NEW MEXICO AMP

ALLIANCE FOR MINORITY PARTICIPATION

2021 Virtual Student Research Conference Program

October 8, 2021

Lead Institution

NM STATE

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2021 Conference Program

Special Thanks

We want to acknowledge the support and assistance since 1993 from our funding agency, National Science Foundation Louis Stokes Alliances for Minority Participation (NSF LSAMP). Today, we welcome our NSF Program Director, Dr. Chrystal A. S. Smith, who is attending our conference today. Dr. Smith guides and assists us with New Mexico Alliance for Minority Participation. Below is more information about Dr. Smith.

Welcome, Dr. Chrystal A.S. Smith, NSF Program Director

Dr. Chrystal A.S. Smith is a cultural anthropologist who has designed and conducted STEM education mixed methods research projects that focus on broadening the participation of underrepresented groups. Currently, she serves as a Program Director at the National Science Foundation (NSF) as part of the Visiting Scientist, Engineer and Educator (VSEE) program. Her portfolio includes the Directorate for Education and Human Resources Core Research (ECR) and the Louis Stokes Alliances for Minority Participation (LSAMP). She is also an Assistant Professor in Residence in the Department of Anthropology at her home institution, the University of Connecticut. Dr. Smith received her Doctor of Philosophy (Ph.D.) in Applied Anthropology from the University of South Florida, her Master of Public Health (M.P.H.) from the University of South Florida, her Master of Applied Anthropology (M.A.A.) from the University of Maryland College Park, and her Bachelor of Arts (B.A.) in Anthropology from Howard University.

A special thanks also goes to the administrators, staff, faculty, mentors, parents, and families for the time, energy, support, and encouragement you have given the students and their research projects represented in this publication.

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. This material was developed under Grant HRD-182675.

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

Acknowledgements:

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

National Science Foundation

State of New Mexico

New Mexico State University (NMSU)

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

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Guillermo Blacker, Business Operations, Spaceport America

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Dr. Assata Zerai, VP for Equity and Inclusion, University of New Mexico

Dr. Salim Bawazir, NM AMP Co-PI and Associate Professor, Department of Civil Engineering, NMSU

Welcome . . .

to the 2021 Virtual New Mexico AMP Student Research Conference. The Conference provides students and faculty the opportunity to network, to share challenges and successes, and importantly, to showcase undergraduate research. The NM AMP Conference provides a forum for faculty and students to grow professionally, share ideas as we engage with and learn from one another. With Science, Technology, Engineering, and Mathematics (STEM) such an important aspect of our everyday lives, the NM Conference reflects the value our society continues to place on the evidence of science and technology and reflects the significant part students will play in broadening the global sustainability of STEM research and development.

This year, the conference provides you with the opportunity to meet and hear from many outstanding individuals. At the Opening Session, you will hear from the NMSU President, Dr. John Floros, who also serves as the NM AMP Principal Investigator. Our Speaker at the Opening session will be Dr. Jessica Perea Houston, who is NMSU Professor and Interim Department Head of Chemical and Materials Engineering. She is an alumna of NMSU and is from Santa Fe, NM. Dr. Houston attended Texas A&M University System in graduate school, and she was in the Louis Stokes Alliance for Minority Participation (TAMUS LSAMP) Bridge to the Doctorate program. Today, Dr. Houston will share her background with LSAMP and her journey to her current position, and she will focus on her research in biomedical engineering with an emphasis on biophotonics and optofluidics. The Keynote Speaker will be the Honorable State Representative Raymundo Lara from Doña Ana County. Representative Lara has a good understanding of the economic challenges in New Mexico and relates well to students, with a career background in Education. Representative Lara is an alumnus of NMSU.

The conference includes several engaging events to inspire and encourage progression in STEM, including workshops and opportunities to learn more about research being conducted at our partner institutions statewide. We welcome the New Mexico MESA and NMSU TRIO Upward Bound GISD/LCPS programs, who will have one workshop devoted to navigation of the conference and learning how to more knowledgeably select research presentations. We also welcome individuals from EPSCoR, the American Indian Program, Chicano Programs, Black Programs, the Indian Research Development (IRD) program, S-STEM programs, STEM-H, ReNUWIt, REinWEST, the MARTE program, MARC and others. A Faculty Panel will be presented with faculty panelists from UNM, NM Tech, NMSU, and NNMC, who will highlight best practices for mentoring undergraduate researchers. Three other workshops will be presented two times, so students can choose one workshop in the 9:15-10:15 timeslot and one workshop in the 10:30-11:30 timeslot. The three workshops will focus on Linkedin networking and practices; success in STEM, and strategies of success for applying to graduate school. The highlight of the conference is the poster research presentations and the Lightning Round competitions by our statewide students. At the final session of the conference, awardees will be announced for 1st, 2nd, and 3rd Place awards and the Lightning Round competition. Enjoy your time at the conference by networking, learning, having fun, and taking away the information to make the most of your academic and future professional careers!

Director of NM AMP, Jeanne Garland, M.A., RPC

NM Alliance for Minority Participation Virtual Student Research Conference

Friday, October 8, 2021

8:00 - 9:00 Opening Session

[Zoom Webinar Link]

RAFFLE

Welcoming Remarks:

- Jeanne Garland |NM AMP Director
- John Floros, Ph.D. | NM AMP Principal Investigator (PI) & NMSU President
- Salim Bawazir, Ph.D. | NM AMP Co-PI & NMSU Assoc. Professor of Civil Engineering
- Chrystal Smith, Ph.D. | National Science Foundation Program Director

Opening Session Speaker : Jessica Perea Houston, Ph.D. | NMSU Interim Department Head & Professor of Chemical & Materials Engineering

9:15 - 10:15 Workshops (Block A)

[Zoom Meeting Link]

Choose a Workshop Breakout Room

NM MESA & TRIO Upward Bound Orientation Anita Gonzales & Rosa De La Torre-Burmeister	**Developing Your Professional Network: LinkedIn** Hayden Randall	**I Am Studying a STEM Field! Now What?!!** Lucas Rivera & Holly Olivarez	**Applying for Graduate School: Strategies for Success** Miriam Chaiken, Ph.D.

9:30 - 11:30 Advisory Board Meeting (by invitation only)

- Welcome: Dr. John Floros, NMSU President and NM AMP Principal Investigator.
- Facilitators: Jeanne Garland, Director of NM AMP and Michelle Bloodworth, NM AMP Evaluator.
- Gaspard Mucundanyi, NM AMP Database Analyst, Sr.: 2020-2021 Data Report.
- Discussion.

10:30 - 11:30 Workshops (Block B)

[Zoom Meeting Link]

(Same Link as Block A)

Best Practices for Mentoring Undergraduate Researchers *Faculty & Staff Only* Caitie Brewer, Chair; Amanda Ashley; David Torres; Curtis O'Malley; David Hanson; Jose Cerrato	**Developing Your Professional Network: LinkedIn** Hayden Randall	**I Am Studying a STEM Field! Now What?!!** Lucas Rivera & Holly Olivarez	**Applying for Graduate School: Strategies for Success** Miriam Chaiken, Ph.D.

Agenda Continues on Page 9

NM Alliance for Minority Participation
Virtual Student Research Conference

Continued Agenda

11:30 - 12:30 Keynote Address [Zoom Webinar Link] RAFFLE

The Honorable Representative Raymundo Lara

Introduced by Ms. Jeanne Garland, NM AMP Director

Mentor of the Year Award presented by Jeanne Garland, Director

12:30 - 1:30 Lunch Break

1:30 - 2:30 Lightning Rounds [Zoom Meeting Link] RAFFLE

Students who wish to gain more public speaking experience will give a quick 2-minute speech about their research project, then answer questions from the Judges. One winner will be chosen from the 4-year universities and one winner will be chosen from the 2-year community colleges. Facilitated by Hayden Randall, NM AMP.

2:30 - 4:00 NM AMP Institutional Coordinators Meeting

By Invitation Only

Facilitators:

- Jeanne Garland, NM AMP Director
- Michelle Bloodworth, NM AMP External Evaluator

2020-2021 Data Report, Gaspard Mucundanyi, NM AMP Database Analyst

2:30 - 4:00 Open Viewing of Student Poster Presentations

To view student presentations, please go to nmampconf.nmsu.edu and click on "Poster Presentations" or go directly to nmampconf.nmsu.edu/poster-presentations/index.html

4:00 - 5:00 Awards Ceremony [Zoom Webinar Link] RAFFLE

- Poster Presentation & Lightning Round Awards, facilitated by Andi Johnson and Hayden Randall, NM AMP Graduate Assistants, Conference Planners, & Lead Judges
- Closing Remarks, Jeanne Garland, NM AMP Director

RAFFLE indicates raffle for students

NEW MEXICO AMP
ALLIANCE FOR MINORITY PARTICIPATION

2021 Conference
October 8, 2021

2021 NM AMP Virtual Student Research Conference Agenda

8:00 a.m. – 9:00 a.m.	**Conference Welcome and Keynote Speaker Presentation:** Welcome to Attendees: Jeanne Garland, Director of New Mexico AMP at the Lead Institution, New Mexico State University; Official Welcome: Dr. John Floros, President of New Mexico State University and NM AMP Principal Investigator; Introduction: NM AMP Co-PI, Dr. Salim Bawazir, Assoc. Professor, NMSU Department of Civil Engineering. Introduction of NSF Program Director for LSAMP: Dr. Chrystal Smith. **Keynote Speaker Presentation**: Dr. Jessica Perea Houston, Ph.D., Interim Department Head and Professor, Department of Chemical and Materials Engineering. Raffle, Hayden Randall. *Zoom Webinar: https://us02web.zoom.us/j/84234753861?pwd=MnJZMGlxRkh0TnZSNEZ3NCs3Z0d0Zz09*
9:00 a.m. – 9:15 a.m.	**Break.** **After the Break, Students, please attend 2 workshops of your choice** from Workshop 1, Workshop 2, or Workshop 3 this morning. Attend **one of the workshops in the 9:15-10:15** time slot and **another workshop in the 10:30-11:30** time slot (workshops listed below). *NM MESA and NMSU TRIO Upward Bound GISD/LCPS students will only choose one workshop from 10:30-11:30.* Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09 Once in the meeting, select the breakout room for the workshop you would like to attend (workshops listed below). This will be the same link for both workshop time blocks.
9:15 a.m. – 10:15 a.m.	**NM MESA Program and NMSU TRIO Upward Bound GISD/LCPS Program Orientation and Workshop**: Presented by Anita Gonzales and Rosa De La Torre-Burmeister. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
9:15 a.m. – 10:15 a.m.	**Workshop 1:** "Developing Your Professional Network: LinkedIn," Hayden Randall, Graduate Assistant, New Mexico Alliance for Minority Participation. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
9:15 a.m. – 10:15 a.m.	**Workshop 2:** "I Am Studying a STEM Field! Now What?!!" Lucas Rivera, NM AMP Alumnus from New Mexico State University (NMSU), currently a graduate student at NMSU, and Holly Olivarez, NM AMP Alumna from University of New Mexico, currently a graduate student at the University of Colorado Boulder. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
9:15 a.m. – 10:15 a.m.	**Workshop 3:** "Applying for Graduate School: Strategies for Success," Dr. Miriam Chaiken, former Dean of the NMSU Honors College. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
9:30 a.m. – 11:30 a.m.	**Advisory Board Meeting:** Welcome: Dr. John Floros, NMSU President and NM AMP Principal Investigator. Facilitators: Jeanne Garland, Director of NM AMP and Michelle Bloodworth, NM AMP Evaluator. Gaspard Mucundanyi, NM AMP Database Analyst, Sr.: 2020-2021 Data Report. Discussion. *Zoom Meeting Link Provided Only to Invitees*
10:30 – 11:30 a.m.	**Faculty Panel (For Faculty and Staff Only):** "Best Practices for Mentoring Undergraduate Researchers," Chaired by Dr. Catherine Brewer, Associate Professor, Chemical and Materials Engineering, NMSU; Dr. Amanda Ashley, Assoc. Professor of Chemistry and Biochemistry, NMSU; Dr. David Torres, Department Head of Mathematics and Physical Science, NNMC; Dr. Curtis O'Malley, Assistant Professor, Department of Mechanical Engineering, New Mexico Tech; Dr. David Hanson, Professor, Department of Biology, UNM; Dr. Jose' Cerrato, Professor, Department of Civil, Construction and Environmental Engineering, UNM. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
10:30 a.m. – 11:30 a.m.	**Workshop 1:** "Developing Your Professional Network: LinkedIn," Hayden Randall, Graduate Assistant, New Mexico Alliance for Minority Participation. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
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10:30 a.m. – 11:30 a.m.	**Workshop 3:** "Applying for Graduate School: Strategies for Success," Dr. Miriam Chaiken, former Dean of the NMSU Honors College. Workshop Zoom Meeting Link: https://nmsu.zoom.us/j/99481645318?pwd=bGliOXBXZ3JxUXY1dGtmcWxGVjZZZz09
11:30 a.m. – 12:30 p.m.	**Keynote Address:** Welcome Back! Jeanne Garland, Director: Introduction of **Keynote Speaker: New Mexico Representative Raymundo Lara**. Announcement of the Mentor of Year Award. Raffle, Hayden Randall. *Zoom Webinar: https://us02web.zoom.us/j/82272293190?pwd=V3NMektYd2VMMFhSbWpDSFlvc1VpUT09*
12:30 p.m. – 1:30 p.m.	**Break for Lunch**
1:30 p.m. – 2:30 p.m.	**Lightning Rounds:** Students who wish to gain more public speaking experience will give a quick 2-minute speech about their research project, then answer questions from the Judges. One winner will be chosen from the 4-year universities and one winner will be chosen from the 2-year community colleges. Raffle, Hayden Randall. *Zoom Meeting: https://nmsu.zoom.us/j/93726214005?pwd=QlRGLzl4Tjg1T3RUdmtNcHZoWVpuZz09*
2:30 p.m. – 4:00 p.m.	**New Mexico AMP Institutional Coordinators (IC) Meeting**: Facilitators: Jeanne Garland, Director of NM AMP and Michelle Bloodworth, NM AMP External Evaluator. Gaspard Mucundanyi, NM AMP Database Analyst, Sr.: 2020-2021 Data Report. *Zoom Meeting Link Provided Only to Invitees*
2:30 p.m. – 4:00 p.m.	**Open Viewing of Student Posters and Video Presentations.** Please go to https://nmampconf.nmsu.edu/ and click on "Poster Presentations" or go directly to https://nmampconf.nmsu.edu/poster-presentations/index.html
4:00 p.m. – 5:00 p.m.	**Awards.** Raffle, Hayden Randall. *Zoom Webinar: https://us02web.zoom.us/j/89472407575?pwd=aVlCM05UNHB6RCttUDRkSXBNZDl4QT09*

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Welcome to Our New Co-PI!

