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BioCONNECT

SF State Biology Newsletter, Winter 2023



Mika Okimura

We hope you enjoy the latest version of the Biology department BIOCONNECT magazine.

This issue focuses on celebrating the stories of our community members. Let us know how you like it. Join our online communities. Links below...



[LinkedIn](#),
[Facebook](#),
[Instagram](#), [Twitter](#),
handle:
@SFStateBio

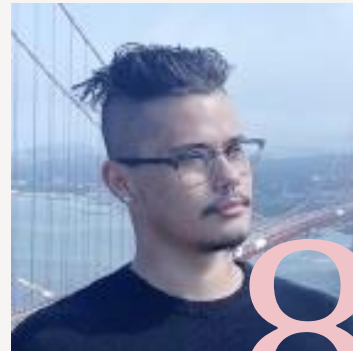


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Alumni, Student,
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Letter from the Chair

Greetings SF State Biology Alumni, Students, Faculty, Staff, and Friends!

Happy New Year! I hope that you all had a restorative holiday season and that you are staying dry and warm this winter. As this issue of BioCONNECT is focused on “My SF State Story”, I thought that I would take this opportunity to tell you a little bit about my own story.

I grew up in East Tennessee in a small town that is home to a National Laboratory. Unlike most students at SF State, I was fortunate to be surrounded by science from the day I was born. I was also surrounded by deep social inequities that affected BIPOC folks as well as LGBTQ folks such as myself. This instilled in me a strong desire to promote diversity, equity, and inclusion. From Tennessee, I then pursued my academic training at 3 institutions, all of which were East of the Mississippi. During graduate school and again as a post-doc, I had the opportunity to attend conferences in CA and to visit Yosemite. I quickly fell in love with CA and its natural beauty. When it came time for me to get my first “real” job, I remember visiting SF State and meeting with a room full of amazing students. I knew I had found my new home. Though I never imagined that I would be here 26 years later, I am sure glad I am!

My experiences growing up in a straight white male dominated culture of the South as a gay woman seeded my deep desire to promote inclusion and equity in all facets of my life. Over time, I have been able to change the narrative of my youth from being on the outside of the circle of privilege looking in to having the power to create my own infinitely large circle of inclusion. This evolution is demonstrated in my professional life, where I have grown from being a small-scale cultivator of inclusion and equity in my research laboratory to an industrial scale cultivator on my campus and beyond. I have broadened my inclusion and equity vision from my relatively small research lab to my larger classrooms to my department and university.

In parallel with these efforts to increase the scale of my impact, I have purposefully increased my visibility as a gay woman so that I can help pave the path for others. I am acutely aware that women of color and LGBTQ+ women report more gender harassment than straight women and men. I employ my experiences with differential treatment based on my gender and sexuality to increase awareness and fluency in the intersectionality among the axes of diversity and increase success among students of historically excluded groups.

I feel so very lucky that my work at SF State has allowed me to combine my interests in science and social justice. That is my SF State Story!!!

Best wishes for a fulfilling and healthy New Year!

Kai (Laura) Burrus, Chair of Biology

Giving Back to Biology...

The Department of Biology is working hard to support all students in their endeavors to promote the health of living beings on this planet. To do this work, we need your support. Please think about giving \$50, \$200, or even \$1,000 to support your favorite cause! Funding priorities are described below:

+GIVING WHERE THE NEED IS GREATEST

Unrestricted Gift | any amount
By giving in this way, you allow us the flexibility to respond to rapidly changing needs.

+PROMOTING STUDENT SUCCESS IN STEM DISCIPLINES

Fund Endowed BioLuminary Awards | up to \$25,000

Our data show that hands-on learning has an enormously positive impact on graduation rates and is critical for launching scientific careers. You could consider a gift towards an existing award. For example, to the newly established Association of Biology Students endowment or in memory of beloved faculty members, Jim Duncan Felipe-Andres Ramirez-Weber.

+DEEP

Diving into Ecology and Evolution Program: Experiential Course in the Galapagos

up to \$10,000

Scholarships for Spring Cohort of Students: Current use funds to off-set travel and participation costs. See page 14 of this BioCONNECT issue.

