterfeiting tags. The distinct SERS signals of 4-mercaptobenzoic acid and malachite green make these ligands excellent candidates for the SERS security tags. By exploring how the concentrations impact the Raman spectra, we can use trace amounts of ligands to produce SERS security tags with differentiable SERS spectra. The large number of molecular combinations coupled with the PCA technology necessary to analyze the SERS security tags would make these nanostars an ideal candidate for a new generation of anti-counterfeit measures.

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

34p - Synthesis and Evaluation of Lipid A Inhibitors: A New Class of Antibiotics to Combat Gram-Negative Bacteria

Katherine Nielson (1)*, Alex Wiley (1), Molly Erickson (1), Allen Wellman (1), Claire Fergusson (1), Dave Bergmann (1), John Dixon (1), Dr. John Dixon (1)**, katherine.nielson@yellowjackets.bhsu.edu

(1) Black Hills State University

Abstract: Resistance to antibiotics, especially with gram-negative bacteria, is turning into an enormous threat for our health care system and society. In 2013, the Center for Disease Control reported that there were roughly 2 million people in the United States alone that were infected with bacteria resistant to antibiotics and that at least 23,000 people die each year as a direct result of these infections. Antibiotics are not a profitable route for pharmaceutical companies. Therefore, over the years, academic institutions have stepped up to the front line for the battle on antibiotic resistance. In our lab, we are working on synthesizing lipid A inhibitors and evaluating via in-vivo assay on two gram-negative bacteria: *Escherichia coli* B and *Pseudomonas aeruginosa*. We have synthesized and tested 17 compounds, including derivatives of 3-hydroxybenzoic acid, using a 96-well micro-titer plate format. With this assay, we have observed moderate inhibition of bacterial growth.

BRIN - Black Hills State University

35p - Tracing Illicit Fentanyl through Synthetic Impurities via Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)

Morgan Logue (1)*, Brian A Logue (1), Brian Logue (1)** , morgan.logue@jacks.sdstate.edu

(1) South Dakota State University

Abstract: Fentanyl is a potent opioid (i.e., 2 mg of fentanyl can be fatal to those without an opioid tolerance). The number of fentanyl-related deaths has increased in the United States based partially on counterfeit opioids containing fentanyl as the active ingredient. Because the synthesis of illicit fentanyl is not controlled, it is more likely to contain impurities than authentic pharmaceuticals. Different synthetic routes exist, which result in different impurities. Therefore, detecting the impurities can help lead back to the source. Ten impurities were used to create three mixtures representing different synthesis methods. LC-MS/MS analysis of these mixtures can identify the synthesis method based on the identity of impurities and their corresponding concentrations. This generalized process may be extended to allow tracing of other illicit or counterfeit drugs back to their source and determination of the source of fentanyl from analysis of blood samples when the opioid material is unavailable.

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

36p - Design of a Wearable Health Monitoring System

J. Michael Bertsch (1)*, Evan Fick (1), Megan Fiala (1), Stephen Gent (1)** , jonathan.bertsch@jacks.sdstate.edu

(1) South Dakota State University

Abstract: Wearable medical technologies have made monitoring a patient's health easy and non-invasive. Unfortunately, these devices are often expensive and rarely capable of monitoring multiple parameters. The goal of this project is to develop an affordable and user-friendly device to monitor many significant elements of patient health. The intent behind this device is to combat two shortfalls of the medical industry by 1.) reducing the time it takes to connect health monitors in emergency medical settings, and 2.) monitoring patients in rural communities without access to nearby medical centers.

REU: High Performance Computing in STEM disciplines (SDSU)

37p - Fabrication and Characterization of PVDF Electrospun Nanofibers

Erin Schnetzer (1)*, Shawn Yang (1), Chaoyang Jiang (1)***, erin.schnetzer@coyotes.usd.edu
(1) University of South Dakota

Abstract: In order to make a better battery, it is essential to develop new types of separation membranes with good ion conductivity, uniform morphology, and strong chemical resistance. Polyvinylidene fluoride (PVDF) is an excellent candidate for such a membrane due to its desirable properties, such as piezoelectric and pyroelectric properties, and mechanical, thermal and chemical stabilities. Here we used the electrospinning method to make PVDF nanofibrous mats and characterize their morphology, porosity, and crystallinity. Various fibrous mats were made with different parameters such as solvents, PVDF concentration, needle-to-collector distance, and flow rate. We found that lower PVDF concentration favors thinner nanofibers with more beading. When using Dimethylacetamide (DMAc), there is a higher percent of beta structures than those made from Dimethylformamide (DMF) solution. With further optimization and study, we expect that PVDF electrospun nanofibers will be suitable for use as separation membranes for lithium-ion batteries.

