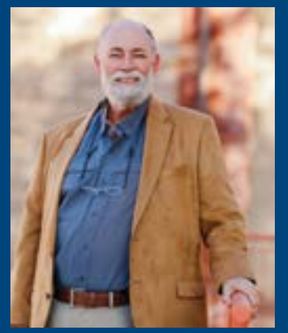

NMT
NEW MEXICO TECH
CHANGING THE WORLD

NMT's Vision

> New Mexico Tech aspires to be a preeminent community of scholars dedicated to research, education, and innovation – advancing science, technology, engineering, and mathematics – to meet the challenges of tomorrow.



For over 130 years, the faculty, students, and graduates of New Mexico Tech have forged new ground in science and engineering through their curiosity and brilliance. They have addressed many of the world's challenges through invention and the development and application of new methods.

New Mexico Tech "Greats" - among them Dr. E.J. Workman, Charlie Moore, Dr. Ross Lomanitz, and Dr. Mahdi Hantush - laid the foundation for NMT's reputation for rigor, excellence, and innovation. These pioneers changed forever how we understand the world. This foundation became our guiding principle and, combined with the unique culture of mentorship, collaboration, and community, makes New Mexico Tech one of the best universities in the world.

Speaking from my own experience as a graduate student working under Dr. Marvin Wilkening, I could not have received a better education. "Marv" became more than a mentor to me, he was a friend.

Nearly 45 years later, and now as NMT's Vice President for Special Research Programs, I can tell you that NMT is still attracting incredible faculty who are not only conducting groundbreaking research, but are true mentors to their students.

Each year, New Mexico Tech reaches out to our alumni and donors for support. Your support provides faculty and students the freedom and flexibility to pursue innovative research unhindered by financial concerns and helps foster the next generation of scientists and engineers we need to make world-changing discoveries.

I hope you will join me in making a gift this year.

Sincerely,

Dr. Van Romero
Vice President
Special Research Programs

P.S. I hope you enjoy this small glimpse into how New Mexico Tech continues to change the world today.

Dr. Patidar's research shows promise in fighting pancreatic cancer.

Welcome to the Patidar Lab where Dr. Praveen Patidar and his students are studying mammalian DNA damage and repair response. DNA damage is a hallmark of several devastating diseases such as neurodegenerative disorders, autoimmune diseases, and cancer. With funding from the NIH, the Patidar Lab is making tremendous strides in understanding the process of carcinogenesis and identifying novel chemotherapeutic approaches to treat numerous cancers including one of the most deadly, pancreatic cancer.

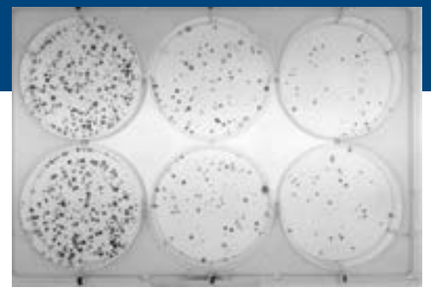
Dr. Patidar came to New Mexico Tech's Chemistry Department in 2016 bringing with him a wealth of knowledge, expertise, and passion for the study of protein biochemistry and DNA damage. Dr. Patidar and his former NMT PhD student, Dr. Talysa Ogas Viera, have a patent pending for their work in discovering a tumor-selective chemotherapeutic approach for pancreatic cancer treatment.

Dr. Patidar and Dr. Ogas Viera's work focused on learning how and why the drug candidate KP372-1 causes cancer cell death through redox cycling by NQO1, an enzyme especially elevated in the majority of solid cancers. They showed how this drug candidate gives cancer cells a "kiss of death" by creating DNA damage and draining their energy pool - laying a foundation to establish KP372-1 as a promising chemotherapeutic agent against cancer.

KP372-1 has already shown efficacy in animal trials and clinicians have reached out to Dr. Patidar with interest in human trials.

"Our team is equipped to do world-class science at a small school like New Mexico Tech."
— Dr. Patidar

Reduction in pancreatic cancer cells after treatment with KP372-1



Current students

Dr. Patidar's current students, Quinn Abfalterer and Ruthie Mulvaney, are expanding the world's knowledge of DNA damage through their own projects.

