2021 AISES NATIONAL CONFERENCE

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Oral and Poster Research Abstract Booklet

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NOTE: Abstracts in each of the above categories are listed in alphabetical order by the last name of the presenter. Abstracts submitted after the deadline may not appear in the abstract booklet.

ORAL RESEARCH PRESENTATIONS SCHEDULE

9:30 – 9:50 AM			
225B	Engineering	Crimson Bloom: A Biological Integration of Seed Types and How They Could Be Used as Data Collectors	Brandon Comsikey-Lucero Keilah South
226A	Physical Science	Selecting Microbial Communities for Disease Suppression in Tomato	Hanareia Ehau-Taumaunu
226B	Biology	Indigenous and Prescribed Fire Potential for Management of Goldspotted Elk Borer	Joelene Tamm
227C	Psychology & Social Sciences	The Perceived Effects of a Sensory Garden on Individuals on the Autism Spectrum	Gabbie Moneymaker
10:00 – 10:20 AM			
225B	Engineering	The Impacts of COVID-19 on Water and Wastewater Operations in Indigenous Communities	Feyisetan Adebayo
226A	Environmental Science	Looking for a Future: Weaving Together Potawatomi Plant Knowledge, Culturally-Informed Mapping & Climate Change	Susannah Howard
226B	Biology	AP1 Regulates Integrin β3 Induction Sustained by MAPK Pathway Activation	Kristen Woody
227C	Psychology & Social Sciences	The Dynamic Mind in a Cave: A Bias for Paleolithic Paintings	Timothy Hubbard

10:30 – 10:50 AM

225B	Engineering	Reaction Condition Optimization of Sorbitol Hydrodeoxygenation over a ReOx-Pd/CeO2 Catalyst via Design of Experiments	Blake MacQueen
226A	Biology	Investigating the Gut Microbiome-Brain-Metabolism Axis in Familial Dysautonomia; Examining the Implication of Choline Metabolism in Disease Phenotype and Progression.	Stephanann Costello
226B	Biology	Preparation of Apolipoprotein C I Peptide Antigens for Display on Virus Like Particles to Combat Adenocarcinoma	Kaelyn Acothley
227C	Psychology & Social Sciences	Racism and Discrimination Broadening Ethical Conflicts for American Indian/Alaska Native Professionals and Students STEM.	Davona Blackhorse

11:00 – 11:20 AM

225B	Engineering	MeduSEA ROV: An Integration of the Biological Locomotion of Cephalopods and the Application of These Dynamics in an Aquatic Remote Operated Vehicle (ROV)	Keilah South Brandon Comsikey-Lucero Xavier Romeo Dr. Mostafa Hassanalian
226A	Energy	A Chemical Approach to Solar Solutions	Adrian Riives
226B	Biology	Automated Analysis Identifies Pericyte and Endothelial Cell Loss in Capillaries of Diabetic Mouse Models	Madison Whitekiller
227C	STEM Education	Lakota Math Connections - Applying Indigenous Research Methodologies with Undergraduate Math Education	Danny Luecke

1:00 – 1:20 PM

225B	Engineering	Model Predictive Control Study for an Electrified Turbofan Engine	Brittany Nez
226A	Health Science	Methamphetamine Hapten Conjugated Peptide Vaccines to Combat Addiction	Jasmyn Genchev
226B	Biology	Sustained Signaling Through the High-Affinity Interleukin-2 Receptor Drives the Development of Terminally Differentiated Effector T Cells	Krystal Charley
227C	STEM Education	Indigenizing the Academy: A Storytelling Journey of Native Student Success in Engineering	Tiffany Smith

1:30 – 1:50 PM

225B	Engineering	Contactless, Reversible Droplet Wetting State Modulation by Dielectric Charge Injection	Paradorn Rummaneethrorn
226A	Health Science	Cleaning the Future: Antimicrobial Resistance in Aviation following the COVID-19 Pandemic	Noah Gunter
226B	Biology	Self-Assembling Peptides (Q11 and KFE8) as a Platform to Create New HPV Vaccines Candidates	Crystal Morales
227C	STEM Education	Using Virtual Reality to Bridge the Gap Between Culture and STEM: Results from an Intertribal Teacher Education Workshop	Nicole Colston

2:00 – 2:20 PM

225B	Engineering	Numerical Modeling of Agricultural Managed Aquifer Recharge: Application of Concepts using the Integrated Water Flow Model on the Toppenish Fan Shallow Aquifer Recharge Project, Yakama Nation, WA	Jordan Jimmie
226A	Health Science	Forced Displacement from Their Lands: Developing a Youth-Elder Mentorship Model to Heal from Loss of Land	Myrle Ballard
226B	Biology	Morphological Phenotype Predicts Tau Aggregate Seeding Activity in Genetically Diverse Drosophila	Dominic Acri
227C	STEM Education	Designing a Hybrid Culturally-Relevant STEM Research Program for Native American Students	Kathryne Headon

2:30 – 2:50 PM

225B	Engineering	Atomistic Modeling Approach to Investigate Surfaces and Heterointerfaces in Next Generation Photovoltaics	Anthony Nickleson
226A	Geoscience	Geological Changes Along the Lewis and Clark and Sacagawea Trail	Noah Gunter
226B	Biology	Nanomedicine, Extracellular Vesicles, Biochemistry, Cancer Biology	Sierra Walker

3:00 – 3:20 PM

225B	Engineering	Droplet-based, High-throughput Microfluidic Assay for Protein Selection	Robinson Tom
226A	Health Science	A Scoping Examination of Health Disparities – COVID-19 in Three Indigenous Contexts: North America, Australia, and New Zealand.	Jonathon MeDrano
226B	Biology	Biocultural Restoration of Fellows Falls: A Historical Ecology Approach	Jade Morning Sky Little

3:30 – 3:50 PM

225B	Engineering	Droplet-based, High-throughput Microfluidics to Fabricate Temperature-responsive Hydrogel Capsules for Drug Screening	Kyra Capitan
226A	Natural Resources	Survey of Edible Plants of the Menominee Reservation	Jasmine Neosh
226B	Biology	Mixed Effects for Shrimp Under Ocean Acidification and Warming Conditions	Jennifer Taylor

AISES Pre-College Student

Poster Research Presentations

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Correlations Between Sugar Content and Vitamin C Content in Fruits and Vegetables.

Does the amount of vitamin C affect how much sugar is in a fruit or vegetable?

The purpose of the experiment was to figure out whether there was a correlation between sugar content and vitamin C. This would be able to help people determine if the fruit or vegetable is good for them. The more vitamin C in a fruit or vegetable the higher the sugar content.

Michaela Alley (Hoyt) Timber Lake Highschool

Michaela a senior. Michaela is involved in FFA, Educators Rising, volunteer tutoring, volunteer work in the garden, and National Honor Society. Michaela hopes to become a high school algebra teacher.

An Inventory of Forest Birds Along the Aiea Loop Trail, Oahu, HI

Where are the native and introduced bird species present along this trail?
How often do they overlap in range?

Understanding the composition and abundances of members of O‘ahu’s forest bird community will offer insight into some of the most prominent issues facing Hawaii’s few remaining native forest bird species. Six point-count bird surveys were conducted, three in the morning and three in the afternoon, along the ‘Aiea Loop trail. Two native species, the O‘ahu ‘Amakihi (Chlorodrepanis flava) and ‘Apapane (Himatione sanguinea), only made up 23% of all birds detected. While the O‘ahu ‘Amakihi was common across all elevations, the ‘Apapane was only detected from 385 m above sea level and higher, possibly in avoidance of avian malaria, which may be more prevalent at lower elevations. Additionally, the House Finch (Haemorhous mexicanus) and Warbling White-eye (Zosterops japonicus), introduced species known for serving as a reservoir for avian malaria, were found to be relatively common and demonstrated a range overlap with all native species.

KELLEN APUNA Kamehameha Schools Kapālama

Kellen is a senior at the Kamehameha Schools Kapālama campus. As a birder, he is strongly interested in the conservation of native bird species. A Bristle-thighed Curlew seen on a field trip to the James Campbell National Wildlife Refuge in elementary school sparked his passion for birds and birding

Identification of the Artificial Synthesis of Aromatic Amino Acid Tyrosine, Based on Π-TO-Π* Absorbance Peaks

The aromatic amino acid Tyrosine was synthesized using three types of clays, water, heat, and a few common compounds. However, initial efforts to identify Tyrosine were stymied by the sole use of the Pearson Correlation Coefficient to statistically compare synthesized compounds with laboratory-grade amino acids, without any understanding of the underlying chemistry.
This synthesis was successfully revisited with the aid of quantitative chemistry, to understand the actual chemical bonding and thus the amino acid synthesized. The Beer-Lambert equation, Plank's equation, and two dominant spectroscopic absorbance peaks at λ1 = 287nm and λ2 = 294nm were critical to this study. The dominant spectroscopic peaks represented πèπ* electron transitions, as these peaks were significantly higher than all other absorbance data in the absorbance versus wavelength graph. These two dominant peaks became a UV/Vis "signature" which led to identifying the aromatic amino acid Tyrosine as having been created by all three types of clays. The Beer-Lambert equation was applied to show that Moroccan Clay produced a higher concentration of Tyrosine than Talc, and Talc produced a higher concentration than Sepiolite.

JORDYN BEGAY Navajo Preparatory School
Navajo

Jordyn is a very outgoing student who has a strong interest in STEM. He served as the Freshman Class President and has shared traditional teachings with his classmates "Honoring & Remembering Sisnaajiní." Jordyn has presented this research at the San Juan Regional Science and Engineering Fair and was awarded 2nd Place in the Life Science category and selected as a 2nd Overall Grand Finalist to the Regeneron International Science Fair.

Ms. Yolanda Flores, Co-Author Faculty, Navajo Preparatory School

Dr. Daniel Winarski, Co-Author Retiree, IBM

Water Filtration with Charcoal

How does particle size affect water filtration in charcoal water filter?

Many commercial water filters contain activated carbon. Activated carbon exists as fine powder, as granules, or as charcoal blocks. How does the particle size of activated charcoal affect the quality of water filtration? I hypothesized that activated carbon in fine powder form would be most effective in removing water contaminants. I used two commercially produced activated charcoals and local charcoals from pinyon wood in my experiment. As my source of contamination, I used two different concentrations of food coloring added to water. Three grams of each type of activated carbon or charcoal were added to clean cups. 100 ml of colored water was added to each cup with charcoal. The solutions were stirred for ten minutes. After ten minutes, the solutions were poured through prepared containers with paper filters. Both the powdered activated charcoal and the ground pinyon charcoal effectively removed food coloring from water. The granulated form of activated carbon was much less effective. My hypothesis was confirmed. Particle size affects the quality of water filtration. Activated charcoal in powder form removed more food coloring than carbon in granular form. Incidentally, I also discovered that charcoal from pinyon wood fires effectively removed water contaminants.

MAKINZIE CADY Owyhee Combined School
Eastern Shoshone

Makinzie is a senior at Owyhee Combined School. She is a member of the Eastern-Shoshone Tribe and lives on the Duck Valley Indian Reservation. MaKinzie is on the Varsity volleyball team and is also in FFA. She shows interest in gardening and sewing in her spare time. MaKinzie plans to attend college to study environmental science.

River Monitoring System

Why do we need to prepare for flash floods?

I chose to do this research because my community can be prone to flash flooding and it provides critical information that can protect property and save lives. Measuring a river's flow rate can yield reliable information, for a variety of purposes like hydrology, ecology, flood warning, and recreational safety. Currently, measuring the flow rate of remote river areas is a very hands-on process. Surveyors need to hike out to the river of interest carrying their equipment, set it up, take measurements, disassemble it and hike back. Because of the effort required to collect a measurement, it's only done periodically for certain rivers. Without continuous monitoring, many of the insights that the flow rate provides are lost. This project aims to solve this problem by making flow rate data easier to collect and more readily available to the users who need it.

KAMRYN CHINO Mescalero Apache School
Mescalero Apache

Kameryn is a senior at Mescalero Apache school, located in southcentral New Mexico. She enjoys science and robotic. She is team lead for her robotic team. She wants to become a degree in business after college.

Brooke Chima, Co-Author Student, Mescalero Apache School

Cyanophage Resistance in Naturally Occurring Cyanobacteria Populations in North Florida

How quickly do cyanobacteria (algae) populations from the North Florida area gain resistance to their common predatory phages?

This study's purpose was to analyze how quickly cyanophage resistance appears in wild populations of cyanobacteria found within the North Florida Area. Data was collected through a multi-step experiment in which cyanobacteria and cyanophages were collected from a body of polluted freshwater and stored in tuppercubes with BG-11 growth media. From there, cyanobacteria and other detritus were filtered out of the samples that showed cyanophage activity and then 5mL of this phage solution was put into each of the remaining tuppercubes. After two hours the effects of this phage application were recorded. This process was repeated twice. Initial results showed immediate resistance in cyanobacteria populations following first phage exposure. This means that of the surviving cyanobacteria, a sizable amount of their progeny kept their parent's resistance from the first exposure. Therefore, the conclusion can be made that cyanobacteria can gain immediate resistance to phages, due to similar methods of phage defense found in most bacteria. However, this cannot be determined for all bacteria as this was only a small selection of species from North Florida. These results are consistent with other studies measuring phage resistance in that the participants gained resistance after a period of time.

SAMUEL GABOVITZ Leon High School
Eastern Band Cherokee

This student has grown up in Tallahassee Florida, a quote, unquote "city" and home of FSU. Expressing curiosity in the natural world from a young age, Sam had undertaken a number of experiments as a small child, even requesting just baking soda and vinegar for his birthday once. This curiosity eventually led him to bacteriophages, the viruses that infect bacteria. The way they worked and the possibility of bringing back their use in medicine inspired him to conduct his study on cyanobacteria and their resistance to their common predatory phages over time.

TOP2A Polymorphisms Influence Lung Cancer Manifestations in Females

Is there a correlation in gene variations between female and male patients with non-small cell lung cancer?

Topoisomerase II alpha (TOP2A) has been shown to be both a proliferation marker and have prognostic significance in small cell lung cancer (SCLC). Further investigations have demonstrated clear evidence that SCLC manifests differently in females compared to males. Although females are more susceptible to molecular abnormalities as a result of tobacco exposure, they tend to be less likely than males to develop SCLC. The purpose of this study was to use bioinformatics analysis tools to assess the differences and the predictive role of single nucleotide polymorphisms (SNPs) found within the TOP2A locus of both female and male patients with SCLC. Our analysis identified 13 SNPs within the protein coding region of TOP2A in the analyzed female group that were absent in the male group. These data suggest that polymorphisms of the TOP2A gene may be a contributing factor to the different manifestations observed in female versus male patients with SCLC.

IAN HU Arnold O. Beckman High School

Ian Hu is a junior currently studying at Arnold O Beckman high school, Irvine, California. Ian is 15 years old, since coming to America to seek education 2 years ago in 2019, he has become interested in the medical field and seeks the chance of becoming a bio major student. With the goal of entering the medical field, he has joined Admission AG for a research program on the study of SNPs in lung cancer patients and controlled group.

Yizhou Zhang, Co-Author Admissions AG

Testing Fabric and Mask Particle Filtration Efficacy

What types of face masks and mask fabrics are most efficacious in filtering respiratory droplets, aerosols, and coughs? What environmentally-friendly alternative is best suited for addressing the nation's N95 mask shortage?

This project focuses on two main elements: first, testing a variety of surgical, homemade, and unique masks and fabrics in order to determine which masks/fabrics provide the greatest particle filtration efficacy, and second, proposing which mask/fabric is best suited to address the nation's N95 shortage. Each mask/fabric was grouped into three categories, common homemade, surgical, and unique. In Experiment 1, two different spray bottles were used, one sprayed a fine mist mimicking aerosols while the other sprayed larger particulates imitating respiratory droplets. Utilizing a 3.0 M NaCl solution, enclosure, microscope slides, and Bio7, each mask/fabric was sprayed, photographed, and analyzed three times with each bottle. Experiment 2 utilized a wide-beam green laser and cylindrical lens to illuminate particulates. It was found that most face masks, excluding the neck gaiter, blocked, and filtered more than 90% of particulates. It was also found that the cotton mask and the bedsheet masks provided the greatest filtration efficacy of the homemade category, while surgical masks like the N95 filtered virtually 100% of particulates. Moreover, steri wrap and Kapa fabric are the most comparable to an N95 respirator, as a single layer of either fabric boasted a nearly identical filtration efficacy to a 3-ply N95.

LOGAN LAU Kamehameha Schools Kapālama
Native Hawaiian

Logan Lau attends is from ʻĀina Haina on the island of O'ahu. Heattends Kamehameha Schools Kampala, a Native Hawaiian High School and enjoys science, math, and economics. Logan is also involved in the Youth Council of the Coalition for a Tobacco Free Hawaii. After high school, Logan plans to study pre-med and major in neuroscience. A few things that he enjoys doing in his free time are playing soccer, bodyboarding, and reading.

Water Quality Monitoring Autonomous

How can we check water level remotely?

ARM mcu based, autonomous waterbot, equipped with sensors to measure water quality of water reservoirs, lakes, and stream both locally and remotely. Water quality data is very important to our reservation for life. We want to collect data on water pollution at the different lakes and streams on the reservation. We want to design an autonomous robot, which can automatically travel through water bodies, collect water quality data, and send those data directly to remote end.

CHRISTIAN LITTLE Mescalero Apache School
Mescalero Apache

Christian is an 8th grade student at Mescalero Apache School, located in southcentral New Mexico. In addition to serving as captain of his school's robotics team, he also enjoys attending tribal ceremonies.

MATTHEW PONCHO Mescalero Apache School
Mescalero Apache

Matthew is an 8th grade student at Mescalero Apache School in southcentral New Mexico. He loves to play video games and enjoys math and science classes. Matthew is an active participant in his school's robotics team. He plans to attend college and pursue a career in Mechanical Engineering.

Make Your Air Safer: Alerting Indoor IoT Air Quality Monitor

How can we improve air quality for elders on the Mescalero Apache Reservation?

Having too many people in one room with poor ventilation can lead to unsafe conditions and an increased probability of sharing airborne viruses. Using ThingSpeak to track the air quality enables live alerts and the ability to visualize historic trends. With this monitor, we can immediately see the local air quality on the 8-pixel LED strip, we will be able to look up what the air quality was yesterday on ThingSpeak, and we can even check the safety of the room when we are far away.

CAYDENCE PALMER Mescalero Apache School
Mescalero Apache

Caydence is a 10th grader at Mescalero Apache School. Located in southcentral New Mexico. She is currently on track to graduate early. She is currently a member of the school STEM program. She has presented in front of NASA and GLOBE International. Caydence enjoys working on projects that involved her community well-being. After high school, she wants to pursue a degree in mechanical engineering.

Angel Enjady, Co-Author Student, Mescalero Apache School

Attitude Towards COVID Vaccination and Masking in Oklahoman Youth at the Height of the Delta Variant Pandemic

Does race and urban vs. rural status determine the attitude towards Covid vaccine and mask wearing in Oklahoman youth?

An anonymous survey available electronically was forwarded to youth eligible for COVID vaccination according to current CDC guidelines in August 2021 in Oklahoma. 32 responses were obtained and tabulated. Nineteen self-identified as Caucasian (C) and 13 as Native American (NA), 23 from urban area and 9 rural, 16 male, 15 female, and 1 non-binary. Median age was 15.5 years. Fifteen C participants reported having received at least one dose of a COVID vaccine, while all 9 NA reported receiving at least one dose. Of the 4 Caucasian participants who had not received vaccination, 1 was planning on receiving it. Of the 4 who had not received vaccination, 2 had at least one parent who had received the vaccine, while 2 had no parents who did so. Of the 32 participants, 60% did not wear a mask in public. Conclusions: The majority of participants have been or are willing to get vaccinated. All of the Native Americans have done so, while a small percentage of Caucasians have not. 75% of those who are not vaccinated live in urban areas.

