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## GREETINGS

We hope this newsletter finds you in good health and good spirits. We have many things to tell you about and enjoy gathering items to share with you in our annual newsletter. Our current and former students make us proud and we are so pleased to keep everyone up-

to-date and connected with what's going on around here.

Most of our alumni will count their former Biology classmates and professors as some of their dearest friends and many of these friendships have lasted multiple decades. We are happy to report that experiences in the department of biology continue to inspire close friendships. In fact, this school year kicked off

with the new BIONeer Mentorship Program and these mentor-protégé partnerships have streamlined the integration of new students into our department and campus community.

We celebrate the many and diverse people who have spent time in Clark Hall. Truly "Where Nature and Revelation Unite in Education" is our legacy.



# DEPARTMENTAL HIGHLIGHTS

## BIOneer Mentorship Program

This is the inaugural year for the department of biology BIOneer Mentorship Program. This program matches upperclassmen mentors with new student protégés. Student mentors help protégés to successfully navigate PUC and the department of biology. The program is designed to foster personal relationships among biology students, with a spiritual and academic emphasis. This program is the result of a student-led initiative that began with a conversation in the senior capstone class in winter 2018.

This year-long mentoring program is available to any student new to the department of biology (B.A. and B.S. Biology, B.S. Environmental Studies, & B.S. Biotechnology) in 2018-19 and is for first-year and transfer students alike! In total, nearly 30 new students have participated since the beginning of the school year. We currently have 17 dedicated mentors who have spent many hours over the last few months giving advice and comfort to their protégés.

BIOneer participants receive tickets to the Dining Commons and the Grind for a free meal and hot beverage. The idea is the partners will meet over coffee or a meal to chat. Most frequently the students keep in touch by text, checking in with each other whenever they feel necessary.

The department is committed to bringing these students together, and we sponsor BIOneer events throughout the quarter. For example, students enjoy light refreshments, play several



Bioneer Mentor Jefferson Richards and his protegé Daniel Loncar.



team-building games, and win prizes at BIOneer mixer events. A quarterly department Colloquy has BIOneer mentors and biology faculty present advice and information critical to success at PUC, in the major, and beyond. Select biology faculty also host a quarterly Friday evening vespers where a delicious meal is served! There are several other opportunities for students to interact with the larger group, typically organized around the latest holiday. In all, the BIOneer partnerships have been successful, and these connections benefit both parties. Here is an example:

### Jefferson Richards (mentor)

I enjoy being a BIOneer mentor because it allows me to serve new biology students. As a freshman, I was blessed to have several upperclassmen friends who were able to give me advice on study habits, class scheduling, and adjusting to life as a biology major. Being able to pass on lessons I have learned and seeing those lessons lead to success in my protégés life is personally fulfilling. I am thankful to be part of the BIOneer program, I believe it is one of many things that makes the department so special.

### Daniel Loncar (protégé)

Joining the BIOneer program is a great way to get to know your professors and upper-class students. They are willing to help any student out in a moment, and they give great advice to any problem. Also, your personal mentor becomes your friend. Jeff and I talk to each other and grab lunch or dinner together whenever we can. He has given me great advice which has made me a more successful student. It's nice to be able to talk to someone who has gone through the same classes. The teambuilding activities and rewards are nice as well, and the BIOneer vespers is quite enjoyable!

I've gotten to know other mentors and students through these meetings. I strongly recommend each new student to sign up to become a BIOneer protégé because your first year at PUC will be a lot more enjoyable!

## Your Donations Make a Difference

Because of your generosity, we purchased two (gently used) instruments within a few weeks of each other in April 2018. First, our existing tabletop centrifuge stopped working, and though Dr. Backil Sung went to great lengths to fix it, we needed a replacement. We now have a working and dependable centrifuge. This crucial instrument is used by many of our labs and is used regularly by Biological Foundations, General Microbiology, Medical Microbiology, Biotechnology I & II, Immunology, and for research.

We are very excited to add a new instrument to our lab, a Real-Time (RT) PCR machine known to be the most sensitive technique for mRNA detection and quantification currently available. Compared to the two other commonly used techniques for quantifying mRNA levels, RT-PCR can be used to quantify mRNA levels from much smaller samples. In fact, this technique is sensitive enough to enable quantification of RNA from a single cell. This instrument is most used in Biotechnology I and II, Genetics, and for research.

In summer 2018, we replaced another eight microscopes. You may remember we did the same in summer 2017. Because of your support of our program, the Microbiology lab is now fully equipped with the latest model of compound Nikon microscopes!



Donations have also made additional faculty and student research possible. With your help, we have funded travel associated with field research in Alaska and Mexico for six students and two faculty. These projects, kleptoparasitism and commensal associations respectively, are described elsewhere in this newsletter.

Two students were awarded a 2018 Summer Undergraduate Research Fellowship (SURF). This fellowship includes four units of academic credit, a stipend to cover summer living expenses, and a sizable scholarship. SURF students work full time on their research project for much of the summer. Both students participated in Dr. Sung's ongoing research of *C. elegans* reported on in this issue and previous newsletters.

Our department continues to thrive, and we appreciate the many direct and indirect ways you show your support for our students, faculty, and program. We are incredibly fortunate and blessed to be part of such a wonderful community. Thank you!

# 2018 GRADUATES

The class of 2018 included 22 biology majors and one environmental studies major (yay for Ernest!). As usual, this is a distinguished class which has since gone on to pursue a variety of academic and professional interests. Several started professional or graduate school in fall 2018, and others have entered the workforce.

