Biomedical Research Infrastructure Network

SD EPSCoR
RESEARCH. EDUCATION. ECONOMIC DEVELOPMENT.

2018 South Dakota Undergraduate Research Symposium & Faculty Meetings

Ramkota Hotel & Conference Center- Pierre, SD ***July 25-26, 2018***

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Ramkota Hotel & Conference Center
Pierre, SD
July 25-26, 2018

Faculty Agenda

Wednesday July 25th

Grant Proposal Development Workshop

8:00 AM – 3:00 PM
Gallery D,E

presented by Academic Research Funding Strategies, LLC
Morning Session 8:00 AM – Noon *Finding Funding and Planning Your Project*
Afternoon Session 1:00 – 3:00 PM *The Nitty Gritty – Writing Your Proposal*

Noon
Gallery D,E

Lunch

3:00 PM – 5:15 PM
Gallery D,E

Concurrent Scientific Sessions

Visualizing Genetically Modified Organisms with Sub-cellular Resolution, Dynamically, and in 3D

3:00 – 3:40 PM Dr. Sen Subramanian (SDSU), "Multi-photon visualization of phytohormones in soy bean and medicago truncatula using a two-color nuclear localization signal vector"
3:40 – 4:20 PM Dr. Scott Wood (SDSMT), "Imaging Fluorescent Reporters of Mechano-transduction, Cell Mechanics and Signaling Pathways in Human Chondrocytes"
4:20 – 5:00 PM Dr. Robert Anderson (SDSMT), Dr. Brandon Scott (SDSMT), "Dynamical, Volumetric Imaging of Phagocytosis and Macropinocytosis in Macrophages using Lattice Light Sheet Microscopy"
5:00 – 5:15 PM Discussion, closing.

"Omics" Research in South Dakota

3:00 – 3:40 PM Dr. Eduardo Callegari (USD), "Proteomics tools applied to proteins identification and characterization from biological samples"
3:40 – 4:20 PM Dr. Khosrow Rezvani (USD), "Understanding and Targeting Perineural Invasion in Human Prostate Cancer"
4:20 – 5:00 PM Dr. Bernie Wone (USD), "Metabolomics, A Functional Genomics Tool"
5:00 – 5:15 PM Discussion, closing.

5:00 – 6:30 PM Discovery Center Reception – Meet the Keynote speaker and network with colleagues

6:30 – 8:00 PM
Gallery A,F,G

Keynote Presentation and Dinner
Author Sam Kean will discuss career opportunities and communicating science.

8:00 – 9:00 PM Collaborative Networking – Informal networking opportunity – Meet your colleagues at River Center Tavern

Thursday July 26th

7:30 – 8:30 AM Gallery A,F,G	Breakfast with a Scientist (Faculty are asked to attend as moderators to encourage students to talk about the research they have been involved in)
9:00 – 11:00 AM Gallery B,C,D,E	Poster Session 1 (All Faculty and Staff attending, please assist with Judging or interact with student presenters)
11:30 – 12:30 Gallery A,F,G	Lunch
1:00 – 3:00 Gallery B,C,D,E	Poster Session 2 (All Faculty and Staff attending, please assist with Judging or interact with student presenters)
3:00 – 5:00 Lake Sharpe	SD BRIN Faculty meeting • Setting Program and Institutional Goals for the Next Round • Communicating with Campus Administrators

Visualizing Genetically Modified Organisms with Sub-cellular Resolution, Dynamically, and in 3D

Synopsis: This symposium will provide a venue for members of SD BRIN and BioSNTR (from the NIH IDeA and NSF EPSCoR programs, respectively) to share research advances, network with one another, and seek out collaborative partnerships. The symposium will showcase using genetically-encoded and/or chemically labelled fluorescence to visualize and track cellular machinery and architecture in conjunction with single and multi photon fluorescence microscopy methods, and their application to visualize native and genetically-modified plants and mammalian cells, dynamically and in three dimensions. State of the art multiphoton fluorescence and lattice light sheet imaging methods applied to plants, animals and mammalian cells will be the focus of the symposium.

Organizers: Dr. Steve Smith (SDSMT), Dr. Adam Hoppe (SDSU), Dr. Sen Subramanian (SDSMT)

"Omics" Research in South Dakota

Synopsis: "Omics" is a term encompassing genomics, transcriptomics, proteomics and the emerging fields of epigenomics and metabolomics. These high-throughput methodologies are used to provide a global view of cellular processes at multiple levels. This session is intended to provide information about the omics capabilities and resources available to South Dakota researchers. Examples of recent proteomics and metabolomics research projects being done in South Dakota will be highlighted. Core Facility leaders will be on hand to discuss the types of research questions the various omics methodologies are able to address.

Organizers: Dr. Eduardo Callegari (USD) and Dr. Bernie Wone (USD)

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South Dakota Biomedical Research Infrastructure Network

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Student Agenda

July 25th

Faculty Grant Writing Workshop
8:00 am- 3:00 pm
Gallery D,E

BRIN is sponsoring a workshop featuring Lucy Deckard to explore and learn about the interworking of grant writing.

Registration and Lunch***
12:00 pm - 1:00 pm
Gallery A,F,G

Students arriving please register with SD EPSCoR or BRIN staff. Lunch is available.

Student Sessions
Gallery B,C

1:00 pm -2:00 pm	Ins and Outs of Medical/Health Professional Schools
2:00 pm-3:00 pm	Improving Science Communication
3:00 pm-4:00 pm	STEM Career Opportunities
4:00 pm-5:00 pm	Hotel Check-in

Discovery Center Reception
5:00 pm-6:30 pm

Keynote Presentation & Dinner
6:30pm—8:00 pm
Gallery A,F,G

Author Sam Kean will discuss career opportunities and communicating science.

*****If you are staying at the Ramkota expect delays for check-in (4 p.m. on 7/25).*

July 26th

7:30 am-8:30 am *Gallery A,F,G*	**Breakfast with a scientist.**
8:30 am-9:00 am *Gallery B,C,D,E*	**First session poster presenters set up posters**
9:00 am-11:00 am *Gallery B,C,D,E*	**Poster session #1**
11:00 am-11:30 am	**Poster takedown**
11:30 am-12:30 pm *Gallery A,F,G*	**Lunch**
12: 30 pm *Gallery B,C,D,E*	**Second session poster presenters set up posters**
1:00 pm-3:00 pm *Gallery B,C,D,E*	**Poster session #2**
3:00 pm-3:30 pm	**Picture of the Conference attendees, Poster takedown, judging time**
3:30 pm-3:45 pm *Gallery A,F,G*	**Award announcements/Meeting Adjourns**
3:45 pm-5:00 pm	**BRIN Student Evaluations**

Poster Session Roster

32p Adam, Grace
16p Akers, Jennifer
57a Ambrose, Javier
2a Anderson, Marie
56a Anderson, Kjersti
28a Baker, Jack
58p Baumgarten, Grace
13p Bear Heels, Maliesha
73a Best, Madison
18p Bien, Heidi
76a Booton-Popken, Amanda
70a Bortz, Tyler
5p Bowman, Gaven
50p Bozer, Kathryn
11a Brands, Hayley
32a Brett, Joseph
54a Brito, Jordan
22p Brown, Rylie
37p Brunmaier, Laura
67p Carlisle, Grady
9a Cheek, Tesla
40a Chov, Ashleigh
65p Clark, Brett
67a Cole, Matthew
25a Cronin, Nicholas
47p Curry, Samantha
69a Dahm, Clarissa
64a Devlin, Molly
52p Diaz, Deanna
29p Diemer, Tanner
35a Doss, David
19p Engebretson, Benjamin
27a Feiner, Josh
2p Feng, Eric
33p Fournier, Austin
77a Freeman, Caleb
11p Fritsch, Luke
20p Fritsch, Luk
20a Genz, Wileen
41p George, Dylan
66p Gibson, Joseph
68p Goerl, Kathryn
40p Goertzen, Rebecca
36a Good, Adam
79p Goodman, Lucas
39a Gubbrud, Jon
12p Hacker, Joseph
46a Haeska, Eleanor
75a Hall, Tanner
42a Hare, Ethan
69p Haskell, Brianne
47a Heger, Parker
70p Hester, Cathryn
21a Hietpas, Taylor
17p Hummel, Faith
38a Irons, Bridger
13a Jackson, Pauline
57p Jackson, Pamela
63a Jangda, Aamna
48a Johnson, Hannah
24p Jones, Jessica
27p Jones, Alison
41a Juntunen, Hope
72a Jurotich, Marcella
1p Keegan, Alek
8a Kelvington, Benjamin
14p Kills The Enemy Jr, Lester
21p Kireopoulos, Caroline
55p Kirkvold, Clara
59p Knoblich, Colewyn
53p Knutson, Christian
4p Koble, MaKenna
48p Koller, Jeffrey
45p Kreutzmann, Sydney
6a Kujawa, Cody
25p Lamoreux, Alec
5a Larson, Caitlyn
68a Lawrence, Jack Lawrence
56p Lee, Erin
66a Lewis, Dylan
77p Liu, Airu
55a Loecker, Josh
29a Lucas, Spencer
31p Madrigal, Nora
53a Mahony, Kristin
51p Marini, Haley
19a Martin, Mackenzie
7p Masching, Hayley
46p McLeod, Wyatt
43p McNally, Alexander
54p Menning, Hope
52a Menzel, Elizabeth
10a Merrill, Lucas
44a Minette, Carrie
62p Mortenson, Autumn
34p Musgrove, Gentry
76p Napoleon, Rachel
61p Nelson, Blaine
30p Noack, Patrick
73p Norwood, James
8p Pohlmann, Matthew
36p Red Owl, Alexis
60a Redinger, Erika
42p Reuter, Andrew
33a Richards, Blake
39p Rodezno, Tania
3p Roth, Brianna
10p Roy, Tristan
78p Ruiz, Amanda
14a Running Crane, Alana
12a Running Horse, Darian
3a Ruppelt, Peter
43a Rust, Haley
23p Salas, Patricia
51a Sandoval, Yasmeen
23a Sands, Emma
45a Schaum, Andre
7a Schull, Annika
71p Schutz, Willliam
63p Selberg, Avery
62a Sharkey, Brandon
9p Shiffler, Janelle
74p Smith, Lorenzo
35p Smithee, Isaac
6p Snyder, Alexa
16a Sorensen, Collin
34a Staudenmier, Nicholas
37a Stein, Sarah
61a Steinley, Alexander
49p Street, Mikayla
26a Sundermann, Rylee
65a Swisher, Dakota
49a Tang, Vienna
58a Theisen, Jonah
71a Tricomi, Angela
22a Tulshibagwale, Nikhil
80a Vargas, Tada
72p Vettrus, Noah
50a Vidmar, Abby
59a Villarreal, Emily
18a Vipond, Jade
74a Vukota, Dartanian
38p Wallace, Chase
1a Wang, Yirong
15p Wanous, Emily
28p Weppner, Hannah
26p Werner, Alexander
17a Westerman, Sarah
60p Whirlwind Soldier, Daniel
79a White Bull, Mark
31a Wiley, Alex
75p Williamson, Austin
64p Wixon, Christopher Wixon
4a Woodward, Jace
78a Yellowhawk, Gabriel
30a Zachman, Michaela
24a Zehner, Donna

a = morning poster session
p = afternoon poster session

1a - Elucidation and Evaluation of Module Detection Methods for Single-cell RNA-Sequencing Data

Yirong Wang (1)*, Juan Xie (1), Qin Ma (1)**, yirong.wang@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Individual cells are commonly viewed as identical functional units of a tissue or organ. However, the deep sequencing of DNA and RNA from single cells suggests a diversity of individual cell states. The most remarkable advantage of single-cell RNA sequencing (scRNA-Seq) is that it can be used to determine cell types in an unbiased manner by integrating transcriptomes with unsupervised clustering. Module detection methods group genes into co-expression modules, which is a crucial step in analyzing large gene expression datasets. Clustering, biclustering, and decomposition methods are three main module detection methods for large gene expression datasets. This study elucidates and evaluates several algorithms from these methods on a set of scRNA-Seq data. The result shows that clustering and decomposition methods outperform biclustering in general. Notably, the biclustering algorithm—QUBIC 2.0 (developed by Ma lab) has the best performance among all the tools.

REU: Interdisciplinary Research Experiences for Undergraduates on Bioenergy (SDSU), SD EPSCoR/BioSNTR

2a - Synthesis of 4-(Methylsulfinyl)benzyl and 3-Pyridylmethyl Glucosinolate via the Nitronate Pathway

Marie Anderson (1)*, Eleanor K Ronning (1), Alexa A Snyder (1), Jared Mays (1)**, maanderson16@ole.augie.edu
(1) Augustana University

Abstract: A decreased risk of cancer development has been linked to diets with high consumption of vegetables from the Brassica family. The chemopreventive properties of Brassica vegetables are partially due to the presence of glucosinolates, β-thioglucoside-N-hydroxysulfate natural products that are abundant in the plants. The action of the enzyme myrosinase on glucosinolates yields biologically-active isothiocyanates (ITCs) believed to be responsible for the anticancer properties. Two previously-described synthetic ITCs, 4-(methylsulfinyl)benzyl ITC and 3-pyridylmethyl ITC have been shown to be potent inducers of antioxidant response element (ARE) promoted genes and are chemopreventive candidates for drug development. This study describes efforts to apply the nitronate synthetic pathway toward the preparation of the two glucosinolate precursors to these ITCs: 4-(methylsulfinyl)benzyl glucosinolate and 3-pyridylmethyl glucosinolate.

BRIN - Augustana University

3a - Elemental Analysis of CdSe/ZnS Quantum Dots by AA and XRF Spectrometry

Peter Ruppelt (1)*, Brianna Roth (1), Jace Woodward (1), Dr. Duane Weisshaar (1), Duane Weisshaar (1)**, pcruppelt11@ole.augie.edu
(1) Augustana University

Abstract: CdSe/ZnS core/shell quantum dots (QDs) were analyzed by x-ray fluorescence (XRF) and atomic absorption spectrometry (AA). XRF promised a fast, non-destructive elemental analysis technique. Initial attempts to analyze solids by XRF proved problematic, so efforts turned to a simpler matrix through solution analysis. Samples were digested to dryness in concentrated HNO3, diluted to 50 mL with 0.12 M HCl, and analyzed for concentrations of Zn, Se, and Cd. Simulated QDs composed of CdSe and ZnS produced relative standard deviation (%RSD) and percent error (%E) of ≤10% for all three elements. The QD sample exhibited %RSD and %E (compared to AA results) for Cd and Zn that were a bit higher (≤18%). The %E for Se was significantly higher due to loss of H2Se during digestion. The next step is to refine the XRF technique to improve accuracy and precision and then return to analysis of solid QDs.

SD EPSCoR/BioSNTR

5a - Construction and Characterization of an External Cavity Diode Laser

Caitlyn Larson (1)*, Andrew Klose (1)**, cmlarson16@ole.augie.edu
(1) Augustana University

Abstract: Single frequency lasers can be applied to many spectroscopic applications in the laboratory, including detection of trace gases using cavity-enhanced laser spectroscopy. Often, stable single-frequency laser systems are expensive to procure. In this work, an external cavity diode laser (ECDL) was constructed from an inexpensive laser diode and off-the-shelf optics components. The Littman-Metcalf configuration was used with this ECDL, and resulted in a narrow-linewidth, single frequency laser that is tunable from 777 to 783 nm. The construction and characterization of the laser will be presented, and future applications will be discussed.

BRIN - Augustana University

6a - Mode-Locking and Characterization of Erbium Doped Ultrafast Laser System

Cody Kujawa (1)*, Gaven A. Bowman (1), Dr. Andrew Klose (1), Andrew Klose (1)**, cykujawa15@ole.augie.edu
(1) Augustana University

Abstract: Mode-locked ultrafast fiber lasers are advantageous in varying laser spectroscopic applications. Here, a 103.1 MHz repetition rate mode-locked laser based on Er-doped optical fiber was constructed. The fiber laser was designed in a ring configuration and contained erbium-doped, single-mode, and dispersion-shifted fibers to produce a cavity with a net dispersion of 0.0067ps2. A polarizing beam splitter was used as an output coupler and polarization-sensitive elements altered polarization evolution through the cavity. Nonlinear polarization evolution of the light through the laser cavity resulted in pulsed operation of the laser. Mode-locking of the laser cavity and characterization of pulse repetition rate is currently ongoing. Additionally, diagnostic tools including an auto-correlator and parallel grating dispersion compensator were constructed and will be discussed.

BRIN - Augustana University

7a - Synthesis of Potential Antimicrobial Novel Propargylic-Isoxazolines

Annika Schull (1)*, Jetty L. Duffy-Matzner (1), Jetty Duffy-Matzner (1)**, alschull16@ole.augie.edu
(1) Augustana University

Abstract: This work synthesized propargylic dihydrofuroisoxazolines via Intramolecular Silyl Nitronate Cycloadditions (ISNC) from nitroethers formed from Michael Additions of alkenynoxides and variable nitroalkenes. These furoisoxazolines underwent boron trihalide mediated ring openings to provide propargylic-isoxazolines. The furoisoxazolines and isoxazolines were tested as antimicrobial agents against E. coli and S. cerevisiae. The stereoselectivity and regioselectivity of the compounds of the Lewis acid catalyzed ring openings were analyzed against NMR predictions and computational models.

BRIN - Augustana University

8a - Quantum Dots and Platelet Activation

Benjamin Kelvington (1)*, Mark Larson (1)**, bakelvington16@ole.augie.edu
(1) Augustana University

BRIN - Augustana University

9a - Optimization of Blood platelets Isolation Protocol

Tesla Cheek (1)*, Benjamin Kelvington (1), Matthew Pohlmann (1), Mark Larson (1)**, tesla.cheek@usiouxfalls.edu
(1) Augustana University

Abstract: Blood platelets are a key factor in coagulation, and aid in repair after injury to the endothelial cell lining of blood vessels. Determining how platelets participate in repair often focuses on how platelets activate and aggregate in response to injury. Therefore, it's critical not to cause premature activation during the blood draw before experimentation. Platelet preparation methods were investigated to determine the best protocol for minimizing premature platelet activation. Comparative methods of resting the whole blood for an hour after drawing to allow the collected blood platelets to recoil into their inactive form. The use of prostacyclin (PGI2) was also explored to determine if chemical signaling was needed to inhibit platelet activation. Standard tools of platelet function were then used to monitor levels of platelet responsivity to agonist stimulation Results show that platelets did not require PGI2 to remain inactive, but that a resting phase after blood collection was needed.

BRIN - Augustana University, SD EPSCoR/BioSNTR

10a - Comparing ROS Production in Microglia in Response to Two Different Types of Particulate Matter

Lucas Merrill (1)*, Kelsey R. Buchmann (1), Nathan M. Stadem (2), Mikayla E. Street (1), Paula A. Mazzer (1), Paula Mazzer (1)**, luke.merrill.16@dwu.edu
(1) Dakota Wesleyan University, (2) Dakota State University

Abstract: Alzheimer's and other neurodegenerative diseases affect nearly 24.3 million individuals globally- a number that will likely increase with the rising world population [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 developing regions . A link between air pollution and neurodegeneration has been established [2-4]. 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 reactive oxygen species when the cells are exposed to these types of air pollution. Thus far, diesel exhaust does appear to activate microglial cells but not increase the production of ROS.

