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BioCONNECT

SF State Biology Newsletter, Spring 2021

Giovanna Tuccori

Happy Spring everyone! We hope you enjoy the latest version of the Biology department BIOCONNECT magazine. This issue focuses on Climate Change. Let us know how you like it. Join our online communities. Links below...

SF STATE
DEPARTMENT OF BIOLOGY

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Faculty, Staff, Alumni and Students

Letter from the Chair

Greetings SF State Biology Community Members!

We hope that this issue of BioCONNECT finds you safe and supported. Here in the SF Bay Area, we are fortunate to be emerging from the pandemic. With the completion of the Spring semester, we sent off roughly 400 newly minted graduates into the world and are excited to be transitioning back to in person instruction next fall.

Having said that, there is one issue that was with us when we entered the long dark tunnel of the pandemic and will still be with us once we have fully emerged – it is Climate Change. Climate Change is the most defining issue of our time and we are now positioned at the defining moment of this crisis. Our response to Climate Change will define us as individuals and as a society. It will also define the quality of life for future generations of living organisms, including humans, on this planet.

As such, we are pleased to announce ongoing and new work on Climate Change in the Department of Biology. First off, we will launch a new campus-wide Certificate in Climate Change Causes, Impacts, and Solutions in Fall 2021. In addition to curriculum relating to the causes, impacts, and solutions for Climate Change, a central tenet of the Certificate is to address Climate Justice. In addition to broadening our educational outreach, the Department of Biology is proud to be home to numerous faculty and students who are engaged in Climate related research. Some of these faculty and students are highlighted in this Climate-focused issue of BioCONNECT.

To stay abreast of Climate Change related activities on campus and in the community, please check out our new ClimateHQ SFSU webpage (https://biology.sfsu.edu/climate-hq) and follow @ClimateHQ on facebook, Instagram, twitter, and youtube!

And, as always, please consider supporting us in our efforts by making a gift to the Department of Biology by reaching out to me at lburrus@sfsu.edu. All gifts large and small are most appreciated and allow us to keep supporting our students..

Best regards,

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! Your donation will target the priorities listed below:

+GIVING WHERE THE NEED IS GREATEST

Unrestricted Gift | 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 | 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 and Felipe-Andres Ramirez-Weber.

+CLIMATE LEADERSHIP Certificate in Climate Change Causes, Impacts, and Solutions |Scholarships for First Cohort: Current use funds to off-set tuition costs for matriculated and non-matriculated students.

+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 or ABS BioLuminary Award)

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

SF STATE
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Dwayne Evans, SF State Biology alum (MS) and current PhD student at Harvard University

Click here to make an online donation today

Lance Lund

Our Endangered Planet

Focus on Climate Change....

For those of us alive today, we face a unique challenge unlike any previous generation. At no point in the history of the Earth has the collective decisions of one species determined the fate of existence for every other species that shares their world. Global extinction and climate change are now the two existential crises of our time. This is a consequence of humanity's drive to support a rapidly growing population, through the over harvesting of natural resources for food, fiber and timber. This has been powered by the burning of fossil fuels, which releases greenhouse gases and discharges pollutants that trap heat, acidify air, water and soils, oxidize living tissue, and contaminate the cellular chemistries of every living inhabitant on our endangered planet.

Vulnerable ecosystems across the globe are now threatened with collapse, as thresholds for survivable temperatures, freshwater and nutrient availability are being rapidly surpassed and becoming irrevocably reset.

With over 90% of the world's terrestrial and oceanic landscapes impacted in some way by human activity, we are now driving a third of all insects, amphibians and freshwater fish, a quarter of all mammals, a fifth of reptiles and a sixth all birds to the brink of extinction within the next 100 years.

Through habitat loss and fragmentation, invasive species, population growth and rampant exploitation of the earth's bio-productivity, this loss of precious biodiversity is compounding at a rate 100-1000x faster than at any point seen throughout the last eon of our fossil record.

So how can we begin to address these challenges which are rapidly driving us towards the tipping points of ecological collapse and ruin?

To reverse course, we must begin to understand the foundational role that biodiversity plays in the natural processes and mechanisms that shape our present environment, and which provide the solutions that will underlay how we ultimately determine the future of life:

1. Organic systems, the bioengineers of the planet we now inhabit, evolved across deep time and forged an interconnected web of living species and ecosystems, which are distributed across spatial and temporal scales and mediate the biogeochemical processes of our planet.

2. The ecological relationships between all living species of the global biosphere - producers, consumers and decomposers - that maintain a dynamic equilibrium of interactions between Earth's biotic and abiotic systems as required to support and sustain life.

3. The existence value of the living heritage of genetic, species, and ecosystem diversity, which enriches and protects our biosphere and provides natural systems with the resilience required for our survival.

4. The application of tools, techniques and principles of conservation biology that can repair, revive and restore the natural interdependence of our ecosystems.

5. A biocentric ethical philosophy rooted in Deep Ecology, one which recognizes and prioritizes the advancement of an equitable and sustainable future to be shared by all living things on Earth.

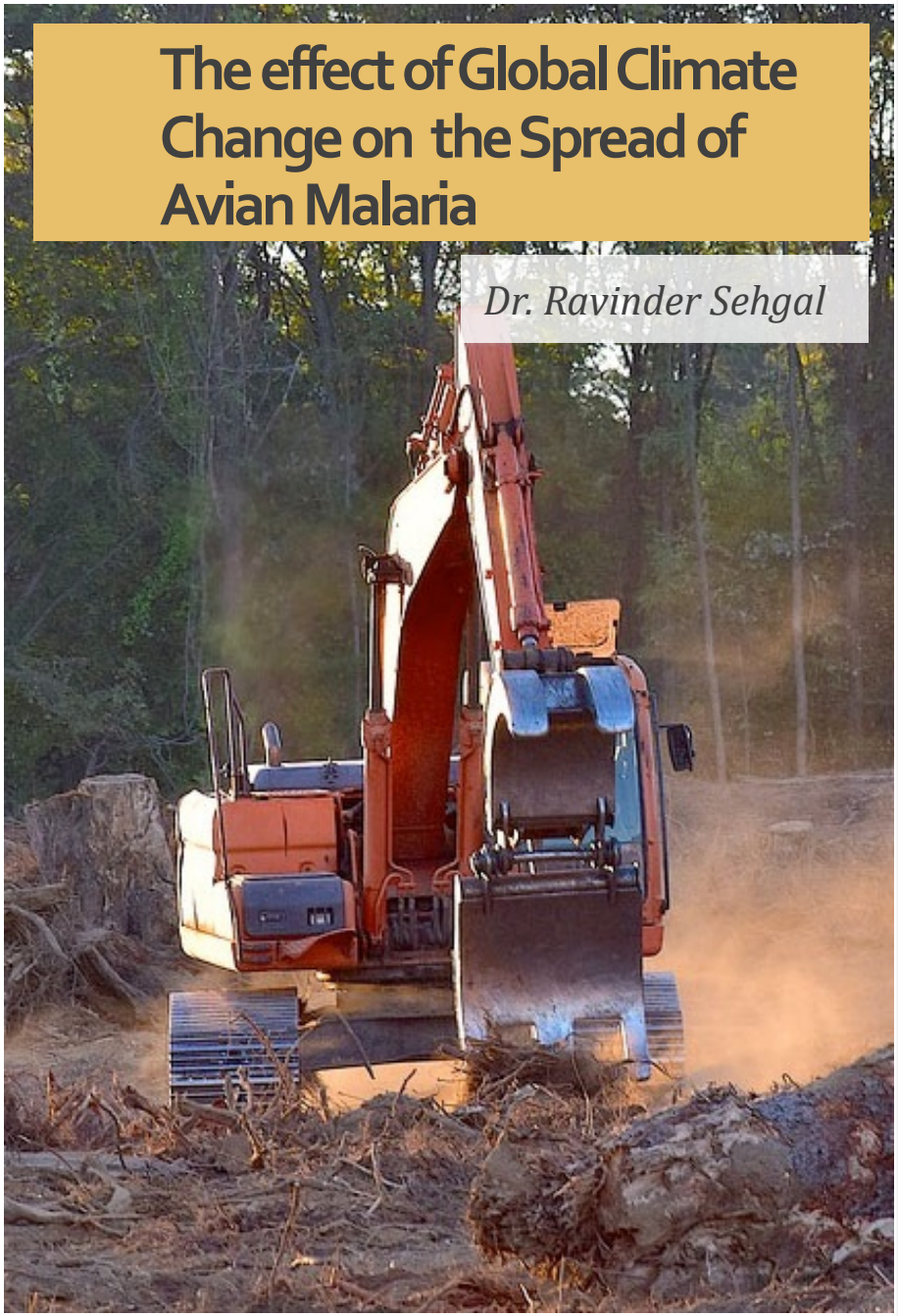
Through the combination of our actions or inactions, we will choose the path to preserve, conserve and restore the survival of our living planet.