+HOW TO GIVE

By mail | Please make your check or money order payable to the University Corporation, San Francisco State and mail to:

Office of University Development
San Francisco State University
1600 Holloway Avenue, ADM 153
San Francisco, CA 94132

Please indicate your funding priority on the check! (eg, Biology Unrestricted Gift, ABS BioLuminary Award, DEEP)

If you have any questions, please call 415-338-1042 or email at develon@sfsu.edu



Jessica Magaña and family celebrating with first generation graduate pride!

[Click here to make an online donation today](#)

Choose a gift amount

\$500	\$250	\$100	Other
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Did you know CASHNet charges the University 2.75% for credit/debit card processing fees? UCorp accounting service fees are 5%, waived for scholarship donations. Please consider adjusting your donation to cover these fees so more of it reaches your designation of choice.

Donation Frequency

ONE-TIME GIFT	SCHEDULED	RECURRING
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Designations*

The SF State Fund (For the greatest needs of the University)	<input type="radio"/>	Athletics	<input type="radio"/>
Division of Graduate Studies	<input type="radio"/>	Division of Undergraduate Education	<input type="radio"/>
College of Ethnic Studies	<input type="radio"/>	College of Extended Learning	<input type="radio"/>
College of Health & Social Sciences	<input type="radio"/>	College of Liberal & Creative Arts	<input type="radio"/>
College of Science & Engineering	<input checked="" type="radio"/>	Graduate College of Education	<input type="radio"/>
Lam Family College of Business	<input type="radio"/>	Additional Giving Opportunities to Other Areas, Initiatives & Funds	<input type="radio"/>

Gift Instructions

Additional Gift Instructions:

I would like to donate to the Department of Biology to support ... (indicate a specific program here)



Sebastian Gomez

Learning to Ask for Help

I arrived at SF State in Summer of 2021, eager to resume research in the wet lab setting after being pulled away from in-person lab work at UCLA due to the pandemic. Although the content of the research in my new lab was intriguing, I struggled to create a healthy relationship with my Principal Investigator and the overall lab environment. I decided to seek advice from other faculty including Dr. Frank Bayliss and Dr. Diana Chu. This was my first instance of seeking guidance from SF State faculty and one of the rare times I admitted that I needed help.

My background has shaped my path in so many important ways. In high school, I

was your stereotypical nerd: Chess Club after school and Robotics competitions on the weekends. Both of my parents are Mexican immigrants and neither obtained a college degree. As their first-born son, I felt a mountain of generational pressure to succeed in school and pursue a fulfilling career.

I thought a career in engineering was my calling, until I stood in front of an ultrasound machine at a family medicine clinic. The ultrasound tech was measuring the blood flow of a patient's heart, and the sound of their heart beating rang in my ears, and the opening and closing of their heart valves was

burned into my eyes. This marked the beginning of a career in medicine.

No other event reaffirmed my career choice than my abuelita's passing at the height of the pandemic. As I grieved her death in isolation, I learned that she passed away from Congestive Heart Failure. I knew from then on that I wanted to combine my research and clinical skills together in the form of an MD/PhD degree to study and treat cardiovascular diseases.



I persist in tribute to my Abuelita, Veneranda S. Torres, who loved to celebrate love, life, and family more than anything else

To accomplish this goal despite any obstacle, I found myself asking for help after landing at SF State, a task that is difficult for many people of color and especially first-generation students.

With the help of Dr. Bayliss and Dr. Chu, my transition into a new lab environment where I created healthy

relationships was smooth and painless. Through this experience, I learned about the importance of admitting when I needed help, and that I could always find a support group within the SF State Department of Biology.

Now, in the Chu Lab, I work as an independent graduate researcher studying spermatogenesis in the *C. elegans* nematode at the molecular level in the hopes of identifying any unique molecular mechanisms that drive chromosome segregation in male sperm meiosis.

I am blessed to have recently been accepted into a Medical Scientist Training Program to begin my MD/PhD training in Fall of 2023.

My SF State Biology Story ...

I used to think that scientists were individuals who were extremely intelligent and knew exactly what to do in any situation. However, my life experiences have shown me that scientists are quite the opposite; scientists are individuals who admit that they do not contain all the answers to their problems, but they are bold enough and curious enough to search for them.



