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**SDSU**  
 San Diego State  
 University



2022  
**Highlights**  
 A Magazine of Research,  
 Scholarship and Creative  
 Activities at SDSU

**SDSU** | San Diego State  
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# Insights from the Vice President

It's fitting that the same year that San Diego State University reached the incredible milestone of 125 years spent educating future generations, our institution also surpassed records for the most research-related funding secured in a single year — reaching \$164.5 million in fiscal 2021-22.



**Hala Madanat**

SDSU is the flagship research institution of the 23-campus California State University and one of the top ten public research universities in the state. Our upward trajectory in research-related funding affirms the university is making progress toward its goal — outlined in its five-year strategic plan — of becoming a premier public research university.

Our faculty make a tremendous contribution to California communities, to research that helps us better understand our world and confront the major challenges of our time, and to the students who work alongside them in their studios, labs and classrooms. In these pages you will read about the transformative power of their transdisciplinary work. Researchers from every college consider complicated

issues from a multitude of perspectives, and these diverse perspectives inform their problem solving.

Our artists' ingenuity provides invaluable support for the creative community, through innovations like a competitive incubator program for early-career playwrights and a novel audio engineering app that makes some of the world's most storied venues available to musicians anywhere (pages 6 and 20). Our scientists work with industry to make their ideas come to life, whether that's overcoming scientific and regulatory obstacles to make aquaculture more prevalent in California or leveraging lessons learned from tubeworms to further genetic modification (pages 10 and 7). And our scholars take a particular interest in confronting injustice, tackling health disparities, addressing inequities in education, and helping students explore these difficult topics through comics (pages 22, 26 and 18).

But one of the very best things about SDSU's growing research enterprise is how seamlessly our students are integrated into nearly every project. Roughly 1,740 undergraduates and 5,500 graduate students participate in research at SDSU each year. They make an immeasurable impact on our work, and get the chance to participate in unforgettable experiences — from considering climate change in the Arctic, to helping NASA engineers test moon rovers, to studying the psychological effects of disordered eating (pages 8 and 9). These students are our future, and our faculty do an incredible job helping prepare them to become the creators, entrepreneurs and scholars that will continue SDSU's work for generations to come.

**Hala Madanat**

Vice President for Research and Innovation

On cover and opposite: Collage of images. Photos courtesy of researchers, Ken Jacques, Sarah White, Carrie Dada and NASA.

## Featured Scholars

Kaveh Abhari  
Amanda Alker  
Todd Anderson  
Renee Angwin  
Elva Arredondo  
Mary Baker-Ericzén  
Leslie Booher  
Annie Buckley  
David Carruthers  
Monica J. Casper  
Iana A. Castro  
Jun Chen  
Gregory Daddis  
Grace DeVega  
Kelsey Dickson  
Matthew Edwards  
Tyler Felgenhauer  
Janet Franklin  
Linda Gallo  
Kayla Gautereaux  
Randall German  
Rachel Haine-Schlagel  
Laura J. Hall  
Brian Hentschel  
Jack Hinzo  
Eunha Hoh  
Carrie House  
Pamela Jackson  
Pascale Joassart- Marcelli  
Paul Kaplan  
Susan Kiene  
Bonnie Kraemer  
Rohan Kumar  
Laís Lima  
David Lipson  
Xiaobai Liu  
Paul Luelmo  
Kristen Hill Maher  
Stanley Maloy  
Kyle Malter  
Corinne McDaniels-Davidson  
Amanda McClain  
Robert Meffe  
Rebecca Mendoza  
Luke Miller  
Aina Narvasa  
Bill Nericcio  
Eugene Olevsky  
Giang Pham  
Elizabeth Pollard  
Sonja Pruitt-Lord  
Penelope Quintana  
Rachael Record  
Erin Riley  
Sarah Rieth  
John Rodriguez  
Nick Shikuma  
Satish Sharma  
Setareh Sterling  
Manal Swairjo  
Greg Talavera  
Van Tarpley  
Emma Topolcsik  
Elisa Torresani  
Satchi Venkataraman  
Chris Warren  
Xiaofeng Xu

## 2022 Highlights

**Editor:** Kellie Woodhouse

**Deputy Editor:** Sarah White

**Designer:** Monika Lemp,  
Instructional Technology Services

### Contributors:

Susanne Clara Bard, Debbie Brighton,  
Rachel Crawford, Michael Klitzing,  
Chris Leap, Peggy Pico, Leslie L.J.  
Reilly, Melinda Sevilla

We welcome feedback:

5500 Campanile Drive  
San Diego, CA 92182-8220  
619-594-5213

dri-news@sdsu.edu

[research.sdsu.edu](https://research.sdsu.edu)

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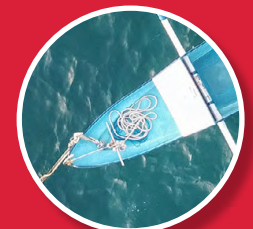
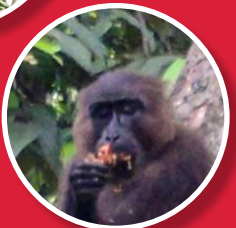
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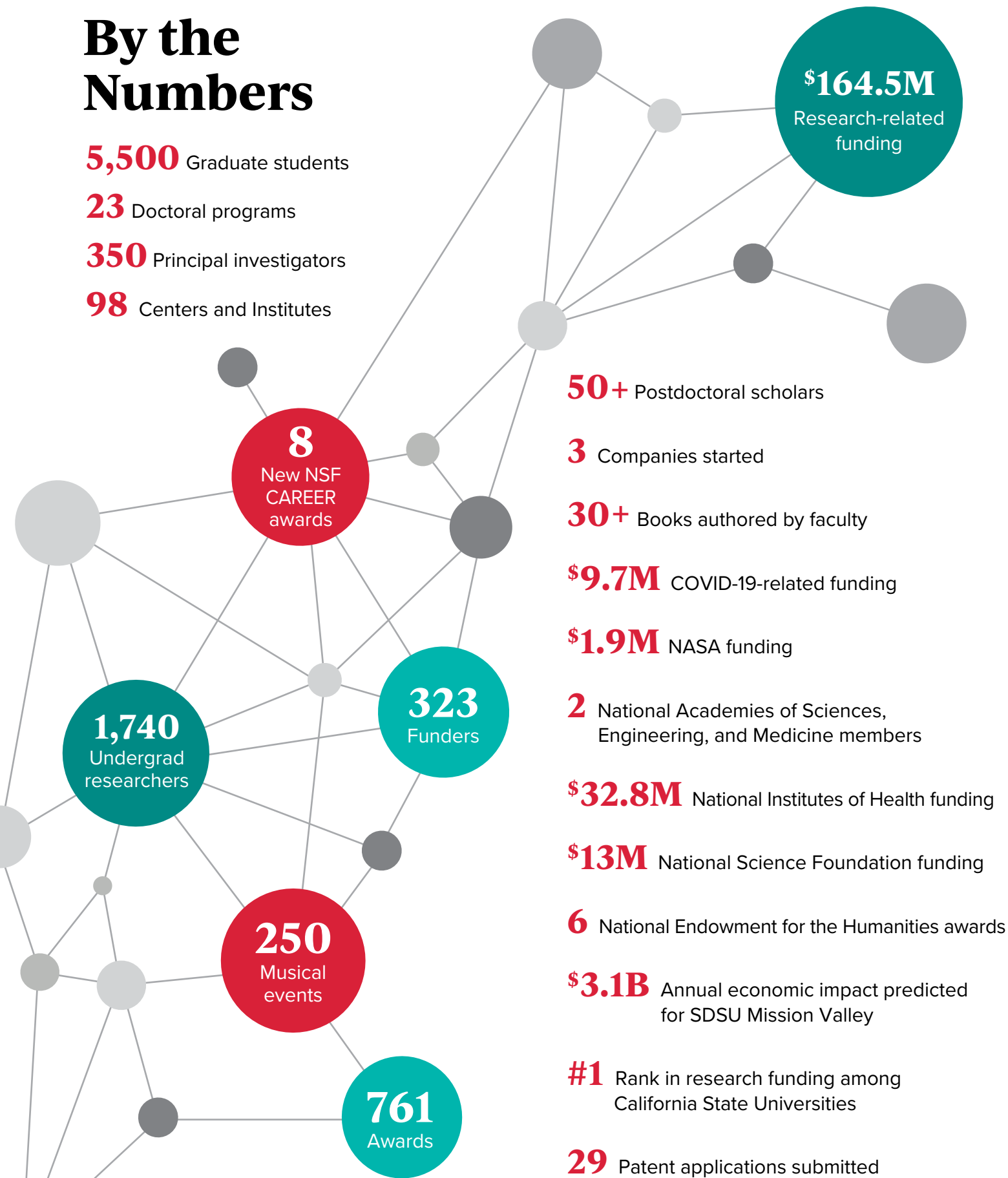
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# By the Numbers

- 5,500** Graduate students
- 23** Doctoral programs
- 350** Principal investigators
- 98** Centers and Institutes



## Lithium Valley Vision

Recent SDSU IV investments tie directly into plans to develop the region into California's "Lithium Valley" centered around the Salton Sea where scientists have recently discovered one of the world's largest untapped reserves of the rare earth element. As the only four-year university in the Valley, SDSU IV is well positioned to build a pipeline of STEM (science, technology, engineering and math) graduates to support the booming lithium industry.

## Research Focus

In recent years, SDSU IV researchers have collaborated with Imperial County on a Centers for Disease Control and Prevention-funded childhood obesity study, investigated asthma rates near the Salton Sea, helped develop and implement an air monitoring quality system in the area, and much more.

## Faculty Hiring

SDSU IV has seen a 350% increase in faculty hiring since 2018. This includes three new researchers hired as part of SDSU FUERTE (Faculty Unified towards Excellence in Research and Transformational Engagement), a National Institutes of Health-funded effort focused on bolstering Latinx health disparities research.

## Funding Infusion

SDSU IV is receiving \$80 million in California state funding to support the construction of a STEM campus and Innovation District in Brawley that will include labs and facilities with cutting-edge equipment, classrooms and space to collaborate with public and private partners.

## STEM Evolution

To boost student success, SDSU IV math professors are developing a National Science Foundation-funded summer bridge program that will help newly admitted students brush up on necessary math skills, explore STEM career options, learn about campus life, and make the most of their college experience.

## Nursing Expansion

Imperial Valley has a severe shortage of qualified healthcare workers — exacerbating health disparities in the area. Starting this fall, SDSU IV is offering an accelerated pre-licensure bachelor of science in nursing (BSN) program — and there's already a waiting list. The three-year program bolsters SDSU IV's existing RN to BSN program, funded by the California Department of Health Care Access and Information, which has already graduated over 250 nurses since 2009. [🔗](#)

# SDSU Imperial Valley on the Rise



**With an infusion of funding to support STEM programs, bolster nursing education and expand health disparities research, SDSU Imperial Valley (SDSU IV) is on the precipice of a major expansion that will allow the border-adjacent campus to better serve the surrounding community during a time of unprecedented growth.**







## The Next Tony Award Winners Could Have an SDSU Program to Thank

It took Lin-Manuel Miranda seven years to write the hit Broadway show “Hamilton,” and the acclaimed playwright is no exception. It can take years for writers to refine their musicals.