CAROLINA PRADO Casady School
Chickasaw

Carolina was born and raised in Oklahoma, where she currently attends high school. She is a member of the Chickasaw nation and also has Caddo and Choctaw heritage. Carolina gravitated to STEM areas early on, while enjoying many other academic endeavors. She founded and is the current president of the Casady Pre-Med Club where she is motivating fellow students to consider medical sciences through engaging and interactive events. Being keenly aware of the critical times we are in; she designed a study to better understand attitudes towards COVID in Oklahoma youth.

Active, Instrumented COVID-19 Mask

Can a respiratory mask be instrumented with temperature sensors and monitored by an Arduino UNO microprocessor, to give an indication of the temperature and health of the wearer?

A prototype respiratory mask having six temperature sensors to detect the wearers health condition was created. This was inspired from the condition of the Navajo Nation as in some areas some are not able to get tested or know their own health condition due to distance or lack of health care. These six temperature sensors were employed in three pairs: two inhale temperature sensors, two exhale temperature sensors, and two skin temperature sensors. These temperatures were monitored by an Arduino UNO microprocessor used with the Arduino Uno program and displayed on the serial monitor of laptop with the USB cable. If the wearer's skin temperature exceeded a preselected value, indicating a fever, a red alarm LED lit, indicating the need to seek medical attention or further inspection. The mask gives needed protection to the wearer providing the information if they need to seek medical attention or getting tested, as well as the mask can still provide protection.

BRENT RAY Navajo Preparatory School
Navajo

A Junior at Navajo Preparatory School, Brent Darien Ray Jr (BJ) is an aspiring STEM student. Their current career goal is Marine Biology.

Analyzing Light Pollution on O‘ahu

What are the effects of light pollution in Hawai‘i

Light pollution is drastically and silently affecting our natural world. It disrupts the photosynthesis process of plants, intervenes in the migration, reproductive, birthing, and mating patterns of many species, and increases the U.S.’s carbon footprint unnecessarily. This project’s main goal is to study the effects of light pollution in Hawai’i, but in order to achieve this, it first had to measure the amounts of light pollution on O’ahu. In order to do this, skyglow was measured at four different locations on the island. Skyglow was measured by taking three pictures with the same camera, same settings, and same positioning, of the sky at each location. The pictures were then processed using ImageJ Software to measure the pixel intensity of each photo. Pixel intensity is the amount of light in a picture, so the average pixel intensity of all three photos was used to give a quantitative measurement of light pollution in a specific location. By comparing pixel intensities at different locations, it was found that light pollution travels across skies to affect nearby rural areas as well. This data can now be used to study the effects of light pollution on different species and variations of wildlife on O’ahu.

EMIL SHIGEKANE Kamehameha Schools Kapālama
Native Hawaiian

Emil is a Native Hawaiian student who is eternally grateful for the opportunities she has been granted throughout her educational career.

The Detection of Two Susceptibility Variants in Prostate Cancer

How can variant calling tools be used to analyze the sequence of PCAT-1 and look for SNPs that might be associated with prostate cancer?

Current investigations suggest that mutated long non-coding RNAs (lncRNAs) can drive tumorigenesis. Our objective was to determine if single nucleotide polymorphisms (SNPs), found in the lncRNA PCAT-1 of prostate cancer patients, are associated with this neoplasm. Genome Wide Sequencing data was obtained from the Sequence Read Archive and then analysis pipelines were constructed to map the sequences against chromosome 8 followed by indexing and variant calling. Our data suggest that the SNPs rs1902432, rs114243354, and rs114904844 are associated with prostate cancer risk.

NICK TRAN Pacific Academy

Nick Tran is currently a senior attending Pacific Academy aiming for his pre-med career. He has accomplished various research such as prostate cancer research, the study of AI technology by utilizing various computational methods for pharmaceutical industries, and the research of COVID-19 as potential therapeutic agents based on drug repurposing. Despite his accomplishments, he also attended a UPenn Medicine Summer Program along with many medical professionals guiding through different specialties and an educational trial of medical techniques such as CPR, AED, or even suturing.

Working with an Artificial Hand

How does the human hand work in a dangerous environment?

A physical science anatomy, and engineering project that we scaffold on building a machine that emulate humans using analog, digital, and data experience. First, we learn about the anatomy of a human hand. Then, we built a robotic hand from cardboard and straws to understand the biomechanics of the hand. Finally, we conduced trials and created data using Excel spreadsheet to generate new ideas for improving our design. After creating our hand models, we learned that by using this type of technology, we are looking at the future of our world and how it will be able to handle hazardous waste and other dangerous materials.

MELANI TRUJILLO Mescalero Apache School

Mescalero Apache

Melani is an 8th grade student at Mescalero Apache School, located in southcentral New Mexico. Melani loves science and she is learning how to code for the first time. She wants to pursue a degree in engineering once she completes high school. She loves tinkering with different things around the house and enjoys spending time with her mom, dad, and baby sister.

DIANDRA MCFADDEN, Co-Author Student, Mescalero Apache School

Mescalero Apache

Deleterious Effects of Atmospheric Sulfur Dioxide (SO2): Farmington, New Mexico Area of the Navajo Nation

Can sulfur dioxide levels in the Farmington, NM region during winter temperature inversions present a health hazard to members of the Navajo Nation?

In early 2020, Farmington, New Mexico experienced a perfect storm of high sulfur dioxide emissions and atmospheric temperature inversions that trapped those emissions in the pre-dawn air. This all-time high SO2 concentration for Farmington, NM was documented on January 13, 2020, at 6:48am via The Weather Channel app on an iPhone: 329 µg/m3. This 329 µg/m3 easily exceeded the EPA standard of 212 µg/m3. This SO2 concentration, and many others, was deemed as unhealthy for sensitive groups of people. This and other high concentrations of sulfur dioxide quickly diminished after sunrise, when the arrival of sunlight would break up the temperature inversion and allow the escape of sulfur dioxide. Thus, this serious problem was transitory, created overnight and disappearing during the day. The goal of this study is to show that regions of the United States, including the Navajo Nation, should not expose sensitive Tribal members to these high levels of toxic emissions when temperature inversions exist.

AMBER WHITE Navajo Preparatory School
Navajo

Amber is 17 years old and lives with her mom and dad on the Navajo Reservation in Red Valley, Arizona. She likes to play basketball and volleyball. She is also right-handed and left-handed.

Dual-Purpose Dual-Sided Solar Water Heater and Electric Generation

Is it possible to generate electricity to recharge a battery and produce hot water using a Dual-purpose solar panel during different times of day?

Heat is harvested by transferring from the front and back of a solar panel to copper tubing which has water flowing through at constant rate. The purpose of this research is to create a dual purpose solar water heater and electric generation that can simultaneously produce hot water and generate electricity that is stored in a 12V rechargeable battery. Water passed through the copper tubing was heated and when exited, the temperature of the water was noticeably hotter than the initial entry temperature. To make it more purposeful, a rechargeable battery was simultaneously charged by the solar panel during the day. To make the overall solar panel reach its highest efficiency, the researcher attached two light reflectors to give the solar panel a boost in gathering solar energy and heating water faster and hotter. This was tested at 5-, 10-, 12-, and 15-minute intervals for 3 hours for three trials to see how hot the water would get by going through the copper tubing. Electricity generated was also measured in DC (direct current) volts and amperes Based on the results of the study, the mornings for 12 minutes wait, the dual solar panel was able to heat up water passing through the copper tubing as high as 20.9 ºC (69.6 ºF), with a delta_T temperature rise of 5.6 ºC (10 ºF) over the temperature of the incoming water.

LIA WILFORD Navajo Preparatory School
Navajo

Hello, my name is Lia Wilford. I'm a senior at Navajo Preparatory School in Farmington, New Mexico. I am very interested in robotics and artificial intelligence. In my spare time, I do digital art or sketching in my sketch book. I also enjoy traveling and learning new things.

Application of Bioinformatic Analysis to Determine SNPs Causative of Melanoma

How do the genomic sequences of normal skin, melanocytic nevus and primary tumors differ in relation to SNPs?

Melanoma is a type of skin cancer that has been increasing among global populations, especially among the young. At this point, the exact cause of melanoma is unknown as is the possibility of developing an effective vaccine to prevent its occurrence. However, there is some evidence that melanoma is a genetic or inherited condition. In this study we used bioinformatics tools to compare genomic sequences of a sample group that was divided into three tissue categories: 1) normal skin, 2) melanocytic nevus, and 3) primary tumor. Through our analytical tools, we were able to detect 3 single nucleotide polymorphisms (SNPs) in the primary tumor samples. One of these SNPs was also found in the melanocytic nevus samples, but none were found in the normal skin samples. Our study contributes to the current knowledge that these SNPs, with an additive or correlational effect, may be associated with the risk for melanoma.

DAVID WOO Portola High School

David Woo is a 12th grader attending Portola High School. He has always played sports when he was young and loves the strong sense of camaraderie that develops among team members as they pursue a common goal. Since he was young, he has had experience working with people living with disabilities. His sister is an epileptic and working with my family and advisors we found a way to make sure her story was being told. Through AISES he was able to learn the scientific aspect of problems. This experience sparked a passion for him to help others.

AISES Undergraduate Student

Poster Research Presentations

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SLOAN INDIGENOUS GRADUATE PARTERNSHIP

Self-Assembling Peptide-Based Vaccines for HIV

Can Self Assembling Peptide-Based Vaccines be used in vaccines for HIV?

The Human Immunodeficiency Virus (HIV) is a virus that attacks cells that aid in helping the body fight off infection, making a person vulnerable to other harmful diseases. The self-synthesizing peptide KFE8 (Ac-FKFEFKFE-NH2) has the ability to form amphipathic fibrils due to alternating hydrophobic and hydrophilic amino acids. KFE8 fibrils are functional biomaterials utilized in biocompatible hydrogels and cell scaffolding. However, recent studies show that they may broaden their use as immune adjuvants and potential vaccine platforms against peptide antigens such as HIV. The KFE8 peptide was synthesized using standard Fmoc based solid phase peptide synthesis (SPPS). The mass of the peptide was confirmed using MALDi-TOF. Purification was analyzed using HPLC. Initial KFE8 syntheses were conducted using manual SPPS. Self-assembling peptide-based vaccines are self-adjuvating and could potentially be utilized against HIV. However, current studies must be repeated to obtain the correct peptide molecular weight. Next steps include obtaining pure KFE8 and HIV peptide antigen. Fibrils will be formed in water (1mM) then the HIV peptide antigen will be conjugated onto the fibril backbone via the lysine side chains.

BEYONCE BAHE Northern Arizona University
White Mountain Apache *bhb47@nau.edu*

Beyonce is a student at Northern Arizona University's Honors College, double majoring in Biomedical Science and Comparative Cultural Studies with a minor in Chemistry and Asian Language. She works part-time on campus as an Undergraduate Researcher under Dr. Naomi Ruth Lee on a Self-Assembling peptides project. Her goal is to continue the route of pre-medical studies to reach medical school and pursue her passions further.

Dr. Naomi Lee, Co-Author Northern Arizona University

Juniper Germination with Hormones and Mechanical Treatment

What impact do hormone inoculation and scarification have on juniper seed germination?

Pinyon-juniper woodlands are dying due to climate change-induced drought around the world. In the southwestern United States, four species of juniper can be found are one-seed juniper, alligator juniper, Utah juniper, and rocky mountain juniper. These four species have been known to be drought-tolerant trees but recently we have noticed that they are starting to die off. We are speculating that this is due to the rising temperatures and drought that is caused by climate change. Our research focuses on the germination rate of juniper seeds from each of the four spices that were mentioned. Our results showed that alligator juniper had the most germination out of the four species and the hormones/peroxide treatments did not differ from the control.

CHASE BEBO Navajo Technical University
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Chase has been a member of AISES since 2019 and is an environmental science and natural resource student at Navajo Technical University. He is perusing his bachelor's degree, which he will obtain in May 2022. Chase has been a student intern working on the Pinyon Pine Climate Change Research Project at Navajo Technical University and is partnered with Northern Arizona University.

Ron Deckert, Co-Author Northern Arizona University
Catherine A. Gehring, Co-Author Northern Arizona University
Maria T. Hernandez, Co-Author Northern Arizona University
Gillian Timber, Co-Author Northern Arizona University
Adair Patterson, Co-Author Northern Arizona University
Amy V. Whippe,Co-Author Northern Arizona University

Fabrication of Microgels with Microfluidics and its Application in Encapsulating Native American Plant Extract

Escherichia coli (E.coli) are bacteria that normally live in the intestines of humans. Most types of E. coli are innocuous, but other strains can cause severe stomach cramps, vomiting, and bloody diarrhea. Juniper berries and Navajo tea are traditional Native American plants known to cure intestinal diseases. The goal of this project is to use polydimethylsiloxane (PDMS) microfluidic devices to controllably encapsulate these plant extracts into pectin-based microgels. These micron-sized, microgel capsules are designed to protect the extract in the acidic
environment of the gut for therapeutic release in the intestine to study the antibacterial effects against pathogenic E. col. The microgels were co-cultured with E. coli at 37℃ and the growth of E. coli was monitored by the turbidity of the culture media each hour for 17 hours. The encapsulated extracts of Navajo tea and Juniper berries both had lower turbidity values compared to a control bacteria culture, indicating promising antibacterial properties. Additional investigations are planned to identify the mechanism for inhibition of E. coli growth in these systems, to quantify the protection offered by the microgels in the gut, and to study the kinetics of the sustained release of the plant extracts in the intestine.

JESSLYN CHIEF — Navajo Technical University
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Jesslynn is from northern Navajo Nation, a biology major graduating with a bachelor's degree in December 2021 with Navajo Technical University. She plans on attending University of Arizona as a graduate student to continue research that affects Native American community health.

Dr. Irene Anyangwe, Co-Author — Navajo Technical University
Dr. Yan Liu, Co-Author — Harvard University
Dr. Abraham Meles, Co-Author — Navajo Technical University
Dr. Thiagarajan Soundappan, Co-Author — Navajo Technical University
Robert Graham, Co-Author — Harvard University
Kathryn Hollar, Co-Author — Harvard University

Broadening STEM Interest in the Navajo Nation using Soft Robotics

How can soft robotics be integrated into curriculum on the Navajo Nation to increase STEM interest?

Native Americans are underrepresented in the STEM field, and many lack the resources and technology to prepare them to seek careers in engineering disciplines. The purpose of this study is to introduce the emerging technology of soft robotics into STEM programs across K-12 schools and universities in the Navajo Nation. Soft robots are devices made from squishy or flexible material designed to handle and move delicate objects when inflated. Our goal is to create a soft robotic instructional kit using accessible resources that will support educators and allow students to design, fabricate, and control their own soft robotic gripper. NTU's lab is equipped with a 3D printer, Smooth On liquid silicone, student-designed vacuum chamber, a pressure pump, and elastic tubing. To date, we have fabricated a leaf inspired soft gripper, tri-finger actuator, and introduced electronic pumps to control these devices. The soft robotics education will incorporate NTU's teachings of Dine Philosophy of Education which include: Nitsáhákess; Thinking, Nahat'á; Planning, Liná; Implementing, Sih Hasin; Reflection. The soft robotics instructional kit will allow educators to introduce robotics in K-12 STEM projects and encourage the next generation of Native American engineers.

JONATHAN CHINANA Navajo Technical University
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Jonathan has been a student member of AISES since 2019. He is pursuing his Bachelor's degree in Electrical Engineering at Navajo Technical University. His main field of study is in electronics but has done extensive research in Soft Robotics. His goal is to study as much as he can and bring this knowledge back to his community.

Antibiotic Alternative: Silver Nanoclusters Conjugated to Virus-Like Particles

What alternate pathways exist for treating antibiotic resistant pathogenic bacteria?

Many harmful bacteria are developing genetic resistances to antibiotics, increasing the risks associated with infections and diseases that have previously been considered treatable. Silver has antibacterial properties, and clusters of 10-100 atoms of silver have been applied commercially to combat bacteria. While the microscopic size of these clusters makes them compatible for biomedical application, their efficiency is limited. To increase efficiency, we aim to attach clusters to a larger platform: virus-like particles (VLPs). They will be conjugated with various linkers including short peptides and PEG monomers to analyze the effect of linker flexibility and length on the productivity of the complex. The linkers and VLPs are synthesized using standard biochemical methods, and the clusters will be reduced from a silver salt. The conjugated complexes will then be tested against drug resistant biofilms. While only peptide synthesis has been confirmed, we predict that the VLP nanocluster complexes will display an increased bioactivity on the biofilms, and we will be capable of determining the ideal linker based on the performance of the various complexes. This research will further develop applications of silver nanoclusters in biomedical fields by measuring the effect of these complexes against antibiotic resistant strains of pathogenic bacteria.

MEREDITH DENNIS Northern Arizona University
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Meredith is a senior at Northern Arizona University studying chemistry with an emphasis in biochemistry. They have been performing undergraduate research under the mentorship of Dr. Naomi Lee since July 2020. Meredith plans to pursue a MPH alongside their career in the Air Force through AFROTC after completing their bachelor's degree.

Dr. Naomi Lee, Co-Author Northern Arizona University

Does Phosphorus Content of Diet Impact Phototaxis in Daphnia?

Does an association between phosphorus use efficiency and migratory behavior of Daphnia.

Zooplankton migrate daily to avoid predation, and access better foraging areas. Anthropogenic activities have altered both predation and food availability. While we know that changes to the environment have driven evolutionary changes in the physiology of zooplankton, comparatively little is known about behavioral responses. This study tested two predictions using the freshwater zooplankter Daphnia: (i) nutrient-limited daphniids will exhibit more migratory behavior than nutrient-replete counterparts, and (ii) daphniid genotypes that are efficient at utilizing nutrients will exhibit more migratory behavior than genotypes that are inefficient at utilizing nutrients. To measure migratory behavior, a tube will represent a water column with three different levels: upper compartment, intermediate compartment, and lower compartment. The number of individuals in each column will be counted to measure the vertical distribution index of the Daphnia. The results of this study will contribute toward deciphering the responses of Daphnia to environmental change (e.g., nutrient pollution) and better understand/manage freshwater ecosystems.

KIERRA DIXON Oklahoma State University
Muscogee Creek Nation *kierra.dixon@okstate.edu*

Kierra Dixon is senior at Oklahoma State University, who is pursuing a dual bachelor's degree in zoology and Microbiology. Following Dixon bachelor's degree, she intends to pursue a PhD program outside of Oklahoma. Since freshman year, Dixon been conducting research and participating in a variety of programs, including the Freshman Research Scholar Program, The Retention Initiative for Student Excellence (RISE) program, Student Support Services (SSS), The Oklahoma Louis Stokes Alliance for Minority Participation (OK-LSAMP) Program, and McNair, as well as AISES, SACNAS, and other degree related organizations on campus.

Dr. Rachel Hartnett, Co-Author Oklahoma State University
Dr. Punidan D. Jeyasingh, Co-Author Oklahoma State University

Picornavirus Infection and Inflammation in the Zebrafish Intestine

How do zebrafish fight back to eliminate virus infection?

The nature of viruses has been problematic for humanity due to its vast diversity and capabilities. Due to the challenging nature of studying viruses in internal tissues, zebrafish are used to study infection and immune systems in living animals. To further study viruses, we used a transparent model organism, zebrafish, to visualize the immune system and its responses to infection. We previously discovered a picornavirus in the gut that infects the zebrafish's intestine. We hypothesize that fish activate inflammation in the intestines to get rid of infection. To test our hypothesis, we used genetically modified zebrafish that label neutrophils and antiviral immune signals. Using confocal microscopy, we imaged infected and uninfected animals and observed higher levels of neutrophils in the intestines of infected animals. These observations were consistent with our hypothesis that higher levels of inflammation are in infected animals. We speculate that these higher levels of inflammation are important to eliminate infection. Further work investigating inflammation and infection in this system will allow us to study inflammation defense and disease to develop new treatments. Our future research will be aimed at confirming the role of inflammation in the intestines and seek if it is present in other zebrafish tissues.

