

New Mexico Research Symposium 2026

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Whose Sky Is It? The Global Weather Tour

Graduate Presenter: Mary Yalnaty, NMSU

K-12 Teacher Presenter: Suneetha Yalnaty, NUSD

As generative AI becomes increasingly integrated into educational settings, students need opportunities to critically examine how AI generates, presents and represents knowledge. Although AI tools are often introduced to support teaching and learning, less attention is given to how students can question the credibility of AI generated information, identify missing perspectives, and recognize whose knowledge is represented. This is particularly important in elementary school education, where students bring their own observations, cultural experiences, and community knowledge into classroom. This study explores how critical AI literacy can be integrated into existing science instruction rather than taught as a separate technological skill.

Whose Sky Is it? The Global Weather Tour is a content embedded instructional activity designed for students in Grade 3 to 5. The study uses weather as a familiar scientific phenomenon to help students explore how people observe, predict and explain the natural world through different ways of knowing. The activity follows a five stop learning experience that connects personal observations, meteorological instruments and data, cultural and community knowledge, AI generated information and family experiences. Through these activities, students engage in scientific reasoning, compare sources of knowledge, and examine how evidence is developed and interpreted across different contexts. A central component of the activity is a AIR (Authority, Information, Representation) framework, which encourages students to critically evaluate AI generated responses by examining how information is presented as authoritative, what evidence supports the responses, and whose voices or perspectives may be missing. For example, students compare a generated explanations of meteorological practices with the responses about Zuni community observations of seasonal birds and monsoon patterns. This comparison creates opportunities for students to recognize how AI may preserve certain information while generalizing or omitting the cultural content, original source, or individual associated with that knowledge. The study is informed by critical AI Literacy, epistemic practices, and the recognition of multiple ways of knowing. Its instructional design also incorporates accessible learning materials, visual support, sentence frames, and collaborative activities to support students with diverse learning needs. The planned classroom implementation will examine how students engage with AI generated information, evaluate evidence, and identify differences in how scientific and community knowledge are represented. This research aims to contribute to the growing discussions on integrating critical AI literacy into content-specific instruction. By connecting AI evaluation to meaningful science learning, the project seeks to provide educators with a practical and inclusive instruction approach that helps students question AI-generated information, recognize diverse knowledge sources, and develop more responsible ways of engaging with AI in the classroom.

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Integrating Agentic AI into Workflow Management: A Framework for Increasing Productivity

Graduate Presenter: David Smith, ENMU

Agentic Artificial Intelligence (AI) has the potential to transform workflow management to automate routine tasks, enhance decision support systems and improve operational efficiency. These capabilities offer opportunities to increase productivity and manage workloads with less increased demand for resources. Organizations may lack a structured approach for how to integrate Agentic AI into existing workflows and how to evaluate its effectiveness. This research will reveal what Agentic AI integration might do for project managers through assessment, adoption and implementation of AI-enabled workflow capabilities. This study will address the question about the relationship between the framework methods and the application tools. Workflow activities like goal setting, budgeting, reporting, coordination, documentation, risk management, stakeholder communication and even e-mail management occupy a sizeable part of any manager's day. This research begins with an analysis of current workflow practices and identifies opportunities where AI integration can provide measurable improvements. Research methods include literature review, interviews, surveys and practical experimentation. The study will anticipate workflow performance before and after AI integration using measures such as simulated productivity, process efficiency, decision quality, workload capacity and user satisfaction. Findings will be used to develop a decision model to address workflow assessment, AI readiness, opportunity identification, capability mapping, tool evaluation, implementation and governance. The expected outcome is a practical framework that enables project managers to integrate Agentic AI into existing workflows, evaluate its impact and identify solutions that deliver sustainable productivity improvements while maintaining transparency, accountability and appropriate human oversight.

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Teachers as Designers: Enacting 3D Printing in K–12 Classrooms

Graduate Presenter(s): Sumanth Reddy Nandhikonda, NMSU; Riges Krishnaraj, NMSU

Author: Sayantan Maity, NMSU

Author: Suparna Chatterjee, NMSU

Three-dimensional printing (3DP), or additive manufacturing (AM), is increasingly promoted in science, technology, engineering, and mathematics (STEM) education as a tool for hands-on learning, real-world problem solving, and workforce preparation. However, successful classroom implementation depends on teachers having the knowledge, skills, and confidence to integrate 3DP into existing curricula. The research question was: “How did participation in an AM professional development influence teachers’ adoption of 3D printing in STEM instruction?” Data were collected from 30 K–12 teachers through surveys, focus group discussions, and individual interviews. Descriptive statistics and thematic analysis were used to analyze the data. Results indicate that teachers’ knowledge of 3DP increased following professional development, with gains across conceptual, technical, pedagogical, and practical domains, increasing from 10–20% to approximately 75%. Teachers’ confidence in implementing 3DP, troubleshooting, curriculum alignment, student learning, and fostering creativity increased from 15–45% to 35–80% after professional development. Confidence was highest in fostering creativity and connecting 3DP to student learning, and lowest in troubleshooting. It shows that 60% of the teachers are ready to implement it in the classroom. Some teachers have implemented it through designing a house, helmets, and molecules in their classes. Teachers expressed interest in using 3DP as a standalone activity, integrating it into existing content, project-based learning, and engineering activities to tailor it to their subjects’ needs. These findings suggest that AM professional development can support teachers’ knowledge, confidence, and readiness to adopt 3DP across diverse STEM instructional contexts, while access to equipment and materials remains important for sustained classroom implementation.

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A Gut Feeling: Investigating the Effects of MASLD on Hormone-Producing Cells in the Gut

Undergraduate Presenter: Veronica Hibler, CNM

Metabolic dysfunction-associated steatotic liver disease (MASLD) is a condition in which excess fat builds up in the liver. While this chronic disease primarily affects the liver, research suggests that it may also influence other parts of the body, including the gut. Previous research from our lab found increased levels of glucagon-like peptide-1 (GLP-1), a hormone that helps regulate blood sugar and reduce hunger cravings, in mice with MASLD. Researchers have also found higher levels of complement C3, a protein involved in the immune system, in individuals with MASLD. However, its role in gut hormone production is not fully understood. To investigate this relationship, we grew miniature, intestine-like structures called organoids from healthy mice and mice with MASLD. We examined proteins involved in C3 signaling and treated organoids with C3a, a protein fragment involved in immune responses. Using fluorescent staining and RT-qPCR, a technique that measures gene activity, we found increased expression of genes associated with hormone-producing cells in MASLD organoids. Treatment with C3a was also associated with increased expression of genes linked to cells that produce GLP-1. These findings suggest that C3 signaling may influence gut hormone production during MASLD. This could help researchers better understand how the gut and immune system respond to changes caused by liver disease.