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

38p - Examining the differences between land-use values and town size of the Upper Missouri River Basin

Ann McGehrin (1)*, Meghann Jarchow (1)***, mcgehrinam@appstate.edu
(1) University of South Dakota

Abstract: The communities along the Upper Missouri River Basin (UMRB) are among the least densely populated regions in the contiguous United States, and primarily utilize the land for agriculture and energy production. Therefore, maintaining the landscape is crucial to the economy and culture of many communities in the region. The purpose of this research is to assess the differences between individual values for recreation, conservation, and agricultural-related land-use, among other societal land-use values in relation to town size. Using qualitative data analysis methods, this research analyzes data collected from in-person conducted surveys along the main states of the UMRB to map and assess the social values of residents in regards to their landscapes. There are 21 locations chosen for this research, specifically chosen to span across the UMRB. Overall, this research shows that larger cities are more prone to value recreation and smaller cities are more likely to value agriculture.

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

39p - Effects of Invasive Trees on Daily Nest Survival Rate of Birds in Missouri River Riparian Forests

Sierra Rider (1)*, Jacob Myers (1), Amanda Hegg (1), David Swanson (1), David Swanson (1)***, sar2593@lockhaven.edu
(1) University of South Dakota

Abstract: Invasive plants may alter habitat features, predation pressure, and nesting success for birds. We examined whether invasive trees, Russian olive (*Elaeagnus angustifolia*) and eastern red cedar (*Juniperus virginiana*), in Missouri River riparian habitats influenced bird nesting success by monitoring nests during the summer of 2019. Preliminary data from 2019 suggest that birds used Russian olive for nesting more than any other nest substrate, and nesting success was generally lower in Russian olive than in native plants. The generally lower nesting success in Russian olive in 2019 is consistent with data from these same sites in 2017, but 2018 nesting success at these sites was generally higher for Russian olive than for other nest substrates. Thus, Russian olive may have a negative impact on bird nesting success in Missouri River riparian forests during some years, but the effect does not appear to be consistent across years.

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

40p - Calibration Methods for In Situ Characterization of Shipwreck Concretions and Metals

Alana Pauls (1)*, Dr. William M. Cross (1), Dr. Michael K. West (1), William Cross (1)**, ampauls98@gmail.com
(1) South Dakota School of Mines & Technology

Abstract: For shipwrecks, corrosion and concretions develop over time. The rate of corrosion/concretion development varies with conditions of the marine environment, leading to the need for analysis of the corrosion rates. In this study, simulated concretions similar to those from a marine environment were examined to develop calibrations for laser ion breakdown spectrometer (LIBS) and X-ray fluorescence (XRF). These calibrations were then tested on shipwreck concretion samples to determine the iron concentration as a function of position within the concretion. The iron content has been shown to be useful in estimating the concretion equivalent corrosion rate (CECR). LIBS and XRF were used to determine the elemental composition of the calibration samples and the concretions. Iron is useful for CECR, while the full elemental composition of the concretion can determine the metal alloy use. Initial research shows that there is a linear relationship between element band height and composition with XRF.

REU: Back to the Future III (SDSMT)

41p - Investigating the Modulation of SIAE and CASD1 Expression and their Influences on Inhibitory Receptor Binding of Cancer Cells

Susan Grabenstein (1)*, Rachel Willand-Charnley (1), Rachel Willand-Charnley (1)**,
susan.grabenstein@jacks.sdstate.edu
(1) South Dakota State University

Abstract: This poster focuses on exploring how the "sugar-coat" of a cell can be used to evade immune cell detection, especially useful for cancer cells. Through altering DNA, the cancer cells were manipulated to test whether parts of the DNA are essential for this evasion.

SD EPSCoR/BioSNTR

42p - Characterization and Optimization of Embedded Electrospun Nanofibers for the CellWell™

E. Celeste Perez (1)*, Ram Saraswat (1), Ishara Ratnayake (1), S. Phil Ahrenkiel (1), Scott Wood (1), Scott Wood (1)**, pereze997@students.cochise.edu
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Abstract: The CellWell™ is a micropatterned platform which is used to model the articular cartilage with the purpose of maintaining the spheroidal morphology of chondrocytes. One of the components used for this platform is PVA (Polyvinyl alcohol) nanofibers used to model type II collagen nanofibers in the articular cartilage. This project is focused on the characterization and optimization of these nanofibers. To accomplish this, fluorescently conjugated PVA solution was electrospun to generate randomly ordered nanofibers. These fibers were then covalently crosslinked via glutaraldehyde vapor, processed into micron-sized pieces, and embedded in agarose hydrogel. By using these techniques, fibers were found to have an agglomerated appearance when embedded in which further optimization will be required to obtain an isotropic distribution. Towards that end, we also tested various electrospinning setups using PVP (Polyvinylpyrrolidone) to establish a novel technique for nanofiber alignment in order to optimize the distribution of these nanofibers in the CellWell™.