As the wise Lorax said, "Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."

However we choose to move forward in this moment, through our personal actions in common cause to protect, heal, and to create a livable world for all, one thing is perfectly clear - we do not have another moment to spare.

The effect of Global Climate Change on the Spread of Avian Malaria

Dr. Ravinder Sehgal



Avian malaria is strongly linked to climate. Dr. Ravinder Sehgal studies the effects of deforestation, which leads to climate change in Africa, where he works with students and professors at the University of Buea in Cameroon.

Dr. Ravinder Sehgal

We aim to answer the question: What are the effects of large-scale deforestation on the transmission of vector-borne infectious diseases? We are approaching this problem by studying malaria in natural populations of rainforest birds threatened by rapid environmental degradation for the development of palm oil plantations in Cameroon.

Our previous work has identified malaria parasites, both generalists and specialists, in African rainforest birds: it is the generalists that have the potential to jump to **naïve hosts** and develop as emerging diseases. We have also identified mosquito vectors of avian malaria, and **demonstrated that patterns of malaria diversity are significantly affected by habitat.**

With our precise knowledge of sectors presently zoned for logging, we are investigating the effects of environmental change on disease transmission. The integration of host, habitat and vector ecology allows us to monitor malaria transmission at the same sites before, during and after large-scale deforestation."

Forest Robin

Focus on Climate Change...

Mosquito

Dr. Vance Vredenburg studies amphibians (including frogs, toads, salamanders) and has proposed that their global decline may signal a sixth mass extinction on earth. More than 40% of all known amphibian species are in trouble: climate change likely plays a large role. Funded by the U.S. National Science Foundation, the Vredenburg lab works with collaborators around the world to delineate and describe the extent of damage posed by a fungal pathogen that has decimated amphibians in western North America, Central and South America, Australia, Africa, and Europe, but has spared Asia. The disease, called chytridiomycosis, has caused more damage to vertebrates (over 500 amphibian species) than any other disease known in all of history. The Vredenburg lab uses natural history museum collections, field data, and lab experiments to study disease.

Emerging infectious diseases are on the rise in humans and in wildlife and climate change is exacerbating the problem. In amphibians, chytridiomycosis is differentially affecting species depending on geography. The Vredenburg Lab is working to help understand why some species are highly susceptible, while others are not. For example in California, the Vredenburg lab documented how epidemics in several species of mountain yellow-legged frogs in the Sierra Nevada mountains led to mass die-offs and population extinction, but other species like the pacific tree frog survived and even thrived after the epidemic.

Investigations have focused on how we can explain different outcomes of disease, such as differences in the timing of pathogen invasion, as well as the protective qualities of the skin micro-organisms that live symbiotically on the amphibian hosts and inhibit the growth of fungi.

Mountain Yellow-Legged Frog

The effects of climate change are predicted to be extreme in montane habitats, exactly where much of amphibian biodiversity occurs. Rising temperatures, increases in the variability and magnitude of rainfall and snow events are likely to impact amphibians. The Vredenburg Lab seeks to understand how changes brought on by climate change intersect with the growing global problem of emerging infectious disease. Our best hope in conserving species is to better understand the underlying biology that has led to the patterns we see today, so that we can mitigate them in the future and save species.

Focus on Climate Change….

Climate change, increasing wildfires, and tick-borne diseases

Dr. Andrea Swei

Dr. Andrea Swei studies the ecology and transmission of tick-borne diseases such as Lyme disease, caused by a bacterial pathogen. Her work is funded by the National Science Foundation and the Centers for Disease Control. Climate change is going to look different in different parts of the world. In California, it is already leading to more extreme weather conditions and greater risk for wildfires. Research in Andrea Swei's lab examines the effects of global change such as climate change, land use, and wildfire on the transmission and risk of tick-borne diseases. Recent research has found that natural wildfires can initially lead to a higher risk of encountering ticks because their natural hosts are more sensitive to displacement from fires (MacDonald et al. 2018).

In addition to higher wildfire risk, climate change is also predicted to lead to hotter and drier summers. In an NSF funded study and in collaboration with researchers at UC Santa Barbara, students in the Swei Lab are conducting an experimental study in southern California that looks at the risk and diversity of tick-borne disease across a climate gradient. The goal of this study is to see how hotter and drier conditions affect the abundance of ticks and the types of pathogens they carry. In this experiment, large, one-hectare enclosures have been placed in three different climate zones to reflect how climate change may be affecting California's interior, savannah landscape.

Image of a deer tick

"We are collecting ticks from each of these experimental sites to see how many ticks are there, how well they survive, and what kinds of pathogens are associated with ticks in each of these areas. Results from these experiments will provide insight into how progressing climate change will affect ticks and the pathogens they vector."

Collecting ticks for analysis...

Focus on Climate Change....

Focus on Climate Change....

The impacts of climate change on marine life

Dr. Jonathon Stillman

Dr. Jonathon Stillman has researched the responses of coastal marine organisms to shifts in habitat temperature, pH, salinity and oxygen levels since the mid 1990s. His research has been funded by US federal agencies including the National Science Foundation, the National Marine Fisheries Service, the National Institutes of Health, the Bureau of Reclamation, the California State University Council on Ocean Affairs, Science & Technology and by private organizations including the Moore Foundation. He collaborates with researchers in California, across the US, and internationally including in French Polynesia, Canada and England. "Climate change is changing the physical and chemical environment of coastal oceans and estuaries.

Porcelain Crab

Ocean warming, salinification, acidification, and deoxygenation mean that our coastal oceans are increasingly "hot, salty, sour and out of breath." Those factors, as well as others (e.g., microplastic and nitrogen pollution), are impacting marine life. Critically, understanding how populations and ecosystems respond to the complex ongoing environmental shifts requires further research on the responses of organisms to levels and variability of temperature, salinity, pH and oxygenation in isolation and in concert. Doing so is the central focus of research in the Stillman Laboratory.

Our laboratory conducts studies on a range of coastal organisms including crustaceans, mollusks, corals and insects and employs a range of approaches including field-based monitoring and environmental simulation aquarium experimentation, and examines a wide range of organismal responses including morphological, behavioral, physiological, biochemical and molecular.

