NMRS
New Mexico Research Symposium

Saturday, October 19, 2024
UNM Domenici Center, 1001 Stanford Dr NE
Albuquerque, NM

Oral and Poster Presentation Abstracts

2024 NMRS Partners

Agenda as of September 12th

Saturday, October 19, 2024
UNM Domenici Center, Albuquerque, NM

The New Mexico Research Symposium (NMRS) will be hosted in 2024 by the New Mexico Academy of Science (NMAS), held in conjunction with the New Mexico Science Teachers' Association (NMSTA) Fall Conference, and collaboratively organized with New Mexico's Established Program to Stimulate Competitive Research (NM EPSCoR). NMRS is an annual conference with oral presentations, a poster competition, and outstanding teacher awards. The conference is geared to undergraduate and graduate students from New Mexico's colleges and universities and to science teachers and faculty members.

8:00 – 9:00	**Registration** – North Wing, first floor, southside commons area
8:00 – 9:00	**Breakfast** – North Wing, third floor commons areas (self-serve)
9:00 - 10:00	**Poster set-up, Judges' Poster Preview, Networking** – North Wing, Room 3740
10:00 – 10:45	**NMRS Welcome** – Diane Peebles, President NMAS**, Keynote presentation** – "*Breaking Heisenberg – Controlling the Quantum World for Tomorrow's Technology*", Ivan Deutsch, UNM - Auditorium
11:00 – 11:45	**Oral presentations** – North Wing, Rooms 1735, 1742 to 1759
12:00 – 1:00	**Lunch** – North Wing, second floor commons areas (self-serve)
12:30 – 1:00	**NMAS General meeting** – Room 1735
1:00 – 2:45	**Poster presentations** – Room 3740
3:00 – 3:45	**Awards session and Closing** – NMAS Outstanding Teacher Awards, NMRS Undergraduate and Graduate Student Poster Awards - Auditorium

2024 NMRS Partners

ORAL SESSION: SPACE GRANT

North Wing, Room 1735

Brooks, Kevin

New Mexico State University

Key Words: Space Grant, Solar Physics, Heliophysics

Authors: Kevin Brooks; R.T. James McAteer

Long Timescale Solar Differential Rotation and Hemispherical Asymmetry

There have been many studies into the differential rotation rate observed on the sun, but many are over short periods of time or at a single temporal snapshot. Creating a function of rotation rate with respect to latitude is a very important undertaking regarding the evolution of magnetic fields which dictate solar activity and space weather. In a similar respect, my research seeks to utilize simple cross correlation or feature tracking algorithms to create mappings of rotation rates. Developing an efficient enough method to accomplish this can then be applied to many datasets over a solar cycle to determine what, if any, effects there are on solar rotation over the 11-year half cycle.

Escarcega, Mario

NM Institute of Mining & Technology

Key Words: Space Grant, High Altitude Platform Stations, Model Predictive Control, Reinforcement Learning

Authors: Mario Escarcega; Tyler Doyle

Adaptive Weight Tuning of a Model Predictive Controller for a Stratospheric Airship Using Reinforcement Learning

This work presents an approach to enhancing the station-keeping capabilities of high-altitude airships by augmenting Nonlinear Model Predictive Control (NMPC) with Reinforcement Learning (RL). High-altitude airships face significant challenges in maintaining their position due to strong and variable winds in the stratosphere. We propose an RL-augmented NMPC framework that dynamically adjusts the NMPC's parameters to improve disturbance rejection. The performance of the RL-NMPC was evaluated against a baseline NMPC in simulated wind conditions. Results show that the RL-NMPC significantly outperforms the baseline NMPC in challenging wind scenarios, particularly when the NMPC becomes unstable. While the RL-NMPC shows increased computational cost, its improved performance in difficult wind conditions suggests a promising trade-off. This study demonstrates the potential of reinforcement learning to enhance the robustness of airship control systems.

This research is based upon work supported by the New Mexico Space Grant Consortium (NMSGC) Space Grant Fellowship through a NASA Cooperative Agreement No. NM-80NSSC20M0034.

Goss, Kaitlyn

University of New Mexico

Key Words: Space Grant, Zircon, Apatite, Moon

Authors: Kaitlyn Goss; Adrian Brearley

Nano- and microstructures of apatite and zircon within lunar samples: Implications for endogenous volatile reservoirs and the age of the Moon

Through studying returned lunar samples, the scientific community has gained an extensive understanding of the formation and evolution of the Moon. However, there remains uncertainty regarding (1) the origin and evolution of the lunar endogenous volatile reservoir and (2) the age and formation of the primordial lunar crust and the Earth-Moon system. We can constrain these by studying and interpreting the micro- and nanostructures of the minerals apatite and zircon, both of which are found in lunar samples and have been used to examine endogenous lunar volatiles and reconstruct lunar chronology. Apatite is useful for constraining geochemical information, such as the volatile record, and zircon is useful as a geochronometer. Limited studies have been conducted to better understand the relationship between these mineral microstructures and the information they provide us with. However, it is imperative to study the microstructures of these minerals to correctly interpret their ages or geochemical information, as many features observable at the nanometer scale are not always apparent at a larger scale (i.e., secondary features caused by impact). We use the SEM to identify and locate mineral grains for study. Microstructures of these grains are first examined using EBSD, followed by extraction of FIB-sections which we study using TEM if necessary. This study works to establish a new body of knowledge that can be applied to interpret the geological history of a more diverse suite of lunar samples and hence contribute to maximizing the samples returned by NASA Artemis III mission.

This research is based upon work supported by the New Mexico Space Grant Consortium (NMSGC) Space Grant Fellowship through a NASA Cooperative Agreement No. NM-80NSSC20M0034.

Huscher, Ezra

New Mexico State University

Key Words: SPACE GRANT, cosmology, theory, supercomputer simulations

Author: Ezra Huscher

A Recipe for Simulating the Universe

In this talk, we explore how astronomers model the entire Universe from its humble beginnings. We will look at how modern supercomputers have made this possible, and how we ensure the simulations match reality. We will close with what work is still to be done as observatories like the James Webb Space Telescope are rewriting our understanding of how the Universe began...

ORAL SESSION: MOTION and DYNAMICS

North Wing, Room 1742

Alam, Unme Kawsar

New Mexico State University

Key Words: Variable arc length soft actuator; soft robotics exoskeleton; quasi-static model; partial feedback linearization

Authors: Unme Kawsar Alam; Mahdi Hagshenas-Jaryani

Modeling and Control of an Underactuated Soft Robotic Exo-digit Coupled to a Human Finger Model

This research presents the kinematics and quasi-static modeling of a soft robotic exo-digit designed to physically interact with a human finger model for trajectory tracking. The hybrid exo-digit, consisting of three soft segments between four semi-rigid blocks, is modeled as a quasi-static lumped system with constant bending curvatures and variable arc lengths. The material is characterized using Yeoh's third-order hyperelastic model, while the human finger is represented as a rigid multi-body structure with torsional springs at the joints to capture biomechanical stiffness. Coupled kinematics and quasi-statics are derived to model the multi-contact interactions between the soft robot and the finger. Experimental studies were conducted on single soft segments under both free and constrained motion, recording overall movement, lengthening, and bending angles. Similar studies were performed on the complete exo-digit interacting with the human finger. Theoretical models were validated experimentally and numerically, showing that the variable arc length model more accurately predicts experimental outcomes compared to a constant-length model. The coupled quasi-static equation is then used to generate a nonlinear discrete-time state-space representation for controlling the human finger's pose, with input-output partial feedback linearization ensuring asymptotic stability. Controller performance was evaluated through experiments and MATLAB simulations.

Aborah, Ebenezer

Eastern New Mexico University

Key Words: Abdominal obesity, Conductance, Diameter, Exercise, Contraction

Authors: Ebenezer Aborah, BS-PA, Morgan Miller, BS, Mathew Barlow, PhD

The difference in vascular conductance responses to the working muscles in the arms and legs during dynamic graded resistance exercise: a study in vascular sensitivity in abdominal obese vs. control

Background: Abdominal obesity is a serious global health problem affecting both adults and children and is directly linked to sedentary behavior. A previous study in our laboratory found differences in vascular dilatation and blood flow in young healthy and abdominal obese premenopausal women measuring the brachial artery conductance during dynamic handgrip exercise. Blood vessels in the arms and legs experience varying hydrostatic pressures and blood flow requirements, with hormonal differences in sex such as estrogen contributing to dilation of blood vessels and controlling blood flow. **Objective:** To determine if health-disparate metabolically compromised individuals will have impaired limb-specific blood flow as compared to a healthy population and also compare limb differences in vascular response to graded exercise in these varying metabolically compromised women. **Methods:** Participants will perform a handgrip and plantar flexion exercise using custom-built devices of graded resistance at a cadence of 30 contractions per minute. They start unloaded contraction and gradually increase the graded workload (Watts) every minute until task failure. Blood velocity and vessel diameter will be measured using a Doppler ultrasound in the brachial and popliteal arteries. **Expected Results:** The control group is expected to have increased vascular conductance response to dynamic graded exercise compared to the abdominal obese group. We expect an increase in vascular conductance in the proliferative phase compared to the menstrual and luteal phases. The tissues in the legs are expected to be under-perfused due to greater tissue volume than the arms and the abdominal obese group as seen in our previous study.

Valles, Ayla

New Mexico State University

Key Words: Snake-Like Robot, Pneumatic Artificial Muscle, Soft Actuator, Pneumatic Artificial-Muscle-Driven Limbless Locomotion, Agile Locomotion, Multi-Objective Optimization, Dynamics

Author: Ayla Valles

Dynamic Modeling and Multi-Objective Design Optimization for a PAM-Driven Snake Robot for Agile Locomotion

Robotic systems that are to be used for planetary space exploration need to be capable of overcoming the unpredictable terrains and extreme environmental conditions that are distinct to other planetary surfaces. This presentation entails an analysis on the dynamics, modeling, and multi-objective design optimization of a pneumatic-artificial-muscle-driven snake-like robot. PAM-driven locomotion will be introduced for a system comprised of a series of rigid links connected by antagonistic pneumatic-artificial-muscles (PAMs), where alternate actuation between these soft actuators causes rotational motion about the connecting joint of each module. The proposed hybrid design integrates flexibility and robustness to address the current challenges in adaptability, versatility, and optimal performance that conventional terrestrial space robots face when enduring extreme conditions of space exploration. Kinematics in both joint and Cartesian spaces with respect to the PAMs were derived for a PAM-driven robot. The Lagrange method was used for developing dynamic models and deriving the equations of motion of the system. Performance of the dynamic model was demonstrated through MATLAB simulation for an N-link robot. Additionally, a multi-objective design optimization was performed on the dynamic model to analyze the optimal geometric parameters of the linkages and dynamic properties of the model that would yield optimal forward velocity and power consumption. This research is based upon work supported by a NASA Research Initiation Award (RIA) grant award No. 80NSSC24K0839 and the New Mexico Space Grant Consortium (NMSGC) Space Grant Fellowship through a NASA Cooperative Agreement No. NM-80NSSC20M0034.