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Micro-environmental Influences on Eye Cancer: Investigating Uveal Melanoma Sensitivity to Cisplatin

Undergraduate Presenter: Zachary Street, CNM / UNM

Uveal melanoma is a cancer of the eye associated with poor outcomes after metastasis. Although local treatments are often effective, limited treatment options for metastatic disease highlight the need to understand factors that influence treatment response. This study investigated whether endothelial cell-derived factors alter the sensitivity of uveal melanoma cells to cisplatin. We selected cell types associated with where this cancer develops in the eye. We treated uveal melanoma (eye cancer) cell lines with diluted growth media from healthy endothelial cells cultures before administering the common chemotherapy drug, cisplatin, at a previously established half-maximal inhibitory concentration (IC_{50}) for the selected cancer cell lines (MP41, MP46, and 92.1). Cells exposed to choroidal endothelial cell-conditioned media showed a reduced response to cisplatin compared with control groups. These findings suggest that factors released by choroidal endothelial cells may decrease cisplatin sensitivity in uveal melanoma cells. Further investigation is needed to identify the factors responsible. This further research will help determine how they influence treatment response, and aid in identifying candidate gene markers that can be targeted by emerging therapies. This work highlights a potential role for endothelial cell-derived signals in resistance to treatment and provides a foundation for investigating interactions between uveal melanoma cells and their surrounding microenvironment.

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Understanding How Cells Respond to Lysosomal Damage

Undergraduate Presenter: Diego Hernandez, UNM

Lysosomes are organelles involved in cellular degradation and recycling. Lysosomal dysfunction disrupts these vital processes and can contribute to cellular damage and cell death. Cells respond to stress through the formation of stress granules, which are membraneless RNA-protein condensates. Stress granules regulate mRNA translation and may promote cell survival over cell death. Previous research has shown that stress granules can inhibit apoptosis by sequestering executioner caspases. Research has also shown that lysosomal damage can trigger the formation of cytoprotective stress granules. Even so, it remains unclear which cell death pathways stress granules may help prevent during lysosomal stress. This study aimed to investigate whether stress granules help protect against lysosomal damage-induced apoptosis by comparing caspase-3 cleavage in wild type (WT) and G3BP1/G3BP2 double knockout (DKO) U2OS cells. WT and DKO cells were treated with LLOMe to induce lysosomal damage. Apoptosis was assessed by Western blot analysis of cleaved caspase-3. Preliminary Western blot results showed variable cleaved caspase-3 levels between WT and DKO cells. Further investigation is needed to determine whether stress granules protect against lysosomal damage-induced apoptosis.

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EGFR and RON Activation in Human Embryonic Kidney Cells

Undergraduate Presenter: Joanna Hernandez, CNM

Receptor tyrosine kinases are proteins that cells use to communicate, in cancer cells these signaling proteins can be responsible for uncontrolled cell growth, cell survival and migration. EGFR and RON are receptor tyrosine kinases. These proteins require a protein ligand to send a signal. Previous research found that EGFR increased RON activation in Human epidermoid carcinoma A431 cancer cells. It is unknown how EGFR and RON activation is affected in Human embryonic kidney cancer cells. In this research, human embryonic kidney cells were treated with a ligand, then were separated in a Western blot and their activation was measured using fluorescent antibodies that bind to the activated protein of interest. The research found that EGFR increased RON activation in human embryonic kidney cells. Further research is required to understand whether an increase in RON activation affects cell growth, cell survival, or migration.

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Physics of the Streaming Instability Clumping Boundary

Graduate Presenter: Olivia Brouillette, NMSU

Author: Wladimir Lyra, NMSU

Planet formation entails the growth of micron-sized dust grains into planets up to roughly one hundred thousand kilometers in size. The initial growth from small dust grains to pebbles, approximately mm - cm in size, likely occurs via dust coagulation. The collisional sticking for grains allows for the dust grains to grow larger. At approximately millimeter to centimeter size, the grains reach size-limiting growth barriers, namely the fragmentation and drift barriers. The fragmentation barrier is a result of collisions between dust grains: although these collisions could result in sticking or fragmenting, when the grains have reached a size of $\sim$ millimeter, the relative velocity of the grains becomes so large that fragmentation is more likely. The radial drift barrier is due to the headwind imposed on the dust grains from the gas, making the dust grains spiral inward towards the star. Given that a dust grain has a drift timescale less than that of the disk lifetime, grains will accrete onto the star rather than contributing to planet formation. Under typical conditions, the fragmentation barrier occurs first, stalling the growth at millimeter to centimeter-sized grains. One possible solution to the fragmentation and radial drift barriers is the streaming instability. The streaming instability is a promising mechanism for planetesimal formation in which differentially drifting pebbles form over densities through aerodynamic effects in the form of axisymmetric filaments, which can collapse under the effect of self-gravity and form ~ 100 km size parent planetesimals, circumventing the growth barriers. Several works in recent years have investigated the feasibility of the mechanism in a parameter space consisting of Stokes number (St), defined as the dimensionless stopping time, and the solid-to-gas column density ratio (Z). These works have identified a clumping threshold for planet formation based on values of Z and St . For this threshold, simulations with a maximum density value higher than the Roche density are considered to be successful by forming planetesimals. Over the past decade, a number of authors have revised the clumping boundary using different physical conditions and numerical techniques. A possibility that cannot yet be disregarded given our current knowledge is that the differences in the location of the clumping boundary may simply reflect differences in numerical treatment between the codes. Given that clumping happens at small scales, numerical discrepancies between methods may be present and must be investigated to ensure accurate interpretation of planetesimal formation. By running the simulations along the current clumping boundary, we will be able to identify the discrepancies caused by different numerics. 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-80NSSC25M7069.

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Modeling the Behavior of Thermal Radiation in Translucent Ceramic Barrier Coatings

Graduate Presenter: Carldon Pascual, UNM

Author: Michael Presby, NASA

Author: Jeffrey Eldridge, NASA

Author: Bryan Harder, NASA

Author: Georgios Koutsakis, UNM

As temperatures rise for a black body, the emissive power increases exponentially and shifts to shorter wavelengths according to Wien's Law. Over time, engines have shifted towards higher combustion temperatures to favor higher efficiency and power. Many of these engines are protected by ceramic coatings to prevent melting. As the shift to higher temperatures continues, thermal radiation is a growing concern as these coatings are translucent in the bandwidths where thermal radiation is greatest. A 1-D heat transfer model was created to understand the behavior of thermal radiative fluxes in a two-layer system consisting of a thin ceramic coating and a superalloy substrate. From this model, the convective, conductive, and radiative thermal fluxes along with the temperatures throughout the coating and substrate can be quantified and examined. The objective is to determine the overall contribution of thermal radiation at higher temperatures, and its importance for the development of future ceramic coatings.