The class of 2018 and biology faculty. (L to R back row) Jeff Grabow, Gavin Skeoch, Stephanie Lee, Celeste Beliard, Graham Foster, Dr. John Duncan, Christian Tran, Dr. Floyd Hayes, Joshua Lara; (middle row) Dr. Bryan Ness, Shannon Henry, Sabrina Mostoufi, John Jung, Gabriel Cenicerros, Dr. Robin Vance, and Dr. Scott Herbert; (front row) Dalia Hernandez, Erika Thalman, Zoe Morphis, Emily Hong, Michelle Tang, Rebecca Chin, Chelsea Paclibar, Ernest Simanungkalit, and Professor Aimee Wyrick. Not pictured: Jeremy Doan, Brandon Kim, Sierra Trogdon, and Jin-Soo (Dan) Park.

# BIOLOGY CLUB

Uniting biology lovers across campus, the PUC Biology Club provides opportunities for students to connect, grow spiritually, and participate in hands-on and exciting outdoor activities. The Biology Club kicked off the year with a great start. During the first week of school, the club grew by more than 35 new members, and the sale of succulents at Fall Fest netted the club a record amount. During fall quarter the club led a pre-vespers worship services and screened "A Night of the Museum" movie in PUC's very own Hansen Museum. Most recently, the club embarked on their annual Albion Field Station adventure. With about 25 members in attendance, the trip was more than a success. The weekend was filled with tide pooling at Glass Beach, hiking to a Mendocino waterfall, and participating in insanely fun and competitive canoe races. With plenty of spirit and camaraderie, the club's focus on God's creation and fellowship remained at





the center of each event. The club is looking forward to its future events which include a day trip to the California Academy of Science Museum in San Francisco and a restoration project in PUC’s beautiful backyard.

## PUC FOREST

PUC has recently completed a conservation easement on 856 acres of its forest and is working to conserve an additional 240 acres of woods. The PUC forest has long been one of the school’s best resources, which can support community and alumni relations, academics, student life, and spiritual life here on campus. PUC is now actively practicing forest management, putting a strong emphasis on being a good steward of our land. As PUC grows into the future, the forest will play an increasingly important role in the mission of the school as something that truly makes PUC stand out as a special place to learn and grow.

## RECENT FACULTY AND STUDENT CONFERENCE ATTENDANCE, SCIENTIFIC PUBLICATIONS, AND PRESENTATIONS

### Dr. Backil Sung

I a research study in a peer-reviewed journal a (<https://www.ncbi.nlm.nih.gov/pubmed/29604467>) about Parkinson’s disease by collaborating with an international research team. The topic was how an abnormal protein aggregates in and degenerates nerves that it inhibits to secrete dopamine, a signal molecule as a neurotransmitter in the brain from the nerves. Parkinson’s disease is one of neurodegenerative disorders, which develops neurological symptoms when the nerves at the substantia nigra in the brain does not release dopamine that modulate motor behaviors. Alpha-synuclein, a protein that is abundant in the brain though with its unclear function, is known to form Lewy bodies, the pathological hallmark of Parkinson’s disease. Our study suggested that a kinase enzyme, serum- and glucocorticoid-inducible kinase 1 deficiency induced by its gene expression reduction

increased alpha-synuclein that resulted in declining release of dopamine, which is typical pathologic mechanism in Parkinson’s disease. This conclusion implies a possibility to reveal a path to discover the pathogenesis mechanism to Parkinson’s disease, a severe neurodegenerative disease suffering so many patients in this world.

### Dr. Floyd Hayes

During 2018 I managed to publish eight research papers in peer-reviewed scientific journals. Three of the research papers resulted from an ongoing 9-year research project with students on the breeding biology of the western grebe (*Aechmophorus occidentalis*) and Clark’s grebe (*A. clarkii*) at Clear Lake, California. In an article published in the “Journal of Ethology” with student coauthors Dylan Turner, Nathan Zimmerly, and Manuel Peralta, we quantified the nocturnal courtship, copulation, and egg laying of the grebes based on photos from motion-activated cameras, and we evaluated seven potential hypotheses for why the grebes engage in nocturnal reproductive activities. In another article published in “Wetlands Ecology and Management” with students Dylan Turner, Douglas Weidemann, Nathan Zimmerly, Manuel Peralta, Daniel Stoppelmoor, and Mychal Hellie, we documented the ecological roles of 47 species of vertebrates using the grebes’ nests, demonstrating the grebes are ecosystem engineers because they alter the environment and provide resources for other species. And in an article published in “Western Birds” with students Dylan Turner, Nathan Zimmerly, Manuel Peralta, and Mychal Hellie, we documented seven instances of male grebes destroying grebe eggs and evaluated several potential hypotheses for why they engage in such a strange and seemingly spiteful behavior.

While studying the grebes from 2010 to 2018, I also documented the relative abundance of invasive red-eared sliders (*Trachemys scripta elegans*) and native western pond turtles (*Emys marmorata*) at various sites along the shores of Clear Lake and adjacent wetlands, where the two species have coexisted for half a century. The results were published in “Chelonian Conservation and Research” with former students and PUC alumni Dylan Turner and Douglas Weidemann.

In 2016 I traveled to Paraguay with students Erika Thalman and Emily Castellanos to study the taxonomic status of Paraguay’s only endemic bird, the chaco nothura (*Nothura chacoensis*), which other colleagues and I suspected was a subspecies of the spotted

nothura (*N. maculosa*). During the trip, we recorded its vocalizations and subsequently compared them with the vocalizations of other nothura species. We also examined a series of specimens of both taxa borrowed from two American museums. The evidence supporting our conclusion the chaco nothura is merely a subspecies of the spotted nothura was published in “Zootaxa” and subsequently accepted by the South American Classification Committee of the American Ornithological Society.

