Investigating the Chemical Composition of Solid Samples from the Jackpile Sandstone Member of the Morrison Formation in New Mexico

Antonella Riega, Carmen A. Velasco, Abdul-Mehdi Ali, José M. Cerrato

We applied spectroscopy, microscopy, and water chemistry techniques to characterize two mining sites from the Jackpile sandstone member of the Morrison formation, Saint Anthony and the Jackpile Mine; two samples from each site were studied. Specifically, Thermogravimetric Analysis (TGA), X-Ray Fluorescent (XRF), and Inductively Coupled Plasma Optical Emission Spectrometry (ICEP-OES) were used to characterize the samples from each site. Prior to performing the characterization, the material was first homogenized and sieved to a particle size of <63 μm. TGA analysis corroborates that the Loss on ignition (LOI) of the samples are on average 13.18% and 22.78% for the Jackpile Mine and Saint Anthony sites, respectively. Results from XRF for the Jack Pile Mine show that the major elements are iron (9.62%), calcium(3.70%), uranium (3.44%), potassium(1.34%) and Carbon (1.70%) while for the Saint Anthony are uranium (4.11%), iron (2.83%), carbon(2.35%), potassium(1.18%) and calcium(0.57%).The mean concentration of metal acid extractable for the Jackpile Mine are iron (6.49%), Aluminum (1.32%), uranium (0.64%), calcium(0.69%) and potassium(0.5%) while for the Saint Anthony are uranium (1.71%), Aluminum (1.36%), iron (0.38%), potassium(0.18%) and calcium(0.09%). This study identified the relevance of characterization of mines sites to better understand mobilization of different minerals and metals in the environment.

Key words: Uranium; Chemical Composition; Characterization; New Mexico Mines

Anthropogenic and Rheocrene Springs in the Cibola National Forest

Brittany Griego, Cory Walk, Kate Mendoza, Tyler Pennington, Livia Crowley, Rebecca Bixby, and Laura Crossey

Springs are an important water resource both for anthropogenic use and support of ecosystems in the arid Southwest. Springs are classified into several different types for purposes of better management. Five spring types are found in the Cibola National Forest in northern New Mexico: Anthropogenic, Rheocrene, Helocrene, Hypocrene, and Limnocrene. In the Cibola National Forest, anthropogenic and rheocrene are dominant spring types. Some of the springs visited for this study were Cole, Big, and Upper Fourth of July (all anthropogenic) due to the human alterations to the spring itself. Torro Spring is a Rheocrene type due to its flow into a stream or a river.

We collected samples from the spring water itself to be analyzed in the lab, wildlife demographics, and in field water quality parameters such as flow discharge and acidity and basic levels of the water at the source. In the lab we analyzed stable isotopes, pH levels, and major solute composition. These data are also compiled into a regional database to provide important baselines for future comparison. We show here the co-parative data for all sites visited in 2017, and compare results with other regional springs.

Assessing the Potential Benefits of the Fungal Endophyte to its Locoweed Host *Oxytropis sericea*

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Locoweeds are *Astragalus* and *Oxytropis* sp. plants that contain the toxin swainsonine, which is produced by fungal endophytes (*Alternaria* section *Undifilum* sp.) living within the locoweed plants. When ingested by grazing animals, the alkaloid toxin causes severe neurological toxicosis. Since toxic locoweeds are found throughout the western United States, the toxicosis causes considerable losses to grazing livestock. The *Alternaria* section *Undifilum* sp. endophyte does not hurt its plant host and could help its plant host by preventing the establishment of plant pathogens. To assess the potential for *Alternaria oxytropis* endophyte to protect its locoweed host from plant pathogens, samples of *Oxytropis sericea* plants were collected from a common garden in Logan, UT, 10 with the endophyte (+) and 6 without the fungus (-). Fungi were cultured from the stems and leaves of the plants using a low stringency surface sterilization and the resulting fungi were characterized by morphology, PCR amplification of the ITS region, and sequencing of the amplified nucleic acids. Fungi were cultured from 100% of endophyte+ plants that contained the endophyte, with 90% of the leaf pieces and 45% of the stem pieces yielding fungi. Fungi were cultured from 90% of the endophyte - plants, with 26% of the leaf pieces and 17% of the stem pieces yielding fungi. The endophyte was cultured from the endophyte+ plants and only a few other fungal species were cultured. The endophyte - plants yielded a diverse set of fungi. These culture results are consistent with those for locoweeds from China.