ORAL SESSION: BIOCHEMISTRY

North Wing, Room 1743

Benham, Allison

Sandia National Laboratories

Key Words: integrases

Authors: Allison Benham; Joseph Schoeniger; Jesse Cahill; Brittany Humphrey

Integrases for Everyone

During infection of the host cell, phages produce integrases and excisionases to insert or remove phage DNA at specific attachment (att) sites in the host chromosome. Of the two integrase protein families, serine integrases can accomplish these DNA rearrangements in the absence of other proteins, so they are widely used in genome engineering of highly diverse organisms. However, the more abundant tyrosine integrases require integration host factor (IHF) for function, limiting their use for biotechnology. The site specificity of integrases limits their use for genome editing to only genomes that contain a compatible att site. This limitation can be overcome by discovering a library of integrases/att sites, which could revolutionize genomic engineering.

Our team developed software (TIGER/Islander) and scanned ~460,000 genomes, allowing us to identify ~1.75 million instances of integrases paired with their att sites. We tested integrase function by arranging candidate att sites so that functional integrases will invert a reporter gene in E. coli. When screened on appropriate media, colonies carrying functional integrases appear blue. Surprisingly, we discovered that 86% of tyrosine integrases were functional in the absence of IHF. These findings contradict the paradigm that IHF is required for tyrosine integrase function. We are now using quantitative approaches to measure the impacts of IHF on tyrosine integrase efficiency. If tyrosine integrases are efficient in the absence of IHF, they will be highly useful for genome engineering and biotechnology, which is currently limited to a small number of available integrases.

Mohammed, Bala

University of New Mexico

Key Words: lasso-peptide, yeast, surface- display, throughput, deep- sequencing

Author: Bala Mohammed

A PLATFORM FOR DEEP MUTATIONAL ANALYSIS AND SUBSTRATE SCOPE OF THE LASSO PEPTIDE MODIFYING ENZYME

Natural products are diverse molecules produced by living organisms which have a huge impact on our wellbeing. A vast number of potential therapeutics are available from research on natural products. Only a small fraction of these molecules with therapeutic potential from microbes, plants and marine organisms have been characterized and a lot more work needs to be done to explore the diverse sources and the characterization of new natural product(-like) compounds. A class of natural products are the Ribosomally Synthesized and Post-translationally Modified Peptides (RIPPs), which include lasso peptides among others. RiPPs are important candidates for bioengineering since they are encoded genetically, and their biosynthetic enzymes generally display a wide range of substrate tolerance.

The bioengineering of the RiPPs is important because it has the capacity to address mass production issues which is often a major challenge especially in clinical trials. To explore the ability to use RiPP biosynthetic enzymes to make new natural product-like compounds we will develop a platform to ensure the substrate scope of a lasso peptide producing enzyme. To achieve this goal, we utilize a high throughput methodology in which yeast surface display of precursor peptides and deep sequencing are used to broadly examine the ability of the modifying enzyme to modify millions of different precursor peptides. This approach requires development of screening methods to identify if the displayed precursor peptide on the yeast cells is modified or not. This measurement takes advantage of the fact that the leader peptide is removed during lasso peptide modification by looking for the loss of the epitope tag genetically encoded on the peptide. The study gives us an unprecedented view of the scope of substrate tolerance of these enzymes and will guide our library development for use when screening for new biological activities.

Cahill, Jesse

Sandia National Laboratories

Key Words: Phage, mRNA, lipid nanoparticles, vaccine

Authors: Jesse Cahill; Joshua Podlevsky; Kimberly Butler; Greyson Lasley

Phage Transfection of RNA into Mammalian Cells

The threat from biological weapons of mass destruction has never been greater. Recent advancements in biotechnology have reduced the complexity of the production (or synthesis) of select agents, so that even low-technology adversaries have access to non-containable, globally devastating bioweapons that can self-spread under the guise of anonymity. Therefore, rapid, scalable, low-cost countermeasures are needed to deter, prevent, and prevail against weapons of mass destruction. We are developing a phage-based system for mRNA delivery and have successfully transfected GFP (green fluorescent protein) into macrophages as a proof-of-concept. We are currently testing cell-specific targeting, which is lacking in current lipid nanoparticle-based vaccine technology. Our hypothesis is that cell-specificity will be enabled by engineering our phage platform to display foreign targeting peptides on the surface of the virion. If successful, this platform could allow the delivery of medical countermeasures and vaccines (mRNA/antisense RNA) with high scalability, improved cold-chain transport requirements, and the modularity to respond to emerging threats.

ORAL SESSION: MATERIALS and CLIMATE

North Wing, Room 1744

Arthur, Clinton

Eastern New Mexico University

Key Words: Organic solar cells

Authors: Clinton Arthur; Juchao Yan

Synthesis of Dicarbaldehyde-Functionalized Ladder-Type Tetra(p-Phenylene) For Organic Solar Cell Applications

Even though the cutting-edge organic solar cells (OSCs) recorded power conversion efficiencies (PCEs) of about 18%, further improvements are required to enhance their competitiveness over other photovoltaic technologies. The key to achieving a high PCE is the search for new organic conjugated molecules that can harvest light, transfer, and transport charges promptly and efficiently. The nature and transport of charges, and blend morphology affect the charge transport and extraction. It is still a challenge to get a controlled morphology with enrichment of the donor near the anode and enrichment of the acceptor near the cathode. To address the inefficiencies of the existing materials, a synthesis protocol for carbonyl-functionalized ladder-type tetra(p-phenylene)s has been proposed. The incorporated carbonyl functional group serves as an infrared reporter, enabling time-resolved infrared measurements of electron delocalization followed by pulse radiolysis.

Joshi, Krishna

University of New Mexico

Key Words: High-temprature Materials

Authors: Krishna Joshi; Arturo Herrera

High-Temperature Oxidation Behavior of Novel Refractory Complex Concentrated Alloys

Refractory complex concentrated alloys (RCCAs) have shown excellent potential for high-temperature application, considering the high temperature strength and thermal stability over extreme temperatures. The oxidation resistance of materials for high-temperature applications beyond the Ni-based alloys has been a significant challenge. Nb-based C103 (Nb-10Hf-1Ti) alloy has been widely used in high-temperature applications. However, due to poor oxidation resistance, C103 alloy is used with reliable oxidation-resistant coatings, which effectively increase the alloy's cost in applications. Despite years of effort, no success has been achieved in developing a niobium-based alloy that forms the protective oxide scale. In this presentation, the high-temperature oxidation behavior of new RCCAs with compositions Nb32.5Ta32.5Mo7.5W7.5V10Ti10 and Nb30.55Ta30.55Mo7.05W7.05V9.4Ti9.4Cr6 were examined at 1000^{o}C for 0.5 Hr, 5 Hr, and 10 Hr. The oxidation behavior of C103 was also compared with the RCCAs' behavior. The visible change in the oxidation was observed at ~ 500^{o}C and ~ 750^{o}C for C103 and RCCAs, respectively. At 1000^{o}C, a liner increase in weight is observed with the oxidation time, while a parabolic increase in weight is observed for both RCCAs' compositions. The increase in weight is reducing with time for the RCCAs. The oxidation kinetic curve shows the oxidation rate is linear with time at 1000^{o}C for C103, which suggests the porous oxidation layer formation in C103 in the oxidation environment. Although the oxidation rate decreases with time at 1000^{o}C for both the RCCAs, Cr containing RCCA shows the lowest oxidation rate. The observed oxidation behavior of the RCCAs will be discussed in terms of the composition and morphology of the respective oxide layers.

Will-Cole, Melanie

Central New Mexico Community College

Key Words: microclimate, urban heat island, climate change, urban planning

Author: Melanie Will-Cole

Are Urban Thermal Anomalies Real? Mapping and Quantifying the Intra-Urban Heat Island Effect in Albuquerque NM.

The phenomenon that urban temperature is higher than that of its surrounding rural areas, known as the Urban Heat Island Effect (UHIE), has been observed and documented worldwide. Although the broad-scale magnitude of the urban-rural temperature differences, e.g., the Urban Heat Island Intensity (UHII), has been studied extensively, less is known about the thermal heterogeneity within cities at the local/neighborhood-scale. To understand the microclimate/intra-urban heat island effect we have evaluated the neighborhood-scale thermal/environmental signatures in-and-around the city-center of Albuquerque NM. The mobile-transect method, walking a 2.5-mile closed-loop path, was used to obtain pedestrian-level air temperatures (TAIR), and particulate matter (PM) levels. Transect data, collected via calibrated hand-held environmental sensors, was tracked via GPS and time stamped. A stationary external temperature data logger was set-up in a non-urban area and served as the rural temperature collection site required for calculating the UHII values. The study covered 7-weeks, (May 19-July 3, 2024) with measurements taken twice per week at three distinct times per day, namely morning (7-8am), afternoon (2-3pm) and evening (7-8pm).

This study was designed to answer 2 research questions:

(1) What is the behavior of the thermal signature in the time-domain and does this behavior exhibit variance at the “neighborhood scale”?

(2) What is the behavior of PM in the time domain and does its distribution vary on the neighborhood-scale?

Our results revealed a large variance in magnitude and range/extent of the thermal and PM signatures as a function of time of day and geospatial position along the transect path. The neighborhood-scale UHII was found to be 15% lower in magnitude, but temporally consistent with the city-scale results obtained in 2021 by CAPA Strategies 1-day thermal mapping campaign. Our approach for monitoring microclimate variables with high accuracy provides a key missing piece required for data-driven urban planning. Utilizing this approach will enable cities to become more resilient to climate change and maintain high-quality living standards for residents.

ORAL SESSION: ENVIRONMENTAL IMPACT

North Wing, Room 1745

Ayitah, Matthew

Eastern New Mexico University

Key Words: Cinnamon, Cumin, Geobacillus stearothermophilus, Escherichia coli

Authors: Matthew Ayitah; Manuel Varela

Comparative Analysis of The Antimicrobial Properties of Cinnamon and Cumin Powder on Escherichia coli and Geobacillus stearothermophilus

Microorganisms are typically responsible for the spoilage of food. These microbes can be inhibited through chemical treatment, heat treatment, carbon dioxide treatment, and treatment with plant extracts. Spices enrich the nutritional value of food and help inhibit food contamination by microorganisms because of their antimicrobial properties. Cinnamon and cumin are common spices used in most homes for food preparation globally; they are known to have antioxidant, anti-inflammatory, antimicrobial, and antidiabetic properties. This study surmised that cumin extracts have antimicrobial properties against E. coli, E. coli KAM32, and G. stearothermophilus. Ethanol extracts from cinnamon powder, cumin powder, and a synergy of both cinnamon and cumin were tested for their antimicrobial activities against the Gram-negative bacteria, such as E. coli, E. coli KAM32, and the Gram-positive thermophilic bacteria, G. stearothermophilus, using the agar well diffusion method and Kirby-Bauer method. The highest mean diameter zone of inhibition was observed with the synergy of both spices on G. stearothermophilus for both techniques at a concentration of 200 mg/ml. The 200 mg/ml concentration activity for the agar well diffusion method was 35.7 ± 0.6 mm, and for the Kirby-Bauer method was 36.0 ± 0.3 mm. The ethanol extracts of the spices were effective against the G. stearothermophilus regardless of the technique used.