Alumnus and PUC Forest Manager Peter Lecourt used his expertise in geographical information systems to assist me with a research paper documenting rapid southward and upward range expansion of a tropical songbird, the thrush-like wren (*Campylorhynchus turdinus*), in South America. The evidence supporting our conclusion that its range expansion is due to either habitat or climate change (we are uncertain which is more important) was published in “Revista Brasileira de Ornitologia.”

I also published two short notes, each based on a single observation. One note provided the first documentation of a peregrine falcon (*Falco peregrinus*) unsuccessfully attempting to steal food from a white-tailed kite (*Elanus leucurus*), based on a series of photographs by a friend, nature photographer Faith Rigolosi. The other note documented the first record of least grebes (*Tachybaptus dominicus*) nesting on a non-floating concrete structure (they normally construct floating nests of vegetation) at Roatán, Honduras, based on a photograph I took during a Tropical Biology trip with students in 2017.

### Mychal Hellie (Environmental Studies Senior)

In the fall of 2018, I had the opportunity to present at the Western Field Ornithologists Conference in Ventura California. At this conference I presented data from a research paper, I had helped Dr. Hayes with in the past. The paper was about how the western and clark’s grebes nests on Clear Lake California impacted the local environment. The study showed a great number of other organisms were using the nests after the grebes had abandoned them. This makes the grebes in the category of ecosystem engineers, like beavers or ants. This experience taught me a lot about what it is like to be a professional scientist and how friendly that community is. I received many compliments about the presentation, even though I did not know anyone there. I enjoyed listening to the other presenters, and I learned a lot about the kind of research happening.

Overall, the experience made me excited to become an environmental scientist, and to preserve and study the natural world.

### Dr. Scott Herbert

This past summer, Mychal Hellie, an environmental studies student, and I traveled to Seward, Alaska, to study the interactions of glaucous-winged gulls (*Larus glaucescens*) with sea otters (*Enhydra lutris*) and steller sea lions (*Eumetopias jubatus*). During our previous Polar Biology field trip to Alaska (summer of 2016), Dr. Hayes and I noticed the glaucous-winged gulls often harassed the sea otters when they were foraging on discarded fish, and we took a couple of videos of glaucous-winged gulls attempting to steal food—a behavior termed kleptoparasitism—from a sea otter. In winter quarter of 2018, Dr. Hayes and I realized there was nothing in the scientific literature that described this interaction, so we decided to take advantage of the Alaska trip in the summer of 2018 to investigate the behavior more thoroughly.

With Mychal’s help, I monitored the Seward small boat harbor where a population of sea otters is known to live. We walked the docks for 12 or so hours a day, and I obtained videos and photos of 16 events of glaucous-winged gulls attempting to steal food from sea otters and seven events of glaucous-winged gulls attempting to steal food from steller sea lions. We attempted to evaluate various factors affecting the success of the gulls that tried to steal the food. From the video we recorded of each incident, we identified the species and age of each gull, what kind of food it was (fish, mussels, crabs, etc.) and its size, how close the gulls approached the mammal, what evasive action (if any) was taken by the mammal, and whether or not the gulls were successful in obtaining food. We have written a manuscript that is nearly ready for submission to a scientific journal.

### Dr. Bryan Ness

I attended the American Scientific Affiliation (ASA) annual meeting last July. The ASA exists to provide scientists who are Christians a place to share scientific ideas and discuss challenges faced at the interface between science and Christian belief. Presentations covered everything from how to harmonize evolutionary concepts and earth history with the Bible to how Christian ethics should be applied to technologies that could potentially modify humans genetically and otherwise. Some sessions were specifically focused on the

teaching of evolutionary biology in a Christian setting, which is extremely relevant to some of the courses taught at PUC. One of the highlights of the meeting was a keynote address by Francis Collins, director of the National Institutes of Health. Collins is both a world-renowned scientist, and a devout Christian. The meetings allowed me to not only network with other Christian scientists but provided exposure to additional resources useful to teaching.

### Professor Aimee Wyrick

Several PUC colleagues and I attended the Future of Adventist Higher Education: Chicago Summit in August 2018. This weekend conference brought together representatives from most North American Division of Seventh-day Adventist (NAD) unions, conferences, and universities/colleges to learn about the challenges facing Adventists higher education. We spent time dialoguing how our various institutions can better work together to strengthen our system. Two of the several resolutions voted are to find ways to make Adventist education more affordable and to make plain to our constituents the value of attending an Adventist college or university. To learn more about this summit and to watch presentations given during the weekend visit [adventistthe.org](http://adventistthe.org).

## RECENT ALUMNI

Since 2013, nearly 70 percent of department of biology graduates enrolled in graduate or professional school, and many of these graduates have already earned advanced degrees. Our graduates are well-positioned for success in a variety of interests including dentistry, entomology, genetics, human and veterinary medicine, pharmacy, occupational therapy, and wildlife biology. They attend schools across California and the nation and these include Loma Linda University, Yale University, Duke University, UC Davis School of Veterinary Medicine, Meharry Medical College, and CSU Long Beach.

Here are a few reports of what our recent graduates are up to.

### 1. Kevin Jahng

I am currently in my second year of the D.D.S. program at Loma Linda University School Dentistry, and I am very grateful for the education and experience I received through the PUC department of biology. In Clark Hall, I took classes like Physiology and Intro to Dentistry

which gave me knowledge and abilities I utilize every day. After graduating in 2016, I was offered the unique opportunity to work as the department’s laboratory coordinator. In that position, I worked closely with the department’s faculty, and they taught me management and interpersonal skills invaluable throughout my career. But, had I chosen not to transfer to PUC, I would not be where I am now.

