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NEW MEXICO ALLIANCE FOR MINORITY PARTICIPATION

2025 NM AMP STUDENT RESEARCH CONFERENCE

October 24, 2025

Hosted by the NM AMP Lead Institution,
New Mexico State University

Held at Corbett Center Student Union, 3rd Floor,
NMSU Main Campus
Las Cruces, NM

NM AMP Statewide Institutional Partners 2024-2029

NM STATE Lead Institution
NEW MEXICO TECH SCIENCE • ENGINEERING • RESEARCH UNIVERSITY
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2025 NM AMP Student Research Conference Program
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Special Thanks and Acknowledgements

We want to acknowledge the support and assistance since 1993 from our funding agency, National Science Foundation, through the Louis Stokes Alliances for Minority Participation (NSF LSAMP) program.

A special thanks goes to the administrators, staff, faculty, mentors, parents, and families for the time, support, and encouragement you have given the students and their research projects represented in this publication. We want to especially thank the Lead Conference Coordinator, Ms. Jeanne Garland, for her leadership in the coordination of this event.

Acknowledgements:

New Mexico AMP wishes to acknowledge and thank the following conference supporters:

National Science Foundation, Award EES 2408898
New Mexico Higher Education Department
(through a Research and Public Service Project)
New Mexico State University

Any opinion, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or other funding sources. This material was developed under Award EES 2408898.

NOTE: *Pictures will be taken at all conference activities and events. Attendance implies permission to use these pictures in appropriate publications as determined by NSF and New Mexico AMP*

We thank the following representatives of the NM AMP Advisory Board who generously provide their service and time:

New Mexico Alliance for Minority Participation Advisory Board 2025-2026

Advisory Board Chair: Dr. Lakshmi N. Reddi, New Mexico State University (NMSU) Interim Provost and NM AMP Principal Investigator (PI)

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Francisco Vigil, NM AMP Alumnus, R&D Manager, Los Alamos National Laboratory, Los Alamos, NM

Michael Voegerl, International Admissions and Recruitment, UNM

Dr. Nadir Yilmaz, Department Chair and Professor of Mechanical Engineering, Howard University, Washington, D.C.

Welcome From the New Director, Dr. Paola Bandini

Welcome to the 2025 New Mexico Alliance For Minority Participation (NM AMP) Student Research Conference! This Conference provides students and faculty the opportunity to network, share challenges and successes, and showcase undergraduate research focused on Science, Technology, Engineering, and Mathematics (STEM). The benefits of participating in the NM AMP Conference for the students are many: to be part of a community where lasting friendships are developed, to attend a forum in which students can share research and ideas, and to participate in a setting where students can find a place of belonging and acceptance. STEM continues to be ever-changing as it continually assists our society to become more efficient and expedient in all we do.

Our former NM AMP Director, Jeanne Garland, retired after 22+ years with NM AMP and has done a Return-to-Work temporarily at 10 hours a week to help with the transition at NM AMP. As the newly named NM AMP Director, I am very honored to serve in this role. In my position as Professor of the Civil Engineering Department for 22+ years at NMSU, I have had the opportunity to mentor many NM AMP students and to serve as a Co-Principal Investigator of the NM AMP grant.

In our 33rd year of NM AMP, we are very proud of our students' accomplishments that include participating in research assistantships, internships, presentations at other conferences nationally and internationally, and some as co-authors of published articles. NM AMP places great value in these accomplishments because we know that undergraduate research experiences in academic, professional, and socialization activities can help cultivate scientific identity and facilitate persistence.

Our focus at NM AMP is to increase the number of all statewide students who earn the B.S. degree in STEM. We believe research opportunities encourage retention of students, which influences progression to graduation. NM AMP research programs provide opportunities to understand more about the value society continues to place on the evidence of science and technology as well as the significant part students will have in broadening the sustainability of STEM research and development to meet national and global challenges.

This year's Conference attendees will have the opportunity to meet and listen to some outstanding speakers. At the Opening Session of the Conference, Dr. Valerio Ferme, the NMSU President, and Dr. Lakshmi Reddi, NMSU Interim Provost and NM AMP Principal Investigator, will welcome attendees to NMSU and provide more information about our organization. The Breakfast Keynote Speaker, Dr. Marcy Litvak, NM AMP Co-PI and UNM Professor of Biology, will kick off the Conference, with an engaging talk on her research titled, "Lessons Learned from the New Mexico Elevation Gradient." After this, from 9:30 a.m.-11:30 a.m., students will have the choice to select two of the three workshops that will be provided. Ms. Debbie Lee will present a workshop titled "Communicating Your Science." Ms. Lee is the Senior Program Manager for the Accelerating Resilience Innovations in Drylands (ARID) Institute at the University of New Mexico and the NM AMP Institutional Coordinator for UNM. She has 18 years of experience in environmental mediation and facilitation, coalition and partnership building, and science communication. Another workshop will be presented by Melinda Cuilty, NMSU Enterprise Instructional Technology Administrator/VR Lead. Ms. Cuilty will present "Immersive Learning at NMSU: VIrtual Reality and Bodyswaps in Action," showcasing some innovative virtual reality initiatives at NMSU. Dr. Curtis O'Malley, a faculty member at NM Tech since 2012, will present another workshop titled, "Cross Over Between Fundamental Research and STEAM Engagement." The workshop will include a demonstration and hands-on activities. Michael Voegerl, Director of International Admissions and Recruitment at the University of New Mexico, will lead the the Community College Professional Development Workshop First Session from 9:30 - 11:30 a.m. on Friday. The second session of this community college workshop will be held on Saturday morning, from 8:00 a.m.- 12:00 p.m. Our Luncheon Keynote Speaker is New Mexico Representative, the Honorable Representative Nathan Small, who will provide his background and discuss the many STEM opportunities in New Mexico. Student presentations from 1:15-3:30 will take place, and then at 4:00- 5:00 p.m., we will have an Award Event to recognize poster presentation winners and announce the final raffle winners of the two Air Pods (you must be present to win). At this important event, we will have an Ice Cream Sundae Bar to make our own sundae.

We welcome to our conference administration and students from TRIO STEM-H, the McNair Program, NM MESA, TRIO Upward Bound GISD and LCPS, faculty and students from Mescalero Apache High School, Honors College, CAMP, IMBRE, and other programs. We also welcome graduate students and faculty, some who are serving as judges, and we welcome statewide students from our seven alliance partner institutions and the Summer Community College Opportunity for Research Experience (SCCORE) 2025 program participants.

The Conference will include activities and events that will educate, inspire, and encourage students to progress to the B.S. degree in STEM and beyond. Enjoy your time at the conference, meet new friends and be with old friends, learn and be inspired, and have fun!

~ NM AMP Director, Dr. Paola Bandini

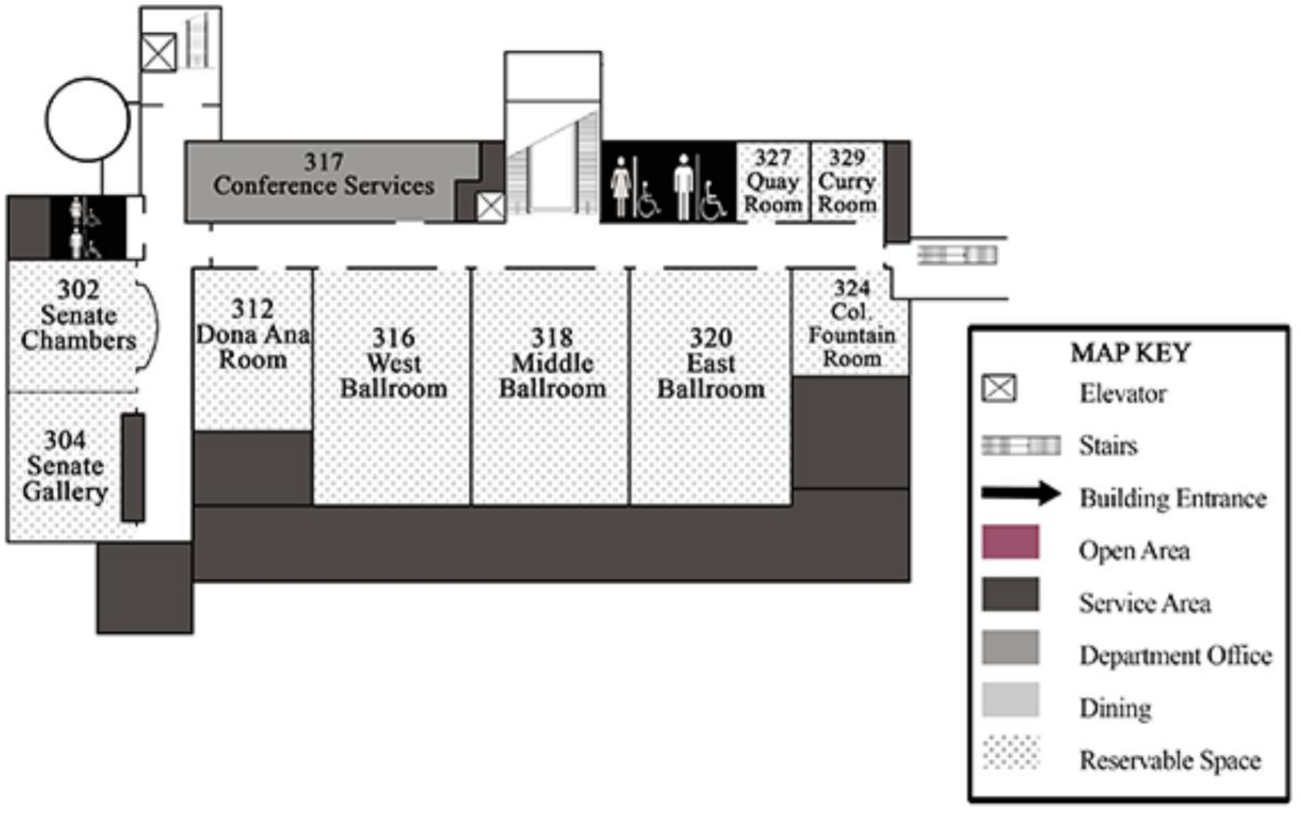
New Mexico AMP Student Research Conference Agenda
October 24, 2025
Corbett Center Student Union, NMSU Main Campus
Las Cruces, NM

