



NCUR 2021 Proceedings

Fundamental Study on Desulfurization of Petroleum Using Synthesized Novel Ionic Liquids and Betaine Moieties

Chemistry - Time: Tue 11:00am-12:00pm - Session Number: 3519

Bryson Blad, Peyton Kiggins, Dr. Karl De Jesus, Dr. Kavita Sharma, Department of Chemistry, Idaho State University 921 S. 8th Ave. Pocatello ID 83201

Bryson Blad, Peyton Kiggins

With conventional light and middle crude oil production in decline, efforts have increasingly turned to heavy and extra heavy crude oils production. However, these oils contain a much greater proportion of sulfur- and nitrogen-containing heterocycles than lighter crude, which is resistant to current desulfurization and denitrogenation processes. These compounds not only contribute to emission of SO_x and NO_x pollutants upon combustion, but also create difficulties in crude oil production, transport, refinery and its conversion to useful petrochemicals.

This research will alleviate that problem by focusing on the ionic liquid extraction of five of the most prevalent heterocyclic compounds - thiophene, dibenzothiophene, alkyldibenzothiophenes, dibenzopyrrole (carbazole), and alkyldibenzopyrroles. By using a two-stage process that first separates the nitrogen-containing pyrroles from the sulfur heterocycles we hope to simplify the purification of individual components for later resale.

Our strategy is to use glycine-derived, tetraalkylammonium carboxylate betaines for the selective extraction of pyrroles taking advantage of the hydrogen bonding affinity of the pyrrole N-H to carboxylates. Subsequently, thiophenes will be extracted from the remaining crude using imidazolium ionic liquids. These ionic liquids will bear a tethered electron-poor aromatic ring, which will act in tandem with the electron-poor imidazolium core to π -stack with the electron rich thiophene core. The selectivity and extractive efficiency of each ionic liquid will be determined using a dodecane model system containing all five components and measuring the extraction content by spectroscopic means, primarily Nuclear Magnetic Resonance spectroscopy.

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Lower Limb Neuromuscular Activities of Gait in People with Traumatic Brain Injury

Exercise Science & Nutrition - Time: Tue 3:30pm-4:30pm - Session Number: 5024

Colton Belnap, Jong Sung, and Karen Appleby, Human Performance and Sports Studies, Idaho State University, 921 South 8th Avenue, Pocatello, Idaho, 83209

Colton Belnap

Gait is an essential task to facilitate proper life functioning and daily activities. During the gait cycle, different muscles in the lower limbs produce necessary movements. A normal task, such as walking can become very complicated for people who have suffered a traumatic brain injury (TBI). A TBI victim has suffered an injury to the brain that often inhibits properly relaying neural signals to muscles. Consequently, the TBI can cause walking impairment by changing how the leg muscles activate and can cause muscle co-activation or overactivation. Thus, this study aims to analyze the abnormalities of gait in TBI victims by monitoring muscular activity in the lower limbs. It is hypothesized that a TBI victim will have an abnormal walking pattern such as muscle co-activation of the quadriceps/hamstring muscles and overactivation of plantar flexors. To investigate our hypothesis, we will recruit ten ambulatory people (5 with TBI and gait impairment, and 5 healthy age and gender-matched controls). To assess the neuromuscular activities during walking in the study participants, electromyography (EMG) will be used. A total of 8 EMG sensors will be placed on the participants' right and left vastus lateralis, biceps femoris, anterior tibialis, and the gastrocnemius. Then, the participants will be asked to walk on a treadmill for 4 minutes at their comfortable speeds. Once the EMG signal is recorded during walking, the lower limb neuromuscular activities will be evaluated and compared between those with TBI and healthy age and gender-matched controls. It is anticipated that the agonist and antagonist muscle co-activations and muscle overactivation in gastrocnemius will be observed in people with TBI. The results will help give more insight into the effects of TBI on walking and improve the treatment plans for people with TBI.