San Diego State University launched the New Musical Initiative in 2016, a competitive incubator and writers-in-residence program that partners


early-career writers with the university’s musical theater MFA program to help workshop their musicals over a two-year period.

The donor-funded incubator, led by **Robert Meffe**, head of the SDSU MFA Musical Theatre Program, supports writers who are exploring difficult subjects through their art,

and encourages them to innovate and take risks in their storytelling.

Meffe and his team work with one creative team for a two-year period, helping the writer consider how elements like score, choreography, and costume and set design will influence their script. Writers visit campus several times for extended workshops, during which MFA students perform their scripts so writers can take notes and work to revise and improve their work. At the end of the two-year period, the musical is given a full-scale production by the same cohort of MFA students who helped workshop it all along.

“Writing a successful musical is equivalent to developing a patent on a new drug. You have to try things out, test them in front of people and see what’s going to make the best theater,” Meffe says, noting that the initiative’s most recent call for musicals received over 150 applications. “Our incubator is a coveted resource. It gives new voices a platform, and it provides our MFA students with an opportunity to work with professionals in the field.”

In April 2022, “Postcard American Town,” a musical written by Lynne Shankel and Crystal Skillman, debuted in San Diego after participating in the multiyear incubator process. The contemporary musical examines the hardship of cultural discrimination and the importance of community activism. 

The musical Postcard American Town debuted in May 2022 after two years working with SDSU’s New Musical Initiative. Photo: Ken Jacques

## C.A.S.H.-ing In

Last year the U.S. Supreme Court ruled the NCAA could no longer prohibit student athletes from seeking product endorsement deals.

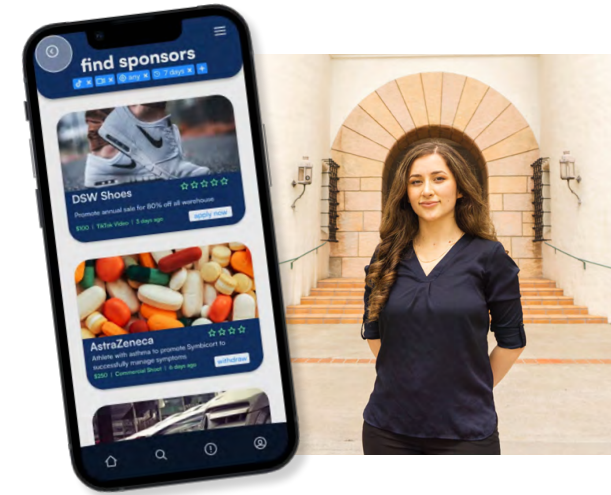
Enter C.A.S.H.: an app that connects student athletes with businesses to negotiate mutually beneficial endorsement deals.

With the assistance of the Zahn Innovation Platform (ZIP) Launchpad, management major **Setareh Sterling** created C.A.S.H. — Competitive Athlete Sponsorship Hub — a digital platform that matches businesses with student athletes to endorse their


products via social media. The entrepreneur has a local focus: she plans on connecting student athletes with small businesses, including restaurants, meal prep companies and exercise studios.

ZIP Launchpad is providing guidance, tools and support to develop their idea and work toward launching their company, and Sterling hopes to get her app in the hands of student athletes in the not-too-distant future.

“We wanted to build something that would be for every athlete — for every sport and skill level — and bridge the gap between student athletes and possible sponsors,” Sterling says. “Without ZIP, I don’t think we



Setareh Sterling’s app pairs student athletes with sponsorship opportunities. Courtesy photo

would have gotten as far as we’ve gotten. It’s going to have a very lasting, meaningful impact on our lives.” 

## San Diego’s Next Innovation Hub

With 1.6 million square feet of office, technology, laboratory and research space, the San Diego State University Mission Valley Innovation District will facilitate collaborations between SDSU researchers and public and private partners.

It will consist of several hubs where transdisciplinary collaborators will combine their efforts to solve urgent societal challenges. Construction related to the first hub — the Health Innovation Hub — is expected to begin in 2023. Initial partners include diagnostic testing company Quidel Corporation, the Naval Health Research Center and the Family Health Centers of San Diego.

The Innovation District will also include an entrepreneurship center and start-up incubator to support university spinoffs and innovators. ■



## From Ships to Syringes

Imagine a syringe that’s small enough to inject cells with whatever proteins you desire. With the potential to revolutionize scientific experiments in academia and industry, biologist **Nick Shikuma** is leveraging an injection mechanism and its ability to genetically modify other organisms to start a biotechnology company.

But entrepreneurship definitely was not on Shikuma’s radar when he received a grant from the Office of Naval Research to reduce the more than \$180 million they spend on removing marine organisms from ships’ hulls. Upon discovering that ship-sticking tubeworms grow into their adult form thanks to a bacterium injecting its own proteins, Shikuma and his now-graduated doctoral students **Kyle Malter** (‘22) and **Amanda Alker** (‘22) sought resources to help share these findings beyond the lab.

“Once we had the intellectual property, we were interested in figuring out how it could be commercialized,” says Malter, who wanted to become an entrepreneur at a very early age.


Malter and Shikuma completed SDSU’s semester-long Innovation Corps (I-Corps) program, led by **Stanley Maloy**, a microbiologist and former associate vice president for innovation.

Hearing from the I-Corps instructors, who themselves were scientists, about their missteps and successes in starting companies was instrumental in helping Shikuma and his team think through the next steps for their venture, **Metamorphotech**. Shikuma was awarded funding from the SDSU Pilot Innovation Fund to help the team along the road to commercialization.

“The Metamorphotech team is a wonderful example of how a surprising basic science discovery can be adapted to solve complex problems in a wide variety of areas, from marine sciences to agriculture to human health,” says Maloy.

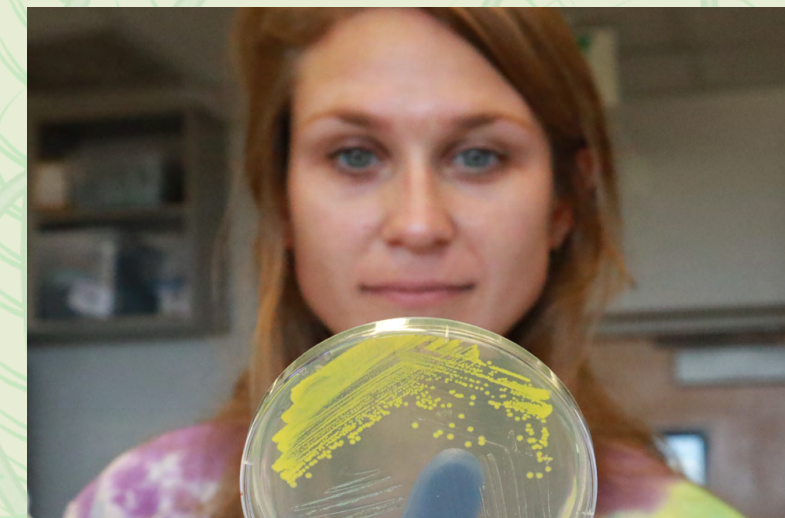
The team plans to provide gene-editing services and custom strains of marine bacteria for fellow academics

who are hindered by the time-consuming process of genetically modifying their own microorganisms. Further along their journey, they’ll adapt the bacteria’s nanosyringe to inject medicinal drugs into a variety of cell types.

“I like the freedom of starting a company,” says Malter. “When you have control over what you’re doing, it makes it a lot easier to have a passion for it. It’s easier to steer the ship because no one else is going to do it.” 

Below: Amanda Alker examines a petri dish of bacteria. Photo: Sarah White

Background: Tubeworm that the Metamorphotech team studies. Illustration: BioRender







# Student Spotlight



**Featured Photo:** Environmental engineer Aina Narvasa interned at NASA's Glenn Research Center in Cleveland, Ohio this summer. The second-year master's student worked on the Volatiles Investigating Polar Exploration Rover (VIPER) project, which aims to send a rover to the south pole of the moon to investigate the concentration of water ice there. In the above photo, she sets up terrain similar to the moon's surface in order to test the rover's navigation capabilities. NASA Courtesy Photo. Photo essay available. [🔗](#)

## Training Tomorrow's Engineers

Buzzing with over a dozen student researchers, **Satchi Venkataraman's** aerospace engineering lab is developing new composite materials to use in planes, spacecraft and potential lunar dwellings. With funding from the California Space Grant Consortium, he is training talented and diverse students to be the research engineers of tomorrow.

### Under Pressure

Venkataraman was scrolling through Etsy looking for gift ideas when he stumbled upon a metal cast of a fire ant nest. He added it to his cart with his mind full of new ideas about how this could help him answer research questions about nature-inspired materials.

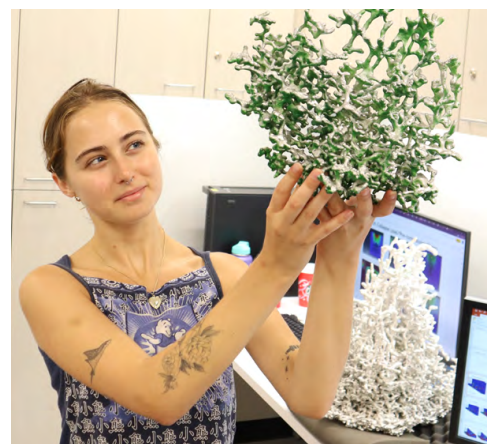
Now that first cast and another with a green sheen sit on the desks of aerospace engineering master's student **Tyler Felgenhauer** and undergraduate engineering student **Emma Topolcsik**. They are trying to determine how the air-filled tunnels and cavities manage to not collapse under the pressure of surrounding dirt or creatures passing over the surface.

Using X-ray computed tomography and digital tools, they created models of these ant nests, allowing them to run simulations of over 3.5 million data points to compare the nests' load-bearing properties to simpler fractal structures.

For Felgenhauer, this is a once in a lifetime project. "It's very intriguing and I wouldn't be able to work on this

in industry," he says. "I enjoy how challenging it is."

Figuring out how these structures work on different scales could inform human-sized underground caves on the moon, foam insulation materials, and even hydrogen energy storage.



Emma Topolcsik examines physical model of ant nest. Photo: Sarah White



**Rebecca Mendoza** is a senior psychology major and the president of the Undergraduate Research Committee. As a researcher in the Body Image, Sexuality and Health Lab, she has collected, analyzed and presented data for several projects, including a personally meaningful investigation of the correlations between disordered eating and trauma in adolescence. Photo: Carrie Dada

## In Her Words

SDSU is the perfect institution for research because, even though it's such a large school and we have a huge research backing, it feels small; it feels like everyone involved in research knows everyone.

I have a lot of friends who are working with multiple faculty in different groups and they're sort of mixing these ideas from different departments on campus. Most problems in society are not one discipline and need expertise from multiple different perspectives.

Research has been the most rewarding experience for me because, at SDSU, I can get one-on-one help, whereas, I believe, if I was at another institution, I couldn't get that kind of mentorship. My mentors helped me through everything that I needed and they genuinely care about teaching

me how to become an independent researcher.

I got involved in research because I knew I wanted to study eating disorders and go on to a clinical psychology graduate program. Eating disorders run in my family and I had to experience eating disorder treatment when I was ten to thirteen. I want to see how I can help those who are in treatment and how I can, hopefully, come up with some sort of new treatment options.

Even if you don't want to go to graduate school, research is important because it teaches you how to be a good worker, how to think analytically and critically of knowledge, something that's applicable to any job.