(*By Invitation Only*) : Community College Professional Development Workshop in, Col. Fountain Room, Rm. 324: Friday, Oct. 24 9:30-11:30 a.m.and Saturday, Oct. 25, 2025, 8:00 a.m.-12:00 p.m. *Participants must attend both sessions to receive a stipend*.	
CC Professional Development Workshops: Friday, October 24 and Saturday, October 25	Go to the Friday Session of the CC Professional Development Workshops (9:30-11:30 a.m.) and the Saturday Final Session of the CC Professional Development Workshop, (8:00 a.m.-12:00 p.m.), both in the Col. Fountain Room (Room 324). The Facilitator of the Workshop is Michael Voegerl, UNM Director of International Admissions and Recruitment. *Start the Conference on Friday at 7:30 a.m. at the Conference Breakfast and Speaker Session, then at 9:30-11:30 a.m., go to Rm.324 for the CC Professional Development Workshop. Then follow the schedule for the rest of Conference Day. On Sat. 8:00-12:00, attend the Breakfast & Workshop in Room 324, ending with a box lunch to go.*
Friday, October 24, 2025: NM AMP Student Research Conference	
7:00 a.m. – 7:30 a.m.	**NM AMP Students Poster Set Up** (East Ballroom). *University and URS, SCCORE, and other Student Presenters are responsible for putting up their own posters at this time.*
7:30 a.m. – 8:00 a.m.	**Conference Check-In** (Hall in front of the Ballrooms)
7:30 a.m. – 8:00 a.m.	**Breakfast Served** (West Ballroom) for all attendees.
8:00 a.m. – 9:15 a.m.	**Conference Welcome; Introductions of Dignitaries; Keynote Address** (West Ballroom, Corbett Center 3rd Floor) - Dr. Paola Bandini, NM AMP Director and NM AMP Grant Co-Principal Investigator: Welcome to the Conference and speakers' introductions. - Dr. Valerio Ferme, New Mexico State University (NMSU) President: Welcome to NMSU. - Dr. Lakshmi Reddi, NMSU Interim Provost and NM AMP Grant's Principal Investigator: Welcome to New Mexico Alliance for Minority Participation (NM AMP). - Keynote Speaker, Dr. Marcy Litvak, NM AMP Co-Principal Investigator and UNM Professor of Biology. "Lessons learned from the New Mexico Elevation Gradient" - Dr. Bandini – Adjourn Breakfast Session and Conference Instructions.
9:15 a.m. – 9:30 a.m.	**BREAK: After the break, students will attend 2 workshops of your choice** from Workshop 1, Workshop 2, or Workshop 3. **Attend one of the workshops in the 9:30 a.m. – 10:30 a.m.** time slot and **another workshop in the 10:30 a.m. – 11:30 a.m.** time slot (workshops listed below). NM MESA and TRIO Upward Bound will attend their own workshop from 9:30-10:30 a.m. and then attend another workshop of their choice from 10:30-11:30 a.m. (Community College Professional Development Workshops 9:30-11:30 a.m. in Col. Fountain Room 324)
9:30 a.m. – 11:30 a.m.	**Student Workshop #1:** (Senate Chambers Room, 3rd Floor, Room 302) "Communicating Your Science" Presented by Debbie Lee, Senior Program Manager, Accelerating Resilience Innovations in Drylands (ARID) Program, UNM, and NM AMP Institutional Coordinator for UNM. This workshop will focus on how to communicate scientific information to different audiences in a clear, accessible, and impactful way and how to distill research down to key points and how to craft messages to communicate their research. **Student Workshop #2** (Senate Gallery Room, 3rd Floor, Room 304) " Immersive Learning at NMSU: Virtual Reality & Bodyswaps in Action" Presented by Melinda Cuilty, NMSU Enterprise Instructional Technology Administrator/VR Lead. Discover how NMSU is leading the way in immersive education through virtual reality. This session will showcase NMSU's innovative VR initiatives, including hands-on learning with Bodyswaps, a platform that builds communication, leadership, and career-readiness skills through engaging simulations. Participants will gain an overview of VR and how these tools transform teaching/ learning. **Student Workshop #3: "** (Middle Ballroom, 3rd Floor) "Cross over between fundamental research and STEAM (Science, Technology, Engineering, Arts, and Mathematics) Engagement" Presented by Dr. Curtis O'Malley, Associate Professor, Mechanical Engineering, NM Tech; Director, MechE Mayhem STEAM Lab, and NM AMP Institutional Coordinator for NM Tech. This workshop will focus on adapting basic engineering research project outcomes to be used as hands-on learning content. Attendees will try a demo of program activities, including operating a bot or wiring simple circuits.
9:30 a.m. – 11:30 a.m.	**Faculty Workshop: "Effective Mentoring Relationships"** (Doña Ana Room, 3rd Floor, Room 312) **(Faculty and Staff are invited),** Moderated by Dr. Cecilia Contreras, NM AMP Associate Director. This session will be a Panel Discussion in which NM AMP alliance faculty from NMHU, NNMC, and NM Tech will discuss their own approaches to mentoring. Dr. Contreras will moderate and present.
9:30 a.m. – 10:30 a.m. 10:30 a.m. - 11:30 a.m.	**NM MESA Program and NMSU TRIO Upward Bound GISD/LCPS Program Orientation and Workshop** (Otero Room, 1st Floor): Welcome to Conference; Facilitators: Anita Gonzales, NM MESA Statewide Deputy Director and Robert Gomez, NMSU Director of TRIO Upward Bound GISD/LCPS Program – "Navigation of the Conference" and "Reading Abstracts and Abstract Exercises." **NM MESA Program and NMSU TRIO Upward Bound GISD/LCPS:** After the 9:30 a.m. session with your groups, attend the conference workshop of your choice at 10:30 a.m. – 11:30 a.m.- Workshop #1, #2, or #3. See above.

9:30 a.m. – 11:30 a.m.	**New Mexico Community College Conference Professional Development Workshop** (*by invitation*): Facilitator Michael Voegerl, UNM Director of International Admissions and Recruitment. **- Title: "Navigation of the Conference" and "Reading Abstracts & Abstract Exercises,"** Col. Fountain Room, Room 324
9:30 a.m. – 11:30 a.m.	**Advisory Board Meeting** *(by Invitation)* (Conference Room 204 A, 2nd Floor) Advisory Board Chair and Moderator, Dr. Lakshmi Reddi, NMSU Interim Provost, will lead. Dr. Paola Bandini, Director of NM AMP, will assist Facilitation.
11:30 a.m. – 11:45 a.m.	**Break Before Lunch**
11:45 a.m. – 1:00 p.m.	**Lunch and Keynote Address** (West Ballroom, Corbett Center 3rd Floor) - Dr. Bandini: Welcome Back; Introduction of Keynote Speaker. - Keynote Speaker: The Honorable New Mexico Representative Nathan Small - Announcement of the NM AMP Mentor of the Year Award and Announcement of NM AMP Institutional Coordinator of the Year Award, and Lunch Raffle, all presented by Michael Voegerl - Guest Speaker: U.S. Representative Gabe Vasquez (introduced by Clayton Abbey, NMSU Assistant Vice President of Government and Community Relations) - Dr. Bandini: Adjourn and reminder of afternoon activities
11:45 a.m. – 12:45 p.m.	**Judges' Check-In and Training** (Doña Ana Room). Facilitator and Lead Judge Cyrena Ridgeway, NM AMP Graduate Assistant. **NOTE**: *Judges, this is an important session that will be a working lunch; please go to the West Ballroom and get your lunch at the Buffet and take* it to the Doña Ana Room.
12:45 p.m. - 1:15 p.m.	**Judges' Poster Preview** (East Ballroom). **Students are not allowed to be present during the Judges Poster Preview until 1:15 p.m.**
1:15 p.m. – 2:15 p.m. 2:15 p.m. – 3:15p.m. 3:15 p.m. – 4:00 p.m.	**NM MESA and Upward Bound Workshop** (Otero Room, 1st Floor). Facilitators: Anita Gonzales, NM MESA Statewide Deputy Director and NMSU Director of TRIO Upward Bound GISD/LCPS Program. **NM MESA and Upward Bound Students:** Attend Session 2 of the Undergraduate Student Poster Presentations. **NM MESA and Upward Bound Students:** Return to Otero Room, 1st Floor, for Feedback Session in group discussion.
1:15 p.m. – 3:15 a.m.	**Information Tables** with industry partners in 3rd Floor Hallway
1:15 p.m. – 2:15 p.m.	**Session 1 Undergraduate Student Poster Presentations & Judging** (East Ballroom) **–** To include: SCCORE presenters and university undergraduate research presenters. (*Presenters – you will be given instructions so you know what Session you will be required to attend and be prepared to present.*)
2:15 p.m. – 3:30 p.m.	**Session 2 Undergraduate Student Poster Presentations & Judging** (East Ballroom) **–** To include: University undergraduate research presenters. (*Presenters – you will be given instructions so you know what Session you will be required to attend and be prepared to present.*)
2:30 p.m. – 4:00 p.m.	**New Mexico AMP Institutional Coordinators (IC) Meeting** (Quay Room): Facilitator: Dr. Paola Bandini, Director of NM AMP, and Dr. Cecilia Contreras, NM AMP Associate Director: Welcome to Attendees; Self-Introduction of Attendees; AMP Updates; Discussion with IC's.
3:30 p.m. – 3:45 p.m.	**Poster Judges' Scoring Discussion and Identification of CC and University First, Second, and Third Place Winners for each category (cc and university).** (Doña Ana Room).
4:00 p.m. – 5:00 p.m.	**Awards and Brownie-Sundae Bar and Social** (West Ballroom). **Cyrena Ridgeway, Lead Judge:** Announcement of Poster Presentation Winners: **First, Second, and Third Place Winners for each category of University and Community College: Michael Voegerl**: Announcement of Final Raffle Winner. **NM AMP Director, Dr. Paola Bandini:** Conference Closing and Adjourn**.**

*****NOTE****: For the Lunch and Awards Raffles, you MUST be present to WIN; otherwise, another winner will be drawn. NM AMP thanks our Keynote Speakers, our Workshop Facilitators, and Student Presenters. Thank you also to our Advisory Board and all NM AMP staff and volunteers.*

Map of the Corbett Center Student Union, 3rd Floor

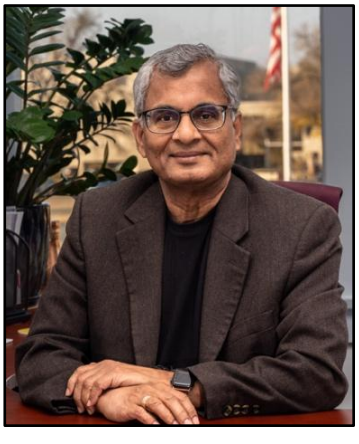


NM AMP Leadership

Dr. Paola Bandini, NMSU Professor of Civil Engineering and Director of New Mexico Alliance for Minority Participation

Dr. Paola Bandini is the Wells-Hatch Professor in the Department of Civil Engineering at New Mexico State University (NMSU). She received the Bachelor of Science degrees in geological engineering and geology from the Universidad de Oriente (Venezuela), and Master and Ph.D. degrees in civil engineering from Purdue University (Indiana, U.S.). Dr. Bandini joined the NMSU faculty in 2002. From 2015 to 2025, she was the NMSU Campus Lead and a Co-Principal Investigator (Co-PI) of the National Science Foundation (NSF)-funded Engineering Research Center for Bio-mediated and Bio-inspired Geotechnics. Dr. Bandini is a co-PI of the NSF grant that funds the NM AMP Program and co-PI of the NSF S-STEM STAR project in the NMSU College of Engineering. She served as President of the New Mexico Section and is a Region 6 Governor (for New Mexico) of the American Society of Civil Engineers (ASCE). She serves in the Technical Coordination Council and is the Vice Chair of a Technical Committee of the ASCE Geo-Institute. Dr. Bandini teaches undergraduate and graduate courses in the geotechnical area and has graduated 11 Ph.D. and 30 master's students. She is a licensed professional engineer in New Mexico. She received the Teaching-Research-Service Synergy Award (2024), the Donald C. Roush Teaching Award for Teaching Excellence (2023), the ACAGE Teaching Excellence Award (2021), the Synergy Faculty Leadership Award (2018), the Wells-Hatch Family Endowed Professorship in Civil Engineering (2017-present), the Patricia Christmore Faculty Teaching Award (2027), and the Outstanding Professor of the Year of the Civil Engineering Department (five years).