Dr. Salim Bawazir, Associate Professor, Department of Civil Engineering, New Mexico State University, Lead Institution of NM AMP

Dr. Salim Bawazir is a tenured associate professor in the Department of Civil Engineering at New Mexico State University (NMSU). He graduated from NMSU with Bachelor's degrees in Civil Engineering and Agricultural Engineering in 1988, Master's degree in Civil-Water Resources Engineering in 1993, and a Ph.D. in Civil-Water Resources Engineering in 2000. He is distinguished in water conservation and management and has over 20 years of experience in research and academia. His research activities include micrometeorological monitoring and instrumentation, riparian and agricultural water conservation, evapotranspiration measurement and modeling, the turbulent exchange above water surfaces and reservoir operation, ecological restoration, and modeling of flow in unsaturated soils.

Dr. Bawazir completed 10 years in June 2021 as the Lead Investigator of the NSF ERC-Stanford ReNUWIt research 10-hectare test-bed to rehabilitate the riparian area at Sunland Park, NM, and is on a no-cost extension until July 2022. During the 10-yrs, the research project at Sunland Park supported 55 students ranging from 2-yr community college to Ph.D. level in civil, mechanical, and environmental engineering. Dr. Bawazir is currently the PI for reservoir evaporation studies at Elephant Butte and Caballo and PI of crop water use measurement and remote sensing as part of a Transboundary Aquifer Assessment Project (TAAP) with USGS/NM Water Resources Research Institute.

During the last 20 years, Dr. Bawazir has completed several research projects and teaching grants as PI and Co-PI, totaling more than $5M. Through these projects sponsored by the U.S. Bureau of Reclamation, U.S. Bureau of Indian Affairs, U.S. Department of Agriculture, National Science Foundation, NM Office of the State Engineer, the Interstate Stream Commission, and others, these projects have provided financial support to several graduates and undergraduate students.

Dr. Bawazir has supervised research programs for several masters and doctoral students and mentored undergraduate students in research from various STEM programs at NMSU and other universities for more than 20 yrs. He has published peer-reviewed technical reports and journals, book chapters, monographs and provided more than 200 poster and oral presentations. He is a reviewer for several journals, including the International Journal of Remote Sensing, Remote Sensing, Journal of Irrigation and Drainage, Pedosphere, and Journal of Mountain Science.

Dr. Bawazir has served two terms as NMSU faculty senator representing the College of Engineering and served as Faculty Advisor to National Society of Black Engineers (NSBE) and American Society of Agricultural and Biological Engineers (ASABE) local student chapter at NMSU. Since 2000, he has provided pro bono consultation on site selection, instrumentation, and installation of climate stations in New Mexico.

Opening Session Speaker: 8:00 a.m. – 9:00 a.m.
Dr. Jessica Perea Houston, Professor and Interim Department Head, Chemical and Materials Engineering, NMSU

Jessica Perea Houston, Ph.D., is Interim Department Head of Chemical and Materials Engineering and Professor at New Mexico State University (NMSU) in Las Cruces, NM (2009-present). Dr. Houston received her Ph.D. in Chemical Engineering from Texas A&M University and was a Director's Postdoctoral Fellow at the Los Alamos National Laboratory Bioscience Division. She is an alumna of NMSU and is from Santa Fe, NM. In graduate school, Dr. Houston was a Texas A&M University System Louis Stokes Alliance for Minority Participation (TAMUS LSAMP) Bridge to the Doctorate (BTD) graduate student (Cohort #1, 2003-2005).

Her research expertise includes biomedical engineering with an emphasis on biophotonics and optofluidics. She studies flow cytometry instrument optimization, the implementation of fluorescence dynamics measurements using high throughput systems, and general science in quantitative single cell analyses. Dr. Houston directs a flow cytometry instrumentation lab at NMSU, and she has trained over 50 graduate and undergraduate students and postdoctoral fellows combined. Many of her mentees are from underrepresented backgrounds and have been successful; for example Dr. Jesus Sambrano Jr., received the NIH Ruth L. Kirschstein NRSA (F31) Predoctoral Fellowship to Promote Diversity in Health-Related Research.

Dr. Houston has also been a recipient of numerous federal research grants for projects that involve novel ways to measure the fluorescence lifetime with a cytometer. She has presented > 400 abstracts, >50 publications; > 30 invited national/international talks. She holds a patent on lifetime measurements with cytometry, and authors book chapters and editorials. Some notable honors include: Faculty Fulbright Scholar to Japan (2018); Best Paper in Cytometry Part A, 2015; a *Synergy-One* award (NMSU College of Engineering) *Outstanding Junior Faculty* (NMSU Hispanic Faculty and Staff Caucus); *Early Career Award* (NMSU Research Council) NSF CAREER award (National Science Foundation); and ISAC Marylou Ingram *Scholar*. She is an Associate Editor for the Journal, *Cytometry Part A,* is Co-Chair for the Photonics West BiOS Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XX conference, and is a standing member of the Cell & Molecular Technolgies Study Section for the Center for Scientific Review, NIH.

Keynote Speaker: 11:30 a.m. - 12:30 p.m. Session
The Honorable New Mexico Representative, Raymundo Lara, (D) 34th District

Raymundo Lara is New Mexico Representative and educator, currently serving as a member of the New Mexico House of Representatives from the 34th district, which includes Santa Teresa and Sunland Park in Doña Ana County. Representative Lara took office on January 15, 2019. He has standing committee membership in House Appropriation and Finance and serves on the Education Committee. Representative Lara serves as Interim Committee Member of the Economic Development and Policy Committee, the New Mexico Finance Authority Oversight Committee, the Legislative Education Study Committee, the Water and Natural Resources Committee, and is Designee to the Legislative Finance Committee.

Representative Lara earned a Bachelor of Arts degree from New Mexico State University. Prior to entering politics, Representative Lara spent 17 years in K-12 education and worked as Program Coordinator for the Gadsden Independent Schools.

9:15 a.m.-10:15 a.m.
New Mexico Mathematics, Engineering, Science Achievement (NM MESA), Inc. and NMSU TRIO Upward Bound GISD/LCPS Workshop for NM MESA and TRIO Upward Bound GISD/LCPS Participants:

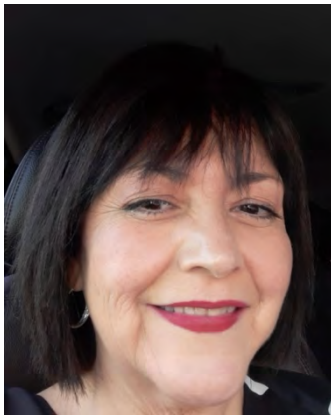
***(NOTE: NM MESA and NMSU TRIO Upward Bound GISD/LCPS students** will have a Workshop at 9:15 a.m.-10:15 a.m. that will be facilitated by Anita Gonzalez and Rosa de la Torre-Burmeister. NM MESA and Upward Bound students will choose one workshop to attend in the 10:30-11:30 a.m. timeslot after they attend the NM MESA and Upward Bound Workshop.)*

"Navigating the Virtual NM AMP Conference and Reading/Deciphering the Abstract"

Lead Facilitator: Anita Gonzales, Statewide Program Coordinator, NM MESA, Inc.

Anita Gonzales, a native New Mexican, Anita Gonzales was born in Las Vegas, NM to both the Lopez Family of Villanueva, NM and the Gallegos Family of Las Vegas, NM. A middle child, Anita moved between Las Vegas and Albuquerque and graduated high school from West Mesa High School. After completing the majority 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. Anita 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 from across the state.

Facilitator: Rosa M. De La Torre-Burmeister, TRIO Upward Bound GISD/LCPS Director

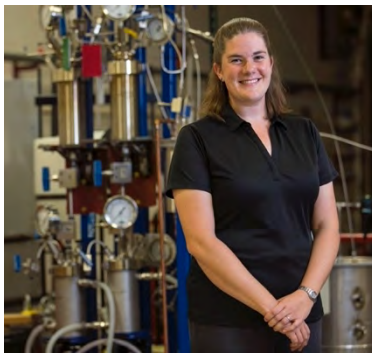


Rosa M. De La Torre-Burmeister is the Director of NMSU's TRIO Upward Bound GISD/LCPS Program. She holds a Master's degree from NMSU and a Bachelor's degree from William Penn University. Ms. Burmeister has over 25 years of experience in higher education and providing student support programs and services at several institutions including NMSU-Las Cruces, NMSU-DACC, University of Missouri, Elizabethtown College, Milton Hershey School, William Penn College, Central College, University of Malawi-Chancellor College. Prior to leading TRIO Upward Bound, she served as the Director of NMSU-DACC's Center for Career and Student Success. She has also worked as an Academic Advisor, Transition Coach, Training & Development Coordinator, Assistant Director of the Family Business Center, Program Specialist, and Graphic Communications Coordinator. Her academic training and experience have allowed her to provide opportunities in Iowa, Pennsylvania, Missouri, Africa, Costa Rica, and Belize.

FACULTY PANEL (10:30-11:30 A.M.)

Designed For Faculty and Staff:

Faculty Panelists:



Panel Chair: Dr. Catherine "Catie" Brewer, Professor, Chemical and Materials Engineering, New Mexico State University)

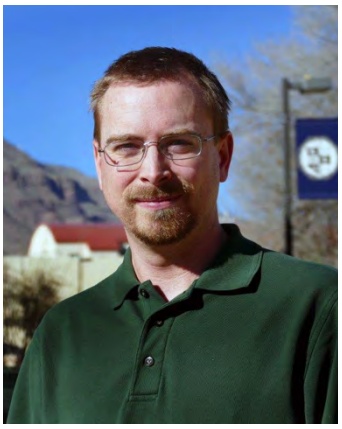
Dr. Catherine "Catie" Brewer is the John Kaichiro Nakayama and Tome Miyaguchi Nakayama Endowed Professor in the College of Engineering and an Associate Professor in the Department of Chemical & Materials Engineering. She received a B.S. in Chemistry from Indiana University of Pennsylvania and a Ph.D. in Chemical Engineering and Biorenewable Resources & Technology from Iowa State University. Prior to joining the faculty at New Mexico State University in 2013, she completed a postdoc at Rice University. Her graduate and post-graduate research focused on biochar characterization and engineering for soil and water remediation application. Her current interests include thermochemical biomass conversion (pyrolysis, hydrothermal liquefaction, torrefaction), products from alternative crops (guar, guayule, hops, hemp), brewing, management of desert soils, and biosystems engineering.

Panelist: Dr. David Hanson, Interim Associate Vice President for Research of Research and Professor of Biology, University of New Mexico

Dr. David Hanson received his Ph.D. in 1999 from the University of Wisconsin-Madison and spent 2.5 years as a post-doctoral fellow at the Australian National University. He joined the faculty at the University of New Mexico in 2002, where his research focuses on physiological, ecological, and energy-related aspects of photosynthesis in plants and algae, particularly elements of the carbon reactions and water relations. He has over 50 peer-reviewed publications, and active funding from seven research grants and contracts totaling ~$14 million: two from the National Science Foundation, one from the Advanced Research Projects Agency-Energy (that produced a patent and his start-up, Growvera, Inc), two from the Department of Energy, and two from NASA for research on the International Space Station. He currently supervises research projects that span biology, engineering, and physics, working with many forms of life from microorganisms to trees, and several of these projects are collaborations with Sandia National Labs and Los Alamos National Lab. His new role in the Office of the Vice President for research will focus on industry relations, economic development, and IP/tech transfer.

Panelist: Dr. Amanda Ashley, Professor of Biochemistry, New Mexico State University

Dr. Amanda Ashley received her B.S. at New Mexico State University and completed her Ph.D. and postdoctoral research at Colorado State University. Her research focuses upon the role of DNA damage and repair in diseases including cancers and neurodegenerative conditions. She is currently an associate professor in the department of Chemistry and Biochemistry. Dr. Ashley's research focuses on replication of genetic information, a fundamental biological process common to all living organisms, and maintenance of its integrity. DNA repair systems protect cells from damage caused by numerous intrinsic and extrinsic sources, thereby helping to maintain genome integrity. The genome is particularly vulnerable during DNA replication, and a growing body of evidence supports a nexus between replication and repair factors that act in complex enzymatic and signaling networks in response to DNA damage-induced replication stress. Various proteins have been identified during the last decade that function to stabilize and restart stalled replication forks, and restart collapsed forks. Many of these proteins have well-defined roles in DNA double-strand break repair, including homologous recombination (HR) repair, non-homologous end-joining (NHEJ) and/or DNA damage checkpoint signaling. Dr. Ashley's research centers on perturbations in DNA replication that can potentially precede carcinogenesis in an attempt to elucidate cancer etiology and provide novel targets for chemotherapeutic interventions.