Novel Hypersaline Strains of Microalgae Growing in Saline Produced Water

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In this study two hypersaline strains of algae, a highly enriched polyculture from produced water (PW) ("Blue-Cyano") (BC) because of its blue color) and another, *Dunaliella tertiolecta*, obtained from UTEX Culture Collection were cultivated in dual open raceway pond (ORP) systems using PW diluted to salinities of 30 ‰ and 70 ‰. BC did not initially demonstrate high growth, but dense algae cultures were eventually established in both ORP's. *Dunaliella tertiolecta* was out-competed by pennate diatoms, amoeba, and rotifers. 23S rRNA genes from the polyculture were sequenced using Illumina MiSeq. The results suggest the culture consisted of *Cyanobacterium aponinum* (62.4%), Uncultured organism related to *Phycisphaera mikurensis* (25.8%), *Parachlorella kessleri* (9.0%) and *Scenedesmus* sp. (1.0%). ICP-OES analysis of the PW samples after cultivation of BC showed that group II cation concentrations were reduced in the reactors. Future work will be to determine if the BC culture can remediate PW so that it can be reused by the oil and gas industry.

The Benefits and Feasibility of Converting Our Locomotive's Engines from Diesel to Natural Gas
David Dodd, Mesalands Community College

With the global concerns of greenhouse gases, ongoing research in the conversion of locomotive engines from diesel to natural gas is extensive. Many studies show that the amount of carbon dioxide and other greenhouse gases emitted from locomotives can be lowered with the conversion of engines from diesel to natural gas. There are two different methods to convert diesel engines. One method is the use of liquified natural gas (LNG). This method involves supercooling the natural gas to a -260 ° Fahrenheit, turning it into a liquid form. The second method is the use of compressed natural gas (CNG). This method involves compressing natural gas, consisting mostly of methane, to less than 1% of its volume at standard atmospheric pressure. Independent studies of locomotive engines converted to natural gas in use in Japan and Canada show that conversion is feasible for locomotive engines. United States governmental studies confirm the independent studies. The California Air Resource Board (CARB) found that CNG emits 20%-29% fewer greenhouse gasses compared to diesel.
Keywords: natural gas, greenhouse gases

Osmotic Power Development: Acquiring Energy from Waste Water

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Geothermal greenhouses grow crops year-round without having to rely on natural gas for heating but still spend millions of dollars. But with the existing energy of the brackish geothermal fluid, membrane distillation can offer a great opportunity to meet the demand for irrigation with the geothermal fluid at a lower cost. Asymmetric hollow-fiber membranes were fabricated and characterized for their application to provide clean irrigation water through the use of the brackish geothermal fluid as the DCMD feed at Masson Greenhouse at Radium Springs, New Mexico. The membranes displayed a dual-layer cylindrical structure with an external sponge layer and an internal macrovoid layer. The intention is to prevent pore wetting from the hot saline fluid with the sponge layer, while using the macrovoid layer to increase the water flux and thermal efficiency of the membrane. Through the use of this irrigation system we can create clean recycled irrigable water.

Keywords: Greenhouses; Fiber Membranes; Masson; Direct Contact Membrane Distillation (DCMD)

Synthesis of first row transition metal nanoparticle for aerosol 3D printing.