BRIN - Dakota Wesleyan University

12a - Baseline Soil Quality at the SGU Bison Field Station

Darian Running Horse (1)*, Dana Gehring (1)**, drunninghorse@yahoo.com
(1) Sinte Gleska University

Abstract: The objective of this project is to determine a baseline projection of the overall soil health at the bison field station for sustainability of vegetation for grazing and hay production. Three areas within the 26,000 acres for research purposes: 1) composed of sandy soils grazing lands with Spring Creek adjacent in the southern field station, 2) composed of sandy soils grazing lands with sand hills and native vegetation in the northern field station, and 3) non-operational irrigated field, that could potentially be used for hay production that is located in the eastern part of the field station with sandy soils. Soil samples were collected and dried then each were tested for pH, nitrates, nitrogen and phosphorus each playing a role in the health of the vegetation. Levels averaged near normal, but static due to the amount of rain fall early on during project as soil warmed, nutrient availability decreased.

SD EPSCoR/BioSNTR

13a - Culex Tarsalis Proportions in Todd County, SD

Pauline Jackson (1)*, Dana Gehring (1)**, pauline.jackson@sintegleska.edu
(1) Sinte Gleska University

Abstract: West Nile Virus (WNV) is spread to humans via contact with specific vector mosquitoes. Studies have concluded that West Nile virus infects residents at higher rates in South Dakota than in other states affecting 2359 people since 2002 (Hult, 2017). Of the 43 mosquito species only one is a known carrier of the virus. The objective of this project is to determine the proportions of Culex tarsalis versus non-vector mosquitoes at four sites within the boundaries of Todd County, SD. Mosquitoes were trapped and identified in order to determine how many were C.tarsalis. C.tarsaliz was found in Todd County, although the results varied depending on site and day of collection. The average ratio in the mosquito catches that resulted in being C.tarsalis were 29.15%. Deducing from South Dakota collection done this year that averaged 8.90%. These results could be due to Todd County having a more favorable climate for the C.tarsalis.

SD EPSCoR/BioSNTR

14a - Survey of Arthropods at the SGU Bison Field Station

Alana Running Crane (1)*, Dana Gehring (1)**, arcjun6@gmail.com
(1) Sinte Gleska University

Abstract: The Bison Field Station is in the south western corner of the Rosebud Reservation in South Dakota. It is necessary to acquire a survey of arthropods as a baseline study prior to the introduction of Bison. The objective of this project is to characterize arthropods at the Bison Field Station. A survey of the arthropod community was done using the pitfall trap method. 6-7 Pitfall traps were set up in 2 areas (one north, one south). The arthropods were taken back to the lab and characterized by morphotype. As expected the most abundant arthropods found include spiders, beetles, grasshoppers, ants, and wasps. Other arthropods found include bees, wasps, mosquitoes, crickets, ticks, ladybugs, and moths.

SD EPSCoR/BioSNTR

16a - Systematic Linear Tracing Analysis of Bone Specific Cre Lines using nTnG Reporter Mice

Collin Sorensen (1)*, Fang Fang (1), Ashley VanCleave (1), Jianning Tao (1)**, colsor556@mtmc.edu
(1) Sanford Health

Abstract: The tissue-specific Cre-loxP system in genetically-engineered-mouse-models is useful to study gene functions in vivo. To investigate skeletal-tissue-specificity and leakage sites of the Cre-lines in postnatal mice, nTnG lineage-reporter lines were crossed with Cre-expressing transgenic mouse strains including Prx1-cre, Osx-cre, Col1α12.3kb-cre and DMP1-cre, which targets mesenchymal stem cells, osteo-progenitors, committed osteoblasts and osteocytes, respectively. Using a confocal microscope, we analyzed and found that all four Cre-lines target osteoblast lineage cells at femoral trabecular bone as expected at 5-7 and 30 days of age, however, different populations of Cre-exposed bone cells. Beyond the skeleton, Prx1-cre targets fat, intestine, liver and muscle; Osx-cre targets liver, fat, and stomach; Col1α12.3kb-cre targets intestine; DMP1-cre targets intestine and stomach. None of them targeted the brain. Conceivable influences from the non-skeletal-lineage cells should be noted when the Cre-lines are used to study congenital skeletal disorders, osteoporosis, and cellular origin of bone cancer.

BRIN - Mt. Marty College

17a - The Immunological Regulation of Preterm Birth

Sarah Westerman (1)*, Sarah J Stein (1), Tania R Rodezno (1), Han Lee (2), David M. Olson (2), Jennifer A. Gubbels (1), Jennifer Gubbels (1)**, swesterman15@ole.augie.edu
(1) Augustana University, (2) University of Alberta

Abstract: Parturition, or labor, is the process wherein peripheral blood leukocytes migrate toward gestational tissues. Our lab specifically investigates the role of neutrophils in this evolutionary conserved process using refined RNA analysis, confocal microscopy, and flow cytometry techniques.

BRIN - Augustana University

18a - The Effects of Environmental Enrichment on Juvenile BTBR Autism Model Mice

Jade Vipond (1)*, Jade Vipond (1), Karisa Hagena (1), Heidi Bien (1), Alexander Kloth (1)**, jevipond15@ole.augie.edu
(1) Augustana University

Abstract: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by behaviors such as repetitive movements, decreased sociability, and impaired communication. Using the BTBR mouse model, an inbred mouse strain that displays key characteristics similar to human ASD, we examined whether environmental enrichment can alter ASD-related behavioral and neurological phenotypes. We hypothesized that BTBR mice placed in environments enriched with cognitive, motor, social, and sensory stimulation for six weeks would ameliorate behavioral deficits compared standard-housed animals. Over the first four weeks, we discovered minor changes in grooming and marble burying. As experiments continue, we test examine social behavior, cognitive function, and anxiety and examine brain areas relevant to these behaviors. By examining the effects of environmental enrichment on the behaviors of BTBR mice, we hope an intervention that may reduce behavioral and neurological deficits found in autism, as it has in other neuropsychiatric disorders.

BRIN - Augustana University, SD EPSCoR/BioSNTR

19a - The Search for Dark Matter

Mackenzie Martin (1)*, Brianna Mount (1)**, mmartin33@murraystate.edu
(1) Black Hills State University

Abstract: Dark Matter is one of the most pressing mysteries of Particle Physics. "The Search for Dark Matter" reviews the impressive coordination and efforts of more than 250 scientists and engineers working together to create the most sensitive particle detectors for direct detection of WIMP-dark matter in the world, LUX-ZEPLIN, and why cleanliness is of utmost importance. Dark Matter is observed by its gravitational effects on galaxies and is believed to make up 80 percent of all mass in the universe yet we don't know much of anything about it. Together the LZ collaboration have been working for years on the design, creation, and accuracy of the the detector. Due to it’s unprecedented sensitivity something as small as dust can affect the detectors data collection. This poster describes the cleanliness tracking, experiments design, and how these scientists and my involvement are making the impossible possible.

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

20a - Characterizing Chemical Composition of Water from the Sanford Underground Research Facility

Wileen Genz (1)*, Micheal Zehfus (2), Micheal Zehfus (2)**, w_genz@coloradocollege.edu
(1) Colorado College, (2) Black Hills State University

Abstract: In the third and final year of this project, water samples were collected from six underground levels of the Sanford Underground Research Facility (SURF). Initial results concluded that each level possessed a unique water chemistry; however, in the second year, more diverse sampling sites suggested that broad trends could not be generalized for each level. This year's samples were obtained from the same levels as done previously with the addition of the 800-foot and 2000-foot levels. Samples were analyzed in situ for temperature, pressure, pH, conductivity, ammonia and dissolved oxygen, as well as for various metal ions, chloride, sulfate, nitrate, bicarbonate, and total alkalinity, employing a variety of analytical methods. Our current analysis confirms last year's conclusions that chemical properties could not be characterized for entire levels due to high variability. These results provide insight into research on underground microbial environments and the hydrology of the SURF complex.

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

21a - Compuational Classification of Biological Image Data for Segmentation and Morphological Analysis

Taylor Hietpas (1)*, Cody Ward (1), Rebecca Leddy (1), Darci Fink (1)**, taylor.hietpas@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Optical spectroscopy and fluorescence have become mainstay techniques for elucidating molecular biological function. Two-photon and confocal microscopy have particularly enabled increased potential for data acquisition and cellular resolution. With this increased potential has developed a need for efficient and reliable methods for evaluating these large data sets. Historically, researchers have relied upon fundamental image processing techniques and manual observations to obtain interpretations of their data. While these methods have proven successful, increased computation power and well-established computational protocols have enabled a renaissance in biological image analysis during recent years. As such it was the objective of this project to utilize unsupervised computational classification algorithms to expedite and refine the process of biological image processing and analysis. K-means clustering algorithms were implemented to optimize partitioning and segmentation of our data. These results were compared against both successfully partitioned data sets and our manually tabulated data sets as a means of optimization.

SD EPSCoR/BioSNTR

22a - Simulating Coil Embolization Treatments of Intracranial Aneurysms using Computation Fluid Dynamics

Nikhil Tulshibagwale (1)*, Stephen Gent (1)**, tulsh002@umn.edu
(1) South Dakota State University

Abstract: Coil embolization is a common endovascular procedure used for treating intracranial aneurysms, which are estimated to occur in 4% of the population. In this study, a commercially available computational fluid dynamics (CFD) program was used to simulate embolization techniques, standard coiling and stent-assisted coiling (SAC), in simplified vessels. The test cases included a curved vessel, ranging from 3mm to 4mm in diameter. The vessel was afflicted with a spherical aneurysm,ranging from 8mm to 16mm in diameter. Blood volume flow into aneurysm, fluid velocity, wall shear stress (WSS), and vorticity were measured and visualized for each simulation. On average, standard coiling and SAC reduced volume flow into the aneurysm by 50% and to over 60%, respectively. Information on standard coiling and SAC efficacy in idealized scenarios could assist medical professionals determining viable approaches for patient-specific cases and lays foundation for future CFD studies exploring coil embolization treatments.

REU: High Performance Computing in STEM disciplines (SDSU)

23a - Unreplicated Strip Trail using Monte Carlo Simulation

Emma Sands (1)*, Gary Hatfield (1)**, sands.emma@gmail.com
(1) South Dakota State University

Abstract: The objective of this project is to develop a valid statistical methodology to determine if a treatment effect is significant for an unreplicated strip trial. Monte Carlo Simulation is used on this project by using geostatistical methods to exploit the underlying spatial structure for predicting the response based on control strips adjacent to the trial. An open source software named R was used for this research to help come up with the findings. Four packages in R were used for this project, those four libraries are named library (gstat), library (sp), library (rgdal), and library (maptools). The main finding during this project was the empirical type one error rate using a paired t-test was 0.4 not 0.05. After finding this out, the next step is to try to make an error rate closer to 0.05 by modifying the test statistic.

REU: High Performance Computing in STEM disciplines (SDSU)

24a - Low Background Studies of Pb – Free Solder Using ICP-MS

Donna Zehner (1)*, Amy Asunskis (1), Amy Asunskis (1)**, zehnerdr@alverno.edu
(1) Black Hills State University

Abstract: Inductively Coupled Plasma Mass Spectrometry (ICP-MS), was used to look for radioactive isotopes 238Uranium and 232Thorium in two lead-free Solder pastes used in electronics built for ultra-low background in rare-event searches. Uranium and Thorium were examined for their decay-chain that causes a bulk of γ-ray, alpha-particle, and neutron-induced backgrounds. The ICP-MS, a sensitive multielement detection instrument, was used to determine these trace elements within the Solder. Low background analysis includes several unique samples that do not have well established digestion procedures, therefore, before analysis the sample must be tested to determine a suitable digestion protocol. A variety of digestions were analyzed using different temperatures, acid concentrations, and acid combinations.

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

25a - Target Membrane Viscosity Controls the Sensitivity of Antibody Dependent Phagocytosis

Nicholas Cronin (1)*, Seongwan Jo (1), Adam Hoppe (1)**, nicholas.cronin@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Phagocytosis is the process by which macrophages and other immune cells destroy viruses, bactiera and infected or cancerous cells by internalization. This well-orchestrated biological event has been a line of research for several decades, however, questions still remain. Recently, phagocytosis of antibody-coated targets by macrophages has gained recognition as an important effector mechanism for antibody-based therapeutics. In immunotherapy, many antibody targets are mobile on the cell surface. However, phagocytosis has been primarily studied on targets that display immobile antigen. Here, we have developed supported lipid bilayers (SLB) on silca particles to enable the study of antibody-mediated phagocytosis of particles with different antigen mobilities. By manipulating the composition of the SLB on silica, the mobility can be tuned from completely fluid to immobile with miminal impact on other parameters such as surface charge and antigen density. Here we show that macrophages preferntailly phagocytose silica beads with fluid bilayers over non-fluid SLBs.

SD EPSCoR/BioSNTR

26a - Towards a Biofilm Model Using High Perfomance Computing

Rylee Sundermann (1)*, Nicholas Stegmeier (1), Jung-Han Kimn (1), Jeffery Doom (1), Nathan McClanahan (1)**, rylee.sundermann@sdstate.edu
(1) South Dakota State University

Abstract: Biofilms are defined by The International Union of Pure and Applied Chemists as an "aggregate of micro-organisms in which cells that are frequently embedded within a self-produced matrix of extracellular polymeric substances adhere to each other and/or to a surface." Biofilms are studied for a variety of reasons, both good and bad. For example, at the Center for Biofilm Engineering at Montana State University biofims are used for bioremediation (introducing organisms break down pollutants). According to the CDC Biofilms also cause most implant-based infections, as well as numerous other infections like Cystic Fibrosis. Because biofilms are primarily water we chose to model them as a fluid. We used the Cahn-Hilliard equation because it models how fluids can start mix and separate into pure states like oil and water. Utilizing HPC, specifically the data structures in PETSc we crafted a parallel implementation of the Cahn-Hilliard equation to model the biofilm.

REU: High Performance Computing in STEM disciplines (SDSU)

27a - Chonodrocytes: Applied Force Characterization

Josh Feiner (1)*, Scott Wood (1)**, josh.feiner.15@dwu.edu
(1) South Dakota School of Mines & Technology

Abstract: Applying a magnetic force to dyna beads attached to chondrocyte cells. I then analyzed flim and fret among the no force applied cells and a dynamic magnet movement on the focal adhesions of the cells.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT), SD EPSCoR/BioSNTR

28a - Swine Flu Pandemic/Epidemic Preparation utilizing the Hemagglutination Inhibition Assay

Jack Baker (1)*, Kara McCormick (1), Sarah Zaiser (1), Victor Huber (1)**, jack.baker@coyotes.usd.edu
(1) University of South Dakota

Abstract: A virus pandemic occurs when a gene exchange called an Antigenic Shift happens and creates a novel virus not yet vaccinated for. Pandemics cause widespread death because the genetic changes that occur within the virus are no able to be vaccinated. Epidemics are a result of genetic changes called Point Mutations that gives the Virus adaptive immunity. Epidemics can be held within check because point mutations can be prevented by annual vaccine changes. This is where the Hemagglutination Inhibition Assay can become a life saving test. This test was ran with pig sera(plasma) against a variety of pandemic/epidemic strains (Cal '09, MN' 11, NC '08) of influenza. The test provided sufficient antibody production against various strains though not specifically vaccinated for them. Building off these results a multitude of these tests could provide pandemic and epidemic prevention.

SD EPSCoR/BioSNTR

29a - Isolation of a SD-grown yeast to be used in commercial brewing

Spencer Lucas (1)*, Paul Egland (1)**, sjlucas15@ole.augie.edu
(1) Augustana University

Abstract: With an aim of producing a 100% locally-sourced beer, we have isolated and grown yeast strains from local plant material. One of these strains, Saccharomyces cerevisiae AU010, has proven to be a candidate for commercial brewing. We have grown pitchable amounts of AU010 and have made beer with this strain. Optimal wort recipes are being developed for commercial brewing with this yeast.

BRIN - Augustana University

30a - NIR-to-NIR Upconversion Nanoparticles for Latent Fingerprint Development: Determination of Optimal Particle Size

Michaela Zachman (1)*, Ganesh Sigdel (1), Aravind Baride (1), P. Stanley May (1), Stanley May (1)**, mzachman@gustavus.edu
(1) University of South Dakota

Abstract: Upconversion phosphors are materials that generate luminescence at shorter wavelengths relative to the excitation light. NIR-to-NIR upconversion nanoparticles (NIR-NIR UCNP), consisting of NaYF₄:Yb,Tm, show great promise for the development of latent fingerprints. NIR-NIR UCNP developed fingerprints can be imaged in ambient light and on substrates which have fluorescent properties or ‘busy’ backgrounds. An investigation into the effect of the size of the upconversion nanoparticles on the quality of the developed fingerprint was conducted. NIR-NIR UCNP covering a range of particle sizes were applied in powder form via two different techniques to develop latent fingerprints. The developed fingerprints were characterized using optical imaging and scanning electron microscopy. Image quality was assessed based on image intensity, resolution, and contrast. No significant size-dependent differences were found between the different NIR-NIR UCNP sizes.

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

31a - Synthesis and Evaluation of Lipid A Inhibitors: A New Class of Antibiotics to Combat Gram-Negative Bacteria

Alex Wiley (1)*, Katie Nielson (1), John Dixson (1)**, alexandra.wiley@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Antibiotic resistance is an ever-growing problem in the health industry. The CDC reported in 2017 that there were 2 million people in the United States that were infected with bacteria resistant to antibiotics and at least 23,000 people die every year as a direct result of these infections. A new antibiotic is sorely needed. We have synthesized and tested twelve derivatives of 3-hydroxybenzoic acid using a 96-well micro-titer plate format on both Pseudomonas aeruginosa and Escherichia coli B. Growth and inhibition levels are evaluated by measuring the optical density at 600 nanometers. We hope to establish sufficient MIC values while stabilizing the compounds to in vivo metabolism and keeping up effectiveness while inhibiting the Lipid A enzyme.

BRIN - Black Hills State University

32a - Implementation of a Total Internal Reflection Fluorescence (TIRF) Structured Illumination Microscopy (SIM) System for Super-resolution TIRF-SIM Bio-imaging Applications

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

Abstract: Structured illumination microscopy (SIM) is a form of super-resolution microscopy which can typically achieve twice the resolution possible with a conventional widefield microscope by illuminating the sample with patterned light and taking multiple exposures at different orientations. Each exposure contains high-resolution information along a specific axis; computationally combining these multiple exposures yields a single isotropic high-resolution image. A spatial light modulator (SLM) can be used to quickly project different patterns onto the sample, permitting rapid image acquisition. When combined with total internal reflection fluorescence microscopy (TIRF), SIM allows high-resolution imaging of samples with minimal background noise. Constructing the SIM system requires that we control the SLM synchronously with the camera and shutters; this is achieved using the LabView programming language, wiring and interfacing an assortment of digital I/O devices, and analysis using an ImageJ plug-in. The SLM is integrated into an existing TIRF system, which is modified for TIRF-SIM.