Panelist: Dr. Curtis O'Malley, Department of Mechanical Engineering, New Mexico Institute of Mining and Technology

Dr. Curtis O'Malley holds a B.S. in Civil and Architectural Engineering from Drexel University, and M.S. and Ph.D. degrees in Civil Engineering from Georgia Institute of Technology. He has been a faculty member at New Mexico Tech since 2012 and is currently Assistant Professor in the Mechanical Engineering Department. He is the department's Director of STEM Outreach, leads the Mechanical Engineering Department's new student advisors, and chairs the department's Transfer Evaluation (Transfer Students), Public Relations and Recruitment, and Safety committees. He teaches the Mechanical Engineering Capstone Design courses, works closely with industry partners and freshman design courses (hands-on design courses for freshmen) as well as general engineering classes. His primary area of research is STEM and Engineering Education. His research group averages 10 students each semester, working on a variety of STEM education projects. These range from developing, implementing, and assessing new content and approaches for freshman engineering courses to developing demonstrations, workshops, and STEM development programs for students in middle and high school. He is currently promoting and developing the New Mexico Robot Combat League (NMRCL) with ongoing STEM classes/workshops. The second NMRCL tournament is scheduled for November 6, 2021 on the campus of New Mexico Tech.

Panelist: Dr. David Torres, Department Chair, Mathematics and Physical Science, Northern New Mexico College (NNMC)

Dr. David Torres is Chair of the Department of Mathematics & Physical Science at Northern New Mexico College (NNMC). He earned his Ph.D. in Mathematics from the University of New Mexico in 1996. His research interests include computational fluid dynamics, parallel computer simulations, and biological models. He has served as the Institutional Coordinator at NNMC since 2009, and he also served as a Faculty Mentor for students' research projects. He was named NM AMP Mentor of the Year in 2020.

Panelist: Dr. Jose Cerrato, Associate Professor, UNM

José M. Cerrato is Associate Professor at the University of New Mexico. He obtained a B.S. in Civil Engineering from the National Autonomous University of Honduras, and M.S. and Ph.D. in Environmental Engineering from Virginia Tech. He was also a Postdoctoral Researcher in Washington University in St Louis. His research interest is related to biogeochemical processes occurring at molecular and macro scales at the interface of water and energy. He has been a recipient of the National Science Foundation (NSF) CAREER Award and Fulbright U.S. Scholar Senior Research Award to Spain. He was also NM AMP Mentor of the Year in 2017.

STUDENT WORKSHOPS:
FIRST SESSION: 9:15 A.M.-10:15 A.M.; SECOND SESSION: 10:30 A.M.-11:30 A.M.

Choose two (2) of the following three workshops to attend. The three workshops will be held from 9:15 a.m.-10:15 a.m. and will be repeated in the 10:30 a.m.-11:30 a.m. timeslot. *(Choose one workshop for the first session (9:15 - 10:15 a.m.) and choose one workshop for the second session (10:30 a.m. -11:30 a.m.)*

WORKSHOP 1: "DEVELOPING YOUR PROFESSIONAL NETWORK: LINKEDIN," HAYDEN RANDALL, PRESENTER.

In this workshop, attendees will learn how to increase their professional networking skills through LinkedIn, including how to write a personal summary.

Presenter: Hayden Randall is a M.S. student in the Civil Engineering Department at New Mexico State University (NMSU). Growing up, Hayden raised livestock and was very involved in the agricultural community of Taos, NM. Hayden merged his passions for agriculture and making the best better by pursuing his Bachelor of Science in Civil Engineering degree at NMSU, with a minor in Agricultural Engineering. Hayden's research centers around streamflow prediction of the Rio Grande using artificial intelligence techniques. Hayden actively works to increase the diversity and abilities of the STEM workforce, and he has worked with the New Mexico Alliance for Minority Participation (NM AMP) for nearly two years.

WORKSHOP 2: "I AM STUDYING A STEM FIELD! NOW WHAT?!!" LUCAS RIVERA AND HOLLY OLIVAREZ, PRESENTERS.

In this workshop, the presenters will focus on a general theme of retention of STEM students. The presentation will include discussion about what it is like to be a first-generation student and the feelings that result from sometimes being treated as the 'other.' The presenters will discuss what it was like to come from a small agricultural town to study at university, and the journey to the success they both achieved during their undergraduate/graduate careers. The presenters will discuss what they felt contributed to their greatest successes as well as the lessons they wished they had learned earlier. The presenters plan for this workshop to be more student-centered, with plenty of time for discussion, questions, and student input.

Presenter: Lucas Rivera is a Master's student in the Civil Engineering program at New Mexico State University. He participated in the New Mexico Alliance for Minority Participation (NM AMP) for three years during his undergraduate degree, and he is working in the same research center as he worked when he began with NM AMP. Lucas loves community service based on engineering infrastructure and has participated in community service initiatives in eight countries around the world as well as locally in his home state of New Mexico. Lucas hopes to use the knowledge he gains as an engineer to continue using engineering infrastructure to make local and international communities a better place.

(continued from p. 11) "I Am Studying a STEM Field: Now What?!"

Presenter: Holly Olivarez is a Ph.D. student in the Environmental Studies Program at the University of Colorado Boulder. Holly began her undergraduate studies at Central New Mexico Community College (CNM), participated in the 2017 Summer Community College Opportunity for Research Experience (SCCORE), transferred to the University of New Mexico (UNM) and continued to be involved in research in NM AMP programs. Holly graduated from UNM in 2019 with a Bachelor of Science in Earth and Planetary Sciences from UNM. Holly also participated in the SOARS program, a ten-week research internship at the National Center for Atmospheric Research in 2018 and 2019. Holly was awarded the National Science Foundation Graduate Research Fellowship (NSF GRFP) and is currently studying oceanography. Holly is active in the work she does for her BIPOC (Black, Indigenous People of Color) colleagues and advocates for her school to prioritize creating large-scale systemic changes that can positively impact racial justice, access, and equity.

WORKSHOP 3: APPLYING FOR GRADUATE SCHOOL: STRATEGIES FOR SUCCESS, DR. MIRIAM CHAIKEN, PRESENTER.

In this workshop, Dr. Miriam Chaiken discusses practical and applicable strategies that can make the academic journey for students more successful.

Dr. Miriam Chaiken is a cultural anthropologist and she has more than three decades of experience working in both leadership in higher education, and international economic development and humanitarian response. In her final position at NMSU as the Dean of the William Conroy Honors College, Dr. Chaiken facilitated opportunities for the university's "best and brightest."

NM AMP STUDENT ADVISORY BOARD for 2021-22

We welcome the following students to the NM AMP Student Advisory Board for 2021-22. On a rotational basis, NM AMP Partner Institutions select Student Advisors to assist the Institutional Coordinators (ICs) with recruitment, important feedback, and attendance at events to represent NM AMP. The Student Advisor serves as a role model for other students and helps to spread the good news about NM AMP and its opportunities through recruitment events and participation in the institution's NM AMP programs during the school year.

This year, we introduce and welcome the new NM AMP Student Advisors from the following partner institutions: New Mexico Institution of Mining and Technology (NM Tech), New Mexico State University, Northern New Mexico College, University of New Mexico, Central New Mexico Community College, Doña Ana Community College, and Luna Community College.

New Mexico Institution of Mining and Technology (NM Tech) Student Advisor, Mya Martinez-Metzger

Mya Martinez Metzger, the Student Advisor at NM Tech, majors in biomedical sciences and technology with an emphasis in biology and a concentration in biomaterials. Mya's life goal is to become a trauma surgeon one day. In her free time, she loves to run and to spend time with her dog.

New Mexico State University Student Advisor: Andy Martinez

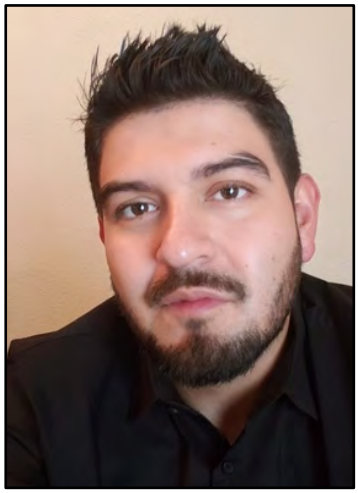
Andy Martinez is a Senior who will be graduating with the Bachelor's degree in Chemical Engineering from NMSU in May, 2022. Andy's research under Dr. Jessica Houston is focused on performing cell cycle analysis of breast cancer cells using flow cytometry. Upon graduation, Andy would like to pursue graduate studies in chemical or biomedical engineering. Andy notes that NM AMP has been incredibly generous in their support of his research journey, and that he is proud to serve as a Student Advisor for NM AMP at NMSU in 2021-2022.

Northern New Mexico College Student Advisor: Josef Weese

Josef Weese is a 22-year-old from Pojoaque that attends Northern New Mexico College and is majoring in Information Engineering Technology. This is his 3rd year as a part of the Undergraduate Research Scholars (URS) program. He works with Charles Knight, his Faculty Mentor, and they have been studying Euclid's Elements and the proof of the Pythagorean Theorem. He has mentored with the Northern New Mexico STEM Mentor Collective for over five years working hands-on with K-12 students in subjects such as Programming, 3-D Printing, Robotics, and Circuits. He is interested in pursuing a Master's degree in Computer Engineering and plans to have a career in Application Development.

University of New Mexico Student Advisor: Brittany Griego

Brittany Griego is a senior at the University of New Mexico working towards a B.S. in Geology and a Minor in History. She has been involved in NM AMP since 2016, beginning with the SCCORE program, then transferring to UNM and participating in the URS program. Brittany is a member of the Honor Society of Leadership and Success Sigma Alpha Pi chapter at UNM and was an active participant in the Academic Honor Society Phi Theta Kappa chapter at Central New Mexico Community College. Future aspirations include attending graduate school in Hydrogeochemistry, with a concentration on different areas of study. Brittany is interested in publishing and continuing to research, with a focus on finding new groundwater sources and the geochemistry changes through water rock interactions in different geological settings.

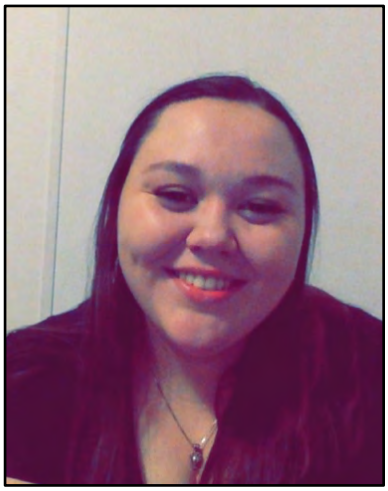


Central Community College Student Advisor: Mario Portillo

Mario Portillo, Central Community College NM AMP Student Advisor, is in the process of completing the Associate degree in Engineering. After that, he plans to transfer to university and pursue a Bachelor’s degree in Mechanical Engineering, with a focus in the robotics field. Mario’s mission is to contribute to the biomedical field with his designs and inventions. Mario currently participates in competitive robotics to get a clearer understanding of computer programming and robotics. He also has a mentor in Machine Tool Technology who has guided him to use sketches or blueprints in design.

Doña Ana Community College Student Advisor: Ashley Medina-Cardona

Ashley Medina-Cardona is originally from Phoenix, Arizona, but lived most of her life in Berino, NM. In middle school, Ashley participated in New Mexico MESA, which introduced her to engineering, where her primary interest lies. Ashley is In her second year at DACC, and her academic goals include earning the Associate of Science degree, then transferring to New Mexico State University and majoring in Chemical & Materials Engineering. Her community college experience has been enhanced by her involvement last summer in the SCCORE/REinWEST program. Ashley plans to continue to seek the NM AMP opportunities. After Ashley graduates from NMSU, she hopes to attend the Illinois Institute of Technology to earn a Master's degree in Food Process Engineering.



Luna Community College Student Advisor: Mary Frances Bibb

Mary Frances Bibb, the 2021-22 Student Advisor for Luna Community College, was born and raised in Las Vegas, New Mexico, where her passion for math and science was fostered. She is a double major at Luna Community College, majoring in General Science and Mathematics. Mary Frances is also currently employed at Luna CC as a Student Tutor for the Academic Center for Excellence, (ACE) Lab, through which she is provided the opportunity to help her fellow classmates reach their educational goals. Mary Frances' career goal is to work for the Forest Service as an Animal Conservationist one day.

STUDENT POSTER PRESENTATIONS

Lead Judges for Poster Presentations: Hayden Randall & Andi Johnson

Lightning Rounds: 1:30-2:30:

The Lightning Round segment of the Conference provides an opportunity for conference student participants to hone their public speaking skills and gain experience to "think on their feet." Students who choose to participate are asked to give a 2-minute speech about their research project, then answer questions from the Judges. One winner will be chosen from the 4-year universities, and one winner will be chosen from the 2-year community colleges.

Student Poster Presentations: 2:30-4:00 p.m.