There's also so many ways on campus that research can be used, either for credit for classes or as funding for tuition through different programs. Research has made college possible for me by helping pay my tuition. [🔗](#)



## An Arctic Adventure

In the tundra surrounding Utqiagvik, Alaska — the northernmost town in the United States and home to nearly 5,000 people — **Kristine Bernabe** stuck a long probe into the ground until she reached frozen earth.

The cell and molecular biology major measured how much of the permafrost had thawed as part of her second time participating in SDSU's Summer Undergraduate Research Program (SURP).

"SURP is a good way to get first-hand experience with doing your own experiments and analyzing data," says Bernabe. "And it's paid!"

Mentored by biologist **Donatella Zona**, Bernabe is helping track the effects of climate change on Arctic ecosystems. As the permafrost melts, methane gases that were trapped in the ice are released into the atmosphere.

In addition to taking depth measurements, she helped graduate students collect data on the temperature and concentration of nitrous oxide of the soil.

"There's lots of stuff happening in the soil that's important to how the world works. It's really cool to see the impact our research has and how it's very relevant to current problems we're facing today," she says.

Outside of collecting data, Bernabe shared in traditional Inupiat meals of bowhead whale and caribou with scientists from Texas and Germany. Other highlights included attending a whaling season festival and seeing four wild polar bears.

"While you're doing the science, you're also learning about the

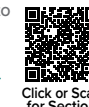
culture and the place," she says.

Back in San Diego, Bernabe will visualize and compare her new data with historical Arctic data from Zona's previous trips. She hopes to also work on a project in local chaparral ecosystems, which she studied during her first SURP.

"I didn't start out very interested in ecology, but I ended up enjoying it way more than I thought I would," Bernabe says. "Don't limit yourself. You never know what you're going to be interested in." ■



Kristine Bernabe collects water samples in the Arctic. Courtesy Photo







# EVOLVING THE BLUE ECONOMY

**What if verdant, sustainable farms could produce alternative fuel sources and nutritious food for indigenous communities and international markets while simultaneously helping slow climate change?**

**That's the untapped potential for aquaculture along the West Coast.**

## By Sarah White

San Diego State University researchers are overcoming the obstacles — both regulatory and scientific — to make it a reality.

SDSU biologist **Matthew Edwards** and post-doctoral researcher and microbial ecologist **Laís Lima (Ph.D., '21)** are leading a team of nonprofits, government agencies, tribal partners and labs across the country to identify and solve problems that are keeping Pacific Ocean kelp farming dead in the water.

## Why Kelp?

Seaweeds, the category to which 30 types of kelp belong, account for 27% of global marine agriculture production. The multiple uses of seaweed — in food, carbon sequestering, ceremonial art and alternative energy, to name a few — are estimated to comprise a \$16.7 billion industry worldwide. But over 97% of seaweed is produced in Asia, with the U.S. contributing less than 1% to international markets.

The slow growth of the industry on the West Coast is partly attributable to the decimation of over 95% of California kelp forests due to warming waters and an explosion of sea urchin populations. Also to blame is a confusing web of local, state and federal rules for securing permission to start kelp farms.

The first North American kelp farm was permitted in 2010. In the 12 years since, around 100 farms have been permitted in the eastern U.S., where sugar kelp is extensively farmed. On the western coast, however, just 20 farms started in Alaska, where kelp is an important part of tribal culture. And on the 7,863-mile stretch of coast from California to Washington, fewer than 10 seaweed farms have been permitted.

## Pain Points

SDSU master's student **Leslie Booher** and her partner **Torre Polizzi** faced the hurdles of permitting and trying to adapt East Coast growing advice when starting their kelp farming company, Sunken Seaweed.

The couple first teamed up with Edwards to study how *Ulva lactuca*, or sea lettuce, could be used to capture toxins in the San Diego Bay. But they had bigger dreams for the scale of kelp farming.

When the National Science Foundation put out a call for what Lima described as “a moonshot idea: something very collaborative, very applied and out there” to reinvent the so-called blue economy, or aquatic agriculture, the four kelp enthusiasts put their hat in the ring.

“It feels like we're living in a historical moment because this industry has so much potential to be renewable, sustainable and bring a lot of value to people,” Booher says.

After receiving an initial round of funding in the fall of 2021, Booher and Polizzi spearheaded interviews with eager farmers and participated in tribal councils in partnership with the Native Conservancy. Interviewees echoed the couple's own experience: navigating the hoops of the regulations and permits was a discouraging, time-consuming and expensive process.

In addition to the challenges of getting started, farmers also face other barriers to success, including an inconsistent demand from buyers, the prevalence of pests, and kelp mysteriously not growing as well as expected.

Continues on next page





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To alleviate these woes, the team is working with Greenwave, an ocean farming nonprofit, to develop a free online hub for future kelp farmers. The hub will provide streamlined permitting software, a network of customers and a best practices manual informed by Lima and Edwards’s research.

“In science, usually the approach is to investigate interesting questions. With this project, everything we think about and design has to help people, a sector, a community,” Lima says.

**Mysterious Microbes**

Answering the unknowns of what helps kelp grow best will require taking a page out of the terrestrial farm playbook.

“In land agriculture, the microbiome is already recognized as important for cycling nutrients and photosynthesis,” says Lima. “Corn and soy have been optimized with their

microbiome communities.”

Yet which microbes are beneficial partners to boost crop productivity is much less understood in the ocean.

Applying their expertise in metagenomics and ecology, the researchers are analyzing which microscopic organisms cohabitate with healthy kelp and what roles they play in growth.




In one of the biggest and most spatially distributed kelp sampling projects ever, the SDSU team and their partners used custom-made syringes called super suckers to collect both the seawater environment and seaweed tissue from over 125 samples from seven species.

Lima’s preliminary analysis of these samples revealed 30 types of bacteria and viruses that could benefit kelp growth.

Giant kelp samples from farms had

similar bacterial communities — which prevent undesirable biofouling organisms from growing on the kelp blades — to a natural kelp bed nearby, suggesting that these farms likely have no negative impacts on the ocean ecosystem. Additionally, different kelp species relied on a variety of microbial partners for cycling nitrogen, which is often more limited in warming waters.

In the next phase of the project, SDSU researchers and their collaborators will further analyze microbial genomes to verify which combinations of bacterial communities, temperature, flow rate and depth of farm will be most productive. Developing probiotics to enhance different physical characteristics of kelp is on the horizon.

“It’s very exciting to be in this position where science meets business,” Edwards says.   

## Recipes for Restoration

Sea urchin gonads are a prized gastronomic delicacy called *uni*, so researchers at the Coastal and Marine Institute Laboratory — led by **Brian Hentschel, Todd Anderson** and **Renee Angwin** — remove urchins from the ocean and study their gonad development in the lab. Comparing purple sea urchin growth before and after they eat manufactured feed and natural kelp diets has had promising results for more sustainable farming. Providing farmers with lab-based methods for *uni* production can further aid kelp forest restoration efforts. ■



Purple sea urchins after their gonads are removed. Courtesy Photo

Torre Polizzi and micro2macro team member assess health of farmed kelp lines. Courtesy Photo



## Oyster Apple Watches



Lauren Strope affixes sensors to oyster and assembles circuitry for underwater monitoring. Photo: Chris Leap

Oysters are the ocean’s cockroaches, surviving stressful situations like warming waters and algal blooms. Students in marine biologist **Luke Miller’s** lab are studying the physiology of these intertidal organisms. To do so, they manufactured “glorified oyster Apple Watches” out of four inches of PVC pipe, a circuit board, a couple of wires, a magnet, an LED and a couple of sensors. Affixed with a little bit of glue on the oysters’ shells, these devices track oyster heart rates and when the bivalves open and close their shells. This research will identify oysters’ preferred growing conditions to inform aquaculture farming practices and efforts to bring oyster species back from near extinction along the Pacific coast. ■







# Meeting Macaques

Macaques and cows on the side of the road in Indonesia. Photo: Melissa Callado

For thousands of years, humans and primates have lived in close proximity, sharing resources. In recent history, this has resulted in conflict where agricultural land meets the forest's edge in Indonesia.

With funding from the ASIANetwork, and in collaboration with Indonesian ecologists, ethnoprimateologist **Erin Riley** mentors undergraduates in studying human-primate conflict mitigation and primate conservation. Students learn about Indonesian culture and harvesting practices, as well as how to conduct unobtrusive observations of wildlife.

Building on this project, she was recently awarded a grant from the

National Science Foundation to bring students to Sulawesi for extended fieldwork experiences. Using cameras positioned amidst the trees and direct observation, they will investigate how endangered moor macaques shift their foraging and movement in increasingly anthropogenic environments and how these endangered primates can contribute to forest regeneration through seed dispersal. ■

Below:  
Left: A moor macaque eating in a ficus tree  
Photos: Lavinia German

Top right: SDSU undergraduates in Java, Indonesia observing the Javan gibbon.

Bottom right: SDSU undergraduates Melissa Callado (pink) and Jady Skipper (purple) with primate conservationist Rahayu Oktaviani.



A moor macaque eating in a ficus tree Photos: Lavinia German



Researchers assemble structure as part of experiment to measure effects of rainfall on plant growth after wildfire and drought.

# What's the Big Deal with Dirt?

Wildfire and drought can have devastating effects on human lives, but also on the soil beneath our feet.

When fire eliminates native plants, fungi and bacteria that create natural glues, soil does not clump together as extensively. And stickier soil can store more carbon, which helps counteract humans' excessive emissions.

With the support of a National Science Foundation RAPID grant, biologists **David Lipson** and

**Xiaofeng Xu** are analyzing soil samples from a recently burned nature preserve in San Marcos to better understand how the ecosystem recovers from the fire and sparse rainfall. Using data from drones and rain shelters, they will refine models of soils' role in climate change around the world, taking into account soil clumpiness and seasonal growth pattern differences between native and invasive plant species. ■



Scientists use cameras on a drone to calculate how much greenery covers a large area of land. Courtesy photos

# Protecting California's 'Stunning Diversity'

Healthy ecosystems support all life, making possible critical environmental resources like clean water and grasslands that support agriculture.

As climate change accelerates, these ecosystems are shifting at a rapid pace — forcing human and ecological communities to adjust to new environmental realities like water scarcity.

Working with tribal groups, state agencies and fellow scientists, and supported by the National Science Foundation, conservation biogeographer and National Academy of Sciences member **Janet Franklin** studies the effects of environmental change on the diversity of plant life and the essential habitats plant communities provide for all species in California. She uses species distribution modeling to predict the fate of native flora — like San Diego Mesa Mint and Engelmann Oak — threatened by climate change, urban sprawl and an abundance of wildfire.

By understanding shifts in the ecosystem, policymakers can adjust their planning to better protect ecosystems and prepare for the future in the face of rapid climate change driven by greenhouse gas emissions.

“The stunning diversity of plant life in California is just a marvel of evolution. These ecosystems have been self sustaining for millions of years and have sustained human life here for more than 10,000 years,” Franklin says. “We have to know how to prioritize efforts to protect our environment. and anticipate the ebbs and flows of ecosystems that are quickly changing and the downstream effect on wildlife, water, forests and people.” ■

Janet Franklin's research has found that several San Diego species are threatened by climate change, including the flora pictured below.