Mishuk, Refat

University of New Mexico

Key Words: Refugee, PTSD, LPM, Logistic Regression

Author: Refat Mishuk

The prevalence of post-traumatic stress disorder (PTSD) and depression among Palestinian refugees

This study aimed to study the prevalence of post-traumatic stress disorder (PTSD) and depression among Palestinian refugees. Past studies found a higher risk of mental health problems among refugees. Those findings, however, were specific to treatment-seeking refugees residing in shelters situated in foreign territories. Similar analyses have not been conducted for non-refugee samples. In the case of Palestine, there were 16 refugee camps located in the Gaza Strip and West Bank in 2022, which offered a unique opportunity to analyze data both from individuals residing inside the camps (refugee) and outside the camps (non-refugee). The study utilized Palestinians Psychological Conditions Survey 2022. The sample of the study consisted of 6133 Palestinian adults (49.05% male & 50.95% female). 64.16% and 6.98% of the samples were suffering from depression and PTSD respectively. Linear probability method (LPM) and logistic regression method were used in this study. Robust analysis was conducted for LPM due to the presence of heteroskedasticity. The likelihood-ratio test ensured absence of multiplicative heteroskedasticity in the logistic regression model. The linear probability model demonstrated that refugee status is associated with an increase of 5.54% to 5.58% of depression ($p<0.05$). The logistic regression model showed that refugees are 28.8% more likely to experience depression compared to non-refugees ($p<0.01$). The study did not find statistically significant evidence indicating an effect of refugee status on the prevalence of PTSD. The findings of this study highlighted the requirement of implementing mental health care facilities for Palestinian refugees.

Rhaman, Md Mhahabubur

Eastern New Mexico University

Key Words: Cyanide, Indicator Displacement Assay, Dinuclear Metal Complexes

Authors: Md Mhahabubur Rhaman; Enrique Martinez

Colorimetric detection of cyanide in water following indicator displacement assay

Cyanide is well known as a fast-acting and potentially deadly chemical to humans, posing a severe threat to public health, the environment, and homeland security. Nevertheless, cyanide is used in many chemical processes, such as electroplating, plastics manufacturing, gold and silver extraction, tanning, resins, herbicides, and metallurgy. It is industrially produced and released into the environment in large quantities each year. Unfortunately, cyanide does not decompose in the environment. The World Health Organization (WHO) has set the maximum contaminant level (MCL) of 1.9 µM for cyanide in drinking water. Therefore, sensitive, selective, simple, reliable, efficient, and affordable sensors for cyanide ions are in great demand. This project involved a chemosensor that was designed to detect cyanide colorimetrically. A pyridine-based polyamine macrocycle was synthesized and converted to dinuclear metal complexes (M) using CuBr2, NiBr2, and CoBr2. These metal complexes were used to detect cyanide colorimetrically following indicator displacement assay using commercially available dyes disodium eosin y and fluorescein at pH 7 using around 20 mM HEPES [2-[4-(2-hydroxyethyl)piperazin-1-yl]ethanesulfonic] buffer. Dinuclear Cu(II) complex with the dye disodium eosin-y showed the most selective sensitivity for cyanide compared to other anions (fluoride, chloride, bromide, iodide, nitrate, carbonate, perchlorate, sulfate, and phosphate) commonly found in the environment. Colorimetrically, cyanide was detected at 0.18 mM under the UV lamp at 254 nm and 365 nm wavelengths.

Acknowledgment: This work acknowledges ENMU for supporting Graduate student Mr. Enrique Martinez and the 2023-2024 NM WRRI Student Grant index GWREM

ORAL SESSION: EDUCATIONAL PROGRAMS

North Wing, Room 1746

Briggs, John W.

The Astronomical Lyceum

Key Words: astronomy, observatory, history of astronomy, astronomy library, optics, research-based education

Author: John W. Briggs

The Astronomical Lyceum in Magdalena and a Proposed Affiliated Observatory

The Astronomical Lyceum in Magdalena, New Mexico, is a private facility serving to house a collection of historical instrumentation and a library featuring early journals and observatory publications. Occupying a 1936 school gymnasium and theater building built by the WPA, the facility is a combination museum, library, laboratory, archive, and lecture hall. Beside serving as an informal headquarters for the Magdalena Astronomical Society, Inc., for some years now the Lyceum has been a successful venue for visiting graduate and undergraduate student groups from, for example, University of Virginia and Austin College, as well as from the distinguished Summer Science Program for secondary students. The historical collections at the Lyceum serve to facilitate surprisingly powerful student engagement & interest in the history of astronomy, physics, optics, and scientific biography. A 43-acre parcel several miles north of Magdalena has been purchased to serve as a dark-sky observatory site for several of the larger telescopes in the collection. The presentation will outline the immediate opportunities presented by Lyceum's historical collection as well as plans for the observatory site that will operate as a new 501(c)(3) non-profit organization.

Nelson, Uloma

New Mexico Highlands University

Key Words: CURRICULUM FOR YOUNG DISABLED STUDENTS THROUGH ARTIFICIAL INTELLIGENCE LEARNING SOLUTION

Author: Uloma Nelson

ADVANCING COMPUTER CURRICULUM FOR YOUNG DISABLED STUDENTS THROUGH ARTIFICIAL INTELLIGENCE LEARNING SOLUTION

This study explores advancing computer curriculum for disabled students through Artificial Intelligence learning solutions. The aim is to address the unique educational needs of this demographic by leveraging cutting-edge technology to enhance accessibility, engagement, and personalized learning experiences. Through a comprehensive examination of existing educational frameworks, the research identifies gaps and challenges in the current system, emphasizing the importance of tailoring computer curriculum content to accommodate virtual abilities.

The proposed AI-driven reinforcement learning solutions harness adaptive technologies to create a dynamic and inclusive learning environment. By analyzing individual learning patterns and preferences, the system can autonomously adapt instructional strategies, providing real-time feedback and personalized support. This approach not only fosters a more accessible and supportive educational experience for young disabled students but also empowers educators with tools to cater to diverse learning needs effectively.

Guiding Terminologies: Advancing, Computer, Curriculum, Disabled, Student, Artificial Intelligence.

Smith, David

Eastern New Mexico University

Key Words: Engineering Curriculum Management

Author: David Smith

Eastern New Mexico University and Electronics Engineering Technology with Amatrol's Learning Systems Labs for the Composite Track Bachelor of Science

Eastern New Mexico University's (ENMU) Electronics Engineering Technology (EET) Bachelor's Degree Programs includes access to Amatrol's Learning Systems (AMATROL, INC. of Jeffersonville, IN) for the Composite Track Bachelor of Science with a Renewable Energy Emphasis. The Hands-On Skills for the Learning Systems equipment and Online Skills coursework are well suited for all EET students to expand their knowledge resource base. I recommend that students in additional EET classes, other than just the Renewable Energy classes, benefit from this opportunity. Expanding the Amatrol Learning Systems into more classes could place additional management policies and procedures on faculty in the EET program; instead, the necessary requirement to manage increased utilization of Amatrol's Learning Systems would fall to Graduate Assistants. The EET Program does not offer graduate degrees. ENMU does offer a Master of Education degree with a Curriculum and Instruction Concentration in Career and Technical Education. ENMU Graduate Assistants participate in undergraduates. If students need anything or have any questions, the Graduate Assistant is available to respond and answer them. The EET Program does not maintain a staff position. The ENMU 2024-26 Graduate Catalog describes, "Graduate assistants are assigned to roles in instruction, professional service, research, creative production, or University service." This proposal seeks to identify and align the EET program's Amatrol Learning Systems Hands-On Skills and Online Skills with specific Electronics Engineering Technology coursework available now at Eastern New Mexico University. Adoption of this strategic adaptation in higher education's evolving taxonomy will enhance the ENMU experience and maintain an environment in which students may continue to build a more sustainable future for our community.

POSTER SESSION

North Wing, Room 3740

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Hall, Ashtin

Eastern New Mexico University

Undergrad

Key Words: Novice Programmers, Code Quality, Code Smells, Static Analysis

Authors: Ashtin Hall; Essa Imhmed

Using Static Code Analysis to Investigate Code Smell Violations in Novice Undergraduate Student Code Submissions

Code smells are coding patterns or structures that indicate potential design and implementation flaws, making code harder to maintain. Novice undergraduate programmers in university-level courses often focus on writing code that solves the problem rather than adhering to best practices and principles of good design. Previous studies [1,2,3] indicate that most students do not consider coding standards compulsory, exacerbated by several factors, such as having a tight schedule for assignments, which suggests that complying with coding standards was not their top priority. In this study, we report on our experiment using static code analysis to identify the most frequent code smells in students' code submissions for the CS 234 Computer Science II, an object-oriented programming course. Based on these findings, we aim to eventually recommend teaching strategies to improve students' awareness of these design aspects.[1] Imhmed, E., Ceh-Varela, E., Abu-Gellban, H., & Kilgore, S. (2024). Fostering Code Quality Practices Among Undergraduate Novice Programmers. Journal of Computing Sciences in Colleges, 39(7), 21-32.[2] Imhmed, E., Ceh-Varela, E., & Kilgore, S. (2023, December). Identifying Code Quality Issues for Undergraduate Students Using Static Analysis and NLP. In 2023 International Conference on Computational Science and Computational Intelligence (CSCI) (pp. 1527-1533). IEEE.[3] XiaosongLiandChristinePrasad.Effectively teaching coding standards in programming. In Proceedings of the 6th Conference on Information Technology Education, SIGITE '05, pages 239–244, New York, NY, USA, 2005. Association for Computing Machinery.

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Zafarano, Eva

Santa Fe Community College

Undergrad

Key Words: Biogas produced with microalgae

Authors: Eva Zafarano; John Michel; Mary Ondine Frauenglass

Just A.D. Algae: Production of Biogas with Lipids and Microalgae

Anaerobic digesters offer the unique opportunity to process organic waste while producing biogas and nutrient-rich fertilizer as ‘by-products’ Currently, the ability to digest organic waste lipids anaerobically is problematic at a large scale. Almost a billion gallons of lipid waste are produced in the US annually and we are forced to dispose of a carbon-rich feedstock with great potential for producing bioenergy. Meanwhile, the accumulation of microalgae in hydroponic plant production systems inhibits system functionality and is cumbersome for operators. Due to this inconvenience, hydroponic water is routinely discharged with unused nutrients; a lost resource that contributes to the eutrophication of waterways.

Our project is to enhance anaerobic biogas production using microalgae cultured in hydroponic wastewater. Microalgae will help overcome the biogas production 'lag' in AD systems when high concentrations of lipids are introduced and increase the biogas yield. Enhanced biogas production from the digesters will then be scrubbed and pressurized for storage. We are experimenting with feeding microalgae effluent from the anaerobic digestors for added nutrients. We will test to see if the same principles apply to water collected from waterways [such as acequias] that have a high concentration of agricultural and urban runoff. Lastly, the liquid effluent discharge from the digestors is being applied to crops with extreme success.

103

Fong, Urena

Eastern New Mexico University

Undergrad

Key Words: Healthcare, Machine learning, Algorithms, Artificial intelligence, Diease diagnois.