These presentations have been recorded, and you can view these until October 31, 2021 on the following link:
https://nmampconf.nmsu.edu/poster-presentations/

ENGINEERING

Alexander S Acuna, Electrical and Computer Engineering Technology
New Mexico State University
Mentor(s): Paul M. Furth, New Mexico State University, Professor of Engineering Technology
Program: NM AMP

Optic Sensor Testing for Visual Emergency Vehicle Detection Sensor

The current emergency vehicle detection sensors only use the loud audio signal of the siren. These detection sensors are used to allow emergency vehicles to enter gated communities. This new sensor could help improve the reliability of current detection systems and may help (the average response time of emergency vehicles in gated communities). The Visual Emergency Vehicle Detection Sensor (VEVDS) is designed to detect emergency vehicles using the time-varying colored light waves emitted from the vehicle's lightbar. In this project, we implement a zero-crossing counter program using an Arduino microcontroller and optical RGB color sensors. Current progress is in the testing a multi sensor design using two or more color sensors for speed, accuracy, static sensitivity, and processing overhead.

Carissa M Arthur, Electrical Engineering
New Mexico Tech
Mentor(s): Jianja Yu, PhD., Adjunct Faculty & Leonard Garcia, Research Asscoiate; New Mexico Tech, Petroleum Recovery Research Center
Program: NM AMP

Navajo Nation Water Purification Project

Water on the Navajo Nation is neither safe nor accessible. Contaminants such as Uranium, Arsenic, Calcium, Manganese, Lithium, and Vanadium have been found in watering holes that Navajo Nation residents depend on. Ingesting these contaminants on a regular basis can result in cancer and shorten life expectancy. Creating a cost-effective, self-supporting filter efficient enough to remove specific contaminants is the challenge being faced. We are working with the Navajo Nation Water Purification Project in which much of the information is classified. We are assisting with the development of specialized hollow fibers to filter out dangerous contaminants. We researched and tested different hollow fibers, and worked on the simplicity, reliability, and strength of them. We recently found a way to package and create the filters, and currently are working on assembly and design. In the future, we will build a portable filtration unit to conduct field testing and data collection. We hope to complete Phase 1 of the project by completing the design of the filters. Access to clean water is a human right, and we hope to help Navajo Nation residents obtain that right.

Mohammad A Badawy, Chemical Engineering
New Mexico State University
Mentor(s): Dr. Reza Foudazi, New Mexico State University Department of Chemical and Materials Engineering, Associate Professor
Program: NM AMP

Fabrication of a Thermoresponsive Pluronic F-108 Membrane for Water Filtration & Purification utilizing Lyotropic Liquid Crystal (LLC) Templating

Water security remains the world's largest public health crisis; billions of people lack access to safe water sources. A primary technology to combat this is membrane water filtration. Our research's focus is on the fabrication of an ultrafiltration stimuli-responsive membrane, utilizing Pluronic F-108 as a thermoresponsive surfactant. Multiple potential mesophase compositions were evaluated via Cross-Polymerized Light Microscopy (CPLM), and a Hexagonal-Structure selected. We then conducted a Small Angle X-ray Scattering (SAXS) Scan and determined a pore size of ~30 nm. We also conducted Differential Calorimetry Scanning (DCS) to identify the thermal responses of F-108, which showed two characteristic transitions at ~33°C and ~49°C, where F-108 melting occurs in two stages, thus proving the potential for F-108 as a thermoresponsive surfactant for ultrafiltration membranes. We fabricated 30 membranes using our CPLM-tested mesophase composition and analyzed the Flux results from repeated cycles of DI-water testing. Our Flux results, however, proved inconclusive, due to errors in the fabrication procedure. Finally, a Total Organic Carbon (TOC) analysis was performed to determine a Molecular Weight Cut Off (MWCO) of ~300 kDa. Future Work still needs to be performed on improving the fabrication procedure, as well as improving the reactivity of the F-108 during polymerization.

Jacob D Barba, Mechanical and Aerospace Engineering
New Mexico State University
Mentor(s): Abdessattar Abdelkefi, New Mexico State University, Associate Professor of Mechanical Engineering
Program: NM AMP

Nonlinear computational modeling and experimental analysis of cantilever beams with bolted joints

Bolted joints remain a source of nonlinearities that are typically difficult to predict in bolted structures and require experimental data for designers to evaluate their effects on prototypes before finalizing products. The need for a predictive model has started efforts to develop a computational model based on well-characterized systems, with the Brake-Reuss Beam being initially used in this project. Towards this goal, this project aimed to compare a simplified model of bolted joints against a cantilever beam. This was done to establish a model that could be used for further nonlinear identification. The study was conducted by establishing two sets linear extremes in Finite Element Analysis, with the softest extreme marked by no friction or hard contact at the joint surfaces, and the stiffest extreme marked by rigid coupling of those surfaces. This was compared against two experimental models of the same design, except one machined without a joint. The jointed beam was tested at three bolt torques, one torqued above that recommended for the bolts, and two at incrementally lower torques than recommended. Overall, the natural frequencies identified experimentally remained within the range predicted from FEA, despite there being a noticeable softening nonlinearity.

Erika A Cano, Chemical Engineering
New Mexico State University
Mentor(s): Dr. Martha Mitchell, New Mexico State University, Professor of Chemical and Materials Engineering
Program: NM AMP

Optimization of Parameters for the Analysis of Enzyme-Induced Carbonate Precipitation (EICP) Cemented Sands

An important characteristic of sands that have been cemented using Enzyme-Induced Carbonate Precipitation (EICP) for ground improvement is the amount of calcium carbonate that precipitated in the sand as a result of the process. The EICP is a soil improvement technique that uses urea hydrolysis catalyzed by urease enzyme to precipitate calcium carbonate and cement soil grains. The calcium carbonate content measurement of biocemented sand can be determined by acid digestion, but the optimal parameters for the digestion have not been determined. The end goal of this research is to study the variation in calcium carbonate reading when the experimental condition for the acid digestion is changed. To get the calcium carbonate measurement we use 4 M of hydrochloric acid to dissolve calcium carbonate from the sample of cemented sand using EICP and then rinse it. The different phases that we were working on is rinse time, HIC concentration, sample size and sample location. Phase 1 - 4 were completed, the rinse time does not show a difference within the variability of the sample. The acid concentration was determined by the acid digestion time, when the acid concertation increments the time increments, the best option is 2 M. The best sample size was 25 g. For sample location it was determined that the upper half of the specimens has smaller variability in CCC compared to the lower half of the specimens. In the future a different sand will be tested to find its optimal parameters for acid digestion.

Micah Cheng-Guajardo, Aerospace Engineering
New Mexico State University
Mentor(s): Abdessattar Abdelkefi, New Mexico State University, Associate Professor of Mechanical Engineering
Program: NM AMP

Beam uncertainties due to boundary conditions, geometry, and material properties

Uncertainties in structures are a often a result of uncertainties in boundary conditions, geometric properties, and material properties. To better understand the effects of some of these uncertainties, the bucking of beams is studied in this research. Uncertainties are introduced into the boundary conditions, geometric properties, and the material properties. The effects are examined in the static buckling and natural frequencies of beams under axial loading. Sensitivity analysis methods are employed to examine the effects of the various parameters. For the static analysis, up to 28% uncertainty is found in the first critical load as a result of 5% uncertainty in the parameters. It is also found that height is the most influential parameter in the static analysis while length is the most influential in the dynamic analysis.

Mario A Escarcega, Mechanical Engineering
New Mexico Tech
Mentor(s): Dr. Arvin Ebrahimkhanlou, New Mexico Tech, Assistant Professor of Mechanical Engineering
Program: NM AMP

Acoustic Emission-Based Structural Health Monitoring For Future Lunar Pipelines

This paper explores the use of acoustic-based structural health monitoring (SHM) in lunar habitats to detect damage and failure in aluminum pipelines used to carry resources across lunar habitats. Acoustic-based SHM on Earth is a well studied field of research. Various studies validate the effectiveness of acoustic-based SHM to detect, locate, and characterize damage in pipelines. To the authors' knowledge, little or no research has been conducted regarding simulated lunar pipelines. In this paper, AE waveforms were collected and analyzed for pipes obtaining damage from simulated lunar conditions. Experiments simulating lunar regolith abrasion, internal galvanic corrosion, and irradiation were conducted on aluminum pipes. Lunar pipelines were constantly exposed to radiation, abrasion, and corrosion, As such, it is important to manage the noise and damage resulting from these lunar hazards. The waveform data was clustered based on hit-driven and time-driven properties. Changes in the wave propagation throughout the tests were observed as clusters in the AE data. These waveform clusters can be used to filter out unnecessary noise and to detect corrosion and abrasion waveforms in real-time. Continually monitoring the AE of common corrosion and damage events using AE sensors will improve the ability to predict and prevent catastrophic pipeline failure.

Brenda Esparza, Chemical & Materials Engineering
New Mexico State University
Mentor(s): Jessica Houston, New Mexico State University, Professor of Chemical & Materials Engineering
Program: NM AMP

Europium Luminescence Analysis with Time-Resolved Flow Cytometry

In this project Europium coated biotin spheres will be analyzed using Danube flow cytometer. Danube is a custom-built flow cytometer that uses hydrodynamic focusing. The purpose of the analysis of europium is to optimize the quality of data gathered from the Danube flow cytometer through calibration and configuration. The flow cytometer consists of two photomultiplier tube detectors, a 375 nm laser for the excitation of the particles and a 530 LP filter. The europium particles are Eu-Streptavidin (Eu-SA) conjugates. Since the Europium particles are small the limits and capabilities of the flow cytometer can be tested. Since the flow cytometer is in constant adjustment, there is much research about laser alignment and ways to improve the signal. The Europium particles give a low signal which are not bright enough to record data for the flow cytometer used therefore biotin spheres are coated with europium to make the signal brighter and have the flow cytometer give good quality data. The data is collected in scopes of points that form Gaussian-shaped curves that are the optical signals gathered using Travis Software connected to the flow cytometer. These curves are useful to obtain the lifetime analysis using a MATLAB code for 9th order polynomial fitting. The peak-to-peak difference between the excitation and emission peaks are recorded for each curve to get average luminesce lifetimes. As new data is gathered it is approached differently in attempt to give it a time reference and make the flow cytometer time resolved.

Christine A Gleicher, Chemical Engineering
University of New Mexico
Mentor(s): Eva Chi, University of New Mexico, Professor of Chemical and Biological Engineering
Program: NM AMP

Quantitative Evaluation of OPE Antimicrobial Activity on Surfaces

Evaluating the effectiveness of novel conjugated oligomers as surface disinfectants. University of New Mexico Eva Chi, Professor and Reagent's Lecturer, Chemical and Biological Engineering, University of New Mexico New Mexico Alliance for Minority Participation URS Bacteria can survive on surfaces and when contacted, could potentially lead to the spread of diseases. Recently, we have synthesized and shown that OPEs exhibit remarkable light activated killing efficiency against bacteria in solution. The primary aim of this project is to investigate the antimicrobial activity of OPE against bacteria on surfaces as a spray disinfectant, test the effect of light exposure on the OPEs ability to inactivate bacteria, and assess the effect of varied OPE concentrations on killing bacteria. To evaluate the effectiveness of OPEs as surface disinfectants, we treated E. coli bacteria contaminated microslides with an OPE solution spray, exposed the microslides to cool white light, transferred the OPE and E. coli on the surface of the microslide to a buffer, performed serial dilution, and cultured each dilution on agar plates to determine colony forming units. The percentage of bacteria killing was calculated to show that cool white light killing alone did not cause significant killing of E. coli, increasing the concentration of OPE showed a significant increase in killing against E. coli in the dark and a slight reduction in killing efficiency against E. coli in the light, and the OPE spray shows significant dark and light activated antimicrobial activity.

Alexander G Logan, Chemical Engineering
New Mexico Tech
Mentor(s): Michaelann Tartis, New Mexico Tech, Associate Professor and Chair of Chemical Engineering
Program: NM AMP

Mondisperity of Titanium Nitride Nanoparticles in an Optically Transparent Matrix Design

Mondisperity of Titanium Nitride Nanoparticles in an Optically Transparent Matrix Design. Titanium nitride (TiN) nanoparticles (NP) are cost-effective, highly efficient photothermal agents that strongly absorb a broad spectrum of sunlight. Given these properties, TiN NP has potential to contribute to novel designs in energy production and drug delivery. In order to harness their photothermal function, TiN NP must be dispersed in an optically transparent matrix. However, nanoparticles easily aggregate, which limits capacity for light-absorption. To prevent aggregation, I chose to suspend TiN NP in a transparent aerogel prepared with sol-gel methods due to its low cost, practical synthesis procedure, and finely tunable parameters to control chemical composition. Here I discuss recent advances in using sol-gel methods for nanoparticle dispersion as well as sol-gel samples absorbances with and without TiN NP.

Santiago A Lopez, Civil Engineering
New Mexico Tech
Mentor(s): Isabel Morris, New Mexico Tech, Assistant Professor of Civil and Environmental Engineering
Program: NM AMP

Estimating Long Term Concrete Strength By Nurse-Saul's Maturity Method

Concrete is one of the most utilized materials in world. Its ability to oppose compressive loads has allowed concrete to develop its own niche in the market that cannot be replaced. With concrete, safety is of major concern during the construction process; with more accurate estimates we can better judge the risks and adjust the plans if needed. Many attempts to generate a functional relationship between time and strength have been established but estimations of the strength have yet to be verified. The Maturity Method is used to estimate concrete strength as a function of both time and temperature. Using the ASTM Standard C1074 a calibration curve of the logarithmic function can be made. Using historical data collected the Steicker Bridge will also be used to calculate equivalent age also known as maturity. Using MATLAB, the data was processed and compiled. Overall estimates were found to be the upper bound of compressive strength since the MM ended-up overestimating by about 10-12%.