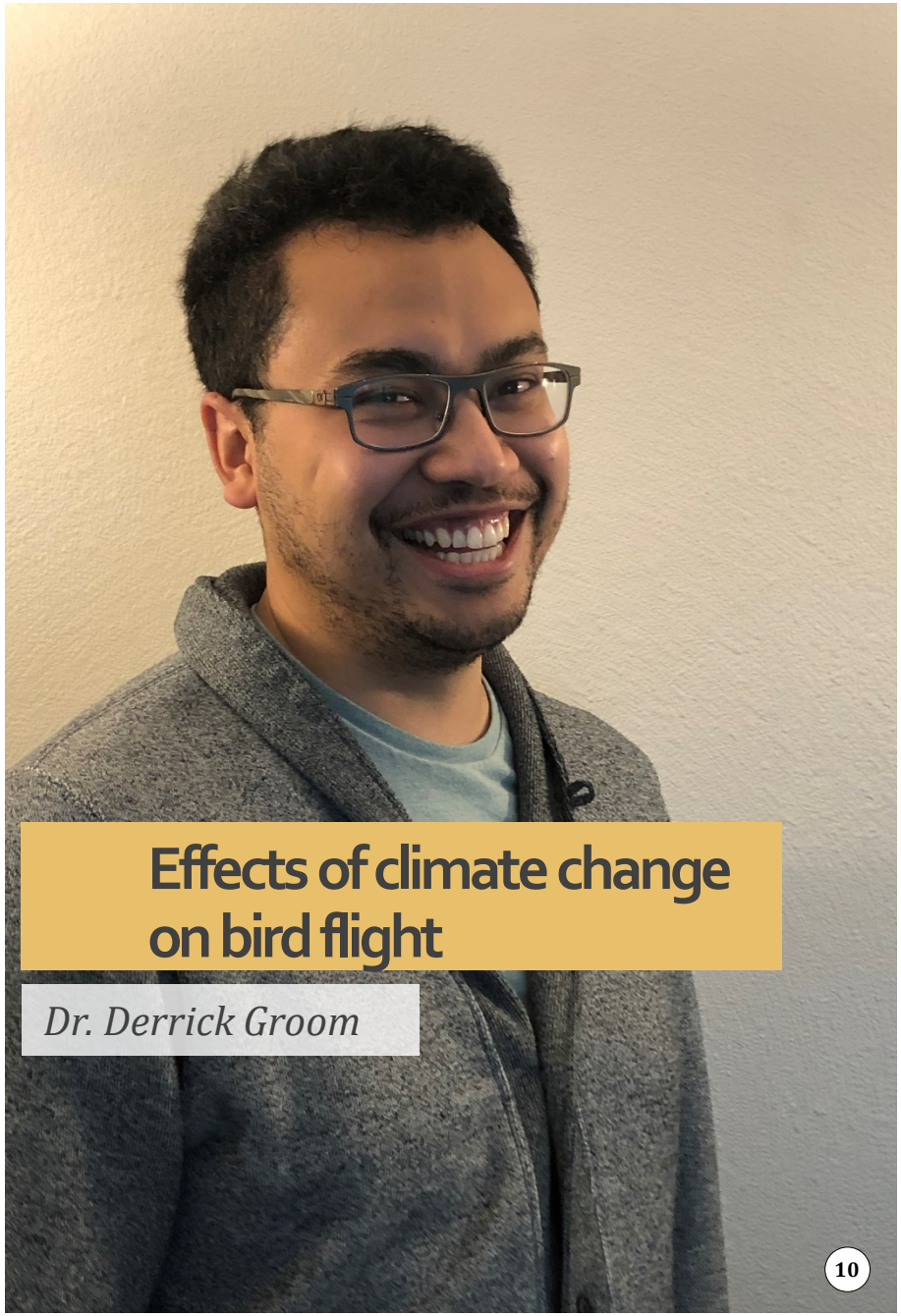
One of our key discoveries is that the most heat-tolerant organisms are those that are also the most susceptible to climate change because they live at their tolerance limits in nature and have a reduced ability to adjust their heat tolerance within a generation. We have also found that temperature is the environmental factor with the greatest impact on organisms, but that in combination with other environmental factors the effects of temperature are exacerbated and have a greater impact on the energetics of organisms. Many of our studies have revealed the unexpected. For example, we have found tremendous family-level variation in the responses of crab embryos to thermal stress and reduced pH. Some parental combinations produce offspring that are very sensitive to warming and acidification, whereas offspring from other parental combinations are completely tolerant. In other studies we have discovered that warmer and acidified oceans are likely to shift the role that calcifying phytoplankton play in global carbon cycling, which is important for understanding the flow of carbon from the atmosphere to the largest organic carbon sink on the planet, the deep sea.

Those findings, as well as others, are used to make predictive inferences about how continuing climate change and the other environmental impacts of the Anthropocene are impacting coastal marine organisms and the ecosystems that they are a part of."

Stillman Lab

Effects of climate change on bird flight

Dr. Derrick Groom



Dr. Derrick Groom has been studying the energy costs of bird flight for the past decade. His work looks at how birds manage their energy across seasons and under different environments, and the impacts of morphology and body size on the metabolic costs of flight.

"In the face of climate change, organisms are changing where they live. Some species, particularly tropical species, are moving away from the equator and closer to the poles, and others are moving up mountains to higher elevations. These changes in elevation are accompanied by a

Hummingbird in flight...

whole host of environmental shifts that animals must contend with, such as low air density and low oxygen levels. These environments can become challenging for some species, especially for birds who will find that sustaining flight becomes more difficult due to the lower air density, but may find generating that energy is more difficult under oxygen limitation. One of the goals of our lab is to examine the energetic consequences of living in different habitats for bird species, including at higher elevations.

This increase is associated with lower air density at elevation, which makes it more difficult to generate the necessary lift to stay aloft. This, along with anthropogenic ecosystem changes in resources and space, can have significant impacts on the amount of energy that hummingbirds must acquire to successfully survive and reproduce.

Focus on Climate Change...

By gaining insights into how hummingbirds balance their energy budget, we can understand and potentially predict how life at higher elevations may impact hummingbird populations."

Leveraging restorative processes to adapt to climate change

Oyster reefs placed in an experiment to test shoreline protection combined with habitat, San Rafael (Photo, Stephanie Kiriakopolos)

Dr. Katharyn Boyer has studied coastal ecology and science-informed restoration for over twenty-five years. She and her students work primarily in submerged vegetation beds and tidal marshes in the San Francisco Estuary (SFE). Their studies have turned increasingly to restoration that can serve in adapting to climate change, including sea level rise and ocean acidification.

Boyer Lab and colleagues planting eelgrass at a living shorelines project, San Rafael (Photo, Stephanie Kiriakopolos)

Boyer says, "I continue as lead scientist on a new living shorelines project that includes numerous climate change-adaptive shore modifications ranging from the shallow waters to the upland transition zone.

Boyer Lab finishing eelgrass collection for a restoration project, Berkeley (Photo, Melissa Patten)

My lab also has a project to develop innovative new oyster reef designs that address the specific conditions of the SFE and maximize potential for community involvement in construction and installation.

Focus on Climate Change….

We provide workforce training in collaboration with socially disadvantaged communities, which are often in some of the lowest lying areas and thus highly vulnerable to flooding from sea level rise.

Boyer Lab heading out to monitor eelgrass restoration near the Richmond Bridge (Photo: Diaspora Arts Connection)

We also have several funded projects to evaluate restoration methods that may increase high tide refuge for wildlife during flooding compounded by sea level rise. This includes determining best methods to restore an endangered tidal marsh plant that may aid in shoreline resiliency

In addition, we are testing effects of ocean acidification and linkages between restoration of aquatic vegetation and amelioration of acidic conditions.

I am actively involved in advancing science and informing policy relating to these types of projects, including as an advisor to federal, state, and local resource and policy efforts and in the recent Resilient by Design Bay Area Challenge."

Animal and plant reporters of coastal climate change

Dr. Sarah Cohen

The increasing dynamic of climate change is bringing many changes to the marine environment including alterations such as rising temperatures, altered salinity, and increases in storm and wave intensity and frequency. What effect will all these changes have on our local shorelines on the Pacific coast of North America? Our lab focuses on these issues using many different organisms from the plant, animal, and microbial kingdoms. Much of our work is focused on the linkage between the bay and the coastal ocean via outflow of water from the bay that then impacts local outer coast environments, *e.g.*, the San Francisco Bay outflow as it impacts the San Francisco and Marin county shorelines and the outer coast organisms.