SD EPSCoR/BioSNTR

33a - Image Analysis of Phomopsis Stem Canker in Sunflower Stems

Blake Richards (1)*, Mukesh Roy (1), Anamika Prasad (1)**, bar@iastate.edu
(1) South Dakota State University

Abstract: South Dakota is the nation's largest producer of Sunflowers, a plant that’s vulnerable to phomopsis stem canker which causes rotting stems and roots. This disease can decimate yields, making early detection important. Early diagnosis requires a better understanding on plant physiology during growth, and the influence diseases have on it. Cross sections of the stem were analyzed at different stages of growth using Raman spectrophotometry, and SEM/optical image analysis. I used MATLAB for image analysis that involves marker controlled watershed method (MCWM) and K-means clustering to analyze SEM, and stained optical microscope images. MCWM is a series of morphological operations/filtering techniques that segment images based on edge detection. K-means clustering is a type of vector quantization, the purpose of which is to break down a SEM into k classes. Moving forward, 3D image segmentation will be coupled with molecular compositional analysis to help with plant disease diagnostics.

REU: High Performance Computing in STEM disciplines (SDSU)

34a - Validation of Actin-Regulating Genes as Mediators of Macropinocytosis

Nicholas Staudenmier (1)*, Kennedy A. Kirsch (1), Louise M. N. Monga (1), Lu Huang (1), Kevin Wanniarachchi (1), Rifat Sultana (1), Jared W. Wollman (1), Natalie W. Thiex (1), Natalie Thiex (1)**, n.staudenmier@gmail.com
(1) South Dakota State University

Abstract: Whole genome screen data indicates that Vav1 and Was, genes involved with branched-actin regulation, inhibit macropinocytosis; whereas Pak2, a kinase that signals for actin depolymerization, promotes macropinocytosis. Targeted CRISPR/Cas9 knockouts were used to validate screen hits. To measure the efficiency of CRISPR/Cas9 targeted gene disruption, we used targeted guide RNAs to disrupt GFP, which is constitutively expressed in our cells. Flow cytometric analysis of GFP fluorescence showed 90% of cells with reduced GFP fluorescence, indicating high disruption efficiency. The effect of targeted gene disruption on macropinocytosis is tested by measuring fluorescent dextran uptake in wildtype and knockout cells using flow cytometry. Was and Vav1 knockouts showed an increase in dextran uptake compared to wild type cells, confirming Was and Vav1 are not required for macropinocytosis and that branched actin formation may have a net inhibitory effect on macropinocytosis. Experiments are underway to determine whether Pak2 gene disruption prevents macropinocytosis.

SD EPSCoR/BioSNTR

35a - Comparative Transcriptomic Data Analysis Between Human Osteosarcoma and M. musculus models

David Doss (1)*, David Doss (1), Dr. Erliang Zeng (1), Dr. Jianning Tao (2), Erliang Zeng (1)**, dave.doss@coyotes.usd.edu
(1) University of South Dakota, (2) Sanford Health

Abstract: Osteogenic sarcoma is a devastating form of bone cancer most prevalent in youth. In this research, we performed a comparative transcriptomic differential expression analysis of transcriptome data (RNA-seq and/or microarray) obtained from mouse models and human patients diagnosed with the disease. The goal of this project is to compare commonalities and differences in gene expressions between the two different species under similar disease conditions. Additionally, these results will help assess the validity of different genetic mutations commonly used to induce cancer, such as those in the Notch or P53 pathway. By comparing these data we will able to determine differences at the cellular level that could impact the growth and development of these cancerous tissues, eventually leading to the identification of therapeutic targets that can be used to develop pathway inhibitors for the treatment of this disease.

BRIN - University of South Dakota

36a - Towards High Fidelity Simulations of Biofilm Fluid Dynamics

Adam Good (1)*, Nicholas Stegmeier (1), Jeffrey Doom (1), Nathan McClanahan (1), Jung-Han Kimn (1), Jeffrey Doom (1)**, adam.good@sdstate.edu
(1) South Dakota State University

Abstract: As part of the larger project combining the Navier-Stokes and Cahn-Hilliard equations we investigated stable, numerical implementations of the Flory-Huggins free energy density equation and its first variation in the modified Cahn-Hilliard equation. The simulation, once completed, can be used to model biofluids, immiscible fluids, combustion, and more. The implementations are written in Fortran and make use of PETSc (Portable, Extensible Toolkit for Scientific Computation) for efficient, parallel computations on high performance computing equipment. The Computational Fluid Dynamics code (CFD) was developed by Doom et al. [1] and named DHMmpi. Reference: 1. J. Doom, Y. Hou, K. Mahesh, A numerical method for DNS/LES of turbulent reacting flows. J. Comput. Phys. 226 (2007) 1136-1151.

REU: High Performance Computing in STEM disciplines (SDSU)

37a - The Immunological Regulation of Preterm Birth

Sarah Stein (1)*, Sarah Westerman (1), Tania Rodezno (1), Jennifer Gubbels (1)**, sjstein16@ole.augie.edu
(1) Augustana University

Abstract: Parturition, or labor, is the process where peripheral blood leukocytes migrate toward gestational tissue. Our lab specifically investigates the role of neutrophils in this evolutionarily conserved process using refined RNA analysis, confocal microscopy, and flow cytometry techniques.

BRIN - Augustana University, SD EPSCoR/BioSNTR

38a - 3D-Printing from Custom-Made Materials

Bridger Irons (1)*, Grigoriy Sereda (1)**, bridger.irons@coyotes.usd.edu
(1) University of South Dakota

Abstract: The use of 3D printers has increased exponentially recently. The ability to replicate items and to design objects has drawn the attention of manufacturers who wish to capitalize on this customizable process. While much of the focus in this industry is placed on finding new printable materials, many are overlooking the possibility of modifying existing materials. Our aim was to modify the compounds and filaments already being used by 3D printers to alter their properties and explore possible applications. We examined carbon microfibers and graphene powder. Porous nanoparticles of calcium carbonate and hydroxyapatite were examined also. XPS was used to identify the composition of these materials. We added graphene powder to a silicone-based resin, and both polycarbonate and acrylonitrile butadiene styrene filaments. Graphene was chosen because of its versatility, which we hypothesized would improve the mechanical strength. The nanoparticles were added to the silicone to explore possibilities of drug delivery.

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

39a -

Jon Gubbrud (1)*, Jon M Gubbrud (1), Alek Keegan (1), Paul Egland (1)**, jmgubbrud16@ole.augie.edu
(1) Augustana University

Abstract: I will be presenting with Alek Keegan on salmonella biofilms

BRIN - Augustana University

40a - Synthesis of NaYF₄: Yb, Er Upconversion Nanoparticles (UCNP) with Nd Shell Addition for Security and Bio-Imaging

Ashleigh Chov (1)*, Aravind Baride (1), Stanley May (1), Stanley May (1)**, ashleigh.chov@coyotes.usd.edu
(1) University of South Dakota

Abstract: NIR-to-Green upconversion nanoparticles (UCNP) convert NIR excitation to shorter-wavelength green emission. NIR-to-Green UCNP have a variety of important applications, including bio-imaging, security printing, and latent fingerprint development. In this project, NaYF₄: Yb,Er UCNP with an active shell consisting of 10% Yb and 10% Nd was synthesized. The 980 nm excitation wavelength required by traditional Yb, Er UCNP overlaps a weak absorbance band of water. Traditional nanoparticles can be used for bio-imaging, but there is a higher chance of overheating tissues while imaging. The addition of the active shell allows for the nanoparticles to be excited by either 800 nm or 980 nm light. Exciting the particles with 800 nm, which is in a transparency window for biological samples, greatly reduces the danger of overheating tissue. For security printing, these particles can also be used to print two different but overlapping images which can be viewed individually using different excitation sources.

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

41a - Ambiphilic Ligand Coordination Complexes: Dual Mode Activationof C-F Bonds

Hope Juntunen (1)*, Haley Rust (1), Alex McNally (1), James Hoefelmeyer (1)**, hope.juntunen@trojans.dsu.edu
(1) University of South Dakota

Abstract: Carbon-fluorine (C-F) bond activation is a challenge due to their large bond enthalpies (~500 kJ/mol) and significant dipole moments. Although attempts have been made to activate C-F bonds, the reactions required large amounts of catalyst and excessive reaction times. We synthesized the frustrated Lewis pair (quinoline-8-yl)dimesitylborane (DMBQ) that will be subsequently complexed to transition metals. The ambiphilic ligand coordination complexes may have unique reactivity with the C-F bond, utilizing the boron in the DMBQ to catch the fluorine as the C-F bond undergoes oxidative addition with the transition metal. The synthesis of DMBQ included converting 8-aminoquinoline to 8-iodoquinoline, followed by lithiation, and reaction with Mes2BF under nitrogen atmosphere. Purification steps and NMR were taken to ensure product formation. Future work includes, reacting DMBQ with nickel, platinum, and palladium to create the aforementioned coordination complexes and then reacting those with fluorobenzene to test the reactivity with C-F bonds.

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

42a - Speciation of Uranyl-Peroxide Building Blocks of Nanocapsules

Ethan Hare (1)*, Pere Miro (1)**, ethan.hare@coyotes.usd.edu
(1) University of South Dakota

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. A wide variety of capsules can be formed and it has been proposed that square and pentagonal building blocks assemble prior to nanocapsule formation. We have studied the speciation of the pentagonal ([(UO2)5(O2)10-x(OH)2x]10-) uranyl-peroxide nanocapsule building blocks using density functional theory calculations. We predicted the most favorable speciation pathways for the self-assembly of the building blocks prior to cluster formation including the effect of pH, temperature and alkali counterions.

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

43a - Frustrated Lewis Pairs and C-F Bond Activation: Interactions with Transition Metals

Haley Rust (1)*, Hope Juntunen (1), Alex McNally (1), Pere Miro (1)**, haley.rust@coyotes.usd.edu
(1) University of South Dakota

Abstract: We are synthesizing a frustrated Lewis pair, (quinolin-8-yl)dimesitylborane (DMBQ), complexing it with group 10 metals (Ni, Pd, Pt), and studying the process of oxidative addition with carbon-fluorine bonds. The synthesis begins with 8-aminoquinoline reacting with sodium nitrite and potassium iodide solutions to create 8-iodoquinoline. Lithiation with n-butyllithium leads to (quinolin-8-yl)lithium(I), and subsequent addition of dimesitylboron fluoride gives DMBQ. Using Density Functional Theory calculations, fully optimized geometries of the DMBQ and its metal complexes were obtained. It was found that the boron Z-type ligand exhibits bonding with Ni. Computational methods were used to investigate the breakage of CH3-F and CH3-H bonds with DMBQ metal complexes. It is more thermodynamically favorable to break the carbon-fluorine bonds. These findings reassure our desire to break carbon-fluorine bonds and use nickel as our transition metal to discover a novel complex.

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

44a - CellTreeGenerator 2.0: An R package for single cell genomics-driven spatio-temporal mapping of cancer genesis

Carrie Minette (1)*, Cynthia H. Curtis (1), Etienne Gnimpieba (1)**, carrie.minette@coyotes.usd.edu
(1) University of South Dakota

Abstract: CellTreeGenerator is an R statistical software package that enables the user to generate cellular hierarchy visualizations from gene sequencing data that uses four different methods and leverages a customized storage class to allow for meaningful comparisons between structural and functional organizational approaches. The current version improves upon this design, featuring a total of ten cell tree extraction methods utilizing a variety of input data, such as gene expression matrices, single nucleotide variation (SNV) data, copy number variation (CNV) data, and clonal phylogeny data. Other new features include a demonstrative web application interface using Shiny R and leveraging geospatial software to view generalized sample locations on the human body. Version 2.0 can also be deployed using a Docker container to isolate software dependencies and facilitate more consistent results across different operating systems and environments.

BRIN - University of South Dakota, SD EPSCoR/BioSNTR

45a - Fabrication of Gold Microcavity Arrays as Substrates for Upconversion Nanoparticle-Containing Thin Films

Andre Schaum (1)*, Aravind Baride (1), Stanley May (1)**, aschaum@cord.edu
(1) University of South Dakota

Abstract: Large area (≥1cm²) hexagonal close-packed (HCP) gold microcavity arrays (AuMCAs) were fabricated via electrochemical deposition on smooth gold substrates with polystyrene microsphere (PSM) templates. Floating PSM monolayers were generated through a self-assembly process at an air-water interface using both Langmuir-Blodgett (LB) and petri dish-scale techniques. The latter technique was shown to provide higher quality monolayers with a higher level of reproducibility despite the lower degree of automation. Effects of compression, PSM surface properties, spreading rate, and surfactant were explored, each being found to significantly impact monolayer formation and quality. The free-standing monolayers were deposited onto hydrophilic gold substrates and quality was assessed using optical microscopy. Samples of high quality were subject to electrochemical plating to produce the desired AuMCA, which may be used as a plasmonic substrate for lanthanide ion-doped upconversion nanoparticles (UCNPs).

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

46a - Electrochemistry and Viscosity of Choline Chloride:Propylene Glycol-Based Deep Eutectic Solvent

Eleanor Haeska (1)*, Douglas Raynie (1)**, eleanor.haeska@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Recently in the field of green chemistry there has been a push to discover, characterize, and utilize more effective and environmentally safe solvents. Deep eutectic solvents (DES) have been identified as a low cost and environmentally benign alternative to both conventional organic solvents and ionic liquids. Characteristic of DES are their conductive nature and depressed melting point, making them of particular interest for use in low temperature batteries. This project sought to determine the effect of additional halide on the conductivity and viscosity of a DES composed of choline chloride and propylene glycol. It can be concluded that additional halide to this DES does not increase the conductivity at room temperature, but does increase the conductivity at 0 and -10□. Additional halide also causes a decrease in viscosity of this DES at all temperatures measured.

SD EPSCoR/BioSNTR

47a - The Effects of Beer Draft Tubing on Biofilm Formation

Parker Heger (1)*, Parker Heger (1), Andrew Russell (1), Andrew Russell (1)**, parker.heger@wolves.northern.edu
(1) Northern State University

Abstract: Due to their significance in industrial and medical applications, biofilms are of primary importance in microbiology. In the brewing industry, taste-altering biofilms in beer draft lines have proven to be a continuous problem. My project is focused on answering two questions: 1) What is the microbial composition of beer line biofilms, and 2) Is one type of tubing more resistant to biofilm formation than another? To answer the first question, we sampled tubing from a local brewery and isolated thirty-eight pure cultures of aerobic and anaerobic species for identification using 16S rRNA sequencing. To answer the second question, a mock draft system with three types of tubing has been assembled. A keg spiked with a microbial cocktail will be added to monitor biofilm growth over four months. Results from these experiments should lead to further improvements in the prevention and control of biofilms in various applications.

SD EPSCoR/BioSNTR

48a - Synthesis and Evaluation of N-Methylfluoxetine and Diphenylpropylamine Derivatives on Plasmodium falciparum

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

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

BRIN - Black Hills State University

49a - Selective Adsorption of Rhodamine 6G using Molecularly Imprinted Polyaniline

Vienna Tang (1)*, Judy Wei (1), Chaoyang Jiang (1)**, vienna.tang@coyotes.usd.edu
(1) University of South Dakota

Abstract: Molecular imprinting is a process where functional monomers and cross-linkers are copolymerized in the presence of a template molecule. Molecularly imprinted polymers (MIPs) have a plethora of applications including material separation, chemical detection, and catalysis. In this presentation, we polymerized aniline to synthesize polyaniline (PANI) and used Rhodamine 6G (R6G) as our template molecule. The polymerization was conducted with an initiator of ammonium persulfate. After washing out the templates, adsorption of R6G was examined using fluorescence spectra. Our results indicate that more R6G molecules were adsorbed in MIPs than in non-imprinted polymers (NIPs). The selectivity of the MIP to the target molecules was also demonstrated. All these results indicated that the fabrication of these MIPs has been successful. Our next step is to prepare PANI MIPs with real templates instead of model compound of R6G and explore the application of PANI MIPs for various sensing applications.

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

50a - Lakota and Arikara Historical Ecology of the Great Plains and Missouri River Region

Abby Vidmar (1)*, David Posthumus (1)**, vidmab01@luther.edu
(1) University of South Dakota

Abstract: The nineteenth-century Lakotas were nomadic equestrian hunter-gatherers who dominated the Great Plains, utilizing the land not just for game but also as foragers. Other tribes, such as the semi-sedentary horticulturalist Arikaras, adapted to the Plains environment differently. Both tribes utilized the flora and fauna along the Missouri River and its tributaries. Using primary and secondary ethnohistorical sources this research analyzes the Lakota and Arikara tribes' interaction with the Missouri River region. Many of the plants of the region had a variety of uses connected to subsistence, medicine, spirituality, and ceremonial life. Today, most of the ecological usages have been lost due to settler-colonialism, relocation to reservations, and various "civilizing" programs. Yet, revitalization projects in Lakota and Arikara communities are reclaiming elements of this cultural and ecological knowledge and traditions once at the heart of indigenous life on the Great Plains and in the Missouri River region.

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

51a - Stage Structured Feeding in Common Carp and Spotfin Shiner

Yasmeen Sandoval (1)*, Abraham Kanz (1), Jeff Wesner (1), Meghann Jarchow (1)**, yasmeensand@gmail.com
(1) University of South Dakota

Abstract: Common carp is an invasive species in the Missouri River, while spotfin shiner is native. Both fish play an important role in the functioning of aquatic food webs. These fish have been chosen to help us better understand how fish with different foraging modes affect aquatic and terrestrial ecosystems. If we have better understanding of what carp and spotfin shiners eat, specifically what life-stage of insect, we can predict the food web effects in both the aquatic to terrestrial ecosystem. Preliminary data from an artificial stream experiment suggest that the fish feed on different life-stages of insects. Specifically, the proportion of pupae in spotfin guts is higher than in common carp, suggesting that these fish partition the same prey taxa across prey-life stages. Because the ecology of insects change across life-stages, these differences in feeding by fish help us to predict different effects of fish species loss or invasion.

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

52a - Quantum dot-aptamer bioconjugates for prostate cancer detection

Elizabeth Menzel (1)*, Thai-Son Nguyen (1), Morgan Rothschadl (1), Barrett Eichler (1)**, eamenzel16@ole.augie.edu
(1) Augustana University

Abstract: Greater than 90% of prostate cancer patients overexpress the protein PSMA, most commonly on LNCaP cells (PSMA+), to which the RNA aptamer A-10 binds specifically and strongly. In an effort to develop a more sensitive method to detect prostate cancer, our lab has previously developed a protocol to combine the A-10 aptamer with QDs using the heterobifunctional crosslinker SBAP. Efforts to develop a protocol to culture and plate LNCaP (PSMA+), PC-3 (PSMA-), and DU-145 (PSMA-) prostate cancer cells, as well as the results of binding the QD-aptamer bioconjugate to the cancer cells, will be presented.

