

# INTERSECTIONS

CAL POLY COLLEGE OF SCIENCE AND MATHEMATICS | 2019-20

## HEALTH

Science and math promote  
healthy minds, bodies,  
communities and ecosystems.





pg.04

## HEALTHY ENVIRONMENTS

04

### PIERING INTO THE OCEAN'S PH

Investigating ocean acidification in Morro Bay and the Cal Poly Pier in Avila Beach

05

### RETURN OF THE PISMO CLAMS

Understanding why Pismo clams are making a comeback

06

### ARE YOU THINKING BIG ENOUGH?

Practicing disruptive science with the Beyond Burger and Perfect Day's Tim Geistlinger

07

### HARNESSING THE SUN TO COOK — AND COOL — IN AFRICA

Building solar systems in Ghana, Africa

## HEALTHY BODIES

12

### COVER STORY: BE WELL

Cal Poly's Center for Health Research creates the knowledge needed for healthier lives

16

### BRINGING IT

Former Mustang athlete expands horizons from football to chiropractic practice

18

### ANATOMY OF A DISCOVERY

Finding unexpected benefits in medical research

19

### MATH IS GOOD FOR YOU

Programming more accurate MRIs and CT scans used to better battle cancer



## HEALTHY MINDS

20

### THE FUTURE OF TEACHING SCIENCE

Inspiring a diverse group of students to become energized K-12 science educators

21

### LIFELONG LEARNER

Retiring teachers' teacher distills decades of instruction with a Learn by Doing approach

22

### THE GIFT OF MATH

Making math accessible to all



## HEALTHY COMMUNITIES

08

### DO NO HARM

Reducing harm at San Luis Obispo's syringe exchange program

11

### AN EXCHANGE OF RESPECT

Student viewpoint: Exchange program fosters compassion in medicine



pg.16



pg.20

# INTERSECTIONS

Cal Poly College of Science and Mathematics | 2019-20

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## letter from the dean

I hope you and those close to you are well. We started this issue of the magazine long before the novel coronavirus that causes COVID-19 changed the way life is lived in California, the U.S. and the world. When we chose “health” as the magazine’s theme, we had no idea that we would all be so powerfully reminded just how precious good health is.

I’m grateful to be part of the truly caring and dedicated community at Cal Poly during this difficult time. Our staff set up shop at home and is providing critical support to keep the university functioning. Our faculty jumped into learning a new way to teach while staying committed to creative, high-quality learning, and our students adjusted to changing scenarios with good will and flexibility.

Even as we practice physical distancing, we’re learning to value our relationships more deeply. We’re reaching out and caring for one another in unprecedented ways, and we are connecting socially despite being apart.

“NOW MORE THAN EVER WE ARE AWARE THAT IT IS ONE COMMUNITY, THAT **WE** ARE ONE COMMUNITY.”

The stories in this magazine are still relevant because they focus on what we have learned is of utmost importance over the last few months: We are all connected, and we can help each other.

The power of science and mathematics is that what we learn can make an impact locally, in the state of California and throughout the world. In the College of Science and Mathematics, our student-faculty research positively affects the Central Coast community that supports us (see the features that begin on pages 8 and 12) and this place we call home.

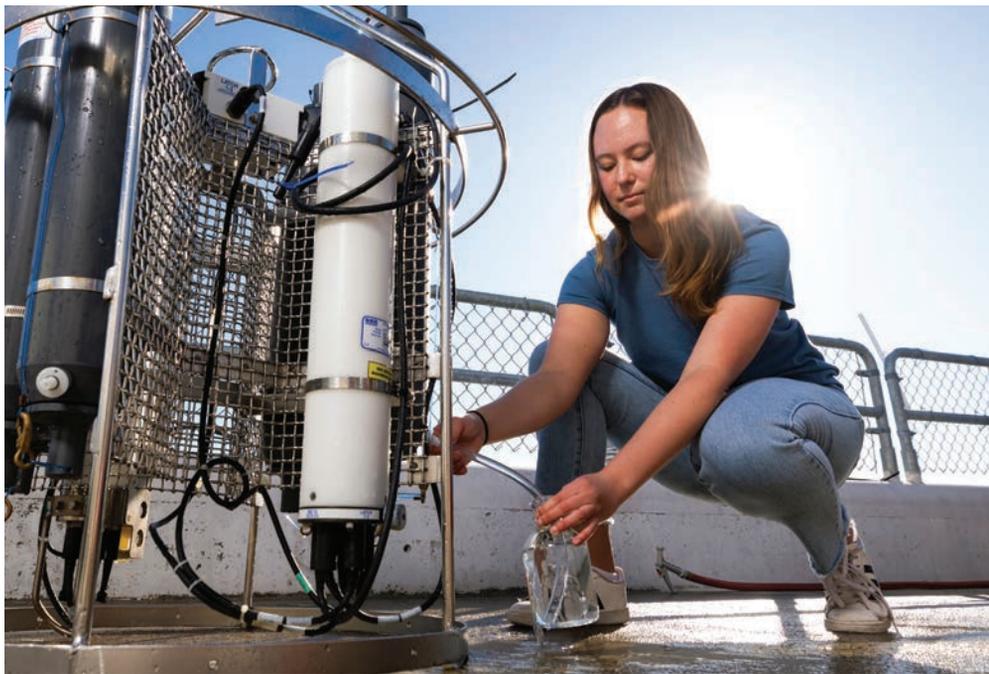
The local recovery of the Pismo Clam (page 5) may help this species whose habitat stretches from Baja California in Mexico to Monterey Bay. The Beyond Burger (page 6), invented by our 2019 Honored Alumnus Tim Geistlinger (Biochemistry, '94), will help feed people around the world, providing a high protein, plant-based dietary option.

The world is an intricately interconnected social and natural global ecosystem. Now more than ever we are aware that it is one community, that we are one community. I’m grateful for all of our connections to our extended family of alumni, donors and friends. Strengthened by your friendship, we will continue to move forward into this new and emerging world together.

In community,

**DEAN WENDT, DEAN**  
College of Science and Mathematics

# PIERING INTO THE OCEAN'S PH



The ocean is a vital natural resource for feeding the world's population and absorbing much of the carbon dioxide that modern societies produce. As carbon emissions have increased, the ocean has absorbed more and more carbon dioxide, which has gradually decreased the sea's pH level. The ocean is becoming more acidic over time.

Understanding the long-term effects of ocean acidification on marine ecosystems is a momentous task, but Cal Poly faculty and students are taking on one piece of the puzzle: the waters on the Central Coast.