Authors: Urena Fong; Ratna Shakya Allamehzadeh

Data ML Save Lives

With the rapidly aging population and medical doctor shortage, early diagnosis of diseases and patient critical conditions has been challenging in recent years. With data collected through different mediums, analyzing those can provide accurate diagnosis of the patient's initial conditions which is critical for effective treatment and resource management. Much research explores the application of different Machine learning (ML)algorithms in the healthcare sector to study patient demographic backgrounds, medical history, and lab results to early diagnose the conditions for an ethical way to boost effective treatment outcomes. In this research we are exploring, the different ML model that employs advanced algorithms, including Random Forest, Decision Tree, K neighbors, and Gradient Boosting, to identify patterns and correlations in the data that may not immediately catch the attention of human clinicians but are critical to diagnose the patient conditions. We use patient-specific factors such as age, gender, blood type, medical conditions, insurance and billing, medication, and test results to determine the admission type based on urgent care Trauma, emergency, urgency, and elective. Also, based on different factors we categorized and predicted the conditions of the patients into three different categories High Priority, Medium Priority, and Low Priority. This will assist in decision-making by analyzing the patient's condition which requires less time thereby enhancing the potential for improved patient outcomes and improving the workloads of medical professionals. This research highlights the promise of AI in supporting healthcare professionals, enabling faster and more accurate diagnoses, and delivering personalized care that meets the unique needs of each patient.

104

Fisher, Maya

Eastern New Mexico University

Undergrad

Key Words: tinyml, Machine learning, Human activity recognition, CNN, LSTM

Authors: Maya Fisher; Sarbagya Ratna shakya

TinyML: Human Activity Recogntion using Edge Computing for Wearable Devices

Human activity recognition (HAR) has been adopted in much research that involves wearable devices. It has been applied in many practical applications, such as healthcare, sports, surveillance, and entertainment. To make it more efficient, these studies focus on executing the algorithms on the edge devices without the need of connecting it to high-performance computing in remote servers such as cloud. Although edge computing HAR have challenges based on resource constrained and low computational capacity, it can provide an advantage in terms of response latency, data security and privacy, communication network efficiency, data transfer speed, power consumptions and bandwidth requirements than traditional HAR. Although, traditional HAR methods have shown great performance in predicting the activity, those algorithms required high computational power and memory usage to train, that make it inefficient to be implemented in the edge devices. In this research we implement a Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) approach, using accelerometer sensor data perceived from two publicly available dataset: UCI dataset and WISDM dataset, and compare the performance with edge computing based and traditional HAR methods. The preliminary experiment results show that with deploying a quantized neural network model, the edge computing-based approach can be implemented and requires minimal memory (about 3 times less) and processing time as compared to the traditional HAR approach performance in terms of accuracy, precision, recall and F1 score. This also provides real time HAR at the edge which can be applied to many resource constraints applications.

105

Duran, Charlize

Eastern New Mexico University

Undergrad

Key Words: Organic Synthesis, Organic Photovoltaics

Authors: Charlize Duran; Juchao Yan

Synthesis of Carbonyl-Functionalized Oligo(p-Phenylene)s for Organic Photovoltaics

Many different types of electronics use donor-acceptor conjugated molecules due to their ability to carry charge and adaptable structure, especially in Organic Photovoltaics or Organic Solar Cells (OSCs). Conjugated molecules make OSCs easier to access and produce, have photovoltaic properties, and are sustainable. The current recorded power conversion efficiency of OSCs is only about 19%. Further improvement requires fundamental understanding and control of charge transport. For this, carbonyl-functionalized ladder-type oligo(p-phenylene)s (LnPCHO, n = 3,4,5,6) are being synthesized and will allow us to evaluate the light converting capabilities with the carbonyl group acting as a detector of electron delocalization. The synthetic path includes Suzuki cross-coupling, bromination, alkylation, and carbonylation. Our preliminary synthetic results will be presented in this poster.

106

Viera, Micah

Eastern New Mexico University

Undergrad

Key Words: Solar Power. golf cart, speech recognition

Author: Micah Viera

SOLAR POWERED GOLF CART WITH SPEECH RECOGNITION

ENMU undergraduate students participated in the research and development of a solar-powered golf cart using speech recognition. With a growing concern for carbon dioxide emissions from gas-powered engines, solar energy is at the forefront of a safer alternative power source. In this project, two 315W solar panels were installed on the golf cart's roof to recharge the golf cart batteries (four 12V batteries). So, as the golf cart is exposed to the Sun during daily activities, the solar panels charge up the batteries. As a result, the golf cart does not need to be plugged in at night. Circuitry techniques were implemented to control the functions of the golf cart; "on," "up," "down," "light," & "security." This was achieved using a human-machine interaction in speech recognition "security" protocol. A SpeakUp Click Board is configured to differentiate multiple voice frequencies, allowing multiple individuals to be recognized and control the golf cart's functions. Speech recognition technology offers greater liberty to people with disabilities, enabling some practical control of a moving vehicle. Using a 12Vdc power relay triggered by an AND logic gate, four transistor & relay configuration stages control the golf cart’s abilities. The network architecture enables the simultaneous and secure operation of the solar powered golf cart project.

107

Pereda, Paola

Eastern New Mexico University

Undergrad

Key Words: federal loans, machine learning, financial futures

Authors: Paola Pereda; Prabha Shrestha

Application of Machine learning methods to analyze students' repayment status of federal loans 7 years after graduation

With growing student loans debt in United States, and lower job markets, it is highly likely to get default the students' loans that could highly hamper the graduates' financial futures. Although the government has introduced several student debt forgiveness plans, it is still in debate.

In this study, we implemented three machine learning algorithms: Random Forest (RF), Gradient Boosting (GB), and, Bagging Regression (BR), that predict whether students who have completed their college degree programs after six years of enrollment and students who have taken out federal student loans will still be in repayment status seven years after graduation.

For our experiments, we used fourteen predictor variables collected from the 2016-2017 data from the US Department of the Education College Scorecard website, with all pertinent characteristics such as the completion rate six years after enrollment, the income of students who completed six years after enrollment, gender, pell or no pell grant recipients percentages, percentage of students who have taken out federal student loans, and the type of university that the students graduated from, i.e., private or public.

The initial results show the RMSE, and R squared score for RF (0.064/0.7873), GB (0.065/0.7843) and BR (0.067/0.7718). This shows that machine learning techniques can be utilized to see if this cohort of students who take out federal student loans is consistent regardless of the year in which a student graduates.

108

Zamora, Micaela

Sandia National Laboratories

Undergrad

Key Words: Bacteriophage, Phi6, Lysis, Pseudomonas syringae

Authors: Micaela Zamora; Jesse Cahill; Greyson Lasley

How Does this Virus Escape? The Mysterious Lysis System of Phage Phi6

Phi6 is a phage (bacterial virus) with an RNA genome that infects plant pathogen Pseudomonas syringae. Most phages must lyse (destroy) the host cell to release phage progeny at the end of the infection cycle. Surprisingly, phi6 and its close Cystoviridae relatives carry a multi-gene lysis system, resembling that of dsDNA phages, instead of a single-gene lysis system used by other RNA phages. However, the unconventional phi6 lysis system remains uncharacterized. Furthermore, the lysis gene encoding for the disruption of the outer membrane of the host bacterium has not been identified in phi6 or other Cystoviridae. To characterize the phi6 lysis system, our initial approach tested whether any of the phi6 lysis components were functional in E. coli, at different expression levels and growth temperatures. Our results indicate that none of the known phi6 lysis genes are functional in E. coli. This is surprising, since many currently understood lysis components have been shown to be functional in orthogonal systems. We have redesigned our lysis testbed to be compatible with expression in the phi6 host P. syringae and testing is underway. Characterizing phi6's unique lysis system could lead to useful technology for biocontainment, microbial control, and biomass harvesting strategies, as well as offering new insights into phage biology.

109

Martinez, Juana

Eastern New Mexico University

Undergrad

Key Words: Edge Computing, TinyML, Fall Detection, Wearable Devices

Authors: Juana Martinez; Sarbagya Ratna Shakya

An Edge Computing based Fall Detection System using Wearable Devices

Fall accidents have been one of the common causes of injury in elderly people. Causes of falls include medical health issues such as Parkinson's disease, insomnia, sedation, and other reasons such as weakness, deficiency of certain vitamins, high blood pressure, and high sugar levels. Without having a way to know ahead of time, this puts the patient at high risk. If monitored continuously about the status of the health conditions, fall accidents can be detected, preventing major damage in real time. To address this issue, an edge-based computing system is proposed in this study, that analyzed the accelerometer data collected from different sensors of wearable devices placed at different body parts of the elderly people. These combined data are used for training and testing a convolutional neural network to detect and predict the fall. The size of the trained model is reduced using Tensorflow lite to be implemented in edge devices. Our preliminary results show that the model has an accuracy of 98.36% with a total loss of 0.055. The model size can be compressed up to one-third of the original size. This study provides the possibility of using machine learning models in edge devices to improve the lives of elderly people by early detecting the symptoms that can cause falls in real-time. The future work includes implementing the model in Arduino, like the Nano33BLE board.

110

Schmith, David

Eastern New Mexico University

Undergrad

Key Words: Water Conservation, Machine Learning, Forecasting

Authors: David Schmith; Eduardo Ceh-Varela

ML-Powered Forecasting for Resilient Water Management in New Mexico's Drought-Prone Regions

Water is an essential resource for daily life, and in regions like New Mexico, where water scarcity is a significant concern, understanding and predicting water levels is crucial for sustainable management. Accurate forecasting of water levels at specific locations has traditionally been challenging due to the complex and dynamic nature of hydrological systems. However, advances in Machine Learning (ML) offer new possibilities for improving prediction accuracy. This study utilizes data from the United States Geological Survey (USGS) for the Rio Ruidoso at Hollywood, NM, to develop a highly accurate ML model capable of predicting future water levels. We evaluated multiple regression models with different combinations of features. The top-performing models were further optimized. Our final model considers previous days' water level data to generate precise daily predictions. By providing reliable water level forecasts, this model has the potential to enhance water resource management, helping communities better prepare for and mitigate the impacts of droughts and other water-related challenges. This research demonstrates the power of ML in addressing critical environmental issues and offers a valuable tool for policymakers and resource managers in arid regions.

111

Casas, Adrian

Central New Mexico Community College

Undergrad

Key Words: Urban hotspot, microclimate, photovoltaic cells

Authors: Adrian Casas: Sierra Cyr; Melanie Will-Cole

Artificial Canopy to Reduce The Urban Heat Island Effect

The urban heat island effect can be defined as an area of cityscape that is significantly warner than the surrounding rural area. This research takes inspiration from the 2021 CAPA Strategies large-scale (city-wide) thermal mapping campaign whereby we elected to study the neighborhood-scale thermal signature or microclimate within the city of Albuquerque NM. Our research sought to investigate optimal conditions that could mitigate the UHE through an artificial canopy comprised of bi-facial photovoltaics (BFPV). Data was collected via the mobile transect method which comprised walking a 2.5 closed-loop every Sunday and Wednesday for 10 weeks (May-July 2024) at distinct time intervals (morning, afternoon, evening). To analyze the neighborhood-scale thermal signatures we used an AirBeam3 and Kestrel-3000 (T-AIR) and ThermalWorks-IF gun (T-SURFCAE). A mathematical model utilizing data from both sensors in combination with a 2nd order polynomial, a curve fit was used to calibrate the T-AIR raw data. To simulate the efficiency of BFPV, we used data library provided by Sandia National Laboratory (Anderson, et al., 2023). The preliminary work has been able to conclude that concrete and asphalt exhibit a higher T-SURFACE absorbance than sand/gravel, which contributes more to the UHIE. Furthermore, less direct sun exposure, leads to reduce thermal heat absorption.

