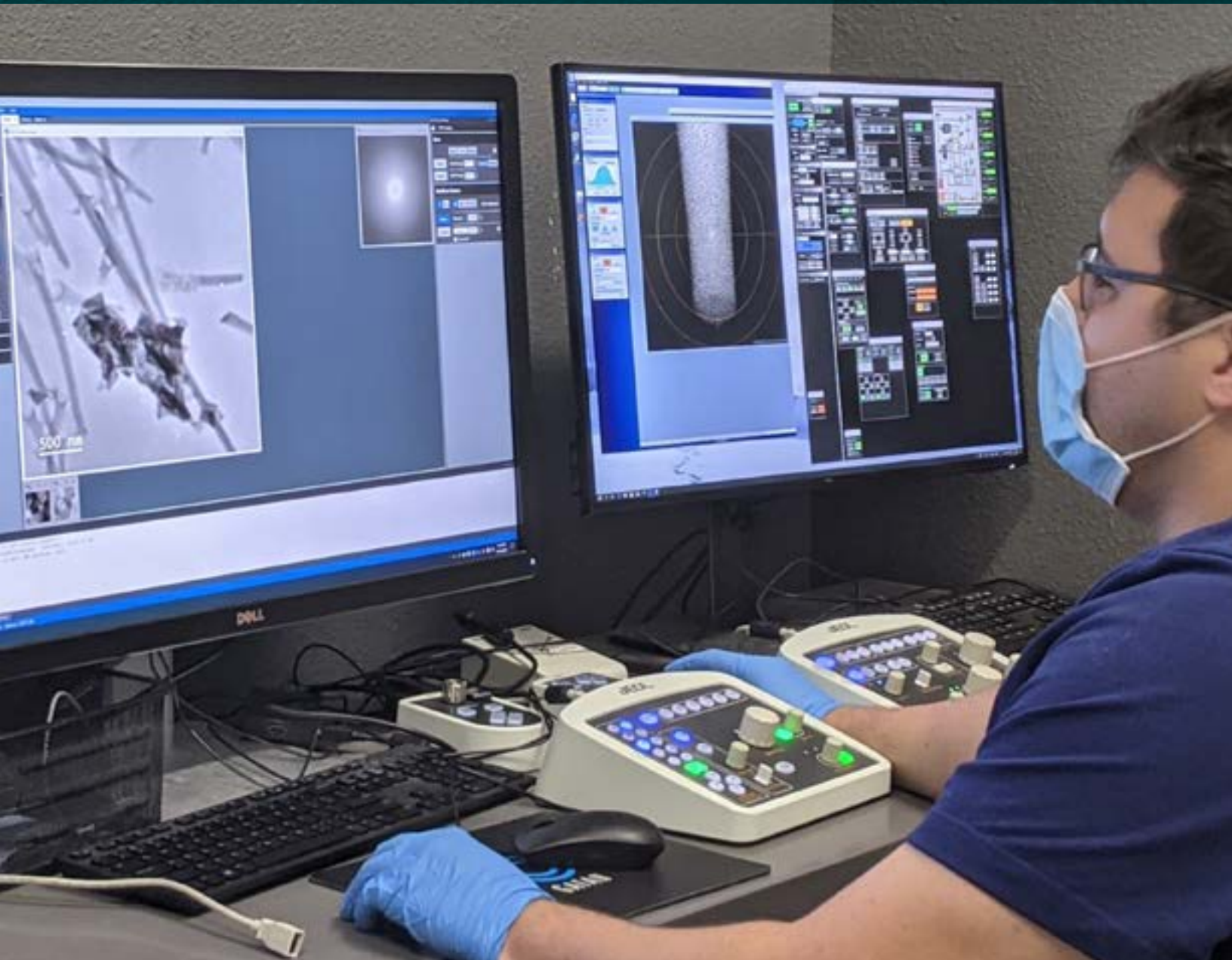


2021

IMPACT REPORT



NM INTERDISCIPLINARY
SCIENCE CO-OP

THE UNIVERSITY OF NEW MEXICO



INTERDISCIPLINARY
SCIENCE CO-OP

2021 IMPACT REPORT

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MESSAGE FROM THE ASSOCIATE DEAN FOR RESEARCH



In 2020, UNM launched the Interdisciplinary Science Cooperative (Co-op) with the goal of increasing collaborative research opportunities across campus. While the pandemic has presented some significant challenges to all of us, you'll see throughout this year's impact report that our goal has not only been realized — it has also expanded into some significant research opportunities for our students, faculty, and the state of New Mexico as a whole.

It has been an honor to serve as the founding faculty coordinator for the Co-op, and I am incredibly proud of the strides we have made in just two short years. Professor of Chemistry and Chemical Biology Jeffrey Rack, who leads the Laboratory for Magneto-optical Spectroscopy, took over as faculty coordinator in November of 2021 and has since hit the ground running with new ideas and a fresh outlook that I am certain will bring new opportunities for our research collaborative. I look forward to supporting him in his efforts in my new role as the associate dean for research in the College of Arts & Sciences.

As the largest College on campus, UNM's College of Arts & Sciences has a long history of providing some of the most diverse research opportunities to both our students and our faculty. With the Co-op, we have not only been able to expand on these opportunities within the College but throughout the University as a whole. Our Centers' and labs' relationships throughout campus — and the world — are drawing attention to the fact that UNM is a leader in research and research education.