Chemistry professor Emily Bockmon and her students study ocean acidification by measuring the pH at the Cal Poly Pier in Avila Beach and the estuary in Morro Bay.

"My focus is really on the chemistry of our local seawater," said Bockmon. "I see our work as gathering baseline data and giving us a starting point so that then we can add layers of biology on top of the chemical understanding to see what will happen at the organism and ecosystem level."

Ocean acidification may already affect local ecosystems. In nearby Morro Bay estuary, eelgrass populations have declined more than 90% since 2007 for largely unknown reasons.

"Part of our work has been trying to understand what about the bay chemistry may be contributing to the difference in the ecosystem that we now observe and how it may relate to the future," Bockmon said.

Students and faculty are taking samples that give them snapshots of the water's chemistry over time. As they help create a better understanding of how healthy the estuary is, students also learn what it means to do science.

"What I find most valuable about Dr. Bockmon's lab is the hands-on experience," said Sarah Bartoloni, a fourth-year chemistry student. "In this lab, we collect, analyze and process every sample. If something breaks, it's up to us to determine what went wrong and how to fix it. This large range of skills and problem solving will definitely help me as I move forward in my career and is something I couldn't have learned in a normal classroom."

As recovery efforts continue, monitoring the pH will give insight into the relationship between water quality and healthy eelgrass populations. This data will help inform local decisions and the future of the Morro Bay estuary. //

"THIS LARGE RANGE OF SKILLS AND PROBLEM SOLVING WILL DEFINITELY HELP ME AS I MOVE FORWARD IN MY CAREER."

— STUDENT SARAH BARTOLONI



**Pictured: (top left)** Biochemistry major Amanda Herbst collects a seawater sample at the Cal Poly Pier. **(top right)** A sampling rosette containing a CDT instrument is used to collect seawater samples from all depths of the ocean and measure conductivity – a function of salinity – and temperature at each depth. **(bottom)** Chemistry major Sarah Bartoloni (right) and Professor Emily Bockmon measure the pH of a seawater sample collected in Morro Bay. **Photographer:** Joe Johnston



## RETURN OF THE PISMO CLAMS

Accessing sometimes remote beaches in the middle of the night, wearing sandy rain boots and waders, and witnessing legendary California sunrises and sunsets is all in a day's work for Cal Poly researchers doing their part to restore an iconic species and contribute to a healthy local ecosystem.

In the last few years, the Pismo clam started showing up on its namesake beach in much higher numbers than had been seen in the last couple of decades – and no one knows why. Cal Poly faculty, students and 130 volunteers surveyed nearly 40 sites in California over a two-year period to create the first and most comprehensive survey of Pismo clams on record.

**“IF WE WANT TO RESTORE THE POPULATION OF PISMO CLAMS, WE MUST FIRST UNDERSTAND WHAT FACTORS CONTRIBUTED TO THE POPULATION DECLINE.” – BEN RUTTENBERG**

“This is the first time anyone has evaluated the status of Pismo clam populations across California,” said Ben Ruttenberg, biological sciences professor and director of the Cal Poly Center for Coastal Marine Sciences.

The research is focused on the life history of these organisms and learning what they need to survive in their environment.

“With life history, we are looking mostly at how quickly they grow, what time of year they reproduce and how that relates to their overall body condition through time,” said Alex Marquardt, the biological sciences graduate student leading the project.

With this data, researchers hope to answer a number of questions. Why did the clams return? Will they eventually grow to a size that is legal to harvest? And could the population ever recover to the levels recorded in the first half of the 20th century?

“We’re trying to understand, specifically with regards to reproduction, what is it in the environment that may be driving the patterns that we see?” Marquardt said.

Traditional wisdom suggests that the Pismo clam population declined because of over-harvesting by humans and over-predation by otters. The data collected by Marquardt and her team of undergraduate researchers, however, suggests that a much more complex set of factors may have affected the species.

“If we want to restore the population of Pismo clams, we must first understand what factors contributed to the population decline,” Ruttenberg said. “Currently, we have data to suggest that the size of sand grains is critically important to where Pismo clams live.”

The research team will continue its study to get a fuller picture of how the species interacts with its environment. The hoped-for return of high numbers of full-grown clams could lead to clearer waters and reduced algal blooms thanks to the clams filtering the water as they feed — not to mention humans with shovels and buckets hunting for dinner on Pismo Beach. //

***Pictured: (clockwise from top left) 1. Marine science major Ellie Maietta measures a juvenile Pismo clam during a survey at Pismo Beach. 2. A data sheet recording the sizes and number of many small clams found during a survey at Pismo Beach. 3. Graduate student and project lead Alex Marquardt (left) and community volunteers sieve sand through a cart to reveal Pismo clams at dawn. Photographer: Maya Vavra (Biological Sciences, '18)***



View related video online at [cosam.calpoly.edu/intersections](https://cosam.calpoly.edu/intersections)

## ARE YOU THINKING BIG ENOUGH?

2019 Honored Alumnus Tim Geistlinger (Biochemistry '94) invented the Beyond Burger, a plant-based meat, and is now working on plant-based dairy products. Previously he helped create cures for breast cancer, malaria and other diseases. Last fall he talked with students about the need for disruptive science and how to practice it.

### ON ENVIRONMENTAL IMPACT

Our industrial dairy and beef production is really out of balance when you think about dynamic homeostasis. We're putting a lot of energy into the system and getting a lot of negative byproducts out, for example methane, which contributes more to global warming than CO<sub>2</sub> does.

At Perfect Day and Beyond Meat, we're not saying get rid of all cows. We want to find a way to supplement the protein supply chain of the world so we can decrease the need for animals without asking people to change their eating habits.

This will actually support small farmers who are using traditional farming and ranching methods. By producing the majority of dairy products through this carbon neutral — or in some cases carbon negative — microbial system, we'll probably help create a premium market for meat products that help re-establish environmental balance, like grass-fed beef.

### ON DISRUPTION AND THINKING BIG

I love disruptive science, engineering and technology. I love working on meaningful things that people say will never work. It'll never work either because of a scientific principle or from a market perspective or whatever metric they have chosen to leverage in order to tear down the idea.

But if people are saying that it just might mean that nobody else is working on it. And this idea may present not only an opportunity for novel intellectual property, for claiming something as your own, but it also suggests that nobody is going to solve the problem without you.

**"WE WANT TO FIND A WAY TO SUPPLEMENT THE PROTEIN SUPPLY CHAIN OF THE WORLD SO WE CAN DECREASE THE NEED FOR ANIMALS WITHOUT ASKING PEOPLE TO CHANGE THEIR EATING HABITS."**

Everything that I've done, I've done because I felt nobody else was working on it, and the world needed it. There are so many opportunities for having a huge impact in the world in a way that nobody else is thinking about, or is scared to do, or doesn't know how to do. And that's where you guys are going to be required because my kids need you to be up here for them when they're in your chair.