Dr. Lakshmi N. Reddi, Provost and Chief Academic Officer of New Mexico State University (Lead Institution), Principal Investigator (PI) of NM AMP



Dr. Lakshmi Reddi has served as Interim Provost and Chief Academic Officer at New Mexico State University (NMSU) since March 25, 2024. Prior to this role, he was the Dean of the College of Engineering at NMSU. With over 25 years of experience in academia, Dr. Reddi has been a distinguished educator and researcher in civil and environmental engineering, focusing on interdisciplinary themes. Dr. Reddi earned his bachelor's degree in civil engineering from Jawaharlal Nehru Technological University in India, and his M.S. and Ph.D. degrees in civil engineering from The Ohio State University. His academic career has been marked by a strong emphasis on both teaching and research across about fifteen disciplines within and outside of engineering.
Dr. Reddi has authored, co-authored, and edited 8 books and more than 120 technical articles on interdisciplinary themes in engineering. His research on biomimetic systems for sustainable engineering and energy efficiency has led to the establishment of a collaborative network of researchers from Africa, America, Asia, and Europe, including core groups from South Korea, France, the US, India, and the UK.

Opening Session, Breakfast Keynote Speaker

The Breakfast Session is held from 7:30 a.m.-9:15 a.m.

Dr. Marcy Litvak, *Professor of Biology, the University of New Mexico and Co-Principal Investigator of New Mexico Alliance for Minority Participation*
"Lessons Learned from the New Mexico Elevation Gradient"

Dr. Marcy Litvak, our Breakfast Keynote Speaker for the Conference, serves as Co-Principal Investigator of New Mexico Alliance for Minority Participation (NM AMP). Dr. Litvak received a B.A. in Biology from Colorado College in 1989, and a Ph.D. in Plant Physiological Ecology in 1998 from the University of Colorado at Boulder. She did her postdoctoral work in the Department of Earth System Science, University of California, Irvine from 1998-2001. Her first faculty position was at University of Texas, Austin, TX. in the Section of Integrative Biology. She joined the Department of Biology at UNM in 2006 and is currently a Full Professor. She also is the Co-PI of the Sevilleta Long Term Ecological Research program, and Co-Director of the new ARID (Accelerating Resilience Innovations in Drylands) Institute at UNM.

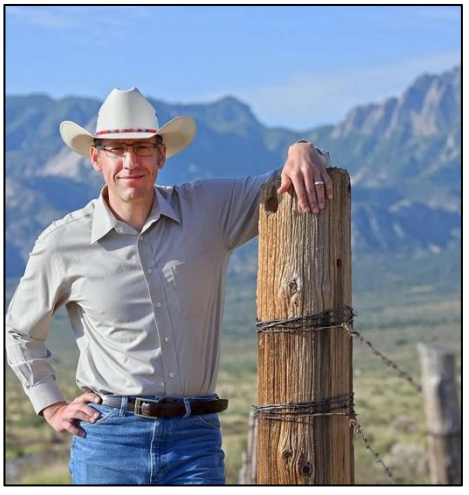
Dr. Litvak's research focuses on quantifying the relationships between structure and function in semi-arid ecosystems. In particular, she uses tower-based eddy covariance as a tool to quantify ecosystem function as carbon, water, and energy exchange with the atmosphere in biomes across the Southwestern U.S. She uses this technique to quantify and understand how sensitive ecosystem processes in these biomes are to both climate and disturbance. She seeks out multi-disciplinary teams to conduct research that bridges science and management expertise to create actionable science and products for federal land managers.

Her talk today focuses on semi-arid ecosystems that are distributed across New Mexico and the Southwestern U.S. that are diverse ecosystems that sequester carbon from the atmosphere, facilitate groundwater recharge, prevent erosion, and regulate climate. Dr. Litvak will give a brief discussion of how they are using a network of sites called the New Mexico Elevation Gradient to quantify these ecosystem processes and how sensitive these processes are to the hotter, drier climate we have experienced over the last two decades.

Luncheon Session Keynote Address

Luncheon held from 11:45 a.m. – 1:00 p.m.

The Honorable New Mexico Representative Nathan Small



The Honorable New Mexico Representative Nathan Small is a third-generation New Mexican, hailing from a family of educators and ranchers. A lifelong outdoorsman with a passion for public service, he has represented Las Cruces' District 36 in the New Mexico House of Representatives since 2016. Throughout his time in the legislature, Rep. Small has been a leading champion for smart budgeting, water conversation, renewable energy and low and zero carbon economic growth in New Mexico.

As Chair of the House Appropriations and Finance Committee, Rep. Small has established himself as a strategic, collaborative leader focused on responsible budgeting that reflects the values of New Mexico's working families. By saving prudently, while also making targeted investments in New Mexico's most pressing needs today, his work is helping steer our state toward a thriving and sustainable future.

NM MESA and TRIO Upward Bound GISD and LCPS Workshop

9:30 a.m. - 11:30 a.m. and 1:15 p.m. - 4:00 p.m.

New Mexico Mathematics, Engineering, Science Achievement (NM MESA), Inc. and NMSU TRIO Upward Bound Workshop for NM MESA and TRIO Upward Bound GISD/LCPS Participants:

***(NOTE: NM MESA and NMSU TRIO Upward Bound GISD/LCPS students** will have a Workshop at 9:30 a.m. that will be facilitated by Anita Gonzalez and Robert Gomez. Then at 10:30 a.m. students will choose one workshop to attend in the 10:30 a.m.-11:30 a.m. timeslot. In the afternoon from 1:15 p.m. – 2:15 p.m., students will have a workshop, again, in the Otero Room, then students will attend Session 2 of the Poster Presentations, and at 4:00 p.m., they will attend the Award Ceremony.)*

Anita Gonzales, *Deputy Director, NM MESA, Inc. and New Mexico Representative, Serving the 70th District*

New Mexico Representative, Anita Gonzales, a native New Mexican, was born in Las Vegas, NM to both the Lopez Family of Villanueva, NM and the Gallegos Family of Las Vegas, NM. She was recently elected to the New Mexico Legislature as a Representative. Representative Gonzales moved between Las Vegas and Albuquerque and graduated from high school at West Mesa High School. After completing most of her degree at Texas A&M University, she returned home to Las Vegas, NM to complete her Bachelor's and Master's degrees at New Mexico Highlands University. Representative Gonzales has worked at NM MESA for over 17 years – an organization that empowers and motivates New Mexico's culturally diverse students with science, technology, engineering, and math (STEM) enrichment. NM MESA has allowed her to network with partners, industry leaders, educational institutions, and contacts.

Robert Gomez, Director, *TRIO Upward Bound, GISD and LCPS, at New Mexico State University*

Born in El Paso, Texas, and a graduate of Gadsden High School in Southern New Mexico, Robert Gomez has dedicated his career to empowering students through education. Currently serving as the Program Director for TRIO Upward Bound at New Mexico State University (NMSU), he is committed to fostering academic success and personal growth for students in the Gadsden Independent and Las Cruces Public School Districts. Prior to this role, Mr. Gomez worked as a Student Program Coordinator with the Student Success Center at NMSU, where he helped develop programs to support student achievement and retention. His extensive teaching experience spans both middle and high school levels, having served as an Intervention and Instructional Support Teacher. He was also instrumental in founding the Fusion Reading Program with Las Cruces Public Schools, a key initiative aimed at improving literacy skills for students in the district. Mr. Gomez earned an undergraduate degree in Criminal Justice in 2004, and a master's degree in Curriculum and Instruction, awarded in 2017.

Community College Professional Development Workshops (Col. Fountain Room in Room 324)

NOTE TO PARTICIPANTS: ***These CC Professional Development Workshops are held Friday, October 24th, the day of the conference, from 9:30 a.m.-11:30 a.m., and Saturday, October 25th, the day after the conference, from 8:00 a.m.-12:00 p.m****.)*

Participants: You must attend the Friday and the Saturday sessions to get a full stipend.

Michael Voegerl, *Director, International Admissions and Recruitment at the University of New Mexico*

Michael Voegerl

Facilitator of the Professional Development Workshop on Friday and Saturday morning.

Michael Voegerl is the Director for International Admissions and Recruitment for the University of New Mexico and the former Institutional Coordinator for many years at NM Tech. He has spent 11 years working with students on their educational journey to ensure that they get the education they want and to help them knock down barriers to that education.

When not in the office, you can usually find Michael somewhere in the woods with his wife, Theresa, and their German Shepherd, Stella, or on the golf course chasing a little white ball.

STUDENT WORKSHOPS

First Session: 9:30 a.m. - 10:30 a.m.; Second Session: 10:30 a.m. - 11:30 a.m.

Choose two (2) of the following three workshops to attend. Workshop #1: "Communicating Your Science," Workshop # 2: "Immersive Learning at NMSU: Virtual Reality and Bodyswaps in Action," and Workshop #3: "Cross Over Between Fundamental Research and STEAM Engagement." The three workshops will be held from 9:30 a.m.-10:30 a.m. and will be repeated in the 10:30 a.m.-11:30 a.m. timeslot. *(Choose one workshop for the first session (9:30 a.m.- 10:30 a.m.) and choose another workshop for the second session (10:30 a.m. -11:30 a.m.) The workshops will be presented twice.*

Student Workshop #1 (Senate Chambers Room, 3rd Floor, Room 302)

"**Communicating Your Science**"

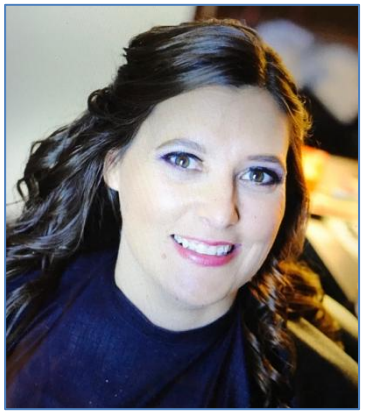
Presented by Ms. Debbie Lee, Senior Program Manager, Accelerating Resilience Innovations in Drylands (ARID) Program, University of New Mexico (UNM), and NM AMP Institutional Coordinator for UNM.