"I love seeing biomolecules in action and learning the chemistry of life. Through my research group, I have learned novel methods and applied them to the study of DNA damage and repair proteins. It is exciting to see how research can lead to completely new routes of study. Even if things don't work out for months on end, the experience I've gained from learning new methods, failing, and overcoming have taught me so much."
— Quinn Abfalterer

Quinn Abfalterer, Class of 2022 Biology & Math, first year Graduate student, Chemistry

Quinn started working for Dr. Patidar as a sophomore in 2020. Now as a first year graduate student he is studying the protein TOP1, an important chemotherapeutic drug target. Through his research on the interactions between TOP1 and a smaller protein, RPRD1B, Quinn has found how the proteins work together to maintain genomic stability. This expansion of knowledge could help demonstrate a new way to target TOP1 and thus a new method of treating cancer.

Quinn enjoys the lab and furthering the world's understanding of fundamental science questions. He is currently working on applications to PhD programs, hoping to continue his work on DNA damage.

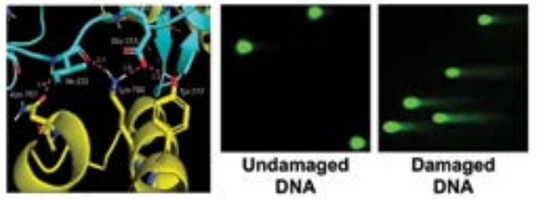
"I started at New Mexico Tech without knowing exactly what I wanted to do with my degree. It was through the school's early exposure to research where I found my passion: studying DNA damage repair pathways and their potential as targets for cancer therapeutics."
— Ruthie Mulvaney

Ruthie Mulvaney, Class of 2023, Biomedical Sciences

Ruthie's research is focused on understanding CPSF73, an enzyme integral to genome maintenance - without it, genes won't be properly expressed.

Ruthie's group found that depletion of this key enzyme results in a high accumulation of DNA damage and cell death. Demonstrating the detrimental damage caused by CPSF73's removal, has improved the scientific community's understanding of the importance of this enzyme and also its potential as target for cancer treatment.

Through her work in Dr. Patidar's lab, Ruthie has found her passion! Her research experience has also prepared her for what to expect as she moves on to graduate school - her eye is set on a PhD from UNC Chapel Hill.



Antarctica - Climate Knowledge Frozen In Time

Containing 90 percent of Earth's ice and 70 percent of Earth's fresh water, the complete melting of the Antarctic Ice Sheets is an absolute worst-case scenario in climate change - causing sea levels to rise over 200 feet, potentially altering the chemistry of the ocean, and doing untold harm to humans and wildlife.

While the worst is not likely to happen in our life-times, polar temperatures are approaching those of the Last Interglacial Period, a time when the global sea level was approximately 20 feet higher than today and global temperatures were about 2°F warmer than the pre-industrial era.

Due to the lack of data, it is difficult to accurately estimate how much climate change will impact the stability of the Antarctic Ice Sheets and therefore how much future sea level is likely to rise. However, the ice holds valuable historical information that can help us better project future changes - and NM Bureau of Geology and Mineral Resources (Bureau) scientists are on the forefront of finding the secrets beneath the ice.

Bureau scientists Dr. Matthew Zimmerer, Dr. Bill McIntosh, and Dr. Nelia Dunbar have an active National Science Foundation award to examine this problem. Collaborating with Bureau scientist Dr. Nels Iverson, they will examine the characteristics of volcanic rocks at a West Antarctic volcano, Mount Waesche, to learn about the past history of the West Antarctic Ice Sheet. These samples will tell us the story of how ice sheets behaved during the Last Interglacial Period.

This research will inform a first of its kind dataset that will allow for the creation of more accurate modeling of how the ice sheets respond to a warming climate - potentially telling us whether there is a temperature threshold at which significant ice melt, and resulting sea level rise, occur.