Focus on Climate Change…

Many marine organisms are sensitive to components in the bay outflow such as lowered salinity, higher temperatures, and increased sediment, as well as human-produced chemicals from urbanized and agricultural landscapes. We documented the disappearance of all the populations of the small six-rayed seastar from bay outflow associated populations in 2015-2016, at a time associated with the impact of the largest known marine wildlife epidemic ever documented: sea star wasting disease.

We are studying remaining populations of this species further north and south of the outflow to compare genetic, behavioral, and physiological features of remaining populations in comparison to those that have perished. We similarly study other organisms impacted at the bay outflow including the symbiosis between anemones and their algal partners, in a system analogous to coral reef inhabitants affected by bleaching in the tropics.

Students working in the field…

We also use disease ecology to study the relationship between pathogens and crabs, sea birds, and otters related to environmental variation and human landscape use. And, we similarly are investigating a fungal pathogen that infects seagrass, a foundation/habitat-forming species in bays. Marine diseases, like those on land, are expected to increase in impact with climate change and yet, marine pathology is severely understudied. Our work will provide environmental context and understanding of current disease levels as well as predictions related to future conditions.

Cactus-based solar energy

Charlie Chesney earned her BSc in Biology with a concentration in Zoology from SF State in 2015 and went on to work in field conservation before pursuing a MSc in Biodiversity, Conservation and Management at the University of Oxford in 2017-18. Here, Charlie turned towards emerging technologies for global wildlife conservation, focusing on blockchain and cryptocurrencies. Charlie then worked as a data analyst and in popular science media before exploring STEM education as a Climate Corps AmeriCorps fellow. She is now a PhD student in the Environmental Studies department at UC Santa Cruz where she is strengthening her interdisciplinary approach to tackling climate change and biodiversity loss.

Our changing climate is pressuring our ecosystems and our food supply. Adapting to our changing planet and mitigating climate change requires bold, interdisciplinary thinking. This is the backbone of my research with Dr. Michael E. Loik at UC Santa Cruz.

Three prickly pear stem pads stand on my patio. They are my first step in exploring if cacti can become a leading player in greenhouse gas mitigation. Cacti thrive in dry, hot conditions; their stomata open at night to absorb CO_2 and close during the day to reduce water loss to the warm atmosphere. Their thick stems and alternative photosynthetic system creates a pH gradient with potential energy. What if this energy could be captured and stored in a battery? Unlike other renewable energy systems that require large land space and tend to harm native flora and fauna, cactus-based solar energy may promote biodiversity and support food production in a changing climate.

Focus on Climate Change....

While the science may be sound, it is also important to understand the realistic potential of cactus energy. For instance, is this new solar energy system economically viable? Will small desert communities, such as those in San Bernardino, Riverside and Imperial counties, welcome or shun yet another energy system in their backyard? Understanding what motivates and concerns stakeholders is integral to finding successful, business-worthy climate solutions.

Tackling climate change requires scientists to step outside of their comfort zone. I must become a social scientist, a plant physiologist, and an electrical engineer. While my Master's in biodiversity conservation has set the stage, I'm pushed to think back to my biology, physics, and chemistry classes taken as an undergraduate at SF State. Innovative solutions to climate change require scientists to become interdisciplinary, to continually learn new concepts, and to gravitate toward ideas that may seem absurd or even impossible. Thinking boldly is the only way towards a stable climate and thriving future.

Robyn Crook receives NSF CAREER award

NSF Career award to research the linkage between sensory neuron plasticity and adaptive injury-induced behavior

In this project the Crook Lab will continue to investigate the way in which tissue injury promotes neural plasticity, and how changes in the nervous system can upregulate defensive and protective behaviors that enhance the survival of animals after minor injuries. Projects funded under the grant range from studies of the cellular neurobiology of nociception (detection of noxious stimuli) up to behavioral ecology studies of animals in their natural environment.

Tropical tank rooms

Hawaiian bobtail squid

The grant's overarching purpose is to shed new light on our understanding of how and why injury changes the brain. Wide-ranging implications include new perspectives on chronic pain in humans, and novel interventions for treating pain in human and animals alike. Studies will also inform and improve animal welfare regulations for invertebrate animals, which are currently unprotected.

Celebrating Our Successes!

Mark Chan Awarded NSF Grant

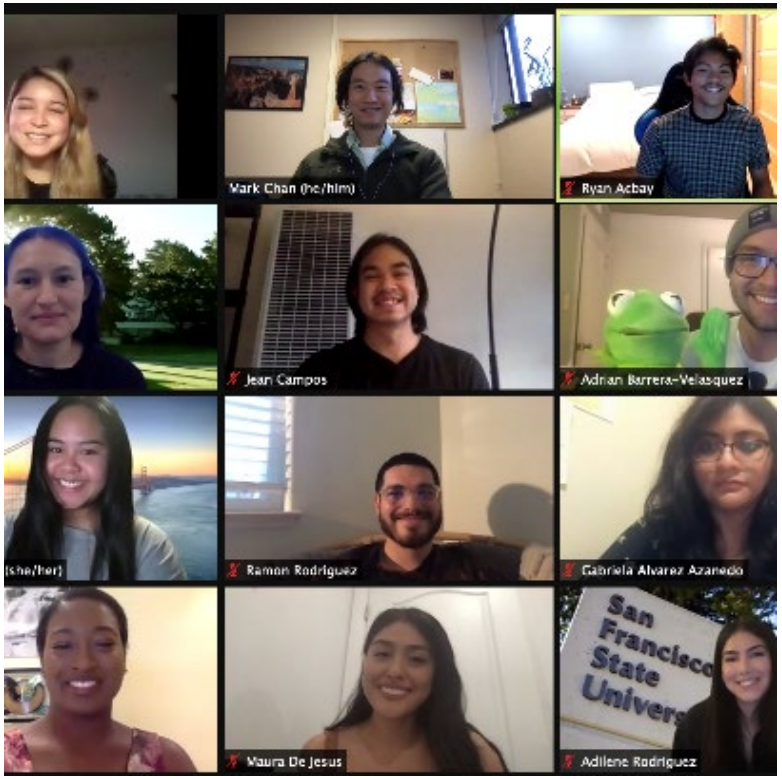
Single-celled organisms like yeast and bacteria can be engineered to synthesize complex chemicals, providing new paths to make pharmaceuticals like insulin or commercial products like vanilla flavoring. To better understand how to perform this sort of cellular engineering, the labs of Mark Chan (SFSU) and John Dueber (UC Berkeley) have entered an exciting collaborative project together. They are both members of the Center for Cellular Construction (CCC), and they share a scientific interest in understanding how cells construct internal structures, called organelles, that serve to house different types of chemical pathways

In particular, the peroxisome organelle is a cellular detoxifier, storing dangerous peroxide and free radical wastes and processing them into safer molecules. Their labs were recently awarded funding from the National Science Foundation for a 4-year project to generate tremendously large peroxisomes in laboratory yeast strains, for which they will use cutting edge techniques including rational genetic engineering and microscopic measurement & validation.

If successful, they will demonstrate key principles in how to design & construct cells for specific tasks like chemical synthesis, and generate new ideas for how to increase the storage capacity of organelles and cells for target molecules. Importantly, this project will support student learning in both labs as a primary goal, connect SFSU and Berkeley students together, and tie in to other educational projects like the CCC Summer Research Workshop hosted at SFSU.

NSF grant to study Engineering of Organelle Size with Co-PI along with John Dueber

Celebrating Our Successes!



Chan Lab Zoom Meeting

Dr. Katharyn Boyer

SF STATE Distinguished Faculty Awards

Dr. Pasion is an Associate Professor in the Department of Biology where she has been a faculty member since 2001. As a first-generation faculty member from a background that is under-represented in the sciences, Dr. Pasion deeply identifies with our students. Her commitment to them shows up in her prodigious service to the Department and College, the Campus, and the Community.