Transferring from a large public university to PUC was a bit of a culture shock. Aside from things like the entirely vegetarian cafeteria, what makes PUC seem so radically different is how much the professors care about their students’ well-being. At the other school, I felt nameless, aimless, and homeless. But the PUC biology faculty made me feel welcome and cared for, and they gave me the education and guidance I needed to get me where I’m going.

### 2. Brandon Painter

I spent four wonderful years at PUC studying biology with the hope of one day becoming a physician. In 2015, I graduated with a B.S. in biology and began medical school at Loma Linda University. Upon graduation in 2019, I plan on pursuing the specialty of surgical oncology.

As I reflect on my pursuit of medicine, I cannot help but be overwhelmingly grateful for the impact that PUC has had on this journey. My time with the department of biology provided me with a strong foundation in the medical sciences, while allowing me to pursue my other passion for marine biology. My first year of medical school was much easier because I had strong foundations in subjects such as cell biology, medical physiology, anatomy, genetics, and histology. In addition to all this, the department gave me the opportunity to travel to Micronesia to conduct ecological research by snorkeling and scuba diving in one of the prettiest out-of-water/underwater places in the world. Yeah, it was rad.

However, the department of biology at PUC gave me something even more important than all this. I was provided with classes that broadened my perspectives, sharpened my critical thinking, fostered my inquisitive mind, and shaped my worldview into something I feel confident taking with me wherever I go. This has been absolutely invaluable to me. I owe this to the teaching staff, which became my mentors and friends, and ultimately a second family that I sincerely miss. Thank you to the department of biology and all the professors!

### 3. Sabrina Mostoufi

Since graduating from PUC in June 2018, I’ve joined the department of biology at the University of Oregon as a graduate student in pursuit of a doctoral degree. In my first year, I’ve been teaching general biology labs, taking graduate courses, and rotating in research labs to find which one will be the best fit for completing my doctoral thesis. I’m primarily interested in using *Drosophila* as a model organism for studying genetics, both at the larger population scale and at the smaller individual or cellular scale.

If I had to look back and choose one thing from PUC that has really shaped my academic and career goals, it would be working as a lab TA for the department of biology. Having the privilege to work in the lab and share my knowledge and love for biology with other students was easily one of the best parts of my senior year! Watching students have an “ah ha!” moment right before my eyes was truly inspiring and I’m grateful I get to continue to mentor and encourage other biology students.

### 4. Amanda Schaff.

I graduated PUC with a biology degree in 2014. Since graduation, I lived in Florida working for a wildlife hospital on Sanibel Island, and now am about to enter into my fourth and final year at Midwestern University, College of Veterinary Medicine in Glendale, Arizona. I’m currently pursuing a career in zoo and wildlife medicine.

It’s been a challenging and exhausting road through veterinary school, and I can honestly say PUC’s department of biology provided me with such an amazing foundation in the basic sciences I felt steps ahead of my classmates during our first year of veterinary basic science courses. My success throughout veterinary school has made me grateful for the level of competence and diligence that was expected of us at PUC.

In less than a month, I’ll be done with all of my classes and exams and will begin my year and half of clinical rotations. I have some exciting rotations coming up at the Phoenix Zoo and the San Diego Zoo later this year and I couldn’t be more excited to finally start working in my field.

### 5. Aimee Peñaloza

If you told me at my graduation from PUC in 2014 that I would be graduating with my master’s in occupational therapy (OT) from San Jose State University in five years, I would not have believed you. If you had continued

to persuade me that the career of my dreams was actually OT and not medicine, I would not have wanted to believe you. For me, achieving anything other than medicine would have been a complete failure. Throughout undergrad, I was laser-focused on getting into medical school. I did not consider any other options. I fought through challenging material, disappointing grades, and difficult life balance with the goal of becoming a doctor. Despite my hard work, it was a rough journey, with multiple doors shutting in my face. It was frustrating to see my diligent effort was not paying off, but I was determined to push forward. After college, I got a job as a scribe in the emergency department. It was there I found out that a career in medicine did not quite fit my passions and talents. I was conflicted. I did not want to give up on the dreams I have had since I was a little girl, but I also knew I was searching for a career that better fit with who God made me to be. It was all unsettling, so I spoke with a friend about everything I was searching for in a career. She replied, “You are describing OT.” It was then I began researching OT and found it is a profession that fits my passions, talents, and personality well. I decided to pursue it, and the doors began opening. I am now finding that my hard work is paying off. Now, I cannot wait to graduate and begin helping children lead meaningful and purposeful lives.

Do I wish I had been pre-OT in college? No. If I had been, I probably would not have chosen to major in biology. I would have missed out on interesting content and wonderful professors but also missed out on the skills and memories that last a lifetime. The rigor of the department taught me how to work hard and never stop pursuing my goals. On top of that, receiving employee of the year showed me I am capable of high achievements. What I have learned through the department of biology has been invaluable. I am happy God led me on the journey to occupational therapy through PUC and the biology department. I look back at those years with happiness. They were some of the best times of my life, and I would happily do it all over again.