REU: Back to the Future III (SDSMT)

43p - Effect of gas environment on cold spray deposition of 6061 Al on ZE41-T5 Mg in the context of aluminum-magnesium cold sprayed + friction stir welded joints

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Abstract: Aluminum to magnesium alloy joining is becoming an essential technique in many industries. Traditional fusion welding and even some solid-state joining techniques are often not viable in creating acceptable Al-Mg joints, due to the formation of intermetallic compounds. Recently, a process was developed where the combined techniques of cold spray deposition (CS) and friction stir welding (FSW) was used to create viable Al-Mg joints. Many aspects of this combined process are unstudied and may be beneficial in optimizing this technique for industry. In this research, the effect of conducting cold spray in an inert helium environment versus an air environment is studied. Results on the overall quality measured by porosity and mechanical properties measured by adhesion and tensile testing will be presented. Preliminary analysis shows that the sample sprayed in air was more porous and brittle than the sample sprayed in an inert atmosphere.

REU: Back to the Future III (SDSMT)

44p - Till vs. No Till Effects on Soil Nutrients and Tomato Node Production

Courtney O'Laughlin (1)*, Courtney O'Laughlin (1), Jennifer Gubbels (1)**, caolaughlin18@ole.augie.edu
(1) Augustana University

Abstract: Soil samples were taken over the course of three months in till vs. no till conditions at a depth of 6 inches in order to investigate the effects on heirloom tomato plant growth. Nodes were also counted. No till conditions revealed more nutrients and higher node counts.

BRIN - Augustana University

45p - Use of Porous Wall Hollow Glass Microsphere Composites for Security Applications

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Abstract: Many counterfeit microelectronic parts are unknowingly used in military equipment and many other critical support systems, introducing unnecessary security and safety risks. A common method of counterfeiting micro-electronics is "black-topping," where the original product markers are sanded away and replaced with a higher quality product marker. This research project was conducted to investigate the incorporation of porous wall hollow glass microspheres (PWHGMs) in a composite material for anti-counterfeiting applications. The PWHGMs were incorporated into a two-part polyurethane resin to form a composite material. This composite material was imaged using X-ray micro-computed tomography (micro-CT) to characterize the distribution of microspheres throughout the composite. For comparison, three composite specimens were developed including (i) PWHGM + polyurethane, (ii) non-coated and nickel-coated PWHGMs mixture + polyurethane, and (iii) solid wall glass microspheres + polyurethane. These findings indicate that PWHGMs can be successfully incorporated into composite materials for use in anti-counterfeiting applications.

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

46p - Effects of Surface Treatment and Edge Preparation on the Microstructural and Mechanical Properties of Aluminum 2524

Cody Marshall (1)*, Dr. Bharat Jasthi (1), Dr. Michael West (1), Todd Curtis (1), Fernando Vazquez (1), Bharat Jasthi (1)**, cody.marshall@mines.sdsmt.edu

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Abstract: Friction Stir Welding (FSW) is a solid-state welding process that has been heavily adopted by the aerospace industry as a method of joining traditionally unweldable aluminum alloys. The purpose of this research is to study the effects of multiple base metal edge preparation methods (shearing, water jet cutting, machining) and surface treatments (alclad, anodization) on FSW of a high strength aerospace alloy. Results of different edge and surface conditions will be presented through data collected from tensile testing, metallography, and microhardness testing. These results will help determine the most cost-effective treatments needed to achieve acceptable welds.

REU: Back to the Future III (SDSMT)

47p - Design of an Adaptable Lattice Structure for Bespoke Orthotic Devices

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(1) South Dakota State University

Abstract: In 2014, 77% of Americans surveyed by the APMA reported experiencing foot pain in the last year. The most commonly prescribed solution to this problem are custom orthotic insoles, which provide arch support while limiting motion and pressure in painful regions of the foot. Custom insoles are usually created from a mold or 3D scan of an unloaded foot, disregarding the dynamic loading that feet experience. Rather than focus on the contours of each patient's foot, this research intends to capture the pattern of forces the foot experiences during that dynamic loading. This unique focus will allow us to build a different structure for each patient, creating footwear that yields or doesn't exactly where needed. A modular lattice structure was developed that allows for easy customization. 3D printing provides an excellent means of producing bespoke products, and recent advances in flexible materials have further assisted this project's application.

REU: High Performance Computing in STEM disciplines (SDSU)

48p - Toluene-in-Water Emulsions Containing Upconverting Nanoparticles for Use in Latent Fingerprint Detection

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Abstract: Despite advancements in the field of forensics, fingerprints are still useful tools in crime scene investigation. This study is focused on latent fingerprints which are usually invisible to the naked eye and composed of finger oils and perspiration. While there are current working methods for latent fingerprint collection, many are not always viable on particular substrates, so it is important that technology for latent fingerprint collection be further developed. Previous research has been done evaluating NIR-to-NIR upconverting nanoparticles (UCNPs) as a fingerprinting powder to reduce background interference. This study investigates the use of UCNPs in a toluene-in-water emulsion as a method for application to latent fingerprints. Using visual observations and thermogravimetric analysis, it was determined that such an emulsion is stable for long periods of time and shows promise in latent fingerprint detection. Upon application to fingerprints, the UCNPs congregated in the print area and displayed level one detail.