This workshop will focus on how to communicate scientific information to different audiences in a clear, accessible, and impactful way. It will also help students know how to distill research down to key points and craft messages to communicate your research.

Need help with your scientific papers, articles, and research posters? This is the workshop for you!

Student Workshop #2 (Senate Gallery Room, 3rd Floor, Room 304)

"Immersive Learning at NMSU: Virtual Reality & Bodyswaps in Action"

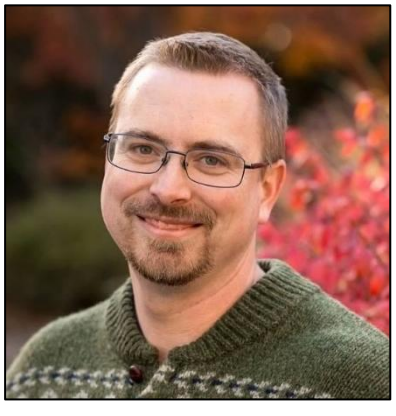


Presented by Ms. Melinda Cuilty**,** Enterprise Instructional Technology Administrator/VR Lead

In this engaging workshop, discover how New Mexico State University is leading the way in immersive education through virtual reality (VR). This session will showcase NMSU's innovative VR initiatives, including hands-on learning with Bodyswaps, a platform that builds communication, leadership, and career-readiness skills through engaging simulations. Participants will gain an overview of VR in higher education and explore how these tools are transforming teaching and learning.

Student Workshop #3 (Middle Ballroom, 3rd Floor)

"Cross Over Between Fundamental Research and STEAM Engagement"



Presented by Dr. Curtis O'Malley, Associate Professor, Mechanical Engineering, NM Tech; Director, MechE Mayhem STEAM (Science, Technology, Engineering, Art, and Mathematics) Lab, and NM AMP Institutional Coordinator for NM Tech.

Dr. O'Malley's talk will discuss the MechE Mayhem STEAM Lab's approach to adapting basic engineering research project outcomes to be used as hands-on STEAM learning content. It will also explain how engineering researchers and educators can share some of the concepts and exciting products of this research effort with the public in a more hands-on way than simply lab tours, or written/oral presentations. Instead, we seek to develop a series of workshops or activities that have K-12 students or the public engage in experimentation or building activities that demonstrate the products of the original research effort. In this workshop, we will begin with a presentation overviewing the content and approach of our engineering education and research effort. We will then open up the room for attendees to work through a trial or demo version of some of our program activities. These demos will include operating a bot or wiring some simple circuits.

FACULTY WORKSHOP (Doña Ana Room, 3rd Floor, Room 312)

(*Faculty and Staff are invited.)*

"Effective Mentoring Relationships"

This session will be a Panel Discussion in which NM AMP alliance faculty from NMHU, NNMC, and NM Tech will discuss their own approaches to mentoring. Dr. Contreras, NM AMP Associate Director, will moderate and present an overview.

Panel Moderated by Dr. Cecilia Contreras, NM AMP Associate Director. Dr. Contreras, Ed.D., identifies as a STEM education researcher due to her academic and professional experiences. She focuses her research on qualitative/mixed methods studies addressing STEM student college performance and persistence, particularly at Hispanic-Serving Institutions (HSIs). Her main lines of inquiry examine best practices in mentoring, promotion of undergraduate research in STEM, and educational technological innovations. She has been the principal investigator of several grants, including the Research-Oriented Learning Experiences Engineering program and the Latinidad STEM Mentoring Program, both funded by the National Science Foundation.

Panelists:

Dr. Brian Pasko, *Professor of Mathematics and Department Chair at Eastern New Mexico University (ENMU). Dr. Pasko serves as a NM AMP Institutional Coordinator for ENMU and is an advisor and mentor to ENMU students.*

Dr. Sushmita Nandy, *Associate Professor of Biomedical Sciences, Chair of the Department of Biology, Chemistry, and Environmental Science, Northern New Mexico College. Dr. Nandy was recognized as one of two NM AMP Mentors of the Year in 2024.*

Dr. Justine Garcia, *Associate Professor of Biology, New Mexico Highlands University.*

NM AMP Mentors of the Year (2024-2025)

Dr. Brian Pasko, Eastern New Mexico University

Brian Pasko, PhD, is Professor of Mathematics and Chair of the Mathematical Sciences Department at Eastern New Mexico University. He has been the NM AMP Institutional Coordinator of ENMU for sixteen years. This is Dr. Pasko's twentieth year as a Mathematics faculty at ENMU. Over his career, he has taught a wide variety of Mathematics courses, from developmental undergraduate courses to graduate courses. While his professional training is in the area of Algebraic Topology, most of his scholarly activity focuses on mathematical modelling and simulation, and assessment.

Dr. Pasko has mentored a great many students working on NM AMP URS projects over the years on a range of topics. These topics include the path of a racquetball around a court, including the effects of interactions between the ball and the various playing surfaces on the motion of the ball; simulation of traffic patterns subject to obstructions, including the phenomenon of virtual intersections; and exploration of behavioral threshold theory applied to the decisions of juries.

Dr. Eric Lindsey, University of New Mexico

Dr. Eric Lindsey joined the University of New Mexico as an Assistant Professor in 2021, bringing expertise in geophysics, remote sensing, and tectonics. His research centers on using geodetic techniques — including GPS/GNSS and satellite-based radar imaging — to quantify both slow and sudden motions of Earth's surface, whether driven by tectonic forces, volcanic processes, or human activities such as groundwater extraction. His work has contributed to new insights into megathrust fault behavior, strain partitioning, and subsidence in urban areas, often combining field campaigns, satellite data analysis, and numerical modeling.

Beyond research, Eric is deeply committed to mentoring students and early-career scholars. He teaches courses in satellite-based geophysics, computational methods, and environmental systems, and leads workshops for undergraduates on programming and data analysis. His engagement spans local to international scales — for example, he has developed capacity-building programs in Myanmar focused on geophysics and earthquake hazards. As a mentor, he encourages students to find creative, hands-on projects that connect geophysics and Earth science with community-relevant questions.

New Mexico Alliance for Minority Participation
Institutional Coordinator of the Year (2024-2025)

Debbie Lee, NM AMP Institutional Coordinator (IC)
at the University of New Mexico

Debbie Lee is the Senior Program Manager for the Accelerating Resilience Innovations in Drylands (ARID) Institute at the University of New Mexico (UNM), where she supports transdisciplinary research to inform climate resilience. She serves as the NM AMP Institutional Coordinator for University of New Mexico and as the Non-Federal Chair of the Middle Rio Grande Endangered Species Collaborative Program.

Debbie has 18 years of experience in environmental mediation and facilitation, coalition and partnership building, and science communication. Her career has been focused on supporting science-informed decision-making, specializing in ensuring clear communications between scientists, managers, and the public.

At UNM, she discovered a new passion in training and supporting students to succeed academically and professionally, emphasizing skills in interdisciplinary thinking, science communication, and community engagement.

Prior to joining UNM, she worked at an environmental consulting firm, an environmental conflict resolution non-profit, a summer camp, and a public butterfly garden. She holds a Master's of Public Policy degree from the University of Maryland and a Bachelor of Arts in History, Political Science, and Public Policy from St. Mary's College of Maryland. In her spare time, she reads, knits, spins yarn, rock climbs, and is a cat and dog mom.

STUDENT POSTER ABSTRACTS

Lead Judge for Poster Presentations: Cyrena Ridgeway

Student Poster Presentations: 1:15 p.m. - 3:30 p.m.

ENGINEERING

Alvin Birmingham-Monroe, Civil Engineering
New Mexico State University
Mentor: Dr. Runwei Li
Sponsored by: NM AMP (URS)

Analyzing Research Trends in Per- and Polyfluoroalkyl Substances (PFAS) via Systematic Review

Per- and polyfluoroalkyl substances (PFAS) have become ubiquitous chemicals that pose potentially serious threats to both human health and the integrity of the ecosystem. This review compiles current knowledge on PFAS contamination in estuaries, focusing on sources, abundance, distribution, fate, and toxic mechanisms. It also addresses the health risks associated with these compounds and identifies research gaps, offering recommendations for future studies. Estuaries are essential for maintaining biodiversity and serve as protective natural buffers against pollution flowing from land to sea. However, PFAS, known for their persistence and bioaccumulation potential, are detected in estuarine waters, sediments, and biota worldwide, with varying concentrations based on geographic locations and environmental matrices. Sources of PFAS in estuaries include routine items like nonstick kitchenware, industrial emissions, landfill sites, civilian and military airfields, and runoff from firefighting activities. The fate of PFAS in estuarine ecosystems is influenced by hydrology, biogeochemical interactions, and proximity to pollution sources.

Audrina Reynolds and Scarlett Duffy
Mescalero Apache High School
Mentors: Jeff Umland, NASA JPL, and Nate Raynor, MAHS STEM Coordinator
Sponsored by: Mescalero Apache High School

Martian Greenhouse 6.0: Student-Led Exploration of Sustainable Plant Growth on Mars

Martian Greenhouse 6.0 is a student-led project designing a robotic greenhouse to study plant growth in simulated Martian conditions, combining technology, teamwork, and sustainability to support future space exploration.

Brandon Garcia-Arvizo, Civil Engineering
New Mexico State University
Mentor: Dr. Zhe Wan
Sponsored by: NM AMP (URS)

Mitigating Alkali-Silica Reaction in New Mexico Aggregates: Sustainability and Resilience of Concrete Structures

Internal pressure propagated by the formation of alkali-silica gel can cause concrete to swell, leading to misalignment, structural deformities, and fractures. Alkali-silica reaction (ASR) is an issue whose complexities have made it difficult to predict and prevent due to a variety of underlying factors, which may or may not occur in structures over a span of multiple years. ASR begins when siliceous components present within aggregates interact with alkali ions in cement, creating an alkali-silica gel that absorbs water, thereby expanding its volume. As various points of expansion begin to appear, the cracks generated from the pressure converge, diminishing the structural properties of the affected concrete. To inhibit ASR, a byproduct of coal-fired power plants, Class F fly ash is used. Although NMDOT has concerns regarding its availability, prompting research into sustainable alternatives within New Mexico. This research project aims to analyze various supplementary cementitious materials (SCMs) and their potential to mitigate ASR through a variety of ASTM standards, identifying the relationship of long-term and short-term testing, while establishing a statewide aggregate reactivity database containing information on local pozzolans.