A previous experimental study is considered to validate the model. This previous work involves using a carbon dioxide laser (10.6 μm wavelength) to apply a uniform heat flux to a Nickel-based superalloy with a 7 wt.% Yttria-stabilized zirconia (7YSZ) thermal barrier coating (TBC). The TBC and superalloy surface temperatures are measured with a single and two-color pyrometer, respectively. The sample also features a sensing layer at the TBC-bond coat interface to enable luminescence-based measurements of the coating-metal interface temperature. The temperature gradient through the system is predicted using the 1-D model based on the material thermal properties and thermal fluxes. The results from the model are shown to correlate well to the experimental data.

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Control System Design for a Rotating Detonation Engine

Undergraduate Presenter: Brendan Canales, UNM

Rotating detonation engines (RDEs) are advanced propulsion systems that harness continuous detonations rather than conventional deflagrations. At the University of New Mexico's Koutsakis Lab, an RDE has been developed as a test bed for evaluating advanced materials and coatings in a high-temperature, high-shock environment. Operating such an engine safely and repeatably demands a dedicated control and data acquisition system. A LabVIEW-based control system was developed on a National Instruments CompactRIO (cRIO) platform to provide automated sequencing, operator-guided manual control, and safety monitoring with automatic shutdown. The system also performs synchronized data acquisition and triggers high-speed diagnostics, enabling both low-speed and high-speed measurements of each test. Using this system, a test campaign of more than 250 engine firings was completed across varied operating conditions, with complete data recorded for each test. 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-80NSSC25M7069.

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LARVAL: Lyman-Alpha Radiative-Transfer Variations in AGN Laboratories

Graduate Presenter: April Barton, NMSU

Author: Moire Prescott, NMSU

Author: William C. Keel, University of Alabama

Lyman-Alpha ($\text{Ly}\alpha$) is the brightest UV emission of galaxies. The $\text{Ly}\alpha$ photon 121.6 nm is created by hydrogen gas in response to intense radiation fields like those near newborn massive stars or rapidly accreting supermassive black holes (SMBH). $\text{Ly}\alpha$'s bright luminosity and short wavelength allow astronomers to trace distant galaxies at a time when the universe was much younger. However, only a fraction of produced $\text{Ly}\alpha$ photons reach our telescopes because of $\text{Ly}\alpha$'s strong scattering tendencies within neutral hydrogen. To accurately interpret observations of the younger universe in $\text{Ly}\alpha$, it is important to understand what features of a galaxy allow $\text{Ly}\alpha$ to easily escape. Because dust and neutral hydrogen inhibit $\text{Ly}\alpha$ transmission, common explanations of $\text{Ly}\alpha$ -escape include dust-free cavities of ionized hydrogen produced by starbursts or active galactic nuclei (AGN). However, these ideas are seldom quantified through spatially resolved observations of individual galaxies. In a sample of 6 AGN-hosting galaxies, Hubble Space Telescope (HST) images of $\text{Ly}\alpha$ -emission and hydrogen-alpha ($\text{H}\alpha$) reveal spatially extended emission > 10000 light years from the center of the galaxies. $\text{Ly}\alpha$ is co-produced with $\text{H}\alpha$ from re-combination of ionized hydrogen. Therefore, differences in their morphology reflect differences in radiative transfer behavior rather than different astrophysical sources. In at least one of the six members of the sample, there are also complex gas kinematics indicated by Gemini Multiobject Spectrograph (GMOS) spectroscopy. We can quantify three aspects of $\text{Ly}\alpha$ radiative transfer, using a combination of spatially resolved $\text{Ly}\alpha$ emission maps and ($\text{H}\alpha$) emission maps from HST, and ground-based GMOS spectra. First, we measure radial diffuseness of $\text{Ly}\alpha$ (quantifies scattering) second, radial-asymmetries (correlated to gas-kinematics and dust) and third $\text{Ly}\alpha$ -escape fraction (the fraction of $\text{Ly}\alpha$ -observed/ $\text{Ly}\alpha$ -produced). $\text{Ly}\alpha$ -produced is derived from the intrinsic $\text{Ly}\alpha/\text{H}\alpha$ ratio ~ 8.7 . The methods for our analysis were inspired by analyses of the Lyman-Alpha Reference Survey (LARS) of 14 $\text{Ly}\alpha$ -emitting starburst galaxies in the local universe ($0.02 < z < 0.18$). We can improve our empirical understanding of $\text{Ly}\alpha$ radiative transfer with exceptionally luminous and spatially extended $\text{Ly}\alpha$ -emitters that are more distant ($z > 0.3$) and powered by SMBHs instead of starbursts. 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-80NSSC25M7069.

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Uncovering High-mass Protostellar Flows with NASA SPITZER Data

Graduate Presenter: Rayna Spencer, NMT

Author: Peter Hofner, NMT/NRAO

Details of the evolutionary sequence of high-mass ($M \geq 8 M_{\odot}$) star formation remain unknown. Understanding their evolution is fundamentally important as massive stars dominate our Galaxy through their enormous energy output. During formation, high-mass protostars eject large amounts of matter at speeds exceeding 500 km/sec, yet the physics driving this ejection remains poorly understood. We combine radio data with space-based infrared data to study the outflowing material from these protostars which excites and shocks the surrounding matter. Although they are exceedingly rare and difficult to find, we have located five such rare high-mass protostellar candidates. This presentation focuses on one of these objects, SMM1, a massive core within the high-mass star-forming region ISOSS J23053+5953. Continuum data from the Karl G. Jansky Very Large Array (VLA) and 1.3 mm Submillimeter Array (SMA) are used to examine the morphology and spatial distribution of emission associated with the core. Spectral energy distributions (SEDs) constructed from the continuum measurements are consistent with an ionized jet, providing preliminary evidence of protostellar outflow activity. These outflows are probed with SiO rotational lines observed with the SMA telescope and are combined with 4.5 μm observations from NASA'S SPITZER telescope, which provides an alternative probe of shocked gas through high excitation H₂ molecule emission. This provides a more direct view of the location of the shocked gas near the protostar, and will serve as a significant counterpart to the VLA SiO data to identify and characterize shocked material associated with the outflows. 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-80NSSC25M7069.

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Validation of Visually Evoked Potentials

Undergraduate Presenter: William Schwindt, CNM

Author: Brandi Hess, UNM

Author: Russell Morton, PhD, UNM

Concussion, or minor traumatic brain injury (mTBI), is a very common type of injury for which there is little modern medical treatment. They are particularly perplexing because accurately assessing brain damage is notoriously difficult given the brain's immense sensitivity and microscopic complexity. Current research into concussions has evolved to see these events as enduring brain injuries causing disordered physiological responses. Utilizing live mice models and electrophysiology, we directly measure brain activity with a classic electrophysiology technique known as Visually Evoked Potentials (VEPs), which acts as a diagnostic of the visual cortex by analyzing specific responses to a standardized visual stimulus. A common symptom of concussion is light sensitivity, and these experiments may give us more insight into why and how this occurs. This research is in early stages, with most of the effort thus far establishing a workflow using a small group of control mice which are uninjured but have implanted electrodes in their primary visual cortex. We describe how we show mice a repetitive visual stimulus and collect neural recordings from their implants. These methods proved to be an effective tool for collecting visual evoked potentials that can be repeated to establish a body of data from both control and concussed mice. This experiment helps pave the way towards a better understanding of the link between brain injury and vision.