### ON CAL POLY

What's special about Cal Poly is that your classes are being taught by professors. Your professors care about you. They care about your future. Take advantage of that. Ask more. Explore opportunities with them.

When you ask them questions, what do your professors tell you? They don't just tell you the answer. They probably ask you a question back. That process of learning is incredibly valuable and will serve you well later on in life. It puts you in an open mindset that lets you look at things more constructively, and a lot of people don't have access to that type of thinking. //

*Pictured: Tom Geistlinger (Biochemistry '94)*

# HARNESSING THE SUN TO COOK — AND COOL — IN AFRICA

Physics professors Nathan Heston and Pete Schwartz teamed up with construction engineering professors Paul Redden and Lonny Simonian to take 11 students to the small village of Agbokpa in Ghana, Africa. Together with the local people, students built solar-powered cookers, a water pump and a refrigeration system.



(clockwise from top left) 1. Professor Paul Redden and students pose in front of the water purification tower they are building. 2. Women in the market unpack farm produce to sell. 3. Completed water purification tower and ice production facility for storing fish to sell at market. 4. Group rest day spent hiking the cliffs above Lake Volta. 5. Traveling across the lake by boat after purchasing supplies. 6. Monitoring the performance of a newly designed insulated solar electric cooker in the village. Photos courtesy of participants.

 View related video online at [cosam.calpoly.edu/intersections](https://cosam.calpoly.edu/intersections)



# do no harm

STUDENTS VOLUNTEERING AT SAN LUIS OBISPO'S SYRINGE EXCHANGE LEARN MORE THAN MEDICINE

Nick Tod came to Cal Poly wanting to be a doctor. He knew how challenging the path would be. But he couldn't have guessed that one service learning class would change the way he thought about medicine and be a key to his future success.

As an aspiring medical school student, Tod wanted to get involved in a research project related to public health to round out his applications. During his junior year he signed up for Bio 301 Service Learning in the Health Professions, taught by Professor Candace Winstead and pre-health advisor Meghan Farrier-Nolan. He was placed as a volunteer at the SLO Bangers Syringe Exchange and Overdose Prevention Program.

SLO Bangers aims to reduce the spread of HIV and hepatitis C among people who inject drugs, an approach known as harm reduction. Participants come to the exchange with used syringes, which could transmit disease, and pick up sterile syringes and other supplies to prevent the spread of infectious disease, such as alcohol wipes and sterile saline. They also offer training in overdose prevention, access to drug treatment, HCV and HIV screening tests and other medical and mental health services.

"People come from work in their work clothes, young people, old people, moms coming in for their kids. It's a lot of different kinds of people," said Winstead, who specializes in infectious diseases.

For more than a decade, Winstead has been in charge of evaluating the effectiveness of the exchange program and writing grants to

**"I'M HERE TO MAKE SURE PEOPLE ARE GETTING WHAT THEY NEED."**

— STUDENT LUCY PASSAGLIA



help maintain funding. Each year, SLO Bangers has taken in and disposed of more syringes than they've given out. This means that the number of used syringes potentially discarded unsafely in the community is decreasing. The program currently takes in around 180,000 syringes per year.

Student volunteers help with the data collection as they distribute supplies to participants. Later, they analyze the data and have presented their findings at national and international conferences. Students also have the opportunity to interact with participants, a meaningful experience for Tod.

"I learned so much more from sitting down with participants and just talking with them," he said. "I learned so much more about addiction and what it's like than I ever will from a documentary or a textbook. That human interaction and learning from people who have actually been through it — you get so much more out of that."

On a recent night at the exchange, biology student Lucy Passaglia collected check-in sheets after participants disposed of their used syringes in a large sharps container. As she handed out sterile syringes and supplies, she chatted comfortably with those in line.

"I LEARNED SO MUCH MORE ABOUT ADDICTION AND WHAT IT'S LIKE THAN I EVER WILL FROM A DOCUMENTARY OR A TEXTBOOK." — ALUMNUS NICK TOD

"I'm here to make sure people are getting what they need," Passaglia said. "Our participants do wonderful things for their communities. I think it's remarkable that people are willing to carry naloxone in order to save lives."

Student volunteers provide much of the people power needed to keep the small non-profit running.

*continued*



“I LIKE TO THINK I’M GOING TO BE A MUCH BETTER DOCTOR BECAUSE OF THE EXPERIENCES I HAD.”

— ALUMNUS NICK TOD

“The students and alumni have been instrumental in the success and expansion of our program,” said Lois Petty, the site director for SLO Bangers. “With their help we have been able to provide overdose prevention and naloxone education in the county jail. As time goes on, you can see them realize the impact that small programs and individuals can have on one person and a community as a whole.”

“I like to think I’m going to be a much better doctor because of the experiences I had,” he said. “Personalized medicine gets talked about a lot in the medical field but doesn’t get executed very well. The time I spent sitting down with participants and talking to them is really going to help a lot with my patient interaction. I can work with patients to find what actually helps them best.”

Tod is now in his first year of medical school at Idaho College of Osteopathic Medicine in Meridian, outside of Boise. His experience at the syringe exchange played a big role during the application process, showing interviewers that he had a passion for public health and the ability to commit and follow through.

“Hopefully I was able to help the participants out, but they definitely helped me out a lot.” //

The most lasting impact, though, will be on Tod’s future patients.

“THE STUDENTS AND ALUMNI HAVE BEEN INSTRUMENTAL IN THE SUCCESS AND EXPANSION OF OUR PROGRAM.”

— LOIS PETTY, THE SITE DIRECTOR FOR SLO BANGERS



*Pictured on pages 8-9: (from left) Cal Poly students Lucy Passaglia and Amelia Johnson, alumna Tayler Garis and biological sciences Professor Candace Winstead set up for a syringe exchange and overdose prevention program at the San Luis Obispo County Public Health Department. Photographer: Joe Johnston*

*Pictured on page 10: Student service learners and volunteers provide program participants with sharps containers with sterile syringes and other supplies, which together help to prevent drug overdose and the spread of HIV and hepatitis C virus. Photographer: Joe Johnston*

# AN EXCHANGE OF RESPECT

BY AMELIA JOHNSON, BIOLOGY STUDENT

To say it simply, SLO Bangers is compassion in action.