Diana Perales, Timothy J. Boyle. LaRico J. Treadwell, Adam W. Cook, Nelson S. Bell, W. Derrick Reinholtz, Devonte Woodard, Sandia National Labs

Direct Write (DW) manufacturing methods can precisely print microcircuits, computer chips, and other electronics. Currently, DW methods have focused on silver and gold printed electronics due to their high conductivity. However, these materials are very expensive, thus, we have been investigating other metals as a more economically favorable alternative such as copper. Copper possess similar conductivity but is significantly lower in cost. In addition to copper, we have expanded our research to other first row transition metals due to their diverse properties such as magnetism, conductive abilities, and corrosion resistance. In order to print these metals effectively, nanoinks (or N-inks) need to be developed, which requires high quality nanometals. In order to generate these nanometals, a variety of tailored precursors such as metal alkoxides, amides, alkyls, as well as commercially available compounds (i.e., metal carbonyls) were explored for optimal (size and shape) nanometal synthesis. All aspects of the precursor synthesis, nanomaterials, N-ink formulation, and fianl properties of printed metals will be presented.

Novel inorganic-organic hybrid material for selective uranium adsorption from natural water supplies.

Chase Kicker, Samantha V. Saville, Liliya V. Frolova, NM Tech

Based on a novel covalent modification method of graphite surfaces we developed a new highly chemically stable adsorbent for selective uranium adsorption from natural water supplies. Commercially available graphite is chemically modified with tetracyanoethylene oxide via 1,3-dipolar cycloaddition.

The modified material shows high selectivity towards uranium even in the presence of competing cations like calcium and magnesium. It further demonstrates that uranium adsorption is not hindered by the presence of many other cations or the change in the pH of the medium. The material showed high affinity and selectivity for natural samples of uranium contaminated water. We showed that overall uranium adsorption is best in basic conditions. We also demonstrated that different mineral acids have different effectiveness at stripping the column of collected uranium and the regenerating of material capacity. Finally, we studied the ability of different oxidation regents to change the uranium adsorption properties of new material.

UNDERGRADUATE STUDENT POSTER #9

Arsenic Comparison of Irrigated and Non-Irrigated Soils in the Middle Rio Grande Valley
Dustin Dealy, Victor French, and Tracy J. Terry, University of New Mexico--Valencia

Arsenic levels in ground water of the Middle Rio Grande watershed of New Mexico (20 ppb to an excess of 600 ppb) and in the Rio Grande itself (2-16 ppb) are higher than the EPA standard for drinking water (10 ppb). Years of irrigation with these high arsenic content waters may lead to build up of arsenic in the fields and increased uptake of arsenic in crops grown in these fields for both human and livestock consumption. In order to determine the extent of arsenic build up in farmed soils due to irrigation, a map of the arsenic content of unfarmed soils is being created between the Rio Grande and the Manzano Mountains parallel to HWY 60 in northern Socorro County. Of particular interest is the depth and arsenic content of the caliche layer where salts tend to deposit after rain events. This data is being compared to the depth and arsenic content of the caliche layer of irrigated soils in northern Socorro and southern Valencia Counties. Soil samples were taken in 6-inch increments using a soil auger until the caliche layer was visually determined in the field. Samples were dried and analyzed via X-ray fluorescence spectrometry (XRF) for arsenic content.

Geothermal Membrane Distillation in Industrial Greenhouse Applications

Allie Arning, New Mexico Tech

Masson Greenhouse is a large-scale indoor greenhouse that employs geothermal brackish water for space heating. Coupling heat exchangers with membrane distillation (MD) would allow Masson to simultaneously extract energy and purified water from the geothermal fluid. MD has the potential to replace the greenhouse's current RO system used for irrigation, and would meet their water demand at a much lower cost. Polyvinylidene fluoride (PVDF) based hollow fiber membranes (HFMs) were fabricated via the dry-jet wet-spinning process and the structure of the membranes was characterized using porometry and scanning electron microscopy. A pilot-scale MD system was set up with the PVDF HFMs to evaluate the feasibility of full scale implementation for water purification at Masson Greenhouse.