Bureau scientists spent their first field season in Antarctica in 2018/2019, and hope to return in 2024/2025 - unfortunately the COVID 19 pandemic disrupted fieldwork across the continent. Between field seasons the researchers found that the volcano becomes more active during interglacial periods, when there is less ice on the continent. This is likely because the heavy weight of the ice during cold, glacial periods creates pressure in the upper part of the Earth's crust, keeping magma, or molten rock, from reaching the surface. When the ice sheets melt, the decrease in pressure allows magma to migrate to Earth's surface and then erupt. Bureau researchers are now working with faculty and students in the Earth & Environmental Sciences Department to better explain this phenomenon.

The current Mount Waesche research project is one amongst many Antarctic research projects that have been undertaken by New Mexico Tech since the early 1980s. The projects have focused on volcanoes, including active Mount Erebus, interactions between volcanoes and ice sheets, and ice core science. This research, much of which has included international collaborators and is published in many international journals, has changed our understanding of how volcanoes and ice sheets work.

"Understanding the future stability of the West Antarctic Ice Sheet is one of the most important topics in earth science because its fate could impact so many aspects of our lives. It's amazing that a largely unknown volcano may hold the key to determining what happened 125,000 years ago, when the planet's climate was similar to today's. I'm grateful that research at NMT can play a role in such important science."
— Dr. Zimmerer

"Understanding the past and future of the West Antarctic Ice Sheet is one of the most pressing questions in earth science today. The research that we are doing on this problem will provide an important piece in solving this globally relevant puzzle."
— Dr. Dunbar

It's a bird, it's a plane, it's a butterfly?

Dr. Mostafa Hassanalian and his students are taking notes from nature in designing drones that have the potential to save lives, money, and the environment.

During his five years in New Mexico Tech's Mechanical Engineering Department, Dr. Hassanalian has put NMT on the map for drone research. His unique approach to applying bioinspiration and bio-mimicry to aerospace and drone technologies has gained worldwide attention and, for the third year in a row, Dr. Hassanalian has made Stanford University's list of the world's top 2% cited scientists.

His most well-known research is his work on taxidermied drones. Funded by the National Science Foundation REU program, Dr. Hassanalian and graduate student Jared Upshaw went "viral" for their work designing and constructing drones that look and fly like real birds. Constructed with real feathers and designed to have flapping wings rather than propellers, these drones are used to monitor wildlife and, if made to look like birds of prey, help with airport bird strike control by deterring other birds from being in the area.

"Through bioinspiration and biomimicry, I am harnessing the power of nature to revolutionize drone technology and make a positive impact on society."
— Dr. Hassanalian

In Dr. Hassanalian's Autonomous Flight and Aquatic Systems Laboratory you will find students drawing inspiration from the monarch butterfly to dandelions and even turtles in designing their drones and robots.

Brenden Herkenhoff, Graduate Student Mech E

Wing Coloration

In their study of the monarch butterfly, Dr. Hassanalian and graduate student Brenden Herkenhoff found that the wing spot patterns on monarch butterflies impact their ability to fly long distances - larger white spots on the butterfly's wings can improve flight efficiency. This work, featured in National Geographic and the New York Times, has inspired subsequent research by other scientists. Brenden was recently named a 2023 Innovator Under 25 by Albuquerque Business Journal for his company, RadiantAero, that applies his research on coloration's impact on lift and drag to airplanes.

"My research at NMT has primarily focused on drone design and energy harvesting for aerospace systems. This experience expanded my interests and has recently introduced me to the entrepreneurial world, where I hope to continue developing new technology that improves lives globally. This research has provided me with many new connections I likely never would have been able to make on another path."
— Brenden Herkenhoff

Going Underground

The mining industry is looking towards drone and robot technology for routine and safety operations but there are significant hurdles when it comes to going underground. Dr. Hassanalian and his students are combating the unique complexities of deploying drones in underground coal mines. Their autonomous drone design is capable of navigating underground and is also equipped with a safe, heat conscious, compulsion system.

Their work in mine safety and rescue continues with the design of a semi autonomous system used to find trapped miners. The system is made up of an Unmanned Ground Vehicle (UGV) housing a drone. The UGV deploys a drone for data collection while also deploying wireless notes for communication with the rescue team.