NATALIA ETSITTY University of Utah
Navajo *nataliaetsitty@gmail.com*

My name is Natalia Etsitty and I am from the Navajo tribe in northern Arizona. I have lived on the Navajo reservation for most of my childhood but relocated to Phoenix, AZ to attend high school at Xavier College Preparatory. I graduated with honors from Loyola University Chicago with my Bachelor of Science in Biochemistry. Currently, I am doing microbiology research at the University of Utah Genomics Institute and plan on applying to graduate programs the following year.

Dr. Keir Balla, Co-Author University of Utah
Dr. Nels Elde, Co-Author University of Utah

Behavioral Evaluation of a Novel Mouse Model with the Loss of GABAB Receptors

What behavioral differences are shown in GAB/CX3ert versus wildtype mice learning and memory as well as male and female differences?

Neurodegenerative diseases (NDD) are described as the progressive degeneration of the central and peripheral nervous system's structures and functions. Neuroinflammation may contribute to deficits in memory and cognition and has shown to be a hallmark in many NDD including Parkinson's Disease, Alzheimer's Disease, and amyotrophic lateral sclerosis (ALS). Microglia are the main glial cells responsible for mediating neuroinflammation. Microglia alterations could be a key in the chronic neuroinflammation observed in NDD. In addition to neuroinflammation, alterations in neurotransmitter systems can contribute to deficits in learning and memory. The principal inhibitory neurotransmitter in the brain, gamma aminobutyric acid (GABA), has demonstrated to be essential for cognition. Changes in the GABAergic system could lead to impairment of learning and memory. GABAB receptors are G-protein-coupled receptors found on microglia exhibiting anti-inflammatory properties. To investigate the role of the GABAB receptors in neuroinflammation, we developed a novel mouse model, GAB/CX3ert, with a knockdown of the GABAB receptor on microglia. In this study, we examined the learning and memory of the GAB/CX3ert mice compared to wildtype controls, as well as comparing males and females.

SKYLYN FERGUSON — University of Nevada, Las Vegas
Choctaw-Apache Tribe of Ebarb — *fergus2@unlv.nevada.edu*

Skylyn has been a student member of AISES since June 2021. She is currently in her senior year of undergraduate studies pursuing a bachelor's degree in Biology and two minors in Neuroscience and Chemistry at the University of Nevada Las Vegas. She plans to pursue a Ph.D. in neuroscience after graduation. Skylyn is a part of the Choctaw Apache Tribe of Ebarb and continues to incorporate her American Indian background with STEM academia.

Dr. Jefferson W. Kinney, Co-Author — University of Nevada, Las Vegas
Dr. Arnold M. Salazar, Co-Author — University of Nevada, Las Vegas
Alexis J. Cox, Co-Author — University of Nevada, Las Vegas
Michael Kimmich, Co-Author — University of Nevada, Las Vegas
Amanda Leisgang Osse, Co-Author — University of Nevada, Las Vegas
Andrew A. Ortiz, Co-Author — University of Nevada, Las Vegas

Extreme Aerosol Events at Mesa Verde, Colorado: Implications for Air Quality Management

What is the temporal nature and source of PM2.5 extreme events between 1989 and 2018 at Mesa Verde, Colorado using Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring data?

The role of fine aerosol particles, specifically particulate matter (PM 2.5) is a significant concern for public health and regional climate especially during extreme events. The purpose of this study was to examine PM2.5 extreme events between 1989 and 2018 at Mesa Verde, Colorado using Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring data. Extreme events were identified as those with PM2.5 exceeding the 90th percentile value for that given month. We examine the weekly, monthly, and interannual trends in the number of extreme events, in addition to identifying the sources of the extreme events with the aid of the Navy Aerosol Analysis and Prediction (NAAPS) chemical transport model. The results indicate that the number of extreme events range from 38 to 43 depending on the month for the cumulative time period analyzed. Wednesday exhibited the most extreme events (143), with the rest of the days of week ranging from 121 (Saturday) to 39 (Monday). Interannual trend analysis suggested that the year 2003 had the most events (34). This presentation will cover the frequency of sources accounting for these extreme events, in addition to characterizing the concentrations of species within the PM2.5 fraction based on each source.

JERI GARFIELD — Northern Arizona University
Navajo — *jgg226@nau.edu*

Jeri is Diné from the Kin Yaa'aanii clan born for the Áshįįhí clan. She is from the Navajo Nation and New Mexico. She is a first-generation student completing her undergraduate studies at the Northern Arizona University. She is majoring in the field of public health in hopes to serve the Indigenous communities. Jeri joined AISES in 2021 in hopes to connect and learn from other Indigenous scholars.

Dr. Armin Sorooshian, Co-Author — University of Arizona
Marisa Elena Gonzalez, Co-Author — University of Arizona

Political Leaning Analysis on Twitter with Machine Learning

Can we characterize the political leaning of user's tweets with machine learning approaches?

We believe we can finetune the labeling to get a better accuracy with our machine learning models. Our results raised questions of "are there right-leaning users who were labeled "Left" because they linked a left-leaning URL(s) which they were speaking of in a negative light and vice versa?" and "are the news media sources have accurate political labeling?" The impacts of our results have encouraged us to try to answer the above questions by implementing more advanced and in-depth methods.

JADE GULLIC Oklahoma State University
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Jade was born and raised in Tulsa, Oklahoma with two brothers and one sister. She is currently a junior at Oklahoma State University, majoring in computer and electrical engineering and minoring in computer science.

Dr. Arunkumar Bagavathi, Co-Author Oklahoma State University
Sadia Kamal, Co-Author Oklahoma State University

Identification of Endolysin and Glycosyl Hydrolase Family 25 Proteins in Streptomyces

How can endolysins (glycosyl hydrolase family 25 proteins) be identified through database research and genome BLASTing for laboratory synthesis in order to investigate a new form of antimicrobial?

Streptomyces is a genus of gram-positive bacteria, of which several species are phytopathogens. Bacteriophages are known to be harbored in Streptomyces genomes. Endolysins are enzymes used by bacteriophages to lyse the bacterial cell wall of the host. This research focuses on identifying potential endolysins that could potentially target and kill Streptomyces that cause the disease of potato tubers. The research was curated to focus on 22 species of Streptomyces. Annotated endolysins and Glycosyl Hydrolase family 25 enzyme protein sequences were found in the NCBI. Phages were also identified and used to custom BLAST against the enzymes. If the protein appears to have come from a phage genome, the confidence that the protein is a putative endolysin was increased. Phylogenetic trees were then created to show the relationships between the proteins. The SignalP program was also used to predict the presence of signal peptides and the location of their cleavage sites. A total of 13 clades were identified. The annotated endolysins were seen to have a 99% or higher percent identity to known phages for a large alignment range. Using the developed phylogenetic framework, we will synthesize twelve putative endolysins and test their potential for lysing the phytopathogenic Streptomyces.

SKY HARPER Drexel University
Navajo *harpers707486@gmail.com*

Ya'at'eeh! My name is Sky Harper, and I am an undergraduate from Drexel University. I am a chemistry major and hope to pursue a career in medicine. I am from the Navajo Nation, and I attended many science fairs in high school.

Dr. Christopher Clarke, Co-Author USDA Agricultural Research Service

Using StoryMaps to Communicate Success of a Tribal Restoration Project

How to communicate to Reservation community members successful restoration projects so they will support future projects.

Stream restoration projects can mitigate water quality issues and restore riparian ecosystem functions. The Confederated Salish and Kootenai Tribes recently implemented such a restoration project on the Mission Creek in Western Montana. Several benefits are visible from the project such as bank stabilization, improved water quality, and habitat restoration. The Mission Creek Project's (MCP) main goal was to restore fish habitat to Mission Creek that once held a population of the endangered bull trout. Communicating the science and outcomes of this type of project to the public can be challenging. The MCP attempted to assist the Tribe by developing an interactive virtual Story Map of the completed project for Tribal education and outreach. This poster serves as a summary of the MCP and the Communicating Science (CS) outcomes for the project. It is intended to illustrate an alternative way to present science to communities and deliver outreach that is less fleeting, more capable of evolving, and capable of reaching a broader audience.

LORI HUCK Oklahoma State University
Cherokee Nation *lhuck@okstate.edu*

I have has been an AISES Student member since 2019, I am a citizen of the Cherokee Nation, and I am also Choctaw. I am currently a senior at Oklahoma State University majoring in Geology and GIS with an expected graduation date of May 2023.

Mas Receptor Agonist Drug Treatment on 5XFAD Mice with Alzheimer's Disease

What is the effect of the novel Mas agonists RASRx1902 and RASRx1911 on cognition using animal behavior analyses? Does the RASRX is effective with 5xFAD mice?

It is well established that oxidative stress (OS) and inflammation contribute to common cognitive decline in Alzheimer's Disease (AD). Additionally, cardiovascular disease and hypertension comorbidities can also increase the risk of subsequently developing AD. Previous studies show that the Renin Angiotensin System presents a potential therapeutic opportunity for AD outcomes, particularly with Angiotensin II (A-II) peptide. This is based on the observation that A-II plays a role in OS, inflammation cascades, and several other molecular mechanisms related to aging that are implicated in the pathophysiology of AD. The Mas receptor is an active peptide within the A-II and commonly displayed in the brain and trauma. This receptor counter-regulates the actions of A-II. Evaluate the effect of the novel Mas agonists RASRx1902 and RASRx1911 on cognition using animal behavior analyses, whether the RASRX is effective with treating 5xFAD. The 5XFAD mouse model, which contains 5 mutations associated with familial AD was used for this study. The 5XFAD mice develop cognitive impairments, neuronal loss, and amyloid β deposition in the brain. Animal behavior tests such as novel object recognition (NOR), catwalk, marble burying, and nestlet shredding were used to estimate cognitive decline. All behavior test results were scored based on standardized protocols.

ALLYSSA JOE — Dine College
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Allyssa Wynter Joe is currently a Bachelor of Biology student at Dine College and is currently in her second year as an URBRAIN intern which will prepare her for graduate school. A local resident to the community of Lukachukai, Arizona on the Navajo Nation she may have been the average student throughout primary school but with a colorful mindset due to her learning disability of attention deficit hyperactivity disorder (ADHD) she has used this weakness and turned it into a positive, thought she has endured such challenges it has only provided motivation to complete her education.

Dr. Roberta Brinton, Co-Author — Center for Innovation in Brain Science, University of Arizona

Dr. Kathleen E. Rodgers, Co-Author — Center for Innovation in Brain Science, University of Arizona

Michael David Trial — University of Arizona

A GWAS Study of Color and Texture on Natto Soybeans

What relationship exists between the alleles and phenotype in soybean varieties that affect color and texture?

Soybeans are an essential component to the contemporary Japanese diet. Natto is a Japanese dish made by fermenting soybeans, and the physical properties of the unprocessed soybeans will affect the natto produced. Pale yellow soybeans that are slightly firm in texture are preferred. The genetic improvement of these qualities is achieved through breeding. The aim of this study was to identify the relationship between the alleles and phenotype in the soybean varieties that affect color and texture of natto soybeans. A genome-wide association study (GWAS) is an important tool for soybean breeding and can be used to associate genomes with a certain genotype. A GWAS program was ran to associate the genotype markers with the phenotypes of color and texture. None of the markers in the study reached the threshold of significance and therefore are not considered to be associated with one of the phenotypes. Further research will be necessary to conclusively determine association for either trait.

GABRIELLE JONES — Oklahoma State University
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Gabrielle has been a student member of AISES since 2018. She is working towards completing her bachelor's degree in Entomology at Oklahoma State University in May 2022. Gabrielle plans to attend graduate school to further pursue entomology and her passion for insect conservation.

Dr. Leandro Mozzoni, Co-Author — University of Arkansas
Jade Walker-Wilson, Co-Author — University of Arkansas at Pine Bluff
Joshua Winter, Co-Author — University of Arkansas

Accelerating Genetic Discovery in Diabetic Kidney Disease Using 'Big Data' and Archived Biospecimens

Can we leverage archived biospecimens from the IHC Biorepository to performing high-quality next-generation sequencing and discover genetic variants/genes that contribute to DKD?

Diabetic kidney disease (DKD) affects nearly 40% of all patients with diabetes. Thanks to high-throughput next-generation sequencing technology, a better understanding of DKD susceptibility and phenotypic variation due to genetic effects has been brought to light. The workflow of genetic analysis starts with electronic medical records to deeply phenotype and select patients of interest. Next is to link well-phenotype patients to large, multigenerational pedigrees in the Utah Population Database that are associated with DKD. Finally, DNA samples are obtained for next-generation sequencing (NGS). However, a bottleneck exists in obtaining samples effectively. The Intermountain Health Care Biorepository, located in Salt Lake City, grants access to more than 4.5 million biological samples thus creating an effective and faster way to analyze data. The purpose of this study is to evaluate 14 known samples from the biorepository and evaluate the overall quality of each sample, through the analysis of genetic variants and mutation detection. All of this will be done on the lab's Sentieon pipeline, a toolkit that provides accurate analyzation of NGS data. The anticipated outcome was the affirmation that the use of known tissue samples from the biorepository do promote a faster way to conduct genetic analyzation and discover novel genes.

LIYANNA LEE Northern Arizona University
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Liyanna Lee is senior undergraduate attending Northern Arizona University seeking a Bachelor of Science in Biomedical Science. Liyanna is a premedical student hoping to attend medical school to become a pediatrician and serve her hometown hospital. She is inspired by the shadowing she has done in her hometown and the connection she made with the patients there. Liyanna has an extensive background with science courses and recently completed a 10-week research internship at the University of Utah.

Dr. Marcus Pezzolesi, Co-Author University of Utah

Digitization for Studies of Neutrino Pileup in Water Cherenkov Detectors

Does our new tool that is extended to simulate and study new pileup effect events have accurate results compared to the previous tool used to simulate neutrino events?

Hyper-Kamiokande (HK) is a next-generation long-baseline neutrino and nucleon decay experiment that is currently under construction, with the operation to begin in 2027. HK will detect muon neutrinos (or muon antineutrinos) produced by the upgraded beam at the Japan Proton Accelerator Research Complex (J-PARC) on the other side of Japan. The Intermediate Water-Cherenkov Detector (IWCD) will be a new detector approximately one kilometer away from J-PARC. IWCD will be used for measuring the neutrinos before the oscillations happen. IWCD could possibly see a pileup of neutrino events on average two and a half neutrinos in each beam spill. This research studies the pileup effect that will happen in the new Intermediate Water Cherenkov Detector (IWCD). This talk will present the digitization of truth information, the waveform simulation, and a charge reconstruction algorithm. The results of the new digitization of the waveforms were compared against Hyper-Kamiokande's previous hit simulation WCSim. They are compared to see if this tool simulates as accurately as WCSim when extended to study pileup effects. This is a starting point for future machine learning studies on PID and event reconstruction for IWCD.

SIDNEY LEGGETT University of Winnipeg
Metis *sidneyleggs@gmail.com*

Tánisi! Wápiskisiw Pinésiw Iskwéw nitisinihkáson! Hello, my name is Sidney Leggett, I am a Métis student entering the last year of my honors computer science degree. I have worked as a Junior Epidemiologist for the past 3 years and I have worked on several research projects including finishing my honors thesis. I believe in the importance of inclusion of Indigenous peoples in STEM fields, and the importance of having diverse views within the STEM world. My current research interests revolve around data analysis and statistical modeling for many fields, especially those that relate to human health and wellness.

Dr. Blair Jamieson, Co-Author University of Winnipeg

A Novel mas Receptor Agonist for the Treatment of Amyotrophic Lateral Sclerosis

Does the novel mas agonist, RASRx1902, extend the life of mutant SOD1 mice after onset ALS symptoms occur?

Amyotrophic lateral sclerosis (ALS) is a fatal neurodegenerative disease that leads to the loss of motor neurons, paralysis, and ultimately death. Approximately 90% of ALS cases are sporadic, while the remaining 10% have a genetic etiology. The four most common genes that are associated with ALS are SOD1, FUS, TDP-43, and C9ORF72. Currently, Rilzole and Edarvarone are the only two FDA approved drugs for ALS, both of which offer limited therapeutic benefits. With the lack of viable treatment options available to these patients, there is an urgent need for the development of novel treatments. In this study, we analyzed the efficacy of a novel mas receptor agonist, RASRx1902, in SOD1G63A mutant mice. Using this widely used ALS model, characterization of phenotypic changes within the spinal cord, neuromuscular junction (NMJ), and survival curves were performed to test the protective effects of RASRx1902 as a potential, novel therapeutic.

ANGEL-GRACE LESLIE Dine College
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Angel-Grace Leslie is currently a student at Dine College pursuing her Bachelor's in Biology and Biomedical Sciences and will be graduating in the Spring of 2022. She has been a student of AISES since Fall of 2020. Over the summer, she participated in the Undergraduate Readying for Burgeoning Research for American Indian Neuroscientists (URBRAIN) Fellowship where she aided in medical research at the Center of Innovation Brain Science at the University of Arizona. Angel-Grace is a dedicated STEM student with a passion for medicine and research.

Dr. Kathleen Rodgers, Co-Author University of Arizona
David Bradford, Co-Author University of Arizona

The Effects of Sex and Time of Day on the Performance of Anolis Aquaticus in Southern Costa Rica

How do environmental and physiological factors affect an animal's performance?

Understanding animal performance (e.g., endurance, locomotion) provides vital information related to behavioral ecology and how individuals may be affected by alterations in their environments. The goal of this study was to examine how sex and time of day affect water anole (Anolis aquaticus) sprint velocities and to determine whether these patterns are influenced by habitat. Time of day had a significant effect on sprint speed, with sprint speed decreasing later in the day. Sex had no effect on water anole sprint speed. Interestingly, the site of collection affected sprint speeds: lizards from the most undisturbed site had faster sprint speeds than those at the abandoned pasture site or the intermediate site. This study adds to the evidence that both sex and time of day are crucial for evaluating the performance of ectotherms and predictions of their activity to consider for an in-depth experimental design.

DEBORAH MELEISEA University of Hawai'I at Hilo
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Talofa! I am Deborah Meleisea, born and raised in the U.S. Territory of American Samoa. I am currently a senior studying Tropical Plant Science at the University of Hawaii at Hilo.

Dr. Lindsey Swierk, Co-Author Binghamton University
Jada Williams, Co-Author University of Connecticut

Decolonizing Hydrologic Terminology-
Expressing the Water Cycle through Indigenous Perspectives and Terminology

Using Ichishkiin language to interpret the Hydrologic Cycle

The hydrologic cycle is critical to understanding ecosystems, including how nutrients, bacteria, and sediment move in the environment. The hydrologic cycle includes three major processes: evaporation, condensation, and precipitation. Since time immemorial, the Confederated Tribes and Bands of the Yakama Nation have understood how water moves and cycles through the earth. Understanding of the water cycle, is fundamental to traditional ecological knowledge and understanding the cycles of the first foods. Western technical terminology has largely supplanted traditional terms for expressing water movement. This project developed a glossary of terms for the hydrologic cycle using the Ichishkiin language. Results were compiled into educational materials and presented to students. High school and undergraduate students were given a survey regarding their knowledge of the hydrologic cycle before and after presentation of the materials. Results showed that education utilizing the prepared materials resulted in increased knowledge of the water cycle amongst participants surveyed.