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

49p - RHEOLOGY OF ENERGETIC POLYMER PASTES

Tavine Legore (1)*, Dr.Lori Groven (1), Lance Kotter (1), Dr.Lori Groven (1)**, tsl2248@email.vccs.edu
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Abstract: ABSTRACT Energetic polymers are found in a variety of everyday products. They produce high temperature and energy; hence they are useful to various industries, especially space exploration. Energetic polymers are used as a component in rocket propellants and extensive research is being done to either replace or improve the commonly used HTPB binder. This research investigates the optimum weight percentage of solids loading in a HTPB binder, for improved burn rate and structural stability for manufactural efficiency. Different energetic polymers were also investigated as a means to improve their efficiency in the products they are currently used in. The rheological properties of the energetic polymer samples were mainly investigated using a capillary rheometer but other methods were also employed. A spindle rheometer was used to verify data from the capillary rheometer and/or produce low shear rates tests.

REU: Back to the Future III (SDSMT)

50p - Latent Fingerprint Development and DNA Extraction Using Upconversion Nanoparticles

Diana Tassew (1)*, Amit Chowdhury (1), Stanley May (1)**, diana.tassew@coyotes.usd.edu
(1) University of South Dakota

Abstract: Fingerprints and DNA profiling have been used in crime investigation as a means of identification for years. Our group uses NIR-to-NIR upconversion nanoparticles (UCNPs) to develop fingerprint images where 976 nm illumination is used to generate 800 nm luminescent fingerprint images. Using NIR-to-NIR UCNPs to develop fingerprints helps produce better quality images with low background interference compared to traditional development methods. Another goal of the research is to synthesize bifunctional UCNPs that can be used to develop fingerprint images and extract DNA from the fingerprint residues. This can be done by functionalizing the UCNPs to be magnetic and further modifying their surface to be able to bind to DNA. Experiments to extract DNA from fingerprints were first conducted using commercially available magnetic bead made for DNA purification. Luminescence techniques for detecting the extracted DNA do not show sufficient sensitivity. The next approach would be trying to amplify the extracted DNA using PCR.

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

51p - End-User Authentication through Multi-linear Algebraic Eigenspace Updating

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(1) South Dakota School of Mines & Technology

Abstract: User Authentication and end-user verification are two fundamental attributes in supply chain security. As such, the research community generally prefers a multimodal fusion approach. A subset of examples of multimodal data may include biometric data, personal information (e.g. hand-writing, password protection, and/or dynamic typing), and audible cues, all of which produces vast amounts of data when multiple user are being authenticated. Two of the many challenges in multimodal data fusion are dimensionality reduction of the data space and real-time updating of the reduced dimensional space. A common technique to solve the dimensionality reduction problem is through some variation of eigenspace decomposition. The current work presents an approach to overcome both issues by extending traditional eigenspace approaches through online multi-linear eigenspace updating.

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

52p - Processing and characterization of TiO₂ nanotubes for Orthopedic Implants

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Abstract: Titanium dioxide nanotubes have gained considerable attention as an osteogenetic surface treatment for titanium bone implants. Physical characteristics of the nanotube coatings have profound impact on biological cell responses (i.e. adhesion, proliferation, and mineralization of osteoblasts). The mechanism by which these diameters influence these biological responses are not fully defined. The purpose of this research is to define fabrication conditions for producing nanotubes with controlled physical characteristics such as diameter, length, and nanostructure such that future experiments dedicated to understanding the influence of nanotube characteristics on biological response can be determined. Titanium dioxide nanotubes were fabricated by anodic oxidation of titanium sheet in an aqueous solution. The structural and morphological characteristics of the samples were evaluated using scanning electron microscopy. Precise measurements of nanotubes diameter and length were carried out through image analysis.

REU: Back to the Future III (SDSMT)

53p - Interferometric Characterization and Mode-Locking of an Erbium-Doped Fiber Laser System

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(1) Augustana University

Abstract: Abstract will be added later.

BRIN - Augustana University

54p - Evaluation of Universal Influenza Vaccines in a Pregnant Pig Model

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Abstract: Influenza viruses are associated with seasonal epidemics, which affect humans and pigs. We have been working to develop vaccines that induce broad immunity, with the goal of boosting immunity against both human and swine influenza viruses. To achieve this broad immunity, we use random shuffling of DNA. One of the DNA shuffled products, HA-129, induced broad immunity with the benefit of being able to be produced as an inactivated influenza virus vaccine. Here, we evaluate this vaccine using a pregnant pig model to mirror the human response. This topic is significant because pregnant women are more susceptible to influenza virus infection than non-pregnant women. The use of sows is important because of their similar anatomy and gestation when compared to humans, which makes this model valuable for research that evaluates vaccine effectiveness. Overall, we evaluated the vaccine-induced antibody responses in pregnant female sows and fetal pigs.