Dr. Cathy Samayoa

Coming home...

Written by Cathy Samayoa

I am the daughter of Latino immigrants who worked tirelessly to make sure I had food and shelter and the first in my family to graduate high school.

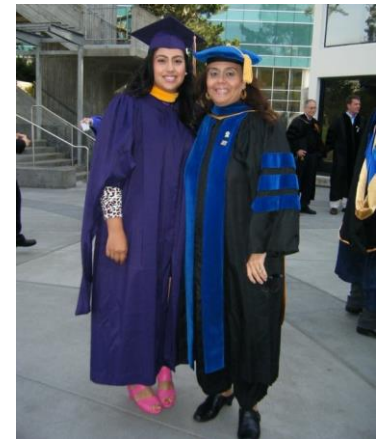
My SF State Biology story began as a transfer student from CCSF, where I completed my general education with support from various scholarships. I came to SF State looking for a science mentor and later finding a role model who would completely change the trajectory of my life. As an

My SF State Biology Story...

undergraduate student I enrolled in “Health Disparities in Cancer” and through mentorship was empowered to chart my own path in molecular biology and social justice.

At SF State, I felt valued by my professor and knew that, just like them, I wanted to have an impact on the next generation of scientists who were committed to health equity. At the time, the job I wanted did not exist, but I knew I that if I had made it this far, then anything was possible. I graduated with a B.S. in Cell and Molecular Biology (CMB), then an M.S. in CMB from SF State University. I went on to earn my PhD from the University of Texas (UT) Health, San Antonio.

Many years after taking the “Health Disparities in Cancer” class, my dream became a reality and I now proudly direct the Health Equity Research lab alongside my lifelong mentor and role model, Dr. Márquez-Magaña. In a full circle moment, I am now the course instructor for the health disparities class that inspired me to take on this career path. I also teach Peer Assistants for Learning Science (PALS) and Biology of Aging.



Cathy Samayoa and Dr. Leti-Marquez Magaña on graduation day (MS degree in CMB)

During my time as a faculty member at SF State, I have co-led the Biology Summer Lab Activity Modification (BioSLAM), a collaborative project where we created remote-ready classes with a racial justice lens. In 2021, I received the Dr. Eddie Méndez award for my contributions to science and for advancing diversity, equity, and inclusion in science. I look forward to continued collaboration and to supporting the next generation of scientists.



Photo by Deanne Fitzmaurice
Written by Kanaga Rajan

Chinomnso Okorie

Using community-engaged research to fight health disparities

Growing up Chinomnso Okorie (B.S., '17; M.S., '19), heard about the environmental pollution in her Bayview neighborhood but didn't understand it. What was happening at the molecular level of Bayview residents?

She came to SF State looking for answers. And she found some. Okorie didn't limit her search for answers to her major. She took classes in everything from human biology and medical sociology to Black literature and more.

"The point of taking all these classes was really to try to understand the Bayview

and the mind of the African American community and the evolution of the African American community in the Bayview environment," Okorie says.

Okorie's scientific and social interests came together at the University's Women's Center, where she volunteered for three years. Experiences there helped her realize that she, as a Black woman, deserved a space in science. She brought science to the center, leading workshops about reproductive medicine and women's health.

"I became so hyperaware of the fact that

Black women suffered from the most disparities in terms of birth outcomes," she says. "I slowly started to fall in love with reproductive health because nobody talks about these things. I was like, 'Oh my gosh — I found my niche!'"

My SF State Biology Story....

As an SF State master's student Okorie found a supportive growth environment at SF BUILD. Her Cell and Molecular Biology thesis project used community-engaged research to investigate the relationship between environmental exposure to lead and preterm birth. Her project highlights the very real social and health disparities experienced by Black communities in San Francisco. It was published in the International Journal of Environmental Research and Public Health.

African American/Black mothers are nearly three times more likely to have premature infants compared with white mothers, according to the San Francisco Department of Public Health.

Okorie knew that to effectively study these problems, she'd have to account for — and challenge — health disparities and inequities.