Medicinal Plant Extraction and Analysis

Shania Sanchez, Victor French, Tracy J. Terry, University of New Mexico--Valencia

Traditional healers have used medicinal plants for ages while more recent efforts have yielded the isolation of plant pharmaceuticals such as aspirin, quinine, and paclitaxel. A rise in interest from across society has led to a rapid growth in the essential oils industry which is expected to double in market value between 2014 and 2020. We have begun a survey of the medicinal properties of common plants of the southwest. Steam distillation for essential oils and solvent extractions have been carried out on various locally sourced plants. These extracts have been analyzed for antibiotic properties via Kriby-Bauer assay using E. coli on Mueller Hinton agar. Zones of inhibition were analyzed and compared to antibiotics Cirpoflaxacin, a positive control, and Penicillin, a negative control. Other assays for biological activity will be conducted in the future. As active agents are identified, further isolation and analysis of compounds and possible synergistic effects will occur.

A Case Study of Pilot-Scale Continuous Flow Reactor for Hydrothermal Liquefaction of Algae

Feng Cheng, Travis Le-Doux, **Brian Treftz**, Scott Woolf, Juanita Miller, Catherine Brewer, Umakanta Jena, New Mexico State University

Algae-based biofuels have attracted significant research interest due to their advantages of not competing with land for food production, abilities to grow in low-quality water, higher growth rates, and strong CO2-mitigation abilities. In recent years, research has focused on hydrothermal liquefaction (HTL) of whole, wet algae biomass. HTL uses hot, compressed water (270-350 °C and 8-18 MPa) to convert the organic constituents into an energy-dense "bio-crude oil" that can be upgraded to liquid transportation fuels. Most HTL research studies to date have reported results from batch reactors of 100-2000 mL sizes operated at 5-20 wt.% algal solids load. In order to develop commercial scale operations, future HTL systems would need a significant technological shift from batch processes to development of continuous flow reactor (CFR) systems. CFR systems suffer from several challenges including smooth flow of biomass slurry through pumping/preheating unit/reactor units, clogging of solids, solid-liquid-gas separation/ filtration, involvement of large number of unit operations and the safety and control issues. Unlike the batch systems, maintaining a high solids loads (>5%) pose a significant challenge for CFR systems. The current study presents New Mexico State University's experience in development and modification of a pilot-scale CFR for HTL of fresh water microalgae. The goal of the reactor is to be able to perform continuous HTL on slurries with solid algae contents of 5-10 wt.%, and to produce char-free bio-oils. The presentation provides an overview of the operational issues with a continuous HTL reactor and the results of the recent runs.

Use of Mayfly Habitat as Indicator of Uranium Pollution

Dionne Paul, Dine College

The USEPA Region IX Cove Watershed Assessment Project (CWAP), currently conducted on the Navajo Reservation in southern Cove, AZ includes Tronox, formerly known as Kerr- McGee, a contributor to the abandon uranium mines (AUM), whom left approximately 50+ mines open and unattended. The project's focus is around the community of Cove, Apache County, Arizona. Team hike consists of several interns, scientists and project managers. The duties of lead scientists and Dine College interns is to assist in collecting samples from the streams in Cove.

One section of this study protocol, "Stream Ecosystem Monitoring (SEM)", include Section 7.2, "collecting macroinvertebrates". The heavy elements of concern that may be in the stream could be contaminating the Cove Watershed flood bank drains, which eventually flow to the agriculture and livestock down below into the Cove community.