Celeste Mora, Environmental Science
Doña Ana Community College
Mentor: Dr. Yanyan Zhang
Sponsored by: NM AMP (SCCORE)

Ammonia Removal and Recovery using Sodium pre-treated Zeolite

Produced water from oil and gas extraction in the Permian basin requires water treatment for safe disposal and reuse. After the desalination process, high concentrations of ammonia, which is toxic to most organisms remain in the treated water. Zeolite, a porous mineral with ion exchange capability, is most commonly used as an absorbent during water treatment processes. This procedure focuses on ammonia removal and recovery for reuse using 5 types of sodium pre-treated zeolites through methods of adsorption, and regeneration through ion exchange. Out of the 5 zeolites tested, zeolites KMI 30-, and KMI 14 x 30 showed the best efficiency towards ammonia removal up to 96%. Given its low cost and ease of operation, zeolite absorption shows strong potential for ammonia removal in produced water.

Cody Rice and Hendricks Aldava
Mescalero Apache High School (MAHS)
Mentor: Nate Raynor, MAHS STEM Coordinator
Sponsored by: Mescalero Apache High School

Testing Metal Durability and Conductivity in Space Using a Student-Built CubeSat

We are testing different metals on a CubeSat to observe how space radiation, microgravity, and extreme temperatures affect their durability, conductivity, and potential use in future spacecraft materials.

Emerald Davis, Mechanical-Aerospace Engineering
New Mexico State University
Mentor: Dr. Shabnam Mohammadshahi
Sponsored by: NM AMP (SCCORE)

Design and Characterization of Superhydrophobic Hierarchical Surfaces with Ceramic and Silicon Coatings for Anti-icing Applications

Ice formation in the fuel, engine, or on the exterior of an aircraft poses serious risks that affect performance and safety. The formation of ice inside fuel lines can interfere with critical monitoring systems related to navigation, stability, and the environment. This research examines the superhydrophobic behavior of microstructured surfaces combined with silicone and ceramic coatings for aerospace applications. Using SolidWorks, we created 3D models featuring microstructures to achieve a water-repelling state. The structure of the surface promotes this effect by trapping air between ridges. By adding ceramic and silicone coatings, the surface generates hierarchical nanostructures, which in turn reduce both surface energy and molecular attraction. We combined these two methods to reduce the accumulation of water and increase the water contact angle, potentially alleviating the formation of ice.

Kayleen Kocharoff, Mechanical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. O'Malley
Sponsored by: NM AMP (URS)

Characterization of 3D Printed Hyperelastic Materials for Soft Robotic Applications

This research focuses on the material testing and characterization of the hyperelastic material Silicone Elastic 50A. The objective is to determine mechanical properties such as Ultimate Tensile Strength (UTS), strain at failure, and nonlinear elastic modulus through an experimental approach. 3D printed dog bone samples, conforming to ASTM D412 standards, were fabricated using a Formlabs Resin Printer and post-processed using the Formlabs Wash and Formlabs Curing Station. By varying the post-processing curing time and temperature parameters, four different types of samples were produced. Digital Image Correlation (DIC) was used during uniaxial tensile testing to capture 2D strain distributions and generate the stress-strain curve. The comparison of the different test samples is used to determine the post-processing steps required for yielding a manufactured part with ideal hyperelastic characteristics. Experimental results allow for the construction of Finite Element Models (FEM) which can be evaluated under complex static and dynamic boundary conditions. The results of this research will inform a material model for the development and iterative digital design of new soft robotic pneumatically actuated artificial muscles.

Lawrence Rael, Arts and Science
University of New Mexico
Mentor: Dr. Jose Cerrato
Sponsored by: NM AMP (SCCORE)

Wildfire Ash and Mine Waste Solids: Influence of Redox on Metal Mobility

The project goal is to investigate chemical reactions between wildfire ash and mine waste solids that affect the mobility of metal in water. The project will consist of the following specific objectives: 1) Identify optimal conditions to generate pinewood ash under controlled laboratory conditions. 2) Measure the concentration of metals in water using ICP (Inductive Coupled Plasma) analysis for batch experiments that will react to pine wood ash and mine waste solids from the Upper Gallinas Creek Watershed, NM. 3) Identify chemical changes in solids before and after the batch experiments using diffraction and spectroscopy methods.

Luis Borja, Mechanical-Aerospace Engineering
New Mexico State University
Mentor: Dr. Abdessattar Abdelkefi
Sponsored by: NM AMP (URS)

An investigation into topology and mesh patterns on an object's dynamical characteristics

Traditional dynamic environment tests are typically conducted in the manner of applying forces ideally one axis at a time along the systemic principal directions. Nonetheless, recent research determines that the simultaneous multi-axis excitation might be much more similar to the real conditions. This method has attracted a lot of players, especially if someone is trying to do multi-axis testing with smaller, distributed shakers. In some situations, like the transportation sector, most of the vibrations arise from the bases of the structures. The present research is aimed at the multi-axis vibration testing setup that consists of a large base-exciting shaker that is assisted with an additional shaker working along a different axis.

Michael Kerns, Chemical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Michaelann Tartis
Sponsored by: NM AMP (URS)

Focused Ultrasound for Delivering Chemotherapy to Metastatic Femur Lesions in Pediatric Neuroblastoma

Neuroblastoma is a type of cancer that typically occurs in infants and can be difficult to treat. This is because it often metastasizes to the bone marrow, which is a hard place to deliver treatment without severe side effects. The major aim of this project is to use microbubbles containing cancer drugs and popping them by inducing cavitation using focused ultrasound. The challenge is that the cortical and cancellous parts of bone have high amounts of attenuation and velocity dispersion, which makes it difficult to detect when the microbubbles cavitate, which would allow us to validate the penetration of ultrasound. The primary objective of this research is to determine if ultrasound can penetrate pediatric femur bone model and if the sound of microbubble cavitation can be detected.

Nathan "Lane" Porter, Electrical Engineering
New Mexico State University
Mentor: Dr. Qianyun Zhang
Sponsored by: NM AMP (SCCORE)

Dual Approach to Bridge Element Identification and Crack Detection

Accurate identification of bridge components is essential for advancing automated infrastructure inspection and condition assessment. This study presents two semantic segmentation models based on the DeepLab v3+ architecture with a ResNet-18 backbone, designed for (1) bridge deck identification and (2) multi-class structural element segmentation, including deck, pier, pier cap, girder, cross girder, and background. Both models were trained on UAV-acquired images specifically collected for visual bridge inspection. The datasets were meticulously labeled: 113 images were manually annotated for deck identification, and 200 images for structural element segmentation. The deck identification model achieved a Global Accuracy of 98.63%, a Mean Intersection over Union (IoU) of 97.18%, and a deck IoU of 96.61%, effectively isolating deck regions for targeted analysis. The element segmentation model exhibited strong class-wise performance across all structural categories, enabling detailed pixel-level component recognition. These models are integral to a broader initiative aimed at developing a dedicated software platform for the New Mexico Department of Transportation (NMDOT), leveraging UAV-based automation to improve inspection efficiency, accuracy, and scalability for statewide bridge management systems.

Riley Morris, Mechanical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Mostafa Hassanalian
Sponsored by: NM AMP (URS)

Vertical Grow Tower Structural Design

This project presents the design and construction of a modular grow tower inspired by origami principles to create a lightweight, foldable, and structurally efficient system for vertical plant growth. The tower is engineered to maximize strength and stability while minimizing material usage and assembly complexity. By applying geometric folding patterns commonly found in origami, the structure can begin collapsed for transport and expand into a rigid, supporting form when deployed. This approach allows for easy scalability and adaptability to different environments, from indoor gardens to compact outdoor setups. The use of interlocking panels and folded reinforcements eliminates the need for complex joints or fasteners, reducing both cost and assembly time. Materials were selected based on rigidity, durability, and resistance to moisture while maintaining low weight. The resulting structure demonstrates how nature-inspired geometry and folding mechanics can be applied to modern agricultural design. The goal of this project is to explore how origami based engineering can enable sustainable, space-efficient growing systems that are accessible, portable, and structurally robust.

Ryne Almarinez, Mechanical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Curtis O'Malley
Sponsored by: NM AMP (URS)

Characterization of 3D Printed Hyperelastic Materials for Soft Robotic Applications

This research focuses on the material testing and characterization of the hyperelastic material Silicone Elastic 50A. The objective is to determine mechanical properties such as Ultimate Tensile Strength (UTS), strain at failure, and nonlinear elastic modulus through an experimental approach. 3D printed dog bone samples, conforming to ASTM D412 standards, were fabricated using a Formlabs Resin Printer and post-processed using the Formlabs Wash and Formlabs Curing Station. By varying the post-processing curing time and temperature parameters, four different types of samples were produced. Digital Image Correlation (DIC) was used during uniaxial tensile testing to capture 2D strain distributions and generate the stress-strain curve. The comparison of the different test samples is used to determine the post-processing steps required for yielding a manufactured part with ideal hyperelastic characteristics. Experimental results allow for the construction of Finite Element Models (FEM) which can be evaluated under complex static and dynamic boundary conditions. The results of this research will inform a material model for the development and iterative digital design of new soft robotic pneumatically actuated artificial muscles.

Shawna Dodge, Mechanical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Mostafa Hassanalian
Sponsored by: NM AMP (URS)

Chemical-Free Sustainability: Smarter Greywater Reuse

Water scarcity and environmental sustainability demand innovative approaches to water reuse. This project presents a 3D-printed greywater filtration system that employs UV disinfection and copper ionization to purify water without the use of chemicals. Traditional water purification methods often rely on chemical additives such as chlorine or sodium borate, which, while effective, can generate toxic byproducts, increase operational costs, and pose environmental hazards during disposal. Designed for eco-conscious applications such as clothes washing and household reuse, the system integrates additive manufacturing to create a compact, customizable, and low-cost solution. The solar-powered UV-C light targets microbial contaminants, while copper acts as a natural biocide, providing dual-action treatment in a sustainable, energy-efficient process. Results demonstrate effective removal of biological impurities while maintaining safe, reusable greywater quality. This work showcases how engineering, sustainability, and design innovation can converge to promote chemical-free water reuse, a step toward smarter resource management and circular living.

Thomas Pierson, Mechanical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Andrei Zagrai
Sponsored by: NM AMP (URS)

Small plate guided wave analysis for ISS experiment

Re-usability of commercial vehicles is essential for the modern commercial space industry and drives the need for in-flight structural integrity assessment. Structural Health Monitoring (SHM) offers a path toward continuous evaluation of vehicle health throughout launch, orbit, and re-entry phases of the flight. This research discusses the implementation of an SHM payload developed for integration into the Materials International Space Station Experiment (MISSE) on the International Space Station. The payload was designed for operation in Low Earth Orbit (LEO), and is instrumented for multiple SHM experiments. Artificial damage was introduced through a machined notch and controlled bolt loosening on an aluminum plate, with containment features preventing the escape of bolts. The aluminum plate is fitted with piezoelectric sensors that actuate and receive elastic guided waves for damage characterization. Such experiments introduce unique design and analysis challenges. SHM uses wave speed dispersion analysis of each guided wave mode, but small-scale plates produce complex response data. This research will discuss some of the numerical methods to determine wave speed in a small, refractive plate used in the payload. The data collected in orbit will provide data for feasibility of on-orbit SHM and piezoelectric sensor behavior in space conditions.