BRIN - Augustana University

53a - Inhibition of Staphylococcus aureus with Rosmarinus officinalis and Coleus blumei

Kristin Mahony (1)*, Kathleen Gibson (1)**, krimah254@mtmc.edu
(1) Mount Marty College

Abstract: Antimicrobial resistance is a growing issue worldwide, and new treatment options for these bacterial infections need to be developed. Many plants have been shown to have medicinal properties, including antibacterial effects. The aim of this study was to identify a new plant with antibacterial potential. Extracts of the ornamental plant Coleus blumei were prepared using varying solvents and plant parts and then screened for bacterial inhibition using the Kirby-Bauer disc diffusion assay. C. blumei extracts (40mg) were also screened with combinations of Rosmarinus officinalis (rosemary)(40mg) and the positive control Gentamicin (10µg per disk). It was determined that Coleus blumei leaf extractions using 75% ethanol as the solvent were the most effective at inhibiting bacterial growth. It was also concluded that combining the plants and antibiotic did not increase the antibacterial potential.

BRIN - Mt. Marty College

54a - Coating Porous-Wall, Hollow Glass Microspheres for Security Printing Applications

Jordan Brito (1)*, Forest Thompson (2), Grant Crawford (2)**, jordanbrito@tamu.edu
(1) Texas A and M University, (2) South Dakota School of Mines & Technology

Abstract: Counterfeit electronics are unknowingly used in military equipment, threatening national security. These deceptive electronics are often created by “black-topping”, or sanding down the original markings to relabel as new products. Improvements in security printing make product authentication more efficient. This research project aimed to coat porous-wall, hollow glass microspheres (PWHGMs) with nickel for security printing applications. PWHGMs were coated through an auto-catalytic electroless nickel plating process to deposit a nickel-phosphorous alloy on the glass surfaces. As-coated microspheres were characterized via scanning electron microscopy, optical microscopy, and energy dispersive x-ray spectroscopy. In addition, the mechanical strength of the coated spheres was characterized using microhardness testing, and the magnetic properties were tested with a magnet. The nickel coating added new functionality to the fragile PWHGMs by increasing the strength and adding magnetic and opaque properties. Coated PWHGMs can be incorporated in direct-write printing, adding new security features to printed materials.

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

55a - Discovery of Novel Agents that Show Selective Cytotoxicity towards Multidrug Resistant Cancer Cells

Josh Loecker (1)*, Surtaj Iram (1)**, joshua.loecker@jacks.sdstate.edu
(1) South Dakota State University

Abstract: The objective of this research is to identify drugs that can selectively kill over-expressing MRP1 multi-drug resistant cancer cells. A later ambition is to identify undiscovered substrates of MRP1.

SD EPSCoR/BioSNTR

56a - Impedimetric DNA Sensor for the Detection of Antibiotic Resistance in N. gonorrhoeae

Kjersti Anderson (1)*, Amber M. Schuster (1), Sabrina Hang (1), Matthew Joseph Hummel (1), ZhengRong Gu (1)**, kma57@cornell.edu
(1) South Dakota State University

Abstract: Current methods for DNA detection are highly sensitive but exhibit major drawbacks in the ease of sample processing, occurrence of contamination, and time required to process. For rt-PCR and ELISA assays, detection can take up to 2 days. To address this issue, we have developed an impedimetric DNA sensor which measures the resistance elicited by the hybridization of DNA on the graphene oxide-coated surface of magnetic nanoparticles. To test this system, we implemented spiked samples of synthetic TEM-1 gene plasmids in bovine serum. The TEM-1 gene is a plasmid responsible for penicillin resistance in gonorrhea-causing cocci bacteria. From sample procurement to the generation results takes <10 minutes. Our sensing platform can detect the presence of hybridization at DNA concentrations <10^-15 molarity in 10 uL samples.

SD EPSCoR/BioSNTR

57a - Additive Friction Stir Reaction Processing

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Abstract: Aluminum metal matrix composites(AMMC) are hard to fabricate and often have flaws such as porosity and nonuniform grain size. This project attempts to use friction stir processing to solve these issues. A consumable tool with Copper II Oxide powder was stirred on to a substrate, creating a layer of Aluminum with the additive particles distributed within. The friction stir processing technique is more cost effective and creates an ultra refined grain structure, improving the material's properties. Copper II Oxide was chosen because it reacts with Aluminum in the presence of heat to form Copper-Aluminum alloys and Al2O3(Alumina). These reaction products are meant to improve the corrosion resistance of the material, so corrosion tests were done in an attempt to quantify the improvements in corrosion resistance. Results are inconclusive and more work will need to be done to improve the uniformity of particle distribution within the AMMC.

REU: Back to the Future III (SDSMT)

58a - Analysis of Cuprorivaite Nanoparticles in Latent Fingerprint Detection

Jonah Theisen (1)*, William Cross (2)**, jonah.theisen@yellowjackets.bhsu.edu
(1) Black Hills State University, (2) South Dakota School of Mines & Technology

Abstract: Latent fingerprint visualization and detection is an important aspect of today's criminal investigations. New and emerging techniques are studied daily, including the use of near-infrared luminescing nanoparticles. Cuprorivaite, Egyptian blue (CaCuSi4O10), is one such nanoparticle with this desirable quality. This report analyzed the use of cuprorivaite nanoparticles in latent fingerprint detection from the visible-to-near-infrared range. Starting from its synthesis and exfoliation, many application and imaging techniques were explored. Application techniques used include dispersions of nanoparticles in toluene and chloroform, as well as using a dry powder and brush to detect latent fingerprints. These prints were then imaged using a video spectral comparator, scanning electron microscope, and an optical profilometer. Results presented a small amount of success with both application techniques and the video spectral comparator. Unfortunately, time constraints seemed to be an issue in running enough tests and trials to obtain more positive or definitive results.

REU: Back to the Future III (SDSMT)

59a - Characterization of Shipwreck Concretions to Improve Existing Corrosion Rate Data

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(1) University of North Texas and SD Mines, (2) South Dakota School of Mines & Technology

Abstract: Validation of current corrosion rate analysis through sample characterization of various submerged maritime sites may be applied to broader applications concerning other legacy steel vessels in compromising environmental situations. In this study, samples from the USS Arizona, a WWII era battleship as well as the Prinz Eugen, a German vessel commissioned approximately at the same time as the USS Arizona, were examined to determine different material parameters. A series of techniques on shipwreck samples, or coupons, were used to characterize the overall density and iron compositional gradient which govern the corrosion rate of the steel. Primary methods include micro-computerized tomography of both samples as well as standardized calibrations for density comparison. Additionally, standardized aqueous density measurements of sectioned pieces of the coupons were taken. X-ray diffraction, x-ray fluorescence, scanning electron microscopy are used to determine the elemental composition and average density. Cumulative results have yet to be determined.

REU: Back to the Future III (SDSMT)

60a - Development of an effective method to quantify discontinuous fiber orientation in composite materials

Erika Redinger (1)*, Cassandra Degen (2)**, erika.redinger@yellowjackets.bhsu.edu
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Abstract: Applications which use thermoplastic composites (TPMCs) are becoming more common, particularly in the transportation industries. Many TMPC manufacturing processes induce anisotropy by orienting fibers throughout the material. Because the mechanical properties of fiber reinforced composites directly correlate to fiber orientation, it is necessary to understand the anisotropy of the material and fiber orientation within the material. For this work, mechanical tensile tests of discontinuous glass fiber polypropylene matrix composite were used to explore mechanical properties such as Young’s Modulus and Poisson’s Ratio in relation to fiber orientation. Three-dimensional imaging of the TPMC resulted in a microscopic visualization of fiber orientation and efforts were made toward developing a fiber orientation analysis process. Future work will utilize the anisotropic information to model the TPMC material in ultrasonically welded lap joints.

REU: Back to the Future III (SDSMT)

61a - Smart3D - a machine learning driven 3D object reconstruction from pictures: application on 3D body model for medical device development

Alexander Steinley (1)*, Isaac Hanson (1), Etienne Gnimpieba (1)**, alexander.steinley@coyotes.usd.edu
(1) University of South Dakota

Abstract: Additive manufacturing processes have become increasingly common, and the desire to produce customized items immediately has grown with it, despite having a high time investment, learning curve, and a relatively large buy-in. This project aims to alleviate two of these drawbacks with our Smart 3D Scanner, which could also lead to benefits in many different industries, such as medicine, entertainment, and therapy. Using a limited number of photos from a camera, along with an object for reference, the system is able to create a relatively accurate 3D model of a given object (e.g. human body) leveraging machine learning capability. Trained off of a library of 3D objects and images, the system can predict an individual’s age and various body dimensions, which it then uses to mold a similar 3D model into one that can have multiple real-world applications, such as finding the best fit for a medical device.

BRIN - University of South Dakota

62a -

Brandon Sharkey (1)*, Michael West (1)**, brandon.sharkey@mines.sdsmt.edu
(1) South Dakota School of Mines & Technology

Abstract: to be added later

REU: Back to the Future III (SDSMT)

63a - Antibacterial Coating using Cold Spray System on Titanium Implants

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(1) South Dakota School of Mines & Technology

Abstract: Bacterial infections are one of the leading causes of implant failure. In this work, antimicrobial biocomposite coatings, comprising Ag, hydroxyapatite, and titanium were deposited on titanium substrates using cold spray technology. The coating design is based on the well-known antibacterial properties of Ag and the excellent biocompatibility of titanium and hydroxyapatite, whereby hydroxyapatite is a biomimetic bioceramic with a composition similar to that of human bone. Ag composition was varied in the as-processed coatings to evaluate the influence of Ag composition on Ag ion release in vivo. Coating composition and microstructure were characterized using optical microscopy, scanning electron microscopy, and energy-dispersive x-ray spectroscopy. To evaluate the amount of Ag ion release, coated titanium substrates were submerged in a simulated body fluid (SBF) solution for various time steps up to 14 days. Ag ion release was measured using inductively coupled plasma mass spectrometry.

REU: Back to the Future III (SDSMT)

64a - Characterization of Microbial Life in Different Stages of Water Treatment at Sanford Underground Research Facility

Molly Devlin (1)*, Dave Bergmann (1)**, mgdevlin@syr.edu
(1) Black Hills State University

Abstract: In this study, we examine how the microbial flora of wastewater from the Sanford Underground Research Facility (SURF) changes as water moves through the different stages of collection and treatment. Microbes were collected from water in the 2000 ft. level, a tailings pond, a water filter, and Rotating Biological contactors and detected by sequencing 16S rDNA. The 2000 foot level was dominated by chemoautotrophic iron-oxidizing bacteria, mostly Sideroxydans or Gallionella. The abundance of ammonia oxidizing bacteria was the same at the start and end of the water treatment process. In the tailings pond, there was a large presence of Sporichthyaceae (Actinobacteria) and eukaryotic algae. There was a strong presence of Thiobacillus, a sulfide oxidizing bacterium, in all surface samples.

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

65a - Evaluating nesting success in Russian Olive (Elaeagnus angustifolia) and native trees along the Missouri River, SD

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(1) , (2) University of South Dakota

Abstract: Riparian forest birds often use invasive trees as nesting substrates, but the impact of this substrate choice on nest survival relative to nests placed in native trees is unknown. A prominent invasive tree in which riparian forest birds nest along the Missouri River is Russian olive (Elaeagnus angustifolia). We located bird nests in Missouri River riparian forests and monitored nesting success at six sites (Alabama Bend, Blickle, Bolton, Elk Point, Frost, and Jepsen-Siple) every three to four days from mid-May to early August in 2017 and 2018 to determine whether nest success rates differed between nests placed in Russian olive trees and in native trees. We recorded nest tree, nest height, and tree species for each nest found as well as the nest fate (fail or fledge). Since Russian olive trees provide camouflage and physical protection against predators, we predicted higher nesting success rate in invasives than in native trees.

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

66a - Development of Spin-Coating Methods for Producing Upconverting Polymer Films of High Optical Quality

Dylan Lewis (1)*, Stanley May (1), Aravind Baride (1), Stanley May (1)**, dylan.lewis@coyotes.usd.edu
(1) University of South Dakota

Abstract: Upconversion nanoparticles (UCNPs), consisting of NaYF₄ doped with luminescent lanthanide ions, convert near infrared (NIR) excitation to shorter-wavelength luminescence. UCNPs have applications in many areas, including bio-imaging, security printing, and forensics. Patterned metal surfaces, such as gold cavity arrays (GCAs) can increase the inherently low-efficiency of UCNP luminescence. Spin-coated polymer films are an ideal medium to deliver UCNPs to GCAs. In this study, spin-coating techniques for coating with thin films of poly (methyl methacrylate) (PMMA) and poly (lauryl methacrylate) (PLMA) loaded with UCNPs have been developed and optimized for optical quality and thickness control. Both film thickness and optical quality were assessed using UV-vis absorbance spectroscopy. The effects of spin velocity and polymer concentration on film thickness were evaluated. Test results indicate that PLMA is superior to PMMA for producing high-quality upconverting polymer films.

REU: Security Printing and Anti-Counterfeiting Technology - (USD), REU: Weak chemical bonds yield strong research experiences in Materials Chemistry (USD)

67a - Extraction of Glucosinolates Using Alternative Solvents

Matthew Cole (1)*, Matthew L Cole (1), ZhengRong Gu (1), ZhengRong Gu (1)**, matthew.cole@sdstate.edu
(1) South Dakota State University

Abstract: Extraction of Glucosinolates from Brassica oilseed meal, using cheaper, safer aqueous solvents other than ethanol or hexane.

SD EPSCoR/BioSNTR

68a - Morphology of Perfluoroalkylated Aromatic Polymers

Jack Lawrence Lawrence (1)*, Siyu Mao (1), Jordan Kramer (1), Haoran Sun (1)**, jack.lawrence@coyotes.usd.edu
(1) University of South Dakota

Abstract: Organic polymeric cathode materials present practicable solutions for developing flexible energy storage devices, offering potential high energy density at cheaper cost compared to traditional transition metal oxides. Research by other groups have focused on fabricating highly crystalline covalent organic frameworks. Although redox active groups have been covalently attached or absorbed to these materials, their capacity are often limited by the slow mass transport and low conductivity due to the structural deformations and inactive additives. Previously, our group has reported using perfluoroalkylated polymers for high capacity lithium-ion battery cathode materials. We report our investigation into the morphology has revealed porous openings within the polymer structures, offering exchange of ions during charging/discharging. These findings give support to the viability of perfluoroalkylated monomers as solutions towards a new era of lithium-ion batteries.

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

69a - The Molecular Underpinnings of Friedreich's ataxia

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(1) Augustana University

Abstract: Friedreich’s ataxia (FRDA) is an autosomal recessive disorder characterized by a trinucleotide GAA repeat expansion in intron 1 of the FXN gene, resulting in decreased FXN expression. Frataxin (Fxn) is a mitochondrial iron chaperone and plays an important role the iron-sulfur (ISC) cluster complex. The decreased levels of Fxn in FRDA causes patients to experience myopathy, diabetes, and vision deficits, with the majority of patients succumbing to heart failure. We have identified an interaction between Fxn and Peroxiredoxin-3 (Prdx3), a mitochondrial antioxidant that facilitates peroxide detoxification and redox-sensitive signaling. We predict that reduced Fxn levels causes decreased expression of PRX3, thereby contributing to the mitochondrial dysfunction seen in FRDA. By understanding the interaction between Fxn and Prdx3, we will better understand how redox status influences Fxn function and disease phenotype.

BRIN - Augustana University

70a - Morphometric Analysis of a Native Thistle Hybrid Zone (Cirsium undulatum x C. canescens, Asteraceae)

Tyler Bortz (1)*, Cathryn Hester (1), Tara Ramsey (1), Justin Ramsey (1), Justin Ramsey (1)**,
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(1) Black Hills State University

Abstract: Interspecific hybridization occurs when related taxa inhabit the same or bordering environments, and it provides insights into the genetic basis of adaptation and speciation. Here we report morphometric analyses (30 traits and ~300 plants) of a recently-discovered six km contact zone between two thistles (Cirsium undulatum and C. canescens) in Thunder Basin, Wyoming. Traits that are diagnostic for C. undulatum and C. canescens – such as flower color, petal size, leaf lobing and decurrence – showed a sharp spatial transition across the hybrid zone. Principle components analysis revealed a bimodal distribution of phenotypes in the study area, with exact morphological intermediates (putative F1 hybrids) being rare. However, trait mismatches (such as individuals with C. undulatums’s purple flowers and C. canescens’s deeply lobed and decurrent leaves) occurred frequently, suggesting the presence of backcross hybrids and introgressed parentals. Future work will evaluate cpDNA sequence variation and expression of pigment genes in this hybrid zone.

BRIN - Black Hills State University

71a - Meter-Scale Land-Use Changes in Drainage Networks of Local Tributaries of the Missouri National Recreational River

Angela Tricomi (1)*, Brennan Jordan (1)**, atricomi6485@westfield.ma.edu
(1) University of South Dakota

Abstract: The purpose of this research is to identify small-scale land-cover/land-use changes (LCLUC) along streams that drain into the Missouri River. This includes perennial streams, mapped intermittent streams, and also some unmapped water courses that drain the landscape. Changes from natural vegetation to agriculture have been significantly influenced by increases in agricultural commodity prices. Stream channels provide critical ecosystem services as they contribute to improving water quality. ArcGIS is utilized to derive a drainage network based on a digital elevation model of the Bow Creeks watershed in Nebraska and compare imagery over a decade to map changes in land-use. Results will be compared to a previous analysis of the Little Vermillion River watershed in South Dakota. A literature survey will assess the impact these changes may have on water quality. This research will provide valuable information regarding trends in LCLUC along the Missouri River and anticipated impacts on water quality.

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

72a - Effect of Tributaries on Suspended Sediment Concentration of the Missouri River below Gavin’s Point Dam

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(1) Carleton College, (2) University of South Dakota

Abstract: Human activity alters sediment transport in rivers; dams trap suspended sediment resulting in sediment-poor water downstream. The purpose of this study is to determine the suspended sediment concentration of three tributaries, the James, Vermillion, and Big Sioux, then to determine the percentage of the Missouri’s suspended load derived from these tributaries below Gavin’s Point Dam. A sediment rating curve is used to establish the annual suspended load transported by each into the Missouri. Bedload and total load are estimated. For the James, Vermillion, and Big Sioux respectively, the suspended sediment concentrations are 376,000 tons/year, 620,000 tons/year, and 565,000 tons/year. The tributaries contribute ~19% of the suspended load of the Missouri. Total load for the James is 458,000 tons/year, 682,000 tons/year for the Vermillion, and 706,250 tons/year for the Big Sioux. Given the impact of suspended sediment on aquatic health, this research is relevant to remediation efforts and river management.