Dr. Yu's Polymer Filter Formulations Clean Produced Water in Two of New Mexico's Largest Industries

2.4 billion gallons of produced water, a naturally-occuring byproduct of oil and gas production, are created every day in the United States, 160 million gallons in New Mexico alone. Fresh water shortage and produced water reuse have always been hot topics in New Mexico and as the climate changes, experts from across the state and around the world are putting their heads together for real solutions.

Dr. Jianjia Yu, Chemical Engineering faculty member and head of the Petroleum Recovery Research Center's (PRRC) Produced Water group, has a patent pending for specific formulations of hollow fiber membranes for particular use in membrane distillation to remediate high-salinity produced water.

Membrane distillation has been around since about 1960, however, the lack of commercially available membranes still limits the technology for large-scale industrial applications. Dr. Yu's team is the first to develop innovative membranes that can be customized depending on the specific demands of membrane distillation. His team does this through creating special formulations of the polymeric membrane itself, all of which are made in house at NMT!

These unique hollow fiber membrane-based modules have been validated in pilot scale testing on produced water from the oil industry in Roswell, NM (cleaning 1,260 gallons per day) and from a local dairy in Clovis, NM (cleaning 20,000 gallons/day). Currently, the processes are able to recover 50% of the produced water with an initial total dissolved solids (TDS) of 155,000 mg/L.

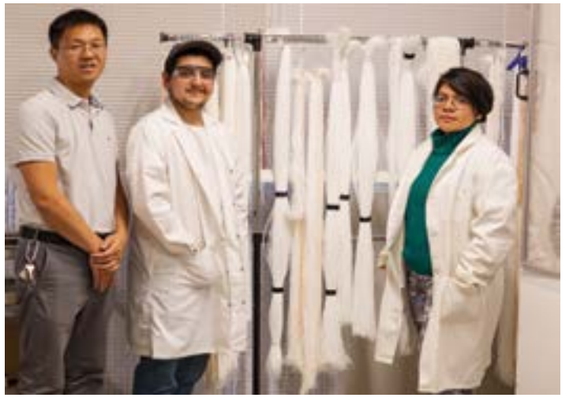
This technology helps industry reduce costs associated with produced water disposal and provides an alternative, usable water source - after treatment the water meets all of the EPA standards, even for drinking water!

"We are developing and advancing innovative membranes, and the membrane-based advanced separation processes to address the most challenging issues on the earth, including water contamination, and climate change."
— Dr. Yu

Zongjie He, PhD student, Materials Engineering

Dr. Yu's team has also developed innovative hollow fiber membranes for carbon dioxide capture. Zongjie He, a current Ph.D. student, is researching highly efficient and scalable membrane processes for carbon dioxide removal directly from the air, which is also called direct air capture (DAC). The experiences learned from produced water treatment will accelerate the scaling-up process of the DAC technology in terms of hollow fiber membrane manufacturing and membrane module assembly. This work is expected to reduce the amount of carbon dioxide in the atmosphere, thereby slowing down the effects of global warming, which is one of the key technologies to combat global climate change.

"This research is very exciting because it helps combat global climate change, which is beneficial to all humans."
— Zongjie He



— Gabriela Torres Fernandez, Graduate Student, Civil & Environmental Engineering

"Working for Dr. Yu in a professional laboratory, especially on this project, has furthered my knowledge on what to expect as a chemical engineer. For example, practicing basic lab safety and operating lab equipment. This has me excited about my major."
— Carlos Carrillo, Freshman, Chemical Engineering

New Mexico Tech, A Leader in Cybersecurity

A cyber attack occurs once every 39 seconds, affecting 800,000 people a year and costing the global economy an estimated $10.5 trillion by 2025. While the financial impacts are significant, as our world becomes more and more reliant on technology, there is a very real possibility for a cyber attack to impact the supply chains that keep us fed or infrastructure that keeps us warm and dry.

NMT's Dr. Lorie Liebrock believes that education is our greatest defense.