LIFE SCIENCE

Ashley Bradshaw, Biology
New Mexico Institute of Mining and Technology
Mentor: Dr. Moustapha Harb
Sponsored by: NM AMP (URS)

Polyvalent Bacteriophages to Combat Antibiotic Resistance Spread during Anaerobic Wastewater Treatment

Antibiotic resistant pathogens pose a critical threat to global public health. While wastewater treatment utilizes disinfection methods aimed at eradicating waterborne pathogens, applications of chlorination are inadvertently bolstering the antibiotic resistance of pathogenic bacteria and non-pathogens alike. With wastewater effluent serving as a reservoir, pathogenic bacteria carrying antibiotic resistance genes (ARGs) continue to disseminate across global water sources. New approaches are needed in order to effectively limit their spread. This project focuses on utilizing bacteriophages to combat antibiotic resistant bacteria in wastewater treatment processes. Previous works have aimed to isolate bacteriophages for application in wastewater treatment plants, with several efforts focused on attenuating antibiotic resistant bacterial occurrence. Given the diverse range of potential groups carrying resistance within wastewater treatment systems, the issue of phage host specificity remains outstanding. To address this issue, approaches have been previously developed aimed at isolating polyvalent bacteriophages (i.e., those that can infect pathogenic bacteria at the interspecies level). Our current work aims to advance knowledge on how polyvalent bacteriophages can target interspecific pathogenic bacteria in previously unstudied wastewater treatment environments. To achieve this, bacterial hosts have been isolated from an operating lab-scale anaerobic membrane bioreactor's (AnMBR) effluent on various types of media for the purpose of isolating polyvalent phages on said hosts. Experiments will be conducted applying these phages in the AnMBR to mitigate the presence of high-risk antibiotic resistant bacteria. Overall, this approach provides a promising avenue for safeguarding public health from the emerging microbial risks.

Austin Fritz, Biology
New Mexico Highlands University
Mentor: Dr. Justine Garcia
Sponsored by: NM AMP (URS)

Using bioinformatics to determine gut microbiome community composition of the squash bug (Anasa tristis) across multiple life stages

Multicellular organisms are host to diverse microbial communities which can have differing effects on the host. Often, microbial symbionts are transmitted vertically from mother to offspring. However, there are symbionts that are acquired horizontally from the environment, requiring targeted host strategies to select them from the environment. The squash bug Anasa tristis DeGeer is an insect (Hemiptera: Coreidae) that uses cucurbit plants as its source of food and habitat. Their primary gut symbionts are bacteria of the genus Caballeronia (formerly Burkholderia) which they contract from detecting and feeding on adult feces in the environment as nymphs, allowing the bacteria to colonize specialized organs in their midguts. Squash bugs can acquire multiple Caballeronia genotypes, but it is not well understood how diversity of symbiont infections are maintained throughout development. Here we survey the gut microbiome across multiple squash bug life stages and throughout the midgut to inform how A. tristis selects for specific Caballeronia bacteria post-acquisition. We extracted bacterial DNA from squash bug midguts, sequenced the 16S rRNA gene, separated into operational taxonomic units (OTUs), and compared against a genome database to determine bacterial species. We found that multiple Caballeronia OTUs are maintained, though dynamic changes in community structure also occur.

Fernanda Caldora, Chemistry
New Mexico State University
Mentor: Dr. Jessica Houston
Sponsored by: Other

Revealing the phenotypic profile of triple negative breast cancer cells from brain metastasis.

The brain is a first metastatic niche of recurrence after treatment of triple negative breast cancer. To successfully colonize the brain, in addition to crossing the blood–brain barrier, breast tumor cells must acquire characteristics to establish a favorable interaction with typical brain cell types. Thus, our main objective was to identify the characteristics of metastatic triple negative breast cancer with tropism for brain. In order to do this, parental MDA-MB-231 and MDA-MB-231-BR (metastatic specificity to the brain) cell lines were cultured for RNA extraction and cDNA first strand synthesis. The study investigated the expression of GABAergic markers (ABAT, GAD1/67, DLX1, and DLX2) and purinergic receptors (P2X7 and P2Y2) in both lines resistant or responsive to the chemotherapy drug Paclitaxel, using RT-qPCR. The relative expression analysis indicated that the BR cell line exhibits a GABAergic-like phenotype, favoring its adaptation to the brain. Chemoresistance intensified this profile, with up to a fivefold increase in the expression of GABAergic markers in the chemoresistant BR line, along with the overexpression of P2X7 and P2Y2. These findings suggest that chemoresistance may drive phenotypic plasticity and facilitate brain metastasis, highlighting the GABAergic and purinergic pathways as potential therapeutic targets for controlling tumor progression and treatment resistance.

Francis Silva, Conservation Ecology
New Mexico State University
Mentor: Dr. Obed Hernandez-Gomez
Sponsored by: NM AMP (URS)

Microbe Diversity on the Skin of Captive and Wild Chiricahua Leopard Frogs

Chiricahua leopard frogs (Lithobates chiricahuensis; CLF) are a vulnerable species of frog native to the southwestern United States and northern Mexico. They face many threats to their continued survival, including water pollution, habitat loss, and fungal disease. The fungus Batrachochytrium dendrobatidis (Bd) causes the skin disease chytridiomycosis in CLF, which is thought to be one of the major causes of their population's decline. A robust skin microbiome may improve survival rates of CLF in the presence of Bd, although it's currently unknown if there are key species in improving survival rates, or if captive breeding for reintroduction purposes negatively impacts CLF microbiomes. The knowledge generated in my study will be beneficial in identifying the effect of captivity on CLF skin microbiomes. Subsequently, these bacteria are being evaluated as potential probiotics in another laboratory project. Identifying the bacteria using genetic methods will provide us with the ability to grow the organisms more efficiently for further study.

Hanna Mora, Wildlife Biology and Conservation
New Mexico Highlands University
Mentor: Dr. Justine Garcia
Sponsored by: NM AMP (URS)

Surveying Dictyostelids in Arid, High-altitude Environments of Northern New Mexico

Dictyostelids, or cellular slime molds, are a group of eukaryotic soil microbes that are known for their multifaceted lifecycle, transforming from unicellular amoeba to multicellular aggregates with visible fruiting bodies. Although D. discoideum is a well-known biomedical model, little is known about the ecology of dictyostelids in general. Research has focused on ecology in subtropical and temperate deciduous forests, but dictyostelids are a global group and far less attention has been paid to slime molds from arid, high-altitude environments. We carried out a comprehensive survey of dictyostelid species present in northern New Mexico's arid, high-altitude forest and grassland environments by combining morphological and molecular analyses. We collected soil samples from a wide array of environmental niches found in Northern New Mexico and isolated dictyostelids by plating soil on hay infusion agar. We observed, photographed, and measured morphological and developmental traits for each dictyostelid morphotype for identification and then froze a clonalized culture. We have tentatively identified several dictyosteld species by morphology, including Acytostelium spp and Polycephalum spp, that may be endemic to Northern New Mexico or other arid regions as well as Dictyostelids known to inhabit other environmental niches and regions. To confirm and refine these identifications, we are amplifying and sequencing a portion of the 18S rRNA gene to identify each morphotype with molecular taxonomy. This survey expands understanding of dictyostelids in arid environments and provides insight into soil ecosystems during changing environmental conditions.

Itxel Barrera Moncayo, Chemical Engineering
New Mexico Institute of Mining and Technology
Mentor: Dr. Michaelann Tartis
Sponsored by: NM AMP (URS)

3D Modeling of a Pediatric Femur Phantom for Ultrasound-Mediated Drug Delivery Studies

Neuroblastoma is inherently difficult to treat due to metastasis in bone and bone marrow, which limits the use of non-aggressive treatments and is further complicated because of chemoresistance. Femurs are a common site for metastasis of neuroblastoma due to its bone marrow content and vascularization. To investigate treatment options, a femur phantom was modeled with a 3D-printed bone and polyacrylamide (PAA) hydrogel representing the bone marrow. Polylactic acid (PLA) filament served as a compact bone substitute, with hexagonal and gyroid infill patterns mimicking cancellous (spongy) bone. To mimic bone marrow, PAA formulations of 12 (w/v)% 60:1 & 15 (w/v)% 60:1 were rheologically analyzed and synthesized within the cancellous bone region of the model. A cavity was incorporated within the model to simulate vascular circulation where treatment can be delivered through ultrasound sonoporation, a technique that uses acoustic waves to create vascular permeation to allow chemotherapy drugs to be delivered. During testing, the hexagonal infill produced large air bubbles that interfered with ultrasound transmission, whereas the gyroid infill minimized large air pockets allowing ultrasound penetration. Further optimization of the model will include testing mechanical properties and acoustic properties before embedding organoids to model a tumor.

Jade Madrid, Biology
Northern New Mexico College
Mentor: Dr. Sushmita Nandy
Sponsored by: NM AMP (URS)

Transient Inhibition of Serum Amyloid A Suppresses the Expansion of Triple Negative Breast Cancer (TNBC) Stem Cell population

Acquisition and maintenance of cancer stem cells (CSCs) affects all stages of tumorigenesis. Enhanced stemness is shown to promote invasion and metastasis and is favored by altered metabolic states like hyperglycemia in Type II Diabetes (T2D). Our preliminary RNA-seq analysis of TNBC-enriched CSC under hyperglycemic conditions indicated increased expression of pro-inflammatory proteins, Serum amyloid A1 and A2 (SAA1/A2). Pathway enrichment analysis of the RNA-seq dataset suggested immune modulation as the most significant signaling pathway in response to hyperglycemia. Based on the preliminary data, we hypothesize that TNBC cells in response to hyperglycemia induce the increased expression of SAA1/2, promoting a pro-inflammatory environment. In this study, we report the impact of SAA1/2 suppression on the TNBC CSC population. To conduct this study, we transiently suppressed SAA1/2 expression using RNA interference in three human TNBC cell lines- MDA-MB-231, BT-549, and MDA-MB-157 and confirmed the inhibition using immunoblotting. CSC populations were analyzed using sphere-forming and flow cytometric assays. Results showed that TNBC cells with SAA1/2 suppression has significantly reduced ability to form tumorspheres and has reduced CD44+/CD24-/low cells compared to control. SAA1/2 might be a potential target for patients with comorbidity for T2D and TNBC.