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

73a - Preparation and Characterization of Nanocomposite films made from Biochar and Nanocellulose

Madison Best (1)*, Lin Wei (1)**, bestx122@umn.edu
(1) South Dakota State University

Abstract: The purpose of this project was to produce functional nanocomposite films with chemical absorption and biodegradable properties for chemical removal by combining cellulose nanofibrils (CNF) with biochar or activated carbon. Several films samples were prepared by varying the ratio of CNF and using either biochar or commercial activated carbon. Characterization was performed by testing moisture uptake, chemical absorption, and also using Scanning Electron Microscopy (SEM). Overall, the nanocomposite films were found to be effective and to have several future applications such as filtration and hygroscopic food packaging. The films produced in this project have the potential to replace petroleum based products normally harmful to the environment and they have the advantage of being biodegradable and renewable.

SD EPSCoR/BioSNTR

74a - Synthesis and Toxicity Testing of Cadmium Chalcogenide Quantum Dots

Dartanian Vukota (1)*, Alison Jones (1), Thomas G. Lewis (1), Amber Seidel (1), Daniel J. Asunskis (1), Daniel Asunskis (1)**, dartanian.vukota@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Cadmium Selenide and Cadmium Telluride quantum dots (QDs) are potential candidates for bio-imaging and solar cell applications due to the size tunable bandgap in these nanomaterials. QDs have seen increases in these and other applications, but with these increased uses comes an increase in the risk associated with these materials. They can have significant potential harmful effects as products break down in landfills and leach into the soil, and eventually the water supply. My research focused on synthesizing CdSe and CdTe nanoparticles under different conditions, such as varied amounts of dodecanethiol as a surfactant, which decreased QD size and ultimately blue shift the emission spectrum. The QDs were then exposed to rat aveolar macrophages at different concentrations to analyze cytotoxicity. Toxicity endpoint measurements were carried out using the LDH and MTS assays, results will be reported.

BRIN - Black Hills State University, SD EPSCoR/BioSNTR

75a - Examining Differences in Strength of Landscape Values Between Age Groups in the Upper Missouri River Basin

Tanner Hall (1)*, Meghann Jarchow (1)**, tanner.hall@coyotes.usd.edu
(1) University of South Dakota

Abstract: Values regarding landscape and land use reflect how residents develop and use the land. Strength of a value implies how steadfast one is in that value. Describing the intensity by which values are held, it is possible to identify populations prone to altering their values. Traveling to communities along the UMRB and administering a brief survey, I obtained data on residents' land use values. Data was analyzed with a one-way ANOVA examining strength of values held by different age groups. It was found that the youngest age group varied significantly in strength of values. Other age groups did not vary significantly from each other. This supports the notion that young people below a certain age have not yet fully developed a strong identity with their values. Therefore, they would be an optimal group to focus on when trying to garner support for land use stewardship and benevolence.

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

76a - Structural Analysis of the USS Arizona

Amanda Booton-Popken (1)*, Amanda J. Booton-Popken (1), Micheal West (1)**, amanda.sharp@mines.sdsmt.edu
(1) South Dakota School of Mines & Technology

Abstract: The USS Arizona was sunk in 1941 during the attack on Pearl Harbor. The USS Arizona has not moved in the 80 years since its sinking. Within the USS Arizona is estimated half a million gallons of oil remains. To prevent the oil releasing into the harbor and destroying the nearby environment, the collapse of the USS Arizona should be avoided. A parameter study was created to develop an understand of when and how the USS Arizona will collapse and how the structural elements within will react over time to the corrosion and concretion that develop. As well as the application of wave loading on a pre-designed finite element model to predict how much loading the ship can withstand over multiple year increments. This poster will detail any and all information gained from the parameter study and application of wave loading.

REU: Back to the Future III (SDSMT)

77a - Development of a Field-Portable Analysis Technique for Determination of Thiocyanate in Fish Blood

Caleb Freeman (1)*, Obed A. Gyamfi (1), Nesta Bortey-Sam (1), Brian A. Logue (1), Brian Logue (1)**, caleb.freeman@jacks.sdstate.edu
(1) South Dakota State University

Abstract: The illegal process of cyanide fishing is a significant problem in Southeast Asia that was first documented in the Philippines. This process is detrimental to fish as well as the surrounding ecosystem especially coral reefs. A new fast and field-portable analytical method has been developed for verification of cyanide exposed fish. The method uses the Cyanalyzer, developed by the Loque lab, for results in one minute. Using thiocyanate, the major metabolite of cyanide, as a bio-marker gives optimal results for verification as well as a longer window of opportunity for testing due to its relatively long excretion time. Potassium permanganate (1 M) is used as an oxidizing agent to convert thiocyanate to cyanide, so that it can be analyzed by the Cyanalyzer. Results show a percent recovery of oxidized thiocyanate to be 75%. Concentration (μM) vs Signal shows a positive correlation with a consistent R-squared value of above 0.9.

SD EPSCoR/BioSNTR

78a - Genetic Structure of the Ornate Box Turtle on the Pine Ridge Reservation, SD

Gabriel Yellowhawk (1)*, Camille Griffith (2), Alessandra Higa (1), Dr. Cynthia Anderson (3), Alessandra Higa (1)**, gyellowhawk@gmail.com
(1) Oglala Lakota College, (2) Purdue University, (3) Black Hills State University

Abstract: Due to a lack of knowledge, the ornate box turtle (Terrapene ornata) is considered a species of greatest conservation need in South Dakota. This study looks at the genetic structure of the ornate box turtle population on the Pine Ridge Reservation and surrounding area in an effort to find whether or not the geneflow within the population has been restricted by landscape barriers. Nail clippings and shell shavings were collected on the reservation and were taken to the Black Hills State University Center for the Conservation of Biological Resources where DNA extraction, amplification, and genotyping was performed. By using microsatellites as genetic markers and programs like Gene-Pop, BOTTLENECK, and STRUCTURE we were able to find that the population is in Harvey-Weinberg disequilibrium due to heterozygote deficiency, a significant population bottleneck has occurred recently, and there is distinct separation between the northern and southern sub-populations on the reservation.

BRIN - Oglala Lakota College

79a - Validating Relative Humidity as an Environmental Control Factor For Observing the Parameters of Successful Michorrizal Growth for Overall Fruiting in Mature Fungi

Mark White Bull (1)*, Ale Higa (1)**, skuyabull017@gmail.com
(1) Oglala Lakota College

Abstract: The purpose of this study is to examine the environmental factors and effects on mycorrhizal fungi, and to evaluate the variables for suitable and successful cultivation of the mushroom species. Mycorrhizal fungi is endemic to South Dakota and there has been relatively little to no studies found in this region. The main species of interest is the Pleurotus pulmonarius and other fungi. Pl. pulmonarius also known as the oyster mushroom is a valuable food source rich in bioavailable nutrients used among the Lakota as a traditional herb, and serves as bioremediation organism. The objective of this study is validate relative humidity as the control factor its effects on P. pulmonarius among several mycorrhizal fungi. To prove the hypothesis that relative humidity is the critical element in cultivation we created two different environments to test these effects on dependent variables.

SD EPSCoR/BioSNTR, OSSPEEC

80a - Explorative Analysis of Biodiversity in SURF Fungal Species through Sanger Sequencing

Tada Vargas (1)*, Shane Sarver (2)**, tadavargas@icloud.com
(1) Oglala Lakota College, (2) Black Hills State University

Abstract: Located in Lead South Dakota, the formally known Homestake Mine, was in operation for approximately 125 years. Although, it officially ceased mining operations in 2002, scientific experiments have been conducted underground since the mid-1960. Currently, it is now called SURF, Sanford Underground Research Facility and is home to various scientific experiments. This project explores the biodiversity and genetic variability in fungal species collected from SURF. In the spring of 2016, 75 samples were collected from various levels of underground. Samples were then cultured and isolated, creating 343 isolate samples. Isolates were lysed and diluted, to amplify DNA, using the ThermoScientific Phire Plant Direct PCR kit. Subsequently, 311 isolates were selected for Sanger Sequencing and 205 samples produced genetic sequence. Samples were organized, identified, and analyzed using genetic software: Sequencher, Blast, and CLCbio.

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

1p - Characterization of Acid-Resistance Biofilm Phenotypes in Samonella enterica

Alek Keegan (1)*, Jon Gubbrud (1), Alek Keegan (1), Paul Egland (1)**, ackeegan16@ole.augie.edu
(1) Augustana University

Abstract: Salmonella enterica is the bacterium that causes the infectious disease salmonellosis. Eleven strains of Salmonella enterica deemed to be acid resistant were isolated previously. The genomes of these strains have been sequenced, allowing correlation of genes that are shared among the strains to acid-resistance phenotypes. To identify genes responsible for acid resistance, the strains were characterized for three phenotypes: planktonic growth, initial adherence to surfaces, and growth and thickness of biofilms attached to a surface. These three phenotypes were measured for each strain in neutral pH (6.57) and low pH (4.02) to characterize the strains' growth in acidic conditions. Strains differed in growth and adherence in a given pH condition. Differences between neutral and low pH conditions were also found within strains. In the future, differences in phenotype could be correlated with genotypic differences between strains, and genes responsible for varying levels of acid resistance could be identified.

BRIN - Augustana University

2p - 3D Visualization of Genomic Data in Virtual Reality

Eric Feng (1)*, Xijin Ge (2), Xijin Ge (2)**, fengeric11@berkeley.edu
(1) University of California, Berkeley, (2) South Dakota State University

Abstract: Historically, we have heavily relied on 2-dimensional (2D) displays in order to both obtain and communicate large amounts of data in concise, understandable plots. As the volume and complexity of data grows, the traditional 2D charts and graphs are becoming inadequate in demonstrating the multi-faceted nature of various datasets. In this respect, Virtual Reality (VR) holds potential in offering a new, more effective approach for data visualization. To this end, this research project will create a VR application using Unity3D that will later run Principal Component Analysis (PCA) on a mouse embryonic development dataset. This analysis will determine the trajectory of embryonic development, proving that the most drastic changes occurs during the formative stages of development, namely, between stages Zy and 4-cell. The analysis and graphical rendering of the previous large genomic dataset demonstrate the potential of VR in data visualization and its increasing importance in the future.

SD EPSCoR/BioSNTR

3p -

Brianna Roth (1)*, Peter Ruppelt (1), Jace Woodward (1), Duane Weisshaar (1)**, blroth15@ole.augie.edu
(1) Augustana University

Abstract: presenting with Peter Ruppelt

SD EPSCoR/BioSNTR

4p - Construction and Characterization of an Iodine Saturated Absorption Spectrometer

MaKenna Koble (1)*, Andrew Klose (1), Andrew Klose (1)**, mmkoble17@ole.augie.edu
(1) Augustana University

Abstract: Precision laser spectroscopic studies, such as collinear laser spectroscopy of rare isotopes, require precise determination of laser frequency. Here, the frequency of a continuous wave laser is being calibrated to a level of 1 MHz using saturated absorption spectroscopy (SAS) of iodine. Iodine has a well-studied absorption spectrum spanning from 400 nm to 850 nm, making it an excellent reference molecule. In this work, a SAS was constructed. The spectrometer features an acousto-optic modulator for pump beam modulation and a 60-cm long iodine cell. A tube furnace was used to heat the cell up to 700°C in order to redistribute the rotational and vibrational population of the molecule. A nonlinear curve fitting routine was implemented to fit the hyperfine spectra obtained and to deduce the centroid frequency of the iodine transition. The construction and initial testing of the spectrometer will be presented, and further experiments with the SAS setup will be discussed.

BRIN - Augustana University

5p - Mode-Locking and Characterization of Erbium-Doped Ultrafast Laser System

Gaven Bowman (1)*, Cody Kujawa (1), Andrew Klose (1)**, gabowman17@ole.augie.edu
(1) Augustana University

Abstract: Mode-locked ultrafast fiber lasers are advantageous in varying laser spectroscopic applications. Here, a 103.1 MHz repetition rate mode-locked laser based on Er-doped optical fiber was constructed. The fiber laser was designed in a ring configuration and contained erbium-doped, single-mode, and dispersion-shifted fibers to produce a cavity with a net dispersion of 0.0067ps2. A polarizing beam splitter was used as an output coupler and polarization-sensitive elements altered polarization evolution through the cavity. Nonlinear polarization evolution of the light through the laser cavity resulted in pulsed operation of the laser. Mode-locking of the laser cavity and characterization of pulse repetition rate is currently ongoing. Additionally, diagnostic tools including an auto-correlator and parallel grating dispersion compensator were constructed and will be discussed.

BRIN - Augustana University

6p - Evaluation of the Antiproliferation Effects of Glucosinolates Against Human MCF-7 Cells

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(1) Augustana University

Abstract: Diets high in vegetables from the Brassica family can confer a variety of beneficial anticancer effects, largely due to the isothiocyanates (ITCs) produced via the enzymatic hydrolysis of glucosinolate natural products by myrosinase. Prior studies have described novel methods to quantify and evaluate the enzymatic hydrolysis of natural and non-natural glucosinolates to ITCs. This work sought to evaluate the conversion of benzyl glucosinolate and 2,2-diphenylethyl glucosinolate to their respective ITCs in a cellular setting, using an anticancer endpoint to measure the effectiveness of ITC formation. In this study, the myrosinase-dependent antiproliferative effects of glucosinolates against human MCF-7 breast cancer cells were evaluated using a commercial MTS assay. When compared to the antiproliferative effects of pure ITCs, the results suggest that the conversion of glucosinolate to ITC occurs efficiently in a cellular setting, with reaction kinetics that are consistent with prior in vitro data.

SD EPSCoR/BioSNTR

7p - Synthesis and Characterization of a DFDPP-CPDT Polymer With Ethynyl Spacers by Means of Sonogashira Coupling

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(1) Augustana University

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

BRIN - Augustana University

8p - Mechanistic Connection Between Ovarian Cancer and Platelets

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Abstract: In metastasis, cancer cells are often capable of utilizing platelets to mask themselves from both the body’s immune response and chemotherapeutic treatments. It has been shown that certain ovarian cancer cells express lower levels of SUSD2, a transmembrane protein believed to hinder this platelet-cancer cell connectivity. Further, ovarian cancer patients with high SUSD2 expression typically live longer than patients with lower expression. Therefore, we sought to further characterize and validate the relationship between SUSD2 expressing cancer cells and platelets as well as to observe key elements of the mechanistic pathway. In order to achieve this, ovarian cancer cells were plated with various platelet binding inhibitors as well as assayed to observe ADP production. We have found that platelets do not have a detectable impact on production of ADP from ovarian cancer cells and that platelets can be activated in the presence of an agonist independent of SUSD2 presence.

BRIN - Augustana University, BRIN - University of Sioux Falls, SD EPSCoR/BioSNTR

9p - Exercise, Estradiol, and Specific Estrogen Receptor Activation for the Prevention of Type 2 Diabetes

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(1) Augustana University

Abstract: In 2017, the United States ranked number one for obesity in the world with over 109 million obese citizens. Obesity is a well-known risk factor for type 2 diabetes mellitus (T2D), and T2D is the seventh leading cause of death in the United States. Insulin resistance is one of 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 provide benefits for T2D, and specifically, activation of estrogen receptor alpha may provide the greatest benefits. In this study, high-fat fed/ovariectomized rats were treated with exercise, estradiol, or specific estrogen receptor agonists This study measured body weight, food consumption, spontaneous cage activity, % body fat, and blood glucose. These data will provide novel insights into the benefits of exercise and estrogen receptor activation for T2D.

BRIN - Augustana University, SD EPSCoR/BioSNTR

10p - Variation in Egg Size and Lifetime Fecundity in 200 DGRP2 Drosophila melanogaster Lines

Tristan Roy (1)*, Tristan Roy (1), Hayley Brands (1), Wyatt Mcleod (1), Cecelia Miles (1)**, tmroy15@ole.augie.edu
(1) Augustana University

Abstract: The field of genetics has excelled quickly due to recent innovations in technology. Yet, there is much to be learned about the exact relationships between genotype and phenotype. Egg length and fecundity were measured in 200 Drosophila lines. The genomes of the lines used were sequenced previously, allowing for a genome-wide association study to be conducted. The phenotypic data were compared to the sequence data and analyzed for associations between the measured phenotypes and the genotypes of the Drosophila lines. These associations can shed light on the relationship between genotype and phenotype. Information gained may increase the understanding of the relationship between the human genome and phenotype.

BRIN - Augustana University, SD EPSCoR/BioSNTR

11p - Exercise and Estradiol Stimulate Lipolysis and Decrease Risk Factors for Type 2 Diabetes

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Abstract: The absence of estrogens in postmenopausal women is linked to an increased risk of type 2 diabetes (T2D). Notably, exercise can treat and prevent T2D. This study examined the effects of estradiol and exercise alone and in tandem as a treatment for T2D. Female rats were ovariectomized (OVX) and fed a high-fat diet (HFD; 60% kCal from fat), with the following 4 groups: 1) no treatment (control), 2) exercise (Ex), 3) estradiol (E2), and 4) Ex+E2. Exercise and E2 alone and in combination decreased weight gain compared to the control group. However, only exercise effectively prevented HFD/OVX-induced hyperglycemia and hyperinsulinemia. These data suggest that estradiol protects against excessive weight gain, but exercise is effective at preventing weight gain and hyperglycemia and hyperinsulinemia.

BRIN - Augustana University, BRIN - University of Sioux Falls, SD EPSCoR/BioSNTR

12p - Surface Water Characteristics at the SGU Bison Field Station

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(1) Sinte Gleska University

Abstract: It is crucial to collect baseline water quality data to understand the impact of bison on the surface and ground water and to see if there are toxins in the water that could possibly harm the bison herd. The objective of this project is to collect baseline surface water quality data within the Bison Field Station in Todd County, SD. 5 sites were chosen as areas of study, east and west boundaries of the Little White River on the north side of the field station, east and west boundaries of Spring Creek on the south side of the field station, and one natural spring ground water sample was collected. In the field, dissolved oxygen, chlorophyll, pH, ammonia, and nitrates were tested using portable monitoring equipment. Water samples were also taken back to the lab to test for chlorophyll and ecoli. All results for the sites tested were within normal ranges.

SD EPSCoR/BioSNTR

13p - WEST NILE VIRUS INFECTION OF THE VECTOR MOSQUITO (CULEX TARSALIS) POPULATION IN TODD COUNTY, SD

Maliesha Bear Heels (1)*, Dana Gehring (1)**, mrosethinelk@gmail.com
(1) Sinte Gleska University

Abstract: The purpose of this study is to provide Todd County with essential data about the number of mosquitoes infected with West Nile Virus because there has been no previously reported data within this county. There are 43 mosquito species in South Dakota, but only Culex tarsalis is an important vector for WNV. The objective of this research project is to identify the proportion of C. tarsalis mosquitoes affected with WNV within four locations in Todd County. This data could then be applied to the prevention, awareness, and prevalence of WNV. A CDC CO2 trap was used to collect mosquitoes in four locations, collections were placed in a freezer, then counted and identified. C. tarsalis were separated and sent to the SD Department of Health Lab, where they were tested for WNV. It was found that the C. tarsalis tested from the Todd County area were negative, none carried the WNV.

SD EPSCoR/BioSNTR

14p - Biodiversity and Population Density of Wildlife at the SGU Bison Field Station in southwest Todd County, SD

Lester Kills The Enemy Jr (1)*, Dana Gehring (1)**, lkillsth@gmail.com
(1) Sinte Gleska University

Abstract: The objective of this project is to estimate the population density of wildlife at the Bison Field Station in southwest Todd County, SD.