Dr. Pasion is a relentless volunteer despite the fact that service is all too often a thankless activity that is not fully recognized in the RTP process. She often takes on the critically important work that no one else wants to do. And she does it day in and day out.

Congratulations to Sally!

Celebrating Our Successes!

Dr. Boyer is a Professor at the Estuary & Ocean Science Center and Department of Biology, where she started as an Assistant Professor in 2004. According to Dr. Karina Nielsen, Director of EOS, "Dr. Boyer exemplifies the teacher-scholar model, bringing the excitement and authenticity of scientific research into her teaching." Her innovative pedagogical approaches have been particularly appreciated during this pandemic year. For example, she managed to deliver field trips virtually using a wifi hotspot, her laptop, and a smart phone. Dr. Boyer also conducted backyard "greenhouse" experiments at her home and had students monitor them via video live streaming sessions so they could get a "real" research experience. Dr. Boyer has also been involved in the development of two innovative programs, the Interdisciplinary Marine and Estuarine Sciences MS program and the Dive into Ecology and Evolution Program (DEEP) for upper division undergraduate students.

Congratulations, Kathy!

Dr. Sally Pasion

Recipients of CSUPERB grants

Celebrating Our Successes!

Dr. Ivan Anastassov will be researching… "Developmental and structural determinants of rod connectivity in the elasmobranch retina"

The retina is a thin layer of tissue that lines the back of the eye. It contains millions of cells, which perform indispensable functions for vision. Light-sensitive cells called rods and cones detect light of different levels of brightness with remarkable efficiency and send information about it through networks of other cells and eventually to the brain. Most retinas have rods and cones; we have been able to describe the arrangement and composition of the networks that connect to rods and cones. Yet, a fish called a skate has a retina with only rods, and has therefore presented us with a new question: how do rods establish a network of connections in the absence of cones? This project will begin to answer this central question by looking at what genetic and anatomical characteristics of the skate retina can provide possible explanations. By examining this unusual retina we will provide fundamental knowledge about the evolution of visual systems and describe novel pathways for the processing of visual information.

Dr. Alejandro Vélez Meléndez will be researching…"Hearing in the Cacophony: Assessing Evolutionary Responses to Urban Noise"

Noise generated by human activity has increased dramatically over the last decades and is considered a major source of pollution. Such high levels of noise can have negative effects on animals, particularly those that communicate with sounds. Several studies have investigated how human-generated noise can impair the recognition of vocal communication signals. Interestingly, some studies have shown changes in signals from animals that live in cities that help them cope with the negative effects of noise. Whether and how the sense of hearing can change in response to human-generated noise is not known. For this study, we will compare the calls and the hearing abilities of Pacific tree frogs frogs that live in urban and rural regions across the San Francisco Bay Area. We will also study whether such changes in calls and hearing abilities allow animals to communicate easier in noise. This study will further our understanding of how sensory systems respond to novel, human-induced environmental changes.

Dr. Joseph Chen will be researching… "Developing a new portfolio of biopolymers".

Biopolymers are ingredients commonly found in foods and cosmetics as thickening or gelling agents. They can come from plants, animals, or microorganisms. For example, gelatin (from animals) gives gummy bears their chewiness, while xanthan gum (from bacteria) helps make lotions silky and gluten-free baked goods less crumbly. Growing aversion to animal products has prompted companies to create plant-based substitutes for meat and dairy, but these companies need ingredients that generate desirable textures in their products. ExoPolymer is a company working to provide these new ingredients. The proposed partnership between San Francisco State University and ExoPolymer will examine beneficial bacteria found in soil and on plants as potential sources for these new thickening agents with the hope of finding better and cheaper substitutes for current biopolymers. The collaboration will also enable students to gain hands-on experience in the biotechnology industry.

Blake Riggs
1000 Most Inspiring Black Scientists

"One of our jobs as scholars at SFSU is to train the next generation of scientist."

Dr. Blake Riggs, Associate Professor of Biology was selected by the Community of Scholars as one of the 1,000 most inspiring Black Scientist in America.

Dr. Riggs has dedicated his career to uplift Black students in Science Technology Engineering and Math (STEM) and continues to support efforts increasing diversity and equity in science.

Congratulations Blake for this accomplishment.

Celebrating Our Successes!

After 25 years of service to San Francisco State University and 17 years of partnership the SEPAL – Science Education Partnership and Assessment Laboratory, our beloved SEPAL Program Administrator – Trisha DeVera – will be retiring.

Many have been impacted in some way by her amazing professional efforts. For those more deeply involved with SEPAL as graduate students, visiting professors, postdoctoral scholars, and collaborators, Trisha has no doubt been instrumental in your learning with SEPAL in more ways than can be counted over the years.

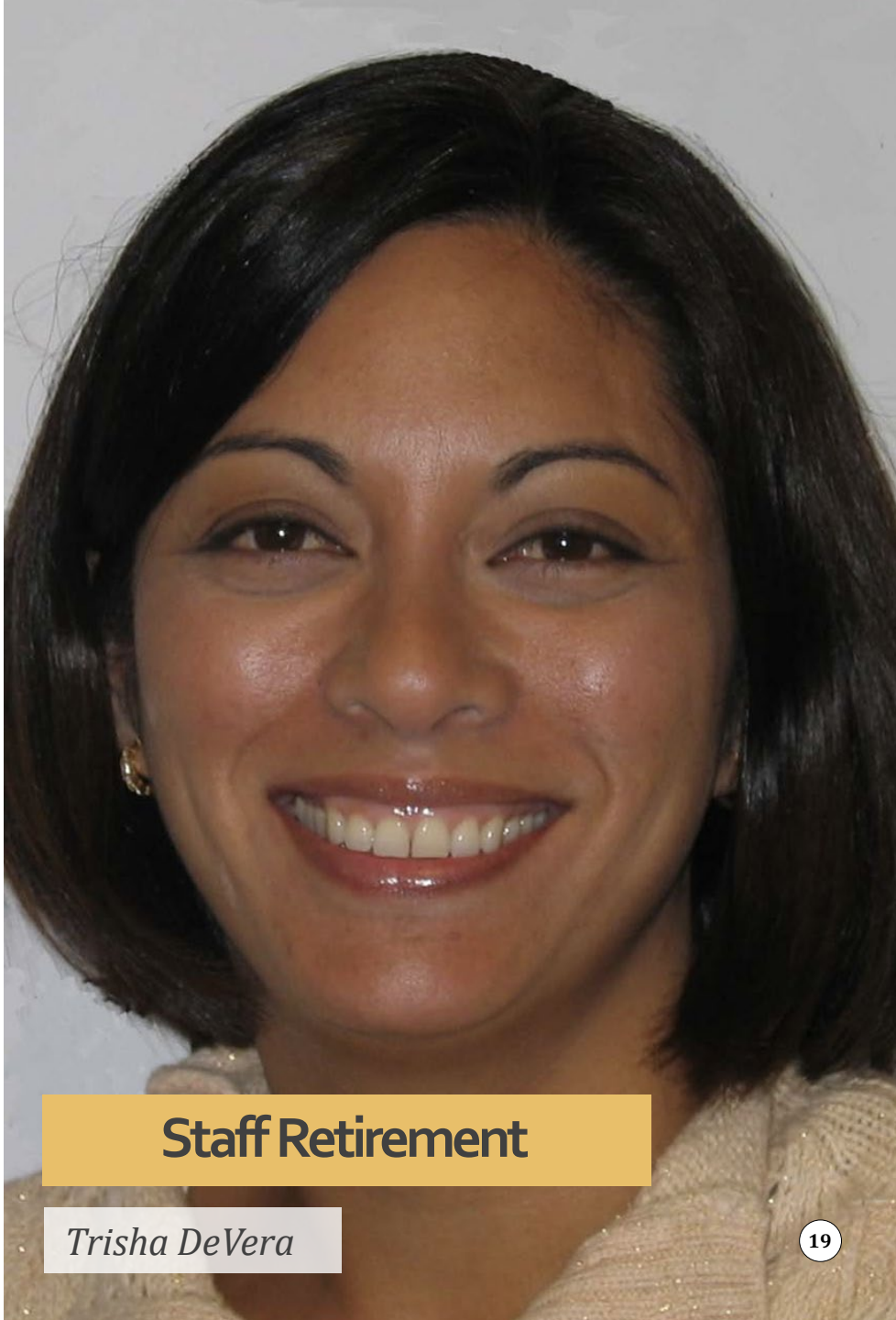
Trisha you will be missed!