*Acanthomintha ilicifolia*  
San Diego Mesa Mint



*Hesperocyparis forbesii*



*Ceanothus verrucosus*  
Wart-stemmed Ceanothus



*Quercus engelmannii*







# The Eternal Afterlife of Tiny Trash

## By Peggy Pico

It's not something most young girls think about. But **Eunha Hoh** did.

"I always knew I'd be a scientist," says the San Diego State University public health researcher, "I was good at math and I loved reading books about invisible things."

Many kids long for superpowers to uncover hidden secrets. But as a child, Hoh experienced the real magic of discovery from her dad — a research and development scientist for the defense department in South Korea. "When my dad returned from his many work trips to the U.S., he brought me encyclopedias and books from NASA and science museums," she says, "I devoured them, and my fascination for invisible molecules and mysteries grew stronger."

Hoh's dad encouraged her scientific curiosity, advising her

to pursue chemistry in college. She complied, won over by his insistence that chemistry contains the basic, and often invisible, building blocks of life.

Armed with a master's degree in chemistry, Hoh landed a prestigious job at a major electronics manufacturer. A few years later, she visited the company's production facility and came face-to-face with a grim reality: "I was shocked to see hundreds of liters of toxic chemicals and solvents pouring from the enormous wastewater pipeline."

The discovery reignited Hoh's childhood pursuit and launched her quest to expose hidden and invisible toxic chemicals. Now, she and her extensive transdisciplinary research teams scour oceans, freshwater, air, farms, houses and roads to "find rarely tested pollutants and novel contaminants previously unknown and to better understand how

they impact humans, wildlife, and our environment," says Hoh.

Through a novel approach of molecular-level analysis, she and her team discovered chemical pollutants, often from everyday items like cloth microfibers and tire dust—the microscopic debris deposited on freeways and streets by millions of cars. Hoh explains further, "The friction between tires and the road leaves tiny particles that are blown or washed away into nearby water. With so many cars on the road, I want to know what that is doing to our environment, fish, air and health—and our findings could lead to more environmentally friendly formulated tire products."

To uncover the unknown, Hoh designed a non-targeted technique for luring toxic organic chemicals out of hiding. Instead of using a standard method to search for known toxins like DDT, she developed new

techniques that identify all the chemicals in a given sample, known or unknown.

The new approach paid off immediately. Researchers identified chemicals that stick around forever, known as persistent organic pollutants (POPs), in flame retardants and documented long-lasting tobacco byproducts in thirdhand smoke. They also discovered previously unknown chemicals from degraded microplastics and emerging contaminants from the breakdown of known toxins, including devolved DDT compounds disrupting reproduction in California condors, risking their comeback in the wild.

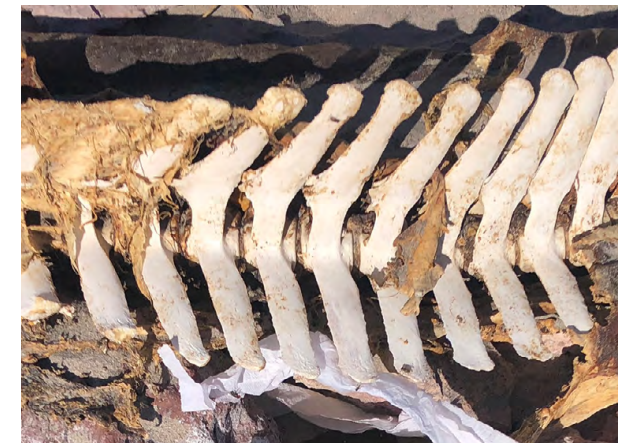
"We have worked with the Hoh Lab at SDSU for more than five years on different projects, and it has proven to be an excellent collaboration. Together, our areas of expertise have allowed us to take a rather integrative look into the possible effects of contaminant exposure on the reproductive success of the Baja condor flock scavenging marine mammal carcasses along the shores of the Gulf of California," says **Chris Tubbs**, associate director of reproductive sciences at San Diego Zoo Wildlife Alliance.

As a result, Hoh's team proved for the first time that condors along the California coast were exposed to so

many environmental contaminants that they were able to propose better potential habitat locations.

Beyond the lab, Hoh leveraged her 'broad is better' approach to establish a vast network of transdisciplinary teams, with unlikely research partners in psychology, nutrition and engineering, to name a few. She also developed collaborative partnerships with a dozen research teams at the National Oceanic and Atmospheric Administration (NOAA), Scripps Institution of Oceanography, and other universities and organizations.

Today, Hoh remains dedicated to discovering more POPs — those eternal tiny tidbits of chemical trash that invisibly infiltrate our environment, potentially making their way into our lungs, water and food from unexpected sources. 🔊 + 📺 + 🔗



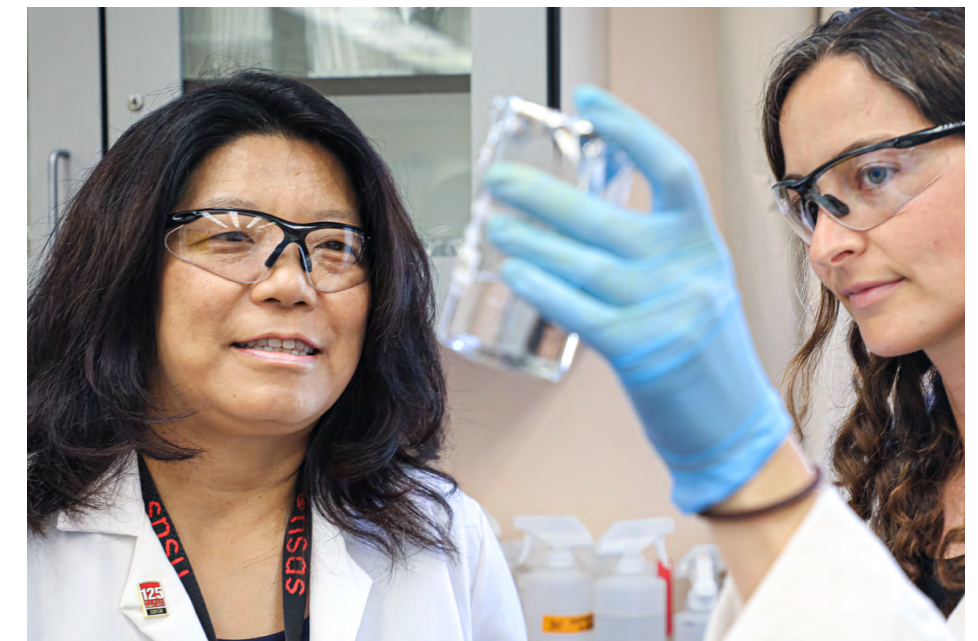
On left page: A whale skeleton found on the Baja California shore had much lower chemical contaminants than similar carcasses in Southern California. Condors scavenge food from deceased marine mammals. Photo: Ignacio Vilchis

On this page:

Top left: Baja condor

Above: A dolphin spine found on the on Baja California coast had much lower chemical contaminants than similar carcasses in Southern California. Photo: Ignacio Vilchis

Below: SDSU Environmental Health Lab members Eunha Hoh and Margaret Stack. Photo: Carrie Dada



"The most rewarding treasure I'm looking for is in the future, where non-targeted detection methods are a conventional practice, leading to better-designed systems to protect and clean up our environments."

Eunha Hoh






# THROUGH A COMICS LENS HISTORY AND SOCIAL JUSTICE COME ALIVE

By Leslie L.J. Reilly

The future is bright for students, researchers and comicphiles.

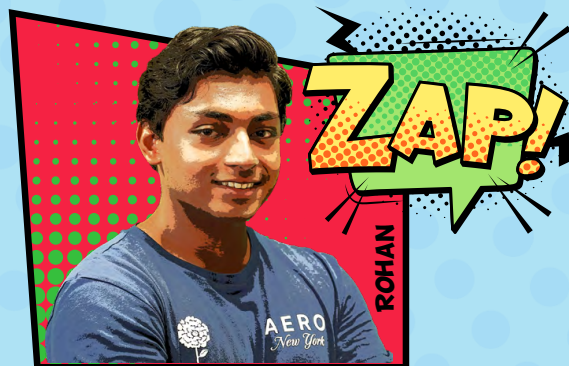
Founded this year, the San Diego State University Center for Comics Studies — the permanent home for academic excellence and research in the study of comics — provides students a new way to study social justice, history, and the humanities.

With a focus on research and analysis, students enrolled in a growing number of interdisciplinary comics courses discover that comics aren't simply a "lowbrow" artform. Instead, comics illuminate issues of identity, race, religion, education and the politics of representation.

Scholars Elizabeth Pollard and Pamela Jackson co-direct the center, which has received funding from the National Endowment for the Humanities and Institute of Museum and Library Services to bolster comics education at SDSU — through activities like developing innovative comics curricula, creating 10 new comics courses and a certificate program in comic studies, and offering workshops that bring scholars to campus to energize the field of comic studies. 



"The Comics and History course breaks any preconceptions about the artform. It changed the trajectory of my college experience, and ultimately my career. I originally went into the accounting program, but after taking the class I seriously could not see myself as an accountant. This class showed me what I really enjoy doing," says **JACK HINZO**, a junior majoring in English.

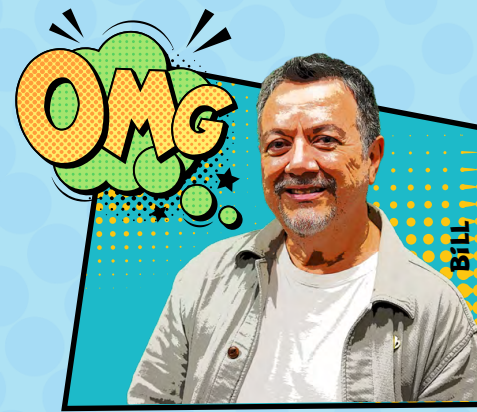


"Going into the class, I was skeptical as to what this course could offer besides checking off a general education requirement. After all, one wouldn't expect a course taught about Superman and Spider-Man comics to be very deep. Throughout the

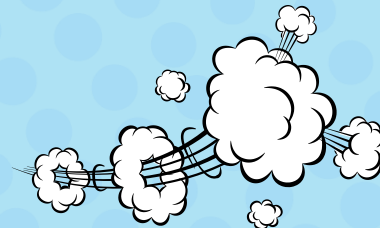
course, we studied several non-mainstream comic books and graphic novels and learned many key insights into the human condition. The class opened my eyes as to how different yet similar all humans are and that if you keep digging, you'll uncover new revelations about yourself," says **ROHAN KUMAR**, a sophomore majoring in statistics and data science.



It has been a career highlight to see our students' passion for the graphic medium grow as we offer more opportunities for student engagement and increase the number of classes that teach comics. I envision opportunities for faculty, students, comics creators, publishers and fans to come together to build community around the study of comics," says **PAMELA JACKSON**, pop culture librarian and comic arts curator.



"At first glance, students think it is easy — you know 'comics are for kids' — but when I link comics to millennia-long practices of humans leaving traces, from the cave paintings of Lascaux to Parisian graffiti and street art, things begin to open up," says English Professor **BILL NERICCIO** who teaches the course titled I/Eyegasm 21st Century Comics, Photography, Cinema, and Cultural Studies.