112

Fox-Gardner, Heather

Central New Mexico Community College

Undergrad

Key Words: Urban Heath Island, Modified Convective Precipitation

Authors: Heather Fox-Gardner; Neil Smith; Melanie Will-Cole

HUMAN MODIFIED PRECIPITATION IN ALBUQUERQUE, NEW MEXICO

INTRODUCTION AND MOTIVATION

The urban heat island effect (UHIE) is indicative of higher temperatures in urban areas than in rural surrounding areas. This has the effect of causing abnormal precipitation within (Manisha Ganeshan, 2013) urban areas. We designed this study to analyze the localized urban heat island - modified convective precipitation events (UHI-MCPE) in a heavily commercial area in Albuquerque.

The study area was primarily composed of public spaces around the perimeter of the Coronado Mall and the Uptown Shopping Center. These public spaces are primarily composed of asphalt parking areas, and concrete sidewalks. There are small green spaces with mostly smaller trees, some large trees, and small foliage. The amount of concrete and asphalt surfaces are composed of an estimated 95% of the overall surface areas surrounding the buildings.

We designed a two-mile closed loop transect with thirteen stations, five minutes walking distance from one another. At each of the stations, environmental data was collected using four sensor devices. The AirBeam 3, PocketLab Air, Kestrel 3000, and Thermoworks IRK-2 IR Thermometer. In addition, we used a HOBO MX2300 Station, which was installed in Tijeras, NM. The data collection took place from May 27, 2024, and July 24, 2024.

RESULTS AND DISCUSSION

This study was designed to answer two primary research questions.

1. Is there a UHI effect occurring in Albuquerque, NM.

2. What effect does it have on the localized precipitation.

Warm season UHIE-MCPE was recorded on June 19, July 17, July 21, and July 24. These were identified by examining the ΔT, which is calculated by comparing the temperature difference between the air

temperature at the transect site and our rural HOBO station at the same time stamps. UHI-MCPE differs from normal precipitation, due to a drastic spike in ΔT, a drop in barometric pressure, and an increase in wind gusts, indicative of convective currents in the atmosphere.

The UHI-MCPE, recorded on July 24, occurred at 9:00 PM, after sunset, when temperatures should have dropped. However, the weather station collected a 25˚F ΔT temperature spike at the time. Two of the other UHI-MCPE, on June 16 and July 21, had ΔT readings of over 30˚F.

The magnitude was approximately 10˚F than expected for this type of UHI-MCPE but was likely due to the substantial volume of asphalt/concrete surface areas and human/vehicle traffic around the site.

CONCLUSIONS

We found meaningful evidence that UHI is modifying localized precipitation on a local level.

Acknowledgements: This work was funded by NSF grant award 2246468. Also, a special thanks to UNM for making the San Pedro Uptown Weather Station publicly accessible.

REFERENCES

Changnon, S. A. (1968). the La Porte weather anomaly - fact or fiction? Retrieved from AMS American Meteorological Society: https://journals.ametsoc.org/view/journals/bams/49/1/1520-0477-49_1_4.xml?tab_body=abstract-display

113

Watkins, Micah

Central New Mexico Community College

Undergrad

Key Words: Urban Heat Island, Green Space, Transect

Authors: Micah Watkins; David Hoang; Melanie Will-Cole

"Cooling the Urban Heat: The Role of Tree Canopy in Mitigating Heat Islands in Albuquerque"

This study examines the influence of green spaces, particularly tree canopy cover, on mitigating urban heat islands (UHIs) in Albuquerque, New Mexico. While green spaces are generally known to reduce UHI intensity (UHII), their cooling effectiveness can vary significantly based on characteristics such as tree canopy coverage. Previous research has shown mixed results regarding the correlation between green space and air temperature, particularly during different times of the day. This research addresses these gaps by measuring air temperature (TAIR) through mobile transects across areas with varying levels of green space, including tree canopy cover, twice a week in the morning, afternoon, and evening. Data from an AirBeam3 sensor were corrected using a Kestrel 3000 sensor. Results indicate that tree canopy cover provides a stronger cooling effect, especially during the morning and evening, compared to general green spaces, with correlations between canopy and TAIR being significantly higher. However, a positive correlation between TAIR and green space, including tree canopy, was observed in the afternoon, suggesting that green spaces are less effective during periods of high solar intensity. These findings underscore the importance of tree canopy in urban heat mitigation strategies and suggest that further research is needed to explore the limitations of green spaces during peak sunlight hours.

114

Gansworth, G.

Central New Mexico Community College

Undergrad

Key Words: Urban heat Island, microclimate, green cover

Authors: G. Gansworth; Sierra Cyr; Adrian Casas

The Many Faces of Urban Heat Island Effect (UHIE): Examining the Effect of Surface-Materials and Green-Cover

The Urban Heat Island Effect (UHIE) is a phenomenon that affects many millions of people worldwide. The higher temperatures experienced in cities compared to the surrounding countryside has consequences for the health of urban populations. Although the UHIE has been studied extensively from the city-wide point-of-view, few studies have focused on the UHIE at the local-neighborhood length-scale.

To bridge this gap this paper aims to quantify and understand the UHIE at the local scale, e.g, examine the microclimate/intra-urban heat island effect. To accomplish this, we walked a mobile-transect (~2.5-mile path), within the Piedras Mercadas neighborhood located on Albuquerque's Westside. To assess microclimates along the transect, we used hand-held environmental sensors: Airbeam-3, Kestrel-3000 and a SanLiang Infrared-gun, to collect data along the path. Data was analyzed with a mathematical curve-fit model. This data, combined with meta-data analysis, was used to see how green-cover and surface-materials affected the intensity of UHIE.

The study addressed two research questions:

1. How does surrounding green-cover and built environment affect UHII

2. How does surface temperature and orientation impact UHII spatio-temporally

Results showed that shade cover reduces effects of UHIE during the afternoon, but traps heat radiated from surface-materials, increasing UHIE in the evening. Orientation was also examined: an east facing slope that experienced the greatest UHIE in the afternoon cooled the most in the evening. Lastly, it showed the total surface-area of materials influences UHIE. This study illuminates the complexities involved in UHIE and how many factors should be considered for new and ongoing development.

115

Hutcherson, Zoe

Eastern New Mexico University

Undergrad

Key Words: Range Expansion, Invasive Species, Geographic Information Systems (GIS), Georeferencing, Ecological Impacts, New Mexico, west Texas, Hemidactylus turcicus

Author: Zoe Hutcherson

Examining Range Expansion of the Non-native Mediterranean Gecko (Hemidactylus turcicus) across New Mexico and west Texas

The Mediterranean Gecko (Hemidactylus turcicus) is a non-native gecko rapidly spreading across large parts of the southern United States. Compared to much of the southeastern United States, there has been little effort to summarize the distribution of this species in the southwest. The first records of the Mediterranean Gecko in New Mexico were from Doña Ana County in 1991, and there have been few isolated reports of this species across other parts of New Mexico. Here, we examined the temporal and spatial dynamics of the Mediterranean Gecko across New Mexico and a portion of west Texas, filling a critical void in the synthesis of occurrence records in this region. Utilizing data repositories such as iNaturalist, VertNet, and ARCTOS, we are in the process of collecting distributional and abundance data of this species from this region. Subsequent phases of our research involve using Geographic Information Systems (GIS) to help visualize the spread and spatial occurrence patterns of the species. Our research aims to deepen our understanding of this gecko's distribution and abundance, with future exploration of factors influencing population establishment, such as climate, habitat suitability, and transportation corridors. Work will contribute to better grasp the occurrence of this non-native species across the state. For effective management and conservation to occur, a thorough understanding of the distribution and duration of how long this species has been present in New Mexico is needed.

116

Nicholson, Benjamin

Eastern New Mexico University

Undergrad

Key Words: 3-D, spiral blades, 3-D printer, renewable energy

Author: Benjamin Nicholson

3-D printing spiral blades for wind turbines

The progress of renewable energy lies in improving its various aspects of study. In recent times, the performance of diverse energy systems, including wind turbines and gas turbines, has been crucial. Our study spans the application of additive manufacturing, precisely 3D printing, in the building of spiral blades designed for turbine applications.

There were several limitations with the production of renewable energy before the inception 3D printing of spiral blades which have improved production processes. The production process can benefit in specific scenarios, but there may be limitations on what we can print.

Pros: Optimally, the 3D printing can cut the supply chain in half, by reducing wait times for shipment and delivery. It may also therefore be more cost effective.

Cons: The 3 – D printer in our laboratory is a plastic 3D printer, which will, in theory, impose design constraints, since the material will be limited to plastic. Some 3D printers take longer to print.

In this research, we will design and test different blades. Then, we will compare the results to what we expect and to the industry results.

We will do this by attaching the wind turbines to the generator, waiting for the wind to blow, and conducting measurements.

201

Agyapong, Charity

New Mexico Highlands University

Grad

Key Words: CO_2 absorption spectrum, Infrared spectroscopy, Wavelength range 2000 nm - 2060 nm, Vibrational transitions, Asymmetric stretching modes, Greenhouse effect, Radiative forcing, Molecular dynamics, Climate modeling, Environmental monitoring

Author: Charity Agyapong

Absorption Spectrum of CO_2 Gas in the Wavelength Range 2000 nm - 2060 nm

This study focuses on the absorption spectrum of carbon dioxide (CO_2) gas within the infrared region, specifically the wavelength range of 2000 nm to 2060 nm. The objective of the project is to analyze how CO_2 absorbs infrared radiation, which is crucial for understanding its role in atmospheric processes, such as the greenhouse effect and radiative forcing. In this wavelength range, the absorption bands correspond to vibrational transitions of the CO_2 molecule, particularly the asymmetric stretching modes.

The experimental setup includes an infrared spectrometer to measure the absorbance of CO_2 gas at various pressures and concentrations. The results are compared to theoretical predictions from quantum mechanical models, which predict specific absorption lines associated with molecular vibrational modes. The data obtained from the absorption spectrum can provide valuable information on the molecular dynamics of CO_2, contributing to climate modeling and environmental monitoring efforts.

The findings are expected to highlight key absorption peaks within this wavelength range, which could enhance our understanding of CO_2's interaction with infrared radiation and help refine models of energy transfer in Earth's atmosphere.