Andrea Loya Lujan, Chemical Engineering
New Mexico State University
Mentor(s): Dr. Catherine Brewer, New Mexico State University, Associate Professor, Department of Chemical & Materials Engineering
Program: NM AMP

Using the Aqueous Phase from HTL of Food Waste in Compost Systems

Disposal of food waste in landfills results in large emissions of greenhouse gases. The availability of fresh water for composting can be a major challenge. Hydrothermal liquefaction (HTL) of food waste has the potential to address both problems. This research focuses on the use of the HTL aqueous phase product in compost production. The aqueous phase contains high amounts of nitrogen and water, both of which are needed for compost. Value-added use of the aqueous phase also increases the potential for implementing HTL as new food waste management systems. In this research, the aqueous phase will be characterized for pH, salinity, carbon and nitrogen content by total organic carbon (TOC) and total nitrogen (TN) analysis, metals by inductively coupled plasma optical emission spectroscopy (ICP-OES), and non-volatiles content by freeze-drying. Previous research has shown that lower temperatures and shorter reaction times (240°C, 0 min) result in the highest amount of nitrogen in the HTL char. Different reaction conditions, and the use of catalysts in HTL, are expected to lead to different levels of nutrients and carbon in the aqueous phase as well. After characterization and comparison among reaction conditions, the aqueous phase product will be tested within a compost system relative to water only and to water + fertilizer additions to understand the impacts of composition on compost performance.

Frank Maldonado, Mechanical Engineering
New Mexico Tech
Mentor(s): Dr. Ashok Ghosh, New Mexico Institute of Mining and Technology, Associate Professor of Mechanical Engineering
Program: NM AMP

NMSEA SunChaser

The goal of the SunChaser is to transition from a former design to a fully functional Mobile Education Tool (MET) that will demonstrate STEM related topics. The SunChaser will display how renewable energy can be implemented in homes and businesses throughout New Mexico and elsewhere. The MET will represent a home or business whose primary renewable energy source is limited to solar. Our work on the SunChaser consisted of developing the educational curriculum for the SunChaser and working on the mechanical subsystems of the SunChaser. The curriculum was finalized over the summer and is suited for K-12 students while being separated into three groups: elementary, middle, and high school. The exterior and interior framing of the SunChaser was also finalized over the summer. Although there are tasks we did not complete over the summer, the project is on track and our work has allowed for the construction of the SunChaser to begin. We will continue to work on finalizing the remaining systems and ensuring that the SunChaser debuts on time.

Emilia Marmolejo, Civil Engineering
New Mexico State University
Mentor(s): Paola Bandini, New Mexico State University, Associate Professor of Civil Engineering
Program: NM AMP

Effect of Alginate Biopolymer Stabilization on Suction and Strength Properties of Cohesive Soil

The demand for environmentally sustainable practices has prompted researchers to investigate alternative materials that could significantly increase strength and durability in adobe. Cement and lime have traditionally been used as additives to improve the properties of poor soils, but they emit significant amounts of CO2 into the environment during their production. Sodium alginate is a natural biopolymer that is extracted from brown seaweed that is believed to affect the soil strength and durability properties depending on percentage of alginate added. The filter paper method is used to determine the soil suction of the adobe, which requires filter papers to be placed within and on top of a soil specimen in an airtight container for at least 14 days at constant temperatures. The suction of the soil and the filter papers will reach moisture equilibrium during this time. The water content of the filter papers is calculated and used to determine matric and total suction which, are graphed on a Soil-Water Characteristic Curve (SWCC) as a function of soil water content. Initial testing on untreated soil revealed that the matric suction was greater than the total suction, which conflicts with definitions of total suction, prompting a second test on untreated soil.

Andy Martinez, Chemical Engineering
New Mexico State University
Mentor(s): Jessica P. Houston, New Mexico State University, Professor of Chemical and Materials Engineering
Program: NM AMP

Development and optimization of a protocol for breast cancer cell synchronization

MCF7 breast cancer cells are known to become resistant to the drug Tamoxifen overtime. Dr. Kevin Houston's lab has hypothesized that the binding protein IGFBP-3 leads to tamoxifen resistance in MCF7 cells. The purpose of this project was to develop a synchronization protocol to offer cell cycle analysis data as additional support for this hypothesis. Flow cytometry and chemical synchronization using the drugs Lovastatin and Mevalonate were used to perform the cell cycle analysis. Successful cell cycle arrest and release were observed in the samples treated with Lovastatin and Mevalonate, respectively. In future experiments, this protocol will be used to perform direct comparison between triple negative and MCF7 cells.

Yaniksa Mata-Solis, Computer engineering
University of New Mexico
Mentor(s): Anjali Mulchandani, University of New Mexico, Professor of Civil, Construction, and Enviromental Engineering
Program: NM AMP SCCORE

Atmospheric Water Capture Using Dehumidifiers

Research has shown that 4 billion people across the globe suffer from water scarcity for at least one month each year, and 500 million people suffer from water scarcity throughout the entire year. The atmosphere contains water in the form of water vapor, clouds, and fog. Atmospheric water capture is the process of capturing that water. One method of atmospheric water capture is performed using dehumidification devices. We used two different types of dehumidifiers, compressor dehumidifier and desiccant dehumidifiers, and our objective was to understand how each dehumidifier works and determine which dehumidifier works best in certain weather conditions. Both dehumidifiers were taken apart to understand how they each work, then they were both ran indoors. The dehumidifiers were ran a total of four times for four hours, the water was collected and measured each time. We found that the compressor dehumidifier works best in humid areas and the desiccant dehumidifier works best in arid areas, but requires more electricity. Future work includes measuring electrical efficiency of both dehumidifiers by running them indoors while being connected to an energy monitor and also setting up sensors to measure the quality of the water.

Arianna Matthews, Chemical Engineering
New Mexico Tech
Mentor(s): Michaelann Tartis, New Mexico Tech, Associate Professor and Chair of Chemical Engineering
Program: NM AMP

Imaging Artifacts in Polyacrylamide Brain Phantoms Undergoing Blunt Impacts

This project used a variety of imaging tools to better understand suspected mechanisms behind traumatic brain injuries with the aim to improve protective cranial equipment and exposure guidelines in military training. Shadowgraph imaging was used to observe shockwave and cavitation events in a polyacrylamide human head model under blunt impacts. It is important when imaging this brain phantom to minimize the number of surface artifacts present, so several methods were investigated to create a phantom with as few artifacts as possible.

Ashley Berenice Medina Cardona, Chemical and Material Engineering
Dona Ana Community College
Mentor(s): Dr. Catherine Brewer, New Mexico State University, Associate Professor, Department of Chemical & Materials Engineering
Program: NM AMP SCCORE/REinWEST

Use of Pyrolysis for Production and Characterization of char

Activated carbon is commonly used in water treatment, however, activated carbon is more expensive than biochar. Pyrolysis is a thermal degradation process of organic compounds in the absence of oxygen or air to produce various gaseous component as well as yield of tar and char residues. Biochar preparation by pyrolysis is relatively low-cost and provides the potential for co-creation of renewable energy. The properties of biochars change depending on their production conditions, therefore, to design the best biochar production process, one needs to understand the effects on biochar properties The end point of the pyrolysis process was decided not on the time but based on the rate of smoke exiting the reactor (approximately 1 hour after the furnace reached 600 °C). The pyrolysis process used appears to create good biochar: the char is black in color. Future work will be addition of instrumental characterization data for the Atriplex char. We will compare the characteristics to commercial activated carbons and other synthesized chars.

Yazbeth Montoya, Mechanical Engineering
New Mexico Tech
Mentor(s): Dr. Ashok Ghosh, New Mexico Institute of Mining and Technology, Associate Professor of Mechanical Engineering
Program: NM AMP

NMSEA Sunchaser

The goal of the SunChaser is to transition from a former design to a fully functional Mobile Education Tool (MET) that will demonstrate STEM related topics. The SunChaser will display how renewable energy can be implemented in homes and businesses throughout New Mexico and elsewhere. The MET will represent a home or business whose primary renewable energy source is limited to solar. Our work on the SunChaser consisted of developing the educational curriculum for the SunChaser and working on the mechanical subsystems of the SunChaser. The curriculum was finalized over the summer and is suited for K-12 students while being separated into three groups: elementary, middle, and high school. The exterior and interior framing of the SunChaser was also finalized over the summer. Although there are tasks we did not complete over the summer, the project is on track and our work has allowed for the construction of the SunChaser to begin. We will continue to work on finalizing the remaining systems and ensuring that the SunChaser debuts on time.

Suzann M Pakozdi , Chemistry
Dona Ana Community College
Mentor(s): Dr. Lambis Papelis, Professor, Civil Engineering, New Mexico State University
Program: NM AMP SCCORE/REinWEST

Removing arsenic and selenium from wast water using zeolite.

Removing arsenic and selenium from a water source using zeolites and microbes This research deals with removing oxyanions of arsenic and selenium from water using a novel approach that combines iron-modified zeolites, a relatively common mineral, and common microorganisms obtained from a wastewater treatment plant. Removing arsenic and selenium from water is important because both of these elements can be encountered at concentrations that are toxic or carcinogenic for humans and wildlife. Elevated concentrations may occur naturally or as a result of industrial operations and mining activities. The proposed technology hinges on a combination of sorption, a physicochemical process, and microbial reduction of elements to less mobile or less toxic forms. The experiments are conducted in columns packed with modified zeolites to which sludge containing microbes, as well as necessary nutrients are added. Columns for arsenic treatment are currently being operated. Column experiments with selenium show removal efficiency up to 98%, depending on selenium oxidation state.

Daniela Palacios, Chemical and Materials Engineering
New Mexico State University
Mentor(s): Dr. Adriana Romero Olivares, New Mexico State University, Assistant Professor of Biology
Program: NM AMP

Growing Biomaterials

The growing concern about our planet and waste production has led to the exploration of new materials to decrease plastic and animal-based production in society. The use of bio-based mycelium materials are trending due to their ability to turn other industries' waste into another material and for their physical and mechanical properties. Previous research has been done in the design and textile applications without any establishment of publicly available scientific procedure and thus producing variable results depending on where and by whom it is produced. Therefore the objective of this project was to conduct a scientific experiment to design a consistent and repeatable procedure to produce a bio-based mycelium material. We used mason jars with two different substrates, oak shavings and pecan shells (i.e., pecan industry waste). In the first round of the experiments, mason jars were inoculated with blue oyster and pink oyster and incubated at 28 °C . We observed mycelium growth after three days of incubation. Ten days later, one of the mason jars which was completely colonized and free of contamination was successfully molded and dehydrated to create a biomaterial. However, the biomaterial developed mold after a couple of days and was not sturdy enough. A new protocol is being developed to eliminate contamination in mason jars and bio-based material, as well as to improve the material strength. Successfully establishing a procedure to create a bio-based textile from mycelium is significant because it could potentially compete with plastic and animal-based material while reducing waste production from different industries.

Edgard Parra, Petroleum Engineering
New Mexico Tech
Mentor(s): Hamid Rahnema, New Mexico Tech, Associate Professor of Petroleum and Natural Gas Engineering
Program: NM AMP

Experimental Design & Oilfield Implementation of A Produced Water Treatment Train

In this paper, a produced water treatment train was designed with the ability to be upscaled for industrial applications. Different technologies were evaluated for their use in treating oilfield produced water. Produced water should be used to waterflood an oil-wet carbonate reservoir for filtering solids and reducing its oil concentration. Thermal distillation can be used for water desalination and to separate produced water into its chemical components, i.e., fractions. The fraction of water will be collected and undergo a liquid-liquid extraction process to remove any residual hydrocarbons that were collected from vapors of chemicals with a low flashpoint. In order to account for the high-heat requirements of water desalination, a proposal is made to use geothermal energy for fractional distillation, water desalination, and energy production from steam turbines. A benchtop apparatus was also created to simulate this proposed method of treating oilfield produced water.

Joel A Ramos, Mechanical Engineering Technology
New Mexico State University
Mentor(s): Samah Ben Ayed, Ph.D. , New Mexico State University, Associate Professor of Mechanical Engineering Technology
Program: NM AMP

Thermal Grid Efficiency in Various Environmental Conditions

Throughout the research Joel had a great advantage of applying what he was learning from two courses and applying them to the research. The heat transfer course and HVAC course were helping Joel gain a better understanding of concepts that he was reading through articles in order to come up with more efficient solutions of implementing HVAC systems. Some of the different strategies that Joel concluded were the most efficient that New Mexico State University tend to implement already is the Ice Thermal Storages. The way in which this works is that the university takes advantage of using electricity to make ice during the night time in the summer when the on-peak period is during the day where it is more expensive to use electricity. To save costs, the ice made at night can be saved throughout the day for cooling to buildings and then distributed through underground tunnels. Joel is trying to research if by using this strategy and combining it with thermal grid, meaning that if the university can save that heat that is being extracted to provide cooling during the summer, possibly that heat could play a part in making that ice saving more on electricity. To be able to gain more experience and gather accurate results the last portion of the research was to gain practice with OpenStudio, SketchUp Pro, and EnergyPlus that can run simulations with buildings using different properties. Some of the challenges that Joel had encountered through this research was trying to find articles that would target what he was trying to research, which was the thermal grid and thermal storage. Another challenge that was encountered was through the second half of the research in trying to find the programs to run a simulation. There were technical difficulties with the different types of files that were only compatible with some types of programs. Since everything is online, there is of course a communication barrier in case of having any questions it will take a while to get it figured out. By being online the experience will be different since there is no hands-on experience.