SD EPSCoR/BioSNTR

55p - Connecting mutations to fitness through metabolism in Arabidopsis Thaliana

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Abstract: Mutations are the ultimate source of all genetic variation, but the mechanisms by which new mutations influence fitness is largely unknown. In this project, we are studying the metabolic consequences of mutations on the glucosinolate pathways. The glucosinolate pathway is an important anti-herbivory pathway that has connections to primary metabolism. We measured glucosinolate concentration in Arabidopsis Thaliana mutation accumulation lines that are fully sequenced and have fitness measures in the field. We also measured glucosinolates on insertion lines to determine how these mutation lines affected pathway output. Our future work will focus on metabolism and connecting specific mutations to physiology and fitness.

BRIN - Augustana University

56p - Polyunsaturated Fatty Acids (PUFAS) in Aquatic and Terrestrial Insects and Riparian and Woodland Birds in the Missouri River Basin and Globally

Kathryn McCarthy (1)*, Jeff Wesner (1)**, kmccarthy36@gatech.edu

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Abstract: Polyunsaturated fatty acids (PUFAs) are important nutrients for metabolic pathways and energy storage in insects and migration in birds (Samuelson 1988 and Guglielmo 2010). The purpose of this study is to analyze fatty acid transfer between aquatic and terrestrial insects and birds in the Missouri River basin and on a global scale. Terrestrial insects, aquatic insects, and bird specimen samples were collected around the Missouri River Basin area. The specimen will be analyzed for several essential nutrients including docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), two omega-3 fatty acids. Stable isotopes and carbon analysis of bird blood samples will be used to determine nutrient derivation (aquatic or terrestrial). A preliminary global literature analysis of fatty acids in 7 aquatic insect families was conducted to estimate the parameters of the Missouri River Basin study. Different insects varied significantly in amount of PUFAs.

SD EPSCoR/BioSNTR

57p - Investigation into the Solubility of Lithium Fluoride in Electrolyte Solutions

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Abstract: Secondary Lithium batteries usage has exploded in the past twenty years especially in commercial electronics; and the need for more energy dense batteries continues to climb. Carbon-Fluorine cathodes present practicable solutions to energy storage, offering high energy density compared to traditional transition metal oxides, however, Carbon-Fluorine cathodes are not rechargeable. One of the reasons why Carbon-fluoride cathodes cannot be recharged is the low concentration of free fluoride in electrolyte solution. This project is focused on determining the ideal solvent/electrolyte composition for dissolving fluoride salts. An investigation to Nuclear Magnetic Resonance (NMR) spectroscopy allows for the identification and measurement of concentration of the free-fluoride ion, allowing for better solvent/electrolyte composition in future trials.

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

58p - Antibody Therapeutics after Influenza Infection

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Abstract: We have evaluated lung pathology in ferrets that were infected with influenza virus prior to treatment with therapeutic antibodies. Therapeutic antibodies were delivered to infected ferrets either at the local site (intranasally) or systemically (intravenously), and lung pathology is compared to virus titers in the upper and lower respiratory tracts. Antibody preparations were also tested for antibodies against influenza neuraminidase as an initial indication of potential protection against secondary bacterial infections.

BRIN - University of South Dakota

59p - Effect of nitrogen source on microbial diversity in a grass-legume (prairie cordgrass-kura clover) intercropping system

Cora Hirst (1)*, Cora Hirst (1), Tanya Li (1), Monica Antoinieta Alba Garcia (1), Quinn Hunter (1), Clairion DuBose (1), Jose Gonzalez Hernandez (1), Sen Subramanian (1), Sandeep Kumar (1), Heike Buecking (1), Udayakumar Sekaran (1), Jose Gonzalez Hernandez (1)**, cora.virginia.hirst@emory.edu
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Abstract: The use of nitrogen fertilizers to improve the efficiency of agricultural practices is currently not sustainable. Excess use of nitrogen fertilizers causes water and air pollution and negatively impacts soil health. An alternative to increase nutrient availability in agricultural soil is to introduce legumes that associate with nitrogen-fixing bacteria. This investigation determines the efficacy of Kura clover intercropping in expanding soil microbial diversity when intercropped with Prairie cordgrass, a notably stress-tolerant grass species and a potential biomass crop. Bulk soils were collected from field plots where prairie cordgrass was cultivated under nitrogen rich, nitrogen deficient, and Kura clover intercropping. Community diversity, enrichment of specific taxa, and abundance of nitrifying and denitrifying bacteria were evaluated by next-generation sequencing of 16S rRNA gene amplicons. An increased microbial diversity of known beneficial taxa in the target crop rhizosphere could distinguish Kura clover as a promising intercropping species.