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Acute Effects of Boxing, Cycling, and Dancing on Freezing of Gait in Parkinson's Disease

Health & Human Development - Time: Tue 3:30pm-4:30pm - Session Number: 5109

Liliana Rosales, and Dr. JongHun Sung and Dr. Karen Appleby, Department of Human Performance and Sport Studies, Idaho State University, 921 South 8th Ave. Stop 8105, Pocatello ID 83209

Liliana Rosales

Freezing of Gait (FOG) is a common disabling motor symptom in people with Parkinson's Disease (PD). FOG is described as akinetic, where no movement of the legs is observed. Patients experience a feeling as if their feet are glued to the floor. FOG frequently affects activities of daily life and results in falls and fall-related injuries. Previous studies have found that medications, surgery, cueing strategies, and physical activity decreased the symptom of FOG in people with PD. However, previous evidence provides valuable treatment suggestions, the effect of non-traditional therapeutic exercise programs including boxing, cycling, and dancing on FOG is not clear. Thus, the purpose of this study is to evaluate the efficacy of boxing, cycling, and dancing programs as a therapeutic exercise to decrease FOG in people with PD. A total of 40 participants who can walk and have FOG symptoms will be recruited. The participants will be randomly assigned to a boxing, cycling, or dancing program (10 subjects for each program). Then, they will be required to attend an assigned program two times a week for 12 weeks. The other 10 participants will be assigned to the control group (no exercise program). To evaluate each exercise program's efficacy on FOG, the Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS), FOG Trajectories Scale, and the Timed Up and Go (TUG) test will be administered one week before and after the program. We anticipate observing a significant reduction in the amount of time in the TUG test and improvements on the MDS-UPDRS and FOG Trajectories Scale in the study participants in the dance program. The dance program is expected to be the most effective on FOG reduction because dance involves choreography learning to a count and involves rhythmic music, which has a similar strategy that a cue training has.

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Comparative Neutron Radiography Analysis of Siliceous Marine Sponges: *Dragnacidon lunaecharta*

Ecology - Time: Tue 12:30pm-1:30pm - Session Number: 510

Amanda Smolinski, College of Science and Engineering-Biology, Idaho State Univeristy 921 S 8th Ave Pocatello, Idaho 83201 Dr. Joshua Kane, Glen Papaioannou, and Dr. Aaron Craft, Advanced Post Irradiation Examination and Characterization, The Idaho National Laboratory 1955 N. Fremont Avenue Idaho Falls, ID 83415

Amanda Smolinski

Climate change and anthropogenic pollution are causing rapid changes to the world's oceans and the ecosystems contained within them. Porifera (sea sponges) have been shown to be useful biomarkers for heavy metal accumulation. Traditional analysis requires the destruction of samples. Given the stress being placed upon marine species, this work seeks to create a viable process to evaluate heavy pollution without destroying the specimen, allowing it to be passed on to other researchers for further evaluation. Success of nondestructive analysis would allow for use of museum quality and other privately held historical specimens to be evaluated and returned to their owner. The data could generate historical and current maps of oceanic pollution to aid in generating future forecasts for the movement of pollutants and the development of successful remediation and marine habitat management strategies.

Six specimens of *Dragnacidon lunaecharta* were exposed to different concentrations of cadmium chloride contaminated sea water, to explore both the heavy metal uptake in the organisms and the capability of different imaging techniques. Cadmium was chosen due to its high neutron absorption cross section and its role as a highly toxic pollutant. Neutron imaging was performed at the Neutron Radiography (NRAD) reactor at Idaho National Laboratory using both digital and indirect film radiography. Multiple artifacts are visible in both sets of neutron radiography images. Comparison with neutron activation analysis data from previous experiments indicates these artifacts had a high probability of being cadmium. Prompt gamma analysis was performed at Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II) facility to confirm the identity if these artifacts. Neutron Computed Tomography, utilizing cold neutrons, was performed at the advanced neutron tomography and radiography experimental system (ANTARES-FRM II), to reveal the structure and distribution of the Cd deposits, allowing for volumetric analysis.

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Controls and Sources of Dissolved Organic Carbon in Intermittent Headwater Streams

Biology - Time: Tue 2:00pm-3:00pm - Session Number: 605

Tej Pandey, Kathleen Lohse, and Dr. Kathleen Lohse, Department of Biological Sciences, Idaho State University, 921 S 8th avenue, Pocatello Idaho 83209