202

Blackwell, Ashley

University of New Mexico

Grad

Key Words: Exoelectrogens, induction, Magnetic Field, wastewater, Resource recovery

Authors: Ashley Blackwell, Dr. Andrew Schuler

Microbial Electrolysis Cell (MEC) alternative: Electromagnetic Induction for Enhanced Hydrogen and Methane Production

A microbial electrolysis cell (MEC) is an advanced water resource recovery technology that has the potential to convert organic matter from wastewater into a valuable energy source such as hydrogen. This bioelectrochemical system uses exoelectrogenic bacteria to donate/accept electrons through metabolic mechanisms. These electrons get transferred to an anode and/or are transferred from a cathode through direct interspecies electron transfer (DIET). An external voltage applied in MECs drives electrons from anode to cathode, facilitating hydrogen production, a reaction that is otherwise not favorable. However, scaling up MECs is difficult due to high costs of electrode materials and the need for large surface areas to maintain effective mass transfer. It's hypothesized that the use of electromagnetic induction to eliminate the need for wired electrodes serves as a potential alternative technology. In this system, exoelectrogenic bacteria would grow and facilitate waste degradation similarly to an MEC, but without the direct connection to an external power supply. Research suggests that in these conditions, the bacteria could use DIET more efficiently, enhancing electron transfer across the biofilm surface and improving hydrogen production. The objective of this study is to demonstrate the principle that electromagnetic induction can enrich exoelectrogens for hydrogen generation during anaerobic waste treatment. A bench-scale system is being developed to test this concept.

203

Ugwuanyi, Ifeanyi

Eastern New Mexico University

Grad

Key Words: Staphylococcus aureus, multi-drug resistance, Loop of Henle

Author: Ifeanyi Ugwuanyi

Loop-Mediated Isothermal Amplification (LAMP) assay for the specific and sensitive detection of S. aureus

Staphylococcus aureus (S. aureus), a Gram-positive bacterium, is a significant human pathogen responsible for a wide range of infections, from minor skin infections to life-threatening conditions. The emergence of multidrug-resistant strains, particularly methicillin-resistant S. aureus (MRSA), has drastically reduced the effectiveness of standard treatments, contributing to higher morbidity, mortality, and an increasing public health threat. Rapid and reliable detection methods are crucial for timely intervention and effective management of S. aureus-related infections. This study focuses on the development of a Loop-Mediated Isothermal Amplification (LAMP) assay for the specific and sensitive detection of S. aureus.

In recent decades, the rise of MRSA has limited treatment options, as most MRSA strains are resistant to multiple antibiotics. The overuse and misuse of antibiotics have accelerated the spread of these resistant strains. Therefore, accurate and rapid diagnosis is critical for guiding the appropriate use of antibiotics in treating bacterial infections. Multiplex PCR is commonly employed to enhance the specificity and efficiency of MRSA detection, with various assays developed based on S. aureus-specific target genes.

The LAMP assay offers a nucleic acid-based amplification method that delivers high sensitivity and specificity comparable to PCR. Its simplicity, rapid amplification at a constant temperature, and minimal equipment requirements make it particularly suitable for point-of-care applications. The developed LAMP assay promises to improve the detection of S. aureus in clinical settings, enabling faster and more accurate diagnoses, and leading to better patient outcomes through timely and precise identification of infection.

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Daniels, Charlotte

Eastern New Mexico University

Grad

Key Words: X-Ray Diffraction

Authors: Charlotte Daniels; Dr. Jim Constantopoulos

Calcination of Gypsum to produce Bassanite under anhydrous conditions and analysis of products using Powder X-ray Diffraction

The study investigates the calcination process of gypsum to produce bassanite under anhydrous and saline conditions and to analyze the results using powder X-ray diffraction. The experiment focuses on the formation of bassanite and its influence on gypsum calcination. Previous research on the playa at Arch Lake, New Mexico, found the metastable mineral in dunes during wet winter. A subsequent study was done on the playa during the scorching summer, and the sediments did not contain bassanite. Mars researchers also believe that environments like this are similar to those at the Jezero crater on Mars and serve as a terrestrial analog. The study also aims to provide insights into industrial applications and an understanding of gypsum transformation mechanisms. Initial experiments looked at the conditions under which gypsum undergoes dehydration to bassanite. Samples of pure gypsum were ground to a fine powder and analyzed for purity using powder X-ray diffraction. Assuming average summertime hot temperatures of approximately 40° C, the pure gypsum was heated in a furnace for 24 hours to test for the conversion to bassanite, and no conversion was observed either because the temperature was too low or because of a kinetic effect. Another sample was heated at 70°C for 24 hours, and the result was 75% gypsum and 25% bassanite. Based on the presence of salt on the playa, the hypersaline brine at the surface may facilitate (catalyze) the conversion of gypsum to bassanite under natural ambient conditions. Future research will investigate this process.

205

Nduul, Andrea

New Mexico Highlands University

Grad

Key Words: Organic inorganic hybrids

Authors: Andrea Nduul; Dr. Steven Karpowicz

Synthesis and characterization of an Organic-inorganic hybrid with a fluoridated pyridine ring

Perovskites and their applications have been widely studied. However, a different variation has been discovered called Organic-Inorganic hybrids (OIHs). The aim of this study is to investigate an organic-inorganic hybrid made with fluoridated pyridine and manganese chloride. We are investigating the influence of the fluorine's electron withdrawing property on the pyridine ring and its effects on the electronic and physical properties of the polymer. The OIH crystals were synthesized in the laboratory. UV-vis, fluorescence, and Raman Spectroscopy were used in analyzing the synthesized compounds. The crystals are composed of a coordination polymer. Pyridine, 3,5-difluoropyridine monomer, and 3,5-difluoropyridine polymer reveal different fluorescent excitation and emission patterns. The preliminary data implies that the fluorine on the pyridine ring does influence the optoelectronic properties of the OIH polymer.

206

Izuchukwu, Chisom

New Mexico Highlands University

Grad

Key Words: Antioxidant, kinetics and spectroscopy

Authors: Chisom Izuchukwu; Dr. Steven Karpowicz

The antioxidant behavior of taurine, hypotaurine and thiotaurine protect biological molecules from reactive oxygen species

Glutathione (GSH), ascorbate (VitC), and NADH are biological reductants found in all human cells at high concentration. Taurine (Tau), hypotaurine (Hyp) and thiotaurine (Ttau) also are biological molecules known to react with reactive oxygen species and so are commonly called antioxidant. Their ability to protect biological molecules from oxidation has not been well-demonstrated. We are performing qualitative and kinetic experiments to determine if they can limit the oxidation of GSH, VitC, and NADH in the presence of hydrogen peroxide and superoxide. The study employs Raman spectroscopy, mass spectrometry, NMR spectroscopy and fluorescence spectroscopy to identify products of the reactions and the rates at which the products are produced. We expect that Tau, Hyp and Ttau will protect the biological reductants from oxidation by hydrogen peroxide and superoxide, which would indicate that they are biologically-relevant antioxidants in humans.

207

Jafaru, Amina

Eastern New Mexico University

Grad

Key Words: Staphylococcus aureus, MRSA, multidrug-resistant, Loop-Mediated Isothermal Amplification (LAMP), rapid detection, nucleic acid amplification, point-of-care, multiplex PCR, antibiotic resistance, clinical diagnostics.

Authors: Amina Jafaru; Ugwuanyi Ifeanyi Raphael

Development of a Molecular Assay for the Detection of Staphylococcus aureus using Loop-Mediated Isothermal Amplification (LAMP)

Staphylococcus aureus (S. aureus), a Gram-positive bacterium, is a significant human pathogen responsible for a wide range of infections, from minor skin infections to life-threatening conditions. The emergence of multidrug-resistant strains, particularly methicillin-resistant S. aureus (MRSA), has drastically reduced the effectiveness of standard treatments, contributing to higher morbidity, mortality, and an increasing public health threat. Rapid and reliable detection methods are crucial for timely intervention and effective management of S. aureus-related infections. This study focuses on the development of a Loop-Mediated Isothermal Amplification (LAMP) assay for the specific and sensitive detection of S. aureus.

In recent decades, the rise of MRSA has limited treatment options, as most MRSA strains are resistant to multiple antibiotics. The overuse and misuse of antibiotics have accelerated the spread of these resistant strains. Therefore, accurate and rapid diagnosis is critical for guiding the appropriate use of antibiotics in treating bacterial infections. Multiplex Polymerase Chain Reaction (PCR) is commonly employed to enhance the specificity and efficiency of MRSA detection, with various assays developed based on S. aureus-specific target genes.

The LAMP assay offers a nucleic acid-based amplification method that delivers high sensitivity and specificity comparable to PCR. Its simplicity, rapid amplification at a constant temperature, and minimal equipment requirements make it particularly suitable for point-of-care applications. The developed LAMP assay promises to improve the detection of S. aureus in clinical settings, enabling faster and more accurate diagnoses, and leading to better patient outcomes through timely and precise identification of infections.

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Kaabo, Matilda

Eastern New Mexico University

Grad

Key Words: Oxalate, Indicator Displacement Assay, Pyrocatechol Violet

Authors: Matilda Kaabo; Md Mhahabubur Rhaman

Colorimetric detection of oxalate following indicator displacement assay

Oxalate in the human diet influences the bioavailability of dietary calcium and magnesium. However, increased dietary oxalate significantly decreases calcium and magnesium absorption by forming insoluble oxalate salts, which finally accumulate in the renal tissue. It may result in several pathological conditions, including renal failure, pancreatic insufficiency, and the development of kidney stones. Therefore, the quantitative information on oxalate is widely used to identify several diseases, including hyperoxaluria, vulvodynia, and kidney stones. Many methods have been developed for quantitative analysis of the oxalate anion, which may not be suitable for general purposes. Nevertheless, colorimetric sensing following indicator displacement assay (IDA) of a specific anion becomes an attractive research area because of its low cost, simplicity, and visual detection of anions without expensive instruments and technically skilled personnel. In this research, the pyridine-based polyamine macrocycle was synthesized by Schiff's base reaction between 2,2'-diamino-N-methyldiethylamine and 2,6-pyridinedicarboxaldehyde in high dilution conditions followed by NaBH4 reduction. Then, the macrocycle was converted to dinuclear Cu(II), Ni(II), and Co(II) complexes (M) and studied for recognition of oxalate anion by indicator displacement assay (IDA) using commercially available dye Pyrocatechol Violet. The chemosensor showed selectivity for oxalate over common anions (fluoride, chloride, bromide, iodide, nitrate, carbonate, perchlorate, sulfate, and phosphates at physiological pH 7.4. In this poster presentation, the work will be explained in detail.

Acknowledge: This project acknowledges the Department of Physical Sciences at Eastern New Mexico University and the internal grant index PIRR3.

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David, Seth

University of New Mexico Neurosciences

Non-degree Grad

Key Words: neuroscience, psychology, alcohol

Authors: Seth David; Dominic Furlano; David Linsenbardt

Prelimbic Cortex to Nucleus Accumbens Circuit Regulates Alcohol Consumption Patterns Predicted by Sex-Specific Behavioral Cue Responses

Excessive alcohol consumption is a significant public health concern in the US, contributing to ~178,000 deaths annually. This high mortality rate is driven by binge drinking, underscoring the need to identify behaviors predicting risky alcohol use. Furthermore, the neural mechanisms driving anticipation for alcohol are largely unknown. Addressing these knowledge gaps could open new avenues for intervention and treatment.