Characterization of protein methyl transferases in Caulobacter crescentus

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Methylation is the process carried out by methyltransferases to add a methyl group to proteins and then change the protein's activity. It is known that in eukaryotic cells, the methylation process regulates cytoskeletal proteins (Park *et al*., 2016). However, in prokaryotic it is still being studied. Our hypothesis is that a set of predicted methyltransferases have a regulatory effect on the cytoskeletal proteins in the bacterium *Caulobacter cresentus*. To test our hypothesis, we deleted 5 genes that are predicted to be the methyltransferases. I worked specifically on deleting gene CCNA_00389 from the wildtype strain. Using double recombination, I constructed the strain ΔCNA_00389, which allowed me to further investigate the gene had an effect on the entire wild type cell. I used colony PCR protocols and DNA gel electrophoresis to confirm the deletion of this gene from the chromosome. I performed growth curves of ΔCNA_00389and of five other strains that had the other putative methytransferases deleted. Each strain was grown in different nutrient levels: rich nutrients (PYE) and minimal nutrients (M2G) for cell growth. My results showed that the ΔCNA_00389 and ΔCNA_00389 grew faster than wildtype in PYE media. It also showed that these mutant strains grew at the same rate in M2G. I am now testing if these mutants have defects in morphology and swimming ability. The importance of my project is to gain a better understanding of methyltransferases and how they affect the cytoskeletal proteins. Having enough knowledge of a prokaryotic cell, doctors, researchers, and scientist will have better ways of killing bacterialpathogens.

Investigating the Chemical Composition of Uranium Mine Samples from New Mexico
Danielson Moreno, CNM

With over 28,000 unremediated abandoned mines in the US, the potential adverse health effects mine contamination has, due to run-off in the surrounding environment, is cause for study and understanding. This experiment helps understand the chemical composition of soil samples taken from the Jack Pile and Saint Anthony Mine in New Mexico. By analyzing the chemical composition, a more accurate understanding of runoff can be obtained.

Since many forms of minerals and rocks that exist in mines, this study aims to explore the levels of organic carbon, uranium, and other co-occurring metals concentrations from the solid samples. Do samples with containing uranium also contain levels of organic carbon? The techniques used include: XRD, ICP-OES, LOI and TGA. ICP-OES and XRD will indicate what types of metals and their concentrations. LOI and TGA will indicate organic carbon content.

The samples studied contained elevated levels of organic carbon as well as elevated levels of uranium. Understanding the concentrations of uranium and other co-occurring metals present in organic carbon-based rocks and minerals will help us understand the overall presence of uranium and co-occurring metals at these mine sites. If the presence and concentration of these metals can be better understood, then understanding the mine and its effects on the surrounding area.

Identification of Markers Contributing to White Mold Resistance in Peanut Using Quantitative Trait Loci Sequencing

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Peanuts are an important crop in several regions of the world for their high essential vitamin properties. Peanuts and peanut oil are used for human and animal consumption, and in a variety of consumer items including paint and furniture polish. Peanut production in the Southeast U.S. is afflicted by white mold, *Sclerotium rolfsii*, and has been for as long as peanuts have been produced in the United States. White mold is the number one cause of yield loss in a season and is particularly hard to manage with fungicides in arid climates. This study utilizes Quantitative Trait Loci sequencing (QTL-seq) to test if markers for white mold resistance can be developed faster and more efficiently. QTL-seq is an approach done by whole-genome resequencing of DNA from two populations showing a desired phenotypical trait and its opposite (i.e. resistance and susceptibility) for a rapid identification of plant QTLs. Our hypothesis is that QTL-seq methods can identify chromosomal regions and markers important to white mold resistance in peanuts. In this study, we phenotyped three years of recombinant inbred lines and ranked the top 5% mold-resistant and bottom 5% mold-susceptible phenotypes. The resistant and susceptible groups were sequenced and mapped to two reference genomes. We estimated allele frequencies at single nucleotide polymorphism sites for both groups, and we observed peaks indicating resistance on chromosomes A01 and A05. We then identified and developed markers spanning resistance hotspots on these chromosomes. These resistance markers are expected to facilitate future selection for mold resistance, which will help farmers cultivate healthier, higher yield crops and reduce the use of fungicides. With this information, the future direction would be to use QTL-seq to find resistance to other diseases, such as late leaf spot (*Mycosphaerella berkeleyi*).