TEJ PANDEY

Water extractable organic carbon (WEOC) accounts for the availability of dissolved organic carbon (DOC) and soil organic matter (SOM) in the stream headwater ecosystems. The availability and controls on water extract organic carbon and its links to streams are poorly characterized in intermittent streams. In this study, we dug soil pits to 1 m or refusal from 4 different habitats within Gibson Jack watershed in southeastern Idaho and sampled soils to analyze the availability of DOC and related this to pH and SOM. We hypothesized that the riparian habitat would have more WEOC than the other three habitats owing to higher SOM. We also hypothesized that higher pH would account for less dissolved carbon and SOM and WEOC would be positively correlated. To test these hypothesized mechanisms, we extracted soil for water extractable organic carbon by shaking the samples overnight, then filtered the samples using 0.45 μm AQUA Whatman filter [KAL1] [Clu2], and analyzed the samples on a Shimadzu TOC/TN analyzer. We found that the sagebrush habitat had higher pH values and lower SOM with depth compared to other habitats. WEOC decreases with depth in the sagebrush habitat. In contrast, WEOC values were higher in the riparian zone with depth. WEOC: SOM varies along the depth on all habitats, which partially supported our hypothesizes. Results suggested DOC availability depends on the soil characteristics especially SOM contents. Results supported that riparian accounts for more organic carbon pools which were more available than other habitats. Understanding DOC predicts the Carbon balance in these habitats.

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Landing Mechanics in Collegiate Athletes with Genu Recurvatum

Exercise Science & Nutrition - Time: Tue 3:30pm-4:30pm - Session Number: 5025

*Dani Mecham, Dr. Karen Appleby, Dr. JongHun Sung, Human Performance and Sport Studies
Department Idaho State University 921 South 8th Ave. Pocatello, ID 83209*

Dani Mecham

Jumping is a frequently performed task in sports such as volleyball or basketball. When jumping, the proper landing technique is extremely important to prevent lower extremity injuries. Improper landing techniques are demonstrated by more upright posture, forward momentum, increased valgus at the knee and greater hip extension, adduction, and internal rotation. Hyperextension of the knee, or genu recurvatum, is a deformity in the knee joint in which excessive extension occurs. Genu recurvatum could often lead to damage of the soft-tissue structure of the knees, such as the anterior cruciate ligament. There have been few biomechanical investigations examining a relationship between genu recurvatum and landing mechanics. Thus, the purpose of this study is to investigate the relationship between genu recurvatum and lower limb kinematics in landing using a 2- dimensional video analysis. It is hypothesized that one would be more prone to having improper landing mechanics when one has genu recurvatum. Thirty collegiate athletes who play basketball and volleyball between the ages of 19-22 who have not had knee surgery prior will be recruited. The study participants will be placed into two groups: (1) those who exhibit greater than -10 degrees of hyperextension and (2) those who exhibit less than -10 degrees. The participants will compete two maximum effort vertical jumps and two downward box jumps. Two high-speed cameras will be used to record/evaluate study participants' landing kinematics of the lower limb in the sagittal/frontal plane. It is anticipated that those with genu recurvatum will demonstrate improper landing mechanics based on the kinematics analysis. This study can lead to a greater understanding of how the genu recurvatum affects the athlete's landing techniques.

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Radio Frequency Identification Vibration Detection Using Long Short-Term Memory

Electrical & Computer Engineering - Time: Tue 2:00pm-3:00pm - Session Number: 4527

Barrett Durtschi, Janita Aamir, Dr. Paul Bodily, and Dr. Andrew Chrysler, Department of Electrical Engineering and Computer Science, Idaho State University, 921 S. 8th Avenue, Pocatello ID 83209

Barrett Durtschi, Janita Aamir

Radio frequency identification (RFID) is a low-cost and important part of the Internet of Things (IoT) technology and has applications in healthcare, inventory management, object detection, tracking, and more. Due to these many applications and attractive cost, RFID technology is being investigated for possible applications in smart-infrastructure such as vibration detection. In this research, we present a method of detecting vibration frequency using RFID technology. By implementing a Low-Level Reader Protocol (LLRP), we can receive the phase angle along with the received signal strength indicator (RSSI) that can be used for further analysis. We have chosen to execute our analysis through the use of a LSTM (Long Short-Term Memory) Network. LSTM Networks, a type of Recurrent Neural Network, are good for both long-term and short-term time-series predictions. The use of LSTM Network, in this application, will enable us to impute vibration frequencies from phase angle and RSSI data. This will help analyze the pattern of previously recorded RFID data readings and make reliable inferences for vibration frequencies. To make a situation in which the RFID data can be interpreted in an LSTM, we use a shake table with a piece of mounted concrete to simulate vibration. RFID data is then gathered by setting the movement of the shake table at several different frequencies. We then train an LSTM model on the recorded and labeled RFID data and use cross-validation to evaluate the network's accuracy at imputing vibration frequency from RFID data.