### 6. Iris Lee

I graduated with a B.S. in biology in 2017. Currently, I am a first-year medical student at Loma Linda University School of Medicine. What I am most grateful to the department is they provided me with a well-rounded education in biology. Being a biology major at PUC has made my transition into medical school a lot smoother than it would have been if I had chosen

a different major. For example, I found Histology very useful and helpful in navigating a similar course at Loma Linda University. All those hours spent on slides during lab have made the class at LLU enjoyable and a little less difficult. My advice to those who are biology majors on the track to medical school (or dental or pharmacy school) is doing research or taking other biology classes that are not necessarily related to their respective professional schools. I had the privilege of taking Flowering Plants and Vertebrate Biology (as well as others), courses that were not necessary for medical school, but ones I (surprisingly) really enjoyed. All in all, my experience with the department of biology at PUC was memorable, and I enjoyed the time I had with my professors and fellow biology majors.

### 7. Seong Hwang

I graduated from PUC in 2017 as a biology major, and I am studying at Herman Ostrow School of Dentistry at the University of Southern California to restore oral health and transform the lives of patients. My education from PUC has been a great foundation for scientific knowledge. PUC biology courses are rigorous and challenge individuals to understand the subjects in a detailed way. Because I had to study very hard to understand the materials, there were times I regretted pursuing a major in biology. However, the knowledge I gained from long nights of blood, sweat, and tears has shaped me to grasp the concepts from basic science better.

In addition to the knowledge I gained from the department, the mentorship I received from the professors has helped me to make better decisions. The professors are willing to talk to anyone who stops by their office. It was definitely one of the most unique experience I had during my time in PUC because it provided an opportunity for me to not only make personal relationships with my professors but also receive advice from them who see things clearer than I do. Personally, I struggled with making decisions during my time in PUC, and talking to professors helped me in that realm.

All in all, my experience in PUC as a biology major was amazing because it both provided a great foundation for scientific knowledge and helped me to make the right decisions. Although the time I spent pursuing a major in biology was difficult, I am forever grateful for the advice and knowledge I gained from it. If anyone considers a biology major, I would strongly encourage them to do it because it is always nice to have someone who cares for

you and supports you throughout the undergrad journey.

### 8. Lily Hufmann

I have been working for the Forest Service as a seasonal wildland fire dispatcher since May 2017. In fall 2018, I had the opportunity to be a research assistant for the Rocky Mountain Research Station (RMRS). RMRS is one of several agencies collaborating to study the long-term effects of fire on a prairie ecosystem. The part of the project I was assisting focused on plants from Buffalo Gap National Grassland in South Dakota. We were closely collaborating with a team of researchers in Thunder Basin National Grassland in Wyoming. Fire is a natural part of ecology in these grasslands, so the researchers ask questions such as “Under what conditions can perennial grasses and wildflowers regenerate after a wildland fire?” The team collected about 300 twelve-inch diameter cores containing plant samples in their original soil from all over the Buffalo Gap and Thunder Basin Grasslands. The cores were then placed in a metal grate covered with hay then burned to simulate a prairie fire. The researchers also went to different sites in the grasslands with a 2 x 4 meter metal perimeter; on site, wildland firefighters would wet down the grass outside of the perimeter and ignite the prairie inside the perimeter. The firefighters made sure the fire did not escape the perimeter and was completely out before leaving the site.

My role was to record data, prepare equipment, measure samples, photograph, and document. An important piece of equipment was a data logger connected to thermocouples, which are wire thermometers wrapped in braided material and fire shelter. The thermocouples are flexible and were positioned to record temperature changes in bare soil, forbs, grass species, litter, and flux meter as a fire would burn over the core sample or burn site.

PUC helped prepare me for working with RMRS in many ways. Ecology and Flowering Plants were useful courses to understand how fire can be an important part of an ecosystem and how to identify plants. The lab courses at PUC helped me to appreciate the importance of understanding procedures, ensuring data accuracy, valuing teamwork and safety.

For more specifics about this fire study, visit: <https://www.fs.fed.us/rmrs/projects/fire-effects-herbaceous-regeneration-across-invasion-gradient-grasslands-and-shrublands>

### 9. Ella Melnik

From the time I was 12, I wanted to be a doctor.

The details of what specialty changed frequently, but the decision to go to medical school stayed constant throughout high school and most of my time at PUC. That began to change when I took Dr. Patty Sanchez’s cancer biology class my second year. She was my guide through the complex and perturbed signaling networks in a cancer cell, explaining how at almost every step, a mutation could lead to cancer. I realized to make the biggest impact on this disease, I would need to approach cancer from the bedside of a laboratory, rather than the bedside of a clinic.

After graduation in 2016, I was fortunate enough to join Loh Lab at the University of California, San Francisco (UCSF). Dr. Mignon Loh and her colleagues study two forms of high-risk pediatric leukemia, hypodiploid B-cell acute lymphoblastic leukemia (ALL) and juvenile myelomonocytic leukemia (JMML). My two years in this lab focused on understanding the sensitivity of hypodiploid ALL to ABT-199, a Bcl-2 inhibitor potentially induces apoptosis both in cell cultures and in patient-derived xenograft mouse models. Currently, I am working on a Ph.D. in Biomedical Sciences at Gerstner Sloan Kettering Graduate School in New York City. I am rotating in structural biology laboratories and will likely complete my thesis on a structural biology project. My time at PUC helped me to not only become familiar with the underlying cell biology and signaling pathways relevant to cancer, but classes such as Professor Wyrick’s BIOL 113 and Dr. Vance’s Systems Physiology helped me to approach scientific questions critically and taught me how to think through complex problems, something invaluable in a Ph.D. program. I am so lucky and so thankful to all the biology faculty at PUC for preparing me for a career in scientific research.