"By examining Cold War comics, students have the opportunity to evaluate how these visual arts depicted race, identity, gender, and social justice during a time when many U.S. citizens believed they

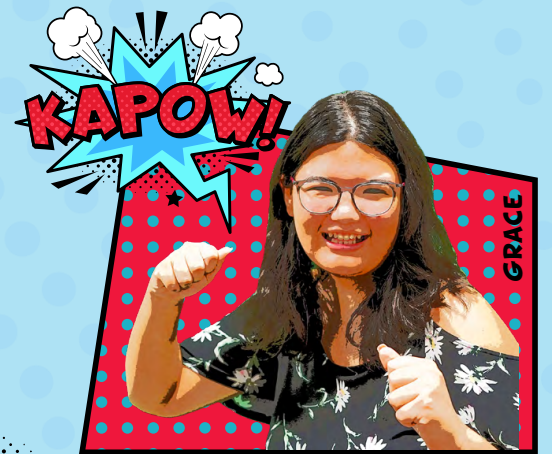


Photos: Chris Leap

were engaged in an existential struggle between good and evil," says history Professor **GREGORY A. DADDIS** who teaches Comics and Cold War America, a course that encourages students to think deeply about some of the core principles of social justice: equality, equity, rights and participation.



"Historians and biographers use the comics medium to help readers experience high levels of immersion, empathy and complexity as they confront the past. Creators also contribute counter-histories and 'histories of the future' that shed light on our common human story," says **VAN TARPLEY**, a history lecturer who teaches a Graphic History course where students explore selected historical problems, eras and events through the lens of graphic histories and novels.



"Studying ancient history through the lens of comic books makes the content feel action-packed and alive, which helps students both become engaged and feel connected to the figures, stories and events about which they are learning. I loved the class and would recommend it to everyone!" says fourth-year history student **GRACE DEVEGA**.



"The new center will provide an opportunity to shine a well-deserved spotlight on the innovative work faculty and students at SDSU are already doing with comics — and to take that work to the next level," says **ELIZABETH POLLARD**, history professor and co-director of the Center for Comics Studies.







Above: Both an experienced musician and an avid adventurer, Warren has traveled the globe capturing sound environments — from concert halls and famous churches to lava tubes and bat caves — and replicating them for EchoThief. The results have been, at times, surprising. In the giant subterranean artillery batteries of an abandoned fortress in Washington, sound resonated as much as six seconds — nearly three times the reverberance of a concert hall. Photo: Paul W. Koester

Background: Chris Warren has digitized sound environments from all over the world, including Nancy Lake Tunnel in Alaska (pictured here). Photo: Chris Warren

## Reclaiming the Air - One Sonic Snapshot at a Time

By Kellie Woodhouse

The space is part of the ensemble.

It's a fact every musician knows, but one that was doubly emphasized during the pandemic. Overnight, musicians saw beloved venues — churches, concert halls, opera houses, stadiums — shut down and lock their doors, with no idea when they would reopen.

For classical vocalist **Kayla Gautereaux**, the experience was visceral.

"I cannot emphasize this enough: space is so important to sound. It changes the whole ambiance of what a performer and audience member is experiencing," says Gautereaux, an assistant professor with the Boston Conservatory. "Being ripped away from our spaces

was such a blow to musicians and our ability to be creative."

Gautereaux tried practicing in her living room, but the experience lacked warmth and ebullience. The environment felt dead. The soundwaves thumped against her walls and died.

She missed the concert hall, with the rich resonance of her voice echoing against the walls and warming the ears of an audience.

Gautereaux, a 2014 graduate of San Diego State University's School of Music and Dance, was sharing her disappointment with a friend and fellow graduate when she learned about the research of **Chris Warren**, an assistant professor of digital composition and sound design at SDSU.



Long before the pandemic upended the performing arts,

Warren was fascinated by the relationship between sound and space. Play a note in the middle of a field, and the soundwaves unfurl evenly across the open space until they dissipate into the air. But walk into a cave and play that same sound, it will bounce around the walls and amplify tenfold.

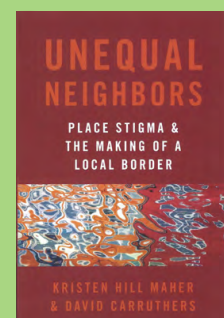
Warren created an algorithm that captures the sound environments of resonant spaces. His program EchoThief takes impulse responses — high resolution sonic snapshots — of any space, digitizes the exact acoustical recipe and then has the ability to apply that acoustic environment to any sound. EchoThief is so precise it measures exactly how long a sound resonates within a space before evaporating into silence.

Gautereaux recalls being in her small Boston apartment during

the height of the initial COVID-19 lockdown, sitting alone in her living room but, thanks to EchoThief, sounding as if she was in large chamber hall of Saint Martin of Tours Church in La Mesa, where she performed countless concerts. The large stained glass windows, the pews packed with people, the crucifixes placed about the hall — all of these elements may have been missing but, if she closed her eyes, Gautereaux was back at the church, singing as if she had never left.

"Through EchoThief, I was able to go back and visit a space that had brought me so much joy," Gautereaux says. "It was a therapeutic experience during an uncertain time, a time when there was no way I could have experienced that environment."  

### RECOMMENDED READING



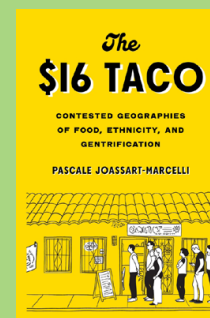
#### Unequal Neighbors: Place Stigma and the Making of a Local Border

Political scientists **Kristen Hill Maher** and **David Carruthers** examine San Diego and Tijuana's intertwined histories, cultures and economies. The duo draws on a large body of original media, archival and interview materials from the bi-national urban region, and considers the role of place stigma in reinforcing actual and imagined inequalities between these cities.



#### "Babylost: Racism, Survival, and the Quiet Politics of Infant Mortality, from A to Z"

The U.S. infant mortality rate is among the highest in the industrialized world, and Black and Indigenous babies are far more likely than white babies to die in their first year of life. **Monica J. Casper**, a sociologist and dean of the College of Arts and Letters, explores social and cultural dimensions of infant death through 58 alphabetical entries, from Absence to ZIP Code. Her book is a sociological study of infant death, an archive of loss and grief, and a clarion call for social change.



#### The \$16 Taco: Contested Geographies of Food, Ethnicity, and Gentrification

Having "discovered" the flavors of barbacoa, bibimbap, bánh mì, sambusas and pupusas, white middle-class eaters are increasingly venturing into historically segregated neighborhoods in search of eateries run by — and for — immigrants and people of color. Drawing on extensive fieldwork in San Diego, geographer **Pascale Joassart-Marcelli** illustrates how food can both enplace and displace immigrants, shedding light on the larger process of gentrification and the emotional, cultural, economic and physical displacement it produces.



#### Crimesploitation: Crime, Punishment, and Pleasure in Reality TV (Cultural Lives of Law)

True crime has sensationalized the nation, and public affairs professor **Paul Kaplan** investigates the moral and ethical challenges presented by the genre in his new book, co-authored by Emory University's **Daniel LaChance**. The authors highlight the troubling nature of a genre that presents itself as ethical and righteous, even as its entertainment value hinges upon suffering.





# Tackling Health Disparities

By Susanne Clara Bard

**Routine screening for cervical cancer can lead to earlier diagnosis, improved treatment outcomes and reduced mortality. But when a family's basic needs aren't being met, screening may be delayed.**

"When you're worried about where your next paycheck is coming from, or whether your kids will be able to eat, you're not necessarily prioritizing cancer screening," says public health researcher **Corinne McDaniels-Davidson**, who adds that screening and follow-up rates are lower among marginalized populations.

McDaniels-Davidson is one of many SDSU faculty who study how health disparities disproportionately impact marginalized populations by partnering with communities to better understand and implement interventions that address deeply-rooted social and economic inequities.

"When we think about health disparities we're really talking about differences in health and health care between groups that stem from these broader inequities," says speech and language professor **Sonja Pruitt-Lord**.

SDSU is well-positioned to take on health disparities. "We have been intertwined with the community for so long that the SDSU name is trusted in the community," says McDaniels-Davidson. "That makes it possible to do work that others might not be able to do."

## Health Care Inequities

In addition to studying disparities in cancer screening, McDaniels-Davidson and her team partnered with the County of San Diego early in the COVID-19 pandemic to implement a community health worker-led contact tracing program. She also collaborated with epidemiologist **Susan Kiene** to implement a National Institutes of Health-funded community testing program, an effort that included middle schoolers in the Sweetwater Union High School District and their family members.

"When you are able to partner with communities to address whatever health issue is important to them, you start to build these very tight relationships," says McDaniels-Davidson.

SDSU's South Bay Latino Research Center (SBLRC), co-directed by psychology professors **Greg Talavera** and **Linda Gallo**, is another trusted community partner. It has long been a leader in community-engaged health disparities research and culturally-informed interventions to improve health among Latinx populations.

SBLRC studies have revealed high rates of undiagnosed diabetes in the Latinx community, as well as a relationship between neighborhood environments and an increased risk of hypertension and diabetes.

The SBLRC has also shown that an integrated care intervention addressing behavioral and physical health needs of people with diabetes improves both diabetes management and psychological well-being.

## Environmental Justice

The San Ysidro Port of Entry, linking Mexico to the U.S., is one of the busiest border crossings in the world. But few of the people living in the adjacent community benefit economically from the trade that passes through. Instead, San Ysidro's residents — mostly low-income and more than 90% of them Latinx — breathe in pollutants from idling vehicles waiting to cross the border and from trucks passing through their community.

Public health professor **Penelope "Jenny" Quintana** has partnered with Casa Familiar, a community development agency in San Ysidro, to measure exposure to traffic pollutants for more than 15 years.

Recently, she has received funding from Caltrans, California's transportation agency, to monitor air quality related to heavy-duty truck emissions along the border and to share this information with the community. The project will serve as a baseline for assessing the effect of ongoing improvements to truck movement and emissions in the border region.

She thinks the air quality data will help shape policy, for example, increasing staffing at the border crossing in order to reduce wait times and building particulate-free gyms where children can safely exercise.

**Continued on next page**



Photo credits from top to bottom:  
 Annabel Clark, Courtesy of Robert Wood Johnson Foundation  
 BrightSide Produce  
 BrightSide Produce  
 Chris Leap  
 Mani Albrecht, U.S. Customs and Border Protection







Continued from previous page

“When you start measuring it and publishing the data, it really brings a lot more attention and political will to the problem,” says Quintana.



### Food Insecurity

Assistant professor of nutrition **Amanda McClain** has seen the choices families face when struggling to access nutritious, culturally appropriate food.

“Food insecurity isn’t just about money, it’s all the things that come along with living in or near poverty in the United States,” she says. “One month, you’re paying bills and not buying enough food, and the next month you’re buying enough food and not buying the necessary medication or paying bills.”

Her research has found links between the stress of marginalization — food insecurity, poverty, identifying as a racial or ethnic minority — and the risk of developing obesity and cardiovascular disease. Recently, her team found that San Diego agencies are tackling food insecurity holistically. In addition to connecting families to food and food assistance, cross-agency partnerships enable agencies to assist



This column: BrightSide Produce members deliver food in National City. Photo: Carrie Dada

families with finding affordable housing, paying bills and accessing mental health services. “All of these things are connected,” she says.