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Measuring Longitudinal Change in Cognitive and Brain Structure Biomarkers

Postbaccalaureate Presenter: Zavien Spann, Mind Research Network/UNM

Author: Arvind Caprihan, Mind Research Network

Author: Katarzyna M Wilamowska, UNM

Objective: A long-term goal of the Memory and Aging Center is to identify biomarkers that predict an early onset of Alzheimer's Disease and vascular dementia. Our objectives are to study if cognitive and MRI brain structure biomarkers from two longitudinal studies, MarkVCID and ADRC can be combined and to identify subjects that have measurable cognitive and brain structure change. **Method:** Due to different measurement ranges, all biomarkers were converted to Z-Scores for a more consistent comparison. Systematic and proportional biases between measurements of the two studies were examined. The change in biomarkers as a function of the time between their measurements were also observed. **Results:** Can the data from the two studies be combined? In subjects common to the two studies and tested within two months of each other, bias was present in measurements of the same biomarker. The bias was not consistent across subjects, and could not be corrected. Both study cohorts are now studied independently. **Biomarker change over the period of the study?** The pattern for the number of participants exhibiting cognitive decline was similar across both cohorts, increasing from normal to severe. Based on MRI biomarkers, most remained stable across the duration of the study. **Conclusions:** The MRI measurements showed a smaller change over time than the cognitive measurements, but the method of defining a significant change needs refinement. We plan to further study the relationship between MRI biomarkers and cognition to better identify biomarkers which can predict cognitive decline.

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Study of T1 and T2 Relaxation Times of Water and Phosphate in the Presence of Bimetallic Complexes of a Furan-Based Polyamine Macrocycle

Faculty Presenter: Md Mhahabubur Rhaman, ENMU

Author: Alesha Foster, ENMU

Magnetic resonance imaging (MRI) is a widely used method for obtaining anatomical images to diagnose various diseases, including cancer. MRI is based on the intrinsic properties of hydrogen, specifically the ^1H nuclei of water molecules in tissue. It depends on two parameters: the Longitudinal Relaxation Time (T_1) and the Transverse Relaxation Time (T_2). Each tissue has its own relaxation time to return to its original state, which depends on its composition and condition. MRI distinguishes normal tissue from pathological tissue based on proton density, T_1 and T_2 relaxation times, and water diffusion rates. Generally, tissue T_1 and T_2 relaxation times are longer, making it difficult to obtain bright images; therefore, contrast agents are needed to address this. Nowadays, gadolinium-based contrast agents are the most used imaging agents. The contrast agents shorten the T_1 and T_2 relaxation times of protons in water or fat molecules, resulting in faster, higher-quality images. Clinically used Gd(III)-based contrast agents (CAs), which are paramagnetic, are synthesized from an octadentate polyaminopolycarboxylato-based ligand and have a ninth coordination site available for water ligation. Water molecules in the vicinity of contrast agents are involved in chemical interactions that play an important role in polarization transmission. The coordinated water can be rapidly exchanged with bulk water molecules. Though Gadolinium-based CAs are routinely used in clinical MRI practice, there are many risks associated with the use of Gd-CAs, such as severe allergic effects, nephrotoxicity, and deposition within the brain. Demand for gadolinium-free MRI contrast agents motivated inorganic chemists to explore paramagnetic transition-metal complexes as potential alternatives. Since Mn(II) complexes are economical, chemically diverse, less toxic, and highly magnetic, they are of interest as potential alternatives to Gd(III)-based CAs for improving efficiency and reducing toxicity. However, few have been clinically approved and have limited applications, particularly in liver lesions. Therefore, there is an ongoing effort to develop new contrast agents with high relaxivities to discriminate pathological tissues from normal tissues. Observing the ligands of FDA-approved CAs, the furan-based polyamine macrocycle was synthesized via the Schiff base reaction of 2,5-furandicarboxaldehyde and N-methyl-2,2'-diaminodiethylamine in high-dilution methanol, followed by a sodium borohydride reduction. This macrocyclic ligand contains six amine and two furan functional groups. It was used to make bimetallic complexes. T_1 and T_2 relaxation times of water and phosphate were measured in the presence of these complexes and compared with those of a similar Gd(III) complex. In addition, T_1 and T_2 relaxation times at various ^1H NMR peaks of the serum albumin protein will be measured. In this oral presentation, the principles of T_1 and T_2 relaxation times, the synthesis of bimetallic complexes, NMR instrumentation, and comparisons of results will be explained. Acknowledgment: Eastern New Mexico University's internal grant PIRR3 primarily supported this work. Ms. Foster acknowledges the

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Assessing Microscale Physiological Heat Stress in Urban Pedestrian Environments

Undergraduate Presenter: Yenyi Nkontchu, CNM

Author: Yifan Zhang, CNM

Author: Mackenzie Groves, CNM

Author: Melanie Will-Cole, CNM

As urbanization accelerates worldwide, the Urban Heat Island Effect (UHIE) has emerged as a major environmental and public health challenge, elevating ambient temperatures and physiological heat stress in urban environments. Although numerous studies have investigated urban heat islands, thermal comfort, and human heat exposure, most have focused on broader spatial scales, providing limited insight into microscale physiological heat stress. By conducting field-based measurements across diverse urban microenvironments in Albuquerque, New Mexico, this study investigates localized variations in physiological heat stress and their relationships with environmental conditions. Results reveal substantial microscale variability in heat exposure, with afternoon periods, sun-exposed surfaces, and areas with limited shade generally experiencing greater thermal stress. Surface temperature was strongly associated with WBGT, while shaded locations experienced considerably lower surface temperatures, highlighting the importance of localized environmental conditions in determining pedestrian heat exposure. These findings provide a scientific basis for identifying localized heat-risk environments and informing targeted heat mitigation strategies, urban planning, and future predictive heat-stress modeling. This work was supported by NSF Grant Award 2246468.