I began volunteering at the syringe exchange during my sophomore year when I decided to pursue a career as a doctor. I hoped to gain experience working directly with a stigmatized population but had no idea that working with our participants would strengthen my desire to practice medicine even more.

SLO Bangers Syringe Exchange is a safe, positive and welcoming environment for all who walk through its doors. This organization provides services to a stigmatized population that is often mistreated and disrespected. Through volunteering, I've learned how to show respect to each and every person and have also come to understand that trust is something you must build. This perspective will help me be a better doctor.

“I... HAD NO IDEA THAT WORKING WITH OUR PARTICIPANTS WOULD STRENGTHEN MY DESIRE TO PRACTICE MEDICINE EVEN MORE.”

There is an existing stigma in medicine against people who use illegal drugs, the unsheltered, the previously incarcerated and many other marginalized communities. Validating all patients' experiences and providing care equally is really important. To do this, I'm continuously learning how to examine, discuss and confront my own unconscious biases and misperceptions through meaningful interactions with other students, volunteers and participants.

I now aspire to be a doctor who practices harm reduction, expanding on the skills I've acquired at the syringe exchange.

While volunteering at SLO Bangers I was able to provide life-saving tools to people in need for the first time, and I am hooked. Currently, many drugs are contaminated with fentanyl, a strong synthetic opioid, that often causes overdoses. SLO Bangers distributes naloxone, an opioid



“I NOW ASPIRE TO BE A DOCTOR WHO PRACTICES HARM REDUCTION, EXPANDING ON THE SKILLS I'VE ACQUIRED AT THE SYRINGE EXCHANGE.”

overdose reversal drug, and trains people on how to use it throughout the local community, including in the county jail where inmates have a high risk of experiencing or witnessing an overdose. To date, our participants have saved many important lives in our community.

The volunteers and participants have taught me that we can make a greater impact working together. The volunteers at the syringe exchange bring together a variety of strengths, skills and experiences to support the same cause. Our individual connections allow us to build community partnerships, opening new opportunities to reach more people. In addition, as volunteers talk with family, friends, coworkers and peers about our personal experiences, we share why these services are valuable, hopefully gaining new support.

In the future, I will continue to address the stigmas our participants experience every day. There is so much more to learn, and I am eager to grow and serve my community in this new chapter. //



**Pictured: (top)** Amelia Johnson volunteers at the SLO Bangers Syringe Exchange and Overdose Prevention Program. **(left)** Professor Candace Winstead and biology and psychology alumnus Tophie Boreham ('16), a volunteer, discuss services at the syringe exchange. **Photographer:** Joe Johnston

# being u



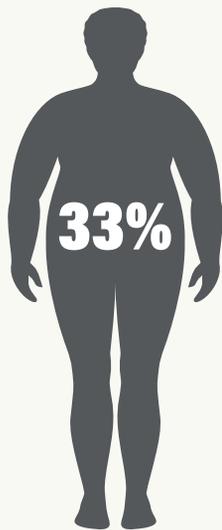
Nothing is more intrinsic to our everyday lives than our health. We spend a lot of time and energy trying to make healthy choices for ourselves and our families. The most reliable information about what's good for us comes from scientific research.

Faculty, staff and students at Cal Poly's Center for Health Research are dedicated to helping all of us make better decisions about our health. Through building the basic knowledge about how to stay healthy, they're answering the questions we all ask at some point.

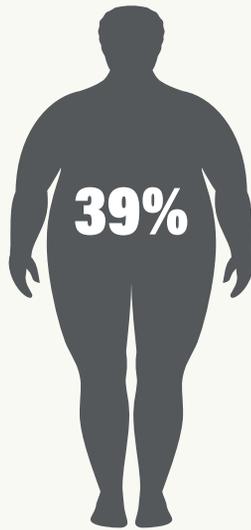


View related video online at [cosam.calpoly.edu/intersections](https://cosam.calpoly.edu/intersections)

33% of adults in the U.S. are overweight



39% of adults in the U.S. have obesity



## HOW DO I MAINTAIN A HEALTHY WEIGHT?

Faculty, student and staff researchers at the Center for Health Research investigate multiple aspects of obesity, one of the country's main health concerns. Obesity increases the risk for heart disease, stroke, type 2 diabetes, cancer, sleep apnea, osteoarthritis and several other health conditions.

Professor Suzanne Phelan, the center's director, led a study of almost 5,000 members of WW (formerly Weight Watchers) who reported losing an average of about 50 pounds and kept it off for more than three years. The research team looked at 54 behaviors related to successful long-term weight management. Findings were published in the journal *Obesity*.

Compared to a group of 500 people with obesity whose weight stayed constant, those who maintained long-term weight loss reported several daily habits that contributed to their success. These habits included choosing healthy foods, tracking food choices and staying positive in the face of challenges.

### STRATEGIES FOR WEIGHT LOSS SUCCESS

- ✓ Record what you eat each day
- ✓ Keep lower-calorie foods more accessible
- ✓ Practice self-kindness and mindfulness



# WHAT'S THE BEST WAY TO FEED MY BABY?



3 out of 4 babies in the U.S. receive some formula at 6 months

**Bottle-feeding is a major risk factor for overfeeding**

Infant overfeeding is widely recognized as a cause of excess weight gain in children up to 2 years old. Infants who gain too much weight are at risk for obesity and metabolic problems later in life. To help prevent overfeeding, Professor Alison Ventura has tested many factors, such as bottle type, that affect how well mothers pay attention to these hunger and fullness cues in hopes of learning how mothers can better respond.

Babies show that they're full with actions such as turning away from the nipple or falling asleep. Ventura has tested many factors, such as bottle type, that affect how well mothers pay attention to these hunger and fullness cues in hopes of learning how mothers can better respond.

## INFANT FEEDING RECOMMENDATIONS

- ✓ Breastfeed as much and as long as possible
- ✓ When bottle-feeding, be aware that overfeeding is more likely
- ✓ Pay attention to babies' hunger and fullness cues, the best guide for how often and how much to feed



In a new project, Ventura and her students will study how feeding interactions develop over time and in different situations. They're teaming up with researchers at the University of Michigan, who will film bottle-feeding and solid food feeding sessions during the infants' first year. Cal Poly students will review the recorded sessions and code the behaviors of both mother and baby. Researchers can then assess which patterns lead to healthy feeding and which lead to overfeeding.

# HOW CAN I REDUCE SCREEN TIME & GET MOVING?

## GET UP AND GET MOVING

- ✓ Break up sitting every 20-30 minutes
- ✓ Replace 1 hr./day of sedentary time with activities such as slow walks, housework or gardening
- ✓ Engage in more intense activity such as a brisk walk or other exercise for additional health benefits



The research team will also track how less screen time affects physical activity level, diet, mood and disease risk factors. Their results will inform public health guidelines for the country.