Julian Martinez, Agricultural Economics and Agricultural Business
New Mexico State University
Mentor: Dr. Frannie Miller
Sponsored by: Other

Economic Pressures and Market Challenges: Coffee Farmers in Puerto Rico

Climate catastrophes, a lack of workers, and restricted access to processing facilities have made Puerto Rico's coffee industry vulnerable to market and economic pressures. Almost 80% of the island's coffee crops were destroyed by Hurricane Maria, making it difficult for smallholder farmers to recover and compete in a global market. Through vertical integration, cooperative development, and modernization this study investigates strategic avenues for resilience and profitability in the production of specialty coffee. Farmers are able to increase their profit margins and retain more value by controlling the entire supply chain, from cultivation to roasting and direct-to-consumer sales. Regional cooperatives provide a cooperative structure for access to modern-day processing facilities, labor pooling through the H-2A program, and cost-sharing. These tactics improve product quality and market diversity in addition to lowering operating costs. The study shows how a cohesive brand strategy prioritizing ethical labor practices, climate resilience, and Puerto Rican heritage could establish local coffee as a high-end product in niche markets. Eventually, Puerto Rico's coffee industry can become a more competitive and sustainable sector by empowering farmers through shared resources, infrastructure, and marketing.

Kaitlin Victorian, Microbiology
New Mexico State University
Mentor: Dr. Jacob Jaszczak
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Exploring Sensory Responses and Tissue Damage Caused by Acid Exposure in Drosophila melanogaster larvae

Chemically induced nociception is the process in which the nervous system produces an escape response to stimuli caused by chemical exposure. Previous research (Lopez-Bellido et al. 2019) shows that when exposing Drosophila larvae to low concentrations of hydrochloric acid (HCl) usually does not cause a nociceptive response, but at high concentrations a response is observed. Hyperalgesia is a state where tissue damage causes hypersensitivity to stimuli. It is unknown if exposure to chemical stimuli can induce hyperalgesia. This study examines whether Drosophila larvae experience hyperalgesia when exposed to a high concentration of HCl and whether recovery time impacts the sensory response. Additionally, the cell signaling response to tissue damage has been examined. A cell signaling damage response can be observed through the activation of an evolutionary conserved pathway known as the c-jun N-Terminal Kinase pathway (JNK). This pathway is activated through cellular stress or cell damage factors. Whether acid exposure activates the JNK pathway will be measured using beta-galactosidase histochemistry. Observing the sensory responses caused by acid exposure can give insight into how tissues recover from harmful stimuli. These findings can inform future therapies to treat tissues that experience damage due to acid exposure.

Kayden Robey, Biology and Economics
New Mexico State University
Mentor: Dr. Immo Hansen
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Buzz-Worthy Behavioral Assays: Understanding Male-to-Female Attraction and Ethanol-Induced Fitness Effects in Aedes aegypti

Aedes aegypti mosquitoes are a widespread nuisance and dangerous vectors of diseases such as dengue, chikungunya, and yellow fever. Sterile insect technique (SIT) is a promising approach for controlling mosquito populations without insecticides or genetically modified organisms. One limitation to SIT is the decreased reproductive fitness that irradiated A. aegypti experience from sterilization. In this study, we tested the fitness of A. aegypti male mosquitoes after feeding with 5% ethanol and 20% sugar compared to mosquitoes fed only sugar solution. Adult males were x-ray irradiated in a Multirad 350 with 50 Gy of exposure. Their activity was then measured immediately following irradiation and 48 hours post-irradiation using a locomotor activity monitor (LAM) assay. We also assessed A. aegypti attraction using various choice assays. Irradiated males with the ethanol-containing feed showed increased levels of activity after 48 hours compared to irradiated control male mosquitoes. There was no preference among irradiated males for female mosquitoes based on choice assays. Our findings suggest that A. aegypti fed hormetic ethanol results in fitter mosquito males, important in support of the development of SIT. Future research investigating other aspects of competitiveness, e.g., mating frequency, courtship behavior, and long-term survival, will be important for improving SIT.

Luis Ponce, Agricultural Economics and Agricultural Business
New Mexico State University
Mentor: Dr. Frannie Miller
Sponsored by: Other

Financial Analysis of Transitioning from Conventional Tillage to No-Till in Dryland Wheat Farming

While no-till or reduced-tillage practices are increasing in the U.S., adoption is much lower in Western states. This study evaluates the financial feasibility of transitioning from conventional tillage to no-till practices in dryland wheat farming in New Mexico, using a capital investment model to assess long-term costs and benefits. No-till agriculture offers proven agronomic advantages, such as improved soil structure, increased organic matter, higher moisture retention, and reduced erosion, but adoption remains limited due to high initial investment, uncertain financial returns, and management changes. The model incorporates equipment expenses, fuel, labor, maintenance, herbicide use, and nutrient savings to calculate net present value (NPV), internal rate of return (IRR), and discounted payback period (DPP) over 20 years. Results indicate that no-till adoption is generally financially viable, with a baseline NPV of $22,520, IRR of 13.24%, and DPP of 11 years. Sensitivity analysis reveals that nutrient savings, while beneficial, are less critical to investment outcomes than labor savings, which strongly influence profitability. Although herbicide costs create short-term risks, historical price stability supports long-term viability. The findings show that no-till is a strong, resilient option for dryland wheat producers when analyzed under realistic economic conditions.

Melanie Gonzales, Biology
University of New Mexico
Mentor: Dr. Jennifer Rudgers
Sponsored by: NM AMP (URS)

Temporal Trends and Climate Predictors of Monthly Abundance for Agapostemon melliventris

We used long-term data from the Sevilleta Long-Term Ecological Research site in New Mexico to study how climate change may affect Agapostemon melliventris, a native bee. This species was monitored across three ecosystems-desert shrubland, desert grassland, and plains grassland-providing a unique record of its abundance over time. To understand how climate influences this bee, we examined relationships with temperature, precipitation, vapor pressure deficit (a measure of heat and dryness), and the standardized precipitation-evapotranspiration index, which reflects drought conditions. We then used models to explore how these factors shape population trends and to forecast possible future changes. Our results shed light on how a key pollinator in arid environments responds to shifting climate conditions. By identifying the climate factors most closely tied to bee abundance, this work helps predict how pollinator communities may change in the future and what that could mean for ecosystems that rely on them.

Mohammad Al Aqtash, Chemical and Materials Engineering
New Mexico State University
Mentor: Dr. Gary A. Eiceman
Sponsored by: NM AMP (URS)

Comparisons of Volatile Organic Compounds Produced from Electrosurgical Cauterization of Human Brain Tumors and Other Tissues

Surgical smoke generated by electrosurgical tools contains aerosols and vapors including volatile organic compounds (VOCs) which can threaten the health of surgeons and surgical teams. These same aerosols and vapors however may provide chemical information on tissue types sufficient to distinguish healthy from cancerous tissues. Previous studies to guide tumor resection using chemical markers have been based on aerosols and pyrolysis mass spectrometry. In studies undertaken at Tampere University (Finland) with human brain tumors and other tissues, volatile organic compounds produced by electrosurgical cauterization were characterized using gas chromatography/mass spectrometry. Mixtures of more than 100 constituents were observed in total ion chromatograms from human samples and porcine brain and muscle (controls). Several tumor types were evaluated during the measurement campaign. Anonymized data sets are currently under evaluation to seek the presence of characteristic markers or other patterns of chemical information to distinguish brain tumors (and perhaps between types) from healthy tissue. The results are intended to contribute to the advancement of cost-effective, real-time tumor diagnostics, offering a potential alternative to conventional surgical margin analysis techniques, such as frozen section pathology. Studies were completed in collaboration with the University Medical Hospital, Tampere University under their ethical guidelines and supervision.

Paulina Castruita Garcia, Chemical Engineering
New Mexico State University
Mentor: Dr. Jessica P. Houston
Sponsored by: Other

Validating flow cytometry as a standard technique of BP3 detection in breast cancer cells.

Breast cancer is one of the leading causes of death and illness among women worldwide. Early detection significantly raise survival rates and reduce the disease's impact. The most common ER+ cancer cell lines used for testing new chemotherapies, exploring mechanisms of drug resistance, and understanding breast cancer biology are MCF-7 and T47D. Malignant tumors are known for having higher levels of Insulin Growth Factor Binding Protein 3 compared to benign ones, and elevated IGFBP3 is associated with poorer relapse-free survival in breast cancer patients. In ER-positive cancer cells, the IGFBP3 typically inhibits proliferation and promotes cell death by interfering with cell cycle-related proteins and activating apoptotic pathways. Over the years, different methods have been used for the characterization and analysis of cancer cells. That is why the aim in this project is to compare both microscopy and flow cytometry techniques to evaluate the expressed BP3 levels in the cancerous cells through fluorescence, in order to determine which technique is more sensitive and standardize flow cytometry for early detection in breast cancer on patients.

Sandra Rios Alba, Biochemistry
New Mexico State University
Mentor: Dr. Alan E. Tomkinson
Sponsored by: Other

Cockayne syndrome Protein B interactions with Poly (ADP-ribose) polymerases in DNA Repair

Cockayne syndrome is a disease that causes premature aging and is associated with developmental and neurological disorders. Cockayne syndrome protein B (CSB) is encoded by the ERCC6 gene, which is the most frequently mutated gene in Cockayne syndrome cases. CSB is best known for the crucial roles it plays in DNA repair and transcription, and is part of the SCWI2/SNF2 family of chromatin remodellers. CSB plays an important role in transcription-coupled repair of bulky DNA adducts, recognizing stalled RNA polymerase II molecules at damage sites. While it is not clear whether CSB is involved in the repair of other types of damage, it has been demonstrated that PARP1 interacts with CSB. The biological consequences of this interaction is unknown. Single-stranded breaks are sensed by PARP1 and 2, which are activated once they bind to single-strand breaks to synthesize poly (ADP-ribose) (PAR) that recruits DNA repair proteins. PARP1 is the most studied PARP enzyme and is recognized for the involvement it has in DNA repair processes and in other cellular processes, which include cell proliferation and cell death. PARP2 goes to repair sites after PARP1, where it starts to accumulate as a result of PARP1 activity. A recent report demonstrated that both PARP1 and PARP2 promote the recruitment of CSB to oxidatively damaged DNA. It is known that CSB has an important role in the regulation of histone PARylation during single-strand break repair (SSBR). A recent study suggested that CSB has a greater role in regulating PARP2 than it does in regulating the function of PARP1 during oxidative DNA repair. However, it is unknown whether CSB and PARP2 interact. The objective for this study is to use purified proteins and pull-down assays to characterize the physical and functional interactions among PARP1, PARP2, and CSB and define the molecular mechanisms of PARP- and CSB-dependent repair of oxidative DNA damage.