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Effects of Vegetation Density on Carbon Dioxide Concentrations and Temperature Along the Eubank Residential Area in Albuquerque, New Mexico

Undergraduate Presenter: Amber Awelagte, CNM

Author: Faith Bartos, CNM

Author: Melanie Will-Cole, CNM

Urban vegetation plays an important role in regulating carbon dioxide (CO₂) concentrations and reducing temperatures through shade and evapotranspiration. However, differences in vegetation density across urban environments may influence the intensity of the Urban Heat Island (UHI) effect. This study investigates how vegetation density affects air temperature, surface temperature, and CO₂ concentrations along the Eubank residential corridor in Albuquerque, New Mexico. Environmental data were collected over approximately two months during morning, afternoon, and evening sampling periods using a Temtop M2000 CO₂ monitor, Kestrel 3000 weather meter, AirBeam 3 air quality monitor, Thermal Works infrared sensor, and a TI250 thermal imaging camera. Sampling sites were classified according to vegetation cover and surrounding land surface characteristics. Preliminary results indicate that locations with greater vegetation generally exhibited lower corrected air temperatures and lower surface temperatures than areas dominated by pavement and sparse vegetation. Average CO₂ concentrations also varied among sampling periods, suggesting that vegetation and local environmental conditions influence atmospheric CO₂ levels. These findings support previous research demonstrating that urban vegetation can help reduce Urban Heat Island effects by cooling surrounding environments and improving local air quality. This research contributes to a better understanding of how vegetation influences urban microclimates and may help guide future urban planning strategies that increase green space and reduce heat exposure in Albuquerque. This work was supported by NSF Grant Award 2246468.

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~~Statistical Benchmarking of Dewatered Cake Solids at Three Water Reclamation Facilities: Preliminary Results~~

~~Undergraduate Presenter:~~ Andrew Cole, ENMU

~~Author:~~ Prabha Shrestha, ENMU

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~~Author:~~ Dipak Dulal, ENMU

~~Sludge dewatering is a resource-intensive but essential step in wastewater treatment, and benchmarking performance across facilities can help reduce hauling costs and improve efficiency. We present preliminary results from a multi-facility statistical benchmarking framework comparing dewatered cake percent solids, the primary indicator of dewatering efficiency, across three water reclamation facilities (WRFs). Operational data were obtained from Cedar City Regional WWTF (UT; daily records, 2021–2026), St. George Water Reclamation Facility (UT; monthly, 2019–2025), and the City of Watsonville WWTP (CA; monthly, 2019–2020). Cedar City's daily readings were aggregated into monthly means ($N = 152$ facility-months). One-way ANOVA and pairwise t tests, corroborated by non-parametric tests, compared mean cake solids across facilities. A multiple regression with heteroskedasticity and autocorrelation-robust standard errors was used to examine operational predictors at Cedar City.~~

~~Mean cake percent solids differed significantly across facilities ($F(2,149) = 129.40$, $p < .001$, $\eta^2 = .635$): St. George averaged 20.4% ($SD = 2.1$), Watsonville 16.8% ($SD = 1.2$), and Cedar City 14.1% ($SD = 2.7$). All pairwise differences remained significant after Tukey's HSD correction. At Cedar City, polymer dosage and digester percent solids were positively associated with cake dryness, while capture rate showed a modest negative association, suggesting a trade-off between solids capture and cake dryness ($R^2 = .19$). More than six percentage points separated the highest- and lowest-performing sites. These preliminary results, from three of nine targeted facilities, demonstrate the feasibility of multi-site statistical benchmarking and motivate continued data collection on equipment type, chemical conditioning, and facility characteristics as drivers of this variation.~~

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A Dynamic Bioeconomic Model of Aquaponic Production

Graduate Presenter: Ziqing Xie, UNM

Author: Jingjing Wang, UNM

Climate change, rising food demand, and environmental constraints are increasing interest in controlled environment agriculture (CEA), which reduces exposure to external weather variability and enables year-round production. Aquaponics is a CEA system that integrates hydroponic plant production and aquaculture. This paper develops a dynamic bioeconomic model for operating an aquaponic farm that jointly produces leafy greens and fish to maximize its profit. The model is motivated by an idle or underused community facility for which initial infrastructure costs are treated as sunk. The dynamic optimization model determines optimal harvest timing, fish feed, and plant fertilizer use while considering nutrient substitution, maintenance costs, and capacity utilization under plant-only, fish-only, and integrated production regimes. Fish production generates both terminal harvest output and plant-available nitrogen, while plants are produced in repeated short cycles within the longer fish-production horizon. The theoretical model is calibrated to a system containing 1,550 kale plants and 106 tilapias. For plant-only production, the optimal kale harvest occurs at 27 days, with an annualized farm profit of \$7,831. Fish-only production is not economically viable under the calibrated conditions, with the optimal solution implying no production beyond the initial period. For integrated plant-fish production, accounting for fish-derived nitrogen shifts the optimal fish harvest date to day nine, yet total farm profit increases by only \$0.05, indicating that fish contribute negligible economic value to the system. Sensitivity analysis shows that kale profitability is driven primarily by kale price, harvest-output share, and production scale. Overall, the results support a plant-led operating strategy and suggest that, despite providing supplemental nutrients to plants, fish production generates little economic value under the calibrated conditions. Given the growing interest in CEA and the limited economic evidence available for U.S. operations, the findings provide an economic assessment of both plant and fish production within an integrated production system. The modeling framework is readily transferable to other aquaponic systems using locally relevant biological, price, cost, and capacity parameters.

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Aortic Stiffening: Histological Analysis of Elastin

Undergraduate Presenter: Katrina Caulder, UNM

Cardiovascular disease accounts for roughly one in three deaths in the United States, and arterial stiffness is a strong predictor of cardiovascular disease risk. Elastin, the protein that allows large arteries to stretch and recoil in response to blood flow, is synthesized primarily during gestation and early childhood. Because it is not replaced in adulthood, damaged elastin is gradually replaced by stiffer collagen, increasing aortic stiffness and exposing high-flow organs such as the brain, kidneys, and heart to damaging pulsatile flow. Although elastin remodeling is linked to aortic stiffening, the extent of age-related elastin loss remains incompletely quantified. This project aimed to quantify age-related changes in aortic elastin in young (6-month) and old (22-month) C57BL/6JN mice fed standard chow. Thoracic aortas were sectioned into adjacent rings for histology and for mechanical testing by pin myograph and tissue puller. For histology, perivascular adipose tissue was retained to preserve structural integrity, and cross sections were stained by immunofluorescence to label elastin, endothelium, and nuclei. Elastin fluorescence intensity was then compared between age groups. Young mice showed higher mean elastin fluorescence than old mice, consistent with age-related elastin loss and fragmentation; however, this difference was not statistically significant. These findings suggest a trend toward reduced elastin with age that warrants a larger sample. Future work will pair these histological measures with tissue-pulling stiffness data to relate structural elastin changes to functional aortic stiffness.