In the present study, we used a mouse model of binge drinking. 48 mice were provided with specialized sippers that provide temporally accurate drinking volumes, dispensing water or alcohol for 2 hours, 19 days in a row. Alcohol consuming mice significantly increased their total consumption and developed front-loading, a heavy drinking pattern indicative of anticipation. To investigate behaviors predictive of heavy drinking, we initiated a cue 15 minutes prior to sipper availability and obtained 24-hour real time home-cage recordings. Both treatments displayed increases in velocity during the cue, suggesting it is salient regardless of predictive value. Time spent oriented toward the sipper during the cue was moderately predictive of front-loading in alcohol females, and distance from the sipper during the cue was moderately predictive of total volume consumed in alcohol males.

Additionally, we identified a neural circuit driving anticipation for alcohol. Using a fluorescent retrograde adeno-associated virus, we confirmed the existence of the prelimbic cortex to nucleus accumbens circuit. We discovered that its activation is not inherently rewarding using optogenetics in a conditioned place-preference paradigm. Lastly, we activated this circuit during an alcohol-predictive cue, significantly reducing subsequent consumption.

210

Ogbe, Matthew

Eastern New Mexico University

Grad

Key Words: Uranium, Ligands, ICPMS, XRF

Authors: Matthew Ogbe; Md Mhahabubur Rhaman

Synthesis of the Organic solid Ligands and the Removal of Uranium From Contaminated Groundwater

Dissolved Uranium (U) in groundwater constitutes a global health hazard to human and ecological health due to its radioactivity and chemical toxicity. About half of the world's population depends on groundwater as the principal source of drinking water. Uranium contamination in groundwater results from natural geochemical processes and anthropogenic activities. Although it exists predominantly at various oxidation states, it can be observed that tetravalent [U(IV)] and hexavalent [U(VI)] are the predominated states in an aqueous environment. U(IV) is poorly soluble in water while U(VI) is sparingly soluble in water. There are various methods, such as adsorption, photocatalysis, electrocoagulation, ion exchange, and membrane filtration strategies, for the remediation of U from groundwater. However, these processes are expensive and inconvenient in remediating U from a large quantity of water in the presence of other minerals. Developing a cheap and efficient technique to remove U from groundwater for agriculture, dairy farming, and consumption is imperative. This project aims to synthesize a water-insoluble ligand with multiple coordination sites from the reaction of terephthaldehyde and cysteine. The advantage of this ligand is its water-insolubility and flexibility of coordination sites. The absorption efficiency and the absorption capacity of the ligand would be measured, and the selectivity of extraction of U would be studied in the presence of iron, copper, nickel, cobalt, and Mn ions. This presentation will display the synthesis and characterization of the ligand.

Acknowledgments: This project acknowledges The Department of Physical Sciences, Eastern New Mexico University.

211

Zhao, Jiaqing

University of New Mexico

Grad

Key Words: Solar photovoltaic, Clean energy, Adoption equity

Author: Jiaqing Zhao

Adoption Equity of Residential Solar PV in New Mexico

In response to increasing concerns about greenhouse gas emissions and climate change, the adoption of solar photovoltaic systems in the U.S. is rapidly growing. Equity issues in solar deployment are a notable concern, with previous studies indicating that high-income and/or White households are more likely to install solar PV systems. We utilize the aggregated installation data from New Mexico, investigating the equity of solar adoption by examining the impact of key factors on both the likelihood of solar PV adoption within census tracts, and the magnitude of solar PV installations. We also address questions regarding the effectiveness of state-level incentives in reducing adoption disparities. Our findings reveal that while state-level incentives have successfully narrowed income-related disparities, they have been less effective in addressing barriers faced by disadvantaged groups. To enhance the equity of solar tax credits and other incentives, we recommend the continuous monitoring of existing policy impacts and adjusting it based on adoption rates and feedback from under-served communities.

212

Adams, Donald

Eastern New Mexico University

Grad

Key Words: Net Zero, Zero Emissions, Renewable Energy, Optimization Mathematics Derivation, Electric Vehicle, Solar Shaded Parking Structure.

Author: BSEET Donald Adams

Investigate and design a total of three 2.0 charging stations for Electric Vehicles. 240 Volt, 32 Amp, each.

Proof of concept, to implement a net zero, solar shaded parking lot to charge electric vehicles using a 2.0 Tesla charger. To do this, there must be a land survey on the size of the parking lot, and assess the potential energy produced. Second this paper will implement a process to determine the solar module and battery units required based on the energy requirements for each 2.0 charging station. The second method will calculate the total energy that is possible to produce based off of the total photovoltaic potential covered by the area of the parking surface. Ultimately there is an optimization that occurs between these two to meet somewhere in the middle. This paper will also serve as a guide for others who wish to apply for a grant to the State of New Mexico or to the Federal Government for a Net Zero Charging Station.

213

Hassan, Rukayat

Eastern New Mexico University

Grad

Key Words: Clean Energy

Authors: Rukayat Hassan; Juchao Yan

Synthesis of mono-carbonyl terminated tetra(p-phenylene) for probing electron delocalization in Organic Solar Cells (OSCs).

The carbonyl-terminated tetra(p-phenylene) compounds hold significant promise for use in electronics and solar cells due to their outstanding thermal and electrochemical stability, which are critical for the performance of organic solar cells (OSCs). These materials offer several advantages, including favorable electronic properties, cost-effectiveness, flexibility, and ease of processing, making them a strong alternative to traditional inorganic solar cells. However, concerns regarding their efficiency have hindered their widespread commercialization. Despite their potential, the application of these compounds in probing electron dynamics within OSCs has not been thoroughly explored. This research investigates the role of the carbonyl group as a reporter in improving our understanding of electron behavior within these molecules. The carbonyl group is more commonly used in OSC building blocks than the nitrile group, and it may play a key role in enhancing cell efficiency.

The molecular structure of carbonyl-terminated tetra(p-phenylene)s is characterized by ladder-like arrangements with continuous chains connected by rigid rings that prevent rotation, thereby maintaining the integrity of the conjugated system. This structural feature enhances the optical properties essential for the effective functioning of solar cells. Additionally, including alkyl side chains in the conjugated molecule improves solubility, which is advantageous for processing.

The synthesis of these compounds involves a combination of Suzuki cross-coupling, bromination, and carbonylation techniques. To investigate electron delocalization and gain insights into the electronic dynamics of these materials in OSCs, time-resolved infrared detection and pulse radiolysis are employed. This study aims to shed light on the electronic properties of carbonyl-terminated tetra(p-phenylene)s, with the ultimate goal of enhancing the efficiency of organic solar cells.

214

Hasan, Md Imran

Texas A&M University – San Antonio

Grad

Key Words: HIV, Molecular Docking, Biomarker Identification, Gene Expression Analysis

Authors: Md Imran Hasan; Ashley Teufel

Unveiling the Molecular Landscape of HIV Infection: Identification of Key Gene Biomarkers and Potential Drug Candidates through Single-Cell RNA Sequencing and Network Based Bioinformatics Approach

Despite significant advancements in treatment and prevention, HIV continues to pose a critical global health challenge, affecting millions of individuals worldwide. A comprehensive understanding of the molecular mechanisms underlying HIV infection is vital for developing effective diagnostics, treatments, and preventive measures. In this study, we utilized single-cell RNA sequencing (scRNA-seq) data from the GEO database to identify 69 differentially expressed genes (DEGs) following gene integration. Gene Ontology and KEGG pathway analyses were performed on these DEGs to elucidate their biological significance. A protein-protein interaction (PPI) network was constructed using the STRING database and visualized with Cytoscape, leading to the identification of 7 hub genes. We evaluated the diagnostic, expression, and prognostic potentials of 5 key genes through ROC curve analysis, with high AUC values underscoring their diagnostic relevance. Additionally, regulatory network analysis identified 7 key transcription factors (TFs) and 8 key miRNAs associated with these genes. ROC analysis highlighted ISG15, STAT1, and MX1 as promising biomarkers. Moreover, molecular docking studies identified Hypersin, Glycyrrhizin, and Baicalin as potential drug candidates targeting CDK1, CCNA2, and RRM2, respectively, given their roles in cell cycle regulation and DNA replication, processes critical for HIV replication. This study offers crucial insights into the molecular mechanisms of HIV, identifying potential gene biomarkers and drug candidates, thus contributing significantly to HIV research and the development of novel therapeutic strategies.

215

Pacheco, Rosalinda

Central New Mexico Community College

Grad

Key Words: particulate matter, respiratory, temperature

Authors: Rosalinda Pacheco; Laurel Cenac; Melanie Will-Cole

HEAT AND HEALTH: THE INTERSECTION BETWEEN AN URBAN HEAT ISLAND AND POLLUTIVE EFFECTS IN ALBUQUERQUE NM

This study seeks to analyze UHI temperature and particulate matter outcomes in a micro-regional sector of Albuquerque. The goal of this study is to gain a greater understanding of how increased instances of temperature and particulate matter can influence respiratory illness. We sought to answer whether there is a correlation between particulate matter distribution and temperature. In addition, we analyzed the variance in particulate matter between residential and commercial areas.

To answer our research questions, we chose a micro-region in the northeast part of Albuquerque. The total transect path-length was a 2.7-mile loop walked at three time points of the day: morning, afternoon and evening. This transect route was taken twice per week over a seven-week period from May 19 through July 28, 2024. Data collection consisted of air temperature, particulate matter, and observational meta-data. The sensor instruments utilized for data collection were AirBeam, Pocketlab, and Kestrel-3000. The two time-series plots of temperature and particulate matter did not show a correlation between both variables. However, our heat maps for particulate matter indicate higher distributions in commercial areas than residential areas.

This research analyzes the connections between the UHIE and environmental particulates within Albuquerque NM to inform future health interventions. This is crucial for addressing social determinants of health for respiratory illness prevention.

216

Paris, Mikem

New Mexico Highlands University

Grad

Key Words: THERMAL PROCESSING, PHYTOCHEMICALS, LYCOPERSICON ESCULENTUM

Author: Mikem Paris

EFFECT OF THERMAL PROCESSING ON THE PHYTOCHEMICAL CONTENTS OF LYCOPERSICON ESCULENTUM

The present study investigates the impact of thermal processing on the phytochemical properties of Lycopersicon esculentum (tomato), focusing on three key compounds: ascorbic acid, β-carotene, and lycopene. The tomatoes were classified into seven groups: one control (unheated), three boiled (for 2, 15, and 30 minutes), and three fried (for 2, 15, and 30 minutes) at a constant temperature of ~95°C. Phytochemical levels were quantified using colorimetry measurements for ascorbic acid and UV-Vis spectrophotometry for β-carotene and lycopene. The results showed a significant increase in lycopene content with extended cooking times up by ~23.6% after 2 minutes of boiling, ~39% after 30 minutes, and ~56.8% after 30 minutes of frying. In contrast, ascorbic acid and β-carotene levels decreased with increased processing time. Both compounds were significantly reduced compared to the control group ($P < 0.05$), with marked reductions noted in the group fried for 30 minutes. These findings suggest that while thermal processing enhances lycopene bioavailability, it degrades heat-sensitive compounds like ascorbic acid and β-carotene. These results underscore the dual role of thermal processing in enhancing certain beneficial compounds while degrading others, highlighting the complexity of cooking as a variable influencing the nutritional quality of tomatoes. This study highlights the complex effects of cooking on the nutritional quality of tomatoes, providing valuable insights for optimizing food preparation to maximize health benefits.