Okorie collaborated with 72 randomly selected hair salons and barbershops

across 19 racially diverse San Francisco zip codes. These are safe spaces for many communities, she explains. Hair was a good conduit because it's a less invasive source and stores metals like lead. However, hair is deeply personal and meaningful for many people, so transparency was important.

"We were trying to create a safe space where we talked about what was going on in our community," she says. "The dialogue before we even got to collecting the samples [is critical]. The data we produced represented the community. We were doing the science on behalf of the community not just for scientific benefit."

Of the 109 hair samples collected, Okorie found lead in every one, with the highest exposure in southeast San Francisco, a region that includes Bayview. These same regions have large African American/Black populations and high preterm birth rates.

Okorie is now a data scientist at the University of California San Francisco. But the work she started at SF State is not done. She continues to explore the effects of environmental exposure in the placenta during pregnancy and examine genetic-level changes

"Over the years, we've gotten better at standing up for what is right and wrong here in the Bayview," she says. "Our voices are starting to be heard, and the community is not relenting."



Jacoby Clark

Jacoby Clark hopes to bridge entomology and social justice as an inaugural Public Health Entomology for All fellow

Only three to five millimeters long, ticks are tiny but can harbor other smaller organisms that can mean big problems for human health. SF State University graduate student Jacoby Clark wants to understand how ticks are spreading disease and how to prevent transmission. He was recently selected to be part of the [inaugural cohort](#) of a new one-year fellowship at the Centers for Disease Control and Prevention (CDC), where he'll build on his thesis work through a public health and social justice lens.

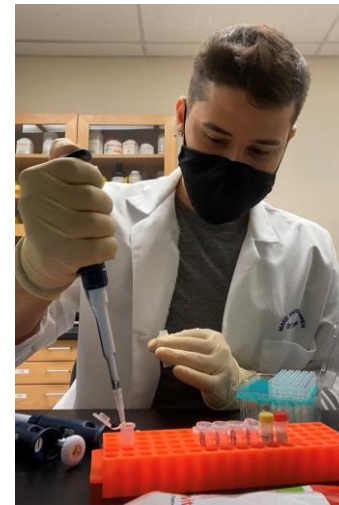
"This is a program where we're serving as public health entomologists,"

explained Clark, who started his fellowship this summer. "We're trying to bridge the intersection between entomology, health equity and social justice."

Clark is one of two fellows in the [Public Health Entomology for All \(PHEFA\) program](#), a partnership between the CDC and the Entomological Society of America. The program targets aspiring public health entomologists from underrepresented communities who studied at minority-serving institutions, such as SF State, in an effort to diversify and make entomology more inclusive for

various backgrounds.

Clark is wrapping up his thesis at SF State, where he investigated how climate change and declining host diversity influence tick pathogen diversity and prevalence. He works in the lab of SF State Associate Professor of Biology [Andrea Swei](#), who introduced him to the PHEFA fellowship after learning about his interests in public health policy.



Jacoby Clark at work in the lab. He brings a valuable perspective to health research.

"The burden and the recent rise of diseases that are spread by ticks are starting to be recognized as a public health concern," Clark explained.

Earlier studies have focused on white populations. But clinical manifestations of tick-borne diseases present differently in people of color. Clark notes that there's been a shift in

research, with more scientists studying diseases and disease manifestations in communities of color. He looks forward to learning more and furthering efforts to make public health education more accessible.

A goal of the PHEFA fellowship is to bring more scientists of color — like Clark — into entomology and public health.

Celebrating Our Successes....

"I'm an Indigenous scientist, and there aren't a lot of us that are in academia or in government. It's been kind of difficult to connect across the board and even in school," said Clark, who identifies as a first-generation, Indigenous, gay scholar.

Other than a brief summer research opportunity, SF State was Clark's first experience in intensive, long-term research. As a graduate student, he was supported by an NIH RISE fellowship from the Student Enrichment Office at SF State, and the Provost Scholars Award in his second year.

"[The PHEFA fellowship shows] that we can kind of have a more expansive scope when we come to the public," Clark said. "Because ultimately, if we're serving the public, we need to look like the public."