Sophia Rosa, Biomedical Sciences
New Mexico Institute of Mining and Technology
Mentor: Dr. Michaelann Tartis
Sponsored by: NM AMP (URS)

Using Decellularized Extra Cellular Matrix to Enhance Cellular Attachment to Hydrogel Surfaces

Traumatic Brain Injuries (TBIs) pose significant health risks in both military and civilian populations due to repeated exposure to blasts and blunt impacts. These injuries remain under investigation because accessing the human head during a TBI is challenging. Polyacrylamide (PAA) hydrogels have been used to replicate brain tissue, however, PAA hinders cell growth. A potential solution involves adding a protein layer to these hydrogels, which may enhance cellular or organoid attachment and improve studies of organoid deformation-a strain measure of damage post-impact. The current approach utilizes Matrigel®, a protein mixture derived from mouse tumors, which can be applied to improve cell attachment. Alternatively, a decellularized extracellular matrix (dECM) can be utilized as a protein-rich layer on the hydrogel surface providing cells with a conducive environment for growth. The dECM can be isolated through cell lysis, a process that breaks down cell membranes and releases intracellular proteins; through methods such as osmosis, and freeze-thaw cycles. Cell surface area analysis indicated no statistical difference between untreated hydrogels, 16.77% ±24.11% (n=4), and hydrogels treated with diluted matrigel, 20.89% ±18.96% (n=6). The findings suggest adding Matrigel to PAA hydrogels doesn't significantly change its proficiency. However, the dECM analysis revealed statistical differences using the freeze thaw method, 6.69% ±3.1% (n=4), and none using the osmosis method, 7.62% ±5.6% (n=4). Future research will explore dECM methods to further enhance the integration of hydrogels and cells, aiming to create biologically compatible surfaces for TBI research.

Willow Cunningham, Biology and Environmental Science
University of New Mexico
Mentor: Dr. Tomasz Falkowski
Sponsored by: NM AMP (URS)

Ecosystem Serivices of Secondary Forest Stages of the Lacandon Maya Agroforestry System

Using data collected by Lacandon Maya farmers to holistically quantify the provisioning ecosystem services provided by secondary forest stages of the Lacandon Maya agroforestry system. The Lacandon Maya milpa cycle is a successional, shifting agroforestry system initiated by cultivating 1-2 ha swiddens. There have been several studies analyzing maize production in the maintained kor stage of the cycle however, there are very few studies analyzing the provisioning services gathered from other forestry stages to support the Lacandon and the forest. This oversight underrepresents the cultural perspective of the Lacandon Maya but also possible restoration impacts, and health impacts. This study aims to provide a holistic perspective between a quantitative analysis and traditional ecological knowledge to determine cultural impact, health, and possible restoration efforts.

Yahir Ronquillo-Ojeda, Agricultural Economics and Agricultural Business
New Mexico State University
Mentor: Dr. Frannie Miller
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Diesel Powered Stationary Units for Irrigation Wells: Modern vs Old

Diesel engines are a cornerstone of agricultural irrigation, particularly in powering water pumping systems. This study evaluates the financial viability of transitioning from old to modern diesel-powered stationary units for irrigation wells, using a representative 100-acre pecan orchard in southern New Mexico as a case study. A capital investment model is employed to assess key economic metrics net present value (NPV), internal rate of return (IRR), and discounted payback period (DPP) under various scenarios. The baseline analysis, which considers fuel efficiency gains and reduced maintenance costs of modern engines against higher upfront costs and added requirements such as diesel exhaust fluid (DEF) and filter replacements, reveals that the investment is not financially justifiable without external incentives. However, incorporating compensation for nitrogen oxide (NOx) emission reductions significantly improves the investment's attractiveness, turning the NPV positive and yielding a viable IRR and DPP. Sensitivity analyses further demonstrate that investment feasibility is highly dependent on acreage size and NOx compensation pricing. The study concludes that while modern diesel units offer operational efficiencies, financial viability is contingent on environmental incentives and scale. Further research is recommended to assess the comparative feasibility of alternative irrigation power systems, such as electric, natural gas, or solar.

Zachary Tebay, Wildlife and Fisheries Science
Eastern New Mexico University
Mentor: Dr. Corey Green
Sponsored by: NM AMP (URS)

Effects of microplastics on aquatic ecosystems in Roosevelt County, New Mexico

This research explores the prevalence of microplastic contamination and its ecological impacts within freshwater systems in Roosevelt County, New Mexico. Our study is designed to measure the concentrations of microplastics in water bodies and fish populations, as well as to evaluate the biomagnification of these particles across food webs. We will gather water samples from a range of habitats, including Oasis State Park, urban runoff drainage areas, wastewater ponds, and private ponds. These samples will be analyzed using microscopy and Fourier-transform infrared spectroscopy (FTIR) to ascertain both the quantity and composition of microplastics present. Furthermore, fish samples will be dissected to investigate the accumulation of microplastics in their gills, muscles, and digestive tissues. By integrating this data, we aim to develop a biomagnification model that assesses how microplastics are transferred across trophic levels and their potential impacts on consumers, including humans and migratory birds. Our research is expected to reveal spatial patterns of microplastic pollution, identify likely sources of contamination, and evaluate the associated ecological and human health risks. Ultimately, this study will deepen our understanding of microplastic contamination in freshwater systems, inform future water quality monitoring efforts, and support conservation and public health initiatives in the southwestern United States.

PHYSICAL SCIENCE

Christopher Somer, Earth and Planetary Science
University of New Mexico
Mentor: Dr. Laura Crossey
Sponsored by: NM AMP (URS)

Water Quality and Recharge within the Sandia Ranger District, Cibola National Forest

The waters of the Sandia Mountains are a valuable resource of unique importance to multiple stakeholders and land managers. As a potential regional site to study the sustainability of aquifer recharge, the complex chemistry of water-rock interactions and fluctuating rates of annual snowpack and monsoonal rains provide opportunities to understand and monitor the effects of Climate Change on our local aquifers. Our aim is to sample, analyze and identify geochemical characteristics of wells, snowpack and springs along the mountain front of the Sandias, comparing our collected data to legacy UNM datasets from established sites as well as new sampling locations.

Eleanor Morton, Physics
New Mexico State University
Mentor: Dr. David Ruth
Sponsored by: NM AMP (URS)

Research and development of the Barrel Hadronic Calorimeter detector for the planned Electron Ion Collider at Brookhaven National Lab

The waters of the Sandia Mountains are a valuable resource of unique importance to multiple stakeholders The world of hadrons has been thought to be understood but is frequently improved upon and revised. The purpose of researching and developing the Barrel Hadronic Calorimeter is to widen the scope of nuclear physics by discovering the mysteries behind the particles that make up our world. Currently we are developing and editing the hyperparameters of a neural network intended to record data sourced from scintillating tiles that detect particles. Our current goal is to nullify data from external radiation and spotlight the data sourced from particles inside the detector. Editing the hyperparameters is more complicated than we would like it to be, so there has been a graphical user interface in development that will showcase the hyperparameters and allow us to edit them while also storing the data for future reference. The current data obtained via a simulation shows: at ~4000 epochs the network becomes the most precise, specifically generating data from values of 2.0 GeV, 5.0 GeV, 10.0 GeV, and 20.0 GeV. The most present data comes from 2.0 GeV with >2250 occurrences, followed by 5.0 GeV at >1250 occurrences, 10.0 GeV at >500 occurrences, and 20.0 GeV at <500 occurrences. We can surmise from this data that the most present particles in the simulation are received with a force of 2.0 GeV.

Mariana Navarrete, Physics
New Mexico State University
Mentor: Dr. Juie Shetye
Sponsored by: NM AMP (SCCORE)

Atmospheric Gravity Waves

Understanding local weather patterns is key for us to interact with the environment we live in. The matter becomes relevant to our daily activities when they are affected by unexpected weather events or potential indicators of turbulence. This research investigates twilight temperature values at ground level in Las Cruces, New Mexico, using a theoretical energy balance model paired with real temperature data from weather stations. We identify consistent oscillations in temperature during evening twilight hours that deviate from the normal cooling curve, which could be related to the formation of atmospheric gravity waves in the upper layers of the atmosphere. To determine whether this behavior is unique to Las Cruces or part of a regional pattern, we compare the temperature trends of different cities with similar characteristics in the area, including El Paso, Texas; Amarillo, Texas; and Tucson, Arizona. Other factors considered in the analysis include air pressure, humidity, wind direction, altitude, and geographic features such as mountain proximity. Results show that Las Cruces experiences intensified evening oscillations in comparison to the other cities. This research aims to use the combination of a theoretical model and real data to improve our understanding of temperature dynamics in arid environments. These findings can support decision-making in agriculture, transportation, and aviation.

Rowan Oglesby, Chemistry
New Mexico Institute of Mining and Technology
Mentor: Dr. Menake Piyasena
Sponsored by: NM AMP (URS)

Isolation of nano and micro plastics from aqueous samples

The occurrence of nano and micropalstics (MNPs) in the natural environment has emerged as a serious threat to human health. Various studies have demonstrated that MNPs can get into the human body via food and water. Though the conclusive studies on MNPs' health impact are still emerging, early studies show the impact can be severe. Thus, the development of MNPs removal techniques is vital. The isolation of small particles, especially in the sub-micron to nano range, has been a challenge for researchers for a while, often involving lengthy, multi-step procedures that can be expensive and time-consuming. Therefore, this research project aims to develop a method of separation for MNPs that is inexpensive, quick, and a single-step process, using acoustic forces integrated in a microfluidic device. A microfluidic device is first designed using CAD software, before being created on a silicon wafer via photolithography, followed by deep reactive ion etching and anodic bonding. An acoustic transducer is used to generate acoustic forces that then move the MNP's. In this poster, we will present our findings on MNPs isolation.

New Mexico AMP Administrative Offices

New Mexico Alliance for Minority Participation

MSC-3AMP
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
Telephone: (575) 646-1846
Fax: (575) 646-2960

Email: nmamp@nmsu.edu
Website: nmamp.nmsu.edu

Principal Investigator:
Lakshmi Reddi, Ph.D.
Director & Co-Principal Investigator:
Paola Bandini, Ph.D.
Associate Director:
Cecilia Contreras, Ed.D
Student Assistant:
Val Valenzuela
Graduate Assistant:
Cyrena Ridgeway, M.S.

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. This material was developed under the Award EES-2408898

New Mexico Higher Education Department

New Mexico AMP Institutions

Seven Formal Partner Universities

New Mexico State University, Lead University
Director, Paola Bandini
Professor, Department of Civil Engineering
paola@nmsu.edu

Eastern New Mexico University
Brian Pasko, Professor and Chair, Department of Mathematics
brian.pasko@enmu.edu

New Mexico Highlands University
Shantini Ramakrishnan, Conservation and Restoration Education Prog. Mgr., Conservation Science Center
shantinir@nmhu.edu

New Mexico Institute of Mining and Technology
Curtis O'Mally, Associate Professor, Department of Mechanical Engineering
curtis.omalley@nmt.edu

Northern New Mexico College
David Torres, Chair & Professor, Department of Mathematics and Physical Science
davytorres@nnmc.edu

University of New Mexico
Debbie Lee, Senior Program Manager, ARID Institute
debbieylee@unm.edu

Western New Mexico University
Zenaido Tres Camacho, PhD
Professor, Cell and Molecular Biology
Department of Natural Sciences
camachoz@wnmu.edu