REU: Interdisciplinary Research Experiences for Undergraduates on Bioenergy (SDSU)

60p - The Synthesis of Phenanthroline-Based Long-Chain Bridging Ligands and their Metal Complexes

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Abstract: Bridging ligands with long-chain carbon backbones have been used to construct large self-assembled structures with inner cavities on the nano scale. These structures can be used as photo responsive sensors to detect metal cations. We have synthesized and characterized ligands with long-chain carbon backbones that have terminal phenanthroline chelating groups and are separated by six to eighteen carbon atoms in length. We started by reacting octadecanedioic acid with an excess of thionyl chloride overnight to make the diacid chloride, followed by reaction with two equivalents of 1,10-phenanthroline-5-amine to form our bridging ligand via amide linkages. A shorter bridging ligand was synthesized using adipoyl chloride and two equivalents of 1,10-phenanthroline-5-amine. We have characterized these ligands using ¹H NMR, LC-MS, and FT-IR spectroscopy. We have reacted our ligands to form coordination complexes with a variety of metal cations. We are currently working to characterize these new compounds by X-ray crystallography.

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

61p - Bioinformatic Prioritization of Proteasomal and Nucleoporin Genes in Human Cardiomyopathy

Carina Cates (1)*, Randolph Faustino (1)**, carinarose1212@gmail.com
(1)

Abstract: Cardiomyopathy is a disorder that causes heart muscle weakening which reduces myocardial ability to pump blood. Cardiomyopathy can be acquired or inherited, however the main underlying cause is not completely known. There are various types of cardiomyopathies, including arrhythmogenic, restrictive, hypertrophic, and dilated, and all of them lead to heart failure. Using bioinformatic analysis, we deconvoluted clinical cardiomyopathy datasets and found novel gene-disease associations. With the well-documented role of nuclear envelope (NE) dysfunction in heart disease, we focused on genes within the NE, in particular genes of the nuclear pore complex, nucleoporins, in the context of cardiomyopathy. Our analysis found multiple differentially expressed genes (fold change > 1.25, corrected p Value < 0.01). We found an up-regulation of genes related to proteasomal function and down-regulation of genes involved in cellular structure and protein binding. Moreover, we found novel nucleoporin genes related to dilated cardiomyopathy, that included Nup214, TPR and Nup50.

REU: Cellular and Molecular Biology (Sanford Research and Augustana University)

62p - Electrochemical Reduction of Nitro Groups: From Bioanalysis to Lightweight High-Energy Density Cathodic Materials for Lithium Batteries

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Abstract: Initially, we investigated the reduction of Sanger (2,4-dinitro-fluorobenzene)-tagged amino acids using liquid chromatography with dual-electrode detection (LC-EC). The nitro groups can be reduced to hydroxylamines that can be reversibly oxidized to nitroso groups. To avoid complications from oxygen in the reduction process, we coupled exhaustive reduction using a coulometric cell with the dual electrode detectors to produce complementary oxidation and reduction-based chromatograms. Our foray into nitro group reduction for bioanalysis shifted our research direction to electrochemical reduction of nitro-substituted aromatics and quinones to create improved cathodic materials for lithium-ion batteries. Cyclic voltammetry was used to investigate the electrochemical aspects of quinones in different electrolyte solutions including aprotic electrolytes, aqueous electrolytes and aprotic electrolytes with lithium hexafluorophosphate. The latter demonstrated that lithium ions behave similarly to protons in quinone reduction.

SD EPSCoR/BioSNTR

63p - Dataset Collection for the Biofilm Data and Information Discovery System (Biofilm-DIDS)

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Abstract: Biofilm-DIDS is a Data-Driven Material-Biofilm Discovery framework that collects and combines disparate big datasets pertinent to biology and material scientist, using artificial intelligence (machine learning approaches) and natural language processing. This system will be used to analyze and predict microbial responses and biofilm phenotypes impacted by nanosomic surficial properties. The primary objective of this project is to develop an extraction module to retrieve the most relevant dataset to populate our Biofilm-DIDS.

SD EPSCoR/BioSNTR

64p - Effect of Surface Functionality on Micro-Particle Motion in Weak Hydrogels

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Abstract: Microrheological studies often use microbeads as probe particles to investigate the properties of complex fluids or soft solids at the micron length scale. To mimic samples of sputum from cystic fibrosis patients, our group has synthesized a model that consists of artificial sputum media (ASM) and xanthan gum (XG). After characterizing these polymer solutions by both macro- and micro-rheological techniques, we found that, as more XG was added, the particles became encased in elastic cages of the polymer microstructure for a longer time. To expand this work, we have focused on investigating the impact of surface chemistry and of size of probe particles on their behavior in similar polymer solutions. Polystyrene microbeads with electrostatically diverse surface modifications of carboxyl or amine groups have been used to investigate the dependence of surface chemistry, while particles with diameters of 500 nm and 1,000 nm have been used to investigate the size dependence.