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Using Pin Myography to Analyze Aortic Stiffness With Young and Old Mice

Undergraduate Presenter: Sarena Gneiting, UNM

Author: Lunden Friberg, UNM

Author: Diego Agado, UNM

Author: Daniel Machin, PhD, UNM

The cardiovascular system is an essential biomechanism responsible for the transport of blood and other substances throughout the body. It is researched extensively that aging is linked to increased vascular stiffness in the cardiovascular system, among other issues; however, the exact degree and mechanisms of damage due to aging remain worth investigating as rates of cardiovascular disease globally continue to rise. Literature reiterates collagenous remodeling and elastin fracturing that occur over time in the fibers that make up the walls of blood vessels, impacting overall elasticity of the vascular system with a special look at the aorta. To investigate loss of aortic elasticity with age, we obtained experimental mice and separated them into young and old groups. The aorta was excised from all mice in each group and cut into small “rings” from three different regions: the superior thoracic aorta (STA), the inferior thoracic aorta (ITA), and the inferior abdominal aorta (IAA). Each ring was then placed around two pins on a pin myograph and stretched consistently for five minutes. Data from each test were collected and converted into elastic moduli for both elastin and collagen fibers in each respective sample. Data analysis comparing these moduli show no difference in elastin changes between young and old mice and some difference in collagen changes between groups for the STA only. Further experimentation is warranted to explore how our results align with other results in current research.

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Validating the Interaction of circNTRK2 and BDNF in the Nociceptive Pathway

Undergraduate Presenter: Manuel Bustillos Lopez, CNM/UNM

Excessive opioid usage has been shown to lead to tolerance, addiction, and increased pain sensitivity. The Dorsal Root Ganglion (DRG) in the spinal cord is a major relay center that can adjust pain signals sent to the brain. My lab has shown that circNTRK2 RNA is heavily downregulated in the presence of opioids in human subjects. circNTRK2 RNA comes from the NTRK2 mRNA, which also codes for the TrkB receptor in the DRG. Brain Derived Neurotropic Factor (BDNF) has been shown to bind to this receptor and cause pain hypersensitivity by overexciting neurons. My goal was to validate the interaction between BDNF and circNTRK2 to show that circNTRK2 binds to BDNF mRNA in order to downregulate the BDNF protein to decrease pain sensitivity. I was tasked with modifying a circRNA Antisense Purification (cRAP) protocol. I had to focus on the RNA gel and sonication steps for this protocol, but data from the BioAnalyzer showed that the RNA kept being degraded. This led me to believe that crosslinking, the first step of cRAP, was really the issue and that another material, such as 4' AMT, would be more fit for RNA-RNA crosslinking instead of paraformaldehyde. I was also tasked with trying to overexpress circNTRK2 in a cell, to then use for further testing. To do this, I followed a transfection overexpression protocol, which turned out to be successful in that circNTRK2 was overexpressed with the vector used. This data gathered could be used to further validate the interaction and its meaning between circNTRK2 and BDNF to help patients suffering excessive pain due to opioid usage feel less pain in the future.

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Music Training-Associated Modulation of Resting State Functional Connectivity in Children with Fetal Alcohol Spectrum Disorder

Graduate Presenter: Hyesun Choi, Mind Research Network/UNM

Author: Andrea Romero, Mind Research Network

Author: Donovan Roberts, Mind Research Network

Author: Jaynie Hakeem, Mind Research Network

Author: Dina Hill, UNM HSC

Author: Fletcher Christensen, UNM

Author: Geoffrey Harman, UNM

Author: Kamilla Venner, UNM HSC

Author: Julia Stephen, Mind Research Network

Topic/Problem: Fetal Alcohol Spectrum Disorders (FASD) affect about 1 in 20 children, yet few evidence-based interventions exist. Music training (MT), which may drive neuroplasticity in musicians, is associated with cognitive, behavioral, and sensorimotor benefits in typically developing children. In children with autism, MT modulated resting-state functional connectivity (rsFC), with post-MT rsFC linked to improved social communication. However, MT's benefits and neural effects in children with FASD are unclear. **Methods:** Twelve children aged 8-16 with FASD were analyzed from a crossover trial of 12 weeks each of MT and music listening (ML; control) in randomized order. Eyes-closed (EC) and eyes-open (EO) resting-state magnetoencephalography (MEG) was recorded at baseline, post-MT, and post-ML. Phase locking value (PLV) in an a priori temporal-parietal network was analyzed with linear mixed effects models including hemisphere, eye condition, and random subject effect. **Results:** Visit affected alpha and beta PLV (both $p < 0.001$). Alpha (8-14 Hz) PLV was higher post-MT versus baseline and post-ML (both $p < 0.001$). Beta (15-29 Hz) PLV was lower at post-ML versus baseline ($p < 0.001$) but not at post-MT ($p = 0.531$). In EO only, post-MT also differed from baseline ($p = 0.020$; visit x condition: $p = 0.014$). Higher post-MT alpha PLV correlated with improved focused attention (Continuous Performance Test Hit Reaction Time Block Change; $p = 0.004$), though not FDR-significant. **Implication:** Twelve weeks of MT showed altered resting-state PLV in alpha and beta bands in children with FASD. With 90% retention and high satisfaction, our findings support MT's

potential for neural modulation. Larger studies with longer MT and cognitive-behavioral outcomes are ongoing.

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Micropolar Continuum Modeling of Microstructured Materials: A Finite Element Approach

Graduate Presenter: Sujata Ghimire, UNM

Author: Madura Pathirage, UNM

Materials with an underlying microstructure can exhibit size-dependent mechanical behavior that is not fully captured by classical continuum mechanics, particularly when the characteristic size of the microstructure becomes comparable to the length scale of the problem. This limitation is especially relevant to biological materials such as bone, where a complex heterogeneous microstructure can lead to size-dependent behavior and localized deformation. Micropolar, or Cosserat continuum theory provides a way to account for these effects by introducing independent microrotations, couple stresses, and an intrinsic material length scale into the continuum description. This work develops a finite element framework to study the static and dynamic behavior of linear micropolar continua. Two and three-dimensional formulations are considered, with translational and independent rotational degrees of freedom incorporated into numerical models implemented in MATLAB. The formulation is evaluated through patch tests, benchmark problems, and comparisons with analytical solutions where available. Verification studies demonstrate the ability of the formulation to reproduce prescribed deformation states and responses consistent with analytical solutions. Building on the verified framework, size-effect predictions and wave dispersion analyses are considered to examine how characteristic dimensions, intrinsic length scales, and micropolar material parameters influence mechanical response and wave behavior. Analytical and computational predictions will be used to investigate departures from classical continuum behavior as these length scales become significant. These studies connect mathematical formulation with the physical influence of material microstructure and provide a basis for future applications to microstructured materials, particularly bone.