Mikayla D Romero, Chemical Engineering
Central New Mexico Community College
Mentor(s): Dr. Catherine Brewer, New Mexico State University, Associate Professor, Department of Chemical & Materials Engineering
Program: NM AMP SCCORE/REinWEST

The Use of Activated Carbons for Uranium Adsorption

Uranium is a toxic element. If ingested, uranium can cause kidney damage and potentially lead to cancer. Groundwater around abandoned uranium mines can contain uranium from erosion. The use of activated carbons has become an increasing interest for water treatment due to the lower-cost and lower energy requirements when compared to other water treatment methods such as membrane filtration. Here, we study the use of a commercial activated carbon derived from coconut shell, a rice husk char, and pecan shell chars that were created at 400°C and 600°C and at 450°C with activating agent, K_2CO_3. Simulant contaminated water solutions were created using uranyl nitrate and deionized water at 20, 50, and 100 µg/L. Adsorbent (50 mg) was added to each concentration and placed on the shaker table for 48 hours. The samples were then filtered into three 10 mL samples and the uranium concentration quantified using inductively coupled plasma mass spectrometry (ICP-MS). Initial concentration results were unable to be interpreted due to ending concentrations appearing to be higher than initial concentrations, we would suggest that the adsorbents already contained uranium-which is known to not be the case. Next steps will include rerunning the experiment being more precise with concentration and solution pH, the testing the adsorbents on contaminated water from a uranium mine site to determine if the lab stimulation is an accurate representation of the adsorption rates needed for the actual problem.

Estela J Salinas, Civil Engineering
New Mexico Tech
Mentor(s): Isabel Morris, New Mexico Institute of Mining and Technology, Assistant Professor of Civil Engineering
Program: NM AMP

Attribute Analysis of Construction Materials with Ground Penetrating Radar (GPR)

The purpose of this project is to develop a program that gives a labeled map of the locations of construction materials based on attribute analysis from Ground Penetrating Radar (GPR) scans. Attribute analysis is advantageous because it allows researchers to study more than one characteristic about a material or structure that is not visible from the surface. Attributes are characteristics of the GPR data that can identify material composition and are calculated from GPR scans of a site. The chosen attribute is attenuation. Attenuation is the rate at which a signal travels or decays through a material. The program is based on a binary classification system that locates different materials based on their attenuation. The binary system allows for more attributes or materials to be added to the program while still being able to locate them properly. We present an application of attribute analysis and classification of GPR scans from Corvin Castle (Hunedoara, Romania), which is composed of many different materials from a number of restorations and expansions since the 13th century. Categorizing materials based on their attributes can improve damage detection techniques. By establishing what range of attribute values correspond to different materials and displaying the resulting classification, the program will provide a visual overview of the locations of the different materials. The information gained from this project can aid restoration and preservation efforts.

Lillian Sandoval, Mechanical Engineering, Aerospace Engineering
New Mexico State University
Mentor(s): Abdessattar Abdelkefi, New Mexico State University, Associate Professor of Mechanical Engineering
Program: NM AMP

Development of Bioinspired Aquatic Unmanned Vehicle

There has been a spike in interest in the development of more innovative Aquatic Unmanned Vehicles (AUVs), with the transition from rigid-bodies to flexible-bodies. Biomimicry allows for the replication of the movement and/or body shape of a fish. The most successful designs provide a combination of rigid and flexible parts, to create a system that mimics the fish movement and has capabilities for maneuverability, power efficiency, speed, endurance, and production of thrust. Research was conducted to develop the fabrication process and create the molds for the compliant tail. To do this, we researched soft robotics and biomimicry and determined the actuation method to be used in the robotic fish drone. We developed a fabrication plan, designed the mold for the fabrication of the compliant tail, and determined materials to be used for our system. We developed the fabrication process for an AUV with both a completely flexible and hybrid design. We will fabricate the tail and develop the gear pump. We will assemble the drone and iterate on our design. We will also address issues including buoyancy and waterproofing and conduct a comparative study to decide the best configuration and discuss the limitations of our designs.

Hunter Sedillo, Mechanical and Aerospace Engineering
New Mexico State University
Mentor(s): Abdessattar Abdelkefi, New Mexico State University, Associate Professor of Mechanical Engineering
Program: NM AMP

Experimental and numerical investigations of environmental effects on BARC systems

The Box Assembly with Removable Component (BARC) structure has been recently introduced by Sandia National Labs and Kansas City National Security Campus as a challenge problem for the study of the effects of boundary conditions on vibration testing and modal analysis. Current efforts in studying shaker input excitations on the BARC structure have focused on either varying the degrees of freedom of the test, varying the input signal or varying boundary conditions. The effects of different environmental conditions introduced to the BARC system have not been fully investigated. This study presents an investigation on the effects of different environmental conditions introduced to the BARC system and how they affect the dynamic response. This investigation will be done by introducing sand/ dust particles to the BARC system to compare any changes to the dynamic responses and to identify any nonlinearities that arise. The anticipated effect due to the introduced environmental conditions, would be a small change in the dynamics response and increase in nonlinear effects.

Nathaniel J Serda, Mechanical Engineering
New Mexico Tech
Mentor(s): Dr. Mostafa Hassanalian, New Mexico Institute of Mining and Technology, Assistant Professor of Mechanical Engineering
Program: NM AMP

Moon Hoppers: Swarming of Jumping Lunar Robot

On July 30th, 2020, NASA launched the Perseverance Rover to Mars. This is an autonomous rover that is going to be used to gather research on the red planet for 687 days (1 Mars year). A problem that can occur with this mission is the possibility of the rover getting stuck in craters or rocky terrain. However, there is an idea that has not been circulated through the space exploration community yet. In this research, a new concept of rover design is proposed to be a robotic mechanism with the ability of jumping, based on the physical structure and characteristics of a locust bug. What is fascinating about the locust is its mobility and movement patterns; the ability to jump from point "a" to point "b". Constructing a robot that has the mobility mechanics of this bug, or similar to the Locust can open more/new areas for scientists to conduct research on. An example of this being that the moon is filled with craters and rocky terrain that a rover cannot access without getting stuck or having great difficulty This is where a locust like design on a rover could potentially successfully take over; being able to jump in, out, or over difficult areas of reach.

Stephen I Simko, Mechanical and Aerospace Engineering
New Mexico State University
Mentor(s): Andreas Gross, New Mexico State University, Associate Professor of Mechanical and Aerospace Engineering
Program: NM AMP

Numerical Investigation of Wake Passing Effect on Laminar Separation for High-Lift Low-Pressure Turbine Airfoil

In today's high-bypass jet engines, the low-pressure turbine (LPT) drives the fan which produces up to 80% of the thrust. For my research, two-dimensional simulations of a 50% reaction stage with two L2F airfoils are performed for a Reynolds number of 100,000. The effect of the wake passing frequency on the laminar separation from the suction side of the rotor blade will be investigated for different wake passing frequencies. Results show that for the two-dimensional instantaneous flow field, the wakes appear to suppress laminar separation from the suction side of the blade, whereas for the flow analysis, the shape factor approaches 1.4 indicating that the boundary layer is fully turbulent at the outflow.

Trevor A Taylor, Chemical Engineering
Arrowhead Park Early College High School
Mentor(s): Yanyan Zhang, Ph.D. Asst. Professor, Civil Engineering, New Mexico State University
Program: NM AMP SCCORE/REinWEST

Removal of Algal Toxins in Freshwater using Modified Sepiolite Clay

Harmful Algal Blooms (HABs) have increased in their frequency and magnitude and spread over the continents in the past few decades. Severe risks for human health, animals, deleterious effects on commercial fisheries and aquaculture, coastal aesthetics, aquatic ecosystems, and tourism are some major challenges caused by HABs. Microcystins (MCs) are a common algal toxin that imposes adverse effects on kidneys, nervous system, and reproductive system when exposed. In this study, sepiolite clay was modified by chitosan and NH4Fe (SO4)2 to test its feasibility in microcystin-LR (MCLR) removal. When the modified sepiolite was added directly to solutions with the MCLR concentrations of 20-200 µg/L, MCLR removal of 96%-99.9% was observed. The modified sepiolite was packed in dialysis tubes to remove MCLR from the water body with HABs without the risk of releasing it. Interestingly, it was found MCLR removal efficiency increased with the initial MCLR concentrations. Due to the low cost and excellent performance of modified sepiolite, the proposed process can be used for algal toxin removal on a large scale.

Azul Toledo Vega, Industrial Engineering
New Mexico State University
Mentor(s): Dr. Delia Valles-Rosales, New Mexico State University, Professor of Industrial Engineering
Program: NM AMP

Integrating Data Analytics in Additive Manufacturing: Fuse Deposition Process

Industrial and, more specifically, consumer level 3D Additive Manufacturing (AM) processes have raised concerns in the technology field regarding health factors associated with their usage. While there is lack of research, it is known that 3D processes expose the user to particles suspended in the area around which could lead to potential damage to internal organs when inhaled. The goal of this project is to measure the particulate suspension characteristics coming from a specific printer using a BLATN Air Quality Monitor during different testing setups and investigate potential particulate suspensions that could be outside the appropriate healthy range. The sensor is to be placed during the mixing of the PLA + metal composite and in a proximity to the 3D Replicator MakerBot printer. Ample data samples will be collected and used to integrate data analytics to propose and design an integral data model that will identify product feature and propose a classification scheme. The use of computer neural networks will assist in creating the characterization data model that will feature representations and recommendations to lessen the health risks associate with AM processes, by alarming the user of live issues that could impact the user's health when 3D printing.

Justin E Walton, Petroleum Engineering
New Mexico Tech
Mentor(s): Dr. Tan Nguyen, New Mexico Institute of Technology, Professor of Petroleum and Natural Gas Engineering
Program: NM AMP

Fundamentals of Drilling Fluids and the Implementation of the API Testing Methods

What are drilling fluids and why are they important to the creation of a successful well? Drilling fluids are added to the wellbore to help with various issues that are present while drilling. Such as cleaning out cuttings, well control, drill bit cooling/lubrication, and prevention of rock formation damage. For my research, I used the Society of Petroleum Engineers Wiki as well as lectures and labs from drilling engineering at the New Mexico Institute of Mining and Technology. I also used the 2009 version of the API Recommended Practice for field testing water-based fluids. As a result, I increased my knowledge and understanding of how to test drilling fluids, specifically water-based drilling fluids. I also completed various tests and calculations for specific properties such as filtration, mud weight, viscosity and gel strength, and sand content. The main goal of this research project was to be a step forward toward understanding the purpose and process of drilling fluids. I will be moving ahead with this goal by completing the remaining methods of testing as well as using this knowledge to assist and work to improve my field of study.

Haoyu B Wang, Environmental Engineering (intended)
Centennial High School
Mentor(s): Pei Xu, New Mexico State University, Professor of Civil Engineering
Program: NM AMP SCCORE

Photocatalytic Degradation of Organic Contaminants in Produced Water

Produced Water is the largest waste stream generated from oil and gas extraction. Produced water is difficult to treat because it contains high levels of salinity and dissolved organics due to millions of years of contact with oil-bearing formations. Removal of organic contaminants is critical to subsequent produced water desalination and to reduce environmental risks. Conventional produced water treatment technologies such as thermal distillation and membrane processes are energy intensive and costly. Photocatalysis is a "green" method of breaking down organics using UV light, which may mineralize the organics into CO2. This project aims to demonstrate photocatalysis as an effective method to degrade the recalcitrant, dissolved petroleum organics in produced water. This study compared two photocatalysts, titanium dioxide (TiO2) nanoparticles and gold modified TiO2 (Au-TiO2). To test the effectiveness of the photocatalysts, Rhodamine B solution was used as an organic indicator. The experimental results showed both catalysts were effective for organic decomposition. The photocatalysis was then applied for produced water samples collected from the Permian Basin. The photocatalysts are shown to decrease the dissolved organic carbon in the produced water by 59%. Further research is needed to further optimize the photocatalysts and evaluate the treatment using sunlight.

Taylor C Yazzie, Environmental Science
New Mexico Tech
Mentor(s): Jianja Yu, PhD., Adjunct Faculty & Leonard Garcia, Research Asscoiate; New Mexico Tech, Petroleum Recovery Research Center
Program: NM AMP

Navajo Nation Water Purification Project

Water on the Navajo Nation is neither safe nor accessible. Contaminants such as Uranium, Arsenic, Calcium, Manganese, Lithium, and Vanadium have been found in watering holes that Navajo Nation residents depend on. Ingesting these contaminants on a regular basis can result in cancer and shorten life expectancy. Creating a cost-effective, self-supporting filter efficient enough to remove specific contaminants is the challenge being faced. We are working with the Navajo Nation Water Purification Project in which much of the information is classified. We are assisting with the development of specialized hollow fibers to filter out dangerous contaminants. We researched and tested different hollow fibers, and worked on the simplicity, reliability, and strength of them. We recently found a way to package and create the filters, and currently are working on assembly and design. In the future, we will build a portable filtration unit to conduct field testing and data collection. We hope to complete Phase 1 of the project by completing the design of the filters. Access to clean water is a human right, and we hope to help Navajo Nation residents obtain that right.