SD EPSCoR/BioSNTR

15p - Modified Silicone Hydrogel Contact Lenses for Ocular Drug Delivery

Emily Wanous (1)*, Jetty Duffy-Matzner (1)**, emwanous16@ole.augie.edu
(1) Augustana University

Abstract: Contact lenses are widely utilized in today's society for cosmetic and vision purposes; however, many health problems are caused by surface properties of contact lenses such as poor wettability and protein deposition. This work will utilize chitosan (CS) and hyaluronic acid (HA) multilayers by immersive layer-by-layer (LbL) assembly on siloxy amino functionalized generation 1 and 3 silicone hydrogel contact lenses. The water retention, protein deposition, and oxygen permeability of the modified contact lenses will be compared to unmodified ones. LbL self-assembled multilayer films have been proven to deliver drugs effectively. The ophthalmic drugs, timolol and norfloxacin, will be trapped via the LbL assembly process and their releasing performances will be tested.

BRIN - Augustana University

16p - Bacterial biofilm formation on drug-modified contact lenses

Jennifer Akers (1)*, Paul Egland (1)**, jlakers15@ole.augie.edu
(1) Augustana University

Abstract: More than half of the adult population uses some form of corrective lenses, either glasses or contact lenses. Current research is aimed at developing ways to deliver medication into the eye by using the contact lens itself. The goal of the work described here is to develop a test to measure the ability of antimicrobial-impregnated lenses to prevent the formation of bacterial biofilms on the lenses. Pseudomonas aeruginosa, an opportunistic pathogen known to cause eye infections, was found to adhere to lenses. Currently, we are treating the medicated lenses with suspensions of P. aeruginosa to determine if it can colonize the lenses and form biofilms on lenses that have timolol and norfloxacin embedded in the them. Bacteria colonizing lenses are then stained and the living and dead bacteria can be quantitatively measured to determine the efficacy of the lenses.

BRIN - Augustana University

17p - The Effect of Type 2 Diabetes on the Reward Pathway and Appetite in the Brain

Faith Hummel (1)*, Nicholaus J. Lawson (2), Tyler J. Field (3), Dr. Patrick J. Ronan Ph.D. (4), Dr. Karen A. Munger Ph.D. (4), Dr. Brittany K. Gorres-Martens Ph.D. (3), Brittany Gorres-Martens (3)**, faith.hummel@yellowjackets.bhsu.edu
(1) Black Hills State University, (2) University of Sioux Falls, (3) Augustana University, (4) Veteran's Affairs Health Care System

Abstract: A neuronal receptor is a protein on the postsynaptic neuron that neurotransmitters bind to once released from a presynaptic neuron that results in a change in the postsynaptic cell. This study focuses on data regarding specific receptors in the brain and how they change under the conditions of type 2 diabetes in female rats in the presence or absence of estrogens and exercise. Female Wistar rats (n = 32) underwent either a sham surgery or ovariectomy (OVX) and were then placed on a high-fat diet (HFD) or a standard diet. A subset of HFD/OVX rats experienced treadmill exercise. The brains were removed, sliced, and punched for regions housing estrogen receptor alpha, ghrelin receptors, leptin receptors, tyrosine hydroxylase, dopamine receptors, dopamine transporters, and orexin receptors. These receptors have an effect on satiety, energy homeostasis, and the reward pathway and could potentially change under conditions associated with type 2 diabetes.

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

18p - Cerebellar Dysfunction in the BTBR Mouse Model of Autism

Heidi Bien (1)*, Karisa R. Hagena (1), Jade E. Vipond (1), Alexander Kloth (1)**, hebien16@ole.augie.edu
(1) Augustana University

Abstract: The cerebellum, a region of the brain associated with sensorimotor function, is commonly affected in patients with autism spectrum disorders (ASD), but its role in this neurodevelopmental disorder remains unknown. The BTBR mouse, a model of autism that displays behavioral deficits analogous to human ASD, has increased cerebellar volume, which makes it an excellent model for this study. To observe cerebellar dysfunction in BTBR mice, we measured the sensorimotor learning through delayed eyeblink conditioning. We hypothesized that the BTBR mice would display learning and performance deficits in this task. We found that the BTBR mice exhibited impaired cerebellar function relative to controls, including deficiency in learning. Studies of timing in eyeblink conditioning and the correlation of these measures to other ASD-related behaviors are ongoing. In studying the involvement of the cerebellum in ASD, we may be able to identify reliable biomarkers of the disorder, which would allow for early intervention.

BRIN - Augustana University, SD EPSCoR/BioSNTR

19p - Validating EphrinB1 binding partners

Benjamin Engebretson (1)*, Paul L. Colbert (1), Marianna Madeo (1), Paola D. Vermeer (1), Paola Vermeer (1)**, benjaminengebretson2021@u.northwestern.edu
(1) Sanford Health

Abstract: Investigation of proteins that associate with EphrinB1 and the PDZ binding motif.

SD EPSCoR/BioSNTR

21p - Modeling Endovascular Treatment of Unruptured Intracranial Aneurysms using Computational Fluid Dynamics

Caroline Kireopoulos (1)*, Stephen Gent (1)**, ckireop1@asu.edu
(1) South Dakota State University

Abstract: A variety of endovascular treatments for intracranial aneurysms are available, but there is limited data comparing the effectiveness of such treatment options from a fluid dynamics perspective. Endovascular treatments achieve occlusion by inserting a device, such as a platinum coil or a meshed stent, into the blood vessel to redirect blood flow away from the aneurysm. These devices occlude inside the aneurysm dome, causing the blood vessel to thrombose over the aneurysm neck. An understanding of the effectiveness of these devices in aneurysms of varying sizes, shapes, and locations can help predict the success of endovascular treatment. Computational fluid dynamics (CFD) was used to compare the effectiveness of standard coiling, hydrogel coiling, and flow disruption treatments. Simulation results were compared to determine which treatments were most effective for each test case. This modeling approach may assist neurosurgeons in identifying the preferred approach to treating patients with intracranial aneurysms.

REU: High Performance Computing in STEM disciplines (SDSU)

22p - Using CFD Modeling to Determine Performance of 3D Printed Plastic Heat Exchangers

Rylie Brown (1)*, Gregory Michna (1)**, brown.rylie24@gmail.com
(1) South Dakota State University

Abstract: 3D printed heat exchangers are favored over traditionally manufactured metal heat exchangers because they are lighter, cheaper, and anti-corrosive. Although the low thermal conductivity of plastic poses some issues, the use of 3D printing allows for creative designs and intricate patterns that can gain back some of the lost performance. The goal of this project was to simulate fluid flow and heat transfer in some of these innovative heat exchanger designs using computational fluid dynamic (CFD) modeling techniques. Three experimentally tested heat exchangers of varying designs were used to verify the validity of the simulations. After confirming the simulation methods and analyzing the literature available, a new design using trapezoidal shaped tubes in a wavy pattern was developed. The new design was simulated in Star-CCM+ under the same conditions. In the future, CFD modeling could replace the need for experimental trials, reducing costs and resources used in developing heat exchangers.

REU: High Performance Computing in STEM disciplines (SDSU)

23p - Grape Berry Ripening Signature Gene Expression Analysis

Patricia Salas (1)*, Patricia Salas (1), Padmapriya Swaminathan (1), Dr. Anne Fennell (1), Anne Fennell (1)**, patricia.salas@sdstate.edu
(1) South Dakota State University

Abstract: Frontenac and Marquette are cold climate hybrids derived from Vitis vinifera and North American grape species. To produce good wines from these cultivars, it is critical to characterize their ripening profile and identify optimal biomarkers. Since the varieties are relatively new, their ripening processes have not been well studied. Titratable acidity, pH, and soluble solids are commonly used to indicate grape maturity but correlate weakly with flavor maturity. Gene expression was analyzed at different fruit maturity stages to identify key genes and pathways linked with flavor development. Using results from data exploration, the cultivars showed distinct signature gene expression during the ripening process. In future research, combined genetic, sensory, and chemical analyses will aid in identifying improved harvest biomarkers. For grape growers, better markers will result in high quality wines and benchmarking cultural practice improvements.

REU: High Performance Computing in STEM disciplines (SDSU)

24p - Analysis of Spatial Agricultural Data: Explaining Variation in Corn Yield Using Multiple and Spatial Regression

Jessica Jones (1)*, Dr. Gary Hatfield (1), Dr. Jung-Han Kimn (1), Gary Hatfield (1)**, jessica.jones@sdstate.edu
(1) South Dakota State University

Abstract: The objective of this research project is to develop a statistical methodology to find a global model and local models to describe yield using multiple and spatial regression. The set up for this project involves combining two diverse spatial data sets and writing an R function to find a multiple regression model to explain the variation in yield. R packages sp, raster, and SDraw are used to create UTM projections and combine the data sets using Voronoi polygons. R packages spgwr, car, and olsrr are used to find a multiple regression model to predict the variation in yield. The key finding of this project is the successful combination of both data sets. A multiple regression model using the combined data set describes 29.8% of the variation in yield. The methodology used in this project can be applied to other diverse data sets and be used to model other response variables.

REU: High Performance Computing in STEM disciplines (SDSU)

26p - Parallel implementation of AC Optimal Power Flow and Time Constrained Optimal Power Flow

Alexander Werner (1)*, Kapil Duwadi (1), Timothy Hansen (1), Jung-Han Kimn (1), Timothy Hansen (1)**, alexander.werner@sdstate.edu
(1) South Dakota State University

Abstract: The objective of this project is to develop a scalable and parallel solution to the Alternating Current Optimal Power Flow (ACOPF) and Time Constrained Optimal Power Flow (TCOPF) problems. Economic efficiency and reliability of the electric power system is dependent on the solution to the ACOPF and TCOPF problems. This project uses the C language and the Portable, Extensible Toolkit for Scientific Computing (PETSc) libraries, particularly DMNetwork and Krylov subspace methods (KSP), to solve the problems. The effectiveness of the solution will be evaluated by looking at the computation time needed relative to the number of processors being used. The scalability has been tested by running optimization on networks with up to 1354 buses

REU: High Performance Computing in STEM disciplines (SDSU)

27p - Toxicity and Gene Expression Studies for CdSe Nanoparticles Exposure to Buffalo Rat Lung Macropahges

Alison Jones (1)*, Amy Asunskis (1)**, alison.jones@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Nanoparticles have been found to hold potential importance in the medical field. Imaging and medicinal agents can be delivered by nanoparticle for diagnosis and therapy. With an increase in nanoparticle use, comes the necessity to understand the toxicity of these materials. One pathway for exposure to toxins is inhalation. In the lungs, an immune response can be activated by the presence of toxins. Macrophages play a key role in the immune system as they are one of the first responders that uptake and process foreign particles in the body. When a toxin is found an inflammatory cytokine is produced by the macrophage such as Interluekin-6 (IL-6) or tumor necrosis factor alpha (TnF-α). Cultured buffalo rat alveolar macrophages were exposed to different concentrations of CdSe nanoparticles and the resultant expressed genes were identified.

BRIN - Black Hills State University, SD EPSCoR/BioSNTR

28p - Analysis of Upconverting Nanoparticles for Latent Fingerprint Detection

Hannah Weppner (1)*, Sierra Rasmussen (1), Dr. Jon Kellar (1), Dr. William Cross (1), Jon Kellar (1)**, hkw4019@rit.edu
(1) South Dakota School of Mines & Technology

Abstract: Because of fingerprints' value as forensic evidence, research into novel latent fingerprint development methods remain important. In this case, two application methods for upconverting nanoparticles (UCNPs), specifically NaYF4:Yb,Tm are considered. UCNPs have previously been investigated as latent fingerprint-detecting powders given their NIR-NIR anti-Stokes properties that can allow for the visualization of fingerprints on fluorescent backgrounds. UCNPs were prepared in a toluene dispersion and an oil-in-water emulsion and applied by immersing the substrate, and, for the emulsion, spraying the substrate. The results were imaged using a 980 nm laser and camera, a scanning electron microscope, and a video spectral comparator. It was found that the emulsion has little utility as a fingerprint development agent due to the oil residue left on substrates. The toluene dispersion appeared more promising. With this application and proper imaging, visualization of fingerprint ridges was visible on some of the glass and silicon substrates tested.

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

29p - Transcriptomic Profiling of Atypical Teratoid Rhabdoid Tumors Response to HDAC Inhibitor 4SC-202 in 3D Spheroids at Bulk and Single Cell Levels

Tanner Diemer (1)*, Etienne Gnimpieba (1), Shanta Messerli (2), Mariah Hoffman (1), Etienne Gnimpieba (1)**, tanner.diemer@jacks.sdstate.edu
(1) University of South Dakota, (2) Sanford Health

Abstract: Atypical teratoid rhabdoid tumors (ATRT) are a rare form of pediatric cancer found in the central nervous system with a poor prognosis. In attempts to find a more effective chemotherapeutic agent, the efficacy of a novel histone deacetylase (HDAC) inhibitor named 4SC-202 is under investigation. Sytox Green cytotoxicity experiments and preliminary single-cell RNA-sequencing (scRNA-seq) results from 3D spheroids showed strong evidence that ATRT tumors have a clear response to 4SC-202. Using the scRNA-seq dataset, a short list of genes of interest (GOIs) were identified as key players in the cancer stem cell (CSC) population. Bulk RNA-seq will be performed in order to validate this scRNA-seq dataset and to contribute to a predictive model which calculates the drug response in specific cell samples. Real-time PCR was performed on our GOIs (SOX2, CD44, KLF4, POU5F1, SOX9, and ALCAM) to validate the scRNA-seq data.

SD EPSCoR/BioSNTR

30p - Comparison of Deep Underground Biofilms and Surface Water Samples using Next-Gen Sequencing

Patrick Noack (1)*, Bethany Reman (1), Shane Sarver (1)**, pn6@humboldt.edu
(1) Black Hills State University

Abstract: The purpose of this experiment is to compare eukaryotic organisms from underground to surface. There is some evidence that surface water, such as Whitewood Creek, contributes to the water in SURF. In this experiment, we used a combination of traditional microscopy and metagenomics to estimate taxonomic diversity.

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

31p - Analysis of Native American Art via Mass Spectrometry

Nora Madrigal (1)*, Dr. Fredrick Ochieng (2), Dr. Brian Logue (2), Brian Logue (2)**, madrigal@grinnell.edu
(1) Grinnell College, (2) South Dakota State University

Abstract: Native American art is counterfeited at an alarming rate. While the Indian Arts and Crafts Act prohibits selling artwork as “Native American” unless it was crafted by a registered tribal member, fakes and forgeries are still sold under misleading labelling, which undercuts and harms legitimate artisans. Mass spectrometry, which is often used in an archaeological context to detect and identify trace compounds, has the potential to be used as a means of authentication for Native American art and artifacts. The dyes present in two pieces of modern artwork and in an artifact from the Red Cloud Indian School Heritage Center were analyzed using mass spectrometry. Through comparison with standards, identification of the dyes and the authenticity of the items was evaluated.

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

32p - Reverse Genetics Creation of Influenza Infection and Immunity

Grace Adam (1)*, Dustin Heiden (1), Victor Huber (1)**, grace.adam@usiouxfalls.edu
(1) University of South Dakota

Abstract: Influenza is a negative sense RNA virus belonging to the Orthomyxvirdae family. Its genome is broken into eight different segments. Those segments are: PB1, PB2, PA, HA, NP, NA, M, and NS. However, Influenza D has a genome that is broken into only seven segments with those being: PB1, PB2, PA, HEF, NP, M, and NS1. My research focuses on the production of Influenza D through the transfection of MDCK cells and 293T cells. The origin of MDCK derives from the kidneys of dogs and 293T cells originate from human kidneys. By using a reverse genetics system of 7 plasmids we are generating whole Influenza D virus in vitro.

BRIN - University of South Dakota

33p - FIRMS Analysis of Isotope Ratios Based on Metabolic Reprogramming for Early Diagnosis of Cancer

Austin Fournier (1)*, Brian Logue (1), Fredrick Ochieng (1), Brian Logue (1)**, amfournier@stcloudstate.edu
(1) South Dakota State University

Abstract: Cancer cells reprogram metabolism by upregulating glycolysis and lactate production. Due to the upregulating of these processes and kinetic isotope effects, cancer cells may have chemicals with modified isotopic composition compared to normal cells. By utilizing Fast Isotope Ratio Mass Spectrometry (FIRMS) to calculate the isotope ratios of lactate produced from normal and cancer cells, we may be able to determine isotope ratio modification during cancer metabolism reprogramming. If successful, this method will be extended to animals for early diagnosis of cancer.

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

34p - FIRMS Analysis of Acetylsalicylic Acid in Aspirin for Source Identification

Gentry Musgrove (1)*, Dr. Fredrick M. Ochienga (1), Dr. Brian A. Logue (1), Brain Logue (1)**, gentry.musgrove@wolves.northern.edu
(1) South Dakota State University

Abstract: The increasing number of counterfeit drugs is a growing health concern in the U.S. and worldwide. An essential component to eliminating the production and supply of counterfeit drugs is identification of the source of the counterfeit pharmaceuticals. Isotope ratios (IRs) of the active ingredients of pharmaceuticals are excellent indicators of the source of the compound. In this study, we calculated the unique IRs of several acetylsalicylic acid (the active ingredient found in aspirin tablets) samples using a technique called Fast Isotope Ratio Mass Spectrometry (FIRMS). FIRMS was used to identify the source of an unknown acetylsalicylic acid tablet based on a database of aspirin IRs (N=4). This project demonstrates the utility of the FIRMS technique in source identification of pharmaceuticals.

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

35p - Intracranial Aneurysm Fluid Modeling and Correction in the Posterior Communicating Artery

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

Abstract: Flow diversion stents are a recent addition to the suite of medical devices used to correct intracranial aneurysms. However, these devices are not widely used due to lack of comprehensive information on their effects on flow behavior. This research aims to add to the overall knowledge of flow diversion stents by demonstrating changes in blood flow behavior caused by the additions of a flow diversion stent in a generic saccular aneurysm. This study involved the fluid modeling and behavior studies of blood flows in treated and untreated saccular aneurysms. Tabulated results include velocity profiles, wall shear stress of both the vessels and the flow diversion stent, and volumetric flow rate comparisons between treated and untreated aneurysms. This study demonstrates that flow diversion stents have the ability to decrease overall fluid flow into a saccular aneurysm.