Thank you for your support in another successful year at the Co-op, and please join me in welcoming Professor Rack to his new position.

Warmly,

Christopher D. Lippitt, PhD
Associate Dean for Research
UNM College of Arts & Sciences

LOOKING AHEAD

BY JEFFREY RACK, PHD
Faculty Coordinator
Interdisciplinary Science
Cooperative



As a member of the Co-op, I have seen first-hand how our students and faculty have benefited from being in a collaborative environment. Now, in my new role as the faculty coordinator, I look forward to expanding on these opportunities so that we can continue to forge new ground in interdisciplinary research and education.

The state-of-the-art capabilities that the Physics and Astronomy & Interdisciplinary Science (PAÍS) building provides has already improved our ability to create more impactful research outcomes. The space was always intended to be shared, however, and over the coming year we hope to do more of that, as safely as possible.

The [2nd Annual Team Research Symposium](#) is scheduled for April 19 - 21, 2022 and we invite all of our external collaborators to join us for this campus-wide event. Through both in-person and virtual sessions, there will be plenty of opportunities for our students, faculty, and alumni to engage. We are especially excited to announce that Dr. Sanjeev Arora of Project ECHO has kindly agreed to serve as our keynote speaker on April 19th.

In addition to this, the Co-op will also be the topic of the UNM Alumni Association's popular [Lobo Living Room](#) which will be held in PAÍS on April 28th. While our October [Open House](#) was virtual this year, we look forward to inviting you in for a more personal tour this fall. Throughout the year, we look forward to inviting new collaborators in for tours as well as our Co-op Collaboration series that will be dedicated to bringing in experts within the field of team research to share best practices.

I look forward to sharing the Co-op with our extended community and invite you to join us in our mission to advance interdisciplinary research opportunities for our campus community.

Last spring, the Co-op, in cooperation with [UNM's Grand Challenges](#), provided our campus community with a special opportunity to connect with one another - virtually - at our [inaugural Team Ream Research Symposium](#). Dedicated to bringing faculty, students, and external partners together in the spirit of producing more productive research teams, this free event was able to draw in nearly 200 individuals from across campus - and the world.

With 20 sessions spread across three days, participants were given opportunities to share best practices, learn about each other's work, and even make new connections through our virtual platform. UNM President Garnett S. Stokes and Provost James Holloway kicked off the three day event, which included keynote presentations from the Director of the [Michigan State University Center for Interdisciplinarity, Michael O'Rourke](#), as well as UNM's new [Vice President for Research, Ellen Fisher](#).

Students and faculty were also given the opportunity to compete for prize money in our team research concept competitions. Associate Provost for Faculty Success, Bill Stanley, PhD and Associate Provost for Student Success, Pamela Cheek, PhD wrapped up the three-day event by presenting the recipients of these awards.

**This year's
symposium will be held
April 19 - 21, 2022.
Contact us at
Teams@unm.edu to get
involved.**

TEAM RESEARCH SYMPOSIUM

Special appreciation goes out to our sponsors for making the student and faculty competitions possible: [The Office of the Vice President of Research, UNM Grand Challenges](#), [Expanding Course-Based Undergraduate Research Experiences \(ECURE\)](#), the [Innovation Academy](#), and the [Museum Research Traineeship](#).

In an effort to make this event accessible to as many individuals as possible, many of the sessions can be viewed for free on the [Co-op's YouTube channel](#). Here, you can view the keynote presentations, Lightning Presentations from UNM faculty, and even the team research concept competitions.

[Registration is now open](#) for this year's interdisciplinary team building event which will take place Tuesday, April 19 - Thursday, April 21, 2022. We look forward to bringing more of our campus community together through in-person networking opportunities as well as virtual sessions for those outside of Albuquerque.

If you are interested in supporting UNM's team research efforts or would like to learn more about how to get involved in the symposium, contact us at teams@unm.edu.

Lands held by sovereign Indigenous nations throughout the United States have been impacted by environmental contaminants from hard rock mining and lack of solid waste disposal facilities. As a result, documenting and addressing health disparities experienced by Indigenous communities remains vital. Yan Lin, Assistant Professor of Geography and Environmental Studies and affiliate faculty at the [Center for the Advancement of Spatial Informatics Research and Education \(ASPIRE\)](#), is leading the way to address these impacts in truly innovative ways.

Through the [Center for Native Environmental Health Equity Research](#) at the UNM College of Pharmacy, which is funded by the National Institutes of Health, Assistant Professor Lin and her colleague, Assistant Professor Joseph Hoover of Montana State University Billings' Department of Social Sciences & Cultural Studies, are co-directing one of three Center research projects.

Their project, ["Evaluating Cumulative Environmental Exposure to Metals and Non-metals and Community-level Health Using Geospatial Modeling and Personal Exposure Assessment"](#) will model multiple exposure pathways using geospatial technology. Their goal is to further our understanding of the extent of chemical mixture



exposures experienced by the Navajo Nation, Crow (Apsáalooke) Nation, and Cheyenne River Sioux tribes.

This community-driven project, initiated by tribal members, builds on research partnerships developed over decades and has active involvement from community leadership and members. The project supports communities as they strive to understand the health disparities they face, as well as address potential contaminant sources in order to protect their land, their ways of life, and their people.