Larissa Zhou, High School (No Major)
Las Cruces High School
Mentor(s): Dr. Hongmei Luo, New Mexico State University, Professor of Chemical and Materials Engineering
Program: NM AMP SCCORE/REinWEST

Li(Ni,Co,Mn)O2 as Cathode Materials for Lithium Ion Batteries

Rechargeable lithium-ion batteries (LIBs) are widely used in cell phones, laptops, and electric vehicles. A LIB cell consists of three main parts: anode, cathode, and electrolyte. The battery type is named after its cathode materials, such as Li(Ni,Co,Mn)O2 (NCM) battery, which is composed of lithium, nickel, cobalt, and manganese. NCM has been the most used cathode for LIB industry due to its considerable capacity and energy density. NCM has different compositions, such as LiNi0.5Co0.2Mn0.3O2 (NCM 523), LiNi0.6Co0.2Mn0.2O2 (NCM 622), and LiNi0.8Co0.1Mn0.1O2 (NCM 811). With the applied NCM 622 and NCM 811 cathodes in coin cells in this research, the goal is to test their battery performance and to understand the composition effects on their electrochemical properties. From the charge-discharge and cycling performance measurements, NCM 811 shows higher capacity and better stability as compared to NCM 622. Future work will employ X-ray diffraction and electron microscopes to examine the phase, morphology, crystal structure, and microstructure and to explore the relationship between composition, structure and battery performance. The goal is to have safe batteries with higher capacity, long cycling life and higher energy and power densities.

LIFE SCIENCES

Adriana Fuentes, Biology
University of New Mexico
Mentor(s): Dr. David Hanson, University of New Mexico, Professor of Biology
Program: NM AMP SCCORE

Effects of Environmental Changes on Gas Exchange and Impedance in Wall-rocket

Wall-rocket plant's petiole and gasket were assessed by determining the effects humidity and temperature have on gas exchange and impedance. The data was collected from using a Li-cor and Multi-PIP by measuring the water loss in the plant at two different temperatures (25 °C and 30 °C). The petiole data determined that when water is being lost, impedance increases while the gasket suggest the leaf has hidden water maintaining. This is believed due to the data showing impedance remaining constant despite water being lost at 30 °C. Future work on impedance and gas exchange results in using different plant species leaves and changing the variables in order to discover what and where the water maintaining mechanism hidden in the leaf is.

Christopher I Gallegos, Biology
University of New Mexico
Mentor(s): Diana Northup, University of New Mexico, Professor of Biology (ret.)
Program: NM AMP

Who Will Be Dead When We Save the Bats?

White-nose syndrome (WNS) is a devastating disease to the bat populations in North America. The causative agent, a fungus, Pseudogymnoascus destructans, causes bats to come out of torpor early in the winter, expending crucial energy stores and resulting in the death of up to 99% of some bat species. A new method of UV-C treatment has been shown to be effective in killing Pseudogymnoascus destructans. However, caves are home to a wide range of microbial communities that may be harmed by UV-C. The aim of this experiment is to investigate if this treatment will have potential collateral damage to native cave bacterial species. Samples were taken from caves across three national parks, sub-cultured in the lab, and resulting isolates are being exposed to UV-C treatment. Initial cultures from Lava Beds National Monument, Oregon Caves National Monument, and Mammoth Caves National Park, have resulted in 2,721 subcultures currently under investigation. Sequencing of the 16S rDNA gene is being used to identify a maximum of 100 representative bacterial cultures per national park for UV-C testing in the lab. Understanding the potential negative implications of UV-C on native microbial cave ecosystems is crucial before this treatment can be considered for wider implementation.

Henry Gatica-Gutierrez, Biochemistry
New Mexico State University
Mentor(s): Dr. Elba Serrano, New Mexico State University, Regents Professor of Biology
Program: NM AMP

Foundations of Hypergravity Research

Interest in deep space travel is increasing and the ability to grow, maintain, and harvest crops in space will be essential to expeditions farther from Earth. Our laboratory is investigating the effects of diverse gravitational forces (micro to 2000 g) on biological processes such as plant growth and gene expression on crop plants. We hypothesize that increasing the gravitational force would cause a decrease in seed germination and root extension. We are undertaking wet lab experiments that are evaluating the ability of readily available crops such as radishes to germinate and extend their roots under constant acceleration conditions with commercially available centrifuges (hypergravity; 10g ,1000g, and 2000g). We found that there is a decreasing trend in seed germination and root extension as you increase gravity ,however, that is at the extreme 2000g. Future projects will measure the roots and quantitatively compare the difference in size as well as using qPCR to identify any changes in gene expression.

Jonte' Green, Biology
University of New Mexico
Mentor(s): Dr. David Hanson, University of New Mexico, Professor of Biology
Program: NM AMP SCCORE

Electrical Impedance and Source-Sink Relationships of Wine Grapes

In my presentation, I will discuss how the electrical impedance of a (Chardonnay) grape vine tends to favor the grape bunch in terms of water and sugar distribution. Electrical impedance is the method of studying plant tissues based on the external electrical currents that pass through the plant cells and how plant tissue effects the electrical current.

Brittany L Griego, Earth and Planetary Sciences-Geology
University of New Mexico
Mentor(s): Laura Crossey, University of New Mexico, Distinguished Professor of Earth and Planetary Sciences
Program: NM AMP

Hydrogeochemistry of Springs in the Sandia Mountains, New Mexico

Springs are an important water resource both for anthropogenic use and support of ecosystems in the arid Southwest. During times of drought, the sustainability of these groundwater systems is a major concern for effective water resource management. During 2017-2019, several springs were visited in the Sandia and Manzano Mountains to perform an inventory of the springs and the surrounding environment. This work is part of an ongoing collaboration between students and faculty at UNM and the US Forest Service (Cibola National Forest). We collected water samples for water quality analysis (major ions and stable isotopes), and field water quality parameters such as pH, total dissolved solids (TDS), dissolved oxygen (DO), and discharge. We analyzed monthly precipitation samples from a collection site near the springs in the Sandia Mountains. We also analyzed snowpack samples from 2019. Spring samples primarily consist of calcium bicarbonate and calcium magnesium chloride sulfate waters. Trends in solute distribution are interpreted to reflect different water-rock interactions on groundwater flow paths. Regional aquifers include the Madera Group (chiefly carbonates) as well as several sandstone aquifers. Fault structures also play a role in controlling spring occurrence. Our results show two distinct trends between spring waters that are interpreted to have undergone silicate weathering and those undergoing carbonate dissolution. Carbonate dissolution occurs in waters traveling through the Madera Group aquifer system while silicate weathering occurs as waters travel through faults within the Sandia granite. Stable isotope analyses show that winter snowpack is the primary recharge mechanism of the majority of these waters. In addition to data collection and analyses, we have made major efforts in compiling all datasets into a regional database (Springs Stewardship Database) to preserve valuable information, make the data accessible to others, and provide important baselines for future comparison.

Sarah Lind, Genetics and Biotechnology
New Mexico State University
Mentor(s): Amanda Patterson, University of Missouri, Assistant Professor of Reproductive Biology
Program: NM AMP

Periostin's Effect on Myometrial to Uterine Fibroid Transition

Uterine fibroids are common tumors that affect between 25% and 89% of women and, when clinically significant, can cause symptoms such as excessive uterine bleeding, pelvic pain and discomfort, as well as anemia. Currently, the only definitive treatment is hysterectomy. Periostin is being studied as a potential druggable target for uterine fibroids because it is a regulator of fibrosis in other tissues, it has been shown to be upregulated in uterine fibroids, and it has been implicated in both TGFβ signaling and Collagen deposition, two hallmarks of fibroids. It was hypothesized that Periostin plays a role in the transition from myometrial to fibroid cells. qPCR was used to analyze expression of known fibroid biomarkers (CCND1, COL3A1, CTNNB1, ESR2, PGR, TGFβ1, and TGIF) and Periostin expression in POSTN-overexpressing cell lines compared to CTRL cell lines. Some fibroid biomarkers showed differences in expression between POSTN and CTRL cell lines, indicating that Periostin may be involved in the transition from myometrial to fibroid-like cells. Ongoing research is being conducted to further determine the effects of Periostin on uterine fibroid development and its potential as a druggable target to treat the disease.

Nicholas B Luke, Environmental Science
Dona Ana Community College
Mentor(s): Dr. Nicole Pietrasiak, New Mexico State University, Assistant Professor for Environmental Soil Microbiology, Plant & Environmental Sciences Department
Program: NM AMP SCCORE

Characterizing Exopolysaccharide Sheathing from Cyanobacteria

Cyanobacteria or blue-green algae are a special group of Bacteria capable of Photosynthesis. They can colonize almost any habitats on earth that receives sunlight including dryland soils. Cyanobacteria produce Extracellular Polysaccharides (EPS) which are a sticky protective layer surrounding their cells. The purpose of this experiment was to characterize the EPS sheath formation of selected filamentous cyanobacteria from permanent and ephemeral freshwater habitats as well as desert soil. Twelve subcultures were sampled and the grown on a Line Orbit Shaker MN 3850 table @ 50 rpm for 14 days. Light was analyzed from different points on the table and the average light that was provided was 40µmol/m2s-1. Then each sample was observed through a Zeiss AxioImager Microscope to survey EPS presence or absence. There was a total of 10 images captured for each of the twelve selected samples. With these images, it was evaluated if the cyanobacteria did or did not produce EPS. Even though the results varied, they all had at least two occurrences of EPS on filaments in the assessed field of view. Quantifying the extend of EPS produced may offer deeper information about potential differences in EPS production of each species and how this may relate to the habitat they occur.

Nathan P Martinez, Genetics and Biotechnology
New Mexico State University
Mentor(s): Immo Hansen, Ph.D. Associate Professor, Molecular Vector Biology, New Mexico State University
Program: NM AMP

Na-K ATPase Subunit Beta Knockdown in Aedes aegypti

Nutrient sensing in mosquitoes is a source for targeting to disrupt egg laying and hatch rates. A cationic amino acid membrane transporter (CAT3) helps with activation for the transcription of yolk proteins. CAT3 is used in the metabolic nutrient-sensing pathway found in mosquitoes. Na-K ATPase beta subunit is thought to interact with CAT3. We hypothesize that the knockdown of the Na-K ATPase subunit beta-2 gene could lead to reduced amino acid transport, and reduced yolk protein production. We predict that lower levels of yolk protein will lead to smaller numbers of eggs laid and lower hatch rates in mosquitoes injected with Na-K ATPase subunit beta dsRNA. Injection of 73 mosquitoes with Na-K ATPase subunit beta (experimental treatment) and 67 mosquitoes with GFP (control treatment) was achieved. Every 24 hours mortality rates were measured in each group. The observed mortality difference between the two groups can be hypothesized that Na-K ATPase knockdown led to a higher rate of mosquito death due to Na-K ATPase significance in the central nervous system. We propose that the significant difference of observed egg numbers laid in our Na-K subunit beta-2 dsRNA group is due to the loss of vitellogenin gene transcription for yolk protein precursors.

Mya M Martinez-Metzgar, Biomedical Sciences and Technology
New Mexico Tech
Mentor(s): Joel Sharbrough, New Mexico Tech, Assistant Professor of Biology
Program: NM AMP

Mitochondrial-Nuclear Genomic Stoichiometery In Diploid vs. Polyploid Snails

Whole genome duplication events (WGDs) are among the most profound mutational changes cells and organisms can endure, and most eukaryotes (including humans) have experienced one or more such events during their evolutionary history. While much work has investigated the immediate and evolutionary consequences of WGD for the nuclear genome, virtually nothing is known about the effects for the mitochondria, the other genomic compartment within the cell. Mitochondria are essential to eukaryotic energy production, and as a result of a history of gene transfers from the mitochondrial genome to the nuclear genome, the proteins that carry out energy production inside the mitochondria are encoded by two distinct and separately inherited genomes: the nuclear and mitochondrial genomes. Successful molecular interactions between the proteins encoded by these two genomes are therefore essential to eukaryotic health and fitness, and changes to one genomic compartment can have dramatic consequences for the other genomic compartment(s) of the cell. Using a previously collected dataset comprised of whole genome sequencing from diploid, triploid, and tetraploid snails, this project will provide the first information collected in an animal about how mitochondrial-nuclear stoichiometry varies in tandem with WGDs in the nuclear genome.The cellular consequences of WGD tested will determine whether WGDs alter stoichiometric balance between the nuclear and mitochondrial genomes resulting in elevated mitochondrial genome copy numbers per cell. We used next-generation sequencing data to quantify the relative numbers of mitochondrial genomes in diploid vs. triploid. vs. tetraploid Potamopyrgus antipodarum, a New Zealand freshwater snail featuring extensive natural variation in nuclear genome copy number. This project provides the first information collected in an animal about how mitochondrial-nuclear stoichiometry varies in tandem with WGDs in the nuclear genome.

Kenda L Pina, Biology
University of New Mexico
Mentor(s): Benjamin Clark, University of New Mexico, Associate Professor of Psychology
Program: NM AMP

Does Moderate Prental Alcohol Impair the Acquisition of Spatial Navigation Strategies by Female and Male Adult Rats in Morris Water Task?

In my research project I am further studying Fetal Alcohol Spectrum Disorders in Prenatal Exposed Rats and the effects this exposure has on the spatial navigation of these rats. Depending on the level exposure I am trying to see whether the rats begin to use other "non-spatial," strategies in learning tasks such as the Morris Water Task which will be the focus of my entire project. The research collected is important because it has the possibility of showing how FASD affects people and the correlation it has with cognitive decline and possibly even the development of neurodegenerative diseases. The overall purpose of this experiment is to find that correlation early on by observing the behavior of these rats and their spatial navigation within the given testing environment. I learned that both exposed/non-exposed groups were able to complete the Morris Water Task in both the independent and control group and therefore more testing needs to be done regarding the prenatal alcohol exposed groups uses different navigational strategies.