REU: BuG ReMeDEE SURE, SD EPSCoR/BioSNTR

65p - Predicting Influential Ecosystem Elements in Creating Suitable Habitat for *Graptemys pseudogeographica* Following River modification

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(1) University of South Dakota

Abstract: The Missouri River has a long history of modification most notably damming. False Map Turtles (*Graptemys pseudogeographica*), have unique habitat requirements that are frequently lost through modification. This project looked to investigate which ecosystem element is the main factor in creating suitable habitat for *G. pseudogeographica*. Deadwood abundance was predicted to be the most influential. Utilizing Esri's ArcGIS software, various ecosystem elements were layered with United States Army Corps of Engineers (USACE) and Kerby Laboratory *G. pseudogeographica* presence data from the past eight years. The completed map displayed that in the 13 mile stretch deadwood abundance could be considered to be the main factor to create suitable habitat. Due to the fact that there is less deadwood and suitable habitat in the river, it is of utmost importance to identify the remaining suitable sections. Furthermore, this project could inform the state how to better manage for *G. pseudogeographica*.

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

66p - A Computational Study of Anthraquinone Fluorescent Chemosensors

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(1) Augustana University, (2) 0, (3) University of South Dakota

Abstract: The gradual accumulation of heavy metals in the environment threatens living organisms; however, current detection techniques are expensive and time-consuming. Therefore, seven anthraquinone ligands were proposed as fluorescent chemosensors—providing a simpler and less expensive alternative to detect heavy metal ions. Three of the ligands have been synthesized and shown to detect Ca, Cd, Hg, and Pb, but a computational study has not been performed to date. In this research, DFT calculations were used to understand the nature of ligand binding strength and fluorescent properties. First, the effect of functionalizing the macrocycle was analyzed by calculating the energies of each ligand bound to six different metals. Then, UV-Vis spectra were simulated to understand/characterize the shift in the characteristic anthraquinone absorption peak when the metal binds. Future work will explore the UV-Vis transitions of various metals, allowing us to predict excitation energies in systems that have not been investigated experimentally.

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

67p - New life for old data: compiling global diet data of freshwater fishes

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(1) , (2) University of South Dakota

Abstract: As the rise of technology and internet has increased society's ability to store and gather information, the amount of available data has grown exponentially. However, much of this data exists in different formats relative to each individual source. This lack of a universal format hinders scientists ability to work with data from multiple sources due to formatting conflict and frequently adds time to meta-analyses. This project refines a method to reformat, or tidy, this large amount of messy data into a universal format to create practical online databases for future scientific research. Data on fish diets taken from primary and gray literature was tidied to create a single database through the programs Able2Extract, Microsoft Excel, and R. 39 out of 71 papers analyzed had usable tables with relevant data, while 32 papers had no relevant or faulty data. 99 tables in total were extracted, yielding a database with 14572 observations of 22 variables.

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

68p - Fluorinated Metal-Organic Supercontainers (MOSCs) for Anion Recognition

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Abstract: Metal-organic super containers (MOSCs) have been shown to be an excellent new class of ionophores, selectively binding to large molecular cations. Compared to traditional ionophores, MOSCs have multiple nanocavity binding sites along with easier structural tunability. The present study explored a new fluorinated MOSC as a potential ionophore for anion recognition. The MOSC was constructed from the assembly of container precursor p-tert-butylsulfonylcalix[4]arene, Co(II), and a perfluorocarboxylate linker, namely, tetrafluoro-1,3-benzenedicarboxylate. We stipulated that by introducing a highly fluorinated carboxylate linker, the MOSC would feature a sufficiently electron-poor nanocavity that favors anion binding. We investigated the anion binding behavior of the MOSC ionophore through liquid-liquid extraction technique and ultraviolet-visible spectroscopy. Preliminary results suggest that, compared to its non-fluorinated analogues, the fluorinated MOSC shows a unique pattern of anion recognition promising as an anion binding element

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

69p - Forensic Analysis on Native American Artifacts

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(1) Oglala Lakota College, (2) South Dakota School of Mines & Technology

Abstract: This poster presentation will report on the scientific and cultural analysis of a buckskin dress that belongs to the Heritage Center at Red Cloud Indian School. It is believed to date back to the late 1800s or early 1900s but limited information is available for it. This analysis was conducted to determine authenticity, provenance, materials and methods of fabrication, and historic and cultural context of the artifact. The dress is adorned with small glass beads, leather fringe, and German coins dating from the late 1800's to the early 1900's. The artifact has little to no proven authenticity, but is believed to have historical significance. Chemical analysis was used to analyze the leather, beads, and coins, and was performed using X-ray fluorescence (XRF), Raman spectroscopy and Fourier transform infrared spectroscopy (FTIR). Hide analysis was performed using optical microscopy. Finally, cultural analysis was performed by consulting with cultural experts and published literature.