SD EPSCoR/BioSNTR

36p - Exploring Enzyme-like Catalysis of Metal Organic Super Containers

Alexis Red Owl (1)*, Zhenqiang Wang (1), Bing Gao (1), Parvathi Jampani (1), Zhenqiang Wang (1)**, alexis.redowl@usd.edu
(1) University of South Dakota

SD EPSCoR/BioSNTR

37p - Development of a Microscope-Guided Unroofing Method to Reveal Nanoscale Cell Architecture Using Correlated Fluorescence and Atomic Force Microscopy

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(1) South Dakota School of Mines & Technology

Abstract: Endocytosis is an essential cellular process that results in the internalization of extracellular macromolecules. Clathrin-mediated endocytosis involves clathrin molecules collecting at the membrane, forming a triskelion structure that invaginates cargo forming endosomes. Upon maturation, dynamin cuts the endosome, forming a clathrin coated vesicle. Here we demonstrate an unroofing process that allows us to use advanced microscopy techniques to visualize the intracellular membrane and machinery at work during endocytosis. The unroofing process applies ultrasonic waves that peel off the membrane, exposing the inner membrane. Unroofing allows us to use epifluorescence and atomic force microscopy to image the cytoplasmic side of the membrane, visualizing the membrane architecture with nanometer precision.The resulting method should allow us to characterize the phenotype of specific gene knock-outs of select proteins mediating endocytosis.

REU: Technical Experience in Advancing Modeling Sciences (TEAMS) (SDSMT), SD EPSCoR/BioSNTR

38p - The use of multi material 3D printing to model the effects of actin fibers on cell mechanics

Chase Wallace (1)*, Zhongkui Hong (1)**, cwllce9@gmail.com
(1) University of South Dakota

Abstract: The goal of this research project was to 3D print models of different cell and tissue types with various materials in order to display how the structure of these cells and tissues affects their mechanics. These models were used to test, and confirm, our hypothesis that the cell mechanics are closely related to the architecture of sub-membranous cytoskeleton, such as cytoskeletal fiber density and orientation. In addition, these 3D models will also be used as a teaching aide with students for our outreach program to demonstrate how the principles of physical science apply on the biological system to regulate the mechanical functions of the cells and tissues. These 3D models are unique because they include various materials, ranging from a basic polylactide (PLA) for structural purposes, to the flexible polyurethane materials for soft tissue and cell structure.

SD EPSCoR/BioSNTR

39p - The immunological regulation of preterm birth

Tania Rodezno (1)*, Sarah Westerman (1), Sarah Stein (1), Jennifer Gubbels (1)**, tgrodezno15@ole.augie.edu
(1) Augustana University

Abstract: 5 groups of pregnant women were studied. Blood samples were acquired, neutrophils were isolated, and their activation in response to different chemoattractants was measured via flow cytometry and fluorescent microscopy.

BRIN - Augustana University, SD EPSCoR/BioSNTR

40p - Molecularly Imprinted Polymers

Rebecca Goertzen (1)*, Alec Lamoreux (2), George Mwangi (1)**, rebecca.goertzen@usiouxfalls.edu
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Abstract: Molecularly imprinted polymers have been considered advantageous compared to biological systems due to their specific recognition properties. Thus, they could be used in various drug delivery or detection techniques. In this work, dopamine was used as the analyte for the polymers. Different formulations were synthesized to determine the optimal ratio of the five components, which were the template molecule (dopamine), functional monomer (ITA, HEMA, TFMA, and AA), porogen (4:1 methanol:water), cross linker (TRIM and MBA), and initiator (AIBN). The ideal polymer will have specificity and maximal template recognition. Analysis of these effects were performed using UV-Vis at =287nm and HPLC at =222nm. In addition, contact and soxhlet extraction techniques were compared to evaluate the removal efficiency.

BRIN - University of Sioux Falls

41p - Ion-Selective Electrodes Based on Metal-Organic Supercontainers

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Abstract: Ion-selective electrodes (ISEs) are analytical tools that allow the sensing of ions and are widely used for analysis in clinical, environmental, industrial, and laboratory settings. ISEs often utilize an ionophore, a structure that binds to the target ion and creates an electrochemical signal which can be measured. Most traditional ionophores are able to bind small elemental and inorganic ions, but are unsuitable for targeting larger molecular ions, limiting the uses of ISEs. Metal-organic supercontainers (MOSCs) represent a new class of receptor molecules that consist of endo- and exo-cavities, which are able to bind molecular ions and serve as a new type of ionophore. In addition, MOSC structures are highly tunable and their cavity size and ion-binding affinities can be systematically modulated. In this presentation, we show that by utilizing cationic MOSC as an ionophore, the ISE exhibits good sensitivity to anions such as NO3-, but no sensitivity to cations.

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

42p - Computational Modeling of Luminescent Anthraquinone Chemosensors

Andrew Reuter (1)*, Bess Vlaisavljevich (1)**, reutean@gmail.com
(1) University of South Dakota

Abstract: A family of anthraquinone ligands has been designed for use as heavy-metal detecting luminescent chemosensors. While the 1,8-anthraquinone-18-crown-5, 1,8-anthraquinone-18-dithiacrown-5, and 1,8-anthraquinone-18-trithiacrown-5 ligands have been experimentally characterized and shown to detect Ca, Cd, Hg, and Pb, a computational study has not been performed to understand the photophysical process. Our study focuses on ten ligands, three of which have been synthesized, and six metals. First free energies of binding for each metal were calculated. The effect that changing the metal or ligand has on the geometry and the energetics of metal binding was evaluated. For select systems calculations were preformed to determine the nature of the excitations observed in UV-Vis spectroscopy. Future work will examine these transitions for all of the ligand systems as well as explore the transitions involved in luminescence. Our objective is to predict these photophysical processes in the systems that have not been confirmed experimentally.

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

43p - The Reduction of Energy Requirements from C-F Bonds through Ambiphilic Ligand Coordination Complexes

Alexander McNally (1)*, Haley Rust (1), Hope Juntunen (1), James Hoefelmeyer (1)**, alex.mcnally@coyotes.usd.edu
(1) University of South Dakota

Abstract: Fluorine has been increasingly used in pharmaceuticals and agriculture, but C-F bonds pose an issue since they act as energy barriers during organic synthesis reactions. In response, this research is dedicated to determining methods of more efficient C-F bond activation. Bond activation occurs when chemical bonds are weakened or cleaved, and there are already known catalysts that would initiate this specific bond activation. By using Lewis acid assisted oxidative addition of C-F bonds, however, lower energy requirements and catalyst activity improvement could be achieved. Our work consists of: creating an ambiphilic ligand coordination complex capable of activating C-F bonds in hopes of developing a synthetic method more easily utilized by chemists for organic molecules. We have been working towards the synthesis of (quinolin-8-yl) dimesitylborane as the ambiphilic ligand in our metal complex of Nickel or Palladium and we will continue to work towards C-F bond activation.

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

45p - Detecting Protein-Protein Interactions in the Corticosteroid Synthesis Pathway in Vertebrates

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

Abstract: Here we study the corticosteroid synthesis pathway in order to understand how the regulation of biochemical pathways can change throughout evolution. Most mammals have a single enzyme, CYP11B, which produces the corticosteroid hormone aldosterone in the exterior layer of the adrenal cortex and the hormone cortisol in the interior layer. The specific production of these hormones in different tissues is thought to be accomplished through allosteric regulation by another enzyme, CYP11A, which is only present in the interior layer of the cortex where cortisol is produced. It is thought that the presence of CYP11A changes the function site of CYP11B, causing the preferential production of cortisol over aldosterone. Here we used Forster Resonance Energy Transfer (FRET) to determine whether CYP11B and CYP11A physically interact and whether or not that interaction would contribute to the allosteric regulation of this pathway.

BRIN - Augustana University

46p - Variation in Egg Size and Lifetime Fecundity in 200 DGRP2 Drosophila melanogaster Lines

Wyatt McLeod (1)*, Tristan Roy (1), Hayley Brands (1), Cecelia McLeod (1)**, wjmcleod16@ole.augie.edu
(1) Augustana University

BRIN - Augustana University, SD EPSCoR/BioSNTR

47p - Using Surface-Enhanced Raman Scattering of Gold Nanostars for Encoding Molecular Information

Samantha Curry (1)*, Yifeng Huo (1), Chaoyang Jiang (1)**, samantha.curry@coyotes.usd.edu
(1) University of South Dakota

Abstract: Increases in the selling of illicit goods warrant a subsequent need for even more sophisticated methods to prevent counterfeit products from being sold. Surface-enhanced Raman spectroscopy (SERS) has the potential to be a powerful tool to thwart counterfeiters because the unique security tags fabricated with this method are difficult to reproduce without knowing the “secret” recipes used in their preparation. In this work, gold nanostars are used as surface-enhancement substrates since their branched structure allows for strong coupling between the light and plasmonic nanoparticles. As a result, Raman signals of trace amount of chemicals can be easily detected. The gold nanostars were used with different combinations of probe molecules so that unique anti-counterfeiting tags can be created. The reproducibility and uniformity of the SERS spectra for these tags were analyzed using principal component analysis (PCA). These SERS tags have a great potential for a variety of anti-counterfeiting applications.

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

48p - Identification of conserved 5’UTR regions required for heterocyst formation

Jeffrey Koller (1)*, Trevor Van Den Top (1), Ruanbao Zhou (1)**, jeffrey.koller@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Anabaena PCC 7120 is a cyanobacterium that is photosynthetic and can also fix atmospheric nitrogen in specialized terminally differentiated cells titled heterocysts. Several genes associated with this change have been identified; unfortunately, little research has been done into how these genes are regulated. This project focuses on a bioinformatic analysis of the promoter region of confirmed heterocyst forming genes to locate highly conserved sequences, called motifs, located within these regions in the genome. After motifs have been identified, the validity of these motifs will be evaluated by comparing a native and mutated motif placed upstream of a green fluorescent protein reporter in E. coli. The confirmation of the native and mutated motif will be through the use of fluorescence microscopy.

SD EPSCoR/BioSNTR

49p - Cytotoxicity of Airborne Particulate Matter in Murine Microglial Cells

Mikayla Street (1)*, Nathan Stadem (1), Lucas Merrill (1), Paula Mazzer (1), Paula Mazzer (1)**, mikayla.street.16@dwu.edu
(1) Dakota Wesleyan University

Abstract: Airborne particulate matter has been linked to neurodegeneration in recent epidemiological studies. Previous work in our lab has shown that different types of particulate matter elicit different reactions. We set out to investigate two different particulate matter types in microglial cells to see whether they would have the same effect in different types of neurological cells. The two particulate matter types were considerably more toxic to microglial cells than astrocyte cells. The results may indicate a different mode of cell death in microglial cells than in astrocyte cells.

BRIN - Dakota Wesleyan University

50p - Adhesion Energy Testing of Silica Beads

Kathryn Bozer (1)*, William Cross (2)**, kbozer@mtech.edu
(1) Montana Tech and South Dakota School of Mines and Technology, (2) South Dakota School of Mines & Technology

Abstract: The main motivation for this research is to determine the viability of a dry process for mineral beneficiation. This research began last summer as creating an adhesion testing device, but no quantitative data was collected. This summer’s project used the same adhesion testing device, while also establishing the protocols to gather all other data necessary to calculate adhesion energies using the Johnson-Kendall-Roberts (JKR) theory. The JKR theory allowed for the determination of the adhesion energies of hydrophilic, hydrophobic, and untreated spherical silica beads on hydrophilic and hydrophobic treated glass disks. Once sufficient data is calculated a model will be made of the spherical silica beads in order to help understand more complex shapes of ore and other particles of interest.

REU: Back to the Future III (SDSMT)

51p - Disruptive Potential of Illicit Supply Chain Members

Haley Marini (1)*, Saurav Kumar Dubey (2)**, marinihaley@yahoo.com
(1) University of Maryland and South Dakota School of Mines and Technology, (2) South Dakota School of Mines & Technology

Abstract: Law enforcement agencies have prioritized efforts to mitigate distribution of illicit substances in response to opioid epidemic facing the United States. Transnational drug cartels establish collaborations with semi-controllable organizations to sustain an illicit supply chain engaged in transportation of illicit goods. Meanwhile, ease of access to illicit drugs by consumers via dark web has disincentivized illicit supply chain members from being part of a centralized criminal enterprise. The study proposes a measure for the propensity of a supply chain member to induce disorder within the drug cartel. Disruption is defined as the interruption of flow of goods when a member chooses to disengage from the drug cartel. Considering a supply chain member as a player and groups of supply chain members as coalitions, the tendency to disassociate from the grand coalition encompassing all players is quantified. Understanding disruptive potential of an illicit supply chain member will facilitate effective counter-intelligence operations.

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

52p - Lattice Light Sheet Microscope Imaging of Cell Adhesion Proteins on Transparent TiO2 Nanotubes

Deanna Diaz (1)*, Jevin G. Meyerink (2), Brandon L. Scott (2), Scott T. Wood (2), Grant A. Crawford (2), Grant Crawford (2)**, deannadiaz@ku.edu
(1) University of Kansas, (2) South Dakota School of Mines & Technology

Abstract: Titanium dioxide nanotubes (TiO2 NTs) have been applied on surfaces of titanium-based orthopedic implants due to their influence on cell adhesion proteins, resulting in less implant rejections. Altering the topographical features of TiO2 NTs affect cellular characteristics and cell fate. However, the mechanisms by which TiO2 NTs influence cells is unexplained. A procedure to obtain high-quality 3-D images of cell adhesion proteins on transparent TiO2 NTs using lattice light sheet microscopy (LLSM) was successfully developed. Filamentous actin (f-actin) and focal adhesion kinase (FAK) were studied in pre-osteoblast mouse cells (MC3T3-E1). TiO2 NTs with outer diameters of 51 ± 5 nm were fabricated via anodization for this procedure. Results show initial cell adhesion occurring within 10 minutes with rapid outgrowth occurring after 20 minutes. This method is expected to allow for enhanced imaging of various cell adhesion proteins to determine the mechanisms by which TiO2 NTs influence cell growth and differentiation.

REU: Back to the Future III (SDSMT)

53p - Historical Pipe Tomahawk Analysis

Christian Knutson (1)*, Madison Phelps (2), Dr. Jon Kellar (3), Dr. Grant Crawford (3), Grant Grawford (3)**, knutson.christianj@yahoo.com
(1) Black Hills State University, (2) Oglala Lakota College, (3) South Dakota School of Mines & Technology

Abstract: We report on the scientific and cultural analysis of a pipe tomahawk that exists in the holdings of the Heritage Center at Red Cloud Indian School. While the item was donated to the Heritage Center in 1985, limited information is available on this item. As such, this analysis was conducted to determine the authenticity of the item while also determining the provenance, materials and methods of fabrication, and historic and cultural context for this item. Chemical analysis of the various materials comprising the pipe tomahawk was conducted using x-ray fluorescence, laser induced breakdown spectroscopy, Fourier-transform infrared spectroscopy, and Raman spectroscopy. Consultation with geologists and paleontologists was performed to determine the type of bones and shells used in construction of the tomahawk. In addition, cultural analysis was accomplished through consultation with cultural and historic experts in addition to literature review.

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

54p - Optimizing Lipid Extraction in Anabaena

Hope Menning (1)*, Paula Mazzer (1)**, hope.menning.14@dwu.edu
(1) Dakota Wesleyan University

Abstract: Lipidomics provides a great snapshot technique to determine how the lipids work in a cell. We do not know a lot about the lipids of cyanobacteria. We set out to optimize an extraction protocol so we can start figuring this out. Our best extraction by mass is with a 10 minute sonication step with a modified Blight and Dyer technique.

BRIN - Dakota Wesleyan University

55p - Ligand-Centered Borenium Reactivity in Triaminoborane-Bridged Diphosphine Complexes

Clara Kirkvold (1)*, Kyounghoon Lee (2), Scott R. Daly (2), Bess Vlaisavljevich (1), Bess Vlaisavljevich (1)**, clara.kirkvold@coyotes.usd.edu
(1) University of South Dakota, (2) University of Iowa

Abstract: Chemically-reactive borane ligands are of high interest for the development of ligands with borenium ions to promote multi-site reactivity in metal complexes. We present a series of ligand centered reactions at a borenium center on a metal complex, ^{Ph}(TBDPhos)MCl₂ (M=Ni and in select cases Pt). The thermodynamics of the reactions of several small molecules were studied with density functional theory. For select cases, the reaction mechanism is computed. Our objective is to understand the role of a labile chlorine ligand and the isomerization of the observed product (only trans-addition is observed experimentally). Results suggest that the labile chlorine plays an important role in the observed reactivity and that thermodynamics drive the product formation. To understand this, additional complexes were studied where either the chlorine ligands are replaced with stronger coordinating ligands or the substituents on the ligand itself are modified.

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

56p - Low-Cost Carbon-Based Supercapacitors via One-Step Thermochemical Conversion

Erin Lee (1)*, Matthew J Hummel (1), ZhengRong Gu (1)**, lee.010198@gmail.com
(1) South Dakota State University

Abstract: A supercapacitor is an energy storage device which stores electricity in an electric field rather than chemicals bonds, as in lithium ion batteries. Supercapacitors in comparison to standard lithium ion batteries have a faster charge time, longer cycle life, and a higher specific power. The electrodes of high-performance supercapacitors are typically made of carbon-based materials such as high-surface area activated carbon and graphene that has been converted from graphite. I have utilized a one-step thermochemical process to convert lignin, an abundant byproduct of the paper and ethanol industries, into a graphene-like material performing at >150 F/g. This has effectively created a low-cost alternative to current supercapacitor technology.

SD EPSCoR/BioSNTR

57p - The Impact of Agriculture and Development in the Micropolitan Community of Yankton

Pamela Jackson (1)*, Meghann Jarchow (1)**, tug32677@temple.edu
(1) University of South Dakota

Abstract: One of least populated regions in the US is the Upper Missouri River Basin (UMRB). Land in this region is used primarily for agriculture. Yankton, an area within the UMRB, is experiencing changes due to a potential conflict between two social values, agriculture and urban development. Yankton is classified as micropolitan because it is “an urban area with a population of at least 10,000 but less than 50,000.” The purpose of my research is to determine how Yankton residents’ views are shaped by the extent to which they value crops for animal food and development. To answer this question, I conducted surveys on values. Of the residents surveyed 93% valued crops, and 80% valued development. How the community plans to provide services and opportunities will determine Yankton’s future.

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

58p - Evaluating Copper(I) Bisphenanthroline as a Photoredox Catalyst in Enantioselective Reactions

Grace Baumgarten (1)*, Cheyloh A. Bluemel (1), Katrina Jensen (1)**, grace.baumgarten@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Photoredox reactions involve the use of photocatalysts to initiate oxidation-reduction reactions, which can be used to synthesize chiral small molecules. We are evaluating the effectiveness of a copper(I) catalyst compared to a ruthenium catalyst in reactions that are enantioselective and couple aldehydes with alkyl bromides. We chose copper because it is more abundant on earth and is cheaper than ruthenium. These reactions require visible light for at least 6 hours, due to the photocatalyst. The product is purified via column chromatography and characterized using Nuclear Magnetic Resonance (NMR) Spectroscopy to determine if the desired product was produced. High Performance Liquid Chromatography (HPLC) was used to determine the enantiomeric ratio of the products. Upon running these reactions with a variety of different aldehydes, we obtained the desired products in up to 79% product yield.