AGNES MENINICK Heritage University
Yakama Nation *meninicka@heritage.edu*

Agnes Meninick is a Sophomore at Heritage University, studying Environmental Science. Agnes is an enrolled member of the Yakama Nation. She is interested in Geology, Archeology, and History. She is also a member of the HUNAC club and AIBL club.

Advanced Membrane Desalination Technology for Navajo Nation Groundwater Remediation

How can we improve the water quality of windmill-pumped groundwater on the Navajo Nation?

A significant shortage of fresh water is a big challenge throughout the Navajo Nation where more than 30% of homes lack access to safe and drinkable water. Livestock in the Navajo Nation mainly rely on windmill-pumped groundwater in which naturally elevated arsenic and uranium pose a serious threat to the animals' well-being. The possibility of residual arsenic and uranium in the animal meat and dairy products is an additional risk to humans. To address these challenges, we developed an innovative water remediation technology using cross-linked polyvinylidene fluoride (CPVDF) hollow-fiber membranes. Laboratory results show salt rejection of >99.9% and > 50 kg/(m2h) water flux in desalination of brine and groundwater samples from the Navajo Nation. Further, no arsenic or uranium was detected in the treated water. The high specific surface area (>1,000 m2/m3) of the hollow-fiber membrane reduces the footprint of the technology and allows the technology to be easily integrated within a portable skid-mounted system that can be installed at any windmill-wellhead for the production of high-quality (TDS<150 mg/L) water free of toxic metals. The NTU-NMT Navajo Nation Water Purification Project (N4WPP) team will install these units at remote locations within the Navajo Nation in partnership with local chapter houses.

KIRBY MORRIS — Navajo Technical University
Navajo — *meninicka@heritage.edu*

Kirby Morris (Navajo) is a sophomore undergraduate studying Environmental Science and Natural Resources at Navajo Technical University in Crownpoint, NM. She is from Saint Michaels, Arizona and is in her first year as an active member of the AISES community. She has worked the summer in several research grant projects; the Climate Change effects on Pinyon Pine and Reclamation of Coal Mine Spoil Gob Piles in Abandoned Mine Lands. She plans to continue her education to get her PhD in Natural Resources Management.

Dr. Abhishek Roychowdhury Co-Author — Navajo Technical University
Dr. Jianjia Yu, Co-Author — Navajo Institute of Mining and Technology
Bonnie Frey — Navajo Institute of Mining and Technology
Darlene Wilson — Navajo Technical University

Cyber Security for Additive Manufacturing 3D Printing Machines

How can we improve the water quality of windmill-pumped groundwater on the Navajo Nation?

A significant shortage of fresh water is a big challenge throughout the Navajo Nation where more than 30% of homes lack access to safe and drinkable water. Livestock in the Navajo Nation mainly rely on windmill-pumped groundwater in which naturally elevated arsenic and uranium pose a serious threat to the animals' well-being. The possibility of residual arsenic and uranium in the animal meat and dairy products is an additional risk to humans. To address these challenges, we developed an innovative water remediation technology using cross-linked polyvinylidene fluoride (CPVDF) hollow-fiber membranes. Laboratory results show salt rejection of >99.9% and > 50 kg/(m2h) water flux in desalination of brine and groundwater samples from the Navajo Nation. Further, no arsenic or uranium was detected in the treated water. The high specific surface area (>1,000 m2/m3) of the hollow-fiber membrane reduces the footprint of the technology and allows the technology to be easily integrated within a portable skid-mounted system that can be installed at any windmill-wellhead for the production of high-quality (TDS<150 mg/L) water free of toxic metals. The NTU-NMT Navajo Nation Water Purification Project (N4WPP) team will install these units at remote locations within the Navajo Nation in partnership with local chapter houses.

NYLANA MURPHY — Navajo Technical University
Navajo — *nylana.murphy@student.navajotech.edu*

Diné Asdzaa mechanical & industrial engineering student with a keen interest in metal additive manufacturing.

Dr. Abhishek Roychowdhury Co-Author — Navajo Technical University
Dr. Jianjia Yu, Co-Author — Navajo Institute of Mining and Technology
Bonnie Frey — Navajo Institute of Mining and Technology
Darlene Wilson — Navajo Technical University

Fabrication of Low-cost, Paper-based Electrodes for Detection of Bisphenol Compounds

The detection of Bisphenol (BP) compounds using fabricated paper-based electrodes.

Bisphenol (BP) is a chemical additive used to strengthen polycarbonate plastics and epoxy resins. Bisphenol, however, is a known toxicant often categorized as an endocrine disrupting chemical (EDC). Bisphenol absorption in the body can result in metabolic disorders, such as type-2 diabetes, obesity, immune toxicity, and other serious diseases. Approximately 90% of humans accumulate BP levels through exposure to food containers, plastic bottles, thermal printing papers and other common plastic products. Herein, we report the development of low-cost, flexible paper-based electrodes for the electrochemical detection of BP compounds. We applied carbon screen printed paste onto our paper substrate electrodes for our three-electrode system. We demonstrate our paper-based electrodes have the ability for BP detection for optimal concentration in the laboratory at physiological pH conditions. Further, the sensitivity of these electrodes and linear electrochemical response makes them well suited for real-time applications and point detections.

MICHAEL NELWOOD Navajo Technical University
Navajo

Michael is a senior Biology student at Navajo Technical University and plans to go to graduate school at Harvard University.
Dr. Thiagarajan Soundappan, Co-Author Navajo Technical University

Community Awareness on Air Quality in the Lower Yakima Valley and the Yakama Nation

We aim to explore different ways to increase community awareness on air quality in the lower Yakima Valley and Yakama Nation region.

The goal of this project was to reduce the health impacts and cultural costs of poor air quality by improving the Yakama Nation community's access to relevant air quality information. The Lower Yakima Valley and Yakama Nation in Washington State was ranked 6th in the nation for poor air quality in the 2019 State of Air Report by the American Lung Association. The Environmental Protection Agency Region 10 started a loan program in partnership with Heritage University to expand access to low-cost sensors for measuring air quality in tribal communities of the Pacific Northwest. 15 Purple Air low-cost sensors were provided for community members to loan through the HU library and an air quality curriculum was tailored to the Yakama Nation community. The engagement enabled the community to better understand the air quality that they reside in. Results of the survey administered to participants found they had a better understanding of the importance of knowing the air quality conditions and the pollution sources in which they live. In addition, participants indicated they were able to better understand the connection between poor outdoor air quality and high incidences of respiratory illnesses commonly found in our community such as asthma.

DARREN OLNEY Heritage University
Yakama Indian Nation

Darren Olney is a senior at Heritage University studying for an Environmental Science Degree. Mr. Olney is an enrolled member of the Yakama Nation and lived and works on the Yakama Indian Reservation. He has always worked in the Natural Resource Department for the Yakama Nation and that is where his interest has always been. After graduation he would like to continue to bring his passion, skills, and knowledge to the Yakama Nation Reservation.

Dr. Jessica Black, Co-Author Heritage University
Agnes Meninick, Co-Author Heritage University
Lillie Wesley, Co-Author Heritage University
Dehlia Wolftail, Co-Author Heritage University

Design and Fabrication of Flexible Paper-based, Electrochemical Sensors to Detect the Presence of Heavy Metals in Ground Water

Fabrication of an affordable sensor to detect hazardous heavy metals in groundwater resources.

The history of mining and mineral extraction across the Navajo Nation has resulted in considerable contamination of the land and the groundwater resources, which is a significant environmental concern. Through a partnership between Navajo Technical University and Harvard University, we have designed and fabricated flexible, paper-based sensors in tandem with electrochemical techniques such as cyclic voltammetry and differential pulse voltammetry to determine heavy metal concentrations in test samples. We have selected to fabricate paper-based electrochemical sensors because; they are low-cost, easy to make, environmentally friendly, and can be deployed for field testing across the Navajo Nation. Furthermore, the sensitivity of these electrodes for heavy metals and linear electrochemical response makes them well suited for real-time sensors in field-testing applications.

JUSTIN PLATERO Navajo Technical University
Navajo

Justin Platero is a third-year student at Navajo Technical University. He is currently majoring in Biology. Justin is currently working at NTU as a research assistant. He is studying how to fabricate paper-based sensors to detect endocrine disruptors and heavy metals. They will apply the knowledge they learn toward creating sensors to detect uranium in Navajo water supplies. In his spare time, he enjoys hiking the mesas near his residence and enjoying the beautiful landscape.

Dr. Thiagarajan Soundappan, Co-Author Navajo Technical University
Khaled Abdelazim, Co-Author Harvard University
Makeiyla Begay, Co-Author Navajo Technical University
Jasmine Charley, Co-Author Navajo Technical University
Katelynn Wilson, Co-Author Navajo Technical University

Building Science Self-Efficacy in Students without Laboratory and Research Experience to Successfully Produce Virus-like Particles (VLPs)

Can proper training help students with minimal to no laboratory experience build science self-efficacy?

Science self-efficacy describes the confidence an individual has in their ability to accomplish specific practices. This is important in aspiring scientists as it is one factor that was typically linked to success and persistence in STEM fields. The purpose of this educational research is to inform and educate new researchers/labs on effective ways to teach their students techniques to produce virus-like particles in a timely manner. VLPs are utilized as multivalent vaccine platforms due to their ability to spontaneously self-assemble. However, the synthesis and characterization of VLPs can be difficult for new researchers, especially ones with minimal laboratory experience or foundational knowledge of molecular biology.

MACIE PROCTOR Northern Arizona University
Navajo *Map697@nau.edu*

Undergraduate Researcher pursuing research in Dr. Naomi Lee's HPV Biochemistry Lab.

Dr. Naomi Lee, Co-Author Northern Arizona University

Comparison Study of 1999-2019 Suicide Rate per 100,000 Population Between Native American and Other Races in the United States of America

This study focuses on the difference in suicide rates between NA and the other races at particular age groups and different genders.

The suicide rate in the USA has been on the rise, which affects specific age groups, genders, and race/ethnicity. Native American (NA) has been known to be on a higher level than that of the other races. This study focuses on the difference in suicide rates between NA and the other races at particular age groups and different genders. Twenty years (1999-2019) of suicide data were retrieved from the CDC database. Microsoft Excel and t-test were employed for data processing and statistical analysis. The results showed that the suicide rate per 100,000 population increased 38.1% nationally with male increased 34.5% and female increased 55%, respectively. However, male was 281.42% higher than female nationally. Among the age groups, NA was 44.48% higher than total nation in age group 10-39 with a significant difference ($P<0.05$), while in age group 40-84, US total was 81.46% higher than NA with a very significant difference ($P<0.01$). Crossing race comparison among NA, African American (AA), Hispanic (His), Asian or Pacific Islander (AP), and White (W) showed that NA and W were much higher than other races. However, NA showed 43.31% higher in the age group 10-34 than W ($P<0.05$), while W showed 86.63% higher in the age group 35-84 than NA ($P<0.01$). In addition, NA showed 99.09% and 89.62% higher in the age group 10-64 than His and AP, respectively ($P<0.01$), while AP showed 31.68% higher than NA in the age group 65-84 ($P <0.05$). There was no significant difference between NA and His in the age group 65-84. Further, NA was 94.07% higher than AA through all age groups. In summary, the suicide rate increased from 1999 to 2019 by about 38.10% with the increased rank as W>His>NA>AA>AP. The suicide rates ranked as W>NA>AP>His and AA. NA was the highest one in the age group 10-34, which should bring more attention to the community for further investigation. This study provides important information for suicide prevention and emphases the necessity of psychological/psychiatric services and family education for those affected age groups national wide, so that a reduction in suicide may positively impact the populations.

EMMA QUINTANA Southeastern Oklahoma University
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Undergraduate student, sophomore, Biology and Chemistry double major, Pre-Medical program

Ning Wu, Co-Author Southeastern Oklahoma University

Measurement and Evaluation of Analyst Workflow when Introducing Enhanced Cyber Threat Intelligence

How can we measure the quality of performance for a cybersecurity analyst, and utilize these measurements to incorporate enhanced cyber threat intelligence throughout one's workflow effectively?

Limited context is provided to analysts when receiving cyber threat intelligence (CTI). To address this, one goal for the Laboratory of Advanced Cybersecurity Research is to advance the CTI analysis tradecraft through research in CTI data modeling, processing, fusion, presentation, and automation. The aim of this study is to establish measures of success for this effort, by answering how we can measure the quality of performance for a cybersecurity analyst. Furthermore, it is important to solve how we can use these measurements to incorporate enhanced cyber threat intelligence throughout one's workflow effectively. Through literature review, two key findings were found; the first finding was that performance could be defined by analytic rigor. Rigor holds specific indicators of sufficiency, and these indicators may experience tradeoffs based on the actions taken by an analyst. It is proposed that an analyst is working most effectively when reaching Nash equilibrium with their indicators of sufficiency. For an analyst's workflow to adapt to maintain Nash equilibrium, a self-adaptive framework can be applied to moderate their actions and provide suggestions for the next steps in their work. This framework would involve a graph model analyzer and architecture evaluator as key components in measuring success.

GEELA MARGO RAMOS

University of Central Florida
geelamargo.ramos@knights.ucf.edu

Geela Margo Ramos (they/she) is a junior at the University of Central Florida with a major in computer science and a minor in cognitive science. Outside of their academics, Geela is involved in various research projects under the Wearable Engineering and Assistive Robotics Lab at UCF. Additionally, they are an intern under the Department of Defense, where their focus lies under advanced cybersecurity research applications.

Defense Mechanism in Plants

What defense mechanism does a plant use against a pathogen?

Plants began from the Cambrian period and have constant evolved in order to defend themselves from herbivores and harmful pathogens.

MARISA SOSA Dine College
Navajo *masosa@dinecollege.edu*

As half-Navajo and half-Mexican, Marisa Sosa is a sophomore at Dine College. Her major is in Bachelor of Science for general biology in the STEM field. In addition, she is a member of the Associated Students of Dine College as a Senator for the Shiprock campus. She serves as a representative and advocate for the Shiprock campus and act as a liaison between the campus, department, school and ASDC. Her interest is in Biomedical Engineering.

Defense Mechanism in Plants

What defense mechanism does a plant use against a pathogen?

Plants began from the Cambrian period and have constant evolved in order to defend themselves from herbivores and harmful pathogens.

BREANNA THOMPSON Navajo Technical University
Navajo *tbreanna.2019@gmail.com*

Breanna Thompson is a recent biology graduate from Navajo Technical University. She is also a first-year generation college student. Her current plans are to attend graduate school and return to Navajo Technical University as a faculty member. Breanna enjoys research experiments, cooking, fishing, travelling, and spending time with friends and family.

Dr. Irene Anayangwe, Co-Author Navajo Technical University
Dr. Abraham Meles, Co-Author Navajo Technical University
Dr. David Weitz, Co-Author Harvard University
Katherine Hollar, Co-Author Harvard University
Pia Sorenson, Co-Author Harvard University

Ethnobotany Outreach at Fish Springs National Wildlife Refuge

Research the existing Flora of Fish Springs National Wildlife Refuge and create a deliverable documenting the Ethnobotanical use by the Goshute Tribe.

Fish Springs National Wildlife Refuge, in western Utah, is a site of cultural significance. There has been little to no documentation of the ethnobotanical use of the local tribe by the U.S. Fish & Wildlife Service. The Goshute (Gosiuta) people inhabited the Great Basin Desert of western Utah and eastern Nevada. They utilized precious springs, like Fish Springs, for centuries representing the ecological sustainability of the people. The expected outcomes were to determine and research the existing flora on the Refuge and develop a Map/GIS Layer showing which plant communities were utilized by the tribe. Then, creating an interpretive deliverable product listing 10 plants and their uses for the public. I decided that the brochure should be consulted with the Goshute tribe to ensure the descriptions of the uses are accurate. As Indigenous People, we understand that outside entities utilize cultural information for their benefit without any proper consultation. The final product of the project was a six-page brochure detailing the history of the Goshute People, and 10 plants that were utilized by them and located on the Refuge property.

ADRIANO TSINIGINE Northern Arizona University
Navajo *atsinigine33@yahoo.com*

Adriano Tsinigine is an undergraduate at Northern Arizona University obtaining a B.S. in Biology and UG-Certificate in Wildlife Ecology & Management in December 2021. In addition to being an undergraduate student, Mr. Tsinigine proudly represents his positions as Youth Representative for the Navajo Nation Youth Advisory Council & the Diné Uranium Advisory Commission. Mr. Tsinigine was raised with the Navajo Culture and incorporates that into his educational studies. Navajo Ethnobotany has been a part of the Navajo Culture since time immemorial and is still actively practiced today.

The Comparison of Microstructure and Mechanical Behavior of Stainless Steel 316L Using Near Net Shaped and Fully Embedded Methodologies Using DED Metal Advanced Manufacturing

The objective of this project was to the microstructure and mechanical behavior SS 316L compare using near net shaped and fully embedded manufacturing extraction techniques?

The objective of this research was to compare the microstructure and mechanical behavior of 3D printed SS 316L using near net shaped and fully embedded manufacturing extraction techniques. Research findings was to determine if two different manufacturing extraction methodologies of a 3D printed stainless steel part will affect the overall performance of test specimens. Research implemented advanced manufacturing, part designing/modeling, part simulation, part production, CT X-ray scanning, material characterization, and material testing.

Printing of test specimens was completed with an Optomec Lens 3D Hybrid Machine Tool Direct Energy Deposition (DED) metal printer. The DED metal printer was used for prototype printing and printing test samples. The areas of study included modeling and design using SolidWorks computer aided design (CAD) software. A comparison of internal composition of printed specimens and testing of material structure in the areas of stress to complete failure of test specimens was performed. Non-destructive internal structure analysis was observed to inspect the porosity levels and its effect of 3D metal printing with near net shaped and cocoon style print parameters. This study addresses the amount of time, production, strength, composition, and overall performance of SS 316L printed material using near net shaped and cocoon style printing parameters.

MARCIE VANDEVER Navajo Technical University
Navajo *m.vandever@student.navajotech.edu*

My name is Marcie Vandever, I'm an enrolled tribal member of the Navajo Nation in New Mexico. I am a dual major student with Navajo Technical University in Crownpoint, New Mexico. I'm majoring in Industrial Engineering with a minor in Advanced Manufacturing Technologies. I'm also a Student Research Assistant with the Center for Digital Technologies. My responsibilities consist of assisting with research projects, operation of machines, equipment, and software within the fabrication lab. Along with these responsibilities, I assist fellow students and professors with learning and operating equipment, software and applying this knowledge to the theory of their course work.

Targeting Oxidant Stress in Diabetic Retinopathy

What is the role of myostatin in diabetic retinopathy?

Diabetic retinopathy (DR) is a microvascular disease of the eye caused by hyperglycemia. In this disease, all major cell types in the retina are affected, including endothelial cells (EC) and pericytes in the microvasculature. Exercise has been known to improve cardiovascular function and hypertension in diabetes. Unfortunately, patients with diabetic retinopathy are not advised to perform physical activities due to possible retinal detachment. For this reason, pharmacological methods of exercise might be an alternative option to treat diabetic retinopathy.

MELISSA VERA Northeastern State University
veram@nsuok.edu

My name is Melissa Vera. I am a Latina student-athlete in STEM. I am currently a senior at Northeastern State University and will graduate in May 2022 with a biochemistry degree. In my free time I enjoy to workout, listen to music, and spend quality time with my family.

Dr. Joshua Butcher, Co-Author Oklahoma State University
Dr. Cammi Valdez, Co-Author Northeastern State University
Austin Fisher, Co-Author Northeastern State University

Installing Stream Gauges and Groundwater Wells to Monitor Head Gradient in a Manoomin Bearing Lake

Do surface water and groundwater flux have an impact on Manoomin habitat loss at Big Rice Lake?