Says Lin, "Our research is directly responding to decades of community concerns about exposures to mine wastes from more than 160,000 abandoned hard rock mines throughout the Western US, as well as new community concerns about the lack of adequate waste management infrastructure common on tribal lands which leads to open dumping and burning of waste. There is a need to consider these synergistic or confounding environmental



ADDRESSING HEALTH DISPARITIES

exposures that disproportionately affect tribal communities."

Lin and Hoover are leading the geospatial work to identify areas that have higher exposure potential to contaminants from abandoned uranium mines and solid waste disposal sites, which could be dispersed through air, water or plants. They developed a Geographic Information System (GIS) model specifically for Indigenous communities to include multiple pathways of exposure relevant to the partners. Using model results, they work with other research team members to identify the sites with greatest exposure potential for further environmental sampling of water, soil, air, and plants.

This model also includes data from domesticated livestock, which will be tracked using Global Positioning System (GPS) collars to gain a better understanding of the areas they congregate and graze. To do this, the research team will place a non-invasive silicone band on the livestock GPS collar. The information recorded will help the research team understand where the animals are getting their food and water and identify potential sources of contaminant exposure.

"There is a need to consider these...environmental exposures that disproportionately affect tribal communities."

YAN LIN, PHD
Assistant Professor of
Geography and
Environmental Studies



This unique technology is currently being used to detect airborne chemicals at dump sites on Tribal lands. In a future phase of this project, community members will wear these silicone bands to assess personal exposures.

Together with the support of community partners from the Navajo Nation, Crow Nation, and Cheyenne River Sioux tribe, Assistant Professors Lin and Hoover and the Center for Native Environmental Health Equity Research are working to address links between exposure and disease in Indigenous communities. Ultimately, through this partnership, they seek to reduce exposure and improve community health.

CULTURE AS TREATMENT



JALENE HERRON
PhD Candidate,
Psychology



KAMILLA VENNER, PHD
Associate Professor,
Psychology

After years of dedicated service working to improve the health and wellbeing of underserved communities. Drs. Robert Duncan and Annette Sobel have created a new opportunity for graduate students to make their own impacts on these communities. The [Science for Health of Indigenous Populations \(SHIP\)](#) award, made possible by a generous gift from Drs. Duncan and Sobel, recognizes one PhD student and their mentor annually for their active understanding and promotion of Indigenous health through interdisciplinary research.

The award is being dispersed through the [Computational Genomics & Technology \(CGaT\)](#) laboratory due to their extensive connections to multiple departments throughout campus, including the Health Sciences Center. By

“I want to thank Drs. Sobel and Duncan for...honoring Native people in our research here at UNM”

bringing attention to their work, Drs. Duncan and Sobel hope that more opportunities will be forged for other research groups like theirs throughout campus. PhD candidate in Psychology, Jalene Herron, and her mentor, Associate Professor of Psychology, Kamilla Venner, were selected as the first recipients of the SHIP award because of their dedication to analyzing the importance of culturally relevant treatment options as a pathway to recovery for substance use disorders. They [presented](#) their research at a special session during the Team Research Symposium on Thursday, April 22, 2021.

In her nomination of Jalene for the SHIP award, Venner said, “Jalene is the ideal candidate for this award. First, she is Indigenous. She has worked for the National Congress of American Indians to influence policy for American Indian/Alaska Native health, and she has focused her research on improving substance use outcomes for American Indian/Alaskan Natives...Her research has remained focused on improving Indigenous health and bringing in cultural lenses to improve our science.” Having grown up in the native village of Bethel,

Alaska, Jalene’s experiences with her Yup’ik culture heavily influenced the work she is doing now to address substance use disorders in Indigenous populations. Jalene has carried with her those connections to home and family throughout her educational experience, from Alaska to Washington state to New Mexico.

“Culture as treatment” guided Jalene’s selected project, which looked at how cultural identity and involvement act as a protective factor against alcohol use disorder. Through a seven-month intervention that used contingency management — a reward structure based on the achievement of target behaviors — Jalene used a method that is traditionally successful in addressing treatment options for recreational drug use but has not been applied widely in alcohol use disorder.

The results of her research found enculturation to be an important protective factor against heavy drinking. In addition, contingency management was found to be an effective intervention in reducing alcohol use amongst rural reservation-dwelling American Indian adults. Ultimately, these findings will help tribal communities deliver culturally-informed and relevant treatment options for reducing alcohol use.

The SHIP award recognized Jalene’s work with a \$10,000 award and Venner’s with \$5,000 in research support. This annual award will continue to recognize important projects like

Jalene’s throughout UNM in order to bring attention to the promotion and understanding of Indigenous health. Jalene expressed her gratitude by saying, “I want to thank Drs. Sobel and Duncan for creating this award, for acknowledging that UNM resides on the land of the Pueblo of Sandia, and that we should be honoring Native people in our research here at UNM.”

For Drs. Duncan and Sobel, this award is intended to “encourage and recognize excellence in science that will advance the health care of Indigenous populations. We are excited to see UNM recognized for its strength in this field of science, and for their commitment to the health of Indigenous populations here in New Mexico, and throughout the world.”