SEPAL

The Science Education Partnership & Assessment Lab
San Francisco State University

SEPAL staff

Faculty, Staff, Alumni, and Students



Staff Retirement

Trisha DeVera

Faculty Retirement

JR Blair

J.R. Blair retired from the Department of Biology faculty in December 2020. Having received his B.S. at the Evergreen State College in Olympia, Washington in 1983, he decided to return to school to get an advanced degree in 1995, choosing San Francisco State. He joined the lab of Dr. Dennis Desjardin shortly thereafter. He attained his M.A. in Biology with a concentration in Conservation Biology in December 1999. His thesis was Fungi Associated with *Arctostaphylos* in Northern California in which he spent two seasons making over 400 collections of about 135 species of mushrooms that were growing under and on Manzanita plants.

Faculty, Staff, Alumni, and Students

He caught the teaching bug while serving as a Graduate Teaching Assistant for World of Plants, Principles of Ecology, and Biology 240 laboratories over the next few years. In the fall semester of 1999 he officially began his career as a Lecturer in the Department of Biology. It was in that semester that he began his position as lecturer, lab coordinator, and lab instructor for World of Plants, an assignment he held every semester until his retirement. Other classes he taught over the his 21 years on the Biology faculty were Introductory Biology I and II labs, Human Biology, Nature Study, Ecology of California, Ornithology, and Natural History of the Vertebrates.

In 2010 he was hired as Director of the Sierra Nevada Field Campus. In that capacity he worked toward increasing the educational and research footprint of the facility, a winning format that was artfully designed by his predecessor, Jim Steele. Although the COVID-19 pandemic interrupted the long-time educational program, the Field Campus has generated a terrific reputation for its innovative and inspiring classes and workshops with an emphasis on field experiences. It continues to serve as a home base for several research endeavors and next summer, if all goes well, it will once again be a destination for hundreds of lovers of learning in the summer of 2022.

J.R. continues to be involved with the Field Campus as a volunteer advisor for the new Interim Director, Amber Johnson. Although there are some obvious impediments to his aspirations as an active retiree due to COVID restrictions he is looking forward to being involved with the Mycological Society of San Francisco Fungus Fair that is scheduled for next January, serving as a docent at the Fitzgerald Marine Reserve in his hometown of Moss Beach, volunteering at the Alemany Farm in San Francisco (a long-time field trip destination for World of Plants), and spending some quality time on the ice-skating rink. However, most importantly, having extra time plus being fully vaccinated has enabled him to spend more play-time with his fun-loving granddaughter, Naomi. "Nothing like a four and a half year old to help keep an old guy feeling young!"

Great Wall of China

Dr. Eric Routman has retired after 26 years with the SF State Biology Department. Dr. Routman earned his Ph.D. in Population Genetics from Washington University in St. Louis. After a postdoc at Washington University School of Medicine he joined the SF State Biology Department in 1990, where he taught Evolution, Herpetology, and Population Genetics.

Dr. Routman's research in population genetics focused on using DNA sequencing to study evolution of salamanders, frogs, lizards, snakes, mice, fish, *E. coli*, and broccoli. With his students and colleagues, he has published 50 papers on topics as diverse as the role of epistatic gene action on additive genetic variance, the use of DNA sequences to separate ecological from evolutionary processes, the ecology and phylogeography of endangered species, and the role of selection in the maintenance of genetic diversity.

Dr. Routman mentored over 30 Masters students and numerous undergrads in his laboratory at SF State. He is hoping to spend his retirement traveling and continuing his research in the Mojave Desert.

Catching a rattlesnake

Catching lizards

Mojave Desert fieldtrip

Faculty Retirement

Dr. Eric Routman

Faculty Retirement

Dr. Dennis E. Desjardin

Dr. Dennis E. Desjardin retired from SF State after 30 years as Professor in the Department of Biology, and Director and Curator of the H.D. Thiers Herbarium. He was born and raised in Del Norte County, CA, where he developed his love of fungi, collecting mushrooms from the age of three with his immigrant grandparents. He attended San Jose State from 1968–1971 as a math major, then dropped out to play music and build homes in the Bay Area. After a ten year hiatus, he returned to college to study mycology with Dr. Harry D. Thiers at San Francisco State, earning a BS in Biology–Botany (1983) and a MA in Ecology and Systematic Biology (1985). He received a PhD in Botany from the University of Tennessee in 1989, then taught at Oberlin College for one year.

Faculty, Staff, Alumni, and Students

Dr. Desjardin returned to his alma mater in 1990 to continue Dr. Thiers' legacy of mycological teaching and research. At State, he taught numerous general biology, botany and mycology courses at both undergraduate and graduate levels, mentoring 23 Masters and 5 PhD students of which 68% were female and 25% were from under-represented minority groups. His research focuses on the distribution, ecology and evolution of mushroom-forming fungi. Supported by eight National Science Foundation grants, he has conducted field studies in the Hawaiian Islands, Micronesia, Indonesia, Thailand, Malaysia, West Africa, Brazil and western USA.

Glow in the dark mushroom

He has published over 150 refereed scientific papers, described over 300 new species of mushrooms, and co-authored two popular field guides, *Mushrooms of Hawaii* and *California Mushrooms*. Over the past decade he has become recognized as a world's authority on bioluminescent fungi. Dr. Desjardin was the first recipient of SF State's Distinguished Faculty Award for Excellence in Professional Achievement, and he is an elected Fellow of the California Academy of Sciences and the Mycological Society of America. In retirement, Dr. Desjardin intends to continue his research on mushroom systematics, hone his musical abilities, and travel the world with his wife.

Dennis with Panaeolus in elephant dung, Thailand

Alumni Accomplishments

Faculty, Staff, Alumni, and Students

Doug Ripley, B.A., Ecology in 1967 and M.A. in Ecology in 1969

A native of San Francisco, James graduated from Lowell High School in 1963 and subsequently enrolled at San Francisco State University. By the time, he started his college career he had decided to major in biology with an emphasis on botany. "The SFSU Biology Department met all of my needs wonderfully thanks to the personalized attention I received from its exceptional faculty."

Upon completing the B.A. degree in 1967, Doug began working on a Master's degree, which he earned in 1969. "My major professor was Dr. James Sweeney who skillfully and sympathetically guided me in my studies of plant ecology. My graduate course work in botany was provided by other very capable members of the Biology Department to whom I am extremely grateful (Dr. Harry Thiers, Dr. Eva Esterman, Dr. Douglas Post, Dr. George Oberlander, and Dr. Arthur Nelson)."

In 1969, Doug entered active duty in the U.S. Air Force for what at the time he believed would be a four-year assignment. However, thanks to a number of very fortunate circumstances, he wound up having a 35-year career in the Air Force that provided him with many adventures and opportunities to pursue interests in the natural sciences.

Doug secured a position teaching biology at the United States Air Force Academy. As part of his Academy assignment, the Air Force unbelievably sent James to graduate school to obtain a doctorate degree in plant ecology, which he completed at Oregon State University in 1983.