Manoomin (Zizania palustrus) or "the good fruit" is both a cultural and economic staple that has sustained the Anishinaabe People of the region. Big Rice Lake was once one of the best producers of Manoomin in the 1854 Treaty Territory, but it has been on the decline since 2006. In partnership with 1854 Treaty Authority, University of Minnesota Twin Cities researchers are using stream gauge wells and piezometers to measure the fluctuating surface water and groundwater flux of the lake. At Big Rice Lake two wells were installed at the inlet and outlet to measure cm level changes. The pressure transducer loggers provided Water level flux data that showed differences at inlet at outlet, but not a correlation with Manoomin loss at the lake. Local knowledge shared with Manoomin stewards, may deepen the knowledge about hydrological stressors that are affecting the region.

CHRISTOPHER VILLARRUEL — Humboldt State University
Ajumawi (Pit River Nation) — *ajumawi1987@gmail.com*

Chris is a member of The Pit River Tribe who are located mostly east of Mt. Shasta in Northern California. His homelands are commonly referred to as the 100 Mile Square and actually consists of 7,000 square miles of The Pit River, its tributaries, and the volcanic geological wonders. Besides the core forestry classes he is also studying hydrology, Geospatial Science (minor), and fire ecology. Through his education and career, he plans to offer forestry expertise with an understanding of tribal community and healthy watersheds as an indicator of good management practice.

Dr. Michael Dockry, Co-Author — University of Minnesota Twin Cities
Gene-Hua Crystal Ng, Co-Author — University of Minnesota Twin Cities
Maddie Nyblade, Co-Author — University of Minnesota Twin Cities
Cara Santelli, Co-Author — University of Minnesota Twin Cities
June Sayers, Co-Author — University of Minnesota Twin Cities

Wild Edible Plants of the Menominee Reservation

Do surface water and groundwater flux have an impact on Manoomin habitat loss at Big Rice Lake?

The purpose of this project would be to investigate some of the health benefits for Menominee people to adopt a community-based foraging program. This project is part of a broader project surveying edible wild foods in the Menominee forest. Using soil and habitat maps, students were able to survey and pinpoint suitable sites to monitor, including a wide variety of soil types and habitat conditions. Students also interviewed experts in the field of forestry, archaeology, and ethnobotany in order to gain a comprehensive understanding of cultural considerations for the selection of plants. Students formed a list of expected plants from historical agricultural and archaeological documents as well as some basic scientific knowledge of the area. Students would then compare and contrast the areas in order to get a more contemporary understanding of the land and its edible plants. Among the deliverables for this project was an on-going nutritional guide. This can be combined with knowledge gained from Menominee ethnobotanists to develop a culturally relevant, nutritionally robust food supplement program to meet the needs of a growing Indigenous community.

LORENZO WARRINGTON College of Menominee Nation
Menominee *lwarrington@menominee.edu*

Lorenzo Warrington is from the Menominee Indian Reservation. He recently graduated with an Associate degree in Liberal Studies and Social Science. He plans to further his education with degrees in Business and Engineering.

Frank Kutka, Co-Author College of Menominee Nation
Jasmine Neosh, Co-Author College of Menominee Nation

Exploring the Microbial Communities of the Silverton Acidic Mine Drainage

What type of microbial communities are present in the San Juan and Animas Rivers?

The full extent of the impact of the 2015 Gold King Mine Spill on the Animas and San Juan River systems is unknown. Research was conducted to conceptualize the effects the mine spill had on the physical and biological components of the Animas and the San Juan River systems. The focus of the research was to identify iron-oxidizing bacteria in the Animas and San Juan River systems. From the Red and Bonita mine site located near Silverton, Colorado to Hogback, New Mexico, water, and sediment samples were collected. Water and sediment samples from each location were inoculated onto ISP media plates. For each sample, several DNA extraction methods were utilized to isolate DNA. High quality DNA was then amplified through PCR utilizing a variety of primers. The amplified DNA were then sequenced with the MinION sequencer.

KAMERON WHITEWATER Fort Lewis College
Navajo *krwhitewater@fortlewis.edu*

Kamron Whitewater is Senior at Fort Lewis College in Durango, Colorado. He is a Biochemistry major researching under Dr. Joslynn Lee in the RENAU program studying iron oxidizing bacteria in the Animas and San Juan River systems.

Shundiian Fisaga, Co-Author
Hailee Steffes, Co-Author

A Look at Native American Identity through Video Art

What does it mean to be a Native artist?

For me, art is an emotional expression. Throughout my creative process, I try to uncover something about the world and myself. The last couple of films I made were influenced by the artists David Choe, Sterlin Harjo, Adam Curtis. My work in the digital medium could be summed up as collages combining both video and imagery. Recent projects have been derived from my journey to find my identity, as a Native American and an artist. I also enjoy making experimental films and learning to create interesting things with a computer. For example, in my videos, I use techniques such as data moshing and facial recognition. Most of my development uses the Adobe Suite but since the end of my undergraduate career I have been dabbling with Cycling '74's Max 8, a visual programming language for music and multimedia. Through these pieces I have discovered the foundation of the person I wish to become. I still have a long way to go in attaining that goal, I intend to continue making art and growing as a person. I can become more successful in conveying my ideas through a multimedia lens as well, which opens yet another door for exploration and experimentation.

CORBIN WILDCATT
Cherokee Eastern Band

University of North Carolina at Asheville
Corbinwildcatt99@gmail.com

Born in Cherokee North Carolina graduated from University of North Carolina at Asheville.

Post Gold King Mine Spill: San Juan River Health Monitoring

The purpose of the study was to conduct a desk-top evaluation of stream, "health" in the San Juan River system that crosses the state lines of Colorado, New Mexico, Utah, and Arizona and flows through tribal lands.

One of the biggest mine-waste (Acid Mine Drainage or AMD) spills in the U.S. occurred on August 6, 2015, when 3 million gallons of AMD water was accidentally released into the Animas River from abandoned Gold King Mine located outside of Silverton, Colorado. The spill temporarily changed the color of the river to orange. The contaminated water flowed down the Animas River, into the San Juan River in New Mexico, was carried into the Colorado River and ended up in Lake Powell in Utah. We have conducted a desk-top evaluation of stream "health" in the San Juan River system that crosses the state lines of Colorado, New Mexico, Utah, and Arizona and flows through tribal lands. In 2016, benthic invertebrate surveys were conducted at San Juan River monitoring sites in the Navajo Nation, and those data are available to the public. Biological indices were calculated using these benthic invertebrates following the guidance of each states' regulatory agencies, and the results were compared to evaluate how the sites would be classified in terms of "impairment" by each state's biocriteria method. Our results showed the nature of resiliency from the microorganisms over the time and their recovery trend.

DARLENE WILSON Navajo Technical University
Navajo *d.wilson01@student.navajotech.edu*

Full time student at Navajo Technical University, I am a Junior studying Biology and Environmental Science. I am Tangle Clan born for Towering House, my paternal Grandfather was Jemez Pass Coyote and maternal Grandfather is Salt People Clan. I enjoy taking care of my livestock and planting crops. I participated in an internship with Department of Defense and NASA. I plan on becoming a Researcher to study cancer and help my people within my community.

Quantification of The Colville and Spokane Tribe Water Right Adjudication and Potential Impacts to Current Junior Water Right Holders

The purpose of this study was to model the pending water right adjudication of two Washington State Tribes and any potential impacts to junior water right holders.

This project aims to explore potential outcomes from the pending water rights adjudication for the Twelve Bands that compose the Confederated Tribes of the Colville Reservation and the Spokane Tribe of Indians using the dynamic modeling software Stella Architect. The out-of-stream water uses for the tribes were quantified at one million cubic acre feet between April and October when the majority of water used for irrigation will come from the Lake Roosevelt Basin (LRB). The Upper Columbia River Basin's minimum Instream flow rule established in1980 to maintain the health and quality of rivers were simulated into four different scenarios to explore different minimum instream flow rules as: before 1943, 1944-1950, 1951-1979, after 1980. With the minimum instream flow rules adjusting for the four different scenarios, predicted results indicate junior water right users' water will not have their water supply cut off during dry years between Banks Lake to Bonneville Dam. Minimum instream flows can still be met according to the tribes' water use plan.

DEHLIA WOLFTAIL Heritage University
Turtle Mountain Band of Chippewa *wolftaild@heritage.edu*

Dehlia Wolftail is a Heritage University student majoring in Environmental Studies. She is enrolled Turtle Mountain Band of Chippewa Indians. She is planning on attending graduate school focusing on governmental policy pertaining to environmental sustainability. She also plans to work with government agencies and tribal representation.

AISES Undergraduate Student

Oral Research Presentations

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Preparation of Apolipoprotein C I Peptide Antigens for Display on Virus Like Particles to Combat Adenocarcinoma

Biological Sciences Track – Undergraduate Research

10:30-10:50 AM **Room 226 B**

Certain adenocarcinoma therapies can extend survival rates to eight months, but treatment can involve invasive surgeries and chemotherapy with no current primary prevention option for patients. Research has found apolipoproteins to be associated with pancreatic cancers by establishing a link between certain APOs and tumor cell progression. The APO-C family consists of proteins with APOC1 found to be overexpressed in pancreatic and prostatic cancer. Increased levels of preoperative serum APOC1 resulted in unfavorable prognoses for patients. Knockdown of APOC1 expression resulted in suppressed tumor cell proliferation. Inhibition of APOC1 expression can induce apoptotic cell death in pancreatic cancer cells. A vaccine that elicits an immune response to reduce serum level APOC1 may increase prognoses in pancreatic cancer patients. We synthesized potential APOC1 peptide antigens using solid phase peptide synthesis and characterized the peptides using MALDI-TOF and HPLC. Using chemical biology, we increase the alpha helical content of APOC1 peptide antigens to best mimic the alpha helical character of human APOC1. Some of the control APOC1 peptide antigens were conjugated to VLP vaccine platforms and mice will be treated with the vaccines to understand the role of immunization on the murine antibody response and the effects on serum levels of APOC1.

KAELYN ACOTHLEY Northeastern State
Navajo Nation
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Kaelyn received her Bachelor of Science in Biomedical Science with a minor in Chemistry from Northern Arizona University and is continuing to pursue research during her post baccalaureate through the Partnership for Native American Cancer Prevention. She has been in the Lee lab since January 2019, and her projects are focused on using MS2 and Q-Beta, Virus Like Particles as vaccine platforms. Kaelyn has presented at the Society for Advancement of Chicanos/Hispanics and Native Americans in Science Conference and the NAU Undergraduate Symposium. In addition to research, she has been a mentor in the ACS CARE summer program in 2019.

Droplet-based, High-throughput Microfluidics to Fabricate Temperature-responsive Hydrogel Capsules for Drug Screening

Geoscience – Undergraduate Research

3:30 – 3:50 PM **Room 225 B**

Using droplet-based microfluidics to generate picoliter droplets containing therapeutics can significantly reduce costs while increasing the sensitivity of drug screening methods. Hydrogel shells that encapsulate drug molecules and can be triggered to release their cargo on demand can be loaded individually into droplets for high-throughput drug screening. The goal of this project is synthesizing and characterize a new, temperature-responsive hydrogel for use fabricating these capsules. The hydrogel is composed of acrylamide and acrylonitrile monomers and bis-acrylamide cross-linker. We investigate the relationship between gel composition and capsule swelling, the aim of controlling gel porosity with temperature. With glass capillary microfluidic devices, we fabricate shells, which to investigate the encapsulation and release of drug molecules due to changes in the porosity of the capsule associated with swelling. When applied to high-throughput drug screening, these shells promise to enable droplet-based, drug screening that can reduce cost and increase throughput relative to existing methods.

KYRA CAPITAN Navajo Technical University
Navajo
kyracapitan@gmail.com

My name is Kyra Capitan. I attend Navajo Technical University in Crownpoint, NM. I am an undergraduate, I am currently in my 3rd year. I am seeking my Bachelor of Science degree, in majoring in Biology.

Methamphetamine-Hapten Conjugated Peptide Vaccines to Combat Addiction

Health Science Track – Undergraduate Research

1:00 – 1:20 PM **Room 226 A**

Methamphetamine (MA) addiction is a serious public health issue as hospitalizations and deaths steadily increased with a sharp rise during the COVID-19 pandemic. The lack of health care and rehabilitation facilities increase the risk for individuals from low-income socioeconomic status. While treatment development and vaccine trials are in progress for nicotine, cocaine, and opioids, there are limited pharmaceutical intervention methods to abate methamphetamine addiction and relapse. Virus-like particles (VLPs) and self-assembly peptide are multivalent platforms that can dramatically increase the immunogenicity of molecules that are normally poorly immunogenic. Therefore, this project aims to develop a methamphetamine-hapten conjugated to peptide- and protein-based vaccine platforms. Ongoing experiments include solid-phase peptide synthesis to optimize the linker peptide, which will then be bound to amphetamine hapten via amide hydrolysis. Future studies include conjugation the amphetamine-hapten to Qbeta VLPs and self-assembling fibrils as vaccine platforms. The vaccine candidates will assess the effects of dose and boosting on immunogenicity with one or two immunizations. All serum samples will be assessed for antibody titers to methamphetamine using an ELISA. End-point dilution IgG titers will be determined and compared between the groups. The long-term goal is to develop a therapeutic vaccine to combat methamphetamine addiction.

JASMYN GENCHEV Northern Arizona University
jrg546@nau.edu

Jasmyn Genchev is a senior at NAU majoring in ACS certified Biochemistry. Her research involves self-assembling peptide-based vaccine for HIV and synthesizing methamphetamine-haptens for VLP conjugated vaccines against methamphetamine addiction. Jasmyn participated in an NSF funded internship at BYU analyzing polymer-lipid hybrid vesicle adsorption onto surfaces (Summer 2019). In addition to research, she is a teaching assistant for general and organic chemistry labs and is a mentor in the ACS CARE Virtual summer program coordinated by Dr. Naomi Lee (Summer 2020, 2021). After her time as an undergraduate, Jasmyn plans to pursue her PhD and become a research scientist.

Cleaning the Future: Antimicrobial Resistance in Aviation following the COVID-19 Pandemic

Health Science – Undergraduate Research

1:30 – 1:50 PM **Room 226A**

This research looked at the cleaning efforts to slow and/or prevent the spread of the ongoing COVID-19 pandemic and how anti-microbial resistance (AMR) could become a major problem if not considered with these cleaning procedures, while also looking at how AMR could be combatted with modified versions of these procedures. Germ Theory was also looked at and how this theory has helped with getting people to understand what causes diseases. This question asked to research was can AMR develop from the cleaning procedures of COVID-19 and create another public health problem in the future? This research was done by reviewing articles and papers published on AMR, COVID-19 cleaning procedures, and Germ Theory. The result of this research was that AMR can develop from COVID-19 cleaning procedures and become a major public health problem in the future if not addressed properly.

NOAH GUNTER Elizabeth City State University
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I am a recent graduate of Elizabeth City State University and plan to attend the University of North Dakota in the Fall for a Master of Science in Aviation. I have always had a passion in many things, but my main passions are Science and History. With my interests I hope to have a successful career in the Aviation Industry and continue to teach students and my fellow peers.

Designing a Hybrid Culturally-Relevant STEM Research Program for Native American Students

STEM Education – Undergraduate Research

2:00 – 2:20 PM **Room 227 C**

The presentation is an informative session on successes and obstacles in designing a hybrid (virtual and in-person) culturally inclusive STEM research training program for Native American students. Native Americans are the least represented population in STEM fields. In 2019, Northern Arizona University launched a new summer internship program for high school students referred to as CARE (Cultural and Academic Research Experience) with the intent to introduce Native American high school students to the STEM field, through culturally relevant training. Originally, the program equipped high school students with hands-on research experience on the Flagstaff campus. However, due to the COVID-19 pandemic, the CARE program ran as a 4-week virtual program in 2020. New students received online chemistry training, which incorporated traditional knowledge with chemistry concepts and techniques. In 2021, the curriculum expanded to offer in-person training, and incorporate advanced biology and neuroscience topics. Throughout the program, all students met virtually to receive training in professional development techniques such as resume building and interview strategies. In summary, 29 students participated across all cohorts. Overall, the CARE program has yielded positive results from surveys, with multiple participants interested in continuing their STEM education, and several declaring a major in STEM.

KATHERYNE HEADON Northern Arizona University
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Kathryne is a senior at Northern Arizona University. Kathryne started working in Dr. Naomi Lee's research laboratory as a teaching assistant for the Cultural and Academic Research Program in June of 2021. She is currently majoring in Biomedical Sciences, with a minor in Chemistry. After she graduates, she plans to either attend medical school, or continue pursuing research in Pediatric Immunology.

The Perceived Effects of a Sensory Garden on Individuals on the Autism Spectrum

Psychology & Social Science Track – Undergraduate Research

9:30 – 9:50 AM **Room 227 C**

This research addressed the question, "What are the perceived effects of a sensory garden on individual well-being for participants on the autism spectrum?" A sustainable, pollinator garden was created in the Summer of 2021. The hypothesis was that time spent in the garden would cultivate positive reactions in autistic participants. A rapid deterioration of green space in urban areas has created a barrier between humans and their surroundings. Humans have biophilia, an innate desire to connect with nature, and a lack of these interactions can have many mental and physical downfalls. The data collection methods included pre and post-surveys of caretakers regarding their perception of participants from the Autism Society of North Carolina. The anticipated results include an increase in participants' positive reactions to nature in the garden. Previous studies have concluded that exposure to nature provides benefits to the well-being of school children, individuals in nursing homes and rehabilitation centers. However, there had not been much data documenting these benefits to individuals on the autism spectrum. This research provides data on the correlation between the well-being of individuals on the autism spectrum and time spent in a garden.

GABBIE MONEYMAKER University of North Carolina Asheville

Squaxin Island

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Gabbie is a new member of AISES and received the Sloan Indigenous Scholarship for research this summer. She is a biology and sustainability student at the University of North Carolina Asheville where she also manages a greenhouse. She is passionate about people, plants, and sustainability. She plans to run and own an inclusive and self-sustainable learning farm for children upon graduating.

Biocultural Restoration of Fellows Falls: A Historical Ecology Approach

Geoscience – Undergraduate Research

3:00 – 3:20 PM **Room 226 B**

How does historical ecology in combination with current plant community assist Indigenous communities in biocultural restoration? Currently, the New York Department of Environmental Conservation, Honeywell, and the Onondaga Nation are discussing transferring title of Fellows Falls, an area that is part of Onondaga ancestral homelands, to the Onondaga Nation. This study will help aid this agreement and lay the groundwork for biocultural restoration of Fellows Falls by providing: an analysis of the historical ecology of plant biota at Fellows Falls, a survey of the current plant community (by conducting plant identification), and in collaboration with members of the Onondaga Nation, a biocultural restoration plan for Fellows Falls. This study is currently being conducted. Some preliminary results will include an analysis of the current plant biota at Fellows Falls and the historical understanding of the area, which will help in compiling a biocultural restoration plan that discusses both environmental and cultural management of Fellows Falls. The goal of this project is to not only address the biocultural management of Fellows Falls, but also the restoration of connections to Fellows Falls by the Onondaga Nation. This work will help strengthen Indigenous methodologies within academic literature and help advocate for Onondaga's relationship to land.

JADE MORNING SKY LITTLE State University of New York Environmental Science and Forestry
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Jade Morning Sky is Oglala Lakota, Gabrielino (Tongva), and Chicana. She is currently a graduate student as ESF studying Conservation Biology with an emphasis in Biocultural Restoration. She has been an AISES member since 2015. She completed her Bachelor of Science degree at University of California Davis in December of 2019 and majored in Wildlife, Fish and Conservation Biology with a minor in Native American Studies. Jade is very passionate about strengthening what it means to be Indigenous in Science and one of her career goals is to become a professor.