Dr. Andrea Swei received official word this past fall that her proposal to the CDC Center of Excellence for Vector Biology in the Pacific Southwest region (PacVec) was approved for funding! The CDC only awarded five of these for the whole country, so this is a great accomplishment.

This program is a 5 year, \$10 million grant that will be shared with others in the consortium to conduct research on vector biology and control and to train the next generation of vector biologists.

Celebrating Our Successes....

As a member of the leadership team, Dr. Swei will help direct the programs and activities in the center and will also receive research and training funds. In addition, she plans to support undergrads for summer internships with public health and vector control agencies.

Dr. Swei has distinguished herself as a



Dr. Andrea Swei collecting ticks for research. Photo credit: ABC News

leader and a reliable resource for students on campus as an associate professor and a faculty advisor for the Pre Veterinary Society. Dr. Swei's research is focused on the ecology and pathogenesis of diseases, especially tick-borne diseases such as Lyme disease. Her research investigates the ways that habitat disturbance, community interactions, and trophic cascades affect the distribution and prevalence of tick-borne diseases. In addition, recent work examines the functional role of microbial communities in pathogen transmission. Research in the Swei lab focuses on the field, laboratory, and metagenomic experiments as well as mathematical modeling to understand the dynamics of emerging infectious diseases.



Dr. Andrea Swei

*Leading vector biology research
in Pacific Southwest Region...*



Noelle Anderson and Dr. Scott Roy

Written by Kanaga Rajan

It's not often that you see genetic systems described as "bizarre" in the title of a scientific research paper. That is unless it's from the lab of San Francisco State University Associate Professor of Biology Scott Roy.

In his latest [paper](#) for the Proceedings of the National Academy of Sciences of the United States of America Roy and his collaborators provide the first empirical evidence supporting a hypothesis for the evolution of haplodiploidy, the sex-determining system found in species like bees, ants and wasps.

In haplodiploidy, females follow the egg-sperm system while males arise from an

egg alone. This means that males only have half the genetic information of their female counterparts (all from their mom).

"There's a sort of fundamental puzzle in biology, which is how is there weird stuff?" Roy said.

The problem is that it's hard to explain the evolutionary transition from the more familiar sex determining XX/XY system to haplodiploidy, Roy says. Since haploid males have less genetic material and no paternal genes (reducing genetic diversity), we'd expect them to have a lower chance for survival. So how have species maintained haploid males? The key might be in conflicts between different genes within an individual that

Celebrating our Successes...

destabilize genetic systems and promote the origin of new systems like haplodiploidy. According to this hypothesis, genes linked to dad's X chromosome might be biasing sperm production towards making more X-containing sperm, leading to more daughters (XX) than sons. If so, this could drive the production of haploid males to rebalance the ratio of males to females. Researchers suspect this would happen in the presence of a larger X chromosome.

"The idea that conflict between genes in a single organism could be propelling evolution has been around for a while. But to date there's are very few or no empirical tests of it," Roy said. That's because it's a difficult hypothesis to test.

But that didn't stop him and his collaborators. They sequenced the whole genome of dark-winged fungus gnats, gall midges/gnats and springtails to work around some of their experimental challenges. These species are essentially haplodiploid but would allow the researchers to separate the conflict hypothesis from other proposed hypotheses.

The analysis revealed that these species indeed have very large X chromosomes compared with related

diploid species. Their large X chromosomes took up between 16% to 66% of a species' genome.

"Typically, 1 to 5% of the genome is about the X chromosome, but in these systems it's almost half the genome. That's a very big and clear difference," said first author Noelle Anderson, a University of California, Merced Ph.D. student in Roy's lab. Anderson, who initially worked with Roy in the summer of 2014 as an SF State NSF Research Experience for Undergraduates researcher, has returned to SF State University a lecturer teaching genome annotation and bioinformatics. She is first author on the PNAS paper.

The exciting thing is how clear the data is, Roy explains. "We're talking about over tens of millions of years of evolution here, maybe hundreds. And to see this clear a pattern in bioinformatics data is almost unheard of," he added.

This evidence supports the idea that intragenomic conflicts could drive the evolution of novel biological systems, Roy says. He credits SF State's culture for emboldening him to pursue this tricky project.