ANNETTE SOBEL, PHD



ROBERT DUNCAN, PHD

Longstanding beliefs about the causes of osteoarthritis, one of the most debilitating joint diseases of our time, are being challenged thanks to research being done at the [Comparative Human and Primate Physiology \(CHMPP\) Center](#). Assistant Professor of Anthropology, [Ian Wallace](#), and his colleagues at a number of institutions including Harvard University and Boston University, are reexamining the causes of osteoarthritis. What they have found may change the way that this and other non-communicable diseases (NCDs) are treated — or possibly even prevented.

Cases of NCDs are on the rise and, as a result, they are quickly becoming one of the most urgent health concerns of today. Alarming, many of these cases are occurring among non-industrial Indigenous communities in low- and middle-income countries, where lifestyles are rapidly changing due to outside economic and cultural influences — putting many people with little access to healthcare at increased risk of NCDs.

For years, researchers have believed that the cartilage breakdown that occurs in osteoarthritis is due to wear and tear from physical activity. However, as a postdoctoral fellow at Harvard, Wallace found through his [research](#) that despite the fact that physical activity has generally decreased in recent decades, the prevalence of osteoarthritis in the United States has doubled since World War II. In fact, by studying ancient skeletons housed at museums throughout the country, Wallace found that the prevalence of the disease is twice as high now as it was during prehistoric times, when people were presumably much more physically active than today. His research made [national news](#).

According to Wallace, “When we started this research, we were puzzled by the common view of osteoarthritis. Why would physical activity be good for every part of our bodies except our joints?”

This led to an experimental [study](#) involving guinea pigs, who develop osteoarthritis in a similar manner as humans. By analyzing the knees from both sedentary and physically active guinea pigs, Wallace and his colleagues found that the rate of osteoarthritis was actually higher in the sedentary group.

Could physical *inactivity*, rather than activity be a major cause of osteoarthritis?

This question led [Wallace and his collaborators](#) to Chihuahua, Mexico, where an Indigenous population of farmers known as the Tarahumara (pronounced taa-ruh-hoo-maa-ruh) reside. The work the Tarahumara do is incredibly strenuous, and they are also well known around the world for the number of ultra-marathoners they have produced.

“Why would physical activity be good for every part of our bodies except our joints?”

As Wallace’s team predicted, they found little evidence that the Tarahumara’s high physical activity levels place them at greater risk of osteoarthritis. However, the Tarahumara are not entirely immune to the disease. Instead of physical inactivity, the greatest threat to Tarahumara joint health appeared to be recent shifts

towards more market-based diets, which have resulted in weight gain and chronic inflammation.

These discoveries have now led Wallace and his colleagues to Malaysia, where the Indigenous people known as the Orang Asli are experiencing rapid lifestyle changes that are expected to be increasing their susceptibility to osteoarthritis and other NCDs. Through their [study of the Orang Asli](#), Wallace’s interdisciplinary team of anthropologists, biomedical researchers, and clinicians aim to determine why lifestyles are changing and how these changes are impacting health.

Over the next five years, this field study in Malaysia will collect a wide range of data through long-term relationships with Orang Asli communities. From these data, they hope to find the intrinsic and extrinsic factors that affect susceptibility or resilience to NCDs. Their findings have the potential to not only help us understand the factors that impact the onset of NCDs but to improve the health of many Indigenous communities throughout the world.

For updates on the Orang Asli Health and Lifeways Project (OAHeLP), visit the newly established website at www.OrangAsliHealth.org.



IAN WALLACE, PHD
Assistant Professor of Anthropology



**RURAL MALAYSIA (Left)
VS. URBAN MALAYSIA
(right)**

PHOTO BY DAVID RAMOS

**UNLOCKING
THE
MYSTERIES OF
JOINT HEALTH**

Thanks to two large developments over this past year, UNM's [Center for Quantum Information and Control \(CQUIC\)](#) is now poised to become the national center of Quantum Information Science (QIS). Led by Regents' Professor Ivan H. Deutsch, CQUIC's rich 25-year history in advancing education and research within QIS has made them the natural choice to help place New Mexico on the map as a truly Quantum State.

A Hub for QIS Theory

In 2021, the National Science Foundation made a \$3,000,000 renewal award to CQUIC over the next five years to spearhead an effort that will not only lead to new advances in QIS but to new educational opportunities for the next generation of scientists as well.

In 2016, CQUIC became a hub for theoretical QIS in New Mexico thanks to an initial award from the NSF's Focused Research Hubs in Theoretical Physics (FRHTP) program. With this renewal award, CQUIC will grow as a national hub that strategically brings the QIS theory-community together through a prize postdoctoral fellowship program that will provide an unrivaled education to future leaders within the field, as well as the ability to host national visitors, workshops, and conferences and help coordinate center across the National Quantum Initiative.

Thanks to the capabilities provided by UNM's new state-of-the-art Physics & Astronomy and Interdisciplinary Science

“Basic research is the foundation of knowledge creation that enables first-class education and training at UNM”

(PAÍS) building, leading experts within the field will have access to a world-class facility that will enable them to come together to collaborate, innovate, and tackle the most important problems within QIS.

To accomplish the project's goals, this collaborative effort will consist of an interdisciplinary team of senior investigators at UNM, including Professors Akimasa Miyake and Elizabeth Crosson in the department of Physics & Astronomy; Professors Tameem Albash, and Milad Marvian of Electrical & Computer Engineering; and Professor Susan R. Atlas, of Chemistry & Chemical Biology.