### 10. Daniela Rodriguez

After graduating from PUC in 2016 with my B.S. in biology, I worked in the emergency room at two different hospitals as a scribe while I began applying to medical schools, continuing my dream of becoming a doctor. In August 2018, I moved to the Midwest and started medical school at Chicago College of Osteopathic Medicine; I’m currently halfway through my first year. I hope to eventually specialize in emergency medicine. Although the perfect Napa Valley weather of PUC did not prepare me for the chill of a Midwestern winter, I will be eternally grateful to the department of biology for providing me with the skills and knowledge to make it through medical school. Several of the classes I was fortunate to take during my time at PUC gave me the perfect foundation for my current classes, including

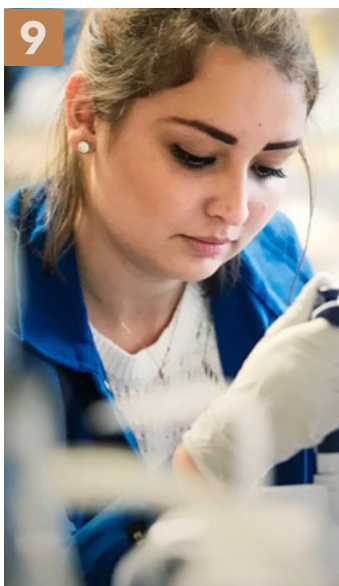
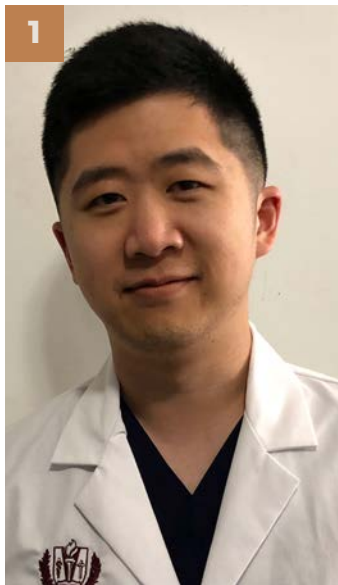
most notably Histology, Systems Physiology, and Genetics, among several others. Most of all, I’m so thankful for the guidance that was given to me by the professors of the department of biology, encouraging me to step outside my comfort zone and follow paths outside of the norm to achieve my goals.

### 11. Cody Holthouse

My current graduate research is focused on the invasive brown marmorated stink bug (BMSB; *Halyomorpha halys*). I have been documenting its host plants, phenology, and biological control agents in Utah, specifically the foothills of the Wasatch Range. BMSB has made for agricultural and urban nuisance problems in many other regions of North America, the current tally being 44 U.S. states and four Canadian provinces. Which means it might live near you! The goal is to refine management practices better so we can integrate this “pest” into a more balanced part of the local ecosystem. To do this, I have set up plant surveys and trapping trials (baited with attractive pheromones) located near urban neighborhoods which back up against agricultural land (orchards, community gardens, etc.) to better observe where and when BMSB occurs throughout the summer months. Understanding which plants best accommodate BMSB or when peak feeding populations occur is important information for local farmers, especially now while BMSB is still only a minor agricultural threat in Utah. The biological control aspect of my research has more to do with how Utah can fight back against the BMSB invasion. I have been documenting native predators are capable of preying on BMSB and am also on the lookout for the samurai wasp (*trissolcus japonicus*), a wasp very successful in killing BMSB eggs in its native home range of eastern Asia (it has yet to arrive in Utah).

My time at Utah State University has been a blessing. I spend summer months in the field and winter months in the lab writing, taking classes, working as a teaching assistant, and presenting my research at local events sponsored by master gardeners, farmer’s markets, USDA events, and more. Graduate school pulls you in many different directions and can be daunting at times; the world expects you to be good at everything, immediately! Luckily I find myself grounded by my love for ecology and faith in God. Both of which were cultivated in my years at PUC (I graduated in 2016). I am forever grateful for the intimate classroom settings of PUC’s department of biology and the research trip to Honduras with Dr. Hayes. The opportunity to work for both Professor Wyrick and Dr. Vance as a teaching





assistant allowed me to learn practical skills from their classrooms. I use these skills on a daily basis. I was also blessed with the convenience of exploring a beautiful forest right next to campus. If I had any advice for PUC biology majors it would be to stay curious (don't let the process of school ever dull your core love for the material), take more stats classes using current analysis software like R, and practice sharing science with anyone and everyone.

## STUDENT INTERNSHIP AND RESEARCH REPORTS

### 1. Jessica Edens

#### Who are you?

My name is Jessica Edens, and I'm a senior environmental studies major. After graduation from PUC, I plan to pursue law school and get my J.D.

#### What did you do?

My internship is with the Bureau of Reclamation within the Department of Interior as a park ranger. While there are many duties, one is working with local non-profits and other organizations to educate youth groups or perform community outreach programs. There are a lot of natural resource activities involved, like trail building and maintenance, invasive species prevention program for quagga and zebra mussels, re-planting of native trees, conservation, and water management.

#### When and where did you do this work?

My internship is at Lake Berryessa, California. I have worked there since July 2018.

#### What did you learn?

A big part of being a park ranger is working with the environment while educating people in the hopes of creating or maintaining good conservation practices. It's trying to spread the idea we only have one earth and we should be preserving what we have.

#### How did your experience at PUC help prepare you for this experience?

Being an environmental studies major, I took a lot of classes about biology and the environment. There were many classes I took at PUC I am able to use in this internship. So much of the material and topics I learned in the classroom have proven invaluable in aiding my ability to speak knowledgeably on a subject.

### 2. Tom Borecky

#### Who are you?

My name is Tom Borecky, and I am a senior biology major. I will be attending medical school in the fall and hope to get a master's degree in public health as well.