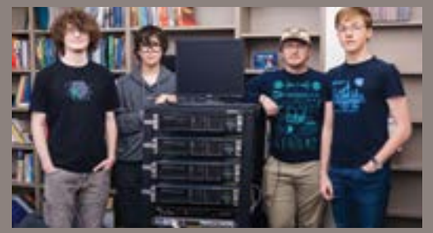
As founding director of the New Mexico Cybersecurity Center of Excellence (NMCCoE), Dr. Liebrock brings her expertise in computer science and cybersecurity to secure New Mexico, and New Mexico Tech, as leaders in cybersecurity economic development, education, innovation, and research.

In addition to helping develop a statewide plan for how New Mexico addresses cybersecurity incidents, Dr. Liebrock aims to educate and train the next generation of cybersecurity experts - a workforce pipeline critical to New Mexico and a market that is expected to grow by over 30% by 2030.

What makes NMT's program different from other cybersecurity programs? New Mexico Tech's Transdisciplinary Cybersecurity degree takes a holistic approach to cybersecurity. Recognizing that cybersecurity is not industry specific and that almost 90% of data breaches are caused by human error, NMT combines expertise across sectors so that students can better understand vulnerabilities and also requires students to take "Psychology of Cybersecurity" to study the human element behind data breaches.

In addition to her role as the Director of the New Mexico Cybersecurity Center of Excellence, Dr. Liebrock has also been appointed to serve on the Federal Emergency Management Agency (FEMA) National Advisory Council, a 40-member group that helps identify and address the nation's emergency management challenges.

"Cybersecurity is a pillar of all things digital - from protecting our privacy and identity to understanding how our psychology and biases affect security operations to securing the communications on satellites that support our communication and navigation. The NMCCoE and our students are working across this spectrum to make us all more secure."
— Dr. Liebrock



Elijah Pelofske, B.S. 2022 Math, B.S. 2023 Computer Science, Current Graduate Student
Transdisciplinary Cybersecurity

Open source data holds a wealth of information that is beneficial for analysts to understand vulnerabilities and detect threats. Unfortunately, the sheer amount of information is overwhelming and difficult for cybersecurity professionals to effectively analyze.

Elijah Pelofske, a research student at NMCCoE for 3 years, is now working as a student with Sandia National Laboratories using artificial intelligence to condense, characterize, and connect open source data, giving cybersecurity analysts a headstart on mitigating threats.

In a project with Sandia National Laboratories, Elijah and the NMCCoE created a system that aggregates shared connections between open source intelligence text (blogs, bulletins, news sites, antivirus scans, social media posts) and threat reports in a graph database. This network of relationships allows known malicious indicators of compromise to be linked with other open source information (such as Common Vulnerabilities and Exposures, IP addresses, domains, email addresses, phone numbers) - making possible a more effective use of open source intelligence for threat hunting, malware family clustering, and vulnerability analysis.

In another collaboration between the NMCCoE and Sandia National Laboratories, Elijah helped train 21 different machine learning models to detect cybersecurity discussions on popular publicly-available sites like Reddit, StackExchange, and arXiv. Together, these models make up the Cybersecurity Topic Classification (CTC) tool, which takes the majority vote of the 21 trained models to classify cybersecurity-related and non-cybersecurity related text efficiently.

Elijah was a 2022–2023 Macey Scholar, one of the most prestigious honors for undergraduate seniors at NMT. Much of Elijah's work with Sandia is with alum Vincent Urias, 2009 Computer Science & 2010 Electrical Engineering.

— Elijah Pelofske

NMT's Mission

We serve the public through research, scientific knowledge, economic development, and STEM outreach benefiting the communities of New Mexico and beyond.

New Mexico Tech is truly a special, one of a kind, place. As time goes on, the things that make New Mexico Tech great remain - brilliant, passionate, and dedicated faculty bringing a personal, world-class education to students.

While the NMT legacy will always endure, your support only helps us grow stronger, support more innovative research, and provide the best possible education to students - empowering them with the knowledge and skills to build a better tomorrow.

Office for Advancement

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