“Basic research is the foundation of knowledge creation that enables first-class education and training at UNM” says Deutsch. “By taking CQUIC to the next level with our partners, this NSF award will vastly expand opportunities for our diverse community of New Mexicans and build national strength right here at home.”

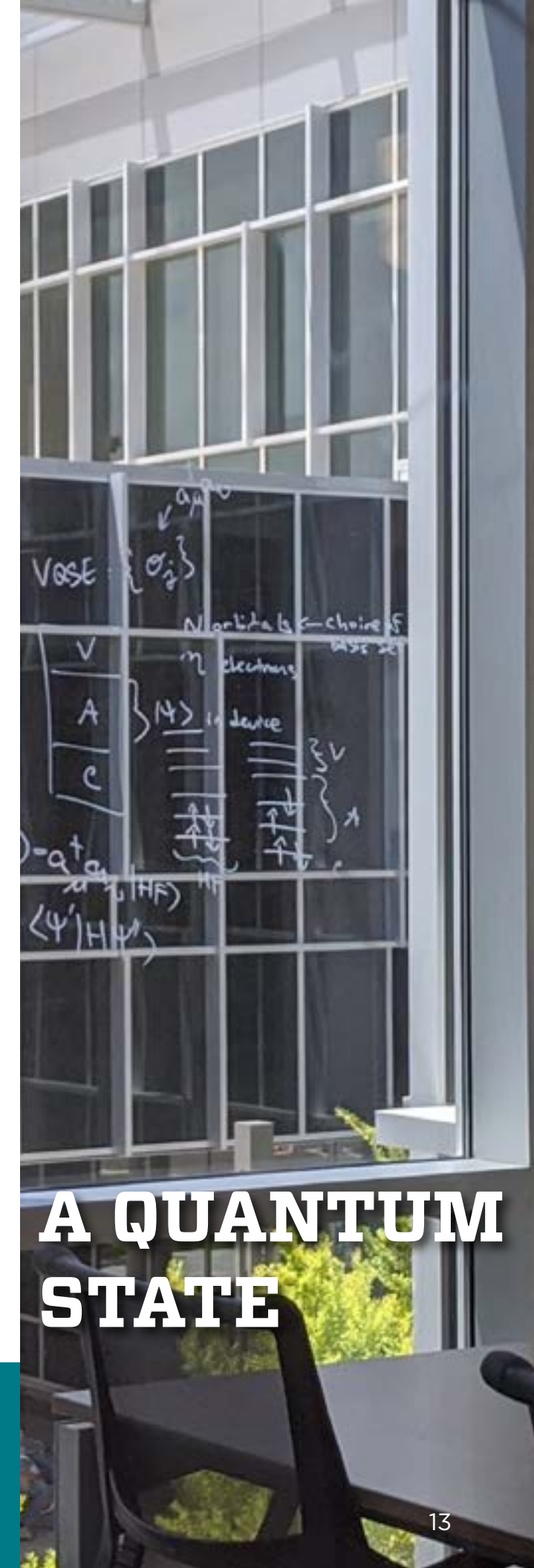
The QNM Institute

The opportunities for postdoctoral students to expand on their education in QIS will continue to grow with the establishment of the Quantum New Mexico (QNM) Institute. In partnership with the Sandia National Labs, this academic institute will bring in students and postdocs as well as other experts within the field to collaborate on research projects between UNM and Sandia.

By bringing together two of the greatest powerhouses in QIS in the state of New Mexico, this unique opportunity to engage with the business, technology transfer, and economic developments groups at Sandia and UNM will provide new prospects for recruitment, funding, and industry.

Now is the ideal time for this initiative, as the quantum industry is growing and the White House's National Quantum Initiative has made this field a priority. Future leaders in QIS will be at the forefront of their field due to this innovative partnership which promises to expand on New Mexico -- and UNM's -- long history in advancing QIS.

To launch the Quantum Institute, a [symposium](#) is being planned for March 31 – April 1, 2022. Over the course of these two days, our campus community, along with our external partners, will gather together to learn about the Institute's goals and form strategic partnerships in order to meet those goals. For more information, or to be put on the invitation list, please contact QNM@unm.edu.



IVAN H. DEUTSCH, PHD
Regents' Professor & Director of CQUIC



TAMEEM ALBASH, PHD
Professor, Electrical & Computer Engineering



SUSAN ATLAS, PHD
Professor, Chemistry & Chemical Biology



ELIZABETH CROSSON, PHD
Professor, Electrical & Computer Engineering



MILAD MARVIAN, PHD
Professor, Electrical & Computer Engineering



AKIMASA MIYAKE, PHD
Professor, Physics & Astronomy



The Center for Stable Isotopes is one of the largest stable isotopes centers in the country in terms of instrumentation, and their new cutting-edge facility, located in the Physics & Astronomy and Interdisciplinary Science (PAÍS) building, is providing a whole new world of opportunities for future leaders in science.

IsoCamp

After 25 years at the University of Utah, the [Center for Stable Isotopes \(CSI\)](#) has taken over the world-renowned [IsoCamp](#), a preeminent international short course which provides graduate students and postdocs from across a variety of majors — and from around the world— a hybrid classroom, field, and laboratory course on stable isotopes.