Doug Ripley's mentor, Dr. James Sweeny

"I remained at the Academy for ten years but eventually was reassigned to the HQ Air Force in Washington, DC where I was responsible for managing the natural and cultural resources conservation programs on Air Force lands. With over 130 installations occupying approximately eight million acres of land, much of it of exceptional environmental quality, the Air Force has a very important responsibility to ensure the protection and sustainability of its lands."

After retiring from active Air Force duty in 1991, James transferred to the Federal Civil Service and continued working for the Air Force until retirement in 2004. "My wife and I eventually decided to settle in Southeastern Arizona where we built a home in the Dragoon Mountains of Cochise County. Since moving to Arizona, I have engaged in some modest environmental consulting work and have performed volunteer work for local environmental organizations such as the Arizona Native Plant Society. For the past few years, I have been working on a small independent botanical research project with the assistance of the University of Arizona, which consists of preparing a flora of the Dragoon Mountains."

Alumni Accomplishments

Faculty, Staff, Alumni, and Students

Jacky Lo
B.S. Microbiology, 2017
M.S. Microbiology, 2019

Jacky Lo, MS'19, arrived at San Francisco State University (SFSU) expecting to follow in the footsteps of his family by pursuing a career in health care. One incredible microbiology course quickly redirected his educational journey and shaped his scientific career path. "Please be careful with the new microscopes, they are $6,000 each," Dr. Govindan cautioned her microbiology lab students. Working with expensive equipment was an eye-opener, and Jackie was captivated by the wonders of microorganisms. He spent the rest of the class adjusting every part of the microscope and observing *Euglena* swimming.

During his undergraduate studies (2016), Jacky learned how microbiology affects the environment from his mentor Darleen Franklin.

He engaged in research for the first time as part of Dr. Lily Chen's lab, joining a team investigating the bacterial diversity of the Bay Area Rapid Transit (BART) system. This research was reported on by KTVU Fox2 News: "Unusual bacteria found on San Francisco public transit." Dr. Chen encouraged Jacky to apply to a master's program after graduation, in order to get broader exposure to applied microbiology. Because of the amazing and dedicated team of faculty and staff in the biology department, Jacky chose to remain at SFSU for his graduate education.

During his graduate studies, Dr. Chen often shared personal experiences relating to her studies, research, and her passion for biology, and Jacky remains extremely grateful for her unyielding support.

As a graduate student, Jacky also had the opportunity to teach, encourage, and help undergraduate biology students succeed as new scientists. This role included providing direct mentorship to students with independent research projects, and training and supervising laboratory fellows.

Following graduation, Jacky has been fighting the COVID-19 pandemic at the Lawrence Livermore National Laboratory (LLNL) as a Biomedical Scientist. His work combines bioscience, bioengineering, and high-performance computing in the support of two research projects: 1) the development of an artificial intelligence-driven computational design platform, which is being used to optimize the binding of antibodies to the COVID-19 virus; and, 2) the use of molecular docking, molecular dynamics simulations, and machine learning in the identification of possible candidate compounds, from a library of 26 million molecules, that may attenuate or neutralize the effects of the virus.

Jacky's work includes transfecting mammalian cell lines for protein synthesis, purification on fast protein liquid chromatography, performing high throughput ELISA, and biolayer interferometry to measure biomolecular interactions between antibodies/small molecules with Coronavirus antigens.

Since joining LLNL, Jacky has received two awards for his extraordinary skill and demonstrated dedication. He received the Spot Award from his division and the prestigious Secretary's Honor Award, which is the highest internal recognition that Department of Energy (DOE) employees can receive and recognizes their service and contributions to the Department's mission and the Nation. Recipients of these awards are traditionally honored at an annual ceremony in Washington, DC, but due to pandemic restrictions it was held virtually this year.

In his off time Jacky participates in Spartan obstacle course racing. He has participated in many races winning countless medals.

New species of fishes that Tyler Phelps described while a graduate student at SFSU.
1 – *Luzonichthys kiomeamea* 2 – *Chromis mamatapara* 3 – *Plectranthias polygonius*
4 – Plectranthias hinano

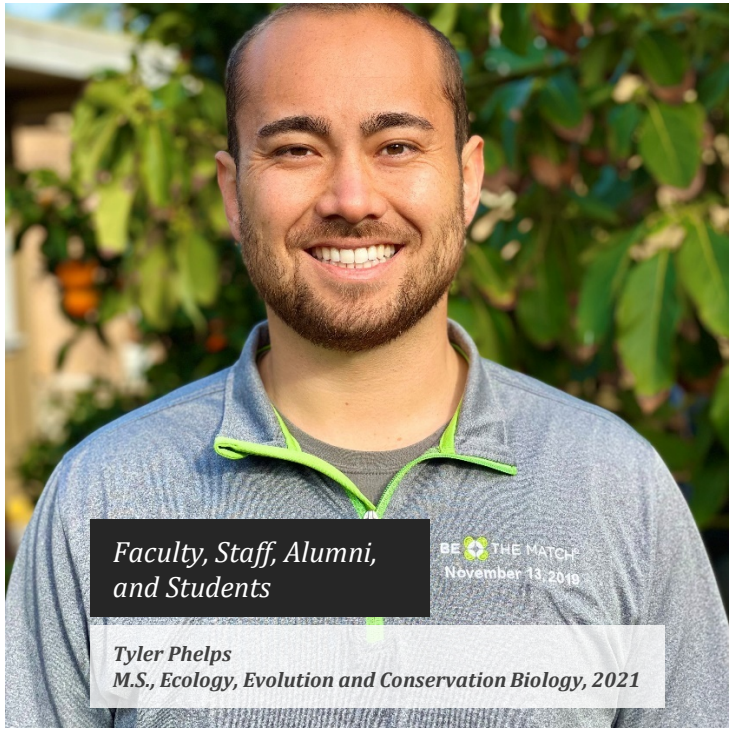
Alumnus Tyler Phelps was an ARCS scholar while at SF State and is grateful to be one of about a dozen scientists in the world using advanced diving technology to study coral reef fish communities at depths of up to 500 ft. These deep coral reefs, also called "mesophotic coral ecosystems," remain largely unexplored due to the challenges of accessing these depths. Dr. Luiz Rocha, whose lab at the California Academy of Sciences has been researching fish ecology and evolution on deep reefs around the world, is Tyler's mentor. Their expeditions to remote localities has resulted in the discovery of many new species, some of which are on display at the Steinhart Aquarium in Cal Academy. During Tyler's graduate studies, he investigated how the community structure and ecology of fishes changed across depth gradients. While on their deep dives, Rocha, Phelps and his lab mates would only have 15 to 30 minutes to survey the fish communities at 150 meters. They needed to complete four to six hours of decompression before being able to analyze their data.

Tyler focused on the ecology of fish communities from Guam, a U.S. island territory in the western Pacific. Contrary to previous studies in Guam, Tyler found the deep reef fish communities to be ecologically distinct from shallow populations with community structure driven predominantly by depth and temperature. His comparison to Pohnpei, a Micronesian island country, served to highlight the precarious situation of Guam's coral reefs and the need for increased conservation. During his graduate studies at SF State, Tyler conducted two field samplings in Hawai'i, two expeditions to French Polynesia (Tahiti and Mo'orea), the Marshall Islands, Brazil and Curacao. He has now co-authored an impressive nine scientific publications. A highlight of his papers includes the description of five new fish species.

Alumni Accomplishments

When asked why he decided to come to SFSU, Tyler said, "It allowed me to work with my advisor, Luiz Rocha at the Cal Academy who leads one of the most active labs studying fish communities on deep coral reefs. Being part of a university that celebrates its diversity and challenging the "status quo" resonated with me and was also a large factor at why I chose SF State."