Photoexcitation in Organometallic Nickel Complexes Used to Study Ligand-to-Ligand Charge Transfer

Adriana Lujan-Paez, Western New Mexico University

Synthesis of metal-ligand complexes for the study of photoexcitation states involved with ligand-to- ligand (L-L) charge transfer. Target complexes focused on the use of nickel as a metal bridge, dichalcogenolene ligands as electron donors, and diimine ligands as electron acceptors. Specific bidentate compounds were chosen to bind to the nickel in a square planar geometry to optimize charge transfer between donor and acceptor ligands. These photoexcitation behaviors are often referenced when study the efficiency of photovoltaic compounds, which can be applied to solar energy materials.

Various diagnostic tests can reveal more about the photoelectrical behaviors of each complex and observe efficiency based on ligands bound to the nickel.

The use of nuclear magnetic resonance, mass spectroscopy, and X-ray crystallography, allow for further confirmation of each of the nickel complex structures.

The use of Raman spectroscopy would allow for the observation of the donor-acceptor energy states, and compare results with existing complexes with similar characteristics.

The crystal structures of a few of the complexes can be viewed and analyzed through X-ray diffraction.

Synthesis of these complexes has already proven fruitful and a few of the products have visible crystalline structures. Methods used to synthesize the compounds were adapted from an existing synthesis procedure (Kamenicek, 2008). Issues with synthesizing one of the compounds were overcome by using a modified, bench-safe procedure. Further syntheses will focus on complex behaviors using different ligand structures.

Climate Variability Over the Past 2,500 Years in the Southwest United States

Holly Olivarez, University of New Mexico

Scientists have documented large amounts of precipitation data in the southwest region of the United States over the last 2000 years. Precipitation patterns vary greatly, and the causes of the variations in climate are unknown. There are proven persistent climate modulators, such as ocean circulation, volcanic activity, and solar variability, which affect precipitation. The most valuable data comes from climate oscillators PDO, ENSO, and AMO, which cycle regularly in patterns that can be measured over years and decades. The Southwest's winter precipitation comes from Pacific-driven rain (PDO and ENSO), and summer precipitation comes from our monsoon season (driven by the Gulf of Mexico and Gulf of California (AMO)). The purpose of our study is to perform a time series analysis of a data set from samples obtained from stalagmites in caves in southwestern New Mexico; so that we might find correlations between the records found in stalagmite rings and precipitation pattern data already obtained. Using wavelet analysis, the data can be examined for the strength of climate variabilities in the past. Combining this analysis with another technology, called Redfit, will allow historical information (gathered from multiple sources) into one presentation; in order to determine if a cause for precipitation variability can be found.

Performance improvement and sensitivity of carbon nanotube-based sensors for medical applications

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In recent years, the research of carbon nanotubes (CNTs) has significantly increased due to their unique material properties. These properties can include high strength and stiffness, high thermal conductivity, and high flexibility. Specifically, for their high stiffness, CNTs are considered as target candidates in medical applications, such as the detection of cancer cells. In this application, the goal is to be able to detect and identify the mass of nanoparticles in the zeptogram range deposited on a CNT based upon a frequency shift and conversion to an equivalent mass. Because experiments in this field are time consuming, difficult, and expensive, the goal is rather to develop accurate reduced-order models that capture phenomena occurring at nanoscale and eventually lead to the detection and characterization of nanoparticles. In developing these models, several different theories, their assumptions, and challenges should be considered including beam theories, shell theories, theories in nonclassical continuum mechanics, and more. In addition, different environments should be considered to most accurately reflect experimental results, i.e. CNTs in a thermal environment. In addition, the geometry of the particle should be considered for specific cases. Considering each of these factors, the limits of applicability of various theories will be discussed, along with their corresponding assumptions and formulation. In doing so, mathematical models reflecting the true behavior of CNTs as biomass sensors can be developed, along with methods for detecting the mass based upon the inherent frequency shift.