IsoCamp takes advantage of the unique facilities of both CSI and PAÍS, bringing together UNM instructors such as CSI Director and Distinguished Professor of Earth & Planetary Sciences, Zachary Sharp; CSI Associate Director and Associate Professor of Biology, Seth Newsome; Professor of Anthropology, Keith Prufer; and Associate Professor of Earth & Planetary Sciences, Joseph Galewsky. Throughout the two weeks, 25 instructors from 17 universities presented to IsoCamp attendees, both in-person and virtually.

Throughout this unique “field camp,” students collect samples from diverse field sites around Albuquerque and process them using CSI’s sophisticated laboratory facilities. They work in teams under the guidance of their instructors to create high-quality research projects, which are presented at the end of the course.

CSI was originally set to launch the first UNM IsoCamp in 2020, but due to the pandemic had to cancel for the first time in its history. In 2021, however, the course was safely executed from August 2-13 with 35 in-person students and 14 virtual students from 42 universities spread across the world. They join a diverse community of approximately 1,000 IsoCamp alumni who have built companies together, produced multiple publications together, and have formed incredibly special bonds with one another.



**WORLD CLASS
EDUCATION**

Stable Isotope Workshop

For the past four years, the Stable Isotope Workshop has invited Albuquerque high school students into the CSI lab to introduce them to isotopes and how they can be used to study the ecology of the Bosque ecosystem along the Rio Grande. The workshop is co-organized by the Bosque School and the Cebrian Goodman Youth Program.

This year, the workshop was held from October 22-23 and welcomed eight students from three schools. Mikayla Ranspot, a UNM sophomore who attended the workshop as a high school student in 2019, came back this year as an instructor because the experience made such an impact on her as a student.

“I was not the biggest fan of chemistry in high school,” Ranspot says, “so when I applied for the Stable Isotopes Workshop my junior year, I wasn’t expecting to find a passion for research.”

During the three-day workshop I was able to work with some amazing scientists and learn about the variety of projects going on in the lab.”

“After the workshop finished,” Ranspot continued, “I had the opportunity to create my own research project and get hands-on experience in the lab. The project I was able to create got me to where I am today, and I am so excited to start creating a research project while being an undergraduate. I am so thankful for everyone in the CSI lab and am excited to continue my journey at UNM and the Center for Stable Isotopes.”

Ranspot was introduced to the workshop through her senior project with the [Bosque Ecosystem Monitoring Program \(BEMP\)](#). The experience inspired her to broaden her research experiences and encourage others to participate as well. She is currently working in CSI on a research project using isotopes to track the movement of gray whales, which she anticipates becoming her senior thesis at UNM.

“When I applied to the Stable Isotope Workshop my junior year, I wasn’t expecting to find a passion for research”

**- Mikayla Ranspot
BS Candidate, 2024**



LABORATORY FOR MAGNETO-OPTICAL SPECTROSCOPY

Research being done in the [Laboratory for Magneto-optical Spectroscopy](#) could impact the future development of quantum computers – and technology as a whole. In a collaborative project with Luping Yu and colleagues at the University of Chicago, Professor Jeffrey Rack and PhD candidate in Chemistry, Emigdio Turner, are chemically engineering materials that have resulted in a publication titled, [“Finely Designed P3HT-Based Fully Conjugated Graft Polymer: Optical Measurements, Morphology, and the Faraday Effect.”](#)

This collaborative project arose through the need to fabricate new magneto-optic active materials and to measure those properties. New emerging and existing technologies are interested in the ability to monitor light polarization for information storage and detection. This area of study involving magneto-optic materials requires experts in both spectroscopy and materials science.

“We met through a mutual colleague and realized that we had similar research interests and that we could help each other in this interesting and collaborative research area,” says Jeffrey Rack.

Using a phenomenon called the Faraday rotation (also known as Magnetic Optical Rotary Dispersion or MORD), which is the rotation of polarized light as it passes through a material

in a magnetic field, the group has created a new material that may more efficiently manipulate light.

The UNM group has developed a new custom-built instrument to measure the rotation of light. The University of Chicago group has prepared the polymeric materials for measurement. While the groups are still in the early stages of their work, the published and unpublished work (a second paper was recently submitted) promise to greatly expand the types of materials displaying this activity and our understanding of how light interacts with these materials.

Students working on this project are learning concepts across multiple disciplines, due to its highly interdisciplinary concepts involving optics (physics), molecular design (chemistry), and ultimately device fabrication (engineering). The project starts with the design and preparation of molecules (or polymers) with specific properties that will enable them to respond to both the magnetic field and light.

“At high enough optical and magnetic powers, all materials will respond to light,” says Rack, “the trick is to have them respond at low intensities and low magnetic field strengths, and to have them respond in a predictable fashion.”

Chemists are adept at synthesizing compounds

“There were these really intriguing reports coming out of Europe, Asia and the US, and I wanted to be a part of the growth of this new field”

- Emigdio Turner
PHD Candidate, Chemistry



and materials with very specific properties. The interaction of light with matter is the field of optics, and the team relies upon these concepts to create magneto-optically active films. In the near future, the team will begin to align the molecules and polymers in a particular orientation in order to optimize the magneto-optical response.

As the project progresses, the group will reach out to others to learn how to create an actual application. There are many classes of molecules that will show this effect, but it is difficult to predict which of these classes will be the most efficient at rotating light or responding to changes in rotation.

“This is part of the reason to collaborate. We cannot make all the measurement and all the materials. There is simply too much for one group to do”, says Rack.