"I have so much gratitude to all my amazing mentors and colleagues at SF State. I am a completely different person today because of Dr. Karen Crow and Dr. Kimberly Tanner. Dr. Crow's Biology of Fishes class challenged me to think about evolution in ways I had not considered before. From day one Dr. Crow has been my loudest advocate and support system at SF State and I owe so many of the unforgettable opportunities at SF State to her! Dr. Tanner's Science Teaching for Scientists class transformed me into a better educator, presenter and person. She inspired me to challenge the "norms" in the classroom and our society."



Soon to be summer 2021 graduate of SF State with a Master's of Science in Ecology, Evolution and Conservation Biology.

Morgan's research looks at plant pollinator interactions within the Presidio of San Francisco in an effort to inform best management practices. Morgan currently teaches high school environmental science and honors marine biology in Orlando, Florida.

While she has always wanted to incorporate education into her career, she was really inspired to begin teaching after taking science education classes taught by Dr. Kimberly Tanner and the outreach programs she was able to assist with through Dr. Gretchen LeBuhn's lab.

Morgan and Rocky

Morgan and Rocky

Morgan recalls the many wonderful memories of her time at SF State from late night study sessions in the lab with peers to camping in the desert with her Plant Taxonomy classmates. "One memory that sticks out is having the opportunity to talk about bees with a group of elementary school students. Speaking with those students, and seeing their curiosity about nature, combined my love of pollinators and conservation education which really got me even more excited about my future (now current) career."

In addition to teaching, Morgan is keeping herself busy as the leader of the sustainability initiative at the school where she is currently teaching; visiting lots of theme parks, and as a dog mom to her sweet pup, Rocky.

Morgan Maria Belle
M.S., Conservation Biology, 2021

Adrienne Le
B.S. Cell and Molecular Biology, 2017
M.S. Microbiology, 2019

Congratulations to Adrienne Le on being accepted to the University of Washington Molecular Medicine and Mechanisms of Disease (M3D) PhD program! Adrienne earned her BS in CMB and her MS in Microbiology at SF State and was a phenomenal leader in the SACNAS club during here time here.

Faculty, Staff, Alumni, and Students

Alumni Accomplishments

Abdulmajid Alrefaie
B.S. Cell Molecular Biology, 2017

Abdulmajid Alrefaie graduated from SF State with a degree in cellular and molecular biology in 2017. He earned his MSc degree in Biotechnology from Johns Hopkins and just started a Ph.D. program at the University of Maryland, majoring in Molecular Environmental Science and Technology.

Congratulations Abdulmajid!

Frederick Santana, was awarded a prestigious Ford Fellowship while pursuing his PhD at UCSF. Before coming to SF State to complete his undergraduate and master's degrees, Fred worked at Starbucks for nine years while earning his Associate's Degree at CCSF.

Congratulations Fred!

Frederick Santana
B.S. Microbiology, 2017
M.S. Cell and Molecular Biology, 2019

Jordan Greer published his MS thesis work in Microbial Ecology. Jordan received his undergraduate degree from UC Riverside in Ecology and Evolution. His thesis focused on bacterial transmission via maternal care in the maritime earwig. Jordan is currently working in science communication for Cell Press.

Parental Care Alters the Egg Microbiome of Maritime Earwigs

Jordan A. Greer, Andrea Swei, Vance T. Vredenburg & Andrew G. Zink

Jordon Greer
M.S., Physiology, 2017

Alumni Accomplishments

Faculty, Staff, Alumni, and Students

Dwayne Evans
M.S., Microbiology, 2018

Congratulations to Dwayne Evans, who was awarded a prestigious Ford Fellowship. Dwayne graduated from SF State with a Master's in Microbiology in 2018. He is now a PhD student in the Biological and Biomedical Sciences Program at Harvard Medical School.

Way to go, Dwayne - we are so proud of you!

Stephanie Seng
B.S., Cell Molecular Biology, 2019

Stephanie Seng graduated from SFSU with a Bachelors in Cell and Molecular Biology and minored in Chemistry and is now almost done with her MS in CMB. She will be joining the Ecology and Evolutionary Biology department at UC Irvine this fall, merging her interests in CMB and ecology. Stephanie has been a RISE and Genentech scholar through SEO and also an ARCS scholar.

Congratulations to Stephanie on the great work and your admittance into the PhD program at UC-Irvine!!

Laurence Henson came to SF State from the Philippines knowing that he wanted to be a doctor. Alas, as his English was not so good, he signed up to be a Hospitality major! He quickly recognized his error and switched to Biology and from there on out, he knocked it out of the park. He completed his MD at UCSF and is now slated to start in his top choice residency program. He also gives back to the SF State community in a number of ways.

Congratulations, Laurence!!

Laurence Henson
B.S., Physiology, 2015

Alumni Accomplishments

Recipient of the UCSF Mentorship Award

Muryam Gourdet
M.S. Cell Molecular Biology, 2016

Muryam Gourdet, a former MS student in the Department of Biology, was recently awarded the mentorship award!!

Muryam's life story is remarkable. She is the daughter of Haitian immigrants. She and her sisters were raised by a single mother who never had the opportunity to attend college. As a young single woman independently pursuing a college degree, she endured staggering personal challenges. She lived on her own, supported herself, and financed her own education. To do so, she worked at least one full-time job and oftentimes even more than that. She was pregnant, lacked secured housing and almost always perched on the brink of financial disaster.

Muryam faced roadblocks that would have stopped most of us in our tracks, but she had the courage to persevere and excel. Though it would be easy for someone in her shoes to be angry or frustrated with the world, she is upbeat and positive, and yet authentic. Her life experiences positioned her to be an empathetic mentor and an inspiration to everyone she knows.

Since graduating from SF State, Muryam

Faculty, Staff, Alumni, and Students

has been actively involved as a mentor. In this role, she has had a profound and expansive effect on students' views regarding the world of science and scientists. Muryam often arrives to meet with students with her daughter in tow. The all too uncommon appearance of a mother with a child, in a science classroom, immediately captures the attention of students. Muryam openly shares her story and describes the weighty challenges she faced as an undergraduate student. She explains how, with the help of many mentors, she navigated her way to and through her BA and MS and then on to a PhD program. She has also helped out with some of our HHMI-funded efforts at SF State, serving as a mentor for our LEADs students, who are enrolled in a service-learning course in which URM students partner with faculty to create culturally inclusive materials for their classes. Muryam was a near-peer mentor with a personal story of perseverance in the sciences. Her presence and her narrative helped to show that students with similar backgrounds can be successful. Muryam is an amazing role model for students who never imagined that someone who looks like, talks like, and acts like them could be a world class scientist. Students at SF State and beyond are captivated and inspired by Muryam's presence.

In addition to her visits to campus, Muryam has served as a near-peer mentor for a number of our student training programs. For instance, she served as a teaching assistant for the NIH sponsored Bridge to Baccalaureate program at San Francisco State University. In 2018, she helped organize two tours of UCSF laboratories: one for SFSU Bridge to Baccalaureate students, and the other for HNU students. One of the HNU undergraduate students was so enthused by what he saw and heard, that he applied to and was accepted into SFSU's summer REU program and made plans to pursue graduate study in neurobiology! She also regularly visits with MARC and RISE students on the SF State campus. Muryam has also been busy building partnerships for high school students. She has been developing a program whereby graduate students and postdoctoral fellows meet with high school students to discuss opportunities in STEM and give "chalk talks" regarding their current research. With the aim of diversifying the sciences, Muryam is targeting these efforts at high schools, which serve students from traditionally underrepresented groups. It is a win-win: the high school students see STEM role models and meet potential mentors, and the graduate students practice speaking about their research to a lay audience. Muryam's grassroots mentoring efforts, aimed at broadening participation in science, are innovative, effective, and amazing. Muryam's passion is to change the face of science. She is helping countless students, mostly from URM backgrounds, navigate this largely uncharted territory. Her presence and her insights are tremendously inspirational to these students and provide a beacon for them to follow.

Congratulations to Muryam on this well-deserved award!