**Sedentary screen time is the single most prevalent use of time for U.S. adults outside of work and sleep.**

**50%+**

**It consumes more than half of U.S. adults' available leisure time.**

Americans spend the majority of their free time in front of their TVs, computers and phones, which means they don't spend that time moving. A new study led by Sarah Keadle, a kinesiology and public health professor, will test different approaches to help adults with overweight or obesity escape their screens. Researchers hope to reduce sedentary screen time by 50% by testing three ways to help people to change their behavior:

- ✓ Receiving text messages that give them immediate feedback on their screen time
- ✓ Getting locked out of further screen time
- ✓ Earning back screen time through exercise



**Excessive sedentary time increases risk for chronic diseases like diabetes, cardiovascular disease and some cancers.**

# HOW CAN WE INCREASE ACCESS TO HEALTH CARE?

Cal Poly's Women and Infants Mobile Health Unit provides free medical care to uninsured women and infants in Santa Maria and Guadalupe on California's Central Coast. Services include obstetrics and gynecology, women's health, family medicine, nursing and pediatrics.

Research indicates that mobile health clinics have helped prevent costly emergency room visits and improved access to care. Providing prenatal care through Cal Poly's mobile unit may lead to fewer pregnancy and delivery complications.

The mobile unit also offers training opportunities for Cal Poly students interested in the health professions. Students experience Learn by Doing as they offer health assessments and referrals in partnership with doctors, nurses and social workers. These and other local health professionals staff the unit through a partnership with the SLO NOOR Foundation.

## ACCESSING MOBILE HEALTH UNIT SERVICES

- ✓ Patients using the mobile unit may receive care in English, Spanish and Mixtec, the language of one of the indigenous peoples of southern Mexico.
- ✓ The calendar for services can be found at [healthresearch.calpoly.edu/mobile-health-unit-calendar](http://healthresearch.calpoly.edu/mobile-health-unit-calendar)



An estimated **20%** of Americans can't afford or access medical care.

**Low income and non-white populations** are most affected.

# HOW CAN I SUPPORT THE CENTER FOR HEALTH RESEARCH?

## HELP PREVENT OBESITY AND IMPROVE FAMILY HEALTH

By giving to the Center for Health Research, you will be part of the groundbreaking research and healthcare facilitated by talented, passionate faculty and students. The Campaign for the Center for Health Research is an opportunity to support the expansion of the clinic and its relocation to the Cal Poly Tech Park, giving patients and research participants easier access and creating a shared research space. State-of-the-art labs, treatment rooms and clinical research facilities are crucial to the future success of this prolific research center.



Your support will contribute to advances in preventing obesity, diabetes, cardiovascular disease and cancer and improving family health. One-time gifts of any amount, multi-year pledges or including the Center in your estate planning all make an important impact. //

### FOR MORE INFORMATION

Contact **Kathryn Dilworth**, assistant dean for advancement, at [kdilwort@calpoly.edu](mailto:kdilwort@calpoly.edu) to discuss a gift.



# bringing it

It's 218 miles from East Oakland to San Luis Obispo, but for kinesiology alumnus and future chiropractor Dave Douglas, it might as well have been another country.

"When I came to SLO, it was a complete culture shock," Douglas said. "Yo, where am I at? People leave their doors unlocked, walk around without socks. I use a lot of slang in my vocabulary, so I struggled with communicating, actually talking to people."

Douglas initially saw himself only the way many others did — as a standout football safety. On the field, he was in familiar territory and knew how to excel.

**"DAVE IS ONE OF THE STRONGEST, KINDEST, MOST EMPATHETIC HUMAN BEINGS I'VE EVER KNOWN."**

— PROFESSOR CAMILLE O'BRYANT

In classes, on the other hand, all the unfamiliar cultural challenges made it difficult to focus on the actual courses. In Oakland, most people looked like him and spoke the same way he did. At Cal Poly, everything about him stood out, which made him feel like an outcast.

On top of that, he hadn't expected to be challenged academically. "All I wanted to do was play football," Douglas said. "What they (people back home) told me was, 'Oh son, you can take a bunch of PE classes and spend most of your time focusing on football.' I had no idea that once I started school I'd be taking classes such as zoology. I'm in cadaver labs, anatomy. No lie, this is hard."

After struggling academically for a couple of years, Douglas began to feel more comfortable on the Central Coast. With supportive

friends in the residence halls and encouragement from former Cal Poly assistant coach Aristotle Thompson, he relaxed. The environment started to feel less threatening.

He was upping his game in class when two events derailed him.

His father, who served as Douglas' bedrock, contracted an illness that would prove fatal. And he found out he was going to become a father himself.

"When Dad fell ill, that took me on my downward spiral," Douglas said. "I was consistently taking trips to Oakland towards the end of my academic and athletic career. When my fiancé got pregnant, I thought OK, the only thing that's going to make everyone happy is if I make it to the NFL. So I prioritized football over school, ultimately leading back down that slippery slope of a hill."

Douglas' dad died soon after, and he left Cal Poly a few units short of graduating. Two kinesiology professors, Camille O'Bryant and Kellie Hall, tried to talk him into returning, but with two kids to support, he couldn't see how college fit into the picture, especially not four hours from home.

Douglas' rebound came two years later when his fiancé landed a better job. Because O'Bryant and Hall had tried to stay in contact with him, he took the risk of reaching out to them after a long silence.

"With open arms, they didn't hesitate or blink to say, 'Yes! Let's get this done.' Camille and Kellie Hall are the reason I'm here and doing anything with my life."

With football off of the table, Douglas was searching for direction in his life. O'Bryant recommended Life Chiropractic College West in Hayward, California, near Oakland, which seemed to be a good fit for him.



“Dave is one of the strongest, kindest, most empathetic human beings I’ve ever known,” O’Bryant said. “When I think of Dave Douglas, I think he’ll give you the shirt off his back. Talented, creative, very bright, but stuck sometimes in an environment that didn’t allow him to show his brilliance. That’s why I could see him as a healer.”

Now entering his third year, Douglas is excelling in his chiropractic studies. He represented Life West at an international chiropractic speaking competition in 2019.

**“NOW, I’M DAVE DOUGLAS, A CHIROPRACTOR. AND I PLAN ON BEING THE BEST HEALER THAT THIS WORLD HAS EVER SEEN, THEREFORE I’M GOING TO BRING IT EVERY DAY.”**

To succeed in chiropractic school, Douglas draws on all he learned at Cal Poly as a student and as an athlete. The academic rigor that challenged Douglas early in his college career has been a benefit in his new field.