Materials such as this thin-film are used to polarize light in applications such as pulsed lasers and telecommunication networks as modulators for phase shifting or optical transduction. They may also become important in next generation photonic technologies such as quantum computers and could effectively streamline the size and power consumption of these future technologies.

Current optical technologies utilize bulk crystalline devices, often with limited

application or high-power consumption. The technology being developed in the Laboratory for Magneto-optical Spectroscopy has the potential to not only make our current technologies more efficient but advance future technologies that will impact our world.

In addition to developing new instrumental methods to monitor the polarization of light, the group is reaching out to other researchers with synthetic expertise, and is even creating their own new materials.



Their interest in this (Faraday) effect grew out of an interest to detect optically detect spin changes in complexes and in materials. Changes in spin occur in a wide variety of photophysical and photochemical measurements and are often critical in the performance of many light-driven processes, such as in photovoltaic devices among many others.

“There were these really intriguing reports coming out of Europe, Asia and the US, and I wanted to be a part of the growth of this new field,” says Emigdio Turner.

Their most recent paper describes a procedure to actually calculate the degree of rotation instead of directly measuring it, which is exceptionally difficult. The new paper also greatly expands the spectral regions of detection.



Earlier this year, the [Nanomaterials Characterization Facility \(NCF\)](#) became one of a few labs within the country to house an Aberration Corrected Scanning Transmission Electron Microscope (AC-STEM). The instrument, a JEOL NEOARM, provides one of the highest resolutions currently available. Throughout the year, students at UNM have had the opportunity to enhance their own research through the use of this incredible machine and are making advancements that will put them well ahead of their peers once they graduate.

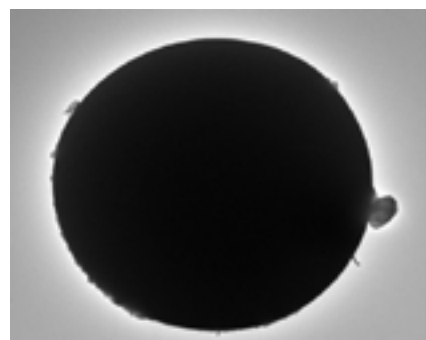
Jasmine Quiambao
MS Candidate,
Environmental Engineering



Environmental contamination from plastics as well as from abandoned mine sites near Indigenous communities has long been a serious health concern. Discarded plastics from personal care products or larger products often break down into microplastics which are barely visible to the eye but cause significant health concerns to the life surrounding the water systems they inhabit. Jasmine Quiambao, a graduate student in Environmental Engineering, is addressing the reaction that these microplastics have in freshwater systems once they interact with the chemicals spilled into these bodies of water from abandoned mine sites.

The Paquate River in the Pueblo of Laguna, the Rio Grande, and Tingley Beach were selected for this project because people can come in close contact with water in these locations. Microplastics and heavy metals were found in all three locations but what she found in her sample analyzed through the NEOARM was especially interesting.

From Jasmine's research, arsenic did not react with microplastics. However, through images on the NEOARM, she found that uranium was attaching to microplastics. Moreover, it was precipitating and accumulating on the surface of the microplastics, indicating that they can serve as a site for metals to accumulate.



Commercial microplastics with uranium precipitate attached to the surface

The implications of these findings are concerning because the interactions of these metals with plastics could be increasing the toxicity of our freshwater systems. As they travel, their effect on the environment has the potential to spread.

"The collaborative work of researchers at UNM and Oklahoma State University is incredible. With the guidance of Dr. Adrian Brearley, the data we collected from the TEM instrument are vital to my research. I want to thank him for allowing me to collaborate with him. My overall experience in this field has been very nurturing, and I am fortunate to be working with amazing people who support self and professional development."

"At the University of New Mexico, we have a lot of brilliant scientists."

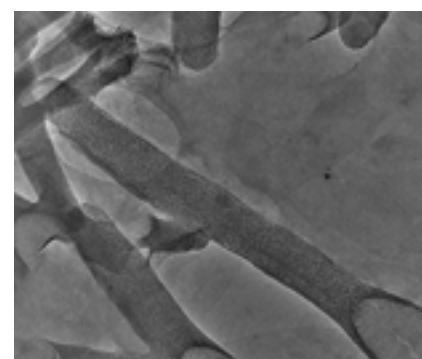
- LJ Ruggiero
MS Candidate 2022,
Biomedical Engineering

LJ Ruggiero
MS Candidate,
Biomedical Engineering



A disappointing end to a potential research project at the beginning of the pandemic coincidentally brought LJ Ruggiero, a graduate student in Biomedical Engineering, an exciting new opportunity to participate in a new project that has not only helped him make connections to some of the brightest minds in the country but will also have significant impacts on industry.

In a project funded by the National Science Foundation (NSF), LJ is getting to participate in research that is so groundbreaking there haven't been many papers published about the



Mesoporous silica/metal hybrid nanorods for hydrogen separation

topic. Common gases such as methane and propane are quite difficult to produce because of the high pressure and temperatures needed to produce these chemicals. Turning them into more desirable gases such as methene, propene, and ethene, which are commonly used to make products like

vinyl and plastic, are not only more cost-effective but efficient.