"I would never have developed the skills or the confidence for us to go off in this [research] direction, and so it's sort of a tribute to San Francisco State," Roy said. "I feel a lot of intellectual freedom here."



GOLD Graduation!

Graduate Opportunities to Learn Data Science

The industry of biotechnology has grown to value data science skills more than ever in recent years. Aptitude tests on data science problems are increasingly part of interviews. We want SF State students to be competitive and have the skills for a secure career after graduation. The GOLD program aims to support students in biotech fields to do just that. GOLD is a collaboration with the SF State Department of Biology,

Chemistry and Biochemistry, and Computer Sciences. Our department's Dr. Pleuni Pennings is one of the creative thinkers at the helm of this operation. The GOLD certificate program equips students with yet another tool for success in their journey after graduate school.

Skills in programming languages such as R, Python, and more. There is a class dedicated to networking. Students learn how to incorporate data programming into research.

Amayrani Villegas-Parra
Amy Wong
Andrés Patino
Andre's Williams
Cassie Vaniotis
Chi Christine Ann Aquino
Christian Guerzon
Christian Valtierra
Corryn Knapp
Daniel Hogan
Eduardo Hernandez
Edward Valenzuela
Evan Ho
Ezra Mendales
Florentine van Nouhuijs
Gilbert Alarcon-Cruz
Jameel Ali
Jesse Espinoza

Jocelyne Milke
Kate Montana
Leonardo Rodriguez
Lorena Benitez Rivera
Marwin Fernandez
MaryGracy Antony
Meris Johnson-Hagler
Mehak Jain
Salma Ahmed
Samuel Cuevas
Sebastian Gomez
Shalom Gutierrez Diaz-Henry
Shea Grady

*Celebrating Our
Successes....*

Alumni Accomplishments

Alumni doing great things!!!

Natalie Saldana-Rivera

Natalie Saldana-Rivera (B.S. in Microbiology '20) will be pursuing graduate school at CSU-Monterey Bay to become a Physician Assistant. Congratulations Natalie!

Faculty, Staff, Alumni, and Student News

Jenee Wilson

Jenee Wilson, SFSU BS Biology Alumnus and SEPAL-affiliated student – who was both a Bio 644: Learners Engaged in Advocating for Diversity in Science (LEADS) student and a published SEPAL researcher – was accepted and just began in the California University of Science and Medicine post-baccalaureate program. This is one-year

program awards students a Master of Biomedical Science and an automatic interview for their medical school upon completion.... Congratulations, Jenee!

Cecilia Hernandez, M.S.

I am a two-time alum having graduated with a B.S. ('17) and M.S. ('20) in Marine Biology from SFSU, and I earned a Single Subject teaching credential in Biology at SFSU shortly after ('21). I jokingly say that I was trapped in SFSU for 8 years of my life, however the people and community made my time feel brief. I remember starting undergrad with the pure focus of obtaining a B.S. in order to become a teacher in Biology. I refused to take "pursuing research" as an option because, as a first generation Latina, I lacked a higher education role model. Nonetheless, it was in my final

year of undergrad that I obtained exposure to research through volunteering in the Cohen lab, more so in the Marine Ecology course taught by Dr. Sarah Cohen.

Next thing I knew I was enrolled as a masters candidate the following semester. I fell in love with travel, taking courses in Latin America and collaborated with experts from all over. It wasn't until I switched my career focus back to teaching that I realized how much I had grown, I had embodied "thinking like a scientist" 100% and the rest seemed doable. I am currently in my second year of teaching at George Washington High School located in the Richmond District of San Francisco. I teach Biology and Health Ed to 9th graders. My focus is to make science, not only Biology, accessible to students of all backgrounds and to make my teaching relevant to what researchers and scientists do today. In other words, you bet we do research in my classroom! .



Natalie Saldana-Rivera



Jenee Wilson



Cecilia Hernandez, M.S.

Alumni Accomplishments



Minerva Orellana



Molly Martin



Rachel Diner

Alumni doing great things!!!