Uranium-bearing dust dissolution in simulated lung fluid

Shaylene Paul, Gayan Rubasinhege, Bonnie Frey, and Dan Cadol
Navajo Technical University, New Mexico Tech

The purpose of this research is to identify the dissolution of uranium dust bearing particles and mineral samples from two types of artificial lung fluids. The study's dissolution of the samples in the two types of lung fluid called "Artificial Lysosomal Fluid (AFL^3)" and Gambles Solution. In New Mexico there are many uranium mines that are left open and unprotected from the elements of the weather. These mines are close to many communities and many of these community members worked for uranium mines. New Mexico has many dust storms that can carry dust particles for many miles. The particle size of dust is wind captured from 1.5 meters high near a uranium mine. Soil Samples are taken from a mine waste pile. The dust samples were taken from Jackpile Mine in Cibola County, NM and St. Antony mine soil sample from Laguna Reservation. The study's conclusion pointed out that the soil sample that was taken from St. Anthony mine were mineral samples of uranium and had different chemical composition than the dust particle samples. This could be described as a scenario of uranium workers working and inhaled uranium from within the mines would affect their lung tissue (AFL^3). AFL^3 replicates as an immune response to foreign substances that enters the lung. The dust particles from an open pit mine could blow around and affect close communities. The person could inhale uranium dust bearing particles and affect the deep lung tissues (Gambles solution). This means that the different uranium chemical composition of its changing states effects the human lung tissues differently by the dissolution dust particles and soil/mineral sample. Both can cause serious health effects and there needs to be more research done, but it gives an idea to open mines that are in the Navajo Nation. There needs to be more research due to large error bars in the data because there may have been contamination during the study. This study gives an idea to how the 1950-1967 uranium workers were affected during their time in the mines and today's long- term effects.

In Vivo Toxicity of Different Shaped GNPs

Tristan Ortega and Jessica Snow, NM Highlands University

Due to their myriad biomedical applications, gold nanoparticles (GNPs) have recently become a focus of heavy research. However, little is known about how the shapes and sizes of GNPs correlate to toxicity, as well as how the properties confer *in vivo* benefits. This research focuses on what effects might arise from in vivo star and spherical shaped GNPs. Previous research indicates that when mice are administered sphere shaped GNPs, they may suffer adverse effects because of accumulation in the liver, spleen, hippocampus, stomach, and other organs. As a result, anorexia may develop from the administration of GNPs by concentrations of nanospheres inhibiting the passage of fluids. Therefore, we hypothesize that in vivo toxicity of both spherical and star-shaped GNPs will result in decreased weight gain in mice. In order to test this hypothesis, C57/bl6 mice were randomized and injected with either GNP spheres, stars, or sterile H_2O (control group). In contrast to our hypothesis, we found that mice tolerated injections of GNPs, and weight gain between groups did not differ. Future studies will address the effect of additional doses of GNPs and how they affect the major organ systems.

Applying GIS Tools to Verify Weather Forecasting Models over a Domain in Southern California

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Advisors: Steven Chischilly, Jeffrey Smith, and Dr. Benjamin MacCall
Navajo Technical University, Army Research Laboratories

Current verification approaches have limited abilities to observe subdomain error variations and to partition them in ways that can improve atmospheric sciences. Our approach was to determine if we can employ GIS tools to assess and verify weather forecast over a terrain. We investigated the spatial analysis tools that are available within QGIS to perform forecast analysis with respect to high resolution terrain and land use variables. We demonstrated how GIS can be applied to building models through spatial analysis through remote sensing methods. Remote sensing is the study of objects from great distance, by obtaining images of the earth's surface. We classified land terrain based on its characteristics; such as vegetation, water, soils, and infrastructure. We also used GIS tools in attempts to look for trends and model errors. In an effort to correlate the mean of errors with its domain, we observed these errors with its terrain characteristics. By doing so, we assessed different aspects using remote sensing methods through GIS tools. We hope to improve errors with the use of remote sensing images of higher band resolution. Overall, we were able to use spatial data through GIS tools using remote sensing methods and bring new approaches in analyzing models from different classification perspectives.