The Center for Innovative and Strategic Transformation of Alkane Resources (CISTAR) is heading up the development of a new chemical processing system that can withstand the high temperatures needed without breaking down the components within these chemicals. Through his work with CISTAR, LJ is collaborating with researchers at UT Austin, Purdue, Northwestern, and Notre Dame to create the technology that will remove hydrogen from these gases in order to make them more reactive.

Through his use of the NEOARM, LJ is learning why certain reactions are happening and determining how he needs to adjust his work. The machine has provided him the ability to do things that no one before him has done, and he is thankful for the experience to work with mentors such as Distinguished Professor and Regents' Lecturer, Adrian Brearley, and Distinguished and Regents' Professor, Jeffrey Brinker.

"At the University of New Mexico, we have a lot of brilliant scientists but it is not just their intellect that makes them incredible scientists, but their love and curiosity of using science to benefit the entirety of humanity with scientific discoveries and application."



INSPIRING CONNECTIONS FOR FUTURE SCIENTISTS

PROTECTING OUR WATERSHED

Thanks to a generous gift from School of Engineering alumnus, Roger Jones, PhD, and his wife, Teri, undergraduate students from various majors are getting a unique opportunity to leverage their own disciplinary backgrounds in educating the public about water resource issues in the Rio Grande. Over the next five years, students from the [Co-op's Undergraduate Fellowship in Water Management](#) are developing a project that will serve as an interactive educational tool – and a call to action in protecting our watershed.

In its initial development, [TreeSim](#) is an interactive game that integrates the civil engineering, environmental science, and population health backgrounds of the fellowship's [first cohort](#) of students. Atlin Johnson (BS candidate, Civil Engineering, 2022), Sofia Jenkins-Nieto (BS candidate, Environmental Science, 2022), and Yoko Kentilitisca (BS candidate, Population Health,

“The solution to this problem in New Mexico will provide a template for solving the problem on a global scale.”

2021), guided by their graduate student mentor from the Water Resources program, Sean O'Neill, created an interactive experience that integrates the sectors of water management, public health, and environmental justice to create more urban green spaces in an era of rapid climate change. The simulation is designed specifically for the Albuquerque area with the overall intent of promoting green spaces by planting trees using stormwater discharge that is not being actively used.

The Jones' were particularly drawn to using an interdisciplinary approach for tackling this issue because of the diversity of stakeholders, stating, “The solution to this problem in New Mexico will provide a template for solving the problem on a global scale.”

Applications for the Co-op's Undergraduate Fellowship in Water Management will open in the Spring of 2022, but interested applicants are encouraged to [reach out](#) with questions at any time.

“The most interesting and engaging parts of the program have been the interdisciplinary debates in the classroom.”

**- Larkin Chapman
PhD Candidate, Archaeology**

This past Fall, the first cohort of students in UNM's newest graduate research experience were able to begin their journey into a truly innovative program. [The Museum Research Traineeship \(MRT\)](#) is an interdisciplinary education and research curriculum designed to inspire MS and PhD students to search for answers to some of the biggest questions in science – all through the lens of museum sciences and collections. It is funded through a five-year National Science Foundation Research Traineeship (NRT) grant that is committed to enhancing diversity in graduate programs in STEM.

The first MRT cohort of 12 student trainees launched at UNM in August 2021. First-year students in Anthropology, Biology, Geosciences, and Geography, are being challenged by a progressive curriculum that includes a weekly interdisciplinary Museum Science course, Colloquium, and Professional Workshop.

Trainees are also provided in-depth tours of some of New Mexico's renowned museums, including the [New Mexico Museum of Natural History and Science](#), the [Museum of Southwestern Biology](#), the [Maxwell Museum of Anthropology](#), and the [Paleobiology Collection in Earth and Planetary Science at UNM](#). The tours provide trainees with an intimate look at some of New Mexico's vast anthropological, biological, and geological objects, artifacts, and specimens. Additionally, trainees have access to the Interdisciplinary Science Co-op's technical centers and laboratories.

Larkin Chapman, a PhD candidate in Archaeology, described her favorite aspect of the program. “The most interesting and engaging parts of the program have been the interdisciplinary debates in the classroom about the journal articles we read. Talking together about the complex issues helps me understand topics outside of my expertise that are essential for learning how to collaborate in an interdisciplinary setting.”

The MRT program provides a competitive yet complimentary environment that encourages interdisciplinary training in object-based museum science. It is designed to educate, train, and connect our trainees to professional opportunities to impact future research, education, and policy in academic, government, non-governmental, and private organizations.

For more information on the MRT, go to mrt.unm.edu



The public is invited to assist this year's cohort of fellows in developing [TreeSim](#) by [playing it](#) and [providing feedback](#) over the course of this next year. This input will be gathered and provided to our students at the beginning of Summer 2022 when they begin developing [TreeSim](#) further. Your feedback will be vital in shaping this project's goal of addressing the issues affecting our community's most precious resource.

2021 BY THE NUMBERS

310

PUBLICATIONS BY
CO-OP FACULTY

\$4,186,900

TOTAL AMOUNT OF AWARDS
RECEIVED BY OUR LABS

147

STUDENTS LEARNING
IN OUR LABS

380

INDIVIDUAL EXTERNAL
COLLABORATORS WORKED
WITH OUR LABS



288

OF THESE FROM OUTSIDE OF
NEW MEXICO

\$29,638,637

TOTAL AMOUNT OF NEW
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