“Dealing with basic anatomy here (at Cal Poly) bumped me ahead of many of my classmates,” he said. “The xiphoid of the sternum? I know where that is. The clavicle? Come on, I know what that is also. And the course load that was here — I have never seen anything like it before. It made me work on my study habits.”

The confidence and determination that served him so well on the gridiron have also carried over, and he brings a competitive edge to his chiropractic studies.

“When I saw a 6’5”, 350-pound lineman across the line, I thought, ‘I’m Dave Douglas. And on this field, I am the best player the world has ever seen. And I’m going to bring it every play.’ Now, I’m Dave Douglas, a chiropractor. And I plan on being the best healer that this world has ever seen, therefore I’m going to bring it every day.”

The philosophy behind chiropractic is to deal with the cause of illness or disease. Douglas is using this idea to work with the community of East Oakland and help children think more broadly about their future.

“I’m able to talk to the youth and the misled teens and tell them, ‘Yo, there’s other options out there for us,’” he said. ‘You gotta have a plan B. Don’t put all your eggs in football, basketball or something like that. You don’t have to play sports, sell drugs or join gangs. Regardless of what our community tells us, there are many occupations outside our stereotypical realm.’

“Camille and Kellie supporting me has opened the door for me to influence hundreds of kids that I talked to. They have shed light in the darkness of my community in the city of Oakland. I can’t thank them enough.” //

*Pictured: (page 16) Dave Douglas on campus in 2019. Photographer: Joe Johnston (above) Dave Douglas was a standout safety for the Cal Poly football team. Photo courtesy of Cal Poly Athletics (inset): Dave Douglas (right) with his fiancé Mele Fifita and children Keilani (second from left) and Kalei in 2016.*



# ANATOMY OF A DISCOVERY

Science doesn't always go as planned. Sometimes, it goes better.

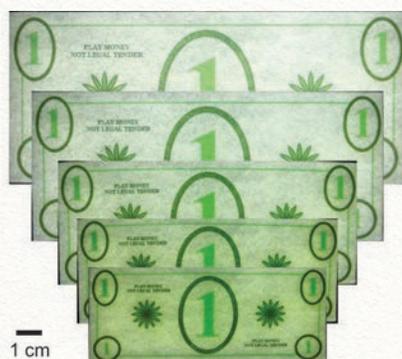


## CHEMISTRY PROFESSOR ANDRES MARTINEZ

and his students developed an inexpensive and portable device for medical tests, the Reagent Pencil. This pencil, which is made of stabilized chemical compounds and deposited on a special piece of chromatography paper, allows users to test for diseases in a drop of urine, saliva or blood. Martinez and his colleagues in the Chemistry and Biochemistry Department received a patent for the Reagent Pencil in March 2019. Then ...



... Martinez's brother, **NATHANIEL MARTINEZ**, who has a background in medical research, joined Cal Poly's Biological Sciences Department. Together they wondered whether they could expand the applications for these diagnostic devices. When they attempted to chemically modify the cellulose fibers in the chromatography paper to better attach biological reagents ...

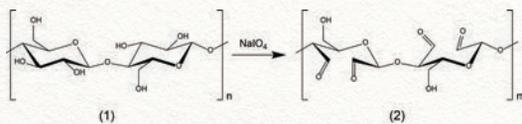


... they observed that not only was there a chemical change to the cellulose fibers, but also **the whole paper shrank!** They used this miniaturization process to make smaller, more efficient devices. But they hadn't predicted ...



... that the change in molecular structure of the paper actually **created a new material**, which they called pDAC, with very interesting properties.

For example, this new material behaves like paper when dry but dissolves in certain solutions, which is exciting because their labs are using pDAC to develop a new tool that may help researchers learn how cancerous tumors metastasize. Currently, cell cultures used in cancer research are typically grown on flat, two-dimensional surfaces. Cells grown this way sometimes behave differently than actual tumors, which grow in three dimensions in the body.



With their new discovery, the Martinez labs aim to create free-standing, 3-D tumor models for studying how cancers spread and how they interact with different drugs. The pDAC material is the key to these models, serving as a 3-D scaffold during the initial growth and setup of cells, but then it dissolves over time. The brothers hope that pDAC will soon serve as a laboratory tool for medical researchers to better understand and ultimately treat cancers. Who knows what other discoveries they might make as they test this new tool? //



## MATH /S GOOD FOR YOU

“Algorithms” has become an everyday word. We use them to find our way to a restaurant or play Minecraft on our phones.

We also use these instructions for performing calculations to cure cancer.

Doctors use MRIs and CT — short for computed tomography — scans to get a picture of tumors before applying radiation. These medical imaging methods depend on algorithms and the mathematics behind them.

Math Professor Dana Paquin and her students are teaming up with Stanford Medical Center to make the way these scans are processed more accurate so that radiation treatments can be more exact.

When treating a tumor with radiation, the goal is to maximize the radiation dose received by the tumor while minimizing the exposure of healthy tissue to radiation. To achieve this goal, doctors use a process called segmentation to separate the image into parts and find the edges of the tumor.

**“THIS PROJECT GIVES STUDENTS THE OPPORTUNITY TO ENGAGE IN A MEANINGFUL, HANDS-ON WAY WITH APPLIED MATHEMATICS IN A REALISTIC SETTING.”**

— PROFESSOR DANA PAQUIN



image. Noise is random imperfections produced by the process of recording an image, like the graininess in a photo taken in low light — there isn’t enough input to make the picture sharp.

The problem with noise in a CT-scan image is that it’s important to know where the edges of a tumor are.

As part of the Frost Summer Undergraduate Research Program, students Brady Berg, Conor Carroll, Weston Grewe, Brian Knight and Tuyen Pham worked on developing algorithms to achieve high-quality segmentation of noisy images. The student research team developed and analyzed computer code using programming languages Python and C++ to implement their segmentation algorithms. Their code is being evaluated and tested using medical images from the Stanford University Medical Center.

“This project gives students the opportunity to engage in a meaningful, hands-on way with applied mathematics in a realistic setting,” Paquin said. “They get to see the power that mathematical analysis has in creating change.”

That change has the potential to improve the lives of cancer patients everywhere, all thanks to some not-so-simple mathematics. //

**Pictured: (clockwise)** Student Brian Knight, Professor Dana Paquin and students Brady Berg, Conor Carroll and Tuyen Pham work on developing algorithms to process MRI and CT scans more accurately. Knight works on equations that form the basis of the algorithms. **Photographer:** Desiree Gillaspay (Graphic Communication, 18)

“We’re developing automatic segmentation algorithms that are more precise than current methods, which are mostly manual,” said Paquin.