#### What did you do?

I had the privilege of participating in a research project examining the impact of the Affordable Care Act on colonoscopy cancellation rates. I was responsible for organizing and collecting data from over 400 cases to analyze the specifics of the reasons for cancellations, such as demographic information and insurance type.

#### When and where did you do this work?

I did this work when I returned home from my gap year as a student missionary in Uganda in March 2018. This research was done at the Sierra Nevada Gastroenterology practice in Grass Valley, California. We spent a few weeks collecting and organizing all the data, and had the opportunity to present a poster of the findings at the American College of Gastroenterology annual conference in Philadelphia in October, 2018.

#### What did you learn?

Throughout my experience, I learned that the intricate process of research, which can be extremely detail-oriented and tedious, is essential to produce accurate information that will guide and help people. Also, the skill of learning how to work with others as a team to accomplish a goal was a major achievement from my research experience. These skills have impacted my life beyond the research in tremendous ways.

#### How did your experience at PUC help you prepare for this experience?

Throughout my time at PUC in the department of biology, the basic skills I have developed through lab such as organizing and processing data in Excel was extremely useful in aiding me in the research process. Also, classes such as Systems Physiology and BIOL 113 allowed me to have a sufficient understanding of the digestive system, which helped guide the conceptual understanding of "why" this research was meaningful.

### 3. Emily Castellanos

#### Who are you?

I am Emily Castellanos, and I am a senior biology, pre-vet major. I plan to go to graduate school for a masters in biomedical sciences: animal anatomy and physiology, then go to professional school to become a veterinarian.

#### What did you do?

I interned this summer as a veterinarian assistant at an animal hospital. I performed simple tasks such as cleaning cages, taking dogs out for short walks, and administering vaccines to cats and dogs to more complicated tasks such as monitoring anesthesia, performing blood draws,

taking notes for the doctors, and interacting with as well as explaining treatment plans to clients.

#### When and where did you do this work?

My initial internship was for two and a half months (summer 2018), but now has been extended to a part-time job until I graduate in 2019. The animal hospital is the California Pet Hospital in Napa.

#### What did you learn?

I've learned so many things during my time at Cal Pet. I've learned about the basic anatomy of cats and dogs, the physiology of and calculations for the dosing of medications. I have had the amazing opportunity to learn how to interact with clients, basic animal behavior cues, surgery equipment identification, how to make estimates for treatments, basic radiography, cytology, and many other valuable skills.

#### How did your experience at PUC help prepare you for this experience?

There are several classes PUC offers which have helped prepare me for this experience. While many of the classes related to medicine are focused on human anatomy and physiology, there are countless comparative similarities between animals and humans. Thus, human anatomy, developmental biology, and systems physiology have been the most helpful in giving me background knowledge for treatments as well as allowing me to be more useful to the veterinarians, because I have knowledge on what they talk about. But even the foundational sequences in biology and chemistry have also proven to be very helpful as well.

### 4. Sean Richards

#### Who are you?

I am Sean Richards, and I am a senior biology major. I plan to go on to graduate school in marine biology to specialize in invertebrate conservation.

#### What did you do?

I participated in a research trip with Dr. Hayes to study the commensal associations between different species of urchins, invertebrates, and fish. During this time, I was responsible for taking photos as well as counting urchin individuals, with and without associating organisms.

#### When and where did you do this work?

This research opportunity took place in January 2019 off the coasts of Cabo San Lucas, in the Gulf of California.

#### What did you learn?

I learned an immense amount on this trip. Though swimming in a wetsuit for multiple hours in a day can be tiring, it is well worth the effort. I saw several species of pufferfish, pipefish, and eels I had only read about or seen in captivity up until that point. It was also interesting to peek into each crevice to find different



species hiding within the urchin’s spines for protection. From this, I learned much about underwater photography, the collection of density measurements, as well as the resources available for fish/invertebrate identification.

**How did your experience at PUC help prepare you for this experience?**

The classes immediately come to mind for me are those of biological foundations ecology, and marine biology. From these classes, I learned an enormous amount about the writing of scientific papers, animal anatomy, as well as the mindset goes into doing this kind of research. Also, students at PUC are lucky enough to have a department that routinely offers research opportunities in a variety of areas.

**5. Emma Payne**

**Who are you?**

My name is Emma Payne, and I am a biochemistry major looking to go into biomedical and pharmaceutical research after graduating before going to medical school.

**What did you do?**

Under the guidance of Dr. Sung, I participated in research of Alzheimer’s disease from a physiological standpoint before continuing on to biochemical experiments. In our experiments, we collected data based on *C. elegans* worm behavior and its attraction to chemoattractants that replicated the smell of food. I was responsible for making more batches of *E. coli* food for the worms, incubating new batches of worms, and carrying out new behavioral tests based on the diet and age of worms.

**When and where did you do this work?**

I was able to work with Dr. Sung in Alzheimer research here at PUC in the research labs of Clark Hall in 2017-18.

**What did you learn?**

In my research experience, I learned to cement process and create consistent procedures to limit the amount of error in data results. I feel as though my experience in my research with Dr. Sung has been foundational to any future opportunities in research or in my practice in medicine later in life. By experiencing research and the process of exploring what causes biological mechanisms I learned to think abstractly and use information I was learning in my chemistry and biology classes to apply in our experiments. Additionally, I learned by reading the articles of others’ work I was able to see how useful it is to use the research of other’s to the furthering the understanding of diseases like Alzheimer’s by working as a community.