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

70p - Vascular Smooth Muscle 2-D Cell Migration

Betty Fanta (1)*, Betty Fanta (1), Courtney Kinser (1), Zhongkui Hong (1)** , betty.fanta@coyotes.usd.edu
(1) University of South Dakota

Abstract: Coronary artery disease (CAD) is responsible for over 360k deaths per year in the US. Atherosclerosis, the main cause of CAD, involves the hardening and narrowing of arteries due to the buildup of plaque in the artery wall. During plaque development, vascular smooth muscle cells (VSMCs) migrate from the artery media to the intima, forming the plaque's protective fibrous cap. Chronic inflammation and increased shear stress at the site leads to thrombosis, restriction of blood flow, and even cardiac infarction. This study investigated the effect of cholesterol-lowering fluvastatin drug treatment on primary VSMC migration. Cells were imaged and tracked over 24 hours to determine their distance traveled over time. Although not significant, the control group tended to travel a greater distance over time. This result supports that further research should be conducted to better understand the effect of cholesterol on VSMC migration.

SD EPSCoR/BioSNTR

72p - Additive Manufacturing with ABS, ASA, and PLA Thermal Properties for Printability

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Abstract: A fused filament fabrication (FFF) 3D printer was used to analyze the thermal properties of thermoplastic polymer filament. This frugal technique allows the printability of the plastic to be evaluated by printing lines over a range of print temperatures. Three commonly used types of plastic filament, acrylonitrile butadiene styrene (ABS), acrylonitrile styrene acrylate (ASA), and polylactic acid (PLA), were analyzed over a range of temperatures. The weights of the melted thermoplastics were recorded as well as the time that was necessary to extrude the material to determine the flow rate at which the thermoplastics melted through the nozzle. The mass flow rate of all plastics was found to be constant for temperatures between 155 to 225°C for ABS, 163 to 225°C for ASA, and 185 to 225°C for PLA. These temperatures include values that are far below the suggested print temperatures that are provided by the manufacturer of each plastic.

SD EPSCoR/BioSNTR

73p - The SUMO E3 ligase, Mms21 is important for DNA protein crosslink tolerance

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Abstract: Accurate duplication of chromosomes and their faithful transmission to daughter cells is essential to all eukaryotic organisms. This essential process can be interrupted by DNA-protein crosslinks (DPCs), which are defined as the covalent attachment of proteins to DNA. DPCs are known to be physical impediments to DNA replication and transcription machinery. Failure to remove DPCs results in genomic instability, which is a hallmark of cancer. Cells have evolved different independent pathways to resolve DPCs. In the budding yeast, one such pathway involves the protease Wss1. However, how Wss1 recognizes DPCs remains unknown. Here we show that the SUMO E3 ligase Mms21 is crucial for tolerance to DPC-inducing agents. Mms21 functions as part of the SMC5/6 complex and mutations in Mms21 or SMC5/6 components render cells hypersensitive to DPC-inducing agents. Our results indicate that cells use the SUMO pathway for marking DPCs for irreversible degradation by Wss1.

SD EPSCoR/BioSNTR

74p - Yankton Sioux Historical Ecology of the Missouri River

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Abstract: Historically, the Yankton Sioux were an equestrian, nomadic, hunter-gatherer group of Sioux Indians whose territory was east of the Missouri in the prairies of South Dakota. I explore traditional Yankton Sioux ecology, most specifically in regards to their lives along the Missouri River. From an anthropological perspective, ecology is looking at how a group of people interact with their surroundings. Interactions such as relationships with plants cultivated, how they hunted, fished, and other subsistence patterns are all looked at. Animism versus naturalist ideas are also explored in order to better understand traditional practices. I also look at the impact of the reservation system and how Yankton were impacted by the damming of the Missouri River, most specifically the impact of Fort Randall. Lastly, in my research, I explore and observe the continuity and change in Yankton culture since the nineteenth century.

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

75p - Fetal Sex Regulates Placental Lipid Processing by Novel SETD8 Pathway

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Abstract: Increasing evidence on developmental origins of health and disease indicate that males are more susceptible to developmentally-programmed disease. Although increased fetal weight, size, and lipid accumulation is correlated with increased risk of chronic disease, the cause of the differential disease incidence is unknown. SETD8 enhances the expression of PPAR γ , a lipid metabolism factor. We hypothesize that fetal sex regulates SETD8 expression, thereby impacting placental lipid transport. We hypothesize that the female fetal side of the placenta will express more SETD8 and PPAR γ for promotion of placental lipid storage and decreased fetal lipid transport. We are studying fetal and maternal sides of male and female human placental samples, by western blotting for SETD8 expression, and lipid transport and storage protein expression; by Oil-Red-O staining to quantify lipid droplets; and by immunohistochemistry to identify the location of SETD8 in placenta. We expect to find more SETD8 on the female fetal placenta.

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