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Reducing the Mental Health Stigma in College Athletics: A Pilot Study

Health & Human Development - Time: Tue 3:30pm-4:30pm - Session Number: 5114

Zak Montoya, Dr. Karen Appleby, and Dr. JongHun Sung, Department of Human Performance and Sport Studies, Idaho State University, 921 S. 8th Ave, Pocatello ID 83209

Zak Montoya

Mental health within college athletics is critical topic of analysis. Ineffectively managing mental health issues can have detrimental effects on academic performance, athletic performance, and overall well-being. Considering the everyday responsibilities student-athletes face, ensuring they feel comfortable seeking out mental health resources is critical. Research on this topic will contribute to the existing body of literature regarding student-athletes and mental health by extending efforts to improve student-athlete mental health and well-being through destigmatizing the use of mental health resources. With this knowledge, athletic departments may modify their mental health education approach, how they teach mental health skills, and how they encourage the utilization of mental health resources. The purpose of this pilot study will be to identify existing barriers preventing collegiate athletes from seeking mental health resources and strategies that can be used to eliminate these barriers.

To investigate this issue, a pilot study will be conducted with 3-5 current collegiate athletes about their experiences and perceptions of seeking mental health support. To gather data, a survey will be distributed to student athletes on campus at a NCAA Division I institution in the Northwest region of the United States. This pilot study will help develop the protocol for a larger study, which will investigate the attitudes of collegiate student-athletes in seeking mental health support and what barriers they face in doing so. This study will impact student athletes with mental health issues by providing them knowledge and resources necessary to effectively deal with them. Further, the study results can help create an environment that emphasizes mental health importance and the importance of seeking help which will contribute to better overall health, and a more successful student athlete experience.

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Running Kinematics Analysis of Collegiate Long Distance Runners with a History of Iliotibial Band Syndrome

Exercise Science & Nutrition - Time: Tue 3:30pm-4:30pm - Session Number: 5026

D'Artagnan Kilgore and Dr. JongHun Sung and Dr. Karen Appleby, Department of Human Performance and Sport Studies, Idaho State University, 921 South 8th Ave. Stop 8105, Pocatello ID 83209

D'Artagnan Kilgore

Iliotibial band syndrome (ITBS) is a common overuse knee injury in long-distance runners causing lateral knee pain. Although there are many risk factors associated with ITBS, some biomechanical risk factors are modifiable through treatment and therapeutic exercise. These factors include, but are not limited to, excessive hip adduction, internal rotation of the hip/knee, and rearfoot eversion while running. Technology such as a 2 or 3-dimensional video analysis allows researchers to evaluate the kinematics (joint angle, velocity, etc.) in various human motions. Thus, the purpose of this study is to comprehensively assess the lower limb kinematics using a 2D motion capture system in collegiate long-distance runners with a history of ITBS and compare them to those without a history of ITBS. It is hypothesized that those with a history of ITBS will exhibit more risk factors associated with ITBS than those with no history. To investigate our hypothesis, 30 collegiate long-distance runners will be recruited. The runners will be divided into two groups: those with a recent ITBS history and those without a history of ITBS. Each runner will be asked to run for 30 minutes on a treadmill with different intervals at several speeds. To record and evaluate the runner's lower limb kinematics during running, two high-speed cameras will be placed in two locations: 1) the side of the treadmill to capture the motions occurring in the sagittal plane, and 2) the back of the treadmill to evaluate the movements occurring in the frontal plane. Once recorded, the runners' running kinematics will be examined to identify biomechanical risk factors associated with ITBS, including excessive hip adduction, internal knee rotation, rearfoot eversion, hip drop, and overstriding. It is expected that the group of runners with a history of ITBS will display one or more of these risk factors.

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Single-leg Balance and Pirouette a La Second Turns in Dancers

Dance - Time: Tue 12:30pm-1:30pm - Session Number: 4072

Kobi Alcocer, Karen M. Appleby, PhD, JongHun Sung, PhD, Department of Education, Idaho State University, 921 S 8th Ave, Pocatello, ID 83209

Kobi Alcocer

Many movements in dance are performed on one leg, such as turns. For example, a pirouette a la second, a common dance motion, is a turn that a dancer completes on one leg with the other leg extended straight out in front of one's body. To perform better dance turns, the single-leg balance may play an important role. Previous studies have shown that with a better single-leg balance, dancers can improve their overall performances and prevent injuries. However, the relationship between single-leg balance and a dance turn remains unclear. If the performance of a dance turn is associated with single-leg balance, turn motions could be more effectively performed or taught by improving single-leg balance. Thus, the purpose of this study is to investigate the association between single-leg balance and a pirouette a la second turn. It is hypothesized that individuals with better single-leg balance will have a higher pirouette a la second turn score.