Survey of Edible Plants of the Menominee Reservation

Natural Sciences Track – Undergraduate Research

3:30 – 3:50 PM **Room 226 A**

The purpose of this student-designed and student-led project is to gain insight into the availability and health of edible wild plants in the Menominee Reservation Forest. Using available soil and habitat maps, the team of students identified appropriate sites to survey, encompassing a wide variety of soil and habitat classes and site conditions. Students also interviewed experts in the field of Menominee ethnobotany to gain an understanding of cultural considerations for plant selection and importance. Students generated a list of anticipated plants from historical agricultural and archaeological documents as well as some basic scientific knowledge of the area. Students then compared their findings to that information to present a more current understanding of the land. They also gathered information for nutritional guides and compiled seasonal calendars, taking notes on specific phenostages. This is a 2.5-yearlong study funded by USDA NIFA as a student-led project.

JASMINE NEOSH
Menominee

College of Menominee Nation

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Jasmine Neosh is a proud member of the Menominee Nation. She is also a student at the College of Menominee Nation, where she obtained her Natural Resources degree and is working toward her Public Administration degree. She has been an NECASC Undergraduate Fellow and blogger for Tribal College Journal, writing on stories of Tribal sustainability under climate change.

Crimson Bloom: A Biological Integration of Seed Types and How They Could Be Used as Data Collectors

Engineering Track – Undergraduate

9:30 – 9:50 AM **Room 225B**

There are many different flying seed types that exist in the world today. Dandelions in particular, have a unique design which uses anti-aerodynamic features in order to travel great distances. Maple seeds use a similar method to travel using the natural wind to its benefit, giving it lift and distance. Triplaris seeds take on the shape of a helicopter and use three leaves to act as its means of flying. Some of these classifications are based on their flight style and include gliders, helicopters, spinners, tumbleweeds, and finally cotton seeds. These seeds have similar aspects for simulated flight, but each varies depending on its native environment. These biological designs found in nature can be replicated and integrated into the exploration of foreign environments such as planets similar to Earth. Before using this technology on other planets, it is necessary to replicate similar weather conditions to observe which seed is best suited for the job. Using similar technology will prove beneficial to gathering data across a very large area. The end goal is to be able to create a biological inspired set of nanobots which will be able to map out the planets better.

KEILAH SOUTH New Mexico Institute of Mining and Technology

Cherokee Nation

keilah_south@yahoo.com

My name is Keilah, I am a Senior at New Mexico Institute of Mining and Technology studying Mechanical Engineering with the hopes of going into Aerospace Robotics.

BRANDON COMSIKEY-LUCERO New Mexico Institute of Mining and Technology

Brandon is a senior at New Mexico Institute of Mining and Technology studying Mechanical Engineering in hopes of pursuing a career in Aerospace Robotics.

XAVIER ROMEO New Mexico Institute of Mining and Technology

Xavier is a sophomore at New Mexico Institute of Mining and Technology studying Mechanical Engineering in hopes of pursuing a career in Aerospace Robotics.

DR. MOSTAFA HASSANALIAN New Mexico Institute of Mining and Technology

Dr. Hassanalian is an Assistant Professor in the Department of Mechanical Engineering at New Mexico Tech. He is doing research on different types of drones (UAV/MAV/NAV/PAV). His main research interests are in the fields of flapping wing micro and nano air vehicles, tilt-rotor and tilt-wing drones, Morphing drones, space and marine drones, separation and swarming flight of micro drones, flight dynamics, biomimetics, fluid-structure interaction, and optimization.

MeduSEA ROV: An Integration of the Biological Locomotion of Cephalopods and the Application of These Dynamics in an Aquatic Remote Operated Vehicle (ROV)

Engineering Track – Undergraduate Research

11:00-11:20 AM **Room 225 B**

It has long been a wonder how squids, a member of the cephalopods group, navigate underwater so quickly and in a highly calculated fashion. The answer is jet propulsion, and we believe that if we are able to apply this to an underwater ROV we could possible collect important seismic data. In order to collect the seismic data, the ROV must be able to hover using mechanics that the Cuttlefish uses. This would be done by a system or device that we would design that would imitate the "cuttlebone" of a cuttle fish. Using the studies available on the locomotion of these cephalopods, we will be able to design an underwater ROV that will be able simulate the movements of these creatures. This also unlocks the opportunity for more extensive research on the locomotion of other underwater creatures that could allow us to expand our efforts to find another sustainable environment outside of earth.

KEILAH SOUTH New Mexico Institute of Mining and Technology
Cherokee Nation
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My name is Keilah, I am a Senior at New Mexico Institute of Mining and Technology studying Mechanical Engineering with the hopes of going into Aerospace Robotics.

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BRANDON COMSIKEY-LUCERO New Mexico Institute of Mining and Technology

Brandon is a senior at New Mexico Institute of Mining and Technology studying Mechanical Engineering in hopes of pursuing a career in Aerospace Robotics.

XAVIER ROMEO New Mexico Institute of Mining and Technology

Xavier is a sophomore at New Mexico Institute of Mining and Technology studying Mechanical Engineering in hopes of pursuing a career in Aerospace Robotics.

Automated Analysis Identifies Pericyte and Endothelial Cell Loss in Capillaries of Diabetic Mouse Models

Biology Track – Undergraduate Research

11:00-11:20 AM **Room 226 B**

Diabetic retinopathy (DR) is a complication of diabetes that is caused by damage to vessels in the retina and can lead to blindness. In the normal retina, there is tight regulation (1:1) of the two cell types, pericytes and endothelial cells, that make up capillaries. In DR, the ratio shifts (1:4) due to pericyte loss. This ratio is observed by manually counting each cell in the capillaries to help characterize vascular integrity. The need for an automated program became apparent when the manual analysis of microvasculature images became too tedious and required increased reliability. This research is advantageous in studying the correlation of cell loss and vision loss in DR patients. To identify the phenotypes of cells in the capillaries of mice, we used the free image analysis software, CellProfiler. We developed a pipeline that was capable of identifying microvascular cells. Any vessels larger than a capillary do not contain pericytes. Therefore, we developed an algorithm to eliminate cells present in vessels larger than capillaries. Based on criteria from our analysis, we were able to create a threshold to distinguish between pericytes and endothelial cells. Our findings suggest that the automated program we developed can reliably identify and quantify cells.

MADISON WHITEKILLER Northeastern State
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Madison is a 22-year-old student attending Northeastern State University in Oklahoma. She is pursuing a bachelor's degree in Biochemistry and will graduate in December '21. She is a proud Cherokee Nation citizen and has served in a number of leadership position for her tribe, including as the 2017-2018 Miss Cherokee. Once she graduates, Madison plans on attending medical school to pursue a medical career that incorporates translational research. Her main career aspiration is to work in an Indian Health Services hospital or clinic and serve Native American populations.

AP1 Regulates Integrin β3 Induction Sustained by MAPK Pathway Activation

Biological Sciences Track – Undergraduate Research

10:00-10:20 AM **Room 226 B**

Abnormal Mitogen-Activated Protein Kinase (MAPK) signaling leads to increased or uncontrolled cell proliferation and resistance to apoptosis. BRAFV600E is the most common constitutively activating mutation in this pathway, and it is found in about 7% of all human cancers such as Melanoma, Thyroid Cancer, Lung Cancer, and Colorectal Cancer. This mutation increases cell motility using integrins. Integrins are important because they are involved in nearly every step of cancer progression from primary tumor growth to metastasis. For our research, we are examining the regulatory mechanisms of Integrin Beta 3 (ITGβ3) induction by sustained MAPK pathway activation. We are questioning if AP-1, a transcription factor that is targeted by MAPK, is required for expression of ITGβ3. We hypothesize there won't be induction of ITGβ3 after RAF activation when we knock down expression of AP-1 genes. To test our hypothesis, we will be using short hairpin RNA (shRNA) to silence target AP-1 gene expression. We will then insert those shRNAs into E.Coli plasmids. With our modified E.Coli plasmids, we will infect NIH3T3 mouse fibroblasts with the plasmids and examine the infected cells using a microscope and flow cytometry. Understanding this signaling pathway could lead to biomarkers of progression of melanoma and other cancers

KRISTEN WOODY University of New Mexico

Navajo

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Kristen grew up in Northern Arizona on the Navajo Reservation. She earned two bachelor's degrees in Biology and Psychology from the University of New Mexico in 2020 and 2021. Kristen strives to give back to her community by serving as a medical physician. In her free time, she enjoys spending time with family, long-distance running, hiking, and eating tacos.

AISES Graduate Student

Poster Research Presentations

Sponsored by:

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Inferring Axon Diameters in White Matter Tracts Of The Live Mouse Brain

Can axon diameters in white matter be inferred using MRI in a short amount of time?

Tissue microstructure, such as axon diameters, can be inferred from MRI diffusion measurements either through relating models of the geometry of the tissue and MR parameters, or through directly relating MR measurements to tissue parameters. Some have implemented geometric models to infer axon diameters using temporal diffusion spectroscopy. In order to target smaller diameter axons, we have replaced the pulsed gradient spin echo pulse sequence used in most temporal diffusion spectroscopy measurements with oscillating gradient spin echo sequence (OGSE). Here we use OGSE temporal diffusion spectroscopy to infer axon diameters is white matter tracts of the live mouse brain. Axon diameters in the live mouse brain were inferred using oscillating gradient spin echo temporal diffusion spectroscopy. Two sets of five images were collected in less than 11 minutes from which the measurements were made. Diameters ranged from 4 to 12 μm in various white matter regions including the optic tract, corpus callosum, external capsule, dorsal hippocampal commissure, and fasciculus retroflexus. Confirmation of axon diameters using electron microscopy remains to be done. The short imaging time suggests this is the first step toward a feasible imaging method for live animals and eventually for clinical applications.

MELISSA ANDERSON — University of Winnipeg
Fox Lake Cree Nation — *melissa.ndrsn@gmail.com*

Melissa has been a member of AISES since 2019 and assisted with creating a new chapter at the University of Winnipeg. She completed her bachelor's degree in physics in 2020 at the University of Winnipeg. Currently, she is completing her master's degree in Biomedical Engineering at the University of Manitoba. Melissa has first-hand experience performing outreach to younger students in the elementary level to inspire them with science. As well, she has assisted the older levels of high school and undergraduate students with research and academia.

Melanie Martin, Co-Author — University of Winnipeg

Henri Sanness Salmon, Co-Author — University of Winnipeg

Emma Wang, Co-Author — St. John's-Ravenscourt School

Gong Zhang, Co-Author — University of Winnipeg

Grace Zhang, Co-Author — St. John's-Ravenscourt School

Chemical Biology Studies of Malleilactone, a Small-Molecule Virulence Factor Produced by Burkholderia pseudomallei

For the purpose of establishing new therapeutics, my aims are to answer whether malleilactone is a natural substrate of the BpeEF-OprC efflux pump and if this pump is regulated by the same pathways as malleilactone.

Burkholderia pseudomallei is an opportunistic human pathogen that causes the potentially fatal disease melioidosis. B. pseudomallei produces malleilactone, a virulence factor and secondary metabolite, to enhance its survival. Some secondary metabolites are self-toxic. Despite their role in pathogenicity, secondary metabolite biology and the mechanisms used to detoxify them are not fully understood. One such detoxifying mechanism is efflux pumps, which are membrane-localized pumps that remove antibiotics and other toxins from the cell. Thus, for the purpose of establishing new therapeutics, my aims are to answer whether malleilactone is a natural substrate of the BpeEF-OprC efflux pump and if this pump is regulated by the same pathways as malleilactone. Here, we show that in B. pseudomallei, BpeEF-OprC is important for preventing malleilactone self-toxicity and is needed to secrete malleilactone to the extracellular environment. The antibiotic trimethoprim is a known substrate of the BpeEF-OprC pump and was shown to activate malleilactone biosynthesis. We show that other substrates of the BpeEF-OprC pump can activate malleilactone biosynthesis, suggesting the regulation of these two gene clusters might have co-evolved. Our findings suggest that the BpeEF-OprC efflux pump detoxifies malleilactone by exporting it from the cell and that BpeEF-OprC and the malleilactone biosynthesis genes may have co-evolved.

ALICIA BROWN University of Kansas
Navajo *pdm950@yahoo.com*

Alicia S. Brown is a 2021-2025 Self Graduate Fellow pursuing a Ph.D. in Molecular Bioscience. Alicia is studying the chemistry and biology of the bacterial human pathogen Burkholderia pseudomallei to ultimately inform innovative therapies to treat disease. A member of the Navajo Nation and originally from northern Arizona, Alicia attended Haskell Indian Nations University in Lawrence, KS to earn a B.S. in Environmental Science. Alicia is passionate about blending Traditional Ecological Knowledge (TEK), based on tribal teaching of the Navajo Nation, with contemporary technology in pursuit of investigating novel therapies relating to infectious diseases.

Dr. Josephine Chandler, Co-Author University of Kansas

Dr. Jennifer R. Klaus Co-Author University of Kansas

Wyatt Hursh, Co-Author University of Kansas

Regulatory Mechanisms of MAPK Pathway Delayed-Early Gene Targets

How are delayed-early genes regulated in oncogenic activated MAPK pathway cancer cells?

One of the top causes of death of Indigenous Peoples is cancer. Mutations in the Mitogen-Activated Protein Kinase (MAPK) signaling pathway regulate key cancer cell hallmarks, including growth and invasion. How these processes are regulated is essential to understand how cells become pro-tumorigenic. One group of genes not well understood are delayed-early genes (DEG). Using Integrin beta3 (ITGB3) as a model for my experiments, we employ molecular biology techniques to elucidate the regulatory mechanisms from BRAF to ITGB3. We hypothesize that the AP-1 transcription factor complex is essential for the induction of ITGB3 expression and other DEG.

KALI DALE University of Utah
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Born and raised in rural Minnesota, Kali has been a member of AISES since 2010 when she began her undergraduate schooling at the University of Minnesota Morris. Now a graduate student at the University of Utah, she is studying cancer signaling pathways in Dr. McMahon's laboratory in the Huntsman Cancer Institute and will be graduating with her Ph.D. in Oncological Sciences this year. When you can't find Kali in the lab, you will find her enjoying the great outdoors of Utah, hiking or skiing.

Martin McMahon, Co-Author Huntsman Cancer Institute

Investigation of Wind Profile Effects on Loads for Increasing Wind Turbine Rotor Sizes

What are the effects of varying wind profiles above 500m on loads for increasing wind turbine rotor sizes?

The sizes of land-based wind turbines are growing at a rapid pace, allowing access to wind at higher hub heights while reducing the cost of wind energy. To predict turbine loading, accurate wind characteristics are needed. Several wind profiles are used for wind energy applications, the most common being the power law. However, its validity above150 m is questionable. This work investigated the differences between wind profiles up to 500 m and quantifies effects on loads for increasing turbine rotor sizes. This was accomplished by running OpenFAST aeroelastic simulations at a range of wind speeds using the power law, logarithmic profile, a low-level jet profile, and two profiles based on actual Lidar measurements. Two turbine blade lengths were investigated (120.97 m and 204.75 m) and loads on the blades and tower were compared. It was found that the power law profile overpredicts loads for larger blades as compared to the Lidar based wind profiles. This variation in loads indicates that the use of the power law is not sufficient when developing wind turbines reaching higher elevations.

SARAH LAVALLIE University of Minnesota Twin Cities
Turtle Mountain Band of Chippewa *slavallie97@gmail.com*

I have been a student member of AISES since 2016. During my undergraduate years, I served as vice president and president of the North Dakota State University chapter. I graduated from NDSU in Spring 2021 with a BS in Mechanical Engineering, and in Fall 2021 will be starting a MS in Science, Technology and Environmental Policy at the University of Minnesota.

Martin McMahon, Co-Author Huntsman Cancer Institute

Risk Factors Associated with Cervical Cancer Screening Among American Indian/Alaska Native Women

How are delayed-early genes regulated in oncogenic activated MAPK pathway cancer cells?

The purpose of this study was to determine the risk factors associated with cervical cancer screening among American Indian/Alaska Native women in the U.S. Retrospective analysis of AI/AN women utilizing the 2018 BRFSS dataset was conducted examining associations between sociodemographic and health behaviors and PAP smear and HPV testing in AIs/ANs women respondents aged 18-64. Exploratory data analysis was performed using bivariate analysis. SAS v.9.4 was used to analyze the data. Of the 2.265 female respondents, 84% reported PAP smear use. Older women, college graduates, higher income level, having health insurance ($p < .0146$), being married, having at least one personal health care provider, and undergoing HIV testing were significantly more likely to report PAP smear use than other women ($p < .0001$). Of the 1,875 AIs/ANs female respondents, 56% reported having an HPV test. Younger women ($p <.0012$), college graduates ($p < .0001$), having health insurance ($p < .0412$), undergoing HIV testing ($p < .0001$), and having at least one personal health care provider ($p < .0001$) were significantly more likely to report HPV testing than other women. Overall, public health campaigns and policies can be designed to reduce morbidity and mortality from preventable cervical cancer using these results.

ERIC LEVEILLE
University of North Dakota School of Medicine and Health Sciences
Sault Ste Marie Tribe of Chippewa Indians
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Eric Leveille is a current fourth-year medical student at the University of North Dakota School of Medicine and Health Science. He is an enrolled member of the Sault Ste Marie Tribe of Chippewa Indians who grew up in Marlette, MI. He attended Alma College for where he obtained a Bachelor of Science. Afterward, he attended Central Michigan University where he obtained his MPH. These steps led him to attend medical school at the UND as part of the Indians into Medicine program with the goal to practice primary care focusing on indigenous populations and/or in a rural underserved area.

James R. Beal, Co-Author — University of North Dakota

Celeste Colegrove, Co-Author — University of North Dakota

Abe E. Sahmoun, Co-Author — University of North Dakota

Searching for RR Lyrae variables in the Second Data Release of the NOAO Source Catalog

How to categorize the many variable stars to help identify new ones and refine measurements of old ones.

RR Lyrae are periodic variable stars with periods of less than one day. They can be used as standard candles for accurate distance measurements and thus are useful for studying the structure of the Milky Way and stellar clusters. The second data release of the NOAO Source Catalog (NSC DR2) is a large collection of 68 billion time-series measurements of 3.9 billion objects. To process such large amounts of data, we are designing a pipeline to automatically detect variable stars in the catalog and measure their properties including period, magnitude, and amplitude of their pulsations by fitting their light curves to templates. In addition to identifying RR Lyrae, we also explore how to identify similar variable stars such as Cepheids and Delta Scutti. With our final catalog of bona fide RR Lyrae, we can map the stellar structure in the outer Milky Way, especially in the southern hemisphere, which has not yet been well explored.

KYLE MATT Montana State University
Blackfeet *kylelmatt@gmail.com*

Kyle is a descendant of the Blackfeet tribe. He grew up in Utah, where he attended college to get a bachelor's degree in Physics-Astronomy. He moved to Montana for graduate school and is currently studying to get a Master's degree in Physics. His research is studying pulsating variable stars, especially RR Lyra variables, and trying to identify and classify new ones.

David Nidever Co-author Montana State University

Antibiotic Glasses for Use in Drug Delivery

The overall purpose of this study is to discover and characterize novel antibiotic glasses.

Active Pharmaceutical Ingredients (APIs) are an essential pillar for medical situations. We investigated putting these APIs in glass form for drug delivery purposes in order to not only discover but characterize them. We performed various techniques for characterization ranging from DSC (Differential Scanning Calorimetry), TGA (Thermogravimetric Analysis), IR (Infrared), to PXRD (Powder X-Ray Diffraction) and more, which provided evidence for the formation of glass and the invariance of the drug itself once it is placed in these glasses. Solubility was also determined for these glasses to understand the drug delivery possibilities in a more comprehensive way. These findings suggest that placing drugs within the glasses themselves alters the way they can be delivered and gives medical professionals another outlet for working with APIs that would otherwise be tricky to deliver to the patient.