Because large amounts of x-ray radiation can be harmful to people, CT scans require a balance of enough x-rays to accurately see the position of an abnormality, such as a tumor, and little enough radiation to not harm the patient. A lower amount of radiation can lead to noise in the



# THE FUTURE OF TEACHING SCIENCE

## Noyce Scholars learn how to inspire students whom science has historically ignored

Do scientists look like you? Biology Professor Ed Himelblau and his colleagues want high schoolers across California to answer “Yes!” to that question, no matter where they go to school. The key is middle school and high school science teachers.

“If you ask a hundred science undergrads, ‘What got you interested in a science major at Cal Poly?’ the vast majority would point to a teacher who gave them an experience in which they could see themselves as scientists,” Himelblau said. “We want all students, regardless of where they grow up and attend school, to have a teacher like that.”

“SCIENCE HAS MISSED OUT ON A HUGE AMOUNT OF TALENT BY NOT BEING AS INCLUSIVE AS IT SHOULD BE OVER THE LAST COUPLE OF DECADES.”

— BIOLOGY PROFESSOR ED HIMELBLAU

With a \$1.2 million grant from the National Science Foundation, Himelblau and his colleagues aim to recruit and educate future teachers who understand how to reach students from historically marginalized groups.

“Science has missed out on a huge amount of talent by not being as inclusive as it should be over the last couple of decades,” Himelblau said.

Through the Noyce Scholars Program, science and engineering majors who commit to becoming teachers can receive \$15,000 annually to fund their senior year and teaching credential. In exchange, they agree to teach at least two years in a high-need school district.

The Noyce program helps future teachers bring Learn by Doing activities into their classrooms in inclusive and effective ways. Scholars have the opportunity to engage in real-world research. They also receive training in how to teach science in a way that builds on the cultural strengths and experiences of students.

“Great teaching can be learned,” said Jane Lehr, director of Cal Poly’s Office of Student Research and one of the leaders of the project.

Cal Poly has also partnered with Cuesta College to help smooth the transition between the schools for students interested in teaching science. Students of color make up a higher percentage of transfer students than of entering first-year students at Cal Poly.

Though Noyce Scholars are only required to teach for two years in high-need districts, most Cal Poly Noyce alumni remain in these districts and are now moving into leadership positions. Lesley Anderson (Biological Sciences, ‘12; Single Subject Teaching Credential, ‘13) has brought her Noyce experience into a new role as an instructional coach for the High Tech High Central Office in San Diego. She helps teachers design hands-on science, technology, engineering and math (STEM) projects for more than 5,000 K-12 students at Title 1 campuses.

“My goal is to help marginalized students become champions of science and mathematics,” Anderson said. “The Cal Poly Noyce Scholarship Program provided me with opportunities to participate in research as a scientist through the STAR Program and supported me in turning those research experiences into learning opportunities that inspire all students.” //

**Pictured (from left):** former Noyce Scholars Anthony Overton (BS, Chemistry, ‘10; MA, Education, ‘17), now principal at Paso Robles High School; Lesley Anderson (Biological Sciences, ‘12; Single Subject Teaching Credential, ‘13), now instructional coach for the High Tech High Central Office in San Diego; and Brittney Nation (Biochemistry, ‘11; Single Subject Teaching Credential, ‘12), now a chemistry teacher at San Lorenzo High School near Oakland. **Photographers:** (left) file photo (center) courtesy of Lesley Anderson (right) Tony Turreto



## LIFELONG LEARNER

### Advice and reflections of teaching from one of Cal Poly's best

When Anne Marie Bergen (Biological Sciences, '85) returned to Cal Poly 10 years ago as a faculty member, she had received the Presidential Award for Excellence in Science and Mathematics and advised state leaders on STEM education. Bergen will retire in June. Here she passes on the wisdom she gained as a passionate teacher and champion of Learn by Doing.

#### WHAT HAS BEEN YOUR GUIDING PRINCIPLE AS A TEACHER?

The philosophy that I realized I had as a young teacher has three components to it: active learning, meaningful experiences and compassionate teaching.

#### HOW DID YOU DEVELOP THAT PHILOSOPHY?

When I was a Cal Poly student, I did a co-op internship as a naturalist, an environmental educator. That experience was a real pivot point in my entire career. I hadn't considered teaching as a profession, but being with young people in the environment was such a match and inspiration — I was hooked! Being out on the trails with students, exploring, having an experience that connected them to the world around them and noticing how strongly the active and meaningful learning experience affected them has totally directed my entire career.



#### ANNE MARIE'S PHILOSOPHY

ACTIVE LEARNING

MEANINGFUL EXPERIENCES

COMPASSIONATE TEACHING

#### HOW DO YOU INVITE STUDENTS TO USE LEARN BY DOING IN THEIR FUTURE CLASSROOMS?

What's extremely important is for them to have that learning experience themselves. We don't just tell them, "This is how we want you to teach." They experience it in a way that they're drawn into the content, drawn into the learning, drawn into asking questions and being curious. They are able to understand how powerful those learning experiences are and transfer them to their own classrooms.

#### WHAT'S YOUR FONDEST TEACHING MEMORY FROM YOUR TIME AT CAL POLY?

Often I facilitate the first class our liberal studies students ever have in college. And four years later, they walk into my class again as seniors. Seeing their progress, their passion and their ease has been a fantastic gift. To watch them through this learning arc has been tremendous for me.

#### WHAT ADVICE DO YOU HAVE FOR FUTURE TEACHERS?

Teachers who are energized and successful are really open to understanding who they have in their learning environment and excited about using different methodologies and pedagogies to engage them. It's about having doors open for all who walk in and being that curious learner alongside them. //

**Pictured: (top)** Anne Marie Bergen's STEM Learning and Teaching class creates Rube Goldberg designs and newscasts in a technology workshop led by middle and high school students. **(below)** Bio 211 students observe insects from egg or larva to adult. **Photographer (bottom):** Sean Galusha



**“THE ABILITY TO GIVE BACK AND HELP STUDENTS LEARN IS WHERE I GOT INTERESTED.”**

— STUDENT MUGEN BLUE

## THE GIFT OF MATH

Not everyone thinks of math worksheets as a gift.

As a kid, statistics instructor Immanuel Williams spent a lot of summer vacation time doing math worksheets, thanks to his dad.

“I wasn’t particularly good at math,” Williams said, an interesting admission from someone who went on to get his doctorate in psychometrics, a branch of statistics.