A cross-sectional study will be performed on 30 collegiate dancers. The single-leg balance will be quantified in two ways: 1) a traditional posturography using a forceplate, and 2) a clinical balance test called the Star Excursion Balance Test. After the completion of these balance tests, each dancer will perform three rotations of pirouette a la second turns two times. These turns will be video recorded and scored by two experienced dancers using a customized rubric. Finally, correlation analysis will be utilized to assess the association between single-leg balance and a pirouette a la second turn. It is anticipated that there will be a correlation between balance and turn scores. This study will provide preliminary evidence on the association between single-leg balance and turns among experienced dancers.

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Traditional Hispanic Healthcare

Gender, Ethnicity, & Cultural Studies - Time: Tue 3:30pm-4:30pm - Session Number: 5054

Denver Dobson, Dr. Karen Appleby, and Dr. Jong Sung, Department of Human Performance and Sport Studies, Idaho State University, 921 S 8th Ave, Pocatello ID 83209

Denver Dobson

With the growing Hispanic population within the United States, providing proper healthcare to the Hispanic population, especially in rural communities, is a growing challenge facing modern medicine.

To address this issue, several barriers to Hispanic healthcare have been studied to provide potential solutions. However, the barrier created by cultural Hispanic beliefs has often been overlooked by other studies. The purpose of this research study is to gain an in-depth understanding of the cultural beliefs that create barriers preventing the Hispanic population within the United States from receiving adequate healthcare and to identify potential solutions.

To investigate cultural barriers arising from core Hispanic cultural beliefs/values as well as traditional medicinal practices, a qualitative pilot study will be conducted. A semi-structure interview will be performed with 1-2 key health care professionals who provide service to Hispanic individuals in rural communities. This pilot study will place emphasis on the prevalence and effects of cultural beliefs regarding traditional illnesses, medicine, and values. The participants interviewed should have experience with past Hispanic patients who had cultural beliefs that clashed with modern medicine practices impeding the healthcare process. Throughout this investigation, I expect to gain an in-depth understanding of the cultural barriers that impact Hispanic healthcare as well as their prevalence within communities in Southeast Idaho. Additionally, potential solutions to eliminate these barriers will be investigated.

By expanding our knowledge of cultural barriers facing the Hispanic population, health care providers can create a trusting and safe healthcare environment for the Hispanic population to know that they do not have to navigate the intimidating US healthcare system alone.

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Using Crowdsourced Observations to Study Road Mortality in Idaho's Amphibians and Reptiles

Biology - Time: Mon 3:00pm-4:00pm - Session Number: 2583

Julie S. Meredith, Patrick D. Giltz, and Dr. Charles R. Peterson, Department of Biological Sciences, Idaho State University, 921 South 8th Avenue, Pocatello ID 83209

Julie Meredith

Collisions with vehicles are an important source of mortality for many species of amphibians and reptiles. The objective of this study was to use crowdsourced observations to study taxonomic, temporal, and spatial variation in roadkilled amphibians and reptiles in Idaho. We searched over 8,000 records from museum specimens, Roadkill & Salvage Highway Mortality Reports from the Idaho Department of Fish and Game, a dedicated road mortality research project by Jochimsen (2006), and crowdsourced observations from the Idaho Amphibian and Reptile iNaturalist Project through 2019. Using text data (e.g., roadkill or DOR) from all sources and photographs from iNaturalist, we identified a total of 660 records, nearly 25% of which were crowdsourced. We summarized these records by taxonomic group (class, order, and species), geographic location, and time (year and month). There was an overwhelmingly high number of snake mortalities compared to all other groups, with Gopher Snakes (*Pituophis catenifer*) accounting for over 55% of all roadkill records. Three areas in Idaho have received the most research and roadkill observations, including (1) Snake River Birds of Prey National Conservation Area; (2) Portneuf watershed; and (3) the Idaho National Laboratory site, while there appears to be a lack of data from northern Idaho. The number of roadkill observations per month shows a bimodal distribution with peaks in the spring and fall. The number of observations per year is generally increasing over time, with crowdsourcing accounting for the majority of most recent observations. This information should be useful for efforts to reduce an important cause of mortality for these animals.

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