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Hotspot Stability of Freight Vehicle Crashes Involving Vulnerable Road Users: A Spatiotemporal Perspective

Graduate Presenter: Daniel Pineda Agudelo, UNM

Author: Carlos Rivera-Gonzalez, UNM

Author: Oriana Calderon, University of Tennessee, Knoxville

Author: Manuela Cordoba-Misas, University of Tennessee, Knoxville

Freight vehicles and vulnerable road users (VRUs), i.e., pedestrians and bicyclists, share urban and regional road networks despite major differences in mass, visibility, and physical protection. Previous freight–VRU transportation safety research has largely emphasized crash characteristics, injury severity, or static hotspot maps, providing limited insight into whether high-risk locations are newly emerging, sustained, or intermittent over time. This study addresses that gap by examining the spatiotemporal stability of freight–VRU crash hotspots in New Mexico and Tennessee and relating those patterns to roadway exposure and operating conditions. Crash records from 2013–2023 in New Mexico and 2015–2024 in Tennessee were standardized by severity and aggregated into annual 1 km² grid cells. Space–time cubes, the Getis–Ord Gi* statistic, and Emerging Hot Spot Analysis classified statistically significant locations as New, Consecutive, Sporadic, and other hotspot types. INRIX-derived average daily traffic (ADT) and average median speed were then compared across hotspot and no-pattern zones, with Welch’s two-sample t-tests used for total-crash comparisons. New, Consecutive, and Sporadic hotspots dominated in both states, demonstrating that freight–VRU crash concentrations are temporally dynamic. In New Mexico, hotspots were concentrated around major urban areas and selected corridors. Statewide hotspot typologies had significantly higher ADT than no-pattern segments ($p < 0.001$), while hotspot segments generally had lower average median speeds. These findings show that temporal hotspot classifications, combined with network context, can help transportation agencies and land use planners distinguish emerging from sustained safety concerns and prioritize context-sensitive freight, pedestrian, and bicyclist interventions

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Canonical Performance Parameters for Rotating Detonation Engines

Graduate Presenter: Dimitrios Vrocharis, UNM

Author: Mario Cestari, UNM

Author: Brendan Canales, UNM

Author: Micah Wolbrecht, UNM

Author: Kristyn Johnson, National Energy Technology Laboratory

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Rotating Detonation Engines (RDEs) introduce efficiency improvements in thermal engines through a pressure gain, supersonic combustion regime. These improvements are significant in comparison to the conventional temperature resistance increase approach in constant pressure combustors and may establish RDEs as the thermal engine of the 21st century. Performance aside, the detonative combustion in RDEs produces extreme thermal stresses that can be potentially devastating for any type of material under any cooling load conditions. A deeper insight into material degradation mechanisms may be gained through the correlation of the engine gas dynamic conditions to the combustor wall failure modes. Thus, the objective of this work is to quantify the material degradation in RDEs through a set of canonical and universal parameters related to engine conditions. These parameters are expressed in the form of non-dimensional numbers that are composed of gas state, flow and thermophysical properties. Measurements of these properties are acquired experimentally in a hydrogen-air modular RDE setup, Hot And Durable Engine System (HADES). The setup can achieve combustion under a wide range of mass flux and equivalence ratio operating conditions, $100 < \dot{m}/A < 400 \text{ kg}/(\text{s}\cdot\text{m}^2)$ and $0.6 < \phi < 1.5$, respectively, and geometrical parameters. Initially, the operating map of HADES is plotted against geometrical and performance parameters to classify the material testing conditions. Then, the material testing campaign focuses on isolating the effect of basic parameters such as the detonation wave speed and the mean combustor pressure. After multiple 10-second tests, the damage accumulation is compared among different center and outer bodies and their respective axial coordinates, to correlate it to the measured gas properties. Results showed that material degradation is more pronounced in the proximity of the injector and correlates proportionally to the detonation wave speed, the wall temperature and the specific heat capacity of the products.

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Sustained Heat Flux Measurements in an Air Breathing Rotating Detonation Engine

Graduate Presenter: Amjad Samra, UNM

Author: Dimitris Terzis, Aristotle University of Thessaloniki

Author: Harold Holliday, NTU

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Author: Georgios Koutsakis, UNM

Rotating detonation engines (RDEs) undergo combustion under a detonation wave that travels continuously around an annular chamber, offering a potential thermodynamic efficiency gain over conventional combustors for propulsion and power generation. However, the wave deposits intense, unsteady heat into the chamber walls, and uncooled hardware survives for seconds. These short runs prevent steady state measurements and long-duration materials testing. Published wall heat-loss data for hydrogen-air RDEs cover only low air flow rates. This work designs and builds an actively water-cooled, 105 mm hydrogen-air RDE that enables minute-scale operation and measures wall heat loss through calorimetry. We developed a one-dimensional thermal-hydraulic model that marches along each cooling channel and keeps every wall location below the local boiling temperature. We coupled this model to the pump and flow control orifices to set the flow and pressure in six independent cooling circuits, and we checked flow distribution and wall temperatures with computational fluid dynamics (CFD). We printed the engine in Inconel 718 using laser powder bed fusion, shaping the cooling channels to meet printing limits. The model and CFD predict boiling-free cooling in all circuits at 2.2 kg/s of water and 17 bar, and the water supply supports runs longer than 15 minutes. Because each circuit acts as a calorimeter, the system will measure wall heat loss, normalized by the fuel's chemical energy, at air flow rates up to 0.8 kg/s, four times the published range. These data will guide cooling design for future detonation-based engines.

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Access Control for Agents Is a Language Problem

Faculty Presenter: Huixin Zhan, NMT

Graduate Presenter: Tyler Del Prete, NMT

LLM agents that call APIs and operate user interfaces are increasingly governed by enforcement systems that check each action against an explicit policy. We survey this literature through a distinction it rarely makes. An action can be enough for the task (sufficiency), within what the user consented to (authorization), and permitted by the enforced policy (compliance), and these three judgments can diverge. Enforcement establishes only compliance; whether compliance preserves authorization depends on three language problems that systems solve in different ways and often simply assume, namely authoring formal policy from stated constraints, inferring what permissions a task requires, and naming the resources that endpoints and interface elements correspond to. We compare eight representative systems by the guarantee they establish, the assumptions it rests on, and whether those assumptions are validated, we read deployed commercial systems against the same frame, and we review five benchmarks for which links between the three judgments they actually measure. The synthesis maps what is established, what is assumed, and what remains unmeasured, and derives a research agenda that treats agent authorization as a natural language processing problem with deterministically checkable output.