CLAIRE MCGUIRE Southern Methodist University
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Claire has been a member of AISES since 2020. She is a student at Southern Methodist University, in Dr. Tomče Runčevski's group, pursuing her doctoral degree in Physical Chemistry working in polymorphs and applied instrument applications including powder X-ray diffraction. She is currently working on organic glasses and their applications and is an NSF GRFP recipient. Claire also brings her experience in Chemistry and Physics to young women in STEM by tutoring them when she gets a chance.

Dr. Tomče Runčevski, Co-author Southern Methodist University

The Association of Telomere Length and Neurodevelopment Performance in Surinamese Infants

The aim of this study was to examine how infant telomere length obtained from buccal swab DNA associated with neurodevelopmental outcomes obtained from BSID-III-NL administration.

The Bayley Scales of Infant and Toddler Development, 3rd edition in Dutch (BSID-III-NL), has been validated for use in Surinamese infants. The BSID-III-NL provides global performance information in cognitive, language, motor, and socioemotional domains, and similar neurodevelopmental assessments have been associated with telomere length, a marker of biological aging. The aim of this study was to examine how infant telomere length (TL) obtained from buccal swab DNA associated with neurodevelopmental outcomes obtained from BSID-III-NL administration. The Caribbean Consortium for Research in Environmental and Occupational Health cohort study collected buccal swabs following BSID-III-NL in approximately 12-month-old infants across Suriname, South America. Scaled scores for the cognitive, receptive communication, expressive communication, fine motor, gross motor, and socioemotional subscales were calculated following the BSID-III-NL manual for 786 infants. DNA was extracted from buccal swabs for measurement of telomere length via monochrome multiplex quantitative polymerase chain reaction. The distributions of BSID-III-NL scores and TLs will be presented, and linear regression will be utilized to assess the relation between BSID-III-NL subscale scaled scores and TL in 786 infants. The present study will build on the existing literature of the associations of biological aging and neurodevelopmental performance in one of the largest infant cohorts to date.

LAUREN MCLESTER-DAVIS Tulane University
Oneida Tribe of Indians of Wisconsin *lmclesterdavis@tulane.edu*

Lauren W. Yowelunh McLester-Davis is a fourth-year doctoral student in the Neuroscience Program at the Tulane Brain Institute in New Orleans, LA. Yowelunh was raised on the Oneida Tribe of Indians of Wisconsin reservation and completed her B.A. in Neuroscience and Biochemistry at Lawrence University in 2018. Her current research focuses on neurodevelopment, neurocognitive decline, and biomarkers in minority populations, and she has had the pleasure to collaborate with indigenous groups in Suriname, South America, and American Indians enrolled in the Wisconsin Alzheimer's Disease Research Center.

Stacy S. Drury, M.D. Ph.D., Co-author Tulane University

Influence of Maternal Dietary Protein on Maternal and Pup Gut Microbiotas and Pup Growth

We investigated the effect of dietary protein on gut and milk microbiotas of pregnant and lactating arctic ground squirrels, and the influence of maternal microbiotas on the gut microbiota and development of pups.

We investigated the effect of dietary protein on gut and milk microbiotas of pregnant and lactating arctic ground squirrels, and the influence of maternal microbiotas on the gut microbiota and development of pups. Pregnant squirrels were trapped in northern Alaska and fed either 9% or 18% dietary protein. In late gestation, we collected gut and fecal samples from a subset of squirrels. We collected milk and fecal samples from the remaining squirrels through lactation, and at weaning collected maternal and pup gut samples. Microbial DNA was extracted from all samples and the 16S rRNA gene sequenced. Milk was also analyzed for nitrogen, fat, and lactose content. Growth of pups was assessed weekly. Alpha diversity of maternal microbiotas was not influenced by diet but was different among sample types. Diet accounted for no more than 6% of the variation in beta-diversity of maternal microbiotas, and pup microbiotas were not impacted by maternal diet. The milk microbiota was more like the maternal skin microbiota than the fecal microbiota. Growth was significantly inhibited in pups from low protein mothers. Dietary protein did not contribute significantly to gut microbiota diversity and composition in pregnant and lactating arctic ground squirrels but did influence offspring growth.

SHANNON MEDLOCK University of Alaska Anchorage
Cherokee Nation *smedloc2@alaska.edu*

Shannon is a non-traditional student seeking a master's degree at the University of Alaska Anchorage. Her research focuses on gut microbial communities arctic ground squirrels. She will be completing her master's degree in the spring of 2022.

Khrys Duddleston, Co-author University of Alaska Anchorage

Premature Apoptosis

When is follicle loss beginning in individuals with POI? Is the follicle loss due to premature apoptosis?

Whole exome sequencing of a large family with a history of primary ovarian insufficiency [characterized by early follicle depletion] demonstrated a heterozygous nonsense mutation in the gene eIF4ENIF1. We hypothesized that like the human, a heterozygous mouse model will have POI, the mechanism for POI will be follicle loss that can be detected at the point where oocyte growth begins, and that follicle loss is occurring via apoptosis. We made a Eif4enif1C57/Bl6 transgenic mouse model containing a floxed exon 10-19 cassette and a conditional knock-in cassette containing exon 10 with the stop-gain mutation causing familial POI and WT exons 11-19. Genotype analyses of DNA extracted from ear or tail biopsies were performed by PCR and Sanger sequencing. Ovaries were collected from mice age days 5-10. Primary and preantral follicles were counted in the fixed and mounted ovaries. Data were analyzed using two-way analysis of variance (ANOVA) with post hoc testing. A TUNEL assay was performed to qualitatively account for apoptosis. We found no significant difference in follicle count until day 7, where the heterozygous ovaries demonstrated more cells undergoing apoptosis. Follicle death begins between days 5 and 7. Polysome profiling will be used to understand the mechanism initiating premature apoptosis.

REHAM PERRY New York University
Ramapough Lenape *rp3017@nyu.edu*

Reham is a first-generation student currently a rising senior at New York University. Her current research interests are in the genetics behind female reproductive disorders and public health interventions.

From Trash to Treasure: Inexpensive Aquatic Invertebrate Sampling Devices Upcycled from Plastic Soda Bottles

Are homemade soda bottle samplers as effective as commercially made Hester-Dendy sampling devices?

Collecting aquatic invertebrates is an important part of monitoring ecosystem health in aquatic habitats. Artificial substrate sampling devices are constructed to attract aquatic organisms that attach to hard surfaces to hide from predators and are an established sampling method for aquatic invertebrates. Hester-Dendy devices are widely used in standard water quality monitoring programs and research; however, the devices are expensive ($22-38 each). We tested homemade artificial substrate sampling devices created from empty 500-milliliter plastic soda bottles to determine if they are as effective as commercially made Hester-Dendy samplers. We placed our homemade samplers alongside Hester-Dendy samplers at eleven stream sites and three lake sites in Oklahoma. We collected samplers after one month, counted, and compared aquatic invertebrates between the sampler types. We found the plastic soda bottle samplers caught the same number of organisms and represented the same diversity as Hester-Dendy devices. This study confirms that plastic soda bottle sampling devices are a suitable substitute for Hester-Dendy samplers, especially in studies where funds are limited

MELISSA REED Oklahoma State University
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Melissa is a PhD student in the department of Entomology and Plant Pathology at Oklahoma State University. She holds a master's degree in Environmental Science (emphasis – Water and watershed management), a graduate grassland management certificate, and a GIS certificate from Oklahoma State University. Additionally, she holds a Bachelor of Science in Biology (emphasis – Environmental conservation). Her area of interest is Aquatic insect ecology.

Gabrielle Jones, Co-Author Oklahoma State University

W. Wyatt Hoback, Co-Author Oklahoma State University

Sustainability Indicators for Selected Greenhouse Production Facilities in North America

The overall purpose was to assess greenhouse facilities for sustainable operations based on numerical sustainability scores or "S-scores".

Greenhouse crop production is increasing as consumer demand increases, specifically in areas where the climate is more hostile to the desired production. However, no assessment of the safety of existing facilities currently exists, and there is sufficient consumer demand for assessing this from seed to shelf. The purpose of this study was to assess the safety of current systems in North America. This was accomplished through the development of various safety or S-score equations. This report focused on greenhouse safety practices at twenty-three observed facilities and specific factors affecting the subsequent S-scores. Each facility was assigned a region: Deep South, Florida, Northeast, Midwest, Northwest, and Southwest. Key parameters were organized according to six general categories based on economic, energy, environmental, social, and safety aspects as well as applied techniques. The final value was an “S-score” for each facility. Descriptive statistics were analyzed to determine parameter dominance and statistical significance. Additionally, a factor analysis will determine which factors are the most relevant. The facilities ranged in size from a small, seasonal greenhouse to large facilities. Furthermore, facilities with either or both vegetable and ornamental production participated in this study. Overall, scores ranged from 4 – 8.5; liability was the primary concern.

JAMIE THISSEN Bemidji State University
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Jaime Thissen is originally from the Lake Traverse region of Western Minnesota, where he developed a passion for environmental and agricultural sustainability. He has previously worked for the USDA, UNEP, the Buccleuch Rangers in Scotland. Jaime was also a McNair Scholar, Nurse Scholar. Fellow at the Institute of Coaching at McLean Hospital-Affiliate of Harvard Medical School. Jaime's research interests include environmental sustainability, including integrated occupational health and safety and project management. Jaime has developed identified and developed safety protocols for grain handling facilities, wineries, breweries, and greenhouses. He has also taught environmental, agricultural and project management courses for eight years.

Dr. Paul Davidson, Co-Author University of Illinois Urbana-Champagne

AISES Graduate Student

Oral Research Presentations

Sponsored by:

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Morphological Phenotype Predicts Tau Aggregate Seeding Activity in Genetically Diverse Drosophila

Biological Sciences Track – Graduate Research

3:00 – 3:20 PM **Room 226B**

Dementia has emerged as one of the most demanding age-related diseases in the United States. A main driver of dementia phenotypes is misfolded tau protein aggregates. Animal models of tau-driven degenerative diseases, such as Frontotemporal Dementia (FTD), often focus on the effect of specific mutations but do not fully recapitulate tau aggregation seen in humans. A possible reason for this is that animal models are homogeneous and do not reflect the genetic diversity of the human population. The aim of this study is to determine the effect of tau aggregates in a panel of genetically diverse flies. To test our central hypothesis, we induce tau aggregate-driven degeneration by expressing mutant human tau protein (hTauP301L) in a panel of Drosophila melanogaster that contains several hundred thousand natural genetic variants. Mutant tau protein is expressed under the Glass Multiple Reporter (GMR) promoter leading to tau aggregates and degeneration of the fly eye. We report significant differences in ommatidial phenotypes, area and diameter of eye, tau expression, and aggregate-seeding activity. Furthermore, we show that this morphological phenotype predicts the formation of seed-competent aggregates. In the future, we will use this model to perform genome-wide association studies to discover novel variants that modify tauopathies.

DOMINIC ACRI Indiana University School of Medicine
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Dominic has been a student member of AISES since 2019 and is an active member of both AISES and SACNAS groups at Indiana University. He is currently pursuing a Ph.D. in Medical Neuroscience at IU's School of Medicine in Indianapolis. Dominic aspires to continue in academia and will begin applying for post-doctoral fellowship opportunities in mid-to-late 2022.

The Impacts of COVID-19 on Water and Wastewater Operations in Indigenous Communities

Engineering Track – Graduate Research

10:00-10:20 AM **Room 225 B**

The emergence of the COVID-19 pandemic highlighted the significant role of water and sanitation utilities in safeguarding public health during an emergency. Given the pre-existing inequalities (such as limited resources and manpower) and the additional impacts of the pandemic, many remote utilities in Canada's Indigenous Communities, especially the First Nations were not adequately equipped for the pandemic. This research study investigates the impacts of the COVID-19 pandemic on the abilities of water and/or wastewater operators to provide safe drinking water and efficient wastewater services during the COVID-19 pandemic and subsequent emergencies. The financial, material, and human capacities of water and wastewater utilities to maintain operations and safeguard public health during a public health emergency were investigated through structured survey questions and semi-structured zoom/phone interviews. Operators, managers and other professionals of water and wastewater systems and utilities in First Nations communities reported increased work responsibilities due to the pandemic and also recorded impacts on operations, communications, costs and other areas. Overall, the impacts of the pandemic are disproportionately higher in Indigenous communities. To minimize these impacts in the future, the appropriate vulnerability assessment tools and emergency toolkits would help facilities transition and minimize the impacts of subsequent emergencies.

FEYISETAN ADEBAYO **FEYISETAN ADEBAYO**
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Feyisetan is a graduate researcher at the University of Calgary with specific interests in sustainable water and wastewater infrastructures in Indigenous communities. Over the past 16 months, she has been exploring the impacts of the pandemic on water and wastewater operations in First Nations communities to develop an appropriate emergency toolkit for small water and wastewater systems. She received a Bachelor of Technology in Civil Engineering from the Ladoke Akintola University of Technology in 2015. Feyisetan is passionate about sustainability and diversity in STEM. Thus, in her free time, she volunteers in STEM outreaches for kids in underrepresented communities.

Racism and Discrimination broadening Ethical conflicts for American Indian/Alaska Native professionals and students STEM.

Social Science Track – Graduate Research

10:00-10:20 **Room 227 C**

The overall consensus of what constitutes ethical science, technology, and engineering (STEM) continue to grow, but we know little about how STEM ethics intersect with Indigenous people's experiences with Racism and Discrimination and how they navigate these obstacles. Thus, we aimed to answer the following questions: (1) How do Indigenous students and professionals in STEM guide the ethical conflicts they experience? And (2) To what extent is the prevalence of these conflicts influenced by racism and discrimination?

DAVONA BLACKHORSE Northern Arizona University
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Davona has been a student member of AISES since 2019. She is pursuing her Doctoral degree in Interdisciplinary Health at Northern Arizona University. Davona brings her Navajo cultural experiences into her role as a Ph.D. Research Student assisting the generation of relevant cultural questions for STEM students and professionals.

Sustained signaling through the high-affinity Interleukin-2 receptor drives the development of terminally differentiated effector T cells

Biology Track – Graduate Research

1:00 – 1:20 PM **Room 226 B**

During acute viral infection, activated CD4 T cells differentiate and expand to generate effector cells that help eliminate the pathogen. Upon resolution of infection, a small proportion survive and form long-lived memory T cells. Exposure of activated T cells to Interleukin-2 (IL-2) drives T cell expansion by signaling through its receptor. T cells with high expression of the high affinity IL-2 receptor (IL-2Ra) are biased towards terminal differentiation and die after pathogen clearance, whereas T cells with low expression give rise to most memory T cells. We found that disruption of IL-2 signals to effector T cells prevented their terminal differentiation and promoted the formation of memory T cells, suggesting that IL-2 is a critical signal for T cell differentiation when T cells vary in their expression of IL-2Ra. Furthermore, sustained IL-2 signaling was required for the emergence of effector cells that have lowered expression of TCF-1, a key transcription factor implicated in the differentiation of memory T cells. Disruption of IL-2 signaling resulted in enhanced formation of long-lived (central) memory T cells, highlighting a potential role for IL-2-dependent modulation of TCF-1. Overall, our results uncover a critical role for IL-2 in regulating effector and memory CD4 T cell differentiation.

KRYSTAL CHARLEY

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Navajo

Krystal has been an AISES student member since 2012 and has experience in leadership due to serving as president of AISES for a semester. She graduated from the University of New Mexico with a B.S. in Biology. She is currently a third-year graduate student in the Matthew Williams laboratory at the University of Utah. She is investigating the role of the growth factor cytokine Interleukin-2 and the transcription factor TCF-1 in the formation of memory CD4+ T cells.

Using Virtual Reality to Bridge the Gap Between Culture and STEM: Results from an Intertribal Teacher Education Workshop

STEM Education – Graduate Research

1:30 – 1:50 PM **Room 227C**

Our project aims to develop a model for culturally responsive computing in afterschool programs. This research examines an intertribal educator workshop utilizing the Spiro Mounds as a contextual background for implementing virtual reality (VR) design challenges with middle school students. The educators learned the history behind the Mounds and rendered a replica of the 'Hollow Mound' in Sketchpad where scanned artifacts can be placed in this virtual space. This workshop introduced seven focused modules and then participants brainstormed culturally relevant design challenges. Our research asked, "In what ways can blended cultural learning and technology-rich immersive professional development support afterschool educator's abilities to translate Indigenous concepts into creative design experiences?" We report preliminary findings from surveys, participant observation, exit tickets, and co-design discussions. This professional development will be ongoing as the educators will eventually be implementing the modules in their respective programs.

NICOLE COLSTON, Ph.D. Oklahoma State University
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Nicole Colston, Ph.D., is an assistant research professor at Oklahoma State University. As an interdisciplinary network scholar, her education research related to Native American participation in STEM focuses on early-age career awareness, identity development, and the institutional contexts for diversity in higher education.

Investigating The Gut Microbiome-Brain-Metabolism Axis In Familial Dysautonomia; Examining The Implication Of Choline Metabolism In Disease Phenotype And Progression.

Biological Sciences Track – Graduate Research

10:30-10:50 AM **Room 226 A**

The associated impacts of climate change on the natural environment is one of the key threats to Indigenous people, negatively affecting the lands, waters, and more than human relatives that Indigenous people have maintained relationships with for millennia, despite the brutality of colonization and ongoing environmental injustice. For the Potawatomi, made up of 11 Nations, traditionally from the lower Lake Michigan region and now spread from Oklahoma to Ontario, climate change is slated to restrict access to healthy, high-quality cultural plants to learn from, harvest, and be nourished by. This study compiles Potawatomi climate change vulnerability assessments and adaptation plans to develop a growing database of cultural plants, identifying the most culturally significant plants to map the historical, contemporary, and potential future distributions in the traditional and modern homelands of all 11 Nations. Interviews with tribal members and literature reviews of Potawatomi-related media are woven in to document changes in our local environments and cultural plants. With this preliminary cross discipline and multi-National study on Potawatomi plants, making plans for the future of our plant knowledge and land stewardship will be bolstered, research gaps will be identified, and the next steps can be taken.

STEPHANANN COSTELLO Montana State University
stephanann.costello@student.montana.edu

Stephanann is a rising 4th year Biochemistry PhD candidate at Montana State University studying the gut microbiome-brain-metabolism axis of the rare neurodevelopmental and neurodegenerative disease Familial Dysautonomia. She is advised by Dr. Valerie Copie (biochemist), Dr. Frances Lefcort (neuroscientist) and Dr. Seth Walk (microbiologist).

Selecting Microbial Communities for Disease Suppression in Tomato

Physical Science Track – Graduate Research

9:30 – 9:50 AM **Room 226A**

Suppressive soils harbor microbial communities that suppress soilborne plant pathogens after severe outbreaks. However, there are no described cases of foliar disease managed by a suppressive phyllosphere community as many live for a short time or are not transferred between harvests. We investigated how the development of a foliar microbial community through artificial passaging can suppress disease using a model system of Pseudomonas syringae pv. tomato (Pto) and tomato. Tomato seedlings were inoculated with a phyllosphere community, then challenged with Pto or buffer, and disease progression was assessed. Microbial material collected from plants showing the least amount of disease or at random was used for new passaging plant inoculations and sequencing. Overall, disease severity increased to a peak at passage 5 followed by a sharp decline, reaching low severity by passage 9. Amplicon sequencing also revealed a treatment effect within the bacterial communities based on whether Pto was introduced or not across all passages. Fungal communities showed no sample clustering, and the relative abundances of taxa were different across all treatments. Hence, the repeated passaging resulted in the selection of communities suppressive towards Pto. Further studies will be required to investigate potential taxa contributing to disease suppression.