Brenda Prieto, Cell & Molecular Biology, Chemistry, and Mathematics
Western New Mexico University
Mentor(s): Nancy Livingston, Western New Mexico University, Professor of Math and Computer Science
Program: NM AMP

Dental Anxiety in Western New Mexico Students

This research is about an overlooked phenomenon called dental anxiety. A survey posted on canvas was used to collect data from anonymous individuals who choose to participate. The main goal for this research was to understand dental anxiety more in college students at WNMU. This data was interpreted as part of a broader population from rural Hispanic Serving Institutions. As a future general dentist, I wanted to comprehend the level of anxiety and ways to cope from students who could be similar to my future patients. The knowledge from this research will hopefully aid the rural HSI population in understanding the phenomenon of dental anxiety and potentially encourage seeking improvement in oral health.

Bryce Roberts, Biology
University of New Mexico
Mentor(s): Davorka Gulisija, University of New Mexico, Assistant Professor of Biology
Program: NM AMP

The Storage Effect Promotes Persistence in Natural Populations in Hostile Habitats

The central question of population biology is "What forces enable population persistence in the face of continuous environmental change?" While classic theory assumed that persistence occurs mostly through genetic adaptation via new beneficial mutations, recent studies propose that populations may persist via adaptation from balanced polymorphism under the storage effect. The theory on storage effects in populations, however, was only examined in models assuming either infinite or a constant population size, where population persistence could not be examined. Here, we extend a model of storage effects under spatially heterogeneous cyclic selection to a population of variable size to explore the effect of storage effects on the persistence of finite populations. Using mathematical modeling and forward-in-time computer simulations, we find that the balanced polymorphism under storage effects promotes population persistence under a wide set of selection regimes and population subdivision scenarios. Models of storage effects under logarithmic population growth, such as ours, are crucial for the understanding of the relevance of storage effects on natural population adaptation and persistence.

Diego Ruiz, Biology and Microbiology
New Mexico State University
Mentor(s): Teri Orr, New Mexico State University, Assistant Professor of Biology
Program: NM AMP

Development of Methods To Determine Bat Sperm Storage/ Reproductive Stage

Establishing a set of methods to determine reproductive stage as well as bat sperm storage is important to begin future research into immune mechanisms of bats. When organisms encounter foreign cells, an immune response protects the host against harm. In certain bat species where sperm can be stored for several months, this can communicate that the immune system is not actively attacking those sperm. Studying these immune mechanisms can have human reproductive health implications specifically in low sperm survival rates. To establish a foundation for these studies, methods to determine five key reproductive stages are needed (proestrus, estrus, metestrus, diestrus and female sperm storage). Vaginal lavages were conducted to obtain cells from the vaginal canal than were stained (using a Papanicolaou stain) to see different characteristics of the cells. Two stages were observed using the lavage and pap stain techniques meaning that the methods were reliable for determining different reproductive stages. To create greater contrast, changes in the lavage technique will be made to have a greater density of cells and the pap staining will slightly change to create a greater contrast of color between cells and more.

Bianca M Soto, Biology
University of New Mexico
Mentor(s): Dr. David Hanson, University of New Mexico, Professor of Biology
Program: NM AMP SCCORE

Capsaicin Content in Martinez Chimayo Chiles

Dr. Jacob Torres started a community science project that UNM collaborated on to figure out which Martinez Chimayo chile pepper is the spiciest. Chiles are specifically favorable for space because of their capsaicin content, which is the spice you feel when you consume them, and their health benefits. The zero gravity environment means astronauts have decreased sense of taste, so chiles would make the best food to consume in space. This project aimed to find if red or green Martinez chimayo peppers had a higher capsaicin content. The goal of this project was to find out who and how the hottest chile pepper was grown (the growth parameters). This project will help NASA collect data and figure out how to grow healthy and successful chiles in the zero gravity atmosphere at the space station.

Karina Alyssa Tovar, Environmental Science
New Mexico State University
Mentor(s): Dr. Nicole Pietrasiak, New Mexico State University, Assistant Professor for Environmental Soil Microbiology, Plant & Environmental Sciences Department
Program: NM AMP

First insights into the soils and their microbiome across microhabitats at the Jornada Experimental Range

Our project goal is to enrich our knowledge of dryland soil microbiology by adding baseline information of how Chihuahuan Desert microhabitats structure soil microbial communities. We will conduct an observational study of Chihuahuan Desert soil microbial communities at the Jornada Experimental Range. Our specific objectives are to: 1) Investigate if the soil microbial communities differ across microhabitats including the soil under a desert shrub, a perennial grass, biological soil crusts, and the barren space in between desert plants, hereafter termed plant interspace. 2) Identify the types of microbes that grow particularly in surface soils. 3) Link the patterns we will observe to ecosystem processes important to support plant life in the desert, e.g., nutrient cycling and availability.

MATHEMATICS

Dominick N Martinez, Mathematics
Northern New Mexico College
Mentor(s): David Torres, Northern New Mexico College, Chair of Mathematics and Physical Science
Program: NM AMP

Analysis of T cell Movement within Lymph Nodes

T cells are lymphocytes that serve an important role in the immune system. The T cells we analyze originate from the lymph nodes of mice. The data comes from the University of New Mexico, where two-photon microscopy was used to record time and three-dimensional Cartesian coordinates of T cell locations. We computed the speed, turning angle, and slopes from the squared displacement of T cell tracks to create distributions. Distributions illustrate the motion type (e.g. Brownian vs ballistic) and the speeds or angles that occur most frequently. We also computed p-values when comparing different T cell movies to quantify differences in T cell speeds.

Jacob R Wood, Applied Mathematics
Western New Mexico University
Mentor(s): Nancy Livingston, Western New Mexico University, Professor of Mathematics
Program: NM AMP

Mathematics and Students Within the Classroom

To gather data about student's math capabilities in and outside of class and create an analysis to see where students are and if there 'should' be a way to better help students in and outside the classroom in regards to mathematics.

PHYSICAL SCIENCE

Zachary Chavez, Earth and Environmental Science
New Mexico Tech
Mentor(s): Daniel Cadol, New Mexico Tech, Associate Professor of Hydrology
Program: NM AMP

Evaluating methods for remote measurement of stream flow velocity in ephemeral flash flood environments

Obtaining measurements of water velocity during flash flooding events is both difficult and dangerous. Safety is of the utmost importance when conducting research in the field, particularly in remote areas with limited vehicle and support access. Traditional methods of measuring water velocity are insufficient, especially when considering the unpredictability of shot-lived ephemeral flash floods. New, automated methods should be evaluated for their accuracy. We evaluated two methods to measure surface water velocity: Doppler velocity radar and Large-Scale Particle Image Velocimetry (LSPIV). The Doppler radar records an average of the surface velocity by directing a beam of radio wave energy at an approaching target. The frequency shift of the reflected energy is proportional to the radial velocity of the target object relative to the velocimeter. LSPIV analysis consists of recording a video of a flood and analyzing each frame for changes in the water surface. Individual particle tracking produces an array of surface velocity vectors. Using cross section and reference target surveys, continuously monitored stage data, and estimates of the ratio of depth-averaged velocity to surface water velocity for a given relative roughness, continuous cross-section-average velocity can be estimated for the flood event, and from this the entire discharge hydrograph.

Jhanene Heying-Melendrez, Physics
New Mexico Tech
Mentor(s): Dr. Kenneth Minschwaner, New Mexico Institute of Mining and Technology, Professor of Physics
Program: NM AMP

Investigations of Ozone Dynamics and Chemistry from Satellite and Balloon Sounding Data

Ozone, is an atmospheric gas that greatly affects the surface ultraviolet radiation, air quality, and climate. In the stratosphere, ozone is considered beneficial as it absorbs ultraviolet light from the sun which reduces the exposure of plants and animals to damaging ultraviolet radiation. Closer to the surface in the troposphere, ozone is detrimental to the environment because it is a strong oxidizer and can attack plant tissue and animal respiratory systems. Ozone is also a powerful greenhouse gas that contributes to global warming. Quantifying observed variations in ozone and potential temperature with altitude allows for the detection of ozone laminae (thin layered features), and thus aids in the identification of the mechanisms that produce or destroy ozone. Data from the National Oceanic and Atmospheric Administration (NOAA) balloon ozonesondes are used along with algorithms in Interactive Data Language (IDL) software to identify spatial patterns in laminar features of balloon soundings. Plots of the measurements taken via ozonesondes will be analyzed for NOAA stations at Boulder, Colorado, and Pago Pago, Samoa, to determine the relationships between ozone and potential temperature at different altitudes in the troposphere and stratosphere. Comparisons of ozone laminae detected at different stations and across different seasons will be presented. Analysis between different periods of time will be done to see if the data is indicative of correlations between seasonality and changing ozone laminae.

Vennessa D Maestas, Biology
Central New Mexico Community College
Mentor(s): Marina Hien, New Mexico Tech, Graduate Student
Program: NM AMP SCCORE

Vegetation Surveys

I filled the position of a vegetation survey intern. My job was to assist my advisor Marina Hien in her research on quantifying Rio Grande water loss due to invasive plants. The vegetation surveys were conducted to collect data on plant variation and quantity. The data was collected by conducting vegetation surveys within 200 meters of the Rio Grande. We would scout the 200 meters then decide what portion was most representative of the area. We would lay a 30-meter tape vertically starting at the west point then heading east. We would carry a meter stick horizontally on the line then walk and record all vegetation within that locality onto a data sheet. The data we collected showed plant variation within the 6 locations surveyed. The data can later be used by Marina to answer her research question "How much water is lost along the middle Rio Grande due to Tamarisk evapotranspiration?" A pattern I was able to observe is that in areas of canopy such as Cottonwoods or Tamarisk there was little ground vegetation. Further research is desirable. Considering the aid, I was able to hand lasted only a month. I was part to the successful completion of 6 out of 7 of the transects.

Fillipp Edvard L Salvador, Chemistry
New Mexico Tech
Mentor(s): Wenyang Gao, New Mexico Tech, Associate Professor of Chemistry
Program: NM AMP

Mechanochemistry of Group 4 Elements-based Metal-Organic Frameworks

Metal-organic frameworks are a growing class of porous materials composed of a metal node and organic linker. The customizability made possible by the many different metal and organic linker combinations allows MOFs to be utilized in many applications. Some of them are gas capture, gas separation, gas storage, catalysis, and drug delivery. This promising family of materials is conventionally synthesized solvothermally or hydrothermally, which uses excess solvent and high temperatures. This takes away from the environmental benefits that MOFs may have. An alternative synthetic method is through mechanochemistry, which forms the extended structure through mechanical force. This method as of now has been used to recreate already known MOFs; we synthesized and characterized a family of hafnium based MOFs mechanochemically. We also synthesized a family of hafnium-zirconium multimetallic MOFs, and found that mechanochemistry allows for the synthesis of cluster precise multimetallic MOFs. Mechanochemistry gives the user a higher degree of control in the distribution of metals in multimetallic MOFs, and we believe that this is a step towards a deeper understanding of MOF chemistry.

James T Sanchez, Physics
New Mexico Tech
Mentor(s): Caitano da Silva, New Mexico Tech, Assistant Professor of Physics
Program: NM AMP

Combining Machine Learning and Monte Carlo Simulations to Probe the Physics of Runaway Electrons

Runaway electron phenomena pose many exciting - and largely unanswered - questions involving their behavior in and implications to earth's atmosphere. Even in the absence of well-defined experimental methods for analyzing runaway electrons, great insight can be gained from utilizing Monte Carlo methods to computationally simulate them. We made use of the Geant4 C++ toolkit to simulate streamer discharges, mirroring an experimental setup carried out in 2017 (da Silva et al., GRL, 44, 11174, 2017). Thousands of (monoenergetic) simulations were carried out, each producing a unique deposited energy spectrum. Methods including random sampling and random combination were used to combine the simulation spectra to yield a non-monoenergetic distribution. The combining of spectra was done for the purpose of matching computational data with experimental data obtained from the experiment that our simulation was modeled after. Estimations of the shape of the energy / initial electron count distribution were made, but to no greater accuracy than R-squared values of 0.52. It is clear that machine learning methods are the next step to obtain the desired energy / initial electron count distribution. Early analysis suggests that an unsupervised probabilistic clustering algorithm would be very useful for this application.

Rosa I Villalba, Environmental Science
New Mexico State University
Mentor(s): Manoj Shukla, New Mexico State University, Professor, Plant and Environmental Sciences
Program: NM AMP

Water Use Efficiency Improvement

The most used irrigation type used in New Mexico is Flood Irrigation. Flood Irrigation has been shown to lose a high percentage of water through evaporation. By incorporating the micro-gravity drip irrigation system, water waste could potentially be cut. Water for agricultural use is becoming scarce globally. It is essential to provide a solution to improve water use efficiency. In this project, the micro-drip irrigation system was installed by one irrigation line per one crop row. Sixteen total Chile rows were used to calculate data. Soil, plant, and water samples were collected and analyzed. Two different irrigation rates were used to compare and determine irrigation water output. This practice provides a demonstration of water conservation innovation. Overall, the micro-gravity drip irrigation system accurately monitors soil moisture and plant stress and determines when to increase or reduce irrigation. And improves crop yields while decreasing incidents of disease.

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