BRIN - Black Hills State University

59p - Synthesis of Phenyl-Substituted Phthalimides and Phthalaldehydes

Colewyn Knoblich (1)*, David Hawkinson (1)**, cole.knoblich@coyotes.usd.edu
(1) University of South Dakota

Abstract: Phthalimide-based compounds have been shown to have numerous useful applications, including preparation of substances with a variety of pharmacological activities, photochemical cyclization via singlet electron transfer reactions and preparation of polymers with unique electrochemical properties. While a plethora of N-substituted phthalimides have been prepared, relatively little work has been done on substituting the phenyl ring. In this paper we describe the synthesis of the ethyl ester of 6-methyl-2-benzofuran-1(3H)-one-7-carboxylic acid and its reactions with aliphatic amines to yield 3-hydroxymethylphthalimides. The 3-hydroxymethyl group can then be transformed to a variety of other functional groups by nucleophilic substitution. Current work also focuses upon conversion of the phthalimides to ortho-phthalaldehydes and examination of their potential as reagents for trace analysis of amino acids and other biological amines via formation of fluorescent adducts.

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

60p - Modeling Smooth Brome (bromus inermus) in Reconstructed Prairies

Daniel Whirlwind Soldier (1)*, Meghaan Jarchow (1)**, daniel.whirlwindsold@coyotes.usd.edu
(1) University of South Dakota

Abstract: Understanding how Smooth brome interacts among native plant species and timing of disturbance can offer information for Smooth brome management in prairie ecosystems. Timing of disturbance and plant community composition can affect plant functionality along with the introduction/management of a problematic invasive species. Looking at the interactions of Smooth bromes abundance in different plant functional groups and disturbance time will aid in the management of the invasive species. The purpose of this research is to model and describe diversity and timing of disturbance can be used to suppress smooth brome in reconstructed prairie ecosystems.

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

61p - Comparative Analysis of the Tumoral Effects on Gene Expression in Different Subgroups of Medulloblastoma

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(1) University of South Dakota

Abstract: Medulloblastoma, a cancerous pediatric brain tumor, consists of at least four subgroups: SHH, WNT, Group 3, and Group 4. Each of these subgroups may be distinguished from one another by their mutations, aberrations, transcriptional profiles, and clinical outcomes. While each subgroup of medulloblastoma is distinct from one another, the extent of the effects on the cellular mechanisms resulting in medulloblastoma formation is not clear. Comparative genomics allows researchers to compare the genomic features of different organisms to one another. In this project, comparative analysis was performed between tumor samples obtained from humans and mice as a way to explore the potential effected genes that may be similar or different among the different subgroups.

BRIN - University of South Dakota

62p - An Analysis of the FIRMS Model

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Abstract: Fast Isometric Ratio Mass Spectrometry (FIRMS) is a new analytical process for solving the isotopic ratios of compounds. FIRMS, using a nonlinear solver, adjusts isotope ratios so that the difference between the experimentally measured abundances and the calculated abundances, by FIRMS, are minimized. The isotope ratio solutions should have zero percent difference between the calculated and the experimental abundances, indicating the correct isotopic ratios of the experimental data have been found. However, the solution does not always obtain a zero percent difference. Thus, this research was conducted to determine why FIRMS is not able to find solutions with zero percent differences through an analysis of the mathematical model in FIRMS. Through the creation of experimental data, the research showed that FIRMS was able to handle certain molecules better than others. Research also identified where error is most likely introduced in the calculations and what calculation series FIRMS handles best.

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

63p - Consequences of hybridization between two native milkweed species (Asclepias) in their natural hybrid zone

Avery Selberg (1)*, Noah Hanson (1), Carrie F Olson-Manning (1), Carrie Olson-Manning (1)**, agselberg14@ole.augie.edu
(1) Augustana University

Abstract: Hybridization between distinct species is common and can be an important mechanism to new introduce adaptive traits, reinforce species boundaries, or even facilitate the generation of new species. Here we are studying the phenotypic consequences of hybridization between two species of milkweed that grow in the Western (Asclepias speciosa) and Eastern United States (A. syrica). In addition to mostly different geographic locations, these species have diverged in a number of important phenotypes including: production of defense compounds and flower morphology. The ranges of these species overlap in the central U.S. and we measured floral characters of A. speciosa and A. syriaca across two transects that span the region of sympatry. Measures of floral traits suggest hybridization with repeated backcrosses to the parental species. This ongoing hybridization can facilitate the introgression of adaptive alleles, including defense compounds and drought tolerance between these species.

BRIN - Augustana University, SD EPSCoR/BioSNTR

64p - In Vivo Antibacterial Analysis of MRSA Acetate Kinase Inhibitors

Christopher Wixon Wixon (1)*, Chun Wu (1)**, chrwix28@mtmc.edu
(1) Mount Marty College

Abstract: The current epidemic of Methicillin-resistant Staphylococcus aureus (MRSA) infections has pushed the demand for alternative antibiotics. Bacterial central metabolism was suggested as a potential drug target. Our previous study has identified MRSA acetate kinase (ACK) as one of the promising drug targets. This enzyme was cloned, expressed, purified and characterized in our lab. High throughput inhibitor screening of 10,500 compounds against MRSA ACK identified 38 inhibitors with IC50 values less than 50 μM, among which 17 with IC50 values less than 10 μM and 12 with IC50 values less than 5 μM. In this study, comparative analysis of antibacterial activity of 56 MRSA ACK inhibitors was conducted against Staphylococcus aureus, Bacillus, and Escherichia coli by Kirby-Bauer disk diffusion method. 15 tested MRSA ACK inhibitors exhibited selective antibacterial activity against Gram-positive bacteria Staphylococcus aureus and Bacillus without influencing Gram-negative bacteria Escherichia coli. The leading inhibitor demonstrated the zone of inhibition of 18.3 ± 0.6 mm and 14.00 ± 0.00 mm against Staphylococcus aureus, and Bacillus, respectively.

BRIN - Mt. Marty College

65p - Background Control in the LUX-ZEPLIN Dark Matter Experiment

Brett Clark (1)*, Brianna Mount (1)**, clarbret@mail.gvsu.edu
(1) Black Hills State University

Abstract: LUX-ZEPLIN is a next generation experiment with the goal of reaching world-leading sensitivity to directly detect WIMP dark matter. As such, background control is of the utmost importance. An essential element to understanding the background in LZ is knowing the amount of dust on the apparatus. Dust is both radioactive enough to cause background itself and also can contribute to radon and radon progeny plate out on surfaces throughout the device. Thus dust analysis of glass microscope slides is employed to further our understanding of dust deposition. This poster gives a brief description and goal of LZ with a listing of pertinent sources of background. It then goes further into the process of dust analysis and the importance of meticulous cleanliness. Further research could quantify the correlation between the dust density in the air and the plate out on various surfaces in the experiment.

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

66p - Investigating the Connection Between Volcanic Eruptions and Environmental Perchlorate

Joseph Gibson (1)*, Amanda Shea (1), Jihong Cole-Dai (1)**, joseph.gibson@jacks.sdstate.edu
(1) South Dakota State University

Abstract: Perchlorate (ClO_4^-) is an environmental contaminant. Currently, little is known about how natural (i.e., not involving anthropogenic emission of organic chlorine) perchlorate is formed. However, we do know that volcanic eruptions have a significant impact on the amount of natural perchlorate in the environment. Quantifying the flux of perchlorate from volcanic activity is important to understanding the natural processes which form perchlorate. Volcanic eruptions can be identified in ice cores by elevated levels of sulfate. Ice cores obtained from Summit Station, Greenland were used to study the relationship between volcanic sulfate and perchlorate for five different eruptions. The ice cores were dated using an annual layer counting method. The results suggest a linear relationship between perchlorate flux and that of volcanic sulfate. More eruptions should be studied in order to verify this relationship.

SD EPSCoR/BioSNTR

67p - Comparison of Water-Related Traits Between Asclepias speciosa and Asclepias syriaca

Grady Carlisle (1)*, Emma Miller (1), Steven Matzner (1)**, gscarlisle15@ole.augie.edu
(1) Augustana University

Abstract: Asclepias syriaca and Asclepias speciosa are two species of milkweed, both found in South Dakota. A. syriaca is native to the eastern side of the state and A. speciosa to the west. South Dakota experiences a strong moisture gradient, with the east receiving >66 cm precipitation/year and the west receiving <43 cm. We hypothesize that water-related traits play a role in the observed distribution of these species. This study measured transpiration rate, stomatal density, stomatal length and trichome density. The two species differed, with A. speciosa tending to have smaller stomata, higher stomatal density and greater trichome density. Stomatal density was found to be positively correlated with trichome density, and stomatal length was found to be negatively correlated with stomatal density and trichome density. These differences in water-related traits may suggest a mechanism important in explaining their distribution.

BRIN - Augustana University, SD EPSCoR/BioSNTR

68p - Making Metal (Pd)-Metalloid (Te) Alloy from Organometallic Precursors Under Ambient Conditions

Kathryn Goerl (1)*, Kadarkaraisamy Mariappan (1), Andrew G. Sykes (1), Kadarkaraisamy Mariappan (1)**, kathryn.goerl@usd.edu
(1) University of South Dakota

Abstract: A palladium-tellurium alloy nanomaterial was synthesized in one-pot by mixing allylpalladium (II) chloride dimer and dppp analogue of Te. PdxTey nanomaterials were characterized through PXRD and SEM. The PXRD data suggests that the chemical composition includes Pd13Te3 and PdTe2, the latter being the major product. A redox reaction through free radical is responsible for the formation of the alloy. Other organic compounds from the redox reaction were isolated and characterized by NMR. The PdTe2 - Pd13Te3 nanomaterial may act as a heterogeneous catalyst for a C-C coupling between an aryl halide and an alkene, also known as the Heck reaction.

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

69p - Understanding the Biochemical Nature of Rumen Un-degradable Protein in Animal Feed

Brianne Haskell (1)*, Andrew Manning (2)**, bkhaskell16@ole.augie.edu
(1) Augustana University, (2) Novita Nutrition

Abstract: Understanding protein in dairy feed and optimizing the nutritional value is of the upmost importance in dairy production. Previous research has deciphered a distinct difference in how protein is digested in ruminant animals. Rumen degradable protein (RDP) feeds protein to symbiont microbes in the rumen while rumen un-degradable protein (RUP) is passed to the small intestine. In further breakdown of RUP, dRUP is the %RUP that is absorbed within the small intestine, and therefore can be utilized by the animal. We focus on understanding the protein biochemistry that separates RDP from RUP, and RUP from dRUP. This understanding prompts development of diagnostic tests to selectively optimize production of protein in NovaMeal. Preliminary work has shown that levels of post translational modification correlate to RUP values. Further understanding of these modifications will allow us to better differentiate between RUP and dRUP.

BRIN - Augustana University

70p - Reproductive Biology and Trait Segregation in a Thistle Hybrid Zone

Cathryn Hester (1)*, Tyler Bortz (1), Tara Ramsey (1), Justin Ramsey (1), Justin Ramsey (1)**, cathryn.hester@yellowjackets.bhsu.edu
(1) Black Hills State University

Abstract: Interspecific hybridization refers to the crossing of different species, and it sometimes occurs naturally in the wild. This process creates new phenotypic combinations and provides insights into the genetic basis of trait differences. We studied a hybrid zone between two thistles, C. canescens and Cirsium undulatum, which on a six km transect shows a gradient of white to purple flower color. We assessed color of five floral structures (petals, anther, stigma, joint, and style) in ~300 plants across the hybrid zone to evaluate correlation of pigment phenotypes. There was a positive relationship between pigmentation of different structures. However, independent segregation was evident for all five traits suggesting that multiple genes regulate pigment expression. Field assays suggested that white and purple flowers produce foul and sweet scents, respectively, which may affect insect visitation. We identified diverse insects on thistle flowers during fieldwork, including species of orders Diptera, Hymenoptera, Lepidoptera, and Coloeoptera.

BRIN - Black Hills State University

71p - Synthesis of a Biphasic Micropatterned Well Array

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Abstract: Fabricating a cell scaffolding medium that hold cells in an environment that models their extracellular matrix in the body would provide more physiological results for cellular responses to external stimuli. Chondrocytes, the only cells found in articular cartilage, are surrounded by an extracellular matrix composed of proteoglycans and collagen II fibers. This project focused on synthesizing a biphasic structure composed of agarose hydrogel and polyvinyl alcohol (PVA) nanofibers to closely mimic the properties of proteoglycans and collagen II fibers, respectively. Agarose hydrogels were successfully produced and retained 98% mass after soaking in phosphate-buffered saline (PBS) for 28 days. PVA nanofibers were crosslinked and maintained an average diameter of 98 ± 3.2 nm which falls within the range of in vivo collagen II fiber diameters (20-200 nm). This PVA fiber-agarose hydrogel medium was found to have >90% optical transmittance, which should be optically transparent enough to facilitate high-resolution fluorescence imaging.

REU: Back to the Future III (SDSMT)

72p - Ceramide Signaling In Apoptosis

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

Abstract: Apoptosis is a complex process involving many different molecules that eventually leads to the programmed death of a cell. Ceramides are believed to function as a second messenger in this process, however the involvement of ceramides is still up in the air. Therefore we set out to measure the levels of ceramides produced by murine astrocyte cells during apoptosis. After trials performed on astrocyte cells, it can be concluded that ceramide levels are affected during apoptosis. We are interested in the role ceramides play in apoptosis of astrocyte cells because of the connection between apoptosis and neurodegeneration.

BRIN - Dakota Wesleyan University

73p - Modeling of Radioactive Background in Germanium Detectors

James Norwood (1)*, Kara Keeter (1), Kara Keeter (1)**, jsn150130@utdallas.edu
(1) Black Hills State University

Abstract: To attempt to learn if neutrinos are their own antiparticles by searching for neutrinoless double beta decay, detectors like the Majorana Demonstrator are installed deep underground. While well shielded, they can not be kept perfectly isolated, and radioactive contaminants generate a background signal in the collected data. Understanding the effects and sources of these background signals is vital to generating meaningful and accurate data. We simulated the effects of a common radioactive contaminant, radon, on a High-Purity germanium (HPGe) detector model. The goal of this project is to build a collection of data sets that will allow researchers to estimate the position of a radioactive contaminant by matching the background recorded in a HPGe detector with a similar, simulated, data set, which contains the position of the radioactive source.

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

74p - Synthesis, Characterization, and Electrochemical Properties of Schiff Base Monomers

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Abstract: The low energy density of traditional LiCoO2 cathodic material (272 mAh/g) has limited its 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 with theoretical capacity of 967 mAh/g. 1H NMR and GC-MS results show that we have successfully prepared the Schiff Base monomers with thiophene functional groups. Initial electrochemical study indicates multiple electron transfer reaction occurs during the reduction at about 2.5 V vs. Li/Li+ redox couple. Future work would focus on the optimization of polymerization condition of the Schiff Base monomer and to begin preliminary lithium 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)

75p - Certified Reference Material Analysis Using Inductively Coupled Plasma-Mass Spectroscopy

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Abstract: Inductively coupled plasma mass spectrometry (ICP-MS) has been demonstrated to be a useful strategy in determining ultratrace amounts of a specific elements in a sample. ICP-MS has clear advantages in its multielement characteristics, speed of analysis, detection limits, dynamic range, and isotope capability in a wide variety of fields including environmental, geological, biomedical, and nuclear applications. To ensure that the ICP-MS instrument is accurate, materials with certified concentrations of trace elements (CRMs) are tested against results produced in the ICP-MS lab. Sample preparation of the material is done through two distinct methods: solution digestion and pressed pellet formation used for laser ablation. These methods are used for sample introduction into the ICP-MS. Through these methods and results, we demonstrate the capabilities of ICP-MS and show if there are possible contaminations with the sample preparation.

BRIN - Black Hills State University

76p - Tile Drains and Food Chains: Tracking Selenium Uptake in Wetland Ecosystems

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Abstract: Increased agricultural activities, especially tile drainage systems, have recently caused concerns for wetland wildlife. Tile drains are outflows from underground pipes that drain directly into nearby wetlands. Wetlands connected to tile drainage systems can be subjected to a rapid release of selenium, which naturally occurs in the sediment. Previous studies have shown higher concentrations of selenium in wetlands that are directly connected to tile drainage systems (tile wetlands) compared to those that do not receive direct tile input (reference wetlands). Selenium is obtainable through dietary transfer and has the ability to accumulate in higher trophic levels. Though selenium is an essential mineral, high concentrations can be toxic to organisms in wetland ecosystems. Total selenium content was compared and analyzed in surface water and sediment, along with larval and emergent insects in the family Chironomidae to better understand the bioaccumulation and movement of selenium in the food web of wetland ecosystems.

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

77p - Association Rule Mining for Combined Microbiome Taxonomic and Functional Profiles

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Abstract: Using next-generation sequencing (NGS), both taxonomic and functional profiles can be obtained for a microbiome. However, integrative analyzing these two different types of data is a challenge. This study explores the applicability of the association rule mining to derive “microbial association rules” from combined taxonomic and functional profiles of a given microbial community. The taxonomic profile was inferred from 16s rRNA NGS data (OTU table). The functional profile was obtained from microbiome metatranscriptome data (COG table). While taxonomic profile tells us which microbes are present, functional profile inferred from metatranscriptome data indicates what specific genes are functioning in a specific microbial environment. The results of association rule mining on the combined two profiles give hints about which functional activities are driven by which specific microorganisms. Using real-world microbiome data, the efficiency of rule mining approach in deciphering multiple (biologically meaningful) association patterns involved by microbes and expressed genes is demonstrated.

SD EPSCoR/BioSNTR

78p - Identifying Additional Land Suitable For Food Production On The Pine Ridge

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Abstract: Honoring my Mentors: Wilmer Mesteth (Lakota Elder, Medicine Man and Uncle) and Dr. LaGarry, Hannan for mentoring me in Lakota Culture, Math, Science, Research, Art, Technology, Geography and Professional Development: Food Sovereignty is based upon the ability to have food security and be self-sufficient. Whether it is a Nation, an Indigenous Tribe, or a community. Producing foods, which will be made readily available to the Oglala Lakota people on the Pine Ridge Indian Reservation, will embrace cultural awareness of food as medicine, restore a healthy balance to individual lifestyle, strengthen food security, and create sustainability on the Pine Ridge Indian Reservation. These goals are dependent on the total available area for food production. This project seeks to fulfill these goals by examining the total available lands for food production as well as by identifying additional lands suitable for food production which may be utilized in the future.

REU: Bringing Us Together, Improving Communications and Lives (SDSMT), OSSPEEC

79p - Analyzing influences of habitat characteristic variation on turtle species in the Missouri River, South Dakota

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Abstract: Habitat alteration, fragmentation, and loss are among the largest reasons for declines in global biodiversity, and this is especially true for many turtle species. Turtle species in the Missouri River have been particularly susceptible to habitat modification (i.e. damming). Previous studies have explored the response of turtle populations to river modification. In our study, we analyzed how variation among habitat characteristics above and below the Oahe Dam, located on the Missouri River in central South Dakota, correlate with turtle species distribution and community composition. We hypothesized that specific habitat variables, such as abundance and type of basking sites, coincided with the presence of different turtle species. Our expected results are that that higher abundance of deadwood basking sites correlated with false map turtle (Graptemys pseudogeographica) presence, while high gravel shoreline abundance correlated with smooth softshell turtle (Apalone mutica) abundance.

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