HANAREIA EHAU-TAUMAUNU Pennsylvania State University

Hanareia Ehau-Taumaunu is a Māori scientist in her 4th year of a Ph.D. in Plant Pathology at Pennsylvania State University. Passionate about preserving te taiao (environment) and plant microbial interactions, she is currently investigating the ecology of bacteriocin production in plants and developing a method to select for plant disease suppressive microbiomes. Hanareia aims to return to Aotearoa to conduct research for Māori with Māori around environmental biosecurity and protecting plants/forests, and also add to the future lineages of Māori scientists through mentorship.

Biocultural Restoration of Fellows Falls: A Historical Ecology Approach

Biological Sciences Track – Graduate Research

3:00 – 3:20 PM **Room 226 A**

This project, which builds upon earlier work by Mitchell (2004) explores the unique cultural geology and geomorphology along the various trails used by the explorers on their journey. Several of the trails followed by the explorers were used by indigenous populations for centuries prior. Today, many of the geological features noted in the journals written by the explorers exist today as observed then whereas others have been changed. These changes are both natural and anthropological in scope. Some changes have only been cosmetic, such as graffiti or ashfalls, whereas other changes have left geological features reduced to remnants. Changes have taken place along the entire length of the trail. Specifically, this project identifies at least one geological feature that has changed in each of the 16 states along the 4,900 miles of trails walked, paddled, floated, or rode upon by the explorers.

NOAH GUNTER Elizabeth City State University
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I am a recent graduate of Elizabeth City State University and plan to attend the University of North Dakota in the Fall for a Master of Science in Aviation. I have always had a passion in many things, but my main passions are Science and History. With my interests I hope to have a successful career in the Aviation Industry and continue to teach students and my fellow peers.

Looking for a Future: Weaving Together Potawatomi Plant Knowledge, Culturally Informed Mapping & Climate Change

Environmental Science Track – Graduate Research

10:00-10:20 AM **Room 226 A**

The associated impacts of climate change on the natural environment are one of the key threats to Indigenous people, negatively affecting the lands, waters, and more than human relatives that Indigenous people have maintained relationships with for millennia, despite the brutality of colonization and ongoing environmental injustice. For the Potawatomi, made up of 11 Nations, traditionally from the lower Lake Michigan region and now spread from Oklahoma to Ontario, climate change is slated to restrict access to healthy, high-quality cultural plants to learn from, harvest, and be nourished by. This study compiles Potawatomi climate change vulnerability assessments and adaptation plans to develop a growing database of cultural plants, identifying the most culturally significant plants to map the historical, contemporary, and potential future distributions in the traditional and modern homelands of all 11 Nations. Interviews with tribal members and literature reviews of Potawatomi-related media are woven in to document changes in our local environments and cultural plants. With this preliminary cross discipline and multi-National study on Potawatomi plants, making plans for the future of our plant knowledge and land stewardship will be bolstered, research gaps will be identified, and the next steps can be taken.

SUSANAH HOWARD SUNY College of Environmental Science and Forestry

Citizen Potawatomi Nation

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Susannah Howard (Citizen Potawatomi Nation) graduated with BA in Geosciences and a Certificate of Native American & Indigenous Studies from Smith College in 2019. She is now a Sloan Indigenous Graduate Partnership Fellow at SUNY ESF where she works with fellow Potawatomi scientist, Dr. Robin Wall Kimmerer to develop strategies for protecting Potawatomi cultural plants and associated knowledge in the wake of climate change. Susannah lives in Vermont, serving as a board member for the Thetford Historical Society and The Kwek Society (a Native-led nonprofit aimed at ending period poverty in Indian Country), and grows her own food.

Numerical Modeling of Agricultural Managed Aquifer Recharge: Application of Concepts using the Integrated Water Flow Model on the Toppenish Fan Shallow Aquifer Recharge Project, Yakama Nation, WA

Engineering Track – Graduate Student Research

3:00 – 3:20 PM **Room 226A**

The Confederated Tribes and Bands of the Yakama Nation (YN) is a federally recognized tribe established by the Treaty of 1855. The Yakama Reservation is in south- central Washington State. Large-scale irrigation combined with creek channelization has changed the hydrology, impacted wetlands, and decreased flows to springs and creeks. In the upland areas, groundwater extraction from the basalt aquifers has resulted in a water-level decline greater than 35 meters in some areas since the 1950s. In 2015, the YN initiated the Toppenish Fan Shallow Aquifer Recharge Project (TFSARP) to address decreasing groundwater elevation, loss of domestic water supply, degraded habitat, and reduced streamflow. The YN diverts water at the time of excess flow from Toppenish Creek (TC) and delivered the water to the Toppenish alluvial fan. The process mimics natural processes and requires no additional reservoir construction while protecting existing farming and built infrastructure. On the Yakama Reservation, groundwater flow direction in the TC watershed was constructed using groundwater elevation data from a transducer monitoring network set in place by the YN and well construction logs from the State of Washington Department of Ecology.

JORDAN JIMMIE
Navajo

Oregon State University

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Jordan is a proud member of the Navajo Nation. He is a hydrologist, by training, with budding expertise in hydrologic modeling, hydrogeology and Tribal water law and policy. He is a PhD student in Water Resources Engineering at Oregon State University. He is from Flagstaff, AZ, loves to lift, run, eat, read, and be outside. He aspires to bring his talents back to the reservation to build up a hydrology program at a Tribal College or University and serve as a hydrologist for a Tribal Nation.

Lakota Math Connections – Applying Indigenous Research Methodologies with Undergraduate Math Education

STEM Education Track – Graduate Research

11:00-11:20 AM **Room 227 C**

Indigenous Research Methodologies has yet to be applied within Research in Undergraduate Math Education (RUME). RUME is a special interest group of the Mathematical Association of America. This investigation sought to answer the question 'In what ways can Indigenous Research Methodologies lead an individual researcher towards more ethical and impactful (beneficial and actionable) RUME at TCUs?' Through an experiential approach to knowledge found within Indigenous Research Methodologies, a specific methodology/theoretical framework was followed. It became coined as 'Circulating Conversations Methodology.' The Circulating Conversations Methodology led to the co-developed research questions and a professional development course for both math instructors at TCUs and Lakota language instructors collectively. The course/workshop was titled "Lakota Math Connections." Developed through Circulating Conversations Methodology, the main idea for the course was that TCU math instructors can develop culturally sustaining pedagogy in their classrooms through relationship and connection with language learners/instructors and fluent Elders. Preliminary results show that the approach of bringing math instructors, language learners/instructors, and fluent Elders together to discuss higher-order math concepts was beneficial and actionable for both math instructors at TCUs as well as for Lakota language instructors.

DANNY LUECKE North Dakota State University

Choctaw Nation of Oklahoma

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Danny is a graduate student at NDSU in math education. He is enrolled in Choctaw Nation of Oklahoma but has grown up and currently lives on the land of the Oceti Sakowin in what is currently known as Fargo, North Dakota. He is learning to honor all his ancestors from multiple European ethnicities as well as his Choctaw heritage. Danny is a proud husband, father, and follower of Jesus. His current work is with math instructors at TCUs in North Dakota and specifically with the Lakota Language Immersion Nest at Sitting Bull College.

Reaction Condition Optimization of Sorbitol Hydrodeoxygenation over a ReOx-Pd/CeO2 Catalyst via Design of Experiments

Engineering Track – Graduate Research

10:30-10:50 AM **Room 225 B**

In this study, we elucidate the temperature, pressure, and Re catalyst loading effects on the simultaneous hydrodeoxygenation of sorbitol to hexanediols using design of experiments. An L9 Taguchi design and a Box-Behnken design of experiments were utilized to model the design space and predict optimal conditions for the sorbitol simultaneous hydrodeoxygenation reaction. The designs varied temperature from 150-170 °C, pressure from 5-10 bar H2, and Reloading from 2-4 wt%. The more simplistic Taguchi design was comparable to the more complex Box-Behnken design and predicted an optimal reaction condition of 170 °C, 10 bar H2, and a 4 wt% Re catalyst.

BLAKE MACQUEEN

Blake is a student member of AISES and is a member of the Cherokee Nation. He is a PhD candidate at the University of South Carolina in chemical engineering and plans to defend in November of 2021. Blake's research focuses on upgrading biomass and biomass derived sugars to fuels and platform chemicals.

Self-Assembling Peptides (Q11 and KFE8) as a Platform to Create New HPV Vaccines Candidates

Biological Science – Graduate Research

1:30 – 1:50 PM **Room 226B**

Self-assembling proteins have been shown to have potential as a vaccine platform with displayed peptide antigens. Amphipathic peptides can self-assemble into a beta-sheet bilayer fibrils with properties that allow for inventive biomaterial applications. Current HPV vaccines comprise virus-like particles (VLPs) but are limited due to limited thermostability. The current HPV vaccines also do not protect against all types of cancer-causing HPV. Therefore, the goal of this project is to develop highly stable vaccine candidates that elicit cross protective antibodies. To accomplish this, we utilized standard Fmoc solid phase peptide synthesis (SPPS) to synthesize two self-assembling fibril platforms, Ac-QQFQFQFEQQ-NH2 (Q11) and Ac-FKFEFKFE-NH2 (KFE8). The fibrils also displayed an HPV consensus epitope along its backbone. Results include peptide synthesis and characterization via HPLC, MALDI-TOF, circular dichroism (CD), and TEM imaging. Ongoing studies include murine immunizations to assess the immunogenicity of the vaccine candidates. Sera will be tested for reactivity using standard ELISA assays. Future studies will assess protection from a genital infection using an HPV pseudovirus (PsV) genital challenge animal model. In conclusion, self-assembling peptides with multivalent display of antigens could be an efficient way to make next generation HPV vaccines with potential for developing vaccines for other diseases as well.

CRYSTAL MORALES Northern Arizona University
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From Phoenix, Arizona. Graduated with a bachelor's degree in Biomedical Science from Northern Arizona University and continued her education there in a biology Master's program funded through RISE - an NIH program to promote higher education with historically excluded students.

Model Predictive Control Study for an Electrified Turbofan Engine

Engineering Track – Graduate Research

1:00 – 1:20 PM **Room 225 B**

A control sensitivity study is conducted for electrified aircraft propulsion concepts using a publicly available turbofan engine simulation. A Proportional-Integral (PI) controller serves as a baseline for comparison against an advanced Model Predictive Control (MPC) approach. MPC is used in the control scheme to allow for subsystem coordination of engine and electric power loads. The electrified turbofan engine includes electric machines to augment the amount of torque being applied to the spools of the engine during transient phases of operation. Power augmentation allows for energy to be stored or exhausted in a manner that increases the fuel efficiency of the engine, reducing aircraft emissions and noise. The study compares the fan speed, high pressure compressor stall margin, and low-pressure compressor stall margin against the baseline PI control system, an MPC system without electric machines, and an MPC system with electric machines. The MPC system with electric machines is optimized using the sample time, control horizon and prediction horizon. The MPC design provided a stable damped response as desired and allowed operability margins to be maintained.

BRITTANY NEZ
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University of Colorado Boulder

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Brittany Nez is pursuing a Master of Science degree at the University of Colorado Boulder focused on atmospheric and oceanic fluid dynamics. She interned with Dr. Joseph Connolly at NASA Glenn Research Center to develop a model predictive control approach for an electrified aircraft propulsion concept that will be used to increase fuel efficiency of commercial aircraft.

A Chemical Approach to Solar Solutions

Energy Track – Graduate Research

11:00 – 11:20 AM **Room 226 A**

The development of next generation artificial photosynthetic devices, including organic photovoltaics (OPVs) and Dye-Sensitized Solar Cells (DSSCs) is essential to combat climate change. We take inspiration from photosynthesis, a process in which photons are captured and converted to chemical energy through a series of pigment-protein complexes known as light harvesting arrays (LHAs). These LHA act as antennas to absorb light with chlorophyll-like pigments (chromophores) which shuttles energy from one chromophore to another chromophore via a migration of excited states (excitons) to the reaction center for later processes. We are interested in not only artificially reproducing this exciton pathway by building an artificial LHA, but also the fundamental study of specific chromophores for specific chemical application within the LHA. Perylene diimide (PDI) is an ideal chromophore to be used in a LHA because the photophysical properties of the PDI can be chemically "tuned" through substitution to the PDI core. We will study if PDIs can be further "tuned" by studying the photophysical properties of three different regiosiomers of a thio-substituted PDI (1,6-, 1,7-, and 1,6,7-Thio-PDI). These studies can be liberally applied to the design of LHAs and subsequently OPVs and DSSCs as carbon-neutral energy sources to combat climate change.

ADRIAN RIIVES
Pic River Ojibwe
Rensselaer Polytechnic Institute (RPI)
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Adrian Riives is a fifth-year doctoral candidate in Chemistry working in the group of Peter Dinolfo at Rensselaer Polytechnic Institute (RPI). Originally from Edmonton Alberta, Canada, Adrian has relocated to upstate New York to focus on her research which applies fundamental chemistry to the development of new renewable and exciting technologies. In her spare time, Adrian beads, oil paints, bikes, travels, and weight lifts. She also loves animals, feminism, equal rights and her three tiny gerbils.

Contactless, Reversible Droplet Wetting State Modulation by Dielectric Charge Injection

Engineering Track – Graduate Research

1:30 – 1:50 PM **Room 225B**

Electrowetting (EW) and electrowetting-on-dielectric (EWOD) are traditional methods for droplet wetting state modulation. However, both require direct droplet contact with an electrode, which may be challenging and undesirable with electrically sensitive cargo in the droplet or microscale droplets. Here we demonstrate a contactless method for reversible droplet wetting via corona discharge-based dielectric charge injection (DCI). The method involves a sharp, conductive probe that induces dielectric breakdown of the surrounding dielectric medium under voltages exceeding the medium's dielectric strength. Ionized dielectric molecules accelerate away from the sharp tip due to electrostatic repulsion, resulting in charge injection onto a target surface. With DCI, we induce wetting transition of a non-wetting pure water droplet in a non-polar ambient phase, and subsequently modulate contact angle up to 140°–competitive or even exceeding EW's and EWOD's capabilities. Upon simple removal of voltage, droplet dewets completely back to initial nonwetting state. DCI can be applied to surface-material interchange, particularly surface deposition of droplet cargo or recovery of surface species. DCI presents a unique strategy for droplet wetting modulation that is simple and powerful, with a wide application space that remains to be explored, especially in contexts where EW and EWOD become inapplicable.

PARADORN RUMMANEETHORN University of Pennsylvania
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Paradorn Rummaneethorn is a PhD student in chemical and biomolecular engineering at the University of Pennsylvania, working in Dr. Daeyeon Lee's lab. His research focuses on high voltage techniques to manipulate wetting state of microdroplets for applications in droplet-surface material interchange. Before Penn, Paradorn studied chemical and biological engineering Princeton University, where he graduated with highest honors with minors in biology and materials science. Outside of lab, Paradorn is active in student government, currently serving as Penn's Graduate and Professional Student Assembly president. He is interested in bridging medicine and engineering to develop new therapeutics and diagnostics technologies.

Indigenous and Prescribed Fire Potential for Management of Goldspotted Elk Borer

Biological Sciences Track – Graduate Research

9:30 – 9:50 AM **Room 226B**

Can indigenous and prescribed fire be used as a management tool for goldspotted oak borer (GSOB)? First steps are to determine the temperature required to kill insects inside infested firewood. Next steps involve developing prescribed pile burn and understory prescribed fires in GSOB infested oak forests. Preliminary results indicate heat-treated firewood had no surviving insects, while untreated controls had evidence of 72 surviving beetles. Preliminary conclusions indicate heating firewood cores to 60 degrees Celsius for 60 minutes effectively sanitizes infested wood products. These findings have the potential to suggest that heat treating firewood can be used to limit the spread of tree killing insects in southern California. Heat, ash, charring, and smoke are byproducts of fire which may decrease GSOB reproduction. The evaluation of Indigenous or prescribed fire to be used as a management tool has the potential to develop a landscape level management tool which promotes healthy resilient forests and decrease wildfire potential over large areas. This research seeks to honor California's First Peoples as effective stewards of the land as it is based on historical records of their intentional and periodic burning to reduce insect damage and increase harvests while living inside the land.

JOELENE TAMM University of California Riverside

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Joelene Tamm is a Squaxin Island Tribal member and an Entomology graduate student researcher at the University of California Riverside studying the potential for Cultural and Prescribed Fire to be used as a landscape level management tool for goldspotted oak borer. Joelene is also the Natural Resource Manager at the La Jolla Band of Luiseño Indians working to provide working solutions for tribal and interagency resources. She has previously been awarded the Cobell and AASONA scholarship and is dedicated to finding solutions and pathways for indigenous land management.

Droplet-based, High-throughput Microfluidic Assay for Protein Selection

Engineering Track – Graduate Research

3:00 – 3:20 PM **Room 225 B**

This project, which builds upon earlier work by Mitchell (2004) explores the unique cultural geology and geomorphology along the various trails used by the explorers on their journey. Several of the trails followed by the explorers were used by indigenous populations for centuries prior. Today, many of the geological features noted in the journals written by the explorers exist today as observed then whereas others have been changed. These changes are both natural and anthropological in scope. Some changes have only been cosmetic, such as graffiti or ashfalls, whereas other changes have left geological features reduced to remnants. Changes have taken place along the entire length of the trail. Specifically, this project identifies at least one geological feature that has changed in each of the 16 states along the 4,900 miles of trails walked, paddled, floated, or rode upon by the explorers.

ROBINSON TOM Harvard University
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I joined Navajo Technical University's (NTU) Environmental Science and Natural Resource BS Program and later changed to BS in Biology. My background is in Biology and majority of my research experience is in electrochemistry, in Biosensors & Energy Storage Systems. I graduated from NTU with my BS in Biology in May 2020. Currently, I am in a post bachelor student in a program call Research Scholar Initiative (RSI) at Harvard University and I am a member in David Weitz Laboratory at the School of Engineering and Applied Sciences (SEAS).

Extracellular Vesicle Glycome In Cancer Detection And Metastasis

Biological Sciences Track – Graduate Research

2:30 – 2:50 PM **Room 227 C**

Up to 90% of cancer related deaths are a result of metastasis. In breast cancer, the median survival of breast cancer patients with metastasis to the brain is only 10 months. Extracellular vesicles (EVs) are small particles (30-800 nm in diameter) which are a primary means of cell-to-cell communication. However, the role of EVs in metastatic niche formation is not completely understood.

The complex surface composition of EVs derived from cancer cells has yet to be fully explored. Preliminary mass spectrometry data have demonstrated that individual glycans may be expressed in a higher concentration on EVs collected from a patient derived cancer cell line known to metastasize to the brain when compared to a local variant.

Analysis of the glycan expression of healthy plasma-derived EVs differs from whole plasma controls, indicating that EVs provide molecularly distinct information.

This project aims to elucidate the role of EV surface glycans in metastatic niche formation. Our two-part hypothesis is:
1) removal of these specific glycans could prevent niche-formation (function)
2) a glycome composition rich in specific glycans is indicative of cancer state (biomarker)

To assess these aims, EVs are concentrated, digested to reduce the concentration of individual glycans on the EV surface, and functionally probed.

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Sierra Walker is completing her doctorate at the Nanomedicine and Extracellular Vesicles Laboratory at Mayo Clinic in Jacksonville, Florida. Her research is focused on the use of biological nanoparticles to treat and diagnose life-threatening diseases. Her mission is to inspire and support underrepresented minorities in science. She is actively involved in community outreach and scientific education and has developed various outreach programs for K-12 grade students in collaboration with the National Cancer Institute, in addition to lecturing at the University of North Florida. She received the Young Investigator Award from Sage Bionetworks and is a Klesch Fellow at Mayo Clinic.

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