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Ojha, Atul

University of New Mexico

Grad

Key Words: glycation, bioconjugation, Staudinger ligation

Authors: Atul Ojha; Matthew Aronoff

Standing on the Shoulders of Staudinger: Leveraging Classical Biooconjugation Chemistry for the Site-Specific Installation of Protein AGEs

Glycation is a non-enzymatic process wherein reactive dicarbonyl species derived from reducing sugars react with lysine and arginine side chains in proteins, resulting in the formation of Advanced Glycation End Products (AGEs). These AGEs have been linked to the most significant health conditions currently affecting humankind, including diabetes, cardiovascular diseases, neurodegenerative disorders, cancer, and aging. To investigate the specific roles of these modifications in disease, precise control over the location of the AGEs in proteins is essential. Currently, chemical synthesis of individual AGE-bearing amino acids followed by their utilization in chemical protein synthesis is the only way to obtain proteins with well-defined glycation patterns. The preparation of AGE-modified proteins and peptides is therefore tedius and only feasible for small proteins, and more practical methods are needed for larger proteins. This study explores a novel variation of the Staudinger reaction—a classical transformation with modern predendence in bioorthogonal chemistry—to achieve site-specific installation of AGEs in proteins with the longterm goal of gaining a molecular understanding of the complex glycation process and its implications in disease and the consequences of aging.

218

Sangber-Dery, Emannuella

University of New Mexico

Grad

Key Words: Osteocalcin, Gamma-carboxyglutamic acid (Gla), Chemical synthesis,Peptide synthesis

Authors: Emannuella Sangber-Dery; Matthew Aronoff

Synthesis and structural analysis of the Gla domain in Osteocalcin

Osteocalcin (OC)—also known as bone gamma-carboxyglutamic acid-containing protein (BGLAP)—is a non-collagenous protein hormone secreted by osteoblasts during ossification. OC is made up of 49 amino acids and exists in two forms in the human body: as uncarboxylated OC (OC-Glu) or as carboxylated OC (OC-Gla) that contains a Vitamin K-dependent post-translational gamma-carboxylation of glutamic acid to form non-canonical Gla (gamma-carboxyglutamate) residues. This unique modification enables Gla domain-containing proteins like Osteocalcin to bind Ca2+, which is relevant for several cellular processes such as cell signaling and mineral absorption. To better understand the structural and functional consequences of these modifications upon the protein, we have undertaken the chemical protein synthesis of the Gla unit and both isoforms of Osteocalcin. Techniques and approaches will be discussed, as well as new insights into the impact of gamma-carboxylation.

219

Navine Nanjo, Bijili

New Mexico Highlands University

Grad

Key Words: Cowpeas , Phenolic acids, flavonoids, and tannins, bioactive antioxidant, anti-inflammatory, anti-carcinogenic compounds

Author: Biliji Navine Nanjo

The effect of forced air solar drying on the quantity of vitamin C of cowpeas leaves

Cowpea is an annual legume thought to have originated in Africa.

Nutrients in whole grain, leaves, and aerial parts of the cowpea plant.

Grown for food, fodder, green manure, and medicine.

It is estimated that about 45% of cowpea are lost per year after harvest (FAO)

Dehydration is essential to reduce post-harvest losses.

The research focuses on applying technology that allows the utilization of renewable energy to preserve the nutritional quality of food and evaluate the effect of forced air on the retention of vitamin C in cowpea leaves

To compare the amount of vitamin C in solar-dried and sun-dried cow-pea leaves

To compare visually the change in the color of cowpea leaves when solar-dried and sun-dried.

220

Akinlabi, Blessing

University of New Mexico

Grad

Key Words: cordysinin A, natural product, peptide synthesis

Authors: Blessing Akinlabi; Jared Balsz-Diaz

Peptide natural product synthesis and investigation- Cordysinin A

Cordyceps sinensis (O. sinensis) is a parasitic entomopathogenic fungus that grows on insects and is found in the Tibetan plateau and Himalayan regions. O. sinensis produces numerous bioactive natural products with a range of pharmacological activities commonly utilized in traditional Chinese and Tibetan medicine. Amongst these compounds are the Cordysinins, a class of small molecule natural products with diverse structures including peptides, nucleoside analogues, and carbolines. One compound with proposed antioxidant activity, Cordysinin A, contains a diketopiperazine moiety formed by a cyclic hydroxyproline and leucine. To explore the bioactivity in further detail and also address ambiguity regarding the absolute configuration of the hydroxyl group, we completed the total synthesis of Cordysinin A. Synthetic approaches and conformational insights gained through experimental and theoretical results will be discussed, including the late-stage hydroxylation of pyrrolidine which facilitated access to both of the two possible diastereomers. This research will contribute to the field of organic and computational chemistry with further implications in the fields of chemical biology and medicinal chemistry.

221

Quartey, Emmanuel

University of New Mexico

Grad

Key Words: Advanced glycation end products (AGEs), Post-translational modification (PTM), synthesis.

Authors: Emmanuel Quartey; Matthew R. Aronoff

Effect of Advanced glycation end products (AGEs) on Alzheimer's Disease

Advanced glycation end products (AGEs) contribute to Diabetes and neurodegenerative diseases like Alzheimer's disease by structurally diverse class of post-translational protein modifications prevalent. but the mechanisms involved are not clear. Targeting AGEs has potential therapeutic implication. This protein glycation is produced through nonenzymatic reactions of arginine or lysine with glucose-derived alpha-dicarbonyl compounds. Glyoxal—a two carbon dialdehyde—is the smallest of this class and generates carboxymethyllysine (CML) from lysine, and Glarg and carboxymethylarginine (CMA) with arginine. While CML modifications in proteins are frequently identified, observations of Glarg are relatively scarce as the imidazolone ring readily hydrolyzes to CMA under harsher conditions. To better understand the impact of these two related modifications on Alzheimer's disease, we elucidate the mechanism of synthesizing the related AGEs Glarg and CMA, and protein with well-defined AGEs. We envision that this research will help provide new insights into the structural and functional impact of these protein modifications.

222

Salika Dulanjali, Sooriyage

University of New Mexico

Grad

Key Words: Bioconjugation, Gla proteins, Selective labeling

Authors: Sooriyage Salika Dulanjali; Victoria Nisoli

Broadening the techniques for protein bioconjugation, particularly by targeting Gla residues in Gla proteins.

Protein bioconjugation techniques have gained significant interest due to their numerous applications in chemical biology, biomedicine, and biotechnology. While proteins possess various functional groups, most conjugation methods target nucleophilic residues like lysine or cysteine. Although carboxylic acid-containing residues are abundant in proteins, there has been relatively limited research on conjugating these residues, and achieving selective covalent labeling of these functional groups in aqueous media remains challenging. To expand the current limitations, we examined existing methods for conjugating carboxylic acid residues, such as aspartic and glutamic acid. We conducted a comparative analysis of these existing conjugation methods, ensuring that reaction conditions like buffer type and pH were consistently maintained with all possible experiments. Additionally, we evaluated the ability of these reactions to form conjugates with noncanonical carboxylic acid-containing amino acids. Specifically, we investigated conjugation reactions involving gammacarboxyglutamic acid residues, a VitaminK-dependent post-translational modification. This approach will open opportunities for expanding the chemical space of bioconjugation reactions.

223

Davoudi, Hamid

New Mexico State University

Grad

Key Words: Contingency Analysis, load uncertainty, nodal reserve requirements, reserve deliverability, robust optimization, umbrella contingencies.

Authors: Hamid Davoudi; Dr. Fengyu Wang

Reserve Deliverability Enhancement by an Umbrella Contingencies Identification Procedure

To improve reserve deliverability in the event of generator failures, reserve procurement enhancement (RPE) constraints can be incorporated into the day-ahead market. However, modeling all generator contingencies within RPE constraints in real-world electricity markets significantly increases the optimization problem's complexity, making it unsolvable within the necessary timeframe. To address this, a subset of these contingencies, known as the Umbrella Contingency Set (UCS), must be identified. The UCS represents a subset of credible contingencies that is sufficient to achieve security and economic performance levels equivalent to, or very close to, those attained when considering all credible contingencies. Post-event reserve deployment and load deviation can alter the flow of transmission lines, leading to congestion and undeliverable reserves. The combination of generator failures, reserve deployment in response, and load deviation generates numerous scenarios. This study proposes a novel approach utilizing robust optimization to identify the UCS, focusing on the worst-case scenario derived from a combination of events, reserve deployment, and load uncertainty. Case study conducted on the IEEE RTS 24-bus system demonstrate the efficacy of the approach in enhancing reserve deliverability and mitigating violations under various levels of load uncertainty while ensuring computational tractability.

224

Ahinful, Isaac

Eastern New Mexico University

Grad

Key Words: Organic Solar Cells, Carbonyl functionalized Penta (p-phenylene)

Author: Isaac Ahinful

Synthesis of carbonyl functionalized Penta(p-phenylene) for probing electron delocalization in organic solar cell applications

Organic solar cells (OSCs) are devices that can convert light energy into electrical energy. Over the past few years, there has been a significant increase in research, development, and production of solar cells due to the rising demand for sustainable energy sources. The synthesis of carbonyl-functionalized Penta(p-phenylene) has proven to be a highly versatile and powerful tool for investigating and manipulating electron delocalization. Its applications continue to expand in the field of organic chemistry. The synthesis of carbonyl-functionalized Penta (p-phenylene) has become a crucial method for probing electron delocalization in organic molecules. This process involves introducing the carbonyl groups at specific positions along the Penta (p-phenylene) backbone, which allows for the manipulation of electron density and the creation of localized or delocalized electronic states. This approach has been utilized in various fields including but not limited to organic electronics, photovoltaics, and molecular electronics to understand and control the electronic properties of these materials. The incorporated carbonyl functional group serves as an infrared reporter, enabling time-resolved infrared measurements of electron delocalization followed by pulse radiolysis.

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Boafo, Kwesi

Eastern New Mexico University

Grad

Key Words: Microplastics, Rio Grande, Fourier-Transform Infrared Spectrometry

Authors: Felix Boafo; Dr. Zachary Mitchell; Dr. Manuel Ivan Rodriguez Borbon; Dr. Manuel Arnoldo Rodriguez Medina

Microplastics Monitoring of Water in the Texas-New Mexico-Chihuahua Region

The initiative named "Microplastics Monitoring of Water in the Texas-New Mexico-Chihuahua Region" tackles the escalating issue of microplastic contamination in the Rio Grande/Rio Bravo. Microplastics, originating from the breakdown of solid plastics, are pervasive in aquatic systems and have been detected in the food sources of both humans and animals. The aim of the project is to create the inaugural transnational microplastics detection laboratory between Mexico and the United States, supplying essential data on microplastic concentrations in the area. Researchers from various universities will perform water sampling at 19 designated locations, including water treatment facilities and reservoirs, employing Fourier-Transform Infrared Spectrometry (FTIR) to assess the presence and concentration of microplastics. The project will encompass public education via workshops and the creation of a machine learning model to predict microplastic contamination. This initiative seeks to guide future regulatory measures and enhance water quality management for human and environmental health. The data will be publicly accessible, with results enhancing the scientific comprehension of microplastics' prevalence and associated health risks.