Minerva Orellana

SFSU MS Biology Alumnae (2019) and HER-lab affiliated student, Minerva Orellana was advanced to candidacy last spring in her PhD program at the Mayo Clinic (Felicitaciones!). She recently earned an award for her poster presentation entitled, Looking at Uterine Fibroids Across the Translational Spectrum. This is part of her doctoral research addressing reproductive health equity issues that affect Latinas."

Molly Martin

Molly (Hayes) Martin, an alumna from the LeBuhn lab, has a new position at the Xerces Society as the Endangered Species Conservation Biologist for the Pacific Northwest. Xerces is also home to LeBuhn lab alumnus, Rich Hatfield who leads Xerces' programs on on Bumble Bee Conservation. Rich played a pivotal role in both the original petition to list four species of imperiled native bumble bees and then the fight for the California Supreme Court to let stand the ruling that determined that these bee species are

eligible for protection under the California Endangered Species Act (CESA).

The Xerces Society for Invertebrate Conservation is an international nonprofit organization that protects the natural world through the conservation of invertebrates and their habitats.

These people are doing amazing work making a difference for pollinators and we are so proud of them!

Rachel Diner, PhD

Rachel joined the Gilbert Lab at UCSD in 2020 as an [SD IRACDA](#) fellow. She is broadly interested in how the environment and human activities impact coastal microbial ecosystems, and in turn, how these free-living and host-associated microbes affect human well-being. Rachel received her Ph.D.

from UCSD's Scripps Institution of Oceanography in 2019 and was a joint postdoctoral researcher with the J. Craig Venter Institute and the Southern California Coastal Water Research Project, where she used genomics-based techniques to investigate interactions between marine algae and bacteria.

Prior to her PhD work, she received a B.S. in Biology from the University of Georgia in 2006 followed by a J.D. from the University of San Diego School of Law in 2009, where she studied coastal environmental law and policy and worked with local environmental groups to reduce coastal wastewater, stormwater, and plastic pollution. In 2013 she earned an M.S. in Marine Biology from San Francisco State University researching the effects of ocean acidification on calcifying marine algae (coccolithophores). In addition to her research, Rachel is a mother of two and is passionate about creating opportunities and inclusive environments for girls and women pursuing STEM careers. For more information, visit her [website](#) and [list of publications](#)

*Faculty, Staff,
Alumni, and
Student News*

Student Adventures

Diving into Ecology and Evolution Program: DEEP



DEEP student preparing for dive

The DEEP field research semester at SFSU provides students with advanced training opportunities that expose them to biological diversity in a context that is environmentally relevant. Students participate in 10 weeks of instruction at SFSU to prepare for 3-5 weeks of full immersion research at a marine field station at sites that would not be possible or tractable in San Francisco.

DEEP 2019 students conducted original research projects at the Hawaii Institute of Marine Biology, and DEEP2023 students will conduct original research at the University of San Francisco de Quito in the iconic Galapagos Islands.

DEEP provides students with hands on experience sampling techniques, experimental design, evaluation of ecological drivers of evolution, as well as scientific writing and presentation of original results. This approach represents the gold standard in Biology education and is associated with increased integration of knowledge and retention in the sciences (*Vision and Change: A Call to Action, AAAS, Washington, DC, 2010).

Students receive 15-17 upper division units that fulfill graduation requirements. DEEP students conduct individual and group field research projects, that have the potential to result in professional conference presentations, publication in peer-reviewed journals, and admission to post baccalaureate graduate programs, as manifest by previous DEEP student outcomes. Finally, while not required, DEEP students can elect to enroll in scientific diving and boating courses that supplement advanced training in field research methods that translates directly to increased job placement and/or acceptance in post-baccalaureate programs.

DEEP in Spring 2019 was a tremendous success by any metric, that resulted in 8 scholarships through faculty fund-raising, which fully covered the course fees and led to a diverse pool of participants (87.5% women, 37.5% Hispanic, and 25% black). The program also resulted in five successful CSU COAST scholarships, 4 international conference presentations, one publication in a peer-reviewed scientific journal, and contributed to four SFSU undergraduate students acceptance into graduate programs, as well as four master's thesis completions at SFSU.

*Faculty, Staff,
Alumni, and Student
News*



*Dr. Karen Crow and DEEP
Students from 2019 Cohort
in Hawaii*