BrightSide Produce, the brainchild of marketing professor **Iana A. Castro**, takes a direct approach to reducing food insecurity. Student interns and staff distribute fresh produce, purchased from wholesalers and local farmers, to underserved communities of National City and San Diego on a weekly basis.

“BrightSide’s primary goal is to make sure that everyone has access to fresh, affordable produce,” she says.

Castro says it is run like a non-profit, and the student interns take on responsibilities related to their interests and majors.

National City, a community in San Diego’s South Bay, has neighborhoods that are considered food deserts because they are located more than a mile away from a supermarket.

“Because of the presence of BrightSide in 13 stores in National City, all residents now have access to produce within a half mile of their homes,” says Castro.



### Family and Community Interventions

Family and community connections can be a powerful way to address health disparities.

Through a partnership with the YMCA, psychology researcher **Elva Arredondo** and her team recently tested a pilot project that promotes physical activity and wellbeing among Latinx mothers and their pre-adolescent daughters. At this age, girls tend to become less active and are bombarded with social media messages about body image.



Young women and their mothers participate in a workout class at a local school. Photo: Chris Leap

“We’re engaging their mothers because mothers still have an influential role at that stage,” says Arredondo. “They can role model physical activity, which is connected to lower risk of depression, to healthier eating, to family engagement and connections. So it’s a very holistic intervention and approach.”

Arredondo also studies how community-engaged interventions can be successful over the long term.

“SDSU has all these programs at work,” she says. “We are constantly thinking about how to translate them into practice, adapt them to diverse communities and sustain them.”



Researchers and policy makers alike are concerned about the high percentage of young adults who vape.

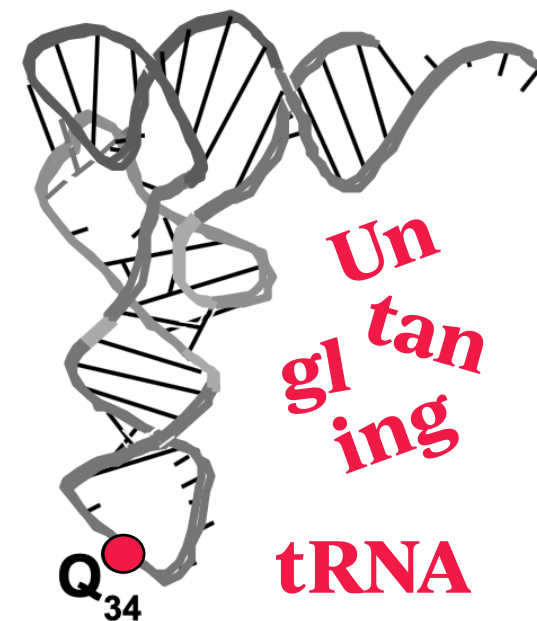
## Are Social Media Hashtags the New Joe Camel?

From celebrity endorsed TV commercials in the 1950s to creating kid-friendly characters like Joe Camel in the 1990s, tobacco companies have a long history of quickly adapting popular marketing strategies.

Now, vaping companies are leveraging social media hashtags, which are currently not restricted by FDA regulations, to reach their target audiences.

Health communications researcher **Rachael Record** worries that co-opting tobacco prevention hashtags such as #smokefree and #kickthehabit could lead young consumers to inaccurately perceive vaping as a safer alternative to smoking, despite these products having nicotine levels similar to combustible cigarettes.

In work funded by the University of Southern California, Record is analyzing how frequently these anti-tobacco hashtags are used on youth-oriented vaping social media posts and how many likes, comments and shares they receive to make the case for more restrictive advertising policies. ■



How is transfer RNA (tRNA) — one of the fundamental components of translating DNA into usable proteins — made? Biochemist **Manal Swairjo** and her students are on a mission to find out and, in the process, determine how mutations in tRNA that result in neurological diseases can be prevented.

Using X-ray crystallography and cryo-electron microscopy techniques to examine details of molecular structure, Swairjo has narrowed in on how a vitamin called queuine is salvaged by bacterial and human enzymes and then integrated into tRNA molecules as queuosine.

Because viruses and bacteria also use queuosine to change the structure of their genetic material, this research, supported by the Department of Health and Human Services’ National Institute of General Medical Sciences, could lead to tools that complement the revolutionary CRISPR method of editing DNA in living creatures to target specific genes by recognizing the location of queuosine. ■

A tRNA strand with location of queuosine highlighted



## End of the Road for Ovarian Cancer

Biologist **Carrie House** is trying to prevent the recurrence of ovarian cancer. Her lab, funded by the Rivkin Center, is elucidating the series of molecules and interactions that allow cancer cells to regrow following chemotherapy.

Several types of cells near treated tumors, like macrophages or fat cells, can release chemicals that make lingering cancer cells act like stem cells, capable of differentiating into additional tumors.

House’s work has shown that specific cytokines, small proteins that usually help repair tissues, also detrimentally kickstart the transformation into stem-like cells. Blocking the cell receptors for these cytokines in tumors in mice slowed the transformation process and led to the mice living longer.

Thus, those receptors are good targets for future drugs to keep patients cancer-free after treatment. ■



Click or Scan for Section





## Ordinary Weekend

by John Rodriguez

Cracked Masks, POPS anthology  
 As I sit there and dwell  
 my head spins while  
 trying to balance the worlds of love and hurt  
 She grabs my hands  
 and I don't know if she sees  
 that they're tattered and beat  
 but not physically.  
 I wonder if they look at me  
 and feel disgust for a fool covered in concrete.  
 They wait in long lines  
 And drive down miles of open road  
 to see if I will respond  
 and in a way learn to love again  
 and not be afraid to have friends  
 and not scared to show my feelings  
 but understand my life has meaning  
 besides simmering in a pool of iron  
 where boots clank and the years wave goodbye.  
 For these few seconds I have it under control.  
 A world is at ease  
 my hands sweat with remorse  
 and learn to ignore the hate and negativity  
 that has  
 built up inside me.  
 But the speaker announces  
 that visiting is over.  
 I give a hug that I will miss  
 and spin away  
 from those  
 who make me feel like I'm worth living.  
 They smile but I know  
 it hurts them as much as it does me.  
 A feeling of gain and loss  
 a true oxymoron.  
 Out they go  
 back to their iron-touched lives  
 and I pass through the doorway  
 that leads to negativity.

## Prison Arts Collective: A Forum for Expression and Connection

By Kellie Woodhouse

**John Rodriguez** was incarcerated at Ironwood State Prison when he learned about Prison Arts Collective (PAC), a program that expands access to the transformative power of the arts to people experiencing incarceration by providing multidisciplinary programming — including creative writing, music and painting.



Rodriguez thrived in PAC. Today, several years after his release from prison, Rodriguez remains involved — now as a program coordinator who facilitates PAC, helping manage relationships with prisons, train facilitators and mentor participants. PAC began in 2013 and operates in 12 California prisons with the help and expertise of faculty, students and staff throughout SDSU and several partner colleges and universities.

The program allowed Rodriguez to tap into the therapeutic benefits of art, envision a version of himself outside of prison and develop leadership skills he continues to use today.

“John brings a wealth of professional, creative and lived experience to our team and his insights add value to our programs,” says **Annie Buckley**, PAC founder and director and a professor in SDSU’s School of Art + Design.

PAC is a product of Arts in Corrections, an initiative of the California Arts Council and the California Department of Corrections and Rehabilitation (CDCR), with additional funding from CDCR Innovative Program Grants and the National Endowment for the Arts.

Rodriguez shared insights about his experience with PAC, from when he first encountered the program as a participant to his time now on the staff.



### What interested you in PAC and why did you get involved?

Although it is an art-based program, it is much more than a space to create art. In retrospect, it validated our

experiences by allowing us to create a curriculum and make choices, something we are seldom allowed while inside. It contributed to the process of building one’s sense of self because it honored our experiences and various approaches to art that are outside of the scope of academia.



### While incarcerated, you became a peer facilitator and led workshops. What did you learn from the experience?

As a facilitator, I had to learn how to step in and step out, prep ahead of time, and build around the ideas and interests of my peers — all the while doing it in a manner that was fun and accessible. That was where I saw the most growth in myself and others. We engaged in activities that were fun and creative, but underneath the material was very intentional and touched on key aspects that allowed participants to dig deep in a protective and personal way.



### When your incarceration ended, you decided to continue with PAC and join the staff. What made you want to stay?

Once somebody is released from prison, it’s rare to see them come back because most people tend to block out that moment in their lives to move forward in life.

However, I wanted to remind the

people inside that they are not forgotten. Although I’m now free, these people are still my peers and I carry them with me into the free community. Ultimately, I want them to benefit from the healing and interpersonal understandings that are found within those classrooms.



### What is so transformative about the arts in a prison setting?

Art allows those inside to connect with themselves, their peers, their families and the outside community in ways that are both simple and intimate. When folks make holiday cards or portraits for their families, it creates a synapse to a conversation with their loved ones. For some, creating is a means of survival because their art is traded for necessary items. For others, it is their only tool of expression and how to make sense of their situation.

Listen to Rodriguez read his poem ‘Ordinary Weekend.’



At left: John Rodriguez found healing through creative expression. Photo: Rachel Crawford

Above: Annie Buckley (right) says Rodriguez is a valuable member of the Prison Arts Collective. Photo: Peter Merts







## ‘Canary in the Coal Mine’

Special education researcher **Paul Luelmo** is leading a new statewide effort to address disproportionate rates of placement in special education along racial and ethnic lines.

More than 130 districts in California — about 10% of the total— were shown to have racial inequalities in special education placements, a phenomenon termed “disproportionality.” The impacts are profound. Data show Latinx students are three times more likely to be placed in special education for learning disabilities, and Black students are three times more likely to be identified for emotional disturbance.

In work supported by the California Department of Education, Luelmo is teaming up with the Napa County Office of Education to study the root



Paul Luelmo’s work seeks to identify the root causes of disproportionate special education placement and develop solutions.

causes of disproportionality and develop a protocol to help districts address the problem.

“Special education disproportionality is like the canary in the coal mine,” says Luelmo. “It’s the sign of something that’s

happening in general education. What we find is that the systems of support for students who might need help are just not there. Or there might be differential treatment among some students.”



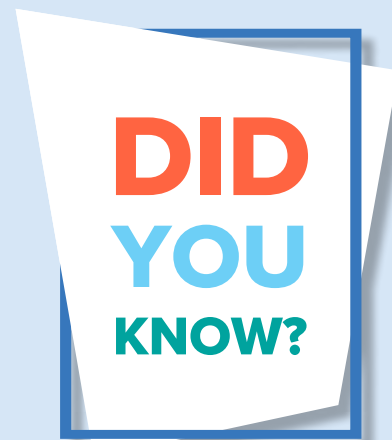
## Diagnosing Language Disorders Equitably

One in fifteen children has developmental language disorder (DLD), which has no identifiable biomedical cause. Tools for diagnosing DLD primarily exist in English, leading to both underdiagnosis and overdiagnosis of children who speak other languages. With funding from the National Institutes of Health, clinical researcher **Giang Pham** is developing tools to more equitably and accurately diagnose bilingual children who speak Spanish or Vietnamese in addition to English.

With the novel methods Pham is developing with her collaborators, children can be assessed in their primary language and secondary language, as well as with memory and attention tasks that don’t require language.

These tools will help more students get the resources they need sooner so they can improve their reading skills and better engage in social relationships.