Now, Williams wants to pass on his dad’s gift of a love of mathematics to future generations. He’s especially interested in reaching children from disadvantaged backgrounds who don’t have the opportunity for extra math practice.

To help these kids, he teamed up with the Boys and Girls Club to offer the GATO365 Math Boot Camp, which stands for Going Above the Odds Every Day.

“I want to provide a resource where they’re doing math during the summer so there’s no lag from spring to fall,” Williams said. “It helps Boys and Girls Club make sure the students are still engaged in education.”

With 250 children in three locations throughout California in 2019, the program has already provided 2,000 hours of math instruction.

While this low-tech approach makes math education easily accessible, it also requires a lot of grading time. Cal Poly business majors Ohana Dorantes, Natalie Lesser and Jadin Stewart collectively have donated hundreds of hours to make sure students at the Boys and Girls Club find out how well they did.

Meanwhile, Williams and data science minor Mugen Blue are working on a high-tech solution to this problem — a machine learning algorithm that could make human graders unnecessary.

Implementing machine learning to grade worksheets is a complex proposition. It requires handwriting recognition to determine the correct answer and an algorithm that can track and adjust the worksheet difficulty for each student.

“The ability to give back and help students learn is where I got interested,” Blue said. “I have learned that things may not always go the way that you want the first time around, but I have been able to work on a passionate team to come up with solutions.”

**250 CHILDREN  
3 LOCATIONS**

**2,000 HOURS OF INSTRUCTION**

When Blue’s improvements are complete, the GATO365 program can expand, making math familiar to large groups of kids who might once have thought it was out of their reach.

“Research shows that children’s math performance has a lot to do with their attitude toward math,” Williams said. “With this year-round exposure to math, I think we could change the minds of a whole population of kids who might never consider a career in STEM because they’re afraid of math.” //

*Pictured (left): Immanuel Williams instructs children at the Boys and Girls Club in Santa Cruz, California. (right) Williams and business majors (from left) Jadin Stewart, Natalie Lesser and Ohana Dorantes develop a math worksheet for use at the Boys and Girls Club. Photographers: (left) Kelley Williams (right) Sean Galusha*

# Health is created thanks to your help.

During the past few months, we've learned how fundamentally we're all connected. Your support develops healthy minds that help create healthy communities.

To make a gift to any of the programs you've read about here or to contribute to services that enrich the well-being of Cal Poly students, please contact:

**Kathryn Dilworth**

*Assistant Dean of Advancement*

[kdilwort@calpoly.edu](mailto:kdilwort@calpoly.edu)



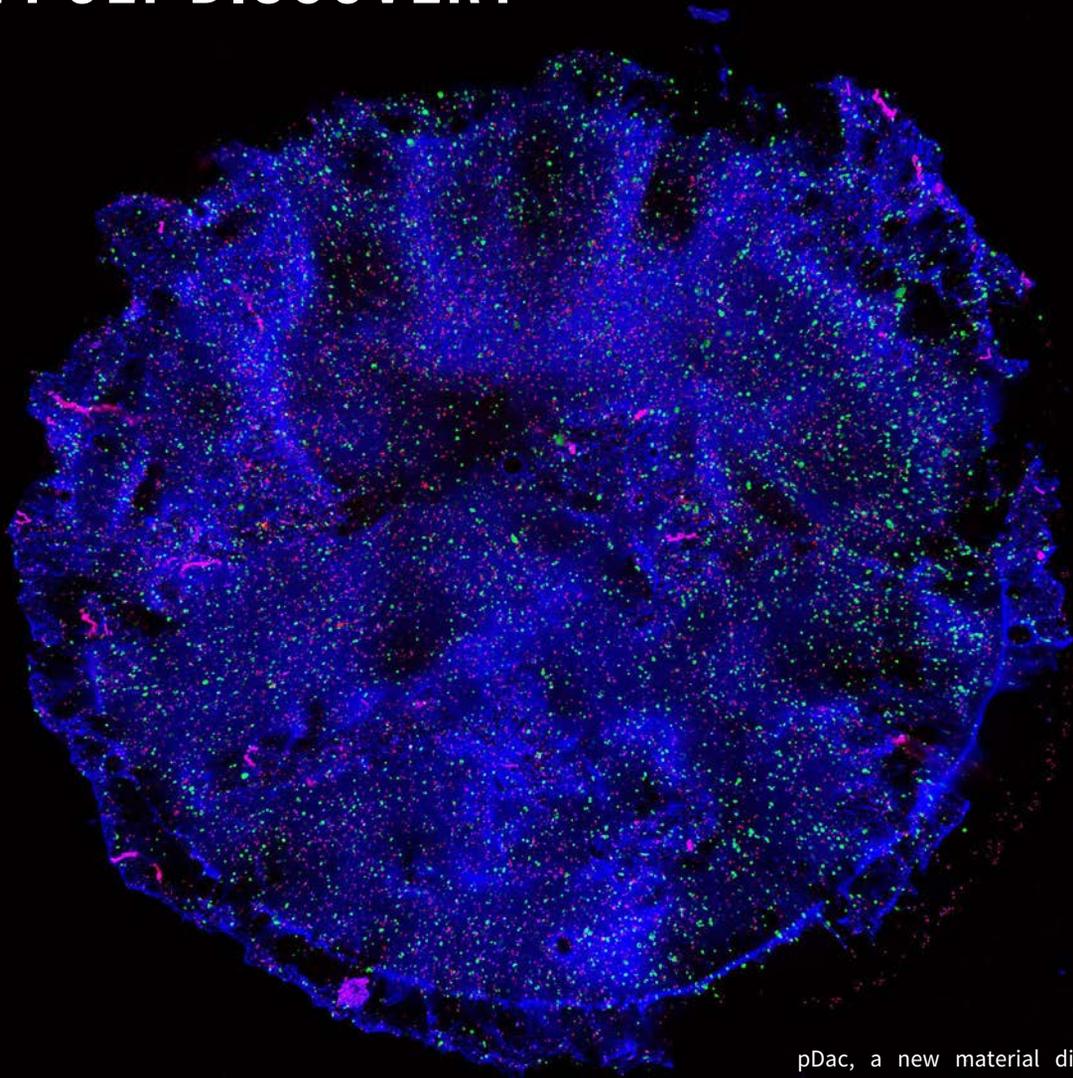


**CAL POLY**

College of Science  
& Mathematics

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# A CAL POLY DISCOVERY



pDac, a new material discovered by Cal Poly faculty and students, could become an important cancer research tool. Here, cells grow on a 3-D pDac scaffold that's about the size of a paper hole punch.