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Landmark-Based Identification of Tooth Indentations on Microvertebrates Allows for Interpretation of Ecologic Relationships During the Eocene-Oligocene Transition and in a Modern Paraguayan Microsite

Undergraduate Presenter: Elena Catherine De Santo, UNM

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Microvertebrates are the most abundant vertebrates but are an underutilized resource in palaeontological research. Despite the importance of microvertebrates, ascertaining predator-prey relationships is difficult as remains are sparse and fragmentary. Taxonomic identification of microvertebrates is often impossible; morphological identification is challenging. We used qualitative and quantitative descriptions alongside Procrustes analysis of taphonomic landmarks to identify the biters of microvertebrate remains from the White River Group of Nebraska, USA, as well as modern microvertebrates from the Paraguayan Chaco. This assemblage allows us to validate the method where predator-prey relationships can be verified. A subset of 1,066 microfossils and 592 modern bones were analyzed for bite marks; 7.70% and 3.21% of the respective assemblages contained tooth indented bones. All three assemblages have bites concentrated on the appendicular skeleton. The Geomorph package in R was used to record the coordinates and size of each suspected tooth mark alongside the cusp patterns from the teeth of potential biter genera. Observed indentation patterns were compared to potential biters using Procrustes analysis and fuzzy data matching, and the most likely biters were identified. Three fossil genera were likely to produce the majority of the tooth indentations, suggesting an omnivorous or carnivorous diet. Molar area ratios were then used to independently confirm that the common biters were likely omnivorous or carnivorous while the infrequent biters were likely insectivorous. This approach is a powerful tool to study animal dietary behavior in the fossil record.

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Optimization of Extraction Conditions for Natural Products from Prickly Pear Cactus (*Opuntia* spp.)

Undergraduate Presenter: Jacob Roybal, UNM

Author: Jacob A Greenberg, UNM

Prickly pear cactus (*Opuntia* spp.) has a long history of use as a food source and in traditional medicine. Its diverse phytochemical composition has generated interest in its potential antioxidant and other biological activities. However, extraction conditions can influence the recovery of plant-derived compounds and their subsequent evaluation. This project aims to investigate how the ratio of fresh cactus material to extraction solvent affects natural product extraction and to establish a reproducible extraction protocol for future chemical and biological analyses. Initial experiments evaluated five solvent volume-to-fresh cactus mass ratios: 0.25:1, 0.5:1, 1:1, 2:1, and 3:1 mL, with three trials conducted for each condition. These ratios span a range of solvent volumes, from more concentrated mixtures to more dilute extractions. The goal is to identify conditions that minimize solvent use while providing a practical and reproducible method for larger-scale extractions and subsequent analyses. Future work will include phytochemical characterization using mass spectrometry and evaluation of antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. Concentration-response data will be used to estimate half-maximal inhibitory concentration (IC_{50}) values where appropriate. This work will establish a foundation for investigating the relationship between extraction conditions, phytochemical recovery, and antioxidant activity in prickly pear cactus.

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Blood Meal Analysis of Mosquito Species in New Mexico

Undergraduate Presenter: Rachel Mann, UNM

Author: Kenwyn R. Cradock, UNM

Author: Jacob Greenberg, UNM

Mosquitoes are the world's deadliest animal, they kill more humans than any other animal on Earth, due to the spreading of diseases. *Aedes aegypti* is a relatively new invasive mosquito to New Mexico. These mosquitoes are well known to spread multiple diseases that are of concern, such as Dengue, yellow fever, and Zika virus. There is plenty of literature on *Aedes aegypti*, but there is a distinct lack of research of these mosquitoes in New Mexico. By analyzing blood meals of New Mexico *Aedes aegypti*, we can see what diseases they are potentially spreading by which vector species they feed from. Four species of interest were collected by the City of Albuquerque *Culex tarsalis*, *Culex quinquefasciatus*, *Aedes vexans*, and *Aedes aegypti*. Using molecular techniques such as DNA isolation, PCR, and gel electrophoresis, the type of DNA found in the bloodmeals was able to be determined by the size of the DNA band. Preliminary results show that these four species fed primarily on birds, with *Aedes vexans* having the most positive DNA readings. Due to our small sample size of *Aedes aegypti* specimens, we were only able to obtain one positive sample. Both of our *Aedes* species are not known to regularly feed on birds for their blood meals, but our findings show the opposite. This research is key to understanding what diseases can spread throughout New Mexico.

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The Underground Pharmacy

Undergraduate Presenter: Leo Jonsson, CNM

Antibiotic resistance is a growing clinical concern, driven by the spread of multidrug-resistant (MDR) pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), and MDR *Pseudomonas aeruginosa*. Bioprospecting for novel antibiotics is one response to this problem. Most clinically used antibiotics derive from microbial secondary metabolites, the majority from the genus *Streptomyces*. Caves are a promising and underexplored source of such compounds: their nutrient-limited, environmentally stable conditions foster intense microbial competition that is thought to drive the evolution of unique secondary metabolites. Caves also harbor abundant *Streptomyces*, many of them undescribed species, along with related genera in the phylum Actinomycetota whose antibiotic potential remains largely unexplored. We screened approximately 100 cave isolates, including undescribed *Streptomyces* species and members of other actinomycete genera, for antagonistic activity using a cross-streak assay. Each isolate was streaked as a 1 cm band down the center of an ISP2 plate and grown for 14 days, after which four clinically relevant BSL-2 pathogens (*Staphylococcus aureus*, *Enterococcus faecalis*, *Proteus vulgaris*, *Pseudomonas aeruginosa*) were streaked perpendicular to it and incubated for 24 hours. Five isolates inhibited the growth of one or two pathogens, and inhibition was consistently restricted to the same two Gram-negative species, *P. aeruginosa* and *P. vulgaris*. These results suggest that cave actinomycetes merit further investigation to identify the compounds responsible for this activity and assess their potential for antibiotic development.

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High Reproductive Output Is Not Associated With Long-Term Physiological Costs in Wild Chimpanzees

Graduate Presenter: Eleanor Matthews, UNM

Author: Cecilia Sena, UNM

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Life history theory posits tradeoffs across maintenance, reproduction, and growth. In long-lived species where offspring are dependent on maternal investment, adult females may maximize reproductive success through tradeoffs between reproduction and individual somatic maintenance. These tradeoffs are orchestrated by physiological mechanisms and influenced by energy availability and context. Here, we tested the hypothesis that increased reproductive effort is associated with increased somatic costs in wild female chimpanzees of the Kanyawara community, southwestern Uganda. To assess physiological costs, we assayed two biomarkers of oxidative stress (OXS) and two biomarkers of chronic inflammation from opportunistically collected urine samples ($n = 719$) between 2009 and 2025 and paired these measurements with individual reproductive state and reproductive effort to date. In generalized additive models controlling for age and including a random effect for chimp ID, we found that heightened OXS biomarkers during early lactation and pregnancy increased the time to the next birth, but biomarkers generally did not increase with reproductive output. These results indicate that wild chimpanzees recover from reproductive bouts before the next birth and do not accumulate somatic costs of reproduction over the lifespan. We suggest that selection has minimized tradeoffs between maintenance and reproduction

in humans' closest living relative; female bodily condition must be prioritized to maximize reproductive success.

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