Giang Pham’s Bilingual Development in Context Lab studies child language development.



Latinx students are **3x more likely**

to be placed in special education for learning disabilities

Black students are **3x more likely**

to be identified for emotional disturbance

**1 in 15** children has developmental language disorder, which has no identifiable biomedical cause

Final grades increase **by 12+%** as underrepresented students benefit from contextual social learning activities that celebrate the richness of their culture

## Designing Canoes – and a New Method of Teaching

As a researcher and educator in Hawaii, information systems scholar **Kaveh Abhari** realized that mainstream textbooks often didn’t use examples and methods relevant for the majority Native Hawaiian student population.

In a series of studies, Abhari found that underrepresented students benefited from contextual social learning activities that celebrate the richness of their culture — a teaching model dubbed Authentic Social Learning — with final grades increasing by at least 12%.

For example, outrigger canoeing is an activity with cultural significance in Hawaii. Abhari and his team developed a hands-on math curriculum that taught advanced concepts by having middle schoolers design canoes themselves. In 2021, Abhari published training materials as a book, titled Authentic Social Learning: Diversity, Equity, & Inclusion in Action, that incorporates problem-based learning, social learning and inclusive pedagogy through culturally relevant concepts like fishing, music and agriculture.

With his information systems background, Abhari used technology to support the curriculum by implementing social learning platforms for both teachers and students.







# Where Research Meets Practice

By Michael Klitzing

For the growing ranks of autism researchers in San Diego State University's College of Education, a lab coat is not required. A few other things, however, are not optional.

Like deep school and community partnerships.

Like an unwavering focus on bridging the gap between research and practice.

Like a passion for meeting the most pressing needs of autistic people and their families.

"So many people are really, truly touched by the research that we do," says **Rachel Haine-Schlagel**, interim associate dean for research in the college. "We're directly impacting the community and the workforce on multiple levels, whether by developing people who can work effectively with autistic children and their families or by creating services that are reaching the community."

The rate of autism diagnosis in the U.S. continues to grow, reaching 1-in-44 eight-year-olds according to recent data from the Centers for Disease Control and Prevention. It's against this backdrop that the College of Education's ranks of faculty members working in the autism area has swelled in the past decade to more than a dozen spread across five departments.

They focus on developing and improving services and service delivery for autistic individuals at different stages of life — from toddlers, to K-12 students, to young adults. Their goal is to positively impact outcomes in education, employment, independent living, mental health and other areas.

The services under the metaphorical microscope are known as interventions — direct service activities designed to be delivered by psychologists, behavioral specialists, speech-language pathologists, occupational therapists, classroom teachers, educational specialists, parents and others. For young children, this could mean play-based coaching strategies for parents, aimed at building social communication skills. For young adults transitioning out of high school, this could mean a curriculum that teaches workplace-related soft skills.

During the 2021-22 academic year, education faculty secured more than \$2.1 million in funding for 13 research and training projects relating to autism. Funders include the U.S. Department of Education, the National Institute of Mental Health (NIMH) and the Institute of Education Sciences (IES).

By both training the interventionists and ensuring the efficacy of the interventions, SDSU faculty are taking a dual role in ensuring quality services for autistic people.

"I think there is a very clear connection between our research and the role of SDSU as an educational facility focused on personnel preparation," says **Laura J. Hall**, professor and chair of the Department of Special Education. "We carefully evaluate how to prepare personnel to support autistic students and learn how to do it well."

**Supporting young adults**  
Mary Baker-Ericzén's research is

deeply embedded in the community, with organizations like San Diego Regional Center (SDRC) and California Department of Rehabilitation (DOR) supporting her work. But the post-secondary education researcher says equally-critical partners come from within the autistic community itself.

"We have a very large team of autistic adults and families who inform every aspect of my research," she says.

"Their voices are heard at every stage

of the program and they ensure the project will have a lot of relevancy."

Baker-Ericzén develops and evaluates services geared to help autistic young adults build the skills needed to enter careers and higher education and — ultimately — lead fulfilling lives on their own terms. Curricula include lessons on cognitive executive functioning, social and communication skills, emotional regulation and self-determination.

"It's the set of soft skills that our

population now calls 'adulting,'" she says. Her newest project is a NIMH-funded multi-site study being done in collaboration with Portland State University and Vanderbilt University. Baker-Ericzén and her team plan to enroll 800 autistic adults as participants in the study, which will develop a set of autistic-informed measurement tools to use in community services designed to address mental and medical health, social support, quality of life, employment satisfaction and more.

Baker-Ericzén notes that these measures were developed or adapted with input from autistic adults and their families, service providers and researchers.

## In the schools

SDSU's Department of Special Education is home to Project EXPRESS, a federally-funded collaboration with the University of North Carolina (UNC)-Chapel Hill. Hall, **Bonnie Kraemer** and **Kelsey Dickson** are part of the five-year study to compare the efficacy of two programs — one focused on executive function and the other on social skills — on autistic middle school students in San Diego County and central North Carolina.

But Project EXPRESS is taking it a step further, performing an additional study to learn what factors — such as teacher quality, levels of school support and staff attrition — might help or hinder successful implementation.

"These are all the supplementary factors that are often not asked," Hall explains. "Typically, published studies are about 'What did you do? What did the research say is needed? What were the outcomes? But you end up missing some of the key ingredients.'"

SDSU's partnership with UNC began in 2014 when **Samuel L. Odom**, senior

research scientist at the UNC Frank Porter Graham Child Development Institute, sought a West Coast partner for a project developing programs for autistic high school students.

"I had worked with SDSU colleagues on other projects and was familiar with their skills as researchers and their strong relationships with the local schools," Odom said. "Their participation greatly strengthened the project."

## Services for toddlers

Since 2013, eight researchers with backgrounds in autism services have joined the College of Education from the Child and Adolescent Services Research Center (CASRC) — a multi-institutional consortium of leading California research institutions. The group includes **Sarah Rieth**, an expert in early autism intervention for young children.

What prompted her and her CASRC colleagues to make SDSU a home base?

**"I think a lot of it is San Diego State's emphasis on applied research that truly impacts the community and is about the community," says Rieth.**

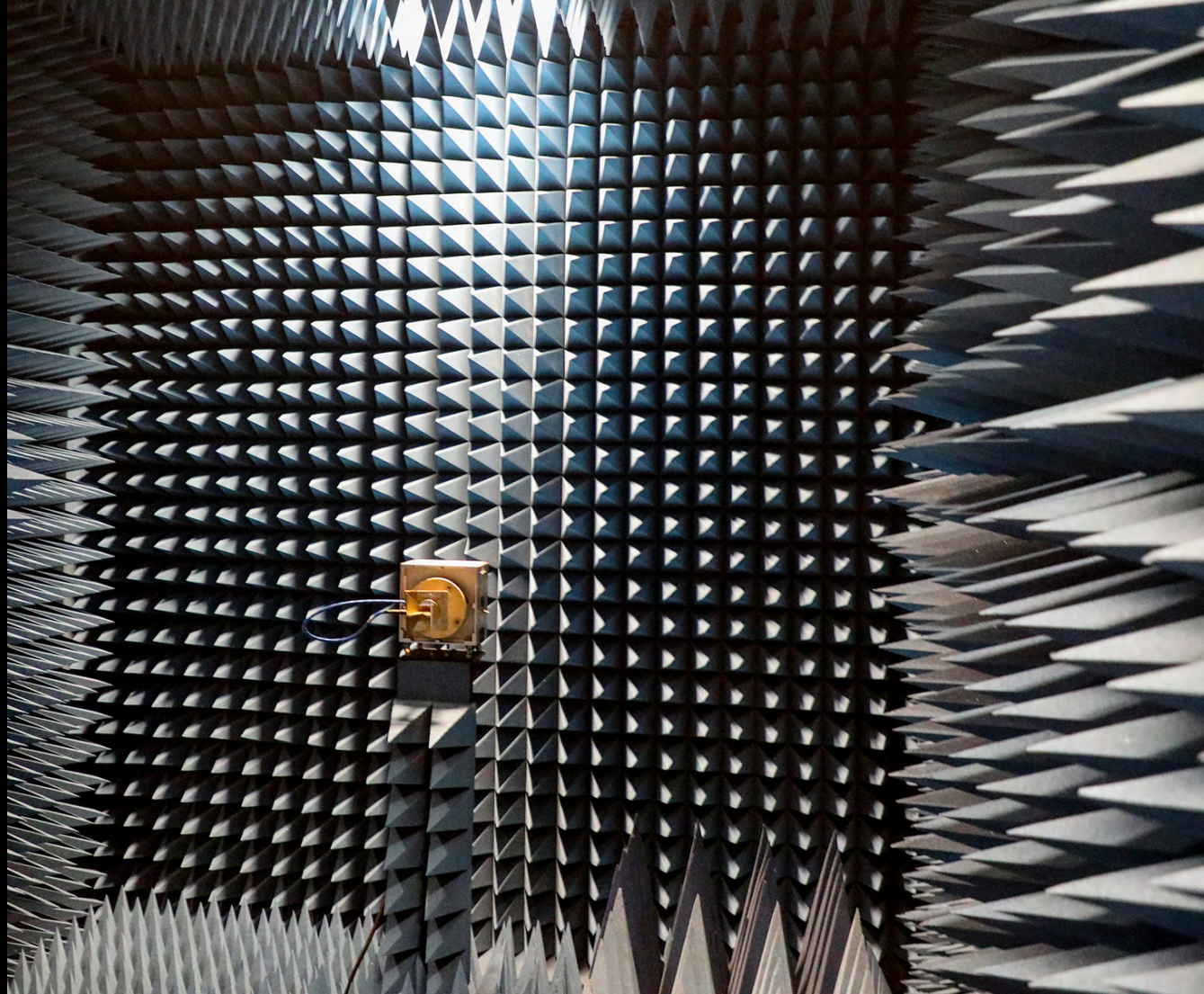
Rieth is currently studying the efficacy of Project ImPACT, a parent-coaching intervention for toddlers at risk for autism. In partnership with San Diego area providers, she compares how children respond to existing services to how they respond when their family receives Project ImPACT. In the process, she trains the interventionist to use Project ImPACT with families.

"The main activities in my research right now are connecting with agencies that are delivering services to families in the community," Rieth says. "My focus is on ensuring these interventionists are effective when they work with families."

**"This is not ivory tower research," she adds. "It's about actually impacting the world around us."**

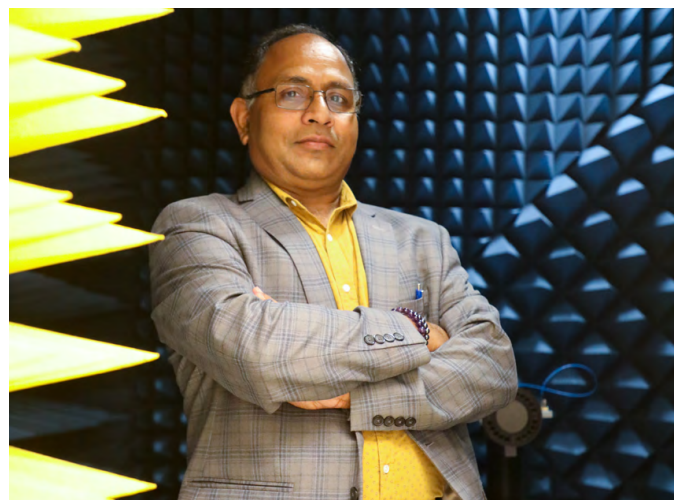






How can the military send messages accurately without GPS or satellites? By capturing radio waves that bounce off clouds in the lowest zone of the atmosphere.