**How did your experience at PUC help prepare you for this experience?**

Previously I curated a love for lab research in high school when I took survey chemistry classes. I have also gotten the opportunity to intern at a clinic in Houston and interact with individuals who suffered from Alzheimer’s disease. In having experience and a background in chemistry, however introductory, lead to my ability to look at biological research on a fundamental and chemical level as well as have skills to understand laboratory procedure and tools.

**6. Antonio Robles**

**Who are you?**

I am Antonio Robles, and I am a junior biology major. I am currently a pre-medicine student looking at research opportunities in the medical field or in marine biology.

**What did you do?**

I participated in research with Dr. Hayes by studying the symbiotic associations of urchins in the Sea of Cortez. Most were done by natural observations by counting holes with the urchins and writing down every species seen in the hole. In the summer I also participated in neuroscience research with Dr. Sung. I was in charge of finding a way to stain the *C. elegans* tissue to link possible neurological damage due to overconsumption of food to dementia.

**When and where did you do this work?**

In the summer of 2018, I spent 11 weeks working with the *C. elegans* alongside Dr. Sung. This was all spent in the microbiology lab at PUC. During the first week of January 2019, I spent working with Dr. Hayes gather data for the associations with urchins in Baja California Sur, Mexico.

**What did you learn?**

From both experiences, I learned about the helpful scientific community and how to use certain equipment. Specifically, with Dr. Sung, I was able to communicate with successful research scientists in Switzerland through the internet to come up with an apparatus that would allow the staining and slicing of *C. elegans*. This cooperation was a highlight as it allowed me to move forward in my research while seeing how there is always collaboration in science. In addition, I learned how to use cryostats, different types of microscopes, micropipettes, and other tools. With Dr. Hayes, I learned the hard work it takes to do fieldwork and how to record data using a computer. Each night Dr. Hayes would spend hours adding all the observations in Excel and being able to observe was a great experience.

**How did your experience at PUC help prepare you for this experience?**

Taking the biological foundations sequence helped me be familiar with lab tools such as the microscope and micropipette. In addition, it

gave me the basic foundation for knowing about the brain and the importance of *C. elegans* for science. Intro to Research Methods II was very helpful in the way we approach research. This allowed me to know how to contact different researchers around the world to collaborate and it also gave me the opportunity to receive a grant for the research in Mexico on urchins. Past experiences with Dr. Hayes doing research in Clear Lake and Roatán, Honduras, also allowed me to be ready.

**7. Caroline Hogan**

**Who are you?**

I am Caroline Hogan, and I am a junior environmental studies major. I plan to go into the Navy or to get my master’s degree in forestry and ecology.

**What did you do?**

I did an internship involving the study on the impact the October 2017 fires had on the plant and tree growth on my burned property. The mission was to count and record the impact the Nuns Fire had on the property and to see if any of the trees like oak and douglas-fir were able to recover from being burned as well as the degree of damage that the survivors had.

**When and where did you do this work?**

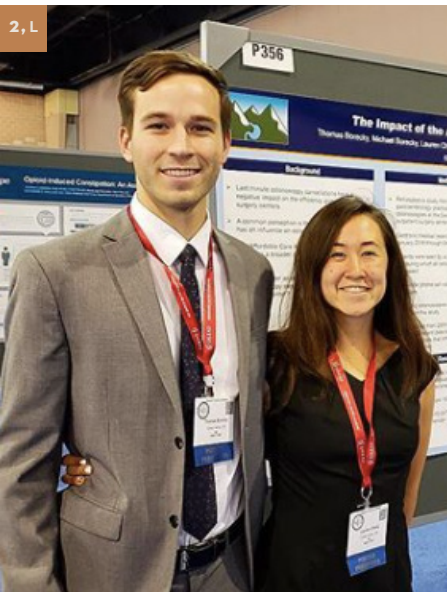
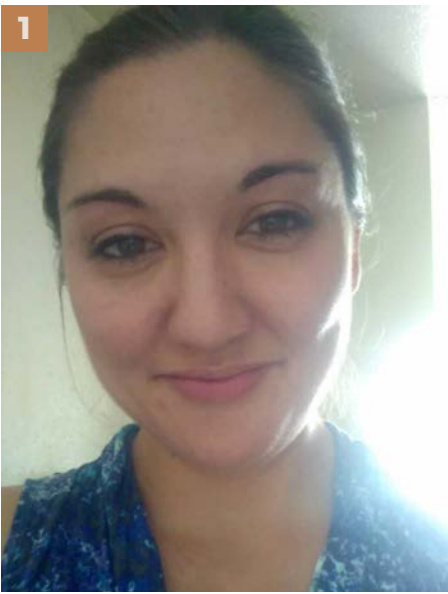
My research internship was for eight months on my property in Sonoma County.

**What did you learn?**

There were so many things I learned when doing this project that I never expected. Much of the work was in the field and involved a lot of hiking and charting down every single individual tree and shrub inhabit the formerly heavily wooded five-acre property. I learned how to chart and map the trees and plants properly and how to identify them in their burnt state. I also learned how to write up a report on the trees for the insurance company and client. This project taught me how to deal with a client professionally and how to work with many different people, agencies, insurance agents, and lawyers.

**How did your experience at PUC help prepare you for this experience?**

I am an environmental studies major, so the class natural history of California helped prepare me to identify the plants and trees that were difficult to identify due to their burnt state. Intro to GIS as well helped me immensely because I learned how to properly use a GPS to map out the entire property and every individual tree. Professor Wyrick also helped me with her knowledge of the native plants of California and how to identify them and gave me tips on how to determine what they were when they were otherwise unrecognizable.



# DEPARTMENT OF BIOLOGY

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