Funded by the Office of Naval Research, electrical engineering professor **Satish Sharma** and his Antenna



and Microwave Laboratory are designing antennas that can pick up faint signals and stay precisely aligned with their source while onboard U.S. Navy vessels in roiling seas.

Inside of an anechoic chamber lined with graphite-dipped foam pyramids that reduce interference from electromagnetic waves, Sharma's students are calibrating the antennas so they can lock in on out-of-sight communications targets. The key components are a reflector 1.5 meters in diameter — a larger than usual size that increases the likelihood of picking up scattered signals — and four receivers positioned at 90 degree intervals to direct the primary high-gain transmitting antenna.

Sharma's team is also adapting 5G technology for antennas that will send data from the lunar rovers to a moon-orbiting satellite as part of NASA's upcoming Artemis missions. ■

Above: An antenna ready for fine-tuning in anechoic chamber. At left: Satish Sharma at the entrance of the anechoic chamber. Photos: Carrie Dada

## Highways in the Sky

Imagine a way to avoid the clogged interstate during that weekend trip from San Diego to Los Angeles. In the not-so-distant future, automated air taxis could make the three hour drive — if you're lucky — a one hour pilotless flight.

But will it be safe?

That's what aerospace engineer **Jun Chen** is working to ensure through research funded by a National Science Foundation Engineering Research Initiation grant. Chen's lab is building a distributed computing framework for a fast and risk-bounded planning algorithm that will allow for dynamic trajectory planning and enable automated aircraft



Engineer Jun Chen's research makes autonomous air taxis one step closer to reality.

to operate safely and efficiently — and not be waylaid by disturbances like wind and weather.

"How can we find the optimal paths that can get us to a destination as fast as possible while ensuring safety

is guaranteed, even in uncertain environments?" asks Chen. "And safety is critical with these autonomous vehicles, because without it regulators won't approve the vehicles and people won't feel comfortable using them." ■

## Simulating Snowy Situations for Self-Driving Cars



A caravan of self-driving vehicles use algorithms to detect changes in the environment on a road through snowy plains.

Self-driving cars are a hot topic in computer science, but how do these cars perform in wintry, cold conditions?

Factors like the type of vehicle, whether it's towing cargo, and how steep and icy the road is affect how quickly a car can brake or accelerate. But governing driving decisions with physics can only go so far.

What will happen when these autonomous vehicles inevitably drive alongside humans — who suffer nearly 117,000 injuries in vehicle crashes in winter conditions annually?

"Autonomous vehicles are actually much more skilled than the average human driver because the skills are programmed as knowledge in the system. They don't take into account if you're late for work, and most of the incidents in winter conditions are caused by mindset," says computer scientist **Xiaobai Liu**.

With funding from the National Science Foundation, Liu is building an online simulation platform that uses machine learning algorithms and Bayesian probabilities to characterize the behaviors of human drivers and assess the safety performance of autonomous vehicles in extreme weather conditions.

Figuring out whether human drivers are statistically more aggressive or risk-averse on a snowy Monday morning or in California versus Utah will inform updates to self-driving car programming and road-sharing traffic laws.

Liu's model will be the first that examines self-driving cars in winter conditions and continuously improves its evaluations of potential crash risks based on real and simulated human driving data. ■







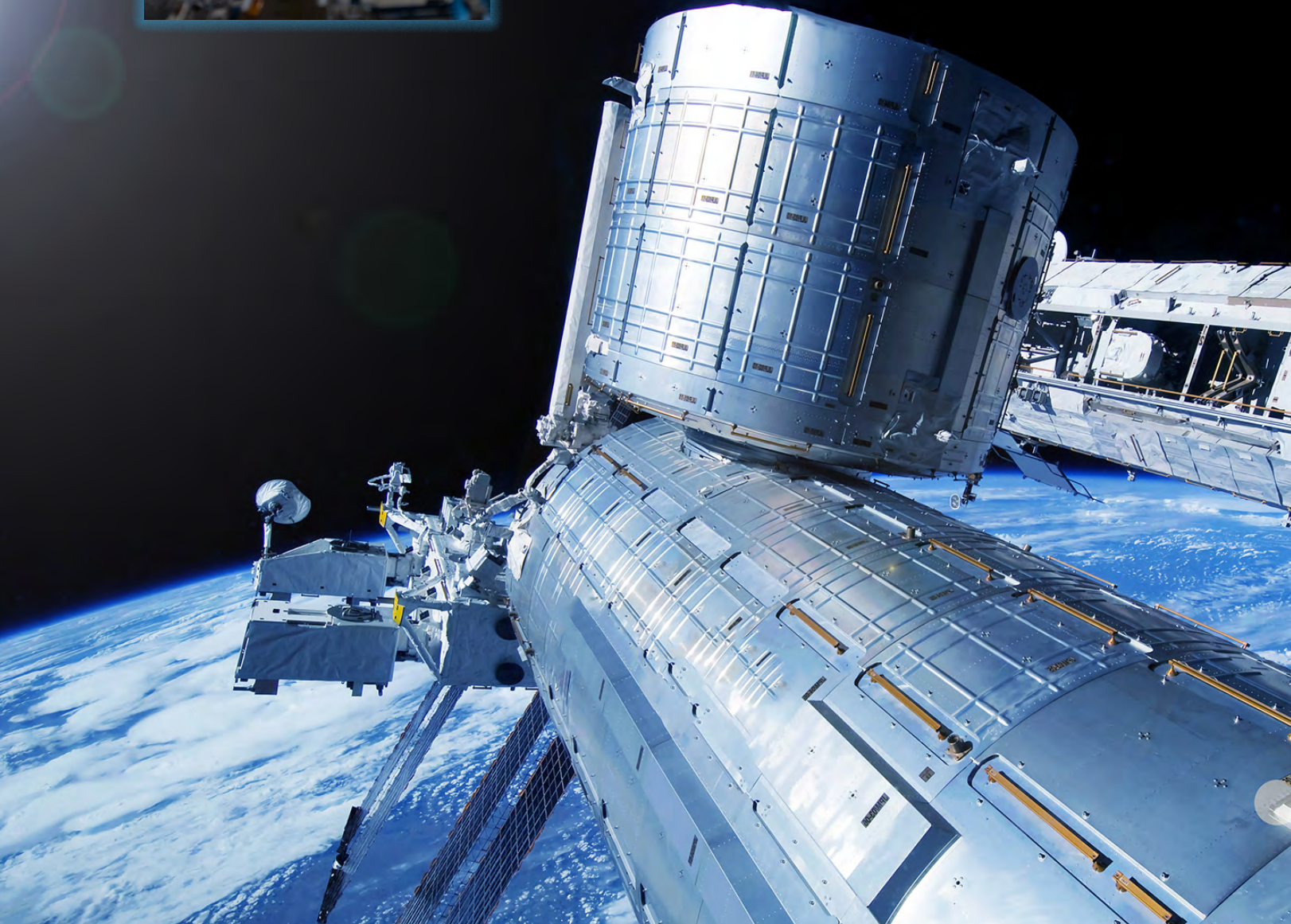
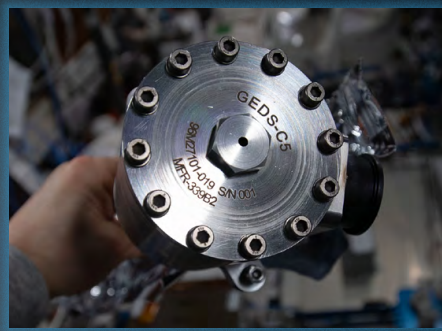
# Optimizing Extraterrestrial Construction and Repair

By Melinda Sevilla

You're halfway through the 71 million mile flight between Earth and Mars when all of a sudden the "check engine" light comes on.

A piece of your spacecraft broke and you need to repair it or manufacture a new part to continue on with your journey. But how do you repair it in the middle of outer space?

In research supported by NASA, San Diego State University mechanical engineers **Eugene Olevsky**, **Elisa Torresani** and **Randall German** are studying how to manufacture and repair materials outside of earthly gravity conditions and ensure that when this zero gravity scenario happens in the future, we'll be equipped with the best tools and processes.



Inset: One of the devices that stores raw sintering materials and is heated up to 2,500 degrees Fahrenheit. (Source: NASA). Main image: The International Space Station orbits above Earth.

Olevsky and Torresani lead the Powder Technology Laboratory at SDSU, which focuses on sintering. Sintering is a technique used to turn a powdered material into a solid mass by heating and compressing it in a furnace chamber. It is broadly used to produce metallic and ceramic parts and can be used in applications such as diamond-cutting tools and drill bits — but the possibilities don't end there.

Their latest project targets the process of sintering itself, and looks forward to when fabrication and repair operations will be necessary in a zero gravity environment, such as a space station, space vehicle traveling from Earth or a futuristic world of extraterrestrial settlements.

As humans expand into space, construction materials will be essential. Yet transporting materials from earth to space would be too burdensome and costly.

"Every mass sent to space is incredibly expensive to transport," says Olevsky, dean of the College of Engineering. "So we need to find something right in space. Something like moon dust. And we need a means of transforming that material."

## Enter sintering.

The team set off to sinter model materials, including heavy alloys, into structures to understand how to sinter in outer space conditions. Heavy alloys consist of tungsten with a nickel-iron or nickel-copper matrix and are the quintessential ingredient to produce a strong and well-shaped part or component using sintering, at least on Earth.

"On earth, the mass of heavy alloys is critically affecting the sintering process, creating a gravitational pressure that helps form the solid material. But what will this process look like in zero gravity environments?" asks Olevsky.

That's just one of the questions the research team is investigating. The engineers are also exploring the use of new materials in the sintering process, and ways to counter the impact of low gravity and improve the quality of sintered components.

The moon's gravitational force is approximately one-sixth that of Earth, meaning that lunar-sintered products are more likely to be weaker components with distortion of shape and density differences.

"This research will help us predict how sintering operations would work under low gravity conditions, and help us determine the most effective solutions to distortion and defects so that sintering might become a useful tool in space," says Torresani, an assistant professor of mechanical engineering.

The team of scientists has been working together since 2019 to create novel materials out of NASA's extraterrestrial sintering furnace in the International Space Station (ISS) — testing the process in zero gravity environments, and measuring density and microstructures in the sintered

material for weaknesses. Torresani worked alongside researchers at NASA's Marshall Space Flight Center, sending instructions up to the ISS. Using computer modeling, the team calibrated their existing on-earth models with the results to predict how the materials would react in space, or in the absence of gravity.

Findings signaled many differences between sintering in space and on earth: among other things, materials sintered in space were less dense — the highest result in a sintered composition was 90% of the ideal theoretical density, meaning the materials are more likely to crack, a dealbreaker when they're used as part of a machine or building.

Their findings provide an essential baseline for whether sintering can be leveraged in outer space.

Next steps? How to optimize sintering conditions to produce high quality materials. The team is seeking continued funding to determine if extraterrestrial manufacturing can be optimized by adding 3D printing techniques into the mix. 🔊 + 🔗



Elisa Torresani tests materials in SDSU's Powder Technology Laboratory